CQ

October 1968
75¢

HOW TO MAKE FIVE MILLION (points, that is)

SEE PAGE 84

Q Reviews:
he HQ-215

SEE PAGE 72

The Radio Amateur's Journal

Some Hams Still Prefer A Separate Receiver

And Transmitter...

We're One Of The Few Places You Can Come To

The HEATHKIT® SB-301 amateur band receiver

'erformance-Plus Features, Top Dollar Value nd Sophisticated, Quality Engineering Have Made The SB-301 The World's Largest Selling 'eceiver

80 through 10 meter coverage on AM, CW and SSB with l crystals furnished • Famous Heath factory assembled nd aligned Linear Master Oscillator for truly linear, high :ability tuning • Crystal-controlled front end for same ite tuning on all bands • 1 kHz dial calibration — 100 Hz per dial revolution • Less than 50 Hz backlash • Less ian 100 Hz drift per hour after warm-up • Bandspread qual to ten feet per megahertz • Tuning dial to knob itio approximately 4 to 1 • Three speed AGC

lus These Extra-Performance Features That ut The SB-301 In A Class By Itself

RTTY position on mode switch — SB-301 is a fully ıpable RTTY receiver • 15 to 15.3 MHz coverage for 'WV reception • Built-in 100 kHz crystal calibrator • uilt-in switch selected ANL — a real help if your QTH in a high noise location • Front panel switching for ɔntrol of optional 6 and 2 meter plug-in converters — ıables complete 80 through 2 meter amateur band ɔverage • Front panel switch selection of optional AM ıd CW crystal filters • Circuit board, wiring harness ɔnstruction make assembly fast and simple

it SB-301, Amateur Band Receiver, less speaker, ; lbs. **$260.00**
BA-301-1, Optional AM crystal filter (3.75 kHz), 1 lb. **$20.95**
SBA-301-2, Optional CW crystal filter (400 Hz), 1 lb. . . **$20.95**
Kit SBA-300-3, 6-Meter Plug-in Converter, 2 lbs. **$19.95**
Kit SBA-300-4, 2-Meter Plug-in Converter, 2 lbs. **$19.95**
Kit SB-600, Communications Speaker, 5 lbs. **$18.95**

Look over the specs and find out why thousands of hams have chosen the SB-301 for their shack!

SB-301 PARTIAL SPECIFICATIONS — Frequency range (megahertz): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 15.0 to 15.3, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megahertz. **Frequency stability:** Less than 100 Hz per hour after 20 min. warmup under normal ambient conditions. Less than 100 Hz for ±10% line voltage variation. **Visual dial accuracy:** Within 200 Hz on all bands. **Electric dial accuracy:** Within 400 Hz on all bands after calibration at nearest 100 kHz point. **Backlash:** No more than 50 Hz. **Sensitivity:** Less than 0.3 microvolt for 10 db signal-plus-noise to noise ratio for SSB operation. **Modes of operation:** Switch selected; LSB, USB, CW, AM, RTTY. **Selectivity:** RTTY; 2.1 kHz at 6 db down, 5.0 kHz at 60 db down (crystal filter supplied). SSB; 2.1 kHz at 6 db down, 5.0 kHz at 60 db down (crystal filter supplied). AM; 3.75 kHz at 6 db down, 10 kHz at 60 db down (crystal filter available as accessory). CW; 400 Hz at 6 db down, 2.0 kHz at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Audio response:** SSB; 350 to 2450 Hz nominal at 6 db. AM; 200 to 3500 Hz nominal at 6 db. CW; 800 to 1200 Hz nominal at 6 db. **Audio output impedance:** Unbalanced nominal 8 ohm speaker and high impedance headphone. **Audio output power:** ½ watt with less than 8% distortion. **Antenna input impedance:** 50 ohms nominal. **Muting:** Open external ground at Mute socket. **Crystal calibrator:** 100 kHz crystal. **Power supply:** Transformer operated with silicon diode rectifiers. **Power requirements:** 120/240 V AC, 50/60 Hz, 50 watts. **Dimensions:** 14⅞" W x 6⅝" H x 13⅜" D.

The HEATHKIT® SB-401 5-Band SSB Transmitter

ıaginative Engineering and Rugged, Reliable erformance Capabilities Have Made The SB-)1 The World's Largest Selling Transmitter

deal power level for barefoot operation — 180 watts 'P SSB, 170 watts CW • Makes a perfect driver for any ear, like the SB-200 • Built-in power supply and small, mpact size make it an excellent self-contained desk p transmitter • Famous Heath pre-built & aligned 1O for rock solid frequency control — less than 100 Hz ft per hour after warm-up • ALC for more talk power ans better DXing through QRM • Crystal filter sidend generation • Built-in antenna change-over relay Operates upper or lower sideband • VOX and PTT ntrol • 1 kHz dial calibration — 100 kHz per dial revolun • 500 kHz per band switch position • Maximum TVI otection from completely shielded and isolated cirits • Relative power meter • Clean signal characterics — carrier and unwanted sideband suppression 55 dB

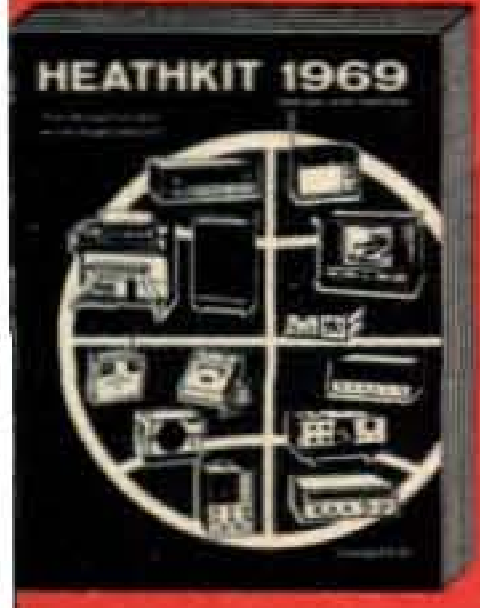
e Versatility You Need For DXing, Round bles, Nets Or Rag-Chews

ust a flick of a switch to select transceive or independent operation of the SB-401 and SB-301 (or SB-300) mbination — no troublesome, time consuming cable anging . . . ideal for cross band work • Can be operated an independent transmitter with any receiver when SBA-401-1 crystal group is installed • Fast, clean break-in CW keying • Meter checks grid current, final plate current, ALC maximum modulation, final plate voltage and relative power, all at the flick of a switch.

Kit SB-401, 34 lbs. **$285.00**
SBA-401-1, Crystal Pack, 1 lb. **$29.95**

Check the specs and see the many reasons why you hear the SB-401 on the air more often than any other transmitter!

SB-401 SPECIFICATIONS — Emission: SSB (upper or lower sideband) and CW. **Power input:** 170 watts CW, 180 watts P.E.P. SSB. **Power output:** 100 watts (80-15 meters), 80 watts (10 meters). **Output impedance:** 50 to 75 ohm — less than 2:1 SWR. **Frequency range:** (MHz) 3.5 — 4.0; 7.0 — 7.5; 14.0 — 14.5; 21.0 — 21.5; 28.0 — 28.5; 28.5 — 29.0; 29.0 — 29.5; 29.5 — 30.0. **Frequency stability:** Less than 100 Hz per hr. after 20 min. warmup. **Carrier suppression:** 55 db below peak output. **Unwanted sideband suppression:** 55 db @ 1 kHz. **Intermodulation distortion:** 30 db below peak output (two-tone test). **Keying characteristics:** Break-in CW provided by operating VOX from a keyed tone (Grid block keying). **CW sidetone:** 1000 Hz. **ALC characteristics:** 10 db or greater @ 0.2 ma final grid current. **Noise level:** 40 db below rated carrier. **Visual dial accuracy:** Within 200 Hz (all bands). **Electrical dial accuracy:** Within 400 Hz after calibration at nearest 100 kHz point (all bands). **Backlash:** Less than 50 Hz. **Oscillator feedthrough or mixer products:** 55 db below rated output (except 3910 kHz crossover which is 45 db). **Harmonic radiation:** 35 db below rated output. **Audio input:** High impedance microphone or phone patch. **Audio frequency response:** 350-2450 Hz ±3 db. **Power requirements:** 80 watts STBY, 260 watts key down @ 120/240 V AC, 50/60 Hz. **Dimensions:** 14⅞" W x 6⅝" H x 13⅜" D.



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OCTOBER, 1968 VOL. 24, No. 10

CQ

The Radio Amateur's Journal

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DEPARTMENTS

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

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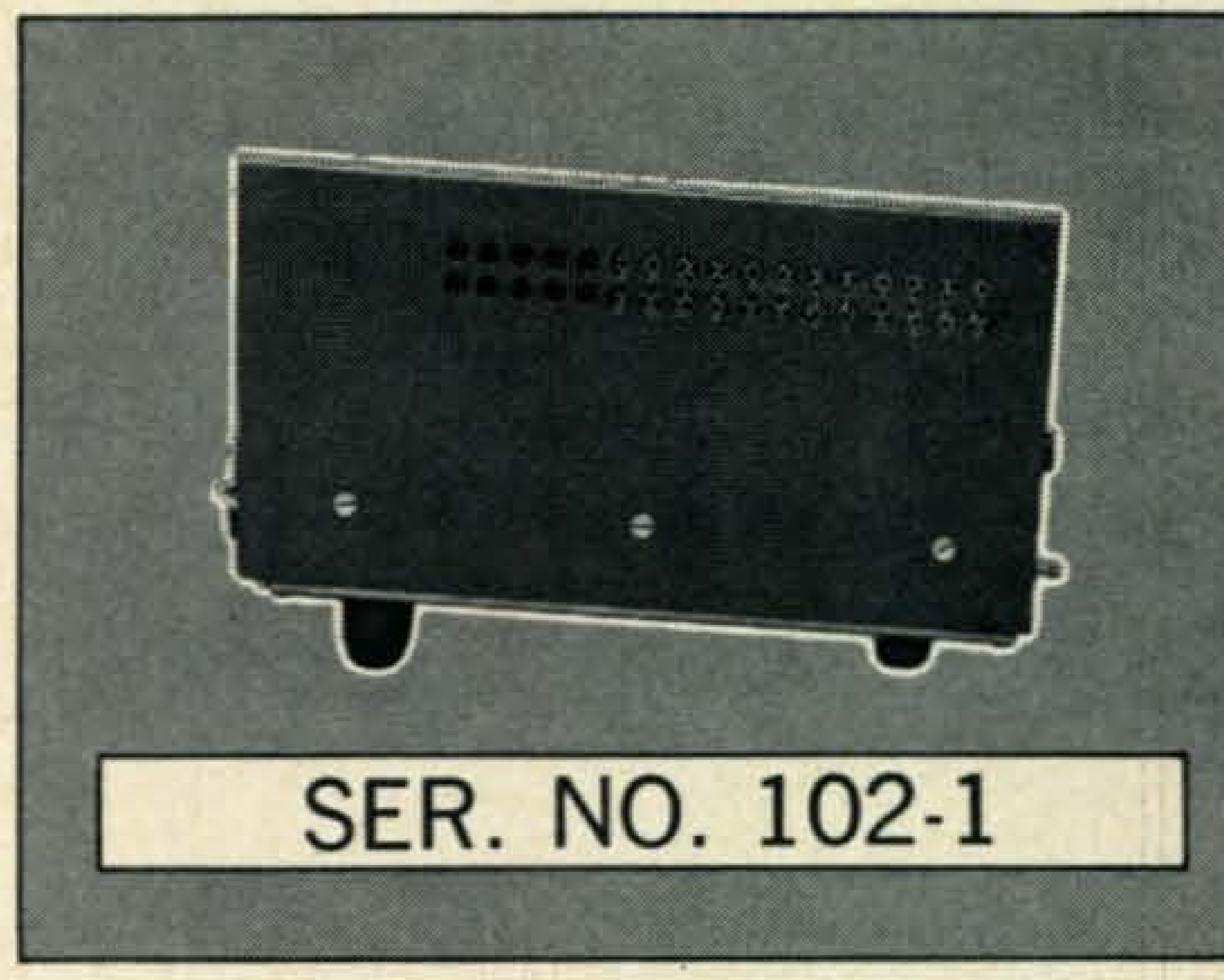
WANTED



Model SW120-Swan Single Bander manufactured in April, 1961 in a garage in Benson, Arizona. Grey, enameled cabinet, clear, anodized panel. Known to frequent the 20 meter band, probably working DX. Height: 5 1/2 inches. Weight: 14 lbs.

REWARD: One new Swan 500C Transceiver with 117-XC power supply.

Swan Electronics began some 7 years ago as a one-man operation with Herb Johnson, then W7GRA, building the first 10 single band Swans. At that time the only other SSB Transceiver on the market was the well known Collins KWM-2, selling, of course, for considerably more money. During the intervening years Swan has consistently offered top quality products at the lowest possible cost and backed them up with customer service that is unparalleled in the industry. As a result, Swan is now a team of 160 skilled craftsmen who are justly proud of their position of leadership in the sale of single sideband Transceivers to the Amateur Radio Service.

The first ten transceivers were serial numbered from 101-1 to 110-1, with the first nine being SW-120's operating on 20 meters, and the tenth, 110-1, being the first SW-140 operating on 40 meters. The company retrieved Serial No. 101-1 about 5 years ago from the original Ohio owner, and have it in our display case. Unfortunately, we have lost the name and call of the original owner of this one. We're wondering now where the other 9 are, and will offer the following rewards for news of them:

(A) A new 500C Transceiver with 117-XC power supply in exchange for the lowest serial number identified by Nov. 1, 1968. This number must be one of the nine from 102-1 to 110-1. We reserve the right to make positive identification before making the exchange.

(B) A new 117-XC power supply will be shipped to each of the other eight early series owners who write in with positive identification by Nov. 1, 1968. If there is any question concerning serial number verification, Swan will pay shipping costs to the factory and return.

You may be interested to know that not only will the current 117-XC power supply run the early model Swan, but the cabinet on the current 500C Transceiver is interchangeable with the one on the earliest models. You might call this being consistent.

SWAN ELECTRONICS
Oceanside, California
A Subsidiary of Cubic Corporatio

ZERO BIAS

We spoke in generalities last month of an approach to renewed interest in amateur radio as a hobby for young people. The basis of that approach is Challenge. We at *CQ* feel that the curtailed growth rate of amateur radio in the U.S. could be rectified by injecting a modern feeling of excitment, competition and challenge into our existing scheme of things. We also feel that we need not water down our technical requirements in the process.

One of the most "turned-on" amateurs we've ever encountered is a local fellow by the name of Fred Capossella, W2IWC. He's an "idea man," and very much in touch with the attitudes and thoughts of young people. A while ago, over lunch, Fred made the comment that "Ham radio has no heros. It lacks its champions." At first you might dispute his statement, but think about it. Name an amateur radio hero of ten years ago. Danny Weil? Okay, name another. You just ran out of heros. How about five years ago? Gus Browning. Name another who truly inspired he imagination of a broad section of amaeur radio's populace. It's not likely that you an, and therein lies one element of our roblem. The people who deserve to be ccepted as the heros of amateur radio chievement are few and far between, and hose people we call champions are almost nvariably so far and away superior to a oungster, (by virtue of age and experience), hat the youngster finds it impossible to elate his own performance to the performnce of the "big gun." We're suffering from generation gap, and the gap is widening. 's gotten to the point where it has become bsolutely impossible for a relative newomer to ever equal the achievements of the ld-timer. Young people want a challenge, ut don't challenge them to a race they can't ossibly win.

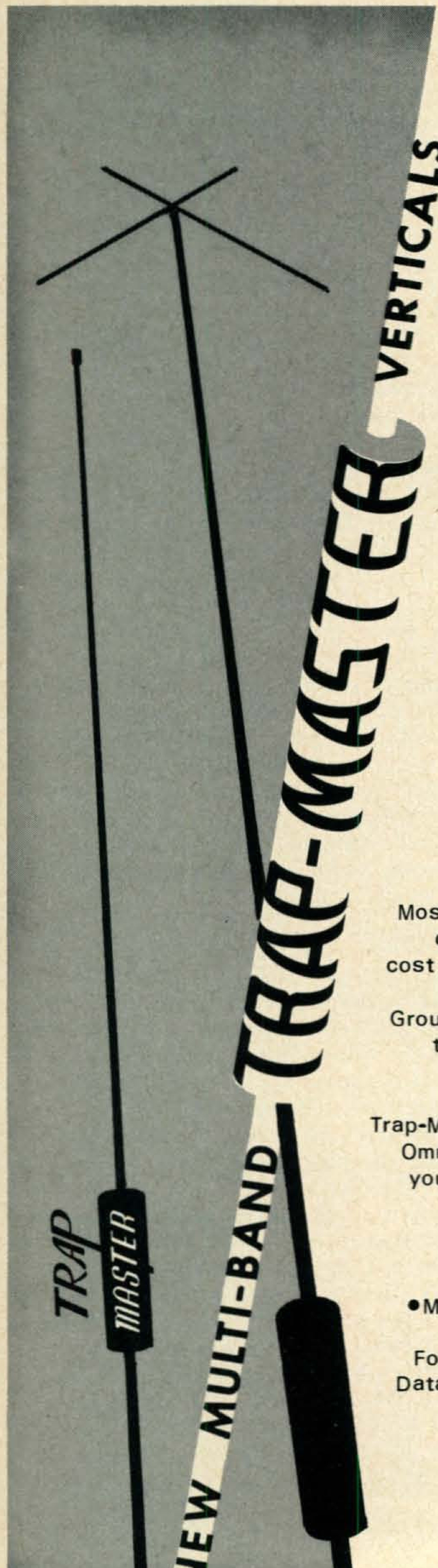
This is at least one way we're discouraging e entry of young newcomers to the hobby. here are other ways, and we'll cover them ter.

What's the solution to this particular proem? There have been several offered. The "term-award" idea is one which has been tried with some success. Term awards are awards given for performance over a relatively short period of time, and in which all participants make a fresh start at the conclusion of each term, usually one year. The contest "handicap" idea is another possibility. Here, contests would be organized to give a graduated handicap for increased experience. An amateur with 20 years experience might be handicapped by 50% of his final score, while the 1 or 2 year man might not be handicapped at all. It would be interesting, to say the least. A third approach is the "fixed goal" whereby the "ultimate" goal of the challenge is stabilized or is consistent over a period of say five years. Let's say the goal is a fixed list of 350 countries. When an operator has accrued that number, that's it. No one sits down and invents new ones to "keep the race running." If the 350 winners want a further means of determining who is king of the hill, let them develop a means of doing so which will be their own little dogfight.

We feel that the salvation of amateur radio in the coming years (neglecting for the moment the consequences of international conferences) lies in the recognition of individual operating accomplishments. Through such recognition amateur radio can hope to retain the interest of those few newcomers still entering the ranks, and additionally, offer the needed challenge to thousands of newcomers who *can* be attracted through planned professional public relations efforts.

The machinery for such a renaissance already exists, but it just isn't turned on. ARRL has the strength and the membership support to renovate amateur radio's values. EIA has the public relations knowhow and business support to bring our story to the masses. Together these two organizations hold the key to the future of the hobby. The biggest task at the moment is convincing them to use it.

73, Dick, K2MGA



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For detailed Brochure on Specifications and Performance Data, see your nearest authorized Mosley dealer, or write factory direct: Dept. 170

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Bridgeton, Mo. 63042

How to choose microphone or SSB

Model 664
$53.40 Amateur Net

Hand us a blank check. Tell us you want the best microphone you can buy for SSB — with price no object. We'll hand you the Model 664 dynamic cardioid microphone. We'd like to tell you why the 664 is so uniquely suited to SSB operation.

Let's start with the transmitter. Almost every quality SSB transmitter, commercial or home-brew, incorporates an automatic level control circuit. And the general practice in transmitter design is to assume that the microphone response will be flat. On this assumption, the audio input circuits are designed to shape your speech characteristics, in conjunction with the ALC control, so that proper transmitter setup gives you maximum PEP.

Anything less than flat microphone response limits your ability to obtain maximum PEP, and your effective radiated power will be reduced. To satisfy this basic requirement, the 664 is unusually free from peaks or dips in response. It allows maximum PEP while retaining your natural voice characteristics.

Another important SSB feature, found in almost every modern transmitter, is voice operation. The 664 flat response, plus the effective Variable-D® cardioid pattern, reduces the possibility of accidentally opening the VOX circuit when speaker level is high. That's because the 664 rejects sound from the back and sides of the microphone. You can operate with higher receiver volume with complete safety. And noise, reverberation and echoes in the ham shack are reduced by the cardioid pattern to give you better intelligibility on the air.

Despite the performance advantages of the 664, this is not a fragile microphone, far from it. It's rugged, almost indestructible. The dynamic design meets the most rigorous tests for quality and service. And at the heart of 664 dependability is the diaphragm, made of Acoustalloy®; a unique plastic material available only from Electro-Voice. Acoustalloy is virtually impervious to shock, temperature extremes, humidity and the countless other environmental conditions that gradually destroy less rugged instruments.

But there's more to the list of 664 advantages: High output level, handsome appearance, and the guaranteed backing of a manufacturer of unquestioned integrity and wide experience in electro-acoustics.

While we manufacture microphones ranging from the communications units in the Gemini space program to professional models that have won an Academy Award for their contribution to motion picture sound, no field is closer to our hearts than amateur communications. And the engineers and hams in our organization are particularily responsive to the needs of the amateur fraternity. They insist on good value for every product, in every price range.

But when price is no object, their choice is the 664 for SSB. Outstanding in performance and value for even the most critical amateur radio operator. We urge you to try the 664 in your own shack soon. We guarantee your satisfaction, or your money back.

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Electro-Voice
A SUBSIDIARY OF GULTON INDUSTRIES, INC.

OUR READERS SAY

KNEES AND SST'S

Editor *CQ:*

Your August cover (in full color) of the SST Series, (like the s.s.b. operators say) is very good and all OK. Where did the photographer and very nice YL go to find such an unkempt lawn complete with foreground sunk cabbage, unraked ·leaves, wire grass and a non-flowering un-trimmed hedge?

Due to summer activities (field day, kids out of school, mobile operations, vacation, a couple of convention type things, some club memberships, etc.) I have not been near my lawn since mid-June and it looks better than that! At least the Rose of Sharon is blossoming, the peach and pear trees did bear fruit and don't look scraggily. The bag-worms have eaten only half of one small apple tree. The mint (yeah, for the Julips) grew so wild I had to pluck it all. The hedge does have a trimmed look, etc.

Any kind of photographer could find several very nice settings for knees and ssts right here in the spacious confines of my 65 X 120 suburban Oklahoma City lot. Of course, the photographer had other things to worry about. (oops! Don't drop that little thing, it's an SST; watch out for poison ivy; oops, knees again; don't use flash fill-in, you'll draw a crowd.)

My overall rating is that it is not too much of a new modern thing. When are you going to join the free expression bunch and go topless in full color on the cover? Now that you are in a plain wrapper, it does have possibilities, doesn't it?

Do you suppose the same good fairies who have been taking care of my premises have turned into gremlins to botch up your cover photo? If the background in that cover photo is a New York City public park (which I think it is), then the whole Park Department ought to be shown the door and jolted out of their summer doldrums. And may Johnny Carson continue to give the New York City Mayor the old what-for about the City.

Frank Jerome, W5OJZ
Midwest City, Oklahoma

Well, that's Central Park for you! Even the ground keepers are afraid to go there alone for fear of the muggers. –Ed.

GRUMBLES

Dear Dick:

I agree with your recent advertisements that you have improved *CQ* and I hope your claims for future improvement come true. However, I have one violent exception regarding improvements. Last month when I received my month-old July copy I was unable to find "Grumbles" which I have followed faithfully since its introduction. When it wasn't there I thought perhaps Sam had gone on vacation and I even went back to the June issue to see if I had missed an advance comment. None to be found.

Yesterday, my month-old August copy arrived and I again can't find "Grumbles" or a comment on why it was dropped. I'm at a loss where to start reading since "Grumbles" was always a perfect opener. I note that the drivvel titled "Scratchi" still appears regularly–such a pity–and you still have room for the junk by Mrs. Margolis–occasionally I do enjoy some of her work, but I can't remember the last good one. But no "Grumbles." Don't tell me that in the few issues it appeared you think that all of the ills of Amateur Radio were discussed! Certainly no sane-minded amateur can believe that.

Luckily, I have a 3 year subscription that has close to 2 years to run, and therefore I am not about to cancel and there is a faint chance that you will reinstate "Grumbles" or perhaps come up with a good substitute–but I doubt that anyone could really equal the performance of Sam. He hurt, but it was true.

Here's to reinstatement of Sam and "Grumbles." I think you goofed!

John P. Piercy, DL4GB/W6QDI
New York, N.Y.

We'll drink to that! Sam will be back next month with more Grumbles. Being such an ornery character anyway, we just couldn't convince him to pound a typewriter during those sweltering summer months. Don't knock Scratchi and Sylvia John. As many readers look forward to reading their writing as look forward to Grumbles. As for the month-old issues, you've got Post Office troubles, my friend, as do the majority of American magazine subscribers–Ed.

GOOD DEED

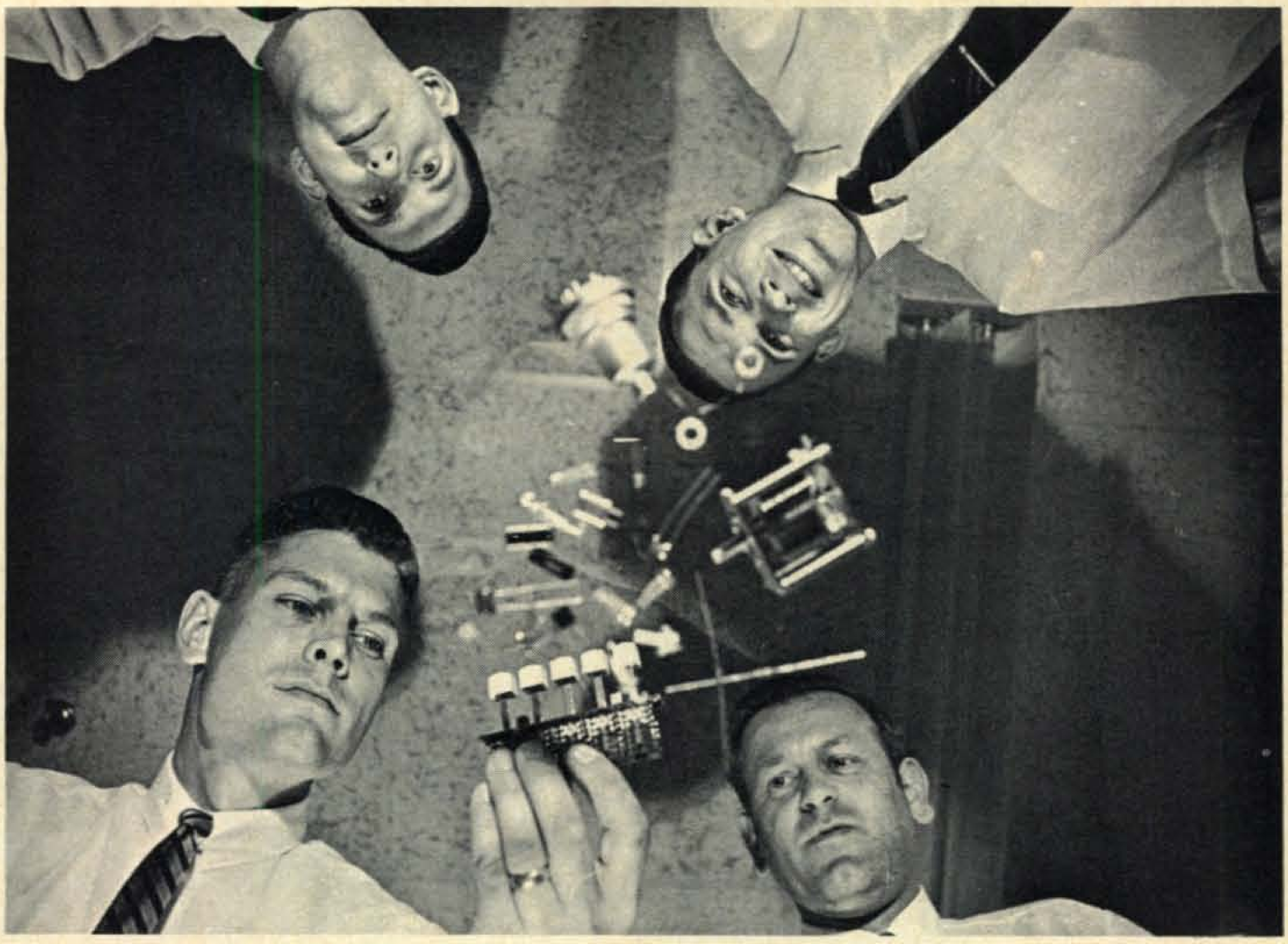
Editor, *CQ*:

May I make use of your columns to thank all those who made a contribution to the Anguilla Scouts Trust Fund, resulting from my vacation expedition there in March last.

Just over $300 was collected, which came from some 26 countries, as far apart as Australia and Japan, to the Soviet and Iran. With a little local help, including the donation of a gas-electric generator by JA1DM, this will be sufficient to donate to the Scouts of Anguilla the first permanent station on the Island. Installation is now proceeding. Any amateur visiting in that area will, I am sure, receive more than a warm welcome from T. R. Lake, Chief Scout Commissioner, Valley, Anguilla.

We shall only be able to donate the bare essentials to accompany a transceiver. If anyone is interested in offering ancillary equipment, the address is as above. Some of the notes which accompanied contributions were most moving, and speak well for the public interest of hams in general. PJ2MI is acting as site engineer.

R. C. Golding, VE2CUS/VP2
Ontario, Canada



Announcements

Tarrytown, New York

The ARRL Hudson Division Convention will be held on October 12 and 13. Focal point for the Convention's activities is the Hilton Inn at Tarrytown, New York.

Advance registration is $3.00 and $4.00 at the door. Banquet tickets in advance are $8.00 and $11.00 at the door. A check or money order to Dave Popkin, WA2CCF, 303 Tenafly Road, Englewood, New Jersey 07631, will speed your tickets to you.

Room reservations, $15 single, $20 double, go directly to the Hilton Inn, 455 South Broadway, Tarrytown, New York.

Millbrae, California

The "Greater Bay Area Hamfest" will be held again this year at the Thunderbolt Hotel, in Millbrae, California, on October 19 and 20, 1968. The event this year is being sponsored by eight of the Amateur Radio Clubs in the San Francisco Bay Area.

Tawas City, Michigan

The Iosco Radio Club presents its 4th Annual Northeastern Michigan Hamfest on October 4, 5, and 6th at East Tawas, Michigan.

This year's event will feature "Your Air Force in Communications." Displays of equipment, Swap and Shop, an auction and a banquet will be the feature events. Programs will begin Friday at 6:00 P.M. and end Sunday at 3:00 P.M.

For additional information contact Jerry Mertz, W8DET, 8303 E. Hawaii St., Oscoda, Michigan or Glenn A. Pohl, K8IYZ, 20245 Oakfield, Detroit, Michigan 48235.

Tampa, Florida

The Hillsborough Amateur Radio Society, Inc., will hold its annual Tampa Hamfest on Sunday, October 13th, in Lowry Park, Slight Avenue and North Boulevard, Tampa.

Boy Scouts Jamboree-On-The-Air

The 11th Jamboree-on-the-Air will take place October 19th and 20th. Starting time is 0001 hours GMT on Saturday, the 19th and will conclude 2359 hours GMT on Sunday, the 20th. As a result of the World Bureau's recent move to Switzerland, the Jamboree will not be able to have its own station. However, 4U1ITV has been placed at the Scouts disposal and will be on the air for the duration.

Waltham, Mass.

The 1968 New England DXCC Meeting will be held October 5th at the Charter House Hotel, Waltham, Massachusetts. Events will begin at 5:00 P.M. Dinner will be served at 7:15 P.M.

For further information contact: R. Hamilton, W1WQC/VP5AA, P.O. Box 368, Coventry, Conn. 06238.

Bedford, Indiana

The Seventh Annual Hamfest held by the Hoosier Hills Ham Club will be held on October 13. The Hamfest site is Spring Mill State Park near Mitchell, Indiana.

Advance registration is $.50 and registration at the park will be $1.00. For advance registration and further information contact Hoosier Hills Ham Club, Inc., P.O. Box 375, Bedford, Indiana 47421.

Slow-Scan TV Rules Adopted

FCC Amateur Radio rules (Part 97) have been amended to permit transmission of pictures by narrow band techniques (slow-scan TV) in telephony bands below 420 mc.

Narrow band TV uses bandwidths of 3 or 6 kc respectively for single or double sideband operation, the same bandwidth required for voice transmission. Simultaneous voice and picture transmission is allowed under the new rules, with a total bandwidth of 6 kc.

Amateurs have their choice of amplitude modulation (A5 emission) or frequency modulation (F5 emission).

Slow-scan TV is transmitted by modulating a subcarrier between frequency limits of 1500 cycles per second (black) and 2300 c.p.s. (white). Vertical and horizontal synchronization is maintained by transmitting short bursts of 1200 c.p.s. tone. Live scenes are transmitted as a series of "stills." A single scene can be scanned in 8 seconds.

The rules are in a revised Section 97.61, completing a rule-making proceeding that the Commission announced Sept. 25, 1967. ARRL had petitioned for slow-scan TV on lower amateur bands. Twenty comments, most of the total that were filed on the proposal, supported it without change. Some others expressed fear of interference with telephony communications. The Commission said, "Since May, 1966, a number of amateur stations throughout the Unites States have been authorized to transmit slow-scan TV signals for test and demonstration purposes. No cases of interference . . . have been reported . . . "

The new rules require use of single sideband on bands below 50 mc and allow double sideband above. Slow-scan TV frequencies below 28 mc are limited to those being reserved for Extra and Advanced Class Amateur licensees. "In addition to providing further incentive to upgrade operator licenses, the limitation should also be some assurance that the operators using slow-scan TV have the requisite technical skill to operate in a manner compatible with existing radiotelephone operation." the Commission said.

"Our Readers Say"

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

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

I've been reeding some science-fictshun books—boy are they grate—espeshyoually those where a guy is in a space ship which having computer in it to doing everything needed, including talking to the spaceman.

I got to thinking what it would be like to having one in ham shack. Maybe like what could happening in yeer 2500. Let's see what might happening. When Scratchi talking, it "S", and when computer talking, it being "C". In case you getting confused, the intelligent conversayshun is from the computer.

So, as I walk in the shack:

C: Good evening

S: Hallo yourself

C: Do you plan to do some operating tonight?

S: (as I sit down at the operating table) Absotively—what's going on?

C: Most of the low-frequency bands are filled with moderate activity.

S: Any good dee-x coming in?

C: The sun-spot cycle is propitious for rather good long-distance transmission and reception.

S: OK, but are any good dee-x coming in?

C: You should be able to converse two-way over paths of at least eleven thousand miles in certain directions.

S: What countries could I work?

C: Would you like me to list them in alphabetical order by call-sign or alphabetically by country name?

S: No, no, no—are there any good countries in that list?

C: Would you care to define what you mean by a good country?

S: Hokendoke!! you know what I mean.

C: If I knew I wouldn't ask. Would you reword your question in that case?

S: Can I work any countries I haven't alreddy worked?

See page 142 for New Reader Service

S: Then why can't I work 'em?

C: The overall sensitivity of your receiver system has dropped 7.3 decibels since you installed it. This is due partially to a 1.7 decibel loss at the coaxial connection on the antenna, caused by a small amount of corrosion. In addition, there is a 4.9 decibel loss due to receiver alignment. I told you about that at 7:29 p.m. last Thursday. Also, a small . . .

S: OK, OK; OK—forget it.

C: You want me to erase that information from my memory?

S: No, for gracious goodness sakes, that's just an expresshun.

C: Yes, "for gracious goodness sakes" is certainly an expression.

S: Oh, for . . . let's start over again, and don't erase anything.

C: As you wish. Good evening.

S: (glumly) Hello

C: Perhaps you would just like to have a pleasant conversation with someone.

S: I hope you meen on the air, on acct. I not doing so well with you.

C: (after a slight pause) Yes, of course.

S: Any good-looking chicks I can QSO?

C: By "chicks" do you mean personable young ladies?

S: Natchyourally.

C: Didn't your fiance, Miss Lil Watanabe, suggest that you stop that practice? You'll recall, she made that remark seventeen days. ago, after she walked in this room and heard you say . . .

S: OK, OK, OK, forg . . . er, that is, don't bother to continue.

C: Should I zero-beat in on some good male conversationalist for you?

S: No, find me a good-looking chick to talk with.

C: But Miss Lil said . . .

S: Never mind what Miss Lil said.

C: But she specifically . . .

S: Find me a chick.

C: I'm sorry, but I must insist that you let me check with Miss Lil, and if she . . .

S: (excited) Oh, shut up!!

C:

S: (after long pause) Well, say something.

C:

S: (shouting) HEY, YOU 21 MEGABUCK MONSTROSITY, SAY SOMETHING!!

C:

S: !!#%(*)×&#%(#)□/×/!! (censored)

Respectively yours,
Hashafisti Scratchi

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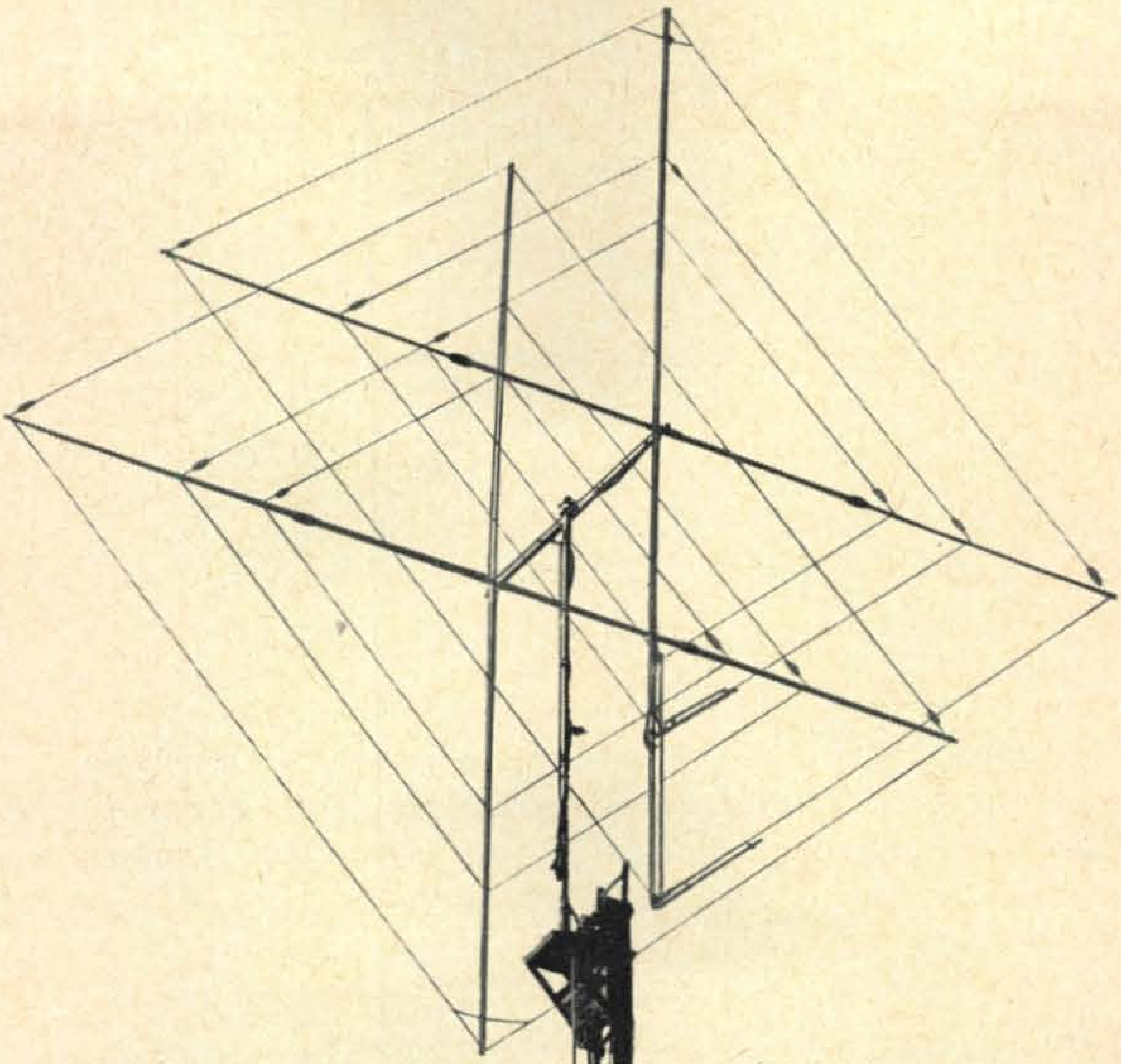

Hy-Gain's all new Hy-Quad will outdo all other quads because it's engineered to do just that. The Hy-Quad is new, it's superior, it's complete. It's the first quad to have everything.

- The Hy-Quad has all parts including those not supplied by others, like a boom, wire and all hardware.
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- Extra heavy duty universal boom-to-mast bracket that tilts and mounts on any mast 1¼" to 2½" in diameter. So get in Hy-Gear to get a Hy-Quad from the best distributors under the sun—he's the one that stocks Hy-Gain!

Specifications

Overall length of spreaders	305"
Turning radius	13'6"
Weight	42 lbs.
Boom diameter	2"
Boom length	8'
Mast diameter	1¼" to 2½"
Wind survival	100 mph
Forward gain	8.5 db
Input impedance	52 ohms
VSWR	1.2:1 or better at resonance on all bands.
Power	Maximum legal
Front to back ratio	25-35 db depending upon electrical height

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H.F. CONICAL CAGE ANTENNAS

BY JOHN SCHULTZ, *W2EEY/1

Conically shaped, cage-type antennas have been used for some years in the v.h.f. range for broad-band antenna systems. The author presents some models which were developed for use in the 80-10 meter range.

THE subject of the ideal multi-band antenna has intrigued amateurs for years. Trap-type dipoles do provide multi-band operation but because the Q of the traps must be high to effectively isolate the various sections, their resonance is narrow within each band and often so restricted that coverage of the phone and c.w. portions of a band are not possible. Paralleling dipoles provides another form of achieving a multi-band antenna system. However, construction does become awkward when 3 or more dipoles are used and if one participates in MARS or other activities on frequencies outside the amateur bands, a separate dipole is needed for these frequencies also.

Military communications people have been faced with the same problem but on even a broader scale. They required an antenna that would be broad-banded for all, or at least a major portion, of the spectrum from 3 to 30 mc and be as efficient as a dipole or quarter-wave vertical dimensioned for a specific frequency.

The main approach used to construct such antennas has been to use the form of broadband v.h.f. antennas dimensioned for the h.f. bands. None of these antennas are "small," since at their lowest operating frequencies they are approximately the same size as a one-band antenna. However, they may be just the answer for someone who enjoys multi-band operation and doesn't want to compromise performance nor have an assortment of antennas draped around his QTH.

The Canadian Royal Air Force was interested for its communications needs in a dipole

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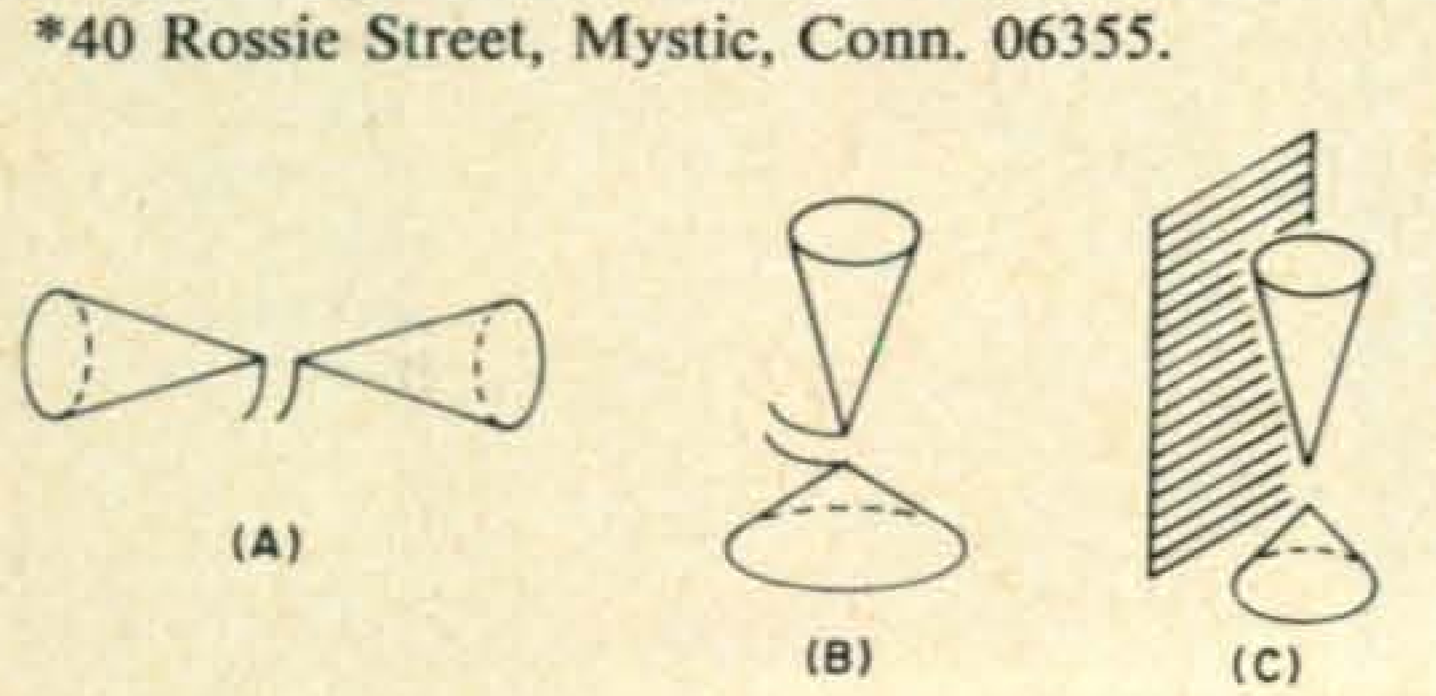

Fig. 1—Types of u.h.f. antennas studied for broadband h.f. usage. Horizontal cone dipole (A), vertical type (B) and vertical with reflector screen (C).

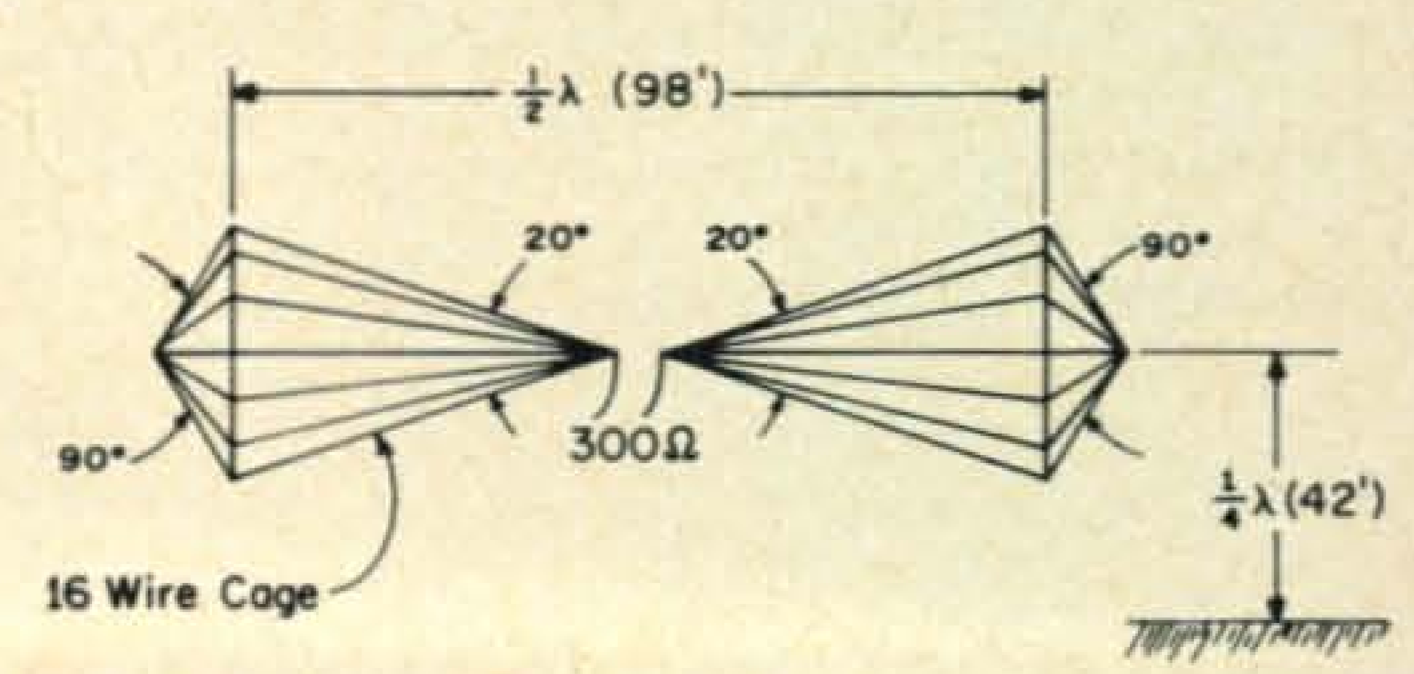

Fig. 2—Dimensions of large horizontal antenna which could be modified to extend down to 80 meters.

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giving continuous coverage of the h.f. range. They performed some very extensive tests on conical dipoles trying to arrive at the simplest design which would satisfy their needs. Courtesy of the RCAF, this article presents some of the results of their tests.

Experiments

The experiments were concerned with studying the three forms shown in fig. 1. Figure 1(A) is a conventional cone element dipole antenna of the type used at u.h.f. frequencies. Figure 1(B) is a vertical version of the conical dipole and Figure 1(C) is the same antenna shown at Figure 1(B) except that a reflector screen is added behind the antenna. The purpose of the screen was to determine if the basic design could also be used as a broad-band directive antenna.

The antenna elements were constructed of wire cages and both the number of wires in the cage and the angle of the cage was varied in order to determine which set of conditions produced maximum bandwidth with minimum design complexity. As might be expected, the greater the number of wires used in the cage, the lower the cone angle could be made and still retain the same bandwidth. Changes in the number of wires, if the cone angle was held constant, increased the bandwidth as the number of wires was increased. The impedance of the antenna also increased slightly as the number of wires was increased.

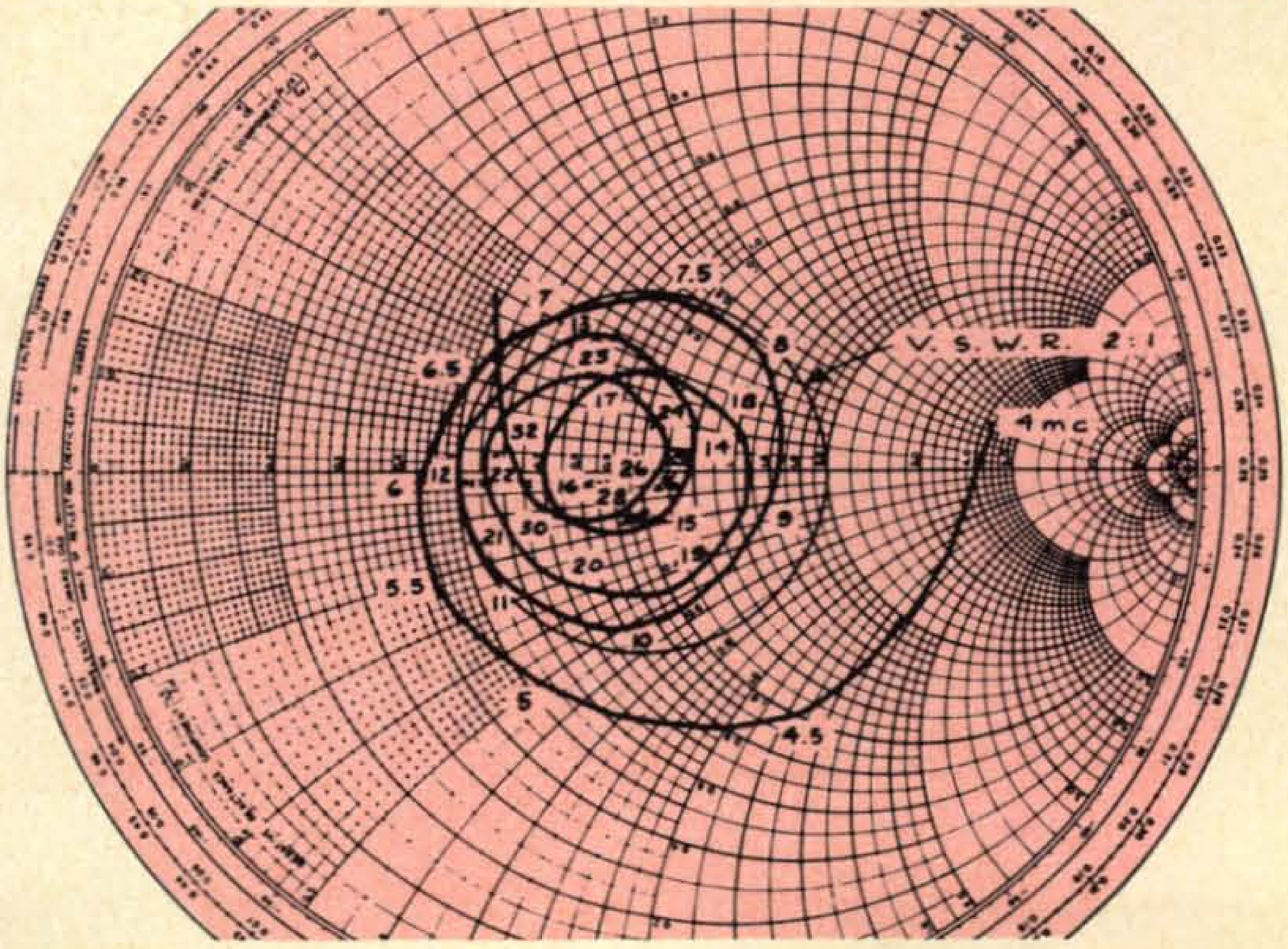
The height of the horizontal antenna above ground was also varied. Generally, the lower the antenna was made, with all other factors held constant, the bandwidth became smaller. A minimum height of ¼λ was found necessary to achieve a reasonably broad bandwidth.

Results

Various combinations of antenna cone configurations were found which would provide reasonably broad-band performance. A cone angle of 20 degrees for the horizontal antenna and for the upper cone of the vertical antenna was found to be the smallest usable which still permitted the rest of the antenna to be reasonably dimensioned. The number of wires in the cage was determined to be 16 since it permitted the 20 degree cone angle, was not too complicated to construct and also produced a convenient input impedance for the antennas. The input impedance of the horizontal antenna was 300 ohms and that of the vertical antenna was 150 to 160 ohms. While these values are not as convenient as a 50 ohm termination, they do permit the use of common baluns, transformers or transmission line devices as matching elements.

Figure 2 shows the dimensions and fig. 3 shows the Smith graph impedance plot for the largest horizontal antenna that was tested. As shown in fig. 3, the s.w.r. remains below 2:1 for all frequencies between 7 and about 33 mc. The s.w.r. rises below 7 mc, although not too rapidly, and reaches 4:1 at 4 mc. Undoubtedly if the antenna dimensions were increased slightly or if it were elevated somewhat higher, the s.w.r. at 4 mc would improve. It should be noted that the total length of the test antenna was about 98 feet which is short, anyway, for an 80 meter dipole.

With slight modification, the antenna



g. 3—Smith Chart impedance plot for antenna with mensions shown in fig. 2.

should work as a design which would cover 80 to 10 meters continuously. Generalized dimensions are given for the antenna in fig. 2 so the design size can be determined for other bands as well. A 40 meter model should do well beyond 10 meters. A 20 meter model will provide 20, 15 and 10 meter service as well as possible 6 meter coverage.

The horizontal radiation pattern of such an antenna is basically the same as that of a dipole broadside to the direction of the wire cage on the lower frequency bands and splitting into lobes on those bands where the antenna is longer than about 1.3λ. The nulls in the radiation pattern aren't as pronounced as those of a single wire dipole, however, and orientation may not be as great a problem as with a normal dipole. Their vertical radiation angle follows that of a normal dipole elevate[d] a similar distance above ground. If the an[-] tenna is elevated ¼λ on the lowest band thi[s] means, generally, higher angle radiation wi[ll] prevail on the lower bands and low angl[e] radiation towards the upper frequency limi[t] of the antenna.

Tests were also run on a small size horizon[-] tal dipole as shown in fig. 4 with the Smit[h] chart impedance plot shown in fig. 5. Th[e] dimensions of the antenna were somewha[t] short for 15 meters but if the elements wer[e] extended from 9 to about 11 feet each, th[e] antenna should easily provide continuou[s] coverage from 15 through 6 meters.

The vertical designs showed, generall[y] the same broad-band characteristic as th[e]

[*Continued on page 130*]

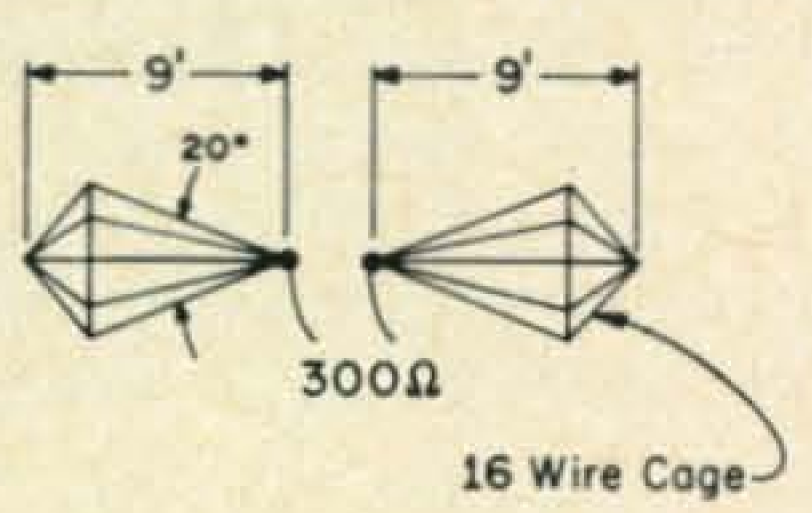


Fig. 4—Dimensions of small conical dipole antenna that can be modified for use from 15 to 6 meters.

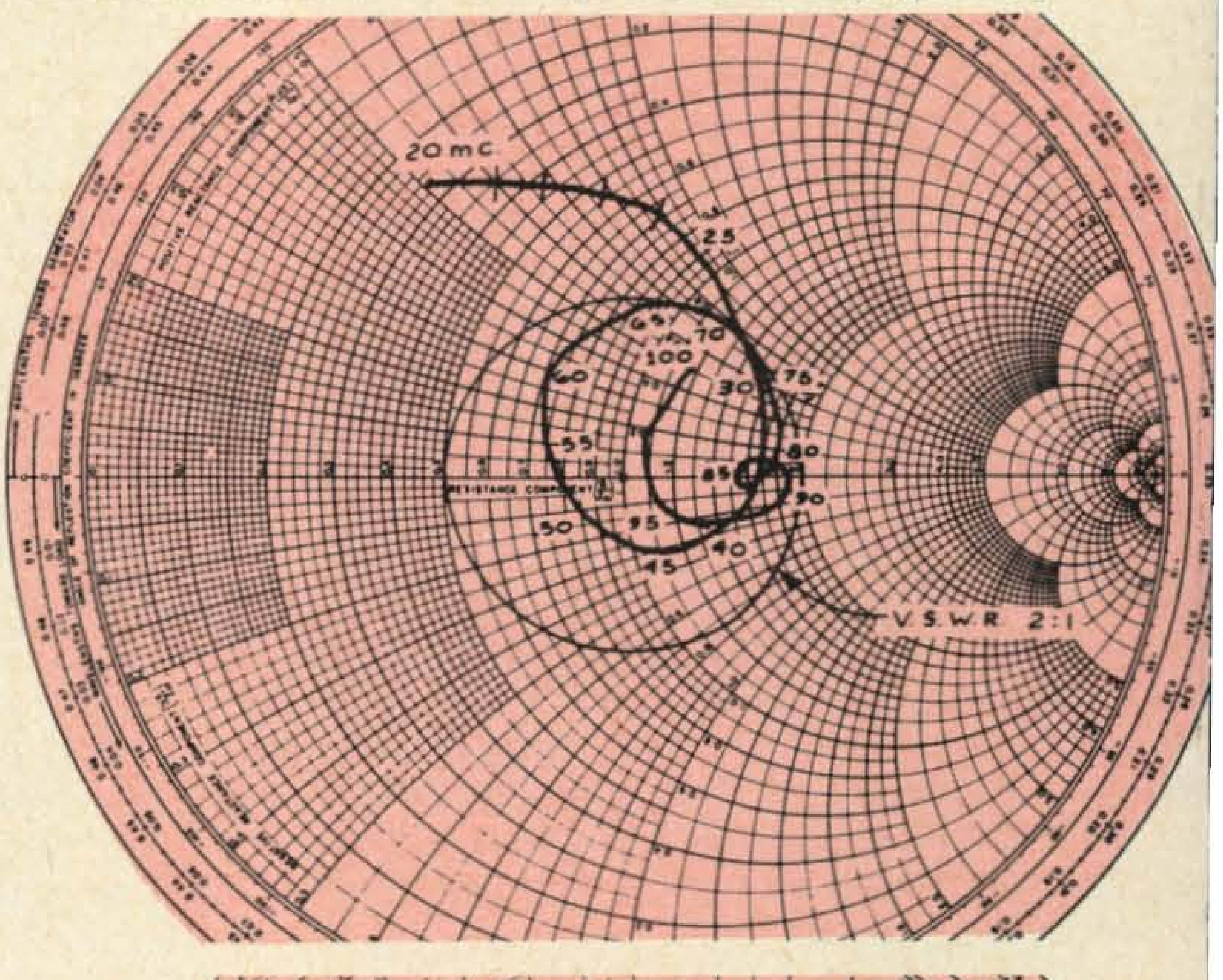


Fig. 5—Impedance plot of antenna of fig. 4. If made slightly longer, coverage of 15 through 6 meters is possible.

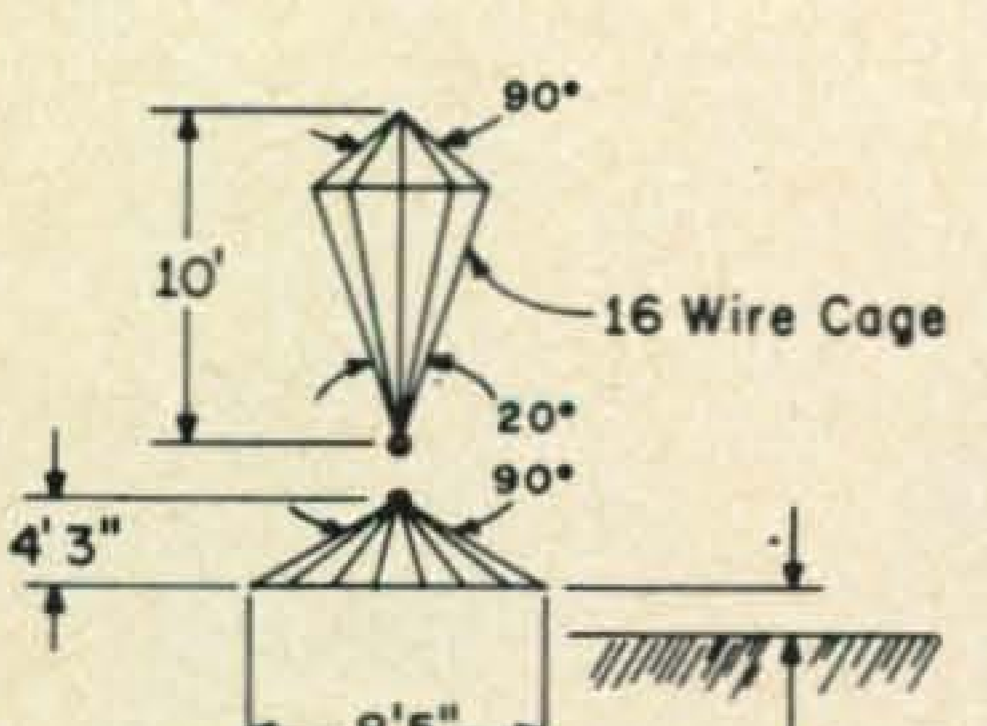


Fig. 6—Dimensions of vertical antenna.

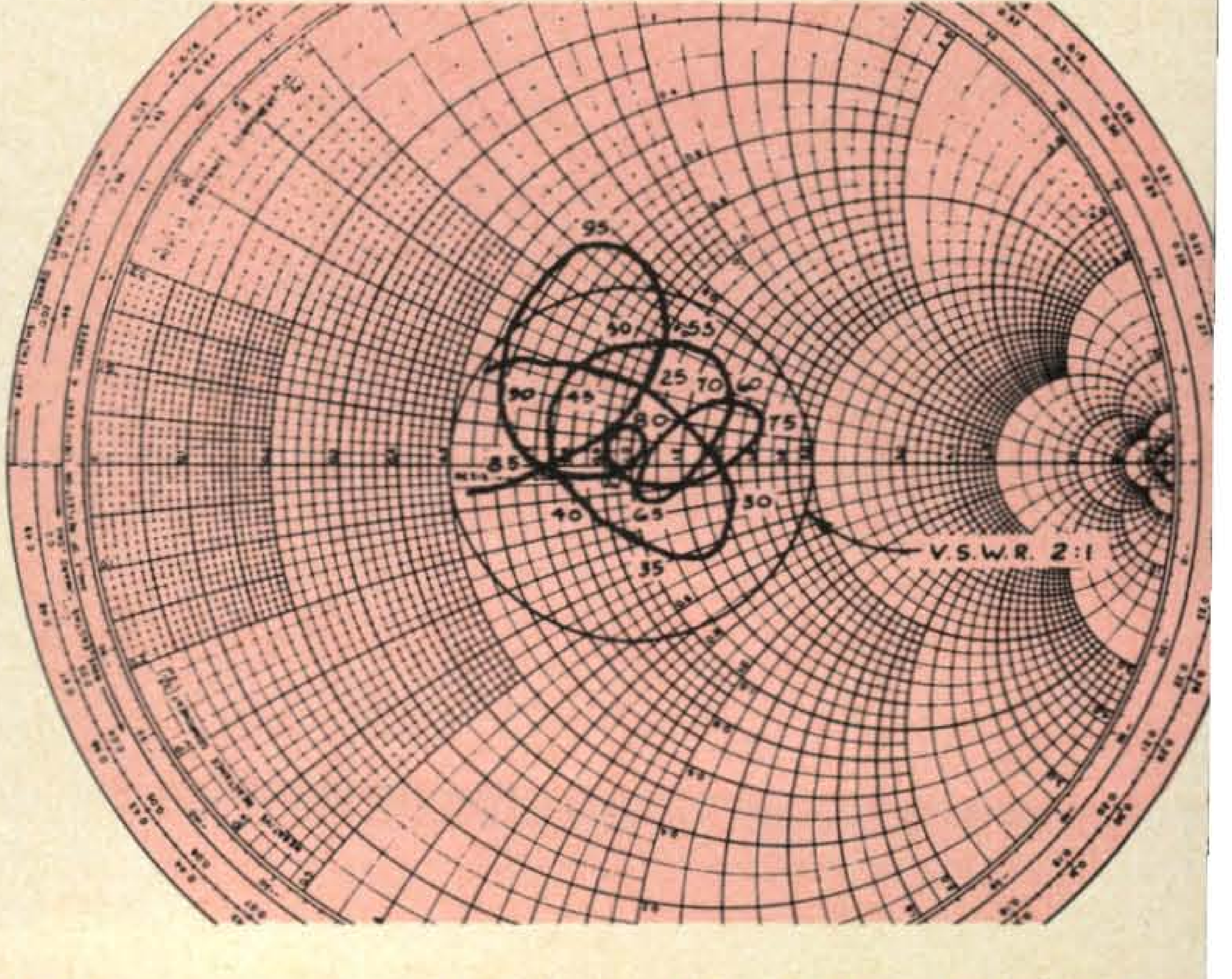


Fig. 7—Impedance plot for antenna of fig. 6.

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AMATEUR RADIO STATION DESIGN

BY LAWRENCE L. LEKASHMAN,* W9IOP

I NOTED with interest over a period of 'ime the absence of editorial material dealing ɲot so much with the techniques of amateur radio, but with the environment, *i.e.* the design of a comfortable and superior amateur radio station. The creation of a station design involves so many variables that it just isn't possible to set down a definitive standard which could serve as a guide for everyone. Most hams have done precisely what I did . . . over a period of time experience taught me many things leading to successive ir provements. Occasionally a good idea a peared in one of the amateur publicatior Frequently very excellent suggestions a peared in the general press dealing with ne materials for construction, new design idea etc. It has been my practice to collect the ideas so that my future construction cou benefit from them.

Having built more than half dozen go installations in my amateur radio experienc and perhaps another half dozen that were n very good, the general guidelines contain

* c/o Electro-Voice, Inc., 618 Cecil St., Buchanan, Mich., 49107.

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Years of collecting selected surplus equipment and some patience in designing and constructing equipment can result in an amateur station such as W9IOP. From a single operating position, any of two bands may be operated by merely moving from one electronic key to another. Split headphones make it possible to listen on two frequencies simultaneously. Redundancy for every function insures uninterrupted operation in a contest. A minimum of "built-ins" have been incorporated to provide flexibility for equipment changes and access in case of equipment malfunction. Every power supply, every transmitter, every operating control is a duplicate of every other one so there is no possibility of errors during the heat of competition.

in this material incorporate everything that I have found to be of consequence. Observing these guidelines can probably do for you what it has done for me. My hours of operating have been immeasurably enhanced by a pleasant surrounding. My family has been able to participate in my hobby at least to some degree by being able to enjoy these same surroundings in an environment that was just as friendly as any other living-room n the house.

Color schemes, the exact dimensions of your station, the number of electric outlets, he ceiling height . . . these things are most ikely dictated by circumstances of your suroundings, and are frequently not precisely what you would like, but what you must work with. Reading through this collection of notes will give you an insight into the deign and operation of my stations which have assed very successfully the test of good appearance, to be shared in by the family, to e enjoyed by myself and to be admired by ellow hams. Even more important, they ave contributed to extremely effective perormance under all types of operating. Good tation environmental design will surely contribute to good performance. It will in no ay reduce it.

Room Layout

Consider some of the generalities which pply to any station room design. There are e questions of room ventilation, adequate ghting and soundproofing so that the op-ration need not disturb other members of e household. Is the station protected against e elements, against uneven heat or exssive cold, can the area be isolated and osed to prevent unauthorized tampering ith your equipment? Are there facilities in hich to work which do not require you to ean up at the end of each work session, d yet will not get in the way of other members of the household? Should you treat your station as the least obstrusive element in a multi-purpose room or should it be the focal point in a special room or a special area?

In the layout of a specially constructed room for a ham station, so much depends upon personal likes and dislikes, available space, etc. that it would be almost impossible to give too much criteria to follow. For the neophyte who has never done this, one point to be considered is the placement of your door entering the shack. Too frequently it is assumed that the center of a wall is the right place and more often than that, it's the wrong place. By moving it to one side or the other, you open up a usable wall; as any good decorator will tell you, inadequate wall space is the bane of their existence. The more usable wall space you have, the better off you will be. Since you probably need a corner for a lounging chair or an old television set or some other discard from other parts of the house, an unbalanced wall will assure you of one long one which is what you are usually looking for—to place equipment against it or the operating desk itself.

By the way, if you have a choice of which end of the basement and in what direction your radio room is going to face, keep in mind that handy access to a lavatory is a nice convenience and so is the opportunity—all other things being equal—of getting to the kitchen to raid the icebox.

The best available location for your amateur radio station should be dictated by its relation to antenna feedlines. A location not quite so ideal from the standpoint of environment might be strongly preferred because it simplifies the problem of feeding antennas. This is to me the number one consideration; with the availability of adequate primary power the second major consideration.

If you can possibly include a closet in your radio room, you should. It's an ideal place

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The station of the late WINWO epitomizes the ultimate in a customized professional appearing amateur radio station. Few amateurs have the resources for this type of construction but, in variations, consoles have been widely utilized with effective results in operating convenience and an especially attractive installation.

to store bulky objects, bedding if you convert a couch occasionally into a place for one of your visitors, and innumerable other purposes that never occur to you until you have the proper storage space.

Fire Protection

No one likes to contemplate the possibility of a fire but wherever electrical equipment is in use that possibility exists. Neat workmanlike wiring of all cables will certainly minimize any possibility of fire from that source, Very careful attention to r.f. entrance and exit, particularly with open wire lines to the antenna tuner is mandatory. Some very substantial voltages can be built up in these areas, voltage which can jump surprisingly long distances to exposed metal parts. A good investment is a CO_2 fire extinguisher mounted permanently just outside the ham shack where other members of the family know of its availability in an emergency. And following good commercial practice, the fire extinguisher should be periodically checked. It's useful not only to have around the ham shack but to have it in the house where furnaces have been known to backfire and appliances occasionally go up in smoke.

Station Wiring

In contemplating a special room for your station, the more obvious factors come to mind quickly. For example, 220-volt primary power should be employed if it is available. The most satisfactory method I have found to minimize interference with household lighting, particularly if you like to work c.w. with a full kilowatt, is to have a 220-volt line run from the house service entry directly to the station and terminated in a switch box. You can then wire from the switch box to your station and to your workshop if you so desire.

It goes almost without saying that wiring done today should use the new 3-circuit grounded pin outlets. Be very careful to prominently mark all 220-volt outlets. Generally speaking, this should be done immediately upon installation. It is hard to believe how easy it is to forget and plug 110-volt appliances into 220-volt outlets. It isn't a bad practice to leave a dummy plug in any 220-volt outlets that might be mistaken by a member of the household who is planning to vacuum clean your radio room or polish the floor with an electric polisher. Another more positive safeguard is to use electric range outlets for 220-volt exclusively.

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In every radio room, one circuit should be ndependent of your equipment. If you blow fuse it is important to have one light at east stay on in the shack. Usually this is asily accomplished because basement overead lights or spare rooms are already wired n the household circuits. If you run in an ndependent line for your equipment and e balance of your station accessories, you ill have the original wiring to use as a standy circuit.

Illumination

In each station that I have designed the uestion of illumination became increasingly nportant, probably as an axiom that one's esight requires more attention as one gets der. There are four principal areas in a ell-designed shack that require special conderation; the operating position, the area rectly behind the transmitter, illumination r reading if furniture is placed in the radio ack, and a source of illumination when tiviating the on/off switch as you enter the ack. Do not place the 110-volt wall outs on the on/off switch as you come into shack! This same line in my shack prodes 110-volts for my receivers and since it my practice to leave the filaments on at all es, the entrance switch was really useless til I rewired the lighting circuit.

The ideal source of illumination for an erating position is the type of commonly ailable fixture, which is suspended with ounter-balance which permits you to raise and lower it at will. It makes for a much er operating position not to have a lamp the desk itself. It is one less a.c. cord to in the way and you can push it out of r vision to work on your equipment or er it for your convenience if you are ng to do very much writing. A mistake I e made, and which should be avoided, e use of recessed fixtures in the ceiling he shack which gives such poor illumina- that the general appearance of the room epressing. If you are going to use ceiling ts, use lights that project below the ceil- lines and give a reasonable amount of nination. It is much more cheerful when are showing off your shack.

Flooring

onsider carefully the question of the in your radio station. There is extremely ctive linoleum and tiles of every detion, either of which provides an economical and attractive means of putting down a floor either above or below grade. Remember that sufficient time should be allowed for the flooring to properly adhere to the substrate. Remember also that heavy equipment and furniture does mark most of this flooring, so you should plan carefully the placement of permanent heavy objects in your station as early as possible. You will find that to place equipment in a room with a linoleum or tile floor and then move it any substantial amount later will leave unsightly marks on the floor which are virtually impossible to remove. From personal experience, I recommend using any of the spatter or mixed color combinations. Avoid solid colors. Just an occasional cleaning of a floor, if it has a design which tends to mask dust, is all that is necessary, whereas solid colors show just about everything that settles on them and requires far more attention. Advice from the housewife in this area can prove helpful for future maintenance.

Moisture Precautions

All of my ham shacks have been located in the basement. If you have lived in a home for any length of time, you have complete knowledge of moisture conditions in the basement. If you are new in a house, my experience has been to proceed as far as possible in construction of a radio room but not put on the final siding until I have had an opportunity to go through some foul weather to make absolutely certain there is no moisture penetration. The biggest difficulty encountered in basement stations has been water coming, not through the walls, but from overflow from washing machines in the basement, from leaky pipes and continuously from outside window wells that seem to fill up unexpectedly and leak through the windows. If it is at all possible, have a drain in the basement. The drain must be equipped with a backstop so that this in itself will not be a source of water in the basement. It is a highly useful consideration that I neglected on one occasion to my regret. There is nothing more frustrating than to be bailing out water from the radio room, and pailfulls of water will look like a flood. Flooding is not a cause for alarm if you have designed your room carefully. You should not have wiring or equipment directly on the floor. A few inches clearance will be all that is required to avoid trouble, except in the case of a catastrophic flood. There are innumerable preparations

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Neat and convenient operating posi-
tions are not confined to American sta-
tions nor do they have to be elaborate.
This extremely typical European DX
station is the well-known Yugoslav
DXer YU3AT. It is a conclusive indica-
tion that neat equipment is compatible
in a living area.

now for waterproofing the inside of a basement which tends to be moisture prone—but this is not a job for an amateur if you are going to install a lot of expensive equipment. If you do have a moisture problem consistently in your basement or if you encounter it with a new house, spend the time and effort to get some professional advice locally.

Room Size Consideration

Not everyone is fortunate enough to be able to select the size of his radio room, but frequently if you are selecting an area of the basement you do have this option. While every radio room is a personal matter, a word of caution about getting too enthusiastic about size! You do have to heat your room in the winter and a very large area presents problems. Likewise if you have central air conditioning, a somewhat smaller room is easier to control when the cold air tends to settle into the basement. The right size will contain your equipment, adequate furniture for visitors to be comfortable and not too much waste area to have to be heated on a cold winter morning when you'd like to operate and just about the time the room gets to a comfortable temperature, you have to leave for work. Consider carefully the question of heating and cooling in laying out the physical dimensions of your proposed station.

Sunlight and Glare

When you are fortunate enough to have good windows available in your radio room, you must consider the placement of your operating desk in relation to excessive sunlight. My first inclination in earlier stations was to have the desk face the window and this proved to be very annoying, particularly after an all-night session when sunrise re sulted in an intolerable amount of light di rectly in my eyes. Of course, good blinds curtains and other window coverings ca control sunlight if you have no other optio and if the view is worthwhile this is a per fectly acceptable alternate. But the place ment of the equipment in respect to th amount of light coming in through your win dows, and where it comes in from, is an im portant consideration in the early plannin stages when you are figuring where to ru your wiring lines, where to place furnitur and where to place door openings if you ar building the room from "scratch".

Radio Frequency Interference Shieldin

While television interference is a dimin ishing problem in most parts of the Unite States, it is not something to be overlooke when you do have the opportunity of plan ning your station initially. The most com mon approach to complete shielding of radio shack has been to use copper wi dow screen carefully bonded together ar grounded. The problem with this approac is the complexity of properly shielding th door, but it can be done and it does wo as demonstrated by many successful insta lations. In recent years there has come the market thin foil, both copper and alum num, which is specifically manufactured f shielding purposes and which has the add tional advantages of providing some insul tion if it is desired. My personal choice co tinues to be good shielding of the transmitt cabinets, without making the effort to shie

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the entire room. This eliminates the necessity of careful bypassing and shielding of a.c. and other lines coming into the room which can be more easily handled at the transmitter. There are definitely materials which can now be handled by the amateur craftsman which make complete roomshielding far less of a chore than previously and if you are contemplating construction in an area where TVI is still a severe problem, further thought should be given to the total room shielding approach. Then, too, there is the room within a room, selecting only the area which will contain the transmitters. This is not too sightly but it is a method which eliminates some of the drawbacks of a completely shielded room.

Cables

How do you connect lots of equipment, run in all kinds of a.c. lines and antenna leads and still keep the room from looking like the proverbial rats' nest of yesteryear? Whether building your shack or converting an existing room, the same procedure has proven effective and very goodlooking. Run a raceway, consisting of a duct or channel around the area which will encompass the operating position and the transmitters. This will permit you to insert or to remove cables for control purposes, interconnections of units and all other functions at will. It has been my experience that you can never accurately estimate exactly what you need, with the result that you either have too few or too many cables for any given tasks. If you want to get very deluxe, you can use a hinged raceway or if you are going to make a more or less permanent installation, there is nothing wrong with screwing down the cover with appropriate entrance ways and exit ways for cable throughout its entire length.

Keep the raceway off the floor. Generally speaking, behind the operating desk, I recommend a height of about 28 inches which gets it just below the top of the desk which is convenient to reach your equipment and yet keeps unsightly leads off the floor where they will show on the front of the operating position. Behind the transmitters, if you have racks as I have always used, keep the raceways at least four or five inches off the floor so that if you have a water problem, you are not going to be in serious difficulty. In order to take the leads from the wall to the racks I either bring the cabling in from the end

Adequate storage for small parts and concealment for unsightly electrical outlets is simply handled by plywood storage cabinets flanked by bookcases for the inevitable ham library. This typical cabinet can be handled by the use of the simplest hand tools and little experience with woodwork.

of the room which does not normally provide access to equipment or used conventional wire mold, which is readily available, for the short distance from the wall to the racks.

Another very important and obvious and frequently ignored procedure is to properly identify the termination of all the cables *as you install them*. This chore has been made immeasurably easier by the very excellent tape printing devices which are available everywhere. It is a simple procedure which if done initially will save the risk of damage to equipment through incorrect connections and a lot of aggravation at just the time when you cannot afford it. In addition to marking all cable terminations with distinctly different colored tabs, I have also used enamel paint to color-code the leads in a bright and bold fashion so that additional identification is quickly available. A set of paints, which might cost a dollar or two, will do the job in an evening's time. When you run your interconnecting leads from one part of the room to the other, do not run them into equip-

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Limited space can be utilized with great effectiveness if some forethought is given to the layout. The total area occupied by this setup at W2IOP is sixty inches by sixty inches. The transmitter is recessed and flanked by bookshelves which are backed up by dead storage for spare parts, test equipment and seldom-used reference material. This installation is equally at home in a family room, a playroom or a basement.

ment directly. Use barrier type terminal strips, well marked. This will give you, a much neater installation and maximum flexibility for the future. It has been my practice always to use a standard desk for an operating console. I have allowed sufficient lead length between the desk and the barrior strips on the wall to permit pulling the desk away and working on leads, connections or adjustments as called for. The lead length necessary to accomplish this still should not drop to the floor, thus with the desk in its normal operating position, you have an uncluttered, clean appearance without anything to tangle in your feet and without anything to get water-damaged should you have trouble with flooding.

One final word of caution: Use top quality cables when you put them in any concealed area. Old surplus cable of questionable parentage will deteriorate surprisingly fast. It's a good idea to use good quality cable, preferably not from war surplus stock, which at this point has outlived the normal manufacturers' longevity for the installation. Any new standard brand is totally acceptable.

Antennas and Indicators

One very important lesson I learned is, if you can do it, bring your antenna in from above the transmitters. It is not as attractive as bringing leads in from behind, but it is very annoying to have to walk behind racks of equipment, ducking under coaxial antenna leads. Bringing leads in from above eliminates the problem of avoiding coaxial leads. On more than one occasion in the excitement of a contest, I have run into such a lead, ripping the cable from the connector causing considerable delay unnecessarily. Another trick that I learned early is that if you are bringing heavy cable in from outside, such as a 12-wire control lead for a rotator, it is a good idea to terminate it in a convenient place and then go to more flexible, lighter cable. Usually you need heavy, waterproof cable for outside; inside you only have to be concerned about the heavy pair for the a.c. line; the balance of the control leads can be light. While you may not consider the necessity for removing your beam indicator more than infrequently, if you have the patience to do it originally, installing a multi-pin connector on the indicator back, using one of the heavy duty miliis well worth the simple "connect and disconnect" routine in the future.

Tuned Feedlines

The problem with termination of tuned antenna lines might be considered under a general question of lead placement and concealment. It has been my practice to always terminate the antenna lines at exactly the prescribed feedline length without regard to where this point might be. By using a simple reversible motor to tune the antenna feeders if this point is outside of the shack, three leads to control the reversible motor plus a coax line make a completely adequate installation. If you are going to work a number of bands employing a zepp antenna, it is more practical to use individual zepp tuners which can be switched as you go from one band to another. This is a simple method as compared with the considerably more complex arrangement of using a Selsyn indicator for retuning on each band. If you have to retune on each band, you are still faced with the necessity of changing coils, a chore completely eliminated with the separate tuner. Since I have always used a zepp on 80 and 40 and never on any other band, it is a relatively unsophisticated switching system to take the lines and switch them.

See page 142 for New Reader Service

Workshop Area

In every station that I have constructed I have been in favor of a formal station of smaller dimensions using some of the area available for a workshop. This made it practical for me to have a separate workshop area where the untidy remains of a technical problem needn't interfere with a neat station or where a project that spread out over a considerable amount of time could be left unattended without creating a mess. My experience indicated that the workshop required little more than a work bench, a vise, an electric drill, a reasonable assortment of good hand tools, storage space for spare parts and test equipment and good illumination for the bench. The fittings for the properly equipped amateur radio workshop is probably a subject for a very comprehensive study and the purpose of mentioning it in this compilation of station design ideas is simply to point out that I have always considered the shop portion separate and extant from the operating station.

Recording

Provide in your shack a place for a tape recorder. One of the most interesting sidelines of my operating in recent years has been the recording of unusual contacts and unusual situations on the band. If you can find time to edit these tapes they become a memorable and worthwhile collection to have. I suppose they are somewhat like movie film—everybody expects to edit his footage carefully when he has time and may be a great project for retirement. If you note on the box containing the tape, the log and the page entry, it gives you a reference point to come back to for editing at a later date.

Miscellaneous

Little things contribute to overall convenience of your ham shack also. Among some of the more useful miscellaneous ideas are these.

Do maintain a clock on GMT. It is also a good idea to keep a clock on local time. You can obtain clocks with two hour hands, but it not, get yourself a second clock. A good 24 hours clock is an investment that made once will be useful so long as you are interested in amateur radio. The best clocks that I have seen for this purpose are widely distributed in Europe. You see them at every public building. They are variations of the 24 hour digital clocks sold in this country, but usually four or more times larger. Some of these European

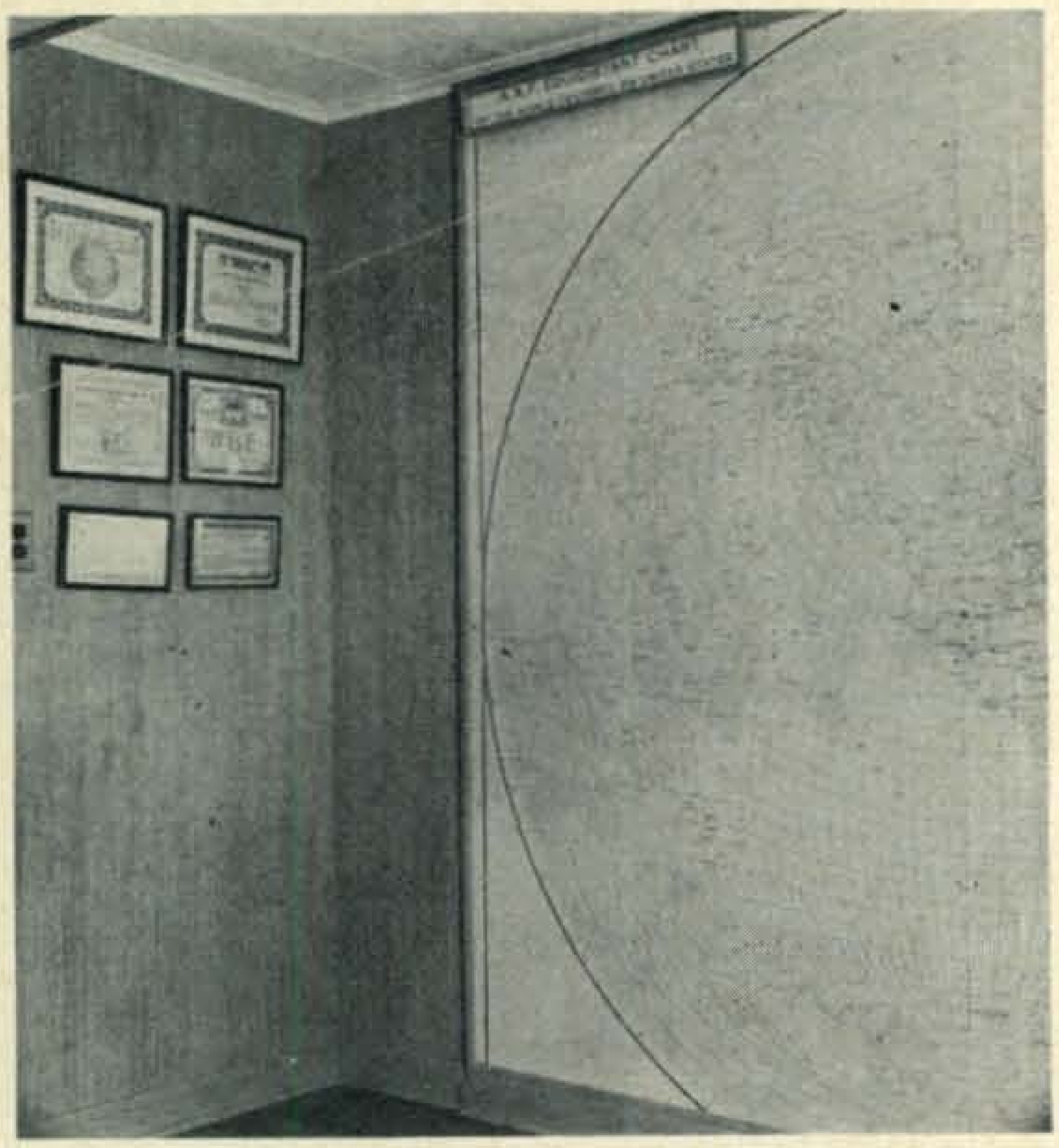
If you wonder how some stations remember the name of previous QSO's, look at this simple but effective index file which is part of the operating position at W9IOP.

beauties include calendar clocks giving the date and the day of the month, but they represent a very sizeable investment and I pass the information only as something to think about. Whatever kind of timepiece you use, place it in a prominent spot in your shack where you do not have to turn your head t olook at it. If you decide to operate in a contest and have to turn your head many times each hour to observe the time, you will find that fatigue won't knock you out of the contest, it will be a stiff neck that can be most uncomfortable.

Keep an organized file on technical data associated with your station. If you do not use a desk for a noperating console, for a modest investment you can get a file case which will provide storage not only for important documents, but for QSL cards. The type of material which should be kept in a prominent file are pencil diagrams of equipment you have built; of control hookups; of manufacturers instruction books; and of reference material which you might have used for guiding you in the construction of equipment or antennas. In addition to technical data, if you are very active, it pays to maintain a file of contest forms, contest rules and regulations, and award information. My practice has been to maintain in this same file a suitable place for photographs, for unanswered QSL cards, and also personal work papers concerning our household. For example, I maintain in this same file data on appliances used in the house which are frequently difficult to locate when in need. More than once my wife has lebeled it the "hero" file.

Don't overlook bookshelf space. If you are anything like me, you will collect back

ee page 142 for New Reader Service



Government maps make inexpensive and strikingly effective wall covers. They are available in virtually every size and shape imaginable in full color, at costs which are even less than inexpensive wallpaper.

issues of your favorite amateur magazines, books about many of the countries that I talk to, and interesting souvenirs of foreign travel, technical books, hand books, and occasionally just good books for reading. They look handsome in a radio shack, especially if you have the proper place to store them. Bookshelves are a curiously overlooked feature of many good amateur stations.

Do you enjoy QSL cards? The exchange of QSL cards is a pleasant aspect of ham radio. If you don't let the paperwork get away from you, you can handle the task of cards effortlessly, and over a period of time build up an interesting collection. An excellent investment is a file cabinet designed to take legal size cards instead of 3x5 cards. If you start keeping your cards in such a file, over the years as your collection grows, you can maintain it simply and generally add drawers to the file. Answering QSL's promptly when they are received and filing them regularly, is the only way I know of beating the paperwork jungle. If you happen to be blessed with an exotic call, then of course keeping up with the paperwork is a never ending battle. You can get surprisingly strong and durable paper file cartons from any stationery supply store, files that are normally meant for keeping cancelled bank checks and similar documents. They are superb for QSL cards and make an expandable and inexpensive file system.

Label your controls . . . your switches . . . your antenna leads. When you make your original installation there won't be any question in your mind exactly what function each part or circuit performs, but occasionally you will have visitors operate who won't be nearly as familiar with the equipment as you are, and time progresses, your own crystal clear memory of why and how you did something might fade. Good labeling is a small chore in the beginning which will pay big dividends in increased operating ease and in simplified trouble-shooting if difficulty does develop, as it surely will.

Invest in a good pencil sharpener. There is nothing more aggravating than to be looking for a sharp pencil when you haven't got one. It isn't terribly important advice, but surprisingly a detail overlooked frequently.

Maps, pictures and other decorations should be added slowly and with some significance. If you consider all of the interesting things that may have happened, or will happen, in your career as an amateur, many of them are worth recording permanently to look back upon with nostalgia. As for example, a collection of pictures of your ham stations as they progressed makes an interesting wall decoration, and preserves photographs that somehow do get lost over time. There is virtually no limit to what can be done, including your first QSL card; memorable contest results; unusual publicity about your station or station activities; photographs of the family, etc.

Recently I admired some needlepoint done by my sister-in-law who proceeded to make for me a needlepoint enlarged version of my personal QSL card, a most unusual and handsome wall piece.

At this crucial point in your design considerations, let me emphasize again a suggestion from an old pro—*don't* make your radio station a special domain for you alone. If the shack is cheerful and pleasant, other members of your family and visitors can enjoy spending time with you and get exposed to our hobby and perhaps share in your enjoyment. The true test of how successful you are in planning your station is if your wife takes visitors into it and shows it off with pardonable pride. When you have achieved this stature, you probably have a station which incorporates many of the parameters discussed in this article. ∎

See page 142 for New Reader Service

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The HW-18 Series . . . CAP, MARS & 160 M Transceivers. 200 watts PEP SSB input. 25 watts input with carrier for AM station compatibility. Crystal filter, ALC, PTT, S-meter.
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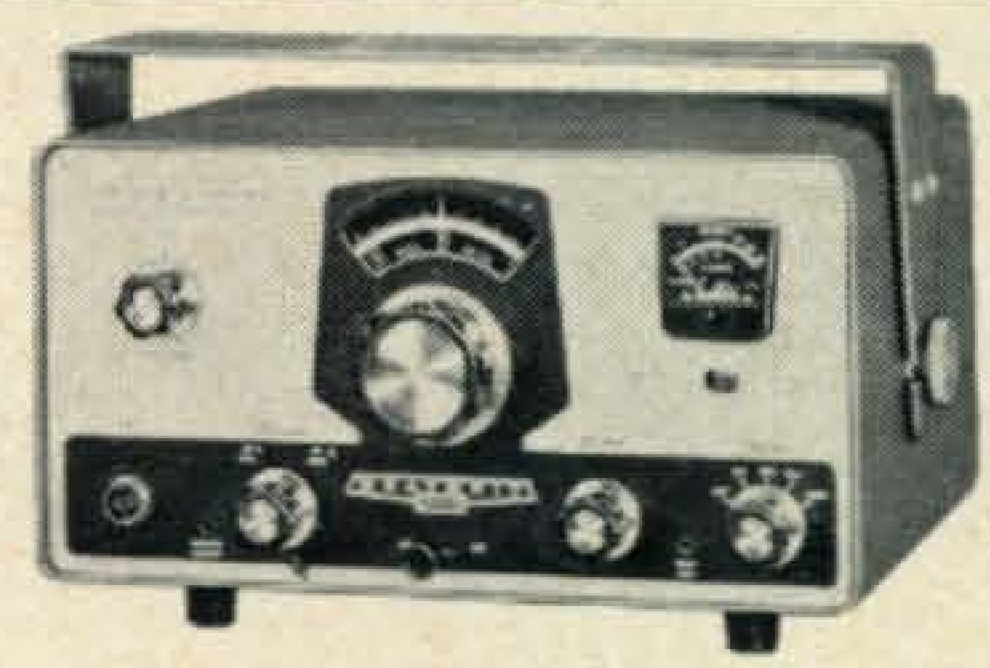

The Single-Bander Transceivers . . . provide 200 watts PEP SSB input on the band of your choice. Now with LSB or USB on 80, 40, or 20. New styling, plus AVC, ALC, S-meter, PTT, and VOX.
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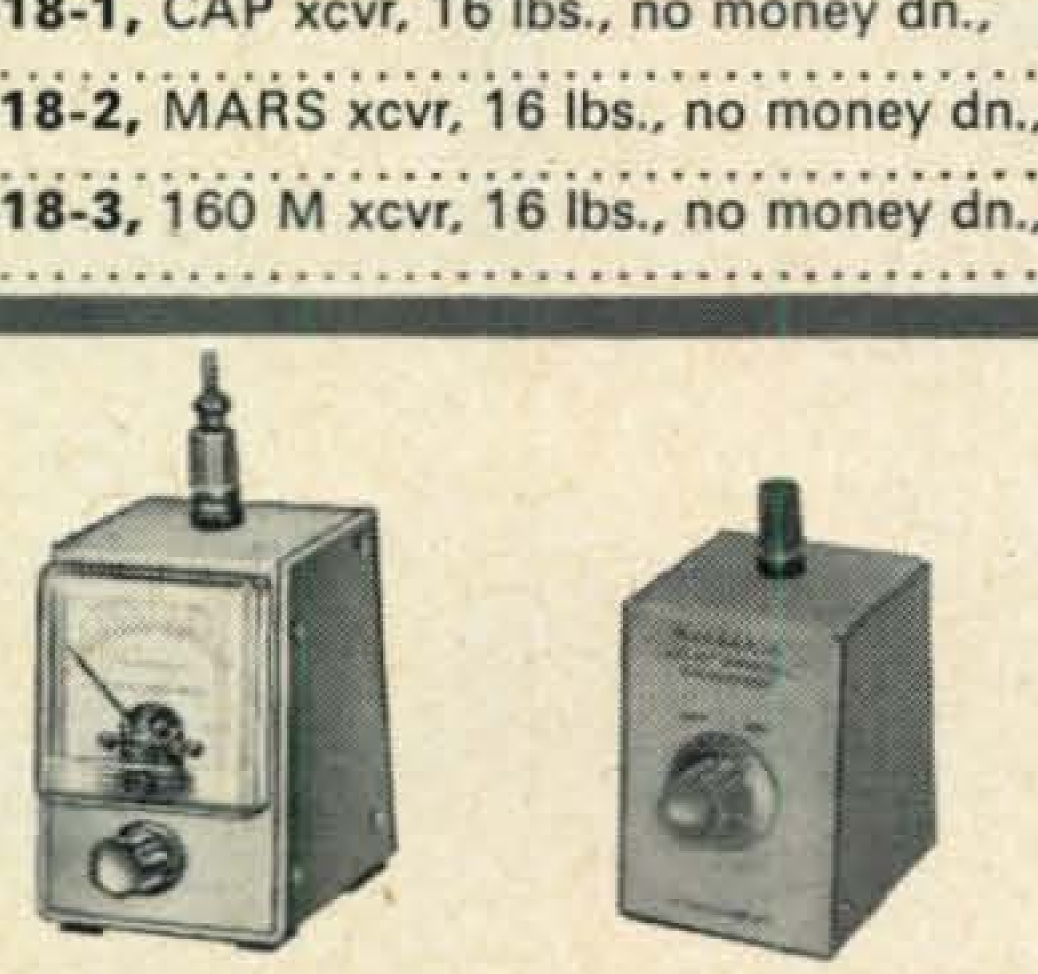


Amateur Station Accessories . . . PM-2 RF Power Meter indicates transmitter relative power. Covers 100 kHz to 250 MHz. No power connections or battery required. **HD-20 100 kHz Crystal Calibrator** provides accurate calibrating signals every 100 kHz up to and beyond 54 MHz. Uses 9 volt battery (not included.)
Kit PM-2, 2 lbs. **$12.95**
Kit HD-20, 1 lb. **$14.95**

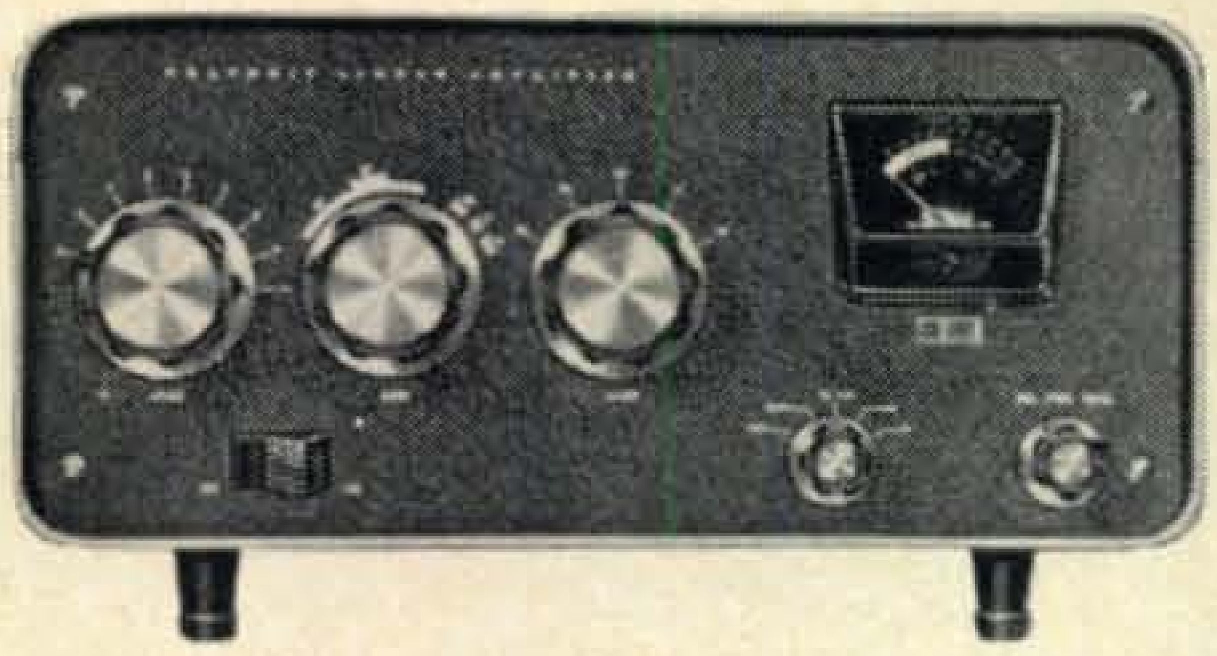
Tools For The Amateur Station . . . HN-31 "Cantenna" Transmitter Dummy Load . . . provides a non reactive 50 ohm load to transmitters up to 1 kw . . . better than 1.5 SWR for frequencies 160 to 2 meters. Oil coolent not included. Soldering iron kits, needle nose pliers, nut drivers and more are included in the new 1968 Heathkit catalog.
Kit HN-31, 3 lbs. **$9.9**

HM-10A Solid-State "Tunnel Dipper" . . . a solid-state version of the classic grid-dip meter. Features a tunnel diode oscillator. Covers 3 to 260 MHz. Uses an AA penlite cell (not included.)
Kit HM-10A, 3 lbs., no money dn., $5 mo. **$29.95**

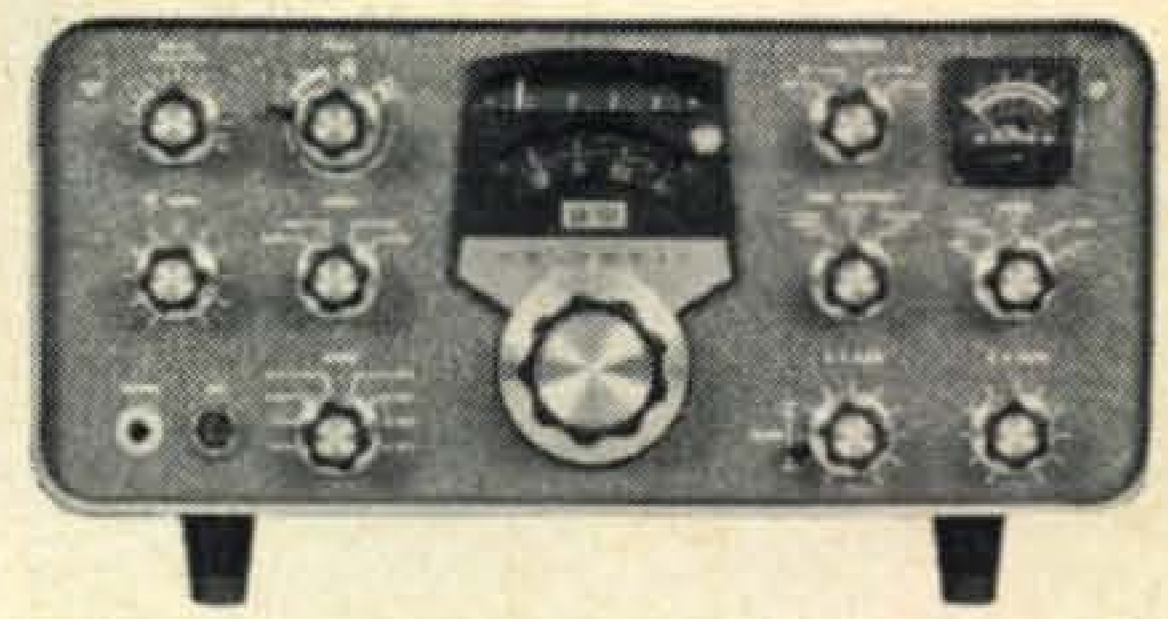
Benton Harbor Lunch Boxes — Complete Transceivers . . . for 6 and 2 meters. Feature crystal-controlled transmitters with 5-watt input and tunable super-regenerative receivers with RF stage. Built-in 115 VAC power supply and speaker. Mike included. Less crystal.
Kit HW-29A, 6-meter, 9 lbs., no money dn., $5 mo. **$44.**
Kit HW-30, 2-meter, 9 lbs., no money dn., $5 mo. . **$44.**
Kit GP-11, Mobile Vibrator Power Supply, 6 lbs. . . . **$17.**

Selection of Amateur Radio Kits

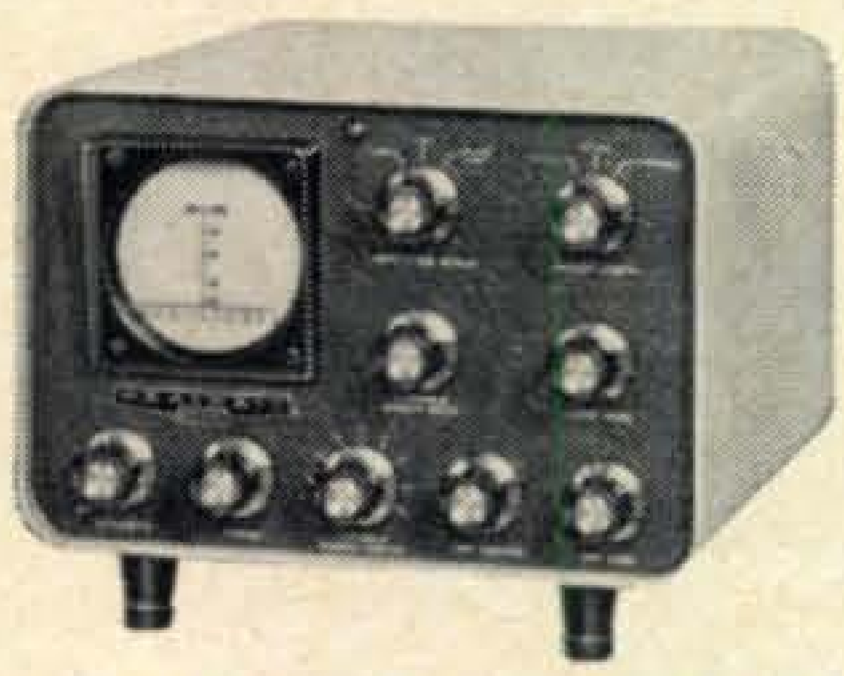
FINE EQUIPMENT AT LOWER COST



SB-200 KW SSB Linear Amplifier . . . 1200 watts PEP input SSB, 1000 watts CW on 80 through 10 meters. Built-in antenna relay, SWR meter, and power supply. Drives with most popular SSB transmitters & transceivers.
Kit SB-200, 41 lbs., no money dn., $21 mo. **$220.00**



SB-101 80 Through 10 Meter SSB/CW Transceiver . . . 180 watts PEP input SSB, 170 watts CW. Front panel selection of SSB filter or optional CW filter makes the SB-101 an exceptional CW rig. Unmatched in engineering and performance.
Kit SB-101, 23 lbs., $37 dn., $35 mo. **$370.00**



B-620 Amateur Radio Spectrum Monitor . . . displays ll received signals up to 250 kHz either side of receiver uned frequency. New narrow sweep function shows 10 Hz for single signal analysis.
it SB-620, 15 lbs., no money dn., $11 mo. **$119.95**

SB-640 External LMO . . . provides an additional LMO (Linear Master Oscillator) for independent control of SB-101 transmitter and receiver frequency.
Kit SB-640, 9 lbs., no money dn., $10 mo. **$99.00**

B-310 Shortwave Listener/Amateur Band Receiver . covers 49, 41, 31, 25, 19 & 16 meter bands plus amateur ands 80, 40 & 20 and 11 meter CB. SB-Series performance nd quality (less speaker).
it SB-310, 24 lbs., no money dn., $23 mo. **$249.00**

SB-600 Communications Speaker . . . matches the Heathkit SB-Series line and includes space for HP-23 fixed-station power supply. Features an 8 ohm 6" x 9" speaker with 300 to 3000 Hz response.
Kit SB-600, 6 lbs. **$18.95**

mmunications Microphones & Solid-State Elec-nic Keyer . . . Heathkit recommended microphones for timum voice communications. Electronic keyer features ilt-in sidetone to provide audio monitor . . . no relays to k or chatter . . . speed ranges 10 to 20 wpm and 15 to wpm. Grid block keying transmitters only.
P-21A Desk-top microphone, 4 lbs., money dn., $5 mo. **$29.40**
-12A, Hand Held PTT Mike, 2 lbs. **$8.50**
-10 Electronic Keyer, 6 lbs., no money dn., $5 mo. **$39.95**

A Complete Line Of Test Instruments . . . to provide the ham with professional instrumentation at a price he can afford. Features **New Heathkit Instrumentation Series** . . . solid-state Volt-Ohm meters, power supplies, and more! See the "new look", new performance instruments in the 1969 Heathkit catalog.

Turn Page for More Heathkit® Values

THE SIGNAL SOUPER

BY K. K. DOBLER*

The Signal Souper contains an audio filter, audio oscillator and trigger circuit. It permits a noisy and weak c.w. signal to trigger the internal oscillator to produce a clean c.w. signal with no background noise.

THE Signal-Souper is a c.w. filter incorporating a "single-signal" circuit. It consists of a dual-triode (12AX7) with one section operating as an audio filter and the other as an audio output stage. Between the filter and the output stage is a blocking circuit that is triggered by the received c.w. signal. The action of the circuit is such that the only signal appearing at the speaker is the desired signal. All other signals and noise are blocked.

What It Does

The desired mode of operation for the Signal-Souper is chosen by the SELECTOR SWITCH. There are three choices of operation. In the first position, the audio signal is bypassed through the Signal Souper and the receiver operates normally.

In position two the c.w. filter functions and the REGENERATION CONTROL peaks an amplifiers the desired signal.

The third position of the SELECTOR SWITC cuts in the triggered circuit. In this positio the only output from the speaker is the de sired signal, assuming of course that it is o a certain minimum strength and above th noise level.

The PITCH CONTROL allows a choice of an of three different audio frequencies to b peaked.

When the triggered circuit is operating, th neon lamp flashes off and on in sync with th signal.

The DUAL SWITCH feeds a small portio of the signal around the triggered circuit t aid in tuning and adjusting when in positio 3 of the SELECTOR SWITCH. It may then b switched off for complete noise-free recep

* 649 Savoy Street, San Diego, California 92106.

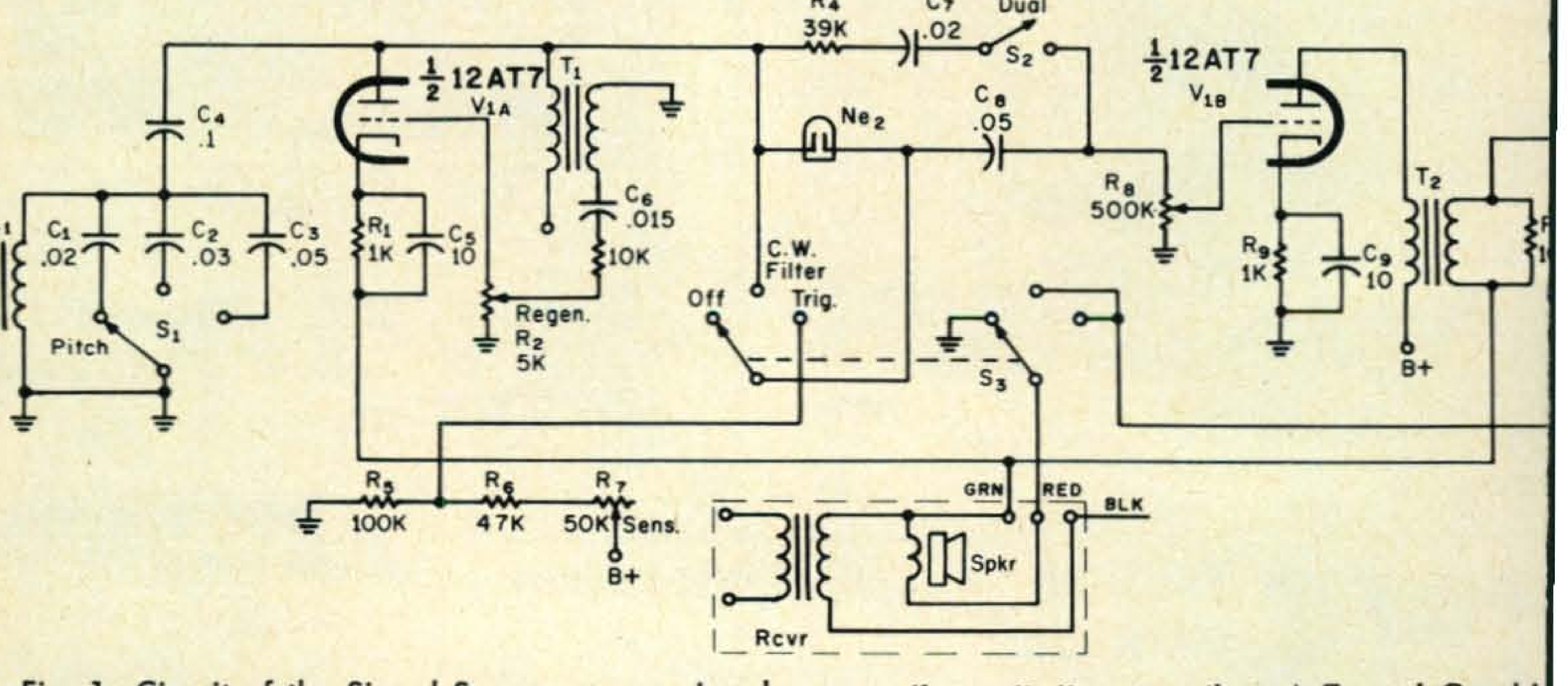


Fig. 1—Circuit of the Signal Souper, a c.w. signal filter and trigger. All resistors are ½ watt, 10%. All capacitors are in mf and are rated for 400 volt operation with the exception of C_5 and C_9 whi can be rated for 6 to 12 volts. Controls R_2 and are linear tapers while R_8 has an audio (log) tape

T_1—A.f. trans. 10K pri., 90K sec. Triad A-31X or equiv.

T_2—Output trans. 5K to 3.2. ohms.
L_1—2h-Triad C-2X or equiv.

See page 142 for New Reader Servi

tion. Where there is appreciable fading the signal level may drop below the trigger point. When this condition exists the DUAL SWITCH may be thrown on again thus feeding a sufficient signal through so that continuity of copying is not lost.

How It Works

The signal from the receiver is taken from the secondary of the output transformer and fed into the Signal Souper through position 2 or 3 of the SELECTOR SWITCH into the cathode circuit of V_1.

Much of the background noise and most of the interfering c.w. signals appearing at the plate of V_1 are shunted to ground through C_4 and the parallel circuit of L_1 and C_1, C_2 or C_3. Everything, that is, except the desired signal which is tuned so that it equals the resonant frequency of the chosen parallel circuit. At this frequency the parallel circuit offers a high impedance path to ground and the desired signal is not shunted as much as the other signals.

The PITCH CONTROL switch chooses which capacitor is shunted across L_1 determining its resonant frequency.

The REGENERATION CONTROL feeds a portion of the output of V_1 back to the grid through the secondary of transformer T_1, capacitor C_6 and resistor R_3.

Position 2 of the SELECTOR SWITCH shorts out the neon lamp and the filtered signal is fed through C_8 to the volume control.

In position 3 of the SELECTOR SWITCH the signal must fire the neon lamp in order to reach the output stage. The SENSITIVITY CONTROL (R_7) is set so that the voltage across the neon lamp is just under its firing potential. Now, when the audio signal causes the instantaneous voltage at the plate of V_1 to rise, the neon lamp fires and feeds the signal through. The rest of the time the neon does not fire and nothing gets through.

The DUAL SWITCH bypasses a portion of the signal around the neon lamp, as explained above, through R_4 and C_7.

How To Install

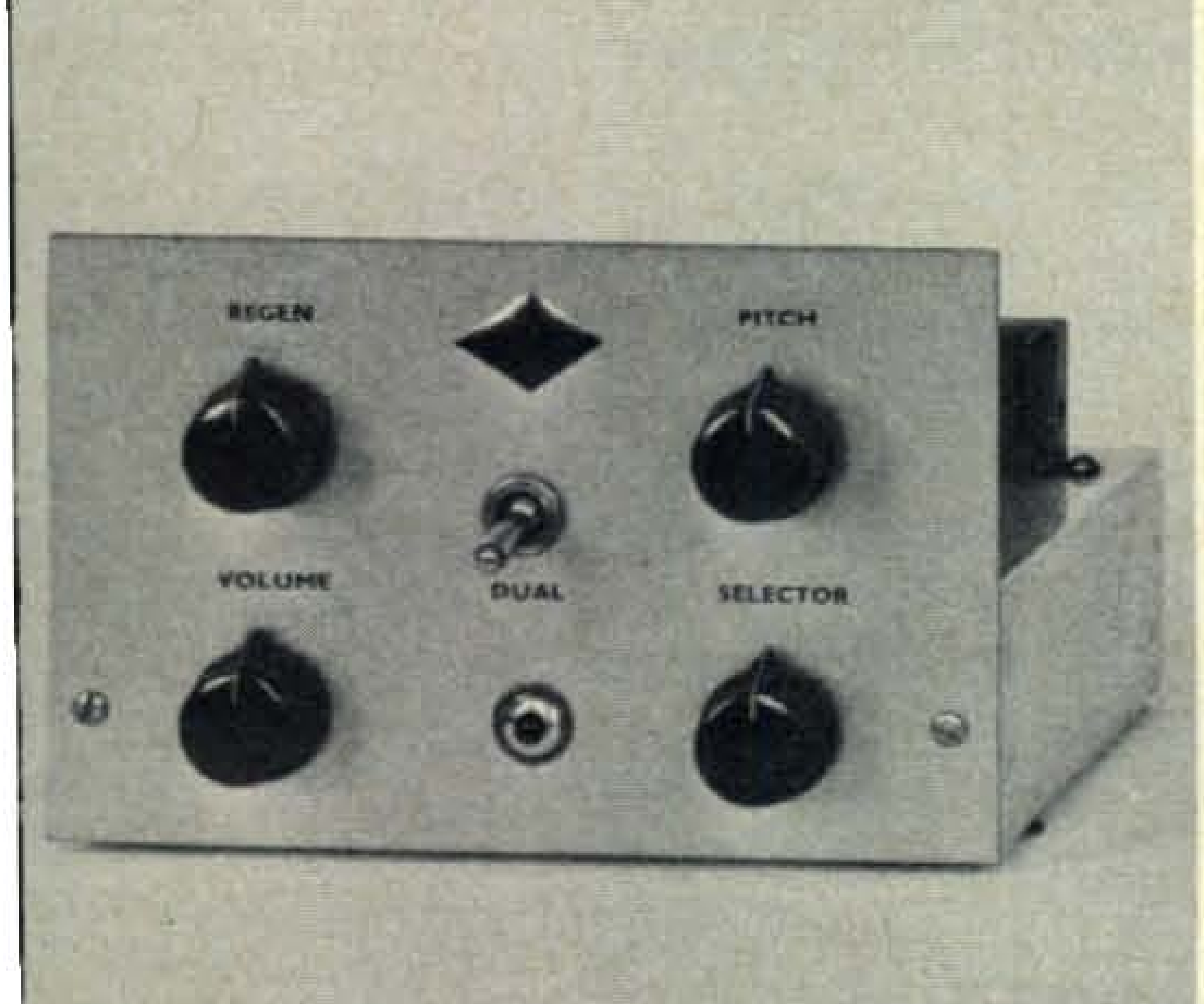
The Signal Souper is simple to hook up; power requirements are small and not critical. Attach the B plus lead to a source of voltage between 175 and 250 volts. Current drawn is from about 5 to 10 ma. Filament voltage may be either 6.3 or 12.6 depending how the filament circuit is wired. In almost all cases the receiver itself can furnish all the necessary power.

To prepare your receiver for the input cable from the S-S merely cut or disconnect one of the leads between the voice coil and the secondary of the receiver output transformer. If the secondary has one side grounded, be sure and cut the grounded side, leaving the ground on the transformer, not on the voice coil. Now connect the input cable from the S-S as shown in the diagram.

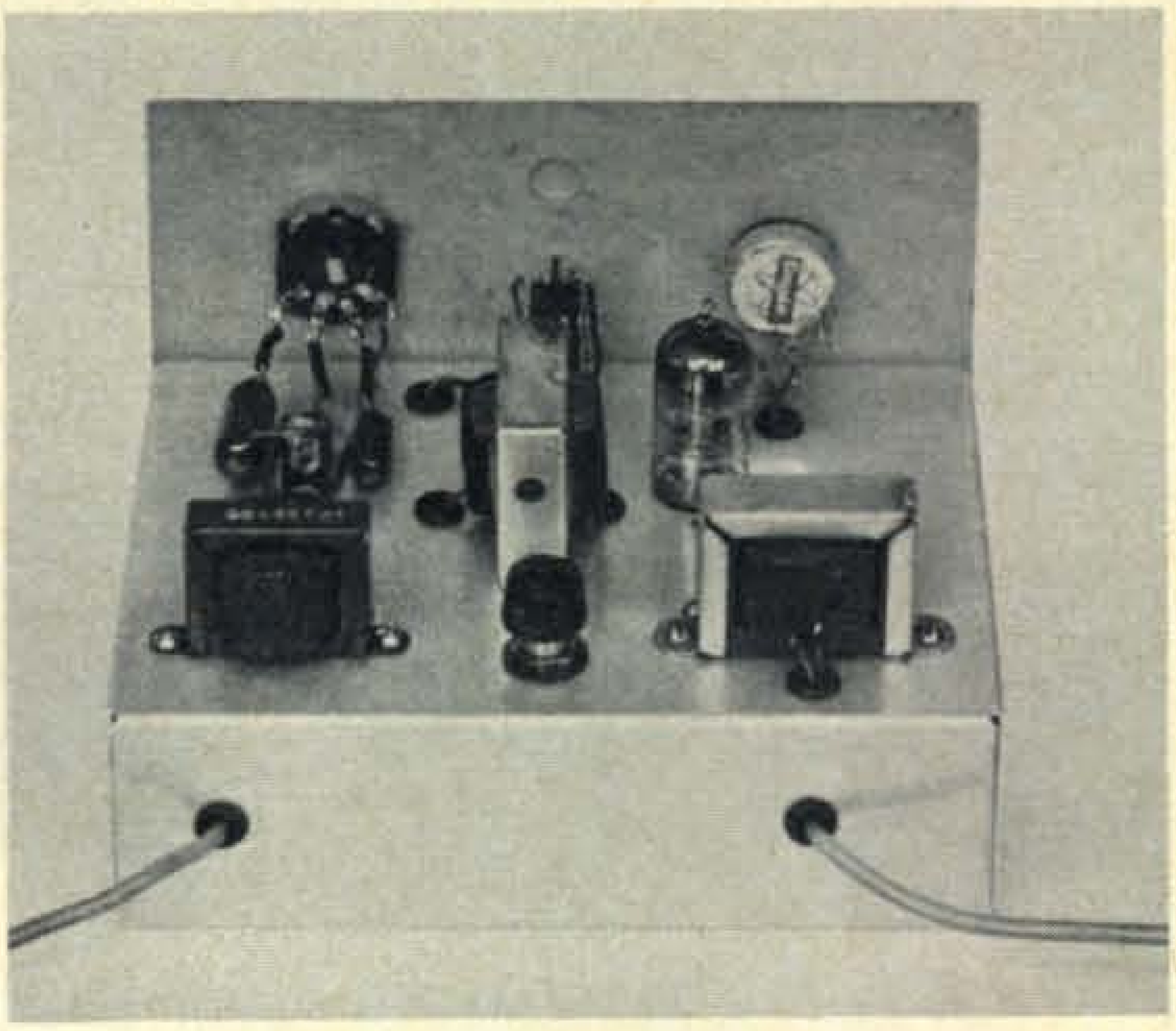
How To Operate

The first thing necessary is to adjust the SENSITIVITY CONTROL. This is a one time operation and once adjusted it is seldom necessary to repeat. Turn the SELECTOR SWITCH

[*Continued on page 132*]



ront view of the Signal Souper showing control ocations. The decorative plate simply covers extra hole.



Rear view of the Signal Souper showing layout. The control in the rear is the Sensitivity adjustment.

"Drake 4-Line is the most satisfying...totally efficient..."

says WØYDB, Minneapolis...

To quote in part from a letter received from W. C. Higgins, WØYDB, Minneapolis, Minn., dated May 10, 1968...

"...Enclosed are several snapshots of my hamshack and equipment. Since the Drake 4-Line is so predominant, I thought that you might like to add to your photo collection of Drake-equipped stations. Granted, the gear is not the new B series but it is still the most satisfying and totally efficient that this old-timer has used in 32 years of amateur, military and commercial electronic experience. I earn my living as a Production Manager of (aerospace) electronic instrumentation production... and I think I can recognize excellence in electronic engineering design and performance when I see it.

"Again, congratulations for developing the 4-Line. 73..."

(Signed) Bill, W. C. Higgins

Ask any ham who owns a Drake 4-Line Rcvr, Xmtr or Linear...

or write for detailed specifications:

Dept. 288 **R. L. DRAKE COMPANY** 540 Richard St., Miamisburg, Ohio 45342

SE AND ABUSE OF CURRENT OVERLOAD PROTECTION DEVICES

BY JOHN J. SCHULTZ,* W2EEY/1

Probably no other circuit component is chosen so haphazardly as fuses and circuit breakers. Everyone understands them; they are the most elemental of devices—maybe!

THE absence or mis-application of circuit verload protection devices is probably one f the most common faults in amateur home-rew equipment construction. The danger in-erent in the absence of such devices, done ither to save some money or to alleviate the eed to drill another chassis mounting hole, is lear. One trades the possibility of ruining a iece of equipment and possibly creating a ersonal safety hazard against the money and me saved during construction. The danger nherent in mis-application of an overload rotective device is not so apparent, although may be the same as though no device were sed. Besides, having invested money and me to install a device, it is a pity not to chieve some value from the installation.

There are a multitude of overload protec-ve devices ranging from fuses to complex lectronic sensing circuits. This article deals ith only two devices—the fuse and circuit reaker—because they are the most com-nonly used devices to protect entire pieces f equipment or individual circuits, and usu-lly the least properly chosen.

No article can indicate exactly what fuse r circuit breaker to use for every specific pplication but once the desired action of a rotective device in a circuit is developed and nce one understands the capablities of dif-erent types of fuses and circuit breakers, it hould not be difficult to choose the correct evice. In other words, to use them properly, one has to regard a protective device the same as any other circuit component and devote some care to its selection.

*40 Rossie Street, Mystic, Conn. 06355.

Location of Protective Devices

Obviously, the location of protective devices in a circuit will dictate its characteristics. Fuses and circuit breakers are *current* sensitive devices only. To protect a particular circuit, one must determine what the normal range of current flow will be and what over-current for a certain period of *time* is regarded as excessive and must be protected against. Normally, it is not difficult to calculate from the total power demand or from a tube or component rating what the maximum normal current flow will be, making provisions for normal line voltage or supply voltage variations. Determining how much excess current can flow for what period of *time* before a circuit component is damaged is not so easy to determine.

A power transformer, for instance, can obviously withstand a surge current for a few cycles which is determined only by the ohmic resistance of its winding. Thus, although the normal current rating may be 1 ampere, a surge current of 6-7 amperes lasting a fraction of a second is normal for the usual power transformer. On the other hand, a transistor having a normal current rating of 1 ampere may be easily ruined by a current surge of a few amperes lasting only a short time. Obviously, different current protective

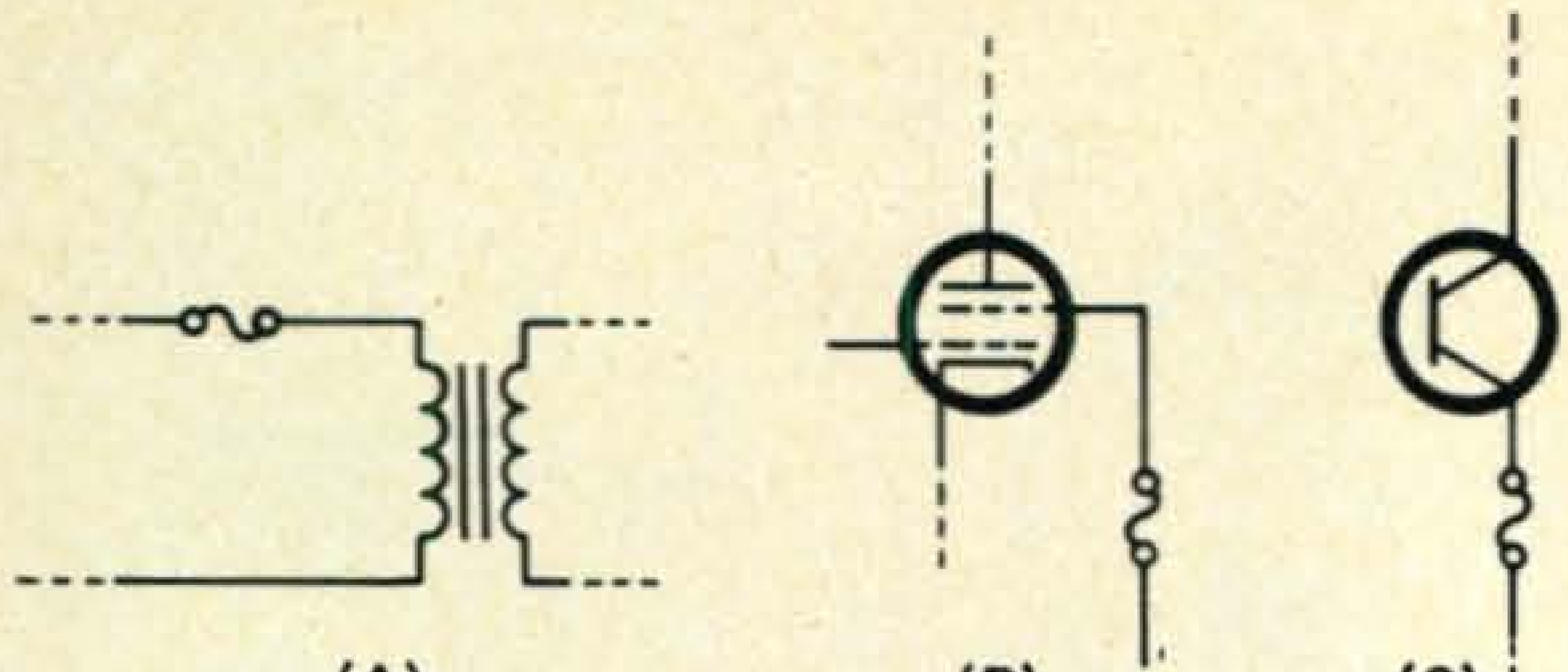


Fig. 1—Circuit application should determine type of fuse to be used for protection. Large inductive circuit (A) might require time-delay fuse, high-power amplifier screen circuit (B) a regular fuse and transistor or meter circuit (C) a quick-blow fuse.

devices should be used with each device.

The usual placement of a fuse or circuit breaker is in the a.c. power line to a piece of equipment, the idea being that any short within the equipment will eventually be *reflected* in increased line current. See fig. 1(A). Of course, this is not always true as almost everyone has seen a resistor inside a unit merrily burn up while the line fuse never blew. One cannot possibly protect every component in a piece of equipment and which components to protect are a matter of judgement. For instance, the screen circuit to high-power linears is frequently separately protected since excessive screen current alone can damage expensive tubes. (Fig. 1(B)). Expensive transistor circuits are usually separately protected since the line fuse which protects the power transformer will not open soon enough to prevent transistor damage. Once one has determined which components to protect and what their overcurrent tolerances are, the proper protective device can be chosen.

Fuses

Fuses are certainly the most common overcurrent protective device and the most basic thing to note about them is that their rating is the current which can flow through them indefinitely. (This statement is not meant to insult anyone's intelligence but some people still think a fuse "blows" when its rated current flows.) The amount of overcurrent to open the fuse in a given time depends upon the fuse type. Figure 2 shows the general characteristics of the various types of "filament" fuses, a glass vial with two end caps between which the fuse filament is connected. These are certainly the most common type used to protect electronic equipment, although the total variety of fuse types available would probably number in the hundreds.

Fast acting fuses are usually used to protect transistors or meter circuits. They are available from ampere size down to values as small as 2 ma. (Bussmann type AGX). Depending upon the magnitude of the overcurrent, these fuses will open about 10 times sooner than regular fuses. These fuse, incidentally, may present a problem when being tested if a low milliampere type is being used. The current flow from an ohmmeter will open them unless a series current limiting resistor is used.

Regular fuses, the cheapest and most commonly used, are designed for situations where a current about 2½ times the normal value can be tolerated for about a second without causing equipment damage. The ubiquitous 3AG fuse is of this type.

The slow opening fuse is designed to handle devices, usually heavy power supply transformers in the amateur case, that have high initial surge currents. All too often builders use an oversized regular fuse to handle the surge but then are left with poor continuing overload protection. As can be noted from fig. 2, the slow type fuse is ideally suited for the power transformer situation where a surge of 6-7 times normal current flow lasts for a fraction of a second. For instance, if a 1 ampere slow type is used where a transformer load is 1 ampere or slightly less, it should withstand the initial surge. If some defect develops and the load increases later on to 2 amperes, the fuse will open in 15-20 seconds. If, on the other hand, a 3 ampere regular fuse were used to handle the surge, the operating current could increase up to 3 amperes and the regular fuse would *never* open!

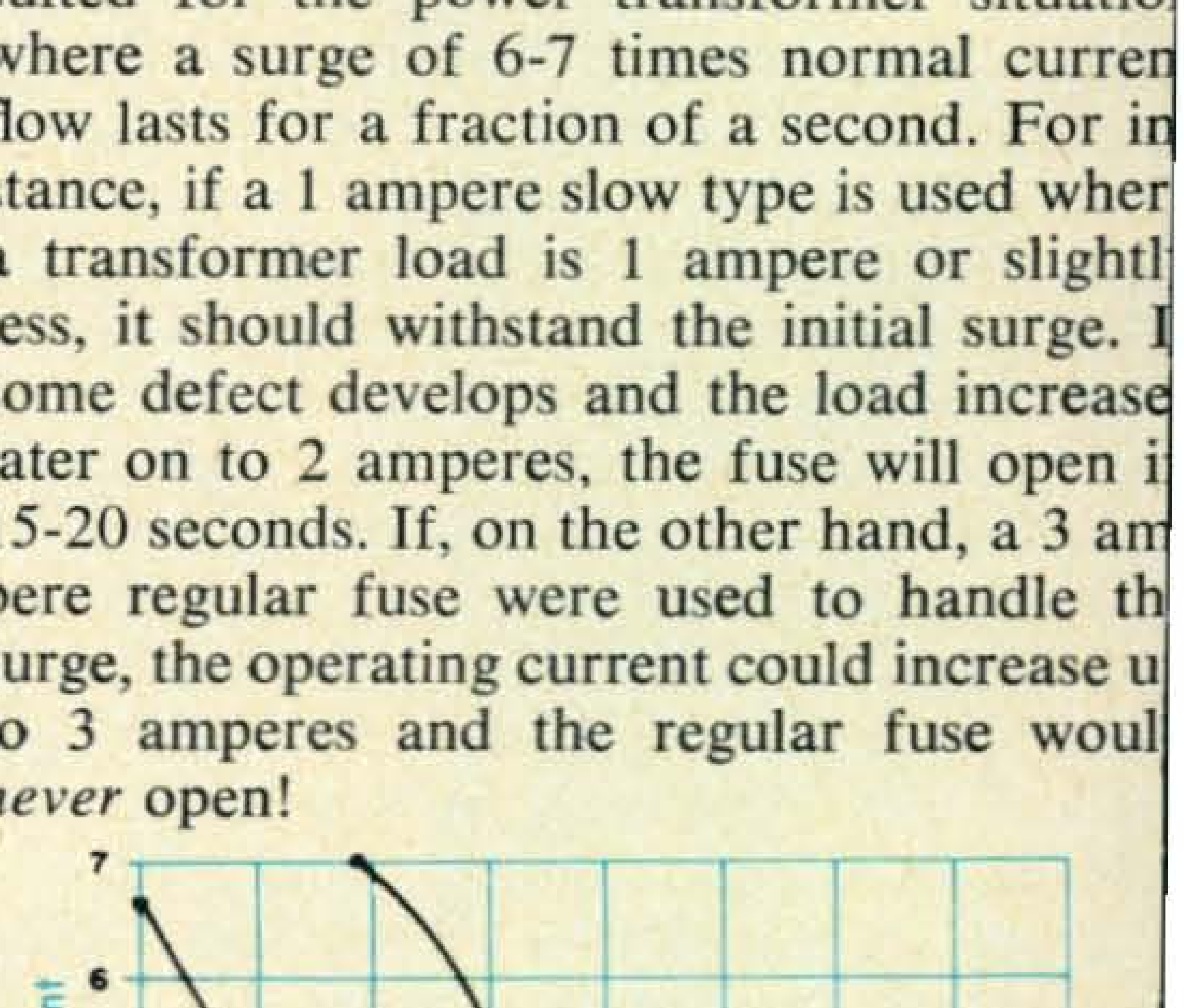


Fig. 2—Typical fuse characteristics. Note that n[o] type opens at its rated current but only after [a] specific time at some overcurrent.

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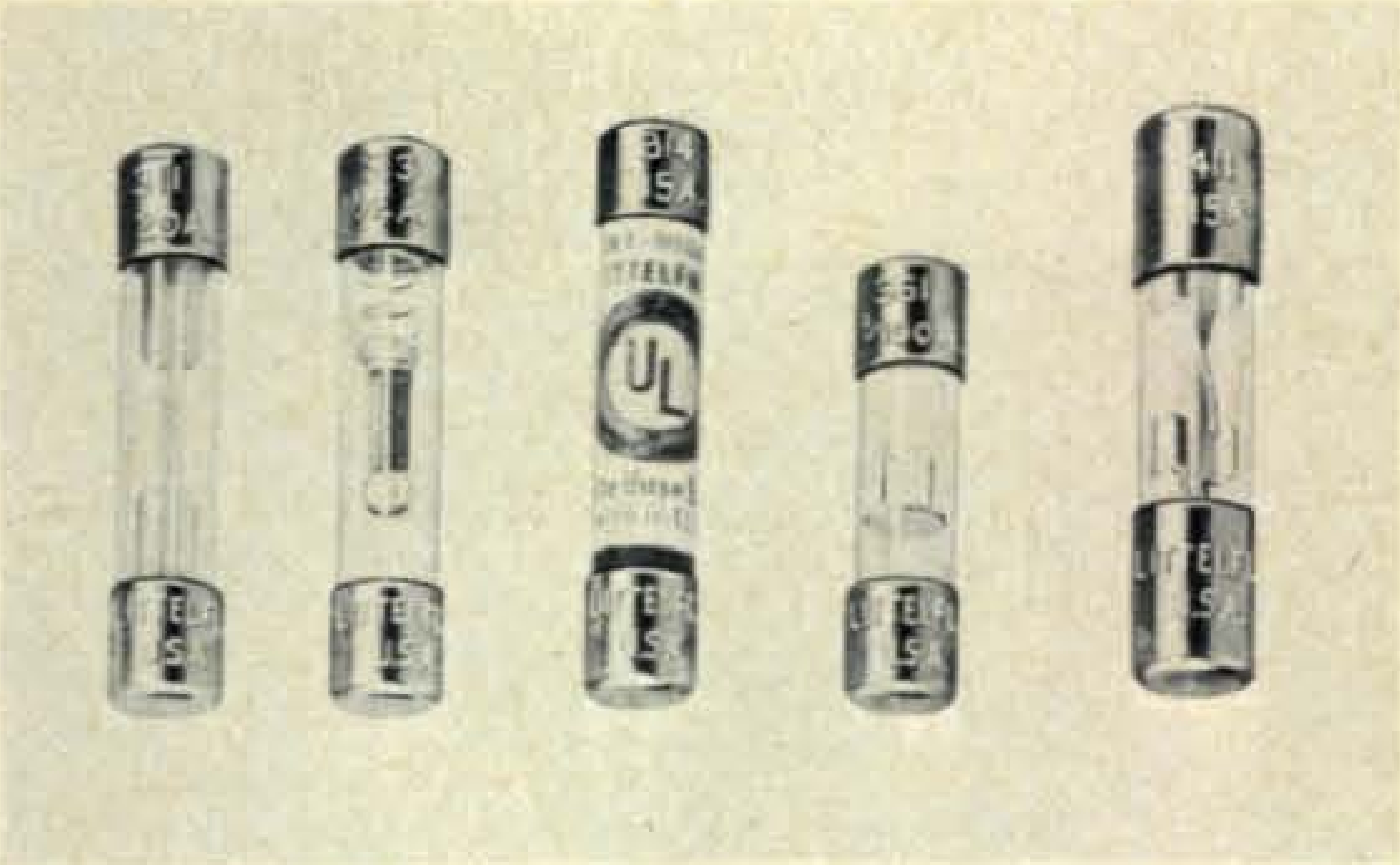
Fuse Voltage Rating

The voltage rating that appears on a fuse often causes confusion. The voltage rating is developed on the basis of container insulation and the arcing that takes place when the fuse filament opens. It represents the maximum voltage that should be impressed across the fuse when it is open. The lesson is that a fuse can be used in any circuit with lower voltage than its rating but a low voltage fuse should never be used in a high voltage circuit. In an extreme case, doing the latter will do nothing more than create an arcing contact once the fuse opens under overload.

Since the filament of the fuse must melt to produce an open, the surrounding temperature obviously affects its performance. The current rating given to a fuse is therefore based upon normal room temperature and a correction factor must be applied if the fuse is used under different conditions. One can obtain exact graphs from a manufacturer that will detail the fuse rating factor for other than room temperature conditions. As a very general rule-of-thumb, however, a fuse should be derated about 20% if it is used under abnormally hot conditions (to protect a piece of mobile equipment mounted in a runk on a hot, summer day). Thus in the atter case, a 6 ampere fuse would be used even though the maximum normal circuit current were calculated to be 5 amperes.

Properly used, simple fuses unquestionably till remain the most dependable and most economical of over-current protection devices. An examination of any fuse manufacurers catalog will confirm how far the techology of fuse development has progressed rom what most of us tend to consider a static omponent status.

Lastly, it should be mentioned that fuses an do one thing that is not possible with ciruit breakers, which are discussed next. Although no one desires to "blow" fuses, when t does happen it is a good idea to examine he blown fuse rather than quickly discardng it and trying a replacement. If the fuse is "cleanly" blown it indicates that some overurrent for a fairly long time duration caused he failure. If, on the other hand, the fuse has een violently blown with the filament completely gone and the glass enclosure blackned, it indicates that a very high current demand, short term fault was present. Thus, one ight be able by these indications to develop ome logical cause for the fuse failure, especially in repeated situations.



Glass vial fuses are available with a wide range of times characteristics and current ranges (10 ma to 20 amp types are illustrated). The glass vial construction permits a visual check of what caused a fuse to open as explained in the text.

Circuit Breakers

There are not as many types of circuit breakers as there are fuse types but, nonetheless, this article must confine itself to the two most commonly used types, the thermal and thermal-magnetic (usually simply called "magnetic" in catalogs). If the fuse is regarded as the simplest and most economical type of overcurrent protection device, the circuit breaker must certainly be regarded as the most convenient because of its resetability rather than its replacement feature.

Unlike fuses, circuit breakers do not have the wide range of operating characteristics associated with fuses. One of the simplest types of thermal circuit breakers is shown in fig. 3 (A). Excessive current flow will cause the bi-metallic element to deflect and open the circuit. This action is not instantaneous, however, and this basic type of circuit breaker has a built-in type of time delay which will cause the breaker to open at a time period somewhat inbetween that for the slow action and regular action fuses, as shown in fig. 2. It is almost impossible to quote any average time delay as they vary considerably from manufacturer to manufacturer. The basic rule remains the same, however, in that the current rating of the breaker is that which can flow indefinitely without causing any breaker action.

Simple thermal type circuit breakers are available in push-to-reset or toggle switch variations. The former is the least expensive (about \$1.50 to \$2.00) and provides only a reset feature but no on-off switch action. Toggle switch breakers provide both the function of circuit on-off switching and

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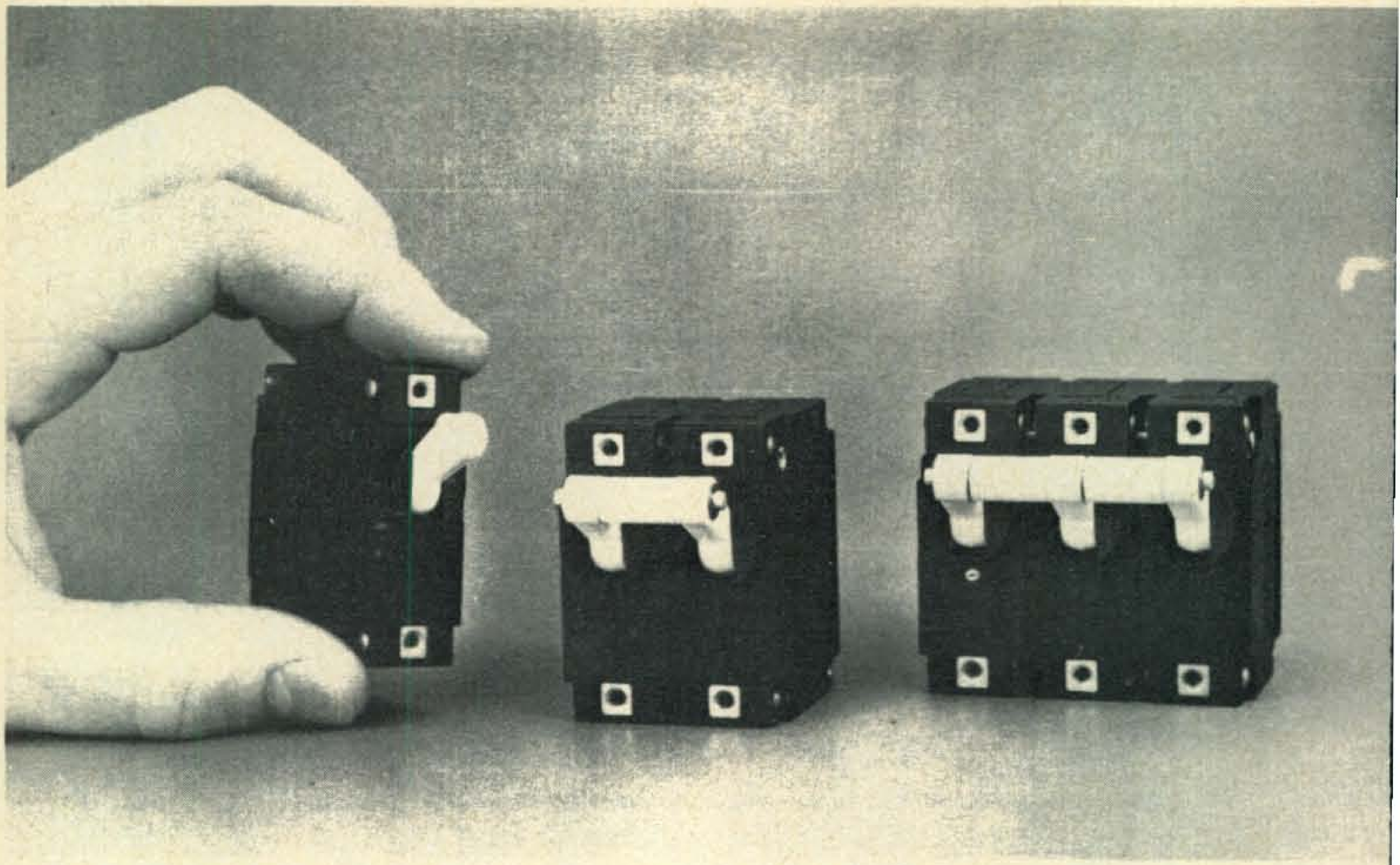

The "ganging" capability of circuit breakers is often very useful. They do not, however, provide any visual "clue" as do simple fuses as to the nature of an overload.

breaker reset through mechanical means inside the breaker.

Although rarely seen in amateur equipment because of its expense, there is another variation of the thermal breaker known as the magnetic type (fig. 3(B)). The coil is wired in parallel with the breaker contacts. Should a sudden high onrush of current be encountered, the solenoid coil will force a plunger to open the main breaker contact. This breaker action is considerably faster than that provided by the bi-metallic element alone since the latter has a definite thermal inertia. In general, such breakers have a reaction time somewhat between those of the regular and fast fuses as shown in fig. 2 and are usually only available in toggle switch types.

Both breakers require some definite time before they can be reset because the bi-

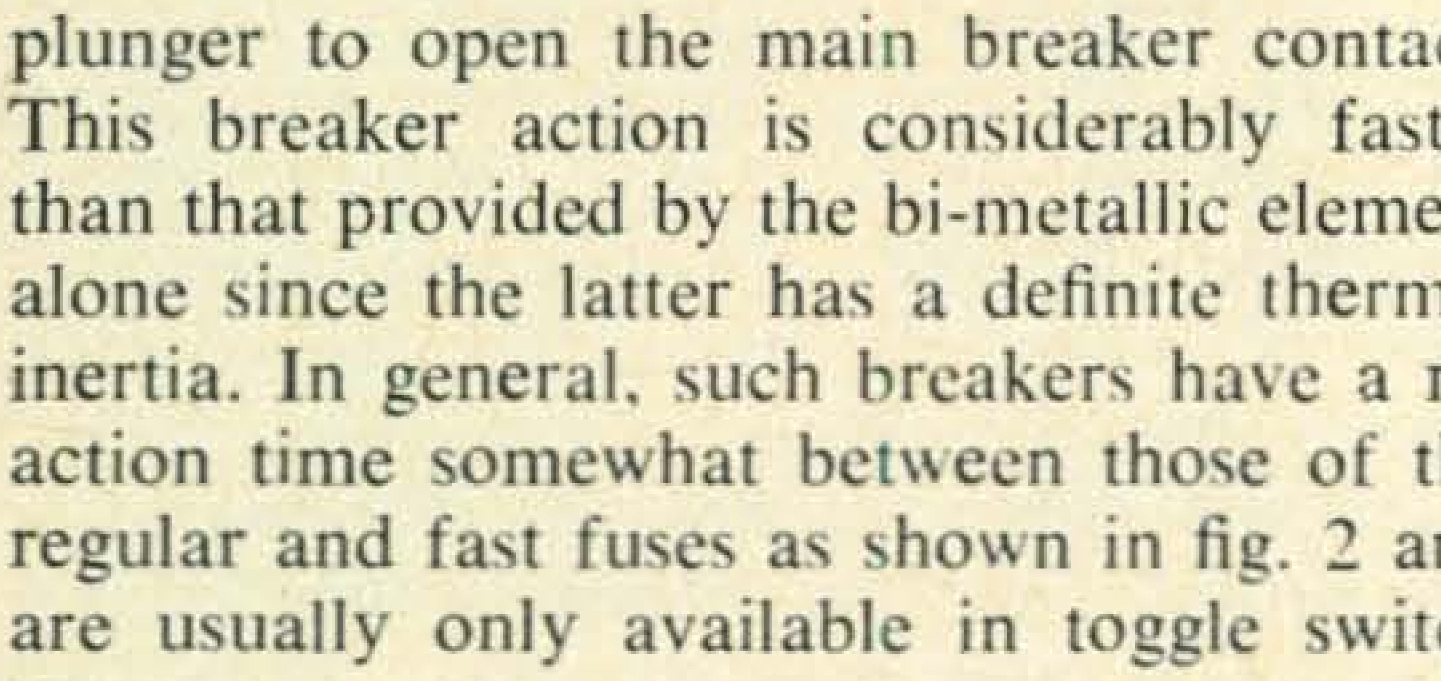

Fig. 3—Basic thermal type circuit breaker (A) and combination thermal-magnetic type (B). Electrical circuits only are shown, not mechanical springing or other linkages.

metallic element must cool and resume its normal shape. For special applications, such as military or aircraft systems, there are breakers available which are designed so one can force the toggle switch closed immediately after the breaker has opened and bypass the action of the bi-metallic element.

Like fuses, simple thermal type circuit breakers can be used in any circuit having a lower voltage than their maximum rating, since only current flow heating the bi-metallic element affects the breaker. However, magnetic circuit breakers, because of the solenoid coil, will only retain their characteristics when used for the type of current (a.c. or d.c.) and the line frequency for which they are constructed. In the same manner as fuses, circuit breakers of the thermal or magnetic types are rated at room temperature. If they are used under unusually warm or cold conditions a compensating factor must be applied to their rating.

Hopefully this article will help home brewers to better choose and utilize fuses and circuit berakers as circuit protection devices. As was mentioned before, there are many many more types of fuses and circuit breakers available than were discussed in this article although they rarely are found in amateur

[*Continued on page 130*]

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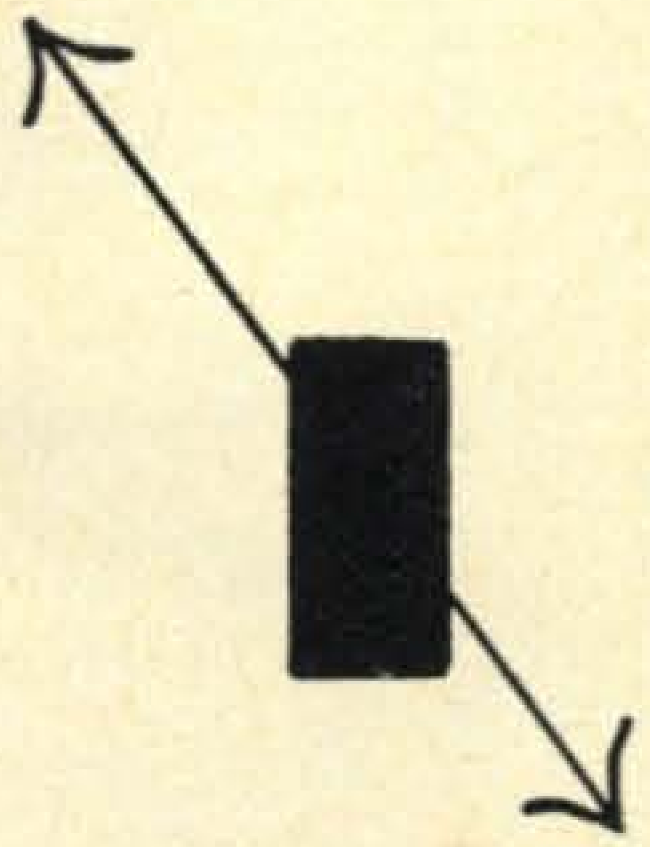

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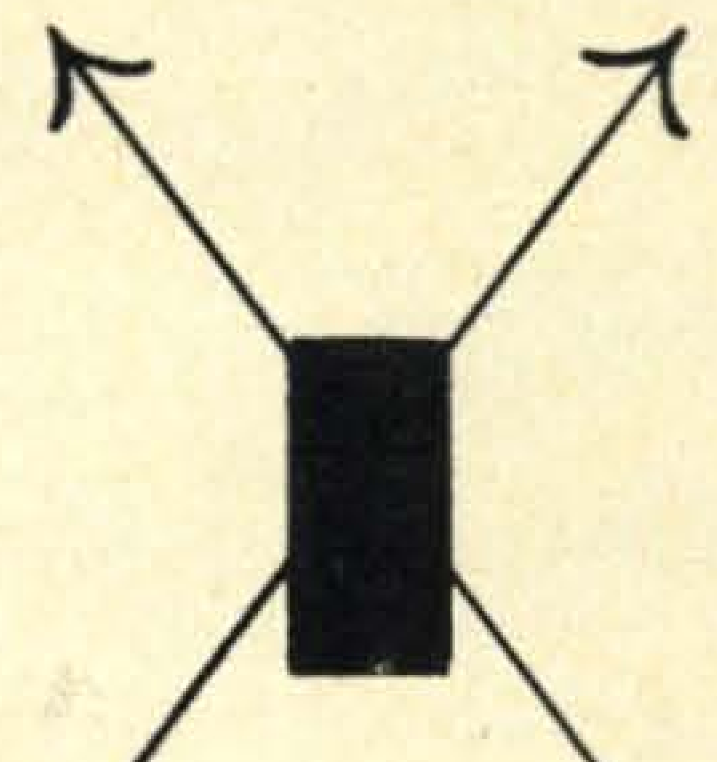

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VERTICAL ANTENNAS

Part V

BY CAPTAIN PAUL H. LEE, *W3JM

An antenna composed of vertically stacked vertical elements produces low angle radiation without wasting power in high angle skywave lobes. In this article of the series, the author covers the theoretical aspects of vertical stacking, and then describes some practical configurations.

In the previous parts of this series of articles, we have discussed vertical antennas composed of a single vertical element, whose height must be limited to ⅝ wave or less. For those who may be confused by the term "height," it is used to indicate the length of the vertical element or radiator. Figure 1 of Part I[42] and Figure 26 of Part IV[43] show the vertical radiation patterns to be expected from antennas of several heights. The pattern for a ⅝ wave vertical radiator is shown. It has a large low angle lobe, and a small skywave lobe. These vertical patterns result from the computation of the factor $f(\theta)$ as shown in Part IV.[43] If the computation is carried out for heights greater than ⅝ wavelength, it will be seen that the low angle lobe shrinks very fast, the skywave lobe increases rapidly, and the pattern becomes useless for long distance communications, as the height G is increased. Thus the statement that the height of the single simple element must be limited to ⅝ wave or less. Perhaps the statement should be qualified by saying that the vertical is most effective when producing low angle radiation for long distance communications. There are simpler antennas for short-hop, high angle skywave (such as a horizontal dipole close to ground).

Lowering The Angle

A look at the pattern of the ⅝ wave vertical shows, however, that some radiation is wasted in that high angle skywave lobe, and that the low angle lobe could be compressed even more and radiated at still lower angle, which is very desirable for long distance work.

Compression and lowering of the main lobe can only be accomplished by vertical stacking of in-phase elements. This is true whether the elements are horizontal or vertical. In the vertical element case, the array which results is called a vertical colinear array, since the elements are in line, or colinear. The vertical radiation pattern which results from a single two element colinear array in free space is shown in fig. 37. This array has a free space gain of 1.9 db over a dipole. The plot actually shows a vertical cross-section thru one side of the pattern. The whole pattern is actually a "doughnut", in three dimensions. The two element colinear in free space, when cut in half, becomes a ½ wave element working against a ground plane. The ½ wave pattern in fig. 26 (Part IV) is the plot of this antenna's theoretical radiation over perfect ground. The affects of imperfect ground on the vertical pattern, and the resulting suck-in at very low angles were thoroughly discussed in Part I.

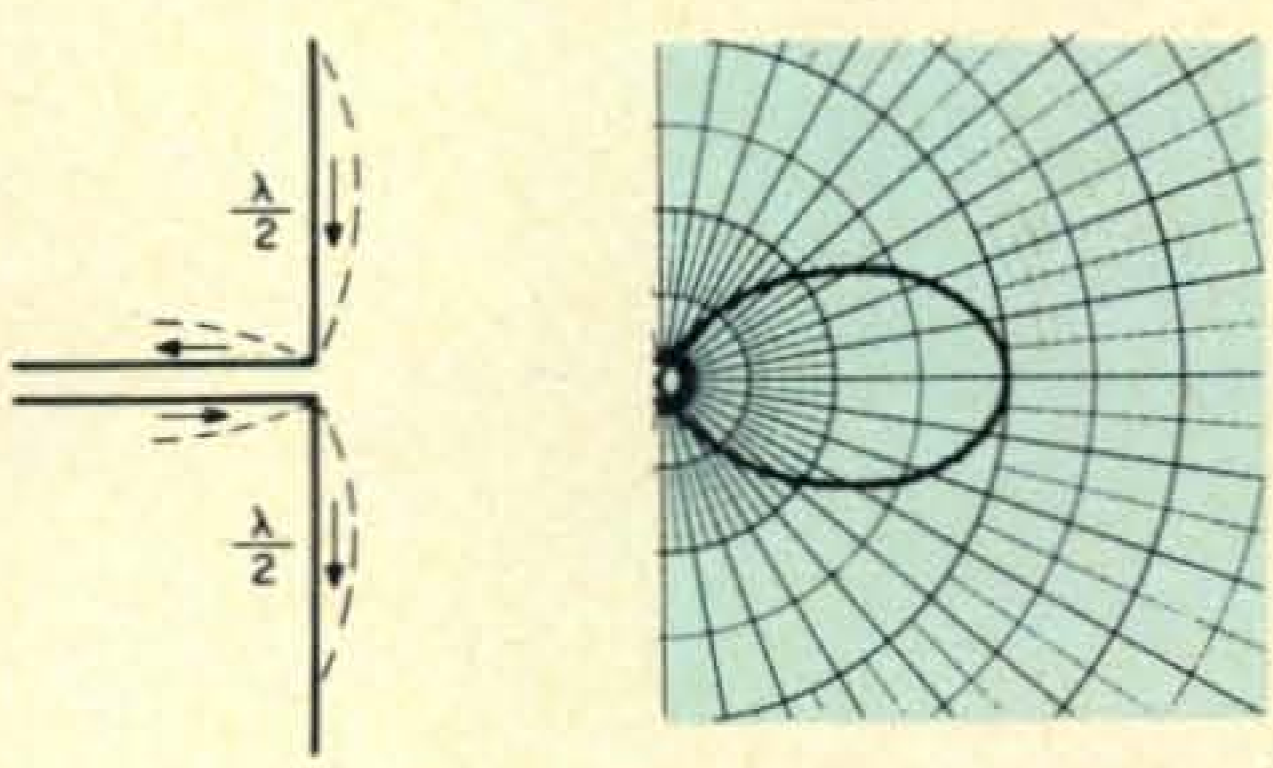

Fig. 37—Configuration and polar pattern of a two element colinear in free space.

* 5209 Bangor Drive, Kensington, Md. 20795.

42 Lee, P. H., "Vertical Antennas, Part I," *CQ*, June 1968, p. 16.

43 Lee, P. H., "Vertical Antennas, Part IV," *CQ* Sept. 1968, p. 37.

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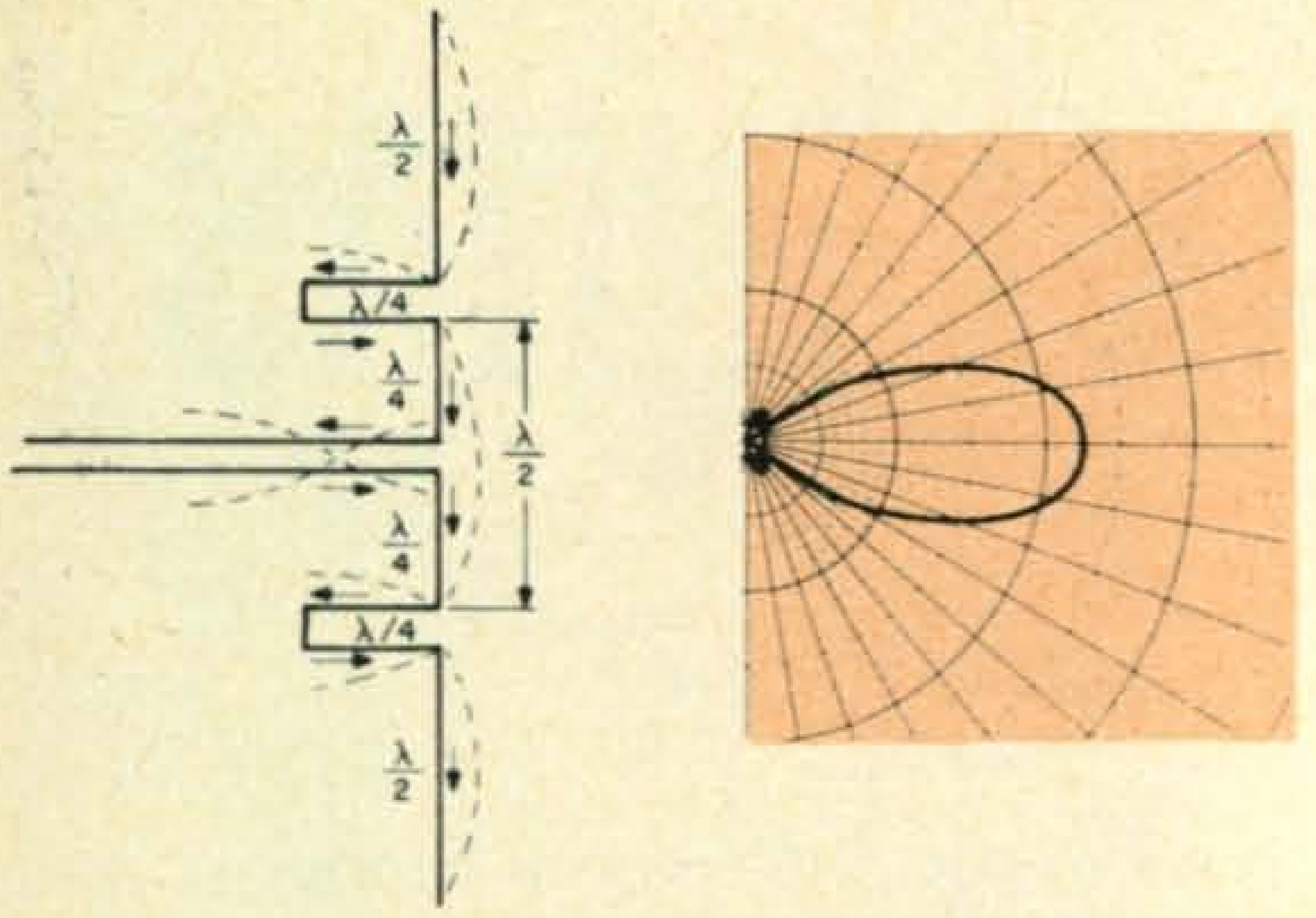

Fig. 38—Configuration and polar pattern of a three element colinear in free space.

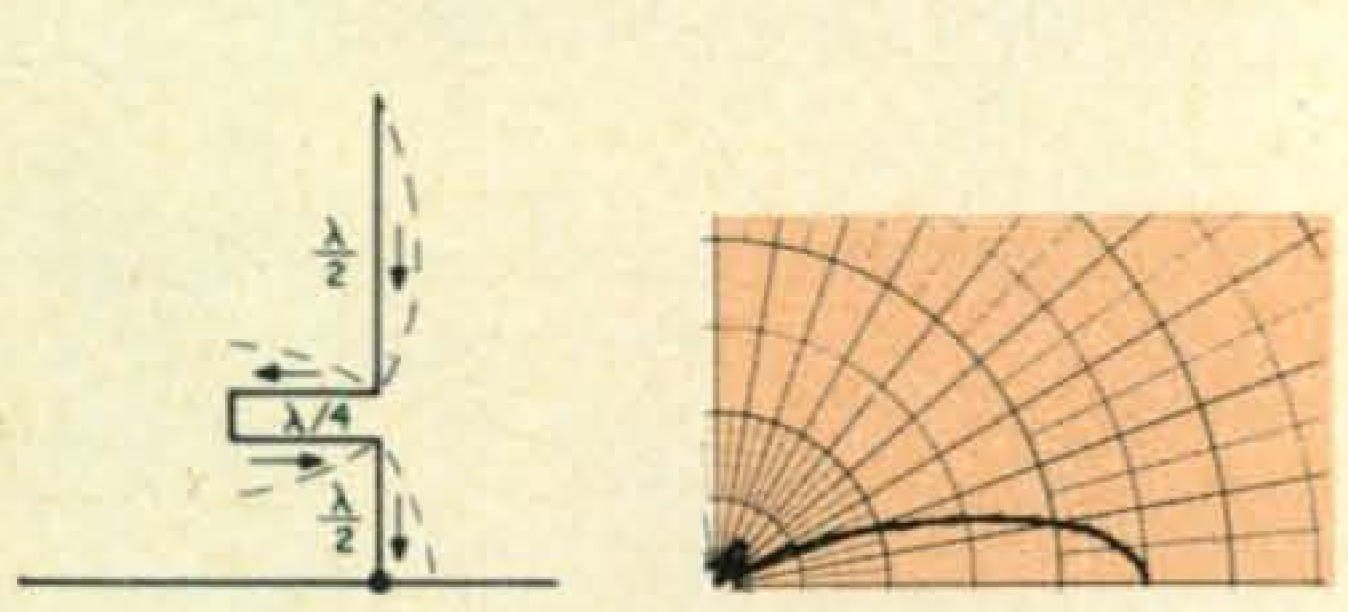

Fig. 39—Configuration and polar pattern of a 1½ element colinear over ground.

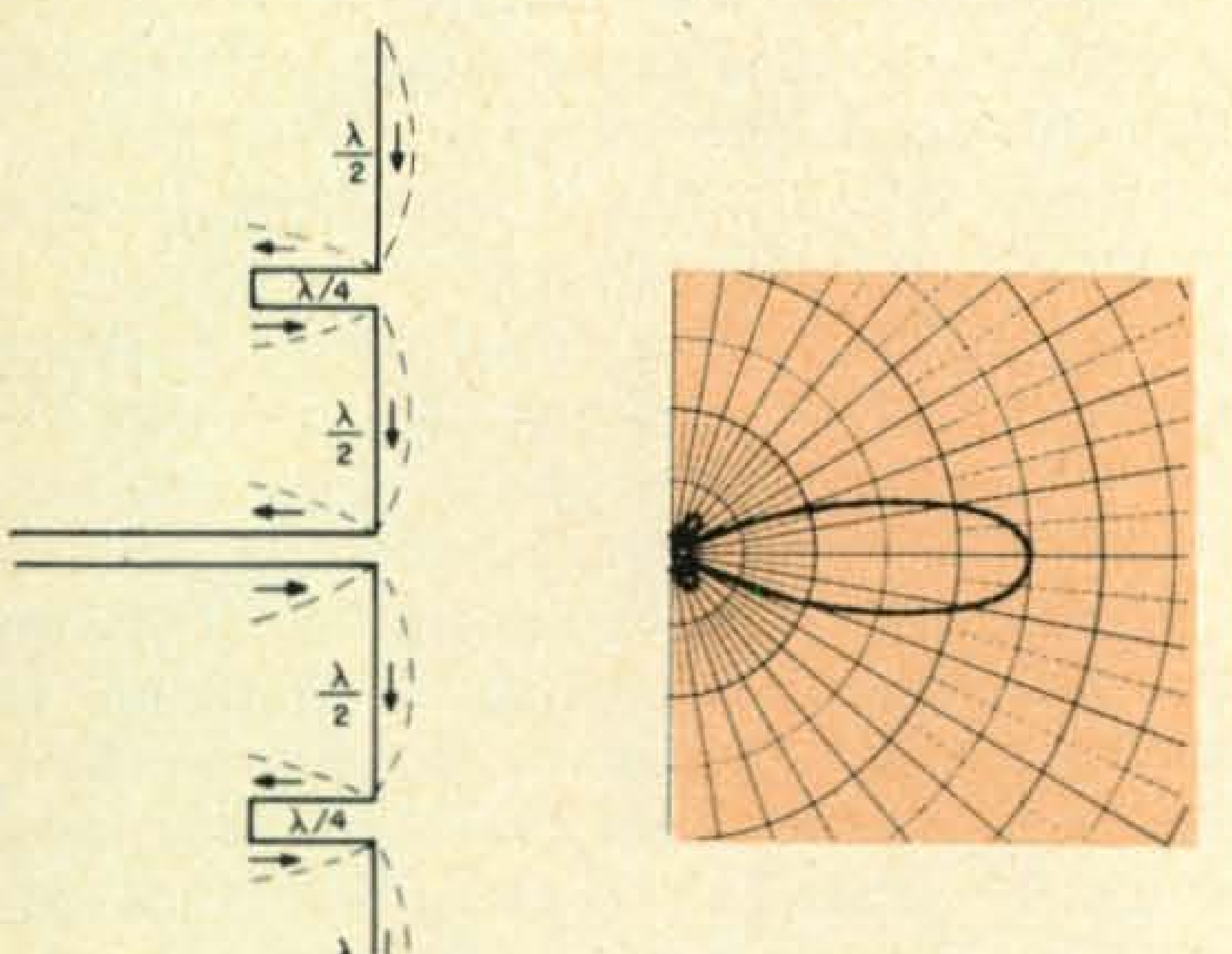

Fig. 40—Configuration and polar pattern of a 4 element colinear in free space.

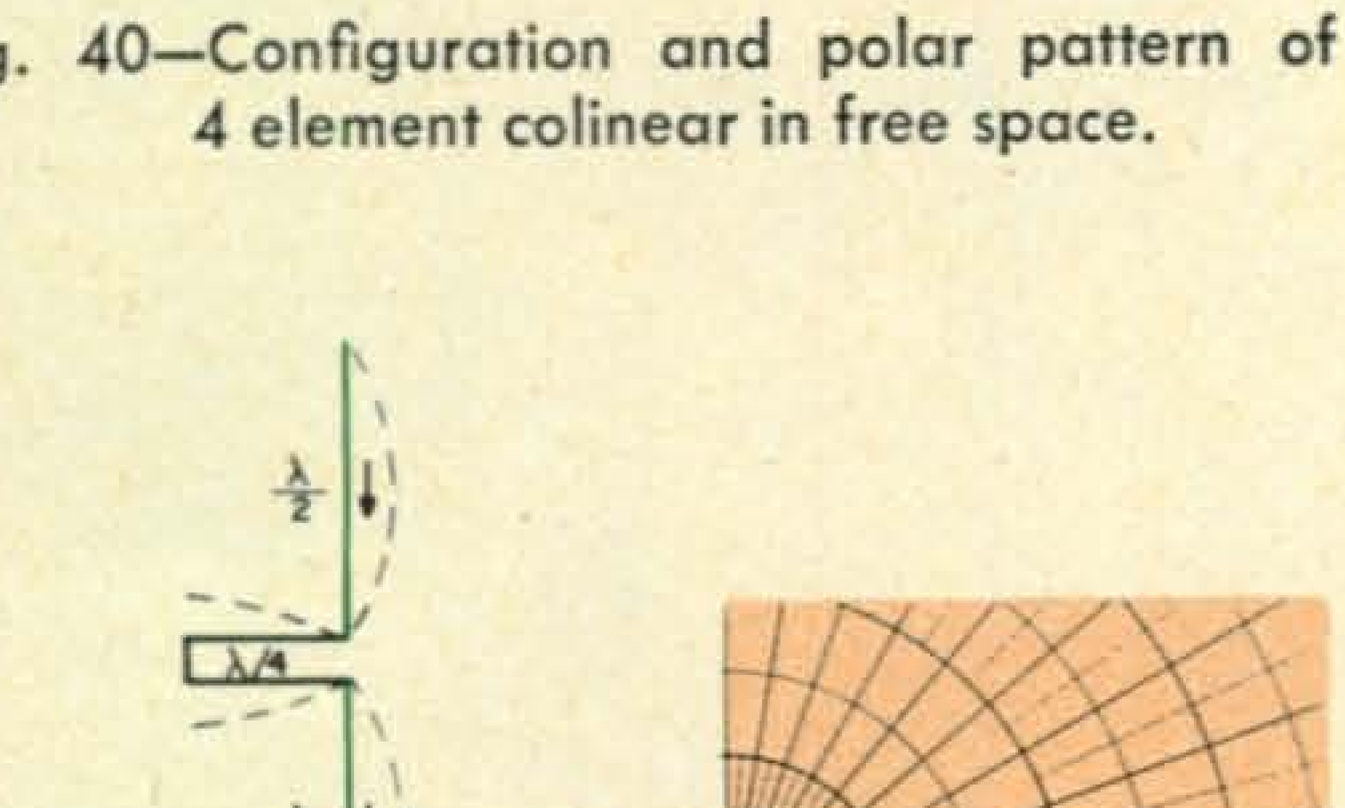

Fig. 41—Configuration and polar pattern of a 2 element colinear over ground.

Figure 38 shows the pattern for a three-element colinear in free space. It has a gain of 3.2 db over a dipole. It also can be cut in half, and operated against a ground plane. Now, however, one must be careful not to call this a ¾ wave antenna, for it is not that at all. It is a ½ wave element stacked above and operated *in-phase with* a ¼ wave element. Figure 39 is the vertical pattern of this antenna over perfect ground.

If we carry the vertical stacking further, we can make a four element colinear array, whose free space pattern is shown in fig. 40. The gain of this one over a dipole is 4.3 db. As in the previous cases, we can replace the lower half by a ground plane, and then we have two ½ wave elements stacked, *in-phase*. This is not the same as a full wave antenna, whose two halves would not be in-phase. Figure 41 is the plot of this antenna's radiation over perfect ground.

Practical Colinear

From a practical standpoint the free space configuration of any of these arrays is impossible to build and feed. It lends itself very nicely to textbook analysis, but it cannot be caused to produce the patterns shown, because of the presence of earth. The configurations which utilize a ground system as a part of the radiating system can be built, however, and the vertical patterns will conform closely to those shown in fig. 39 and 41, dependent on ground characteristics and frequency as discussed in Part I. The effects of ground system design at h.f., and particularly the effects on low angle radiation, have been quite well documented in three reports by the U.S. Navy Electronics Laboratory.[44,45,46] The U.S. Navy uses many vertical antennas at its shore radio stations, mostly in broadband configurations, and each one has its properly designed ground system. Briefly these reports show that greatly improved radiation at low angles will result when the number and length of ground system radials is increased, and that the improvement obtainable is a function of

44 "Ground System Effect on HF Antenna Propagation," Report 1346, *U.S. Navy Electronics Laboratory*, San Diego, 4 Jan. 1966 (Unclassified).

45 "HF Extended Ground Systems: Results of a Numerical Analysis," Report 1359 *U.S. Navy Electronics Laboratory*, San Diego, 24 Feb. 1966 (Unclassified).

46 "A Numerical Analysis of HF Extended Sector Ground Systems," Report 1430 *U.S. Navy Electronics Laboratory*, San Diego, 19 Jan. 1967 (Unclassified).

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ground conductivity and frequency, with larger improvements being realized over poor ground (as would be suspected).

It may be seen from the above configurations and pattern plots that, within practical limits, the greater the number of vertical in-phase elements, the more the main lobe will be compressed and lowered, and the greater will be the gain. One such design, which carried the number of elements to a very high number, was the Franklin Antenna whose designer, C. S. Franklin, was very well known in the earlier years of radio communication in England. It was based on the principle that a vertical wire carrying uniform currents in-phase over its length is the ideal radiator for producing the lowest possible angle of radiation. In the Franklin Antenna, as described in two of the references,[47,48] each successive ½ wave length of wire is folded back on itself in such a way that the radiation from its central part assists the radiation from its neighbors. This is shown in fig. 42 which depicts the current distribution on a Franklin Uniform Aerial. The exact dimensions in terms of wavelengths are in fig. 43. The major portions of the currents are in-phase, and the resulting current distribution is almost the ideal of a uniform current. As a matter of historical interest, there is, in one of the references, [47] a very good photograph of a large Franklin Antenna array with reflectors at a Marconi station at Bodmin, Cornwall, England. This array consists of a series of vertical Franklin Antennas in line, with a reflector screen behind them. No gain figures are given for such arrays, but based on present designs of horizontal dipole curtain arrays of similar parameters, [49] the gain can be estimated at about 20 to 22 db. Such a Franklin array produces a narrow, low main lobe, broadside to the line of elements, by proper spacing and phasing of the elements.

Franklin Antenna Applications

You might well ask, if this array is so good, why do the Voice of America, the BBC, Radio Free Europe, *etc.* not use it in preference to the horizontal dipole curtain arrays? The

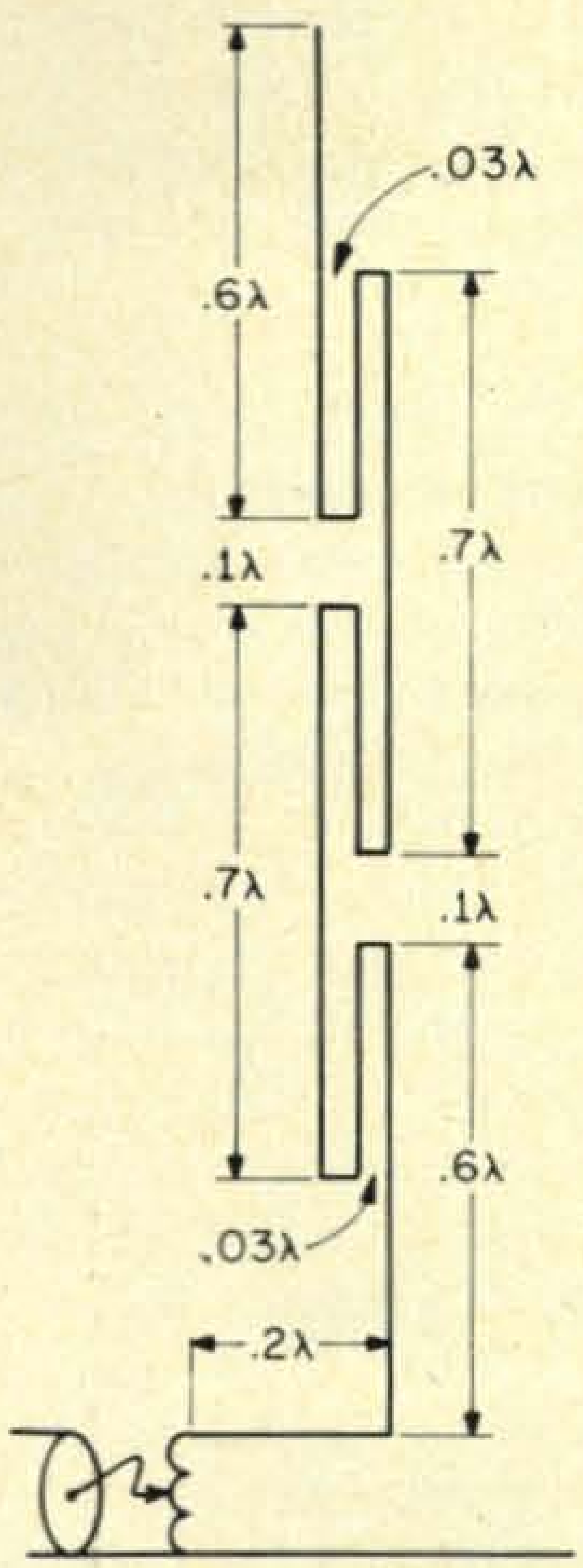

Fig. 42—Current distribution on a folded Franklin Antenna.

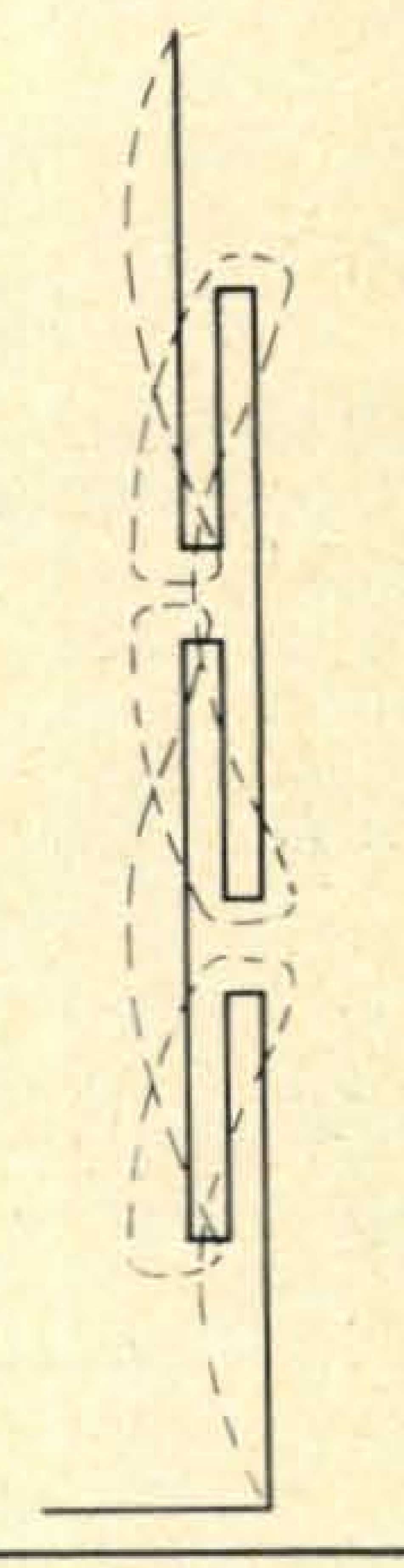

Fig. 43—Dimensions of a folded Franklin Antenna.

answer can be readily seen from the dimensions in fig. 43, which are very critical, and which make the Franklin Antenna a single frequency antenna. The horizontal dipole curtain array can, by use of broadbanding techniques in the design of the dipole elements and the feed system, be made to cover at least two adjacent high frequency broadcast bands, such as 7/9 mc, 11/15 mc or 17/22 mc, with one antenna. Also, the Franklin Antenna is a bit more inconvenient to construct and rig, and it is difficult to isolate the vertical tower supporting structures, due to the vertical polarization. Thus the broadcasters and others engaged in long distance communications have turned to broadband types such as curtains and rhombics, with horizontal polarization. It is not a matter of the polarization itself, but is a matter of operational and constructional convenience.

For v.h.f. or u.h.f. use, however, an amateur could easily bend up a Franklin Antenna out of stiff rod, and make it self-supporting and small in size, even though consisting of three or four ½ waves stacked. Figure 43 can be followed for design. If desired, the antenna can be fed against a ground plane, either by coaxial line directly (tolerating some v.s.w.r.), or via a suitable matching network

[47] Williams, H. P., "Antenna Theory and Design, Vol. II," Pitman and Sons, Ltd.

[48] Ladner, A. W., Stoner, C. R., "Short Wave Wireless Communications," 5th Edition, John Wiley and Sons.

[49] Jasik, H., *"Antenna Engineering Handbook,"* McGraw Hill.

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composed of small components. Reference should be made to Part II of this series for matching techniques.[50] This will make a very fine v.h.f. or u.h.f. antenna, with low angle radiation and worthwhile gain.

Phasing Methods

The Franklin Antenna accomplished the necessary phasing between ½ wave elements by means of lengths of transmission line (although folded in a peculiar manner). This is one way of accomplishing the phasing, as shown in figs. 39 and 41, by use of shorted ¼ wave stub lines. This is a bit impractical to rig mechanically, unless one has suitable supports for the vertical elements and for pulling off the wire stubs horizontally. There are two other ways which are more practical, and they are the use of tuned circuits and the use of coaxial sleeves. First, let's discuss the use of tuned circuits.

As you know, the ¼ wave shorted stub is the electrical equivalent of a parallel resonant circuit. Thus it can be replaced by a parallel resonant circuit, electrically. A vertical antenna consisting of ½ wave stacked over ¼ wave, or ½ wave stacked over ½ wave, or any other such combination, may be phased in this manner. The problem resolves itself into one of mechanical design, and weatherproofing the tuned circuit which must be mounted in the open on the mast or other support, or actually suspended in the antenna itself. One might think that such a tuned circuit would function as a trap, in the manner of traps used in multiband Yagi arrays, but it does not. The reason for this is that the length of the element beyond the tuned circuit is ½ wave resonant and it draws power through the tuned circuit. This is not the case with the length of the element beyond the trap in the Yagi. That short portion of the element in a Yagi cannot draw any power through the trap at the trap's resonant frequency. Thus the trap in the Yagi acts as an isolating device, not as a phase reversing device.

[50] Lee, P. H., "Vertical Antennas, Part II, *CQ*, July 1968, p. 25.

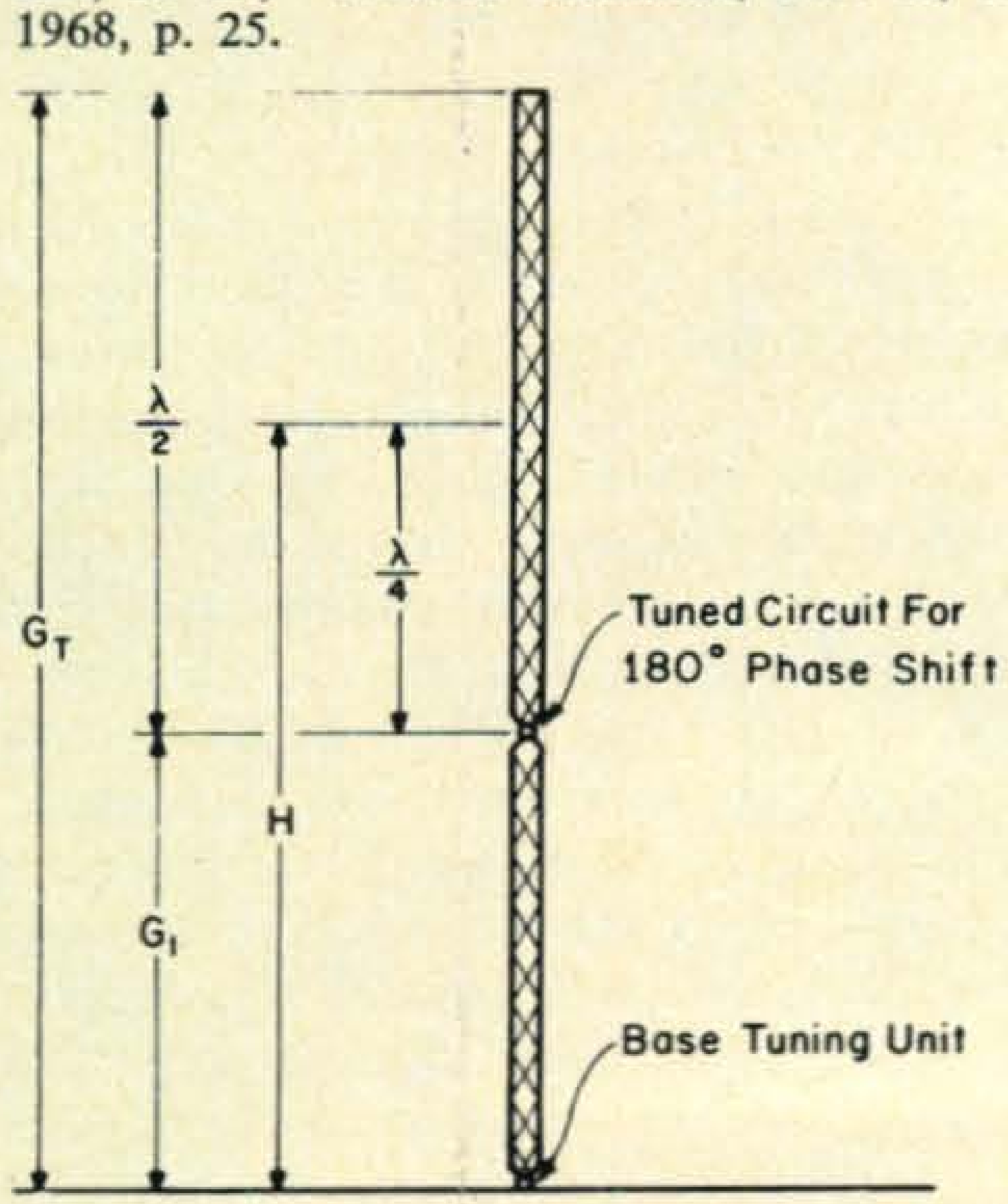

Fig. 44—Sectionalized vertical radiator isolated by a tuned circuit. Length G_1 is less than λ/2.

There have been some really large-size examples of vertical antennas with tuned circuits for phase reversal. Several examples of this are shown in *Jasek*[49] in the chapter devoted to medium frequency broadcast antennas. The design of sectionalized vertical tower radiators is shown. In such cases, the tower is actually broken at the proper height by insulators, across which the tuned circuit is connected. Of course such a structure must be very carefully designed mechanically, and suitably guyed as it is quite tall. The reference shows the design of a sectionalized antenna of overall height of 300° used at WHO, Des Moines. The upper 180° (½ wave) of the tower is actually isolated from the lower 120° by insulators, and fed through a phase reversal tuned circuit mounted up in the tower. The vertical radiation pattern of such an antenna is given by the following equation:

$$f(\theta) = \frac{2\cos(90\sin\theta)\cos(H\sin\theta) + \cos(G_1\sin\theta) - \cos G_1}{\cos\theta}$$

where H and G_1 are defined in fig. 44.

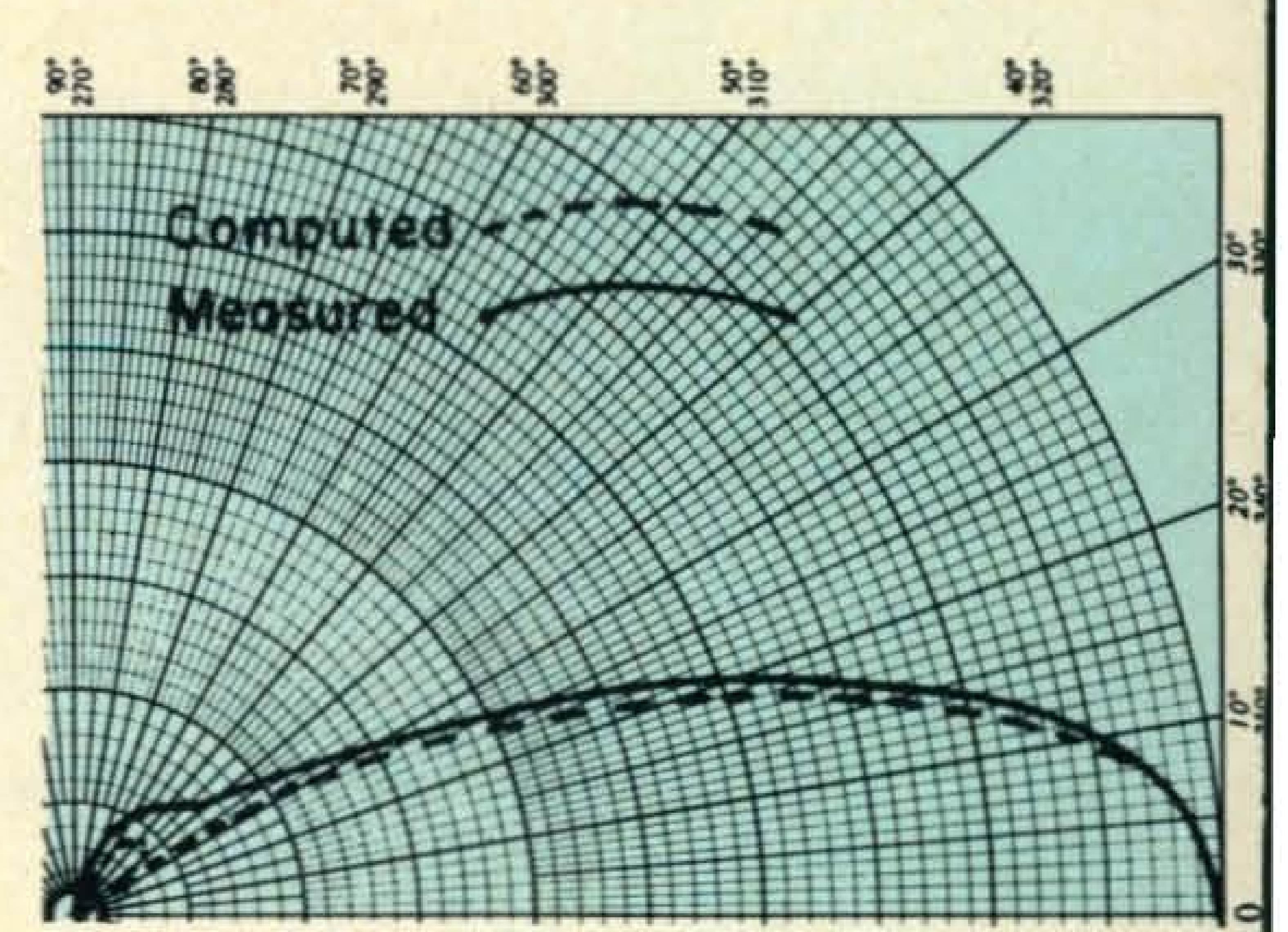

Fig. 45—Vertical patterns for 300° sectionalized radiator at WHO, Des Moines. This is a plot of $f\theta$ where θ is the angle above the horizon. The measured pattern is normalized to 1.0 maximum value for $\theta = 0$

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It may be seen that this is similar to the equation for $f(\theta)$ given in Part IV for a simple single vertical element. The vertical pattern of the WHO sectionalized tower is shown in fig. 45. There have been other such high power installations for m.f. and l.f. broadcasting in this country and in Europe. The tuned circuit must be built of suitable components and mounted in a weatherproof enclosure, as considerable r.f. voltage will exist across it.

Coaxial Sleeve

The other way of obtaining the required 180° phase shift is by the use of a coaxial ¼ wave sleeve. This is shown in fig. 46. The Mark III DX Antenna described in *CQ*[51] is an example of a design of this type for use at h.f. The design of antennas of this type is covered in detail in several of the references[47, 52]. Because of the mechanical problems connected with the design and mounting of the sleeve, such antennas are usually used for v.h.f. and u.h.f. where they can be physically small in size and easily supported. Some are even self-supporting, easily mounted on a mast. A coaxial sleeve on the Mark III was simulated by means of a wire cage, and it worked fine. Several readers did not quite have faith and confidence in the cage, and asked if they could build the sleeve out of sheet metal. I was a bit dubious as to their ability to install and support such a thing, and to maintain it in the face of problems of wind resistance, weight, *etc.*

[51] Lee, P. H., "Mark III DX Antenna," *CQ*, December 1962, p. 43.

[52] King, R. P. W. *et al*, *"Transmission Lines, Antennas and Waveguides,"* McGraw Hill.

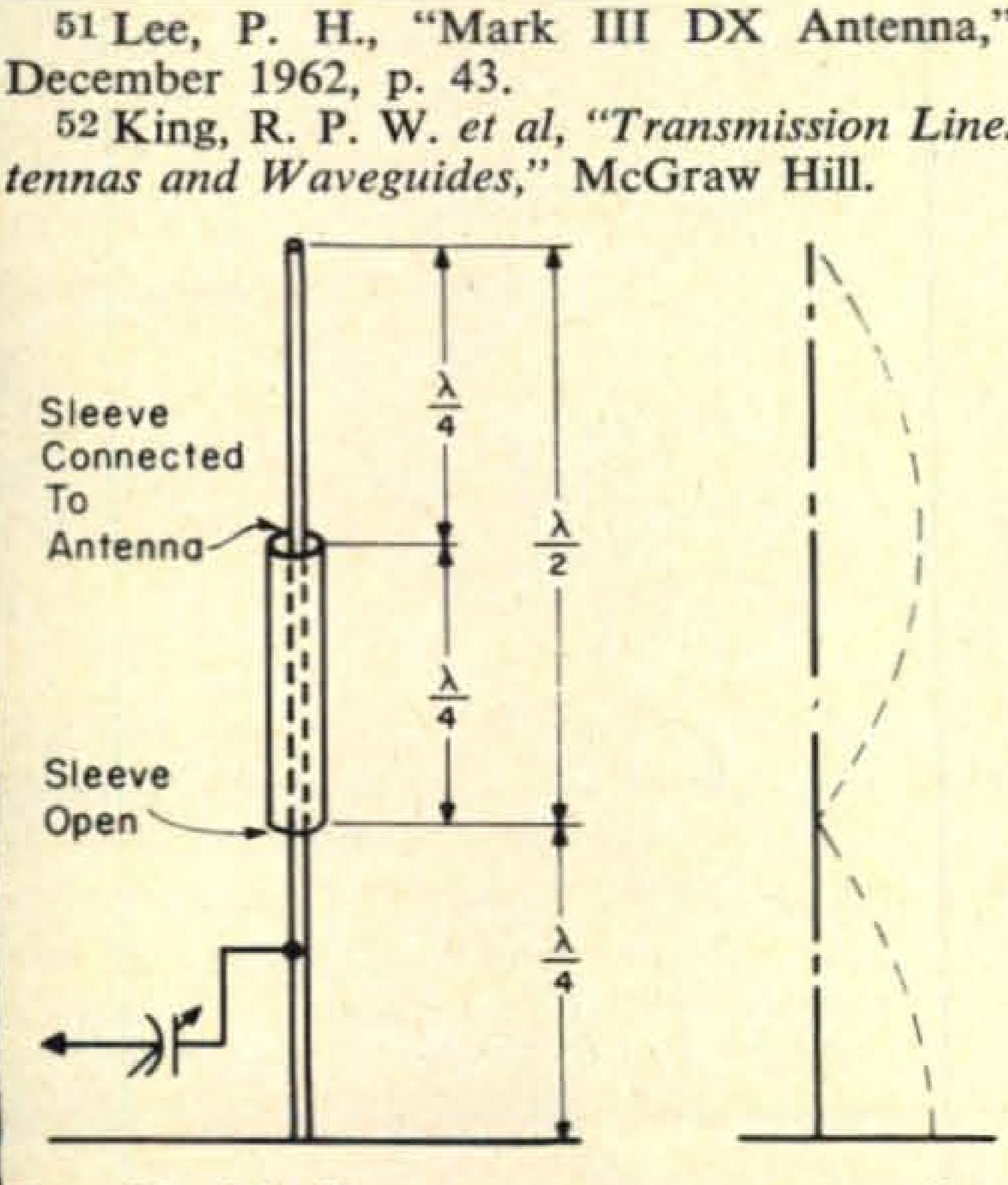


Fig. 46—A half wave over quarter wave in phase, with sleeve for phase reversal and its current distribution.

Rigid Coax

Figure 47 shows a suitable design for v.h.f. or u.h.f. using rigid coaxial line. Several sleeves are used over the outer conductor of the line, for phase reversal. The lower sleeve, it will be noted, is mounted with its upper end open, and is shorted to the coaxial line at the bottom. It acts in this manner as a detuning sleeve or "choke," preventing antenna currents from flowing any further down the outer conductor of the coaxial line. No ground plane is required in this case.

The ¼ wave coaxial sleeve is really nothing but a ¼ wave shorted section of transmission line, configured coaxially *around* the vertical radiator, instead of being made of wire and pulled off horizontally from it. It is quite a simple and effective device. There are, however, certain design precautions which must be observed. For maximum radiation it is necessary to individually tune (adjust the length of) each antenna section and each sleeve. In the case of the ¼ wave wire stub, this is quite easy. In the case of the coaxial sleeve, the outer surface (nominal ¼ wave) cannot be made shorter than the inner sur-

[*continued on page 134*]

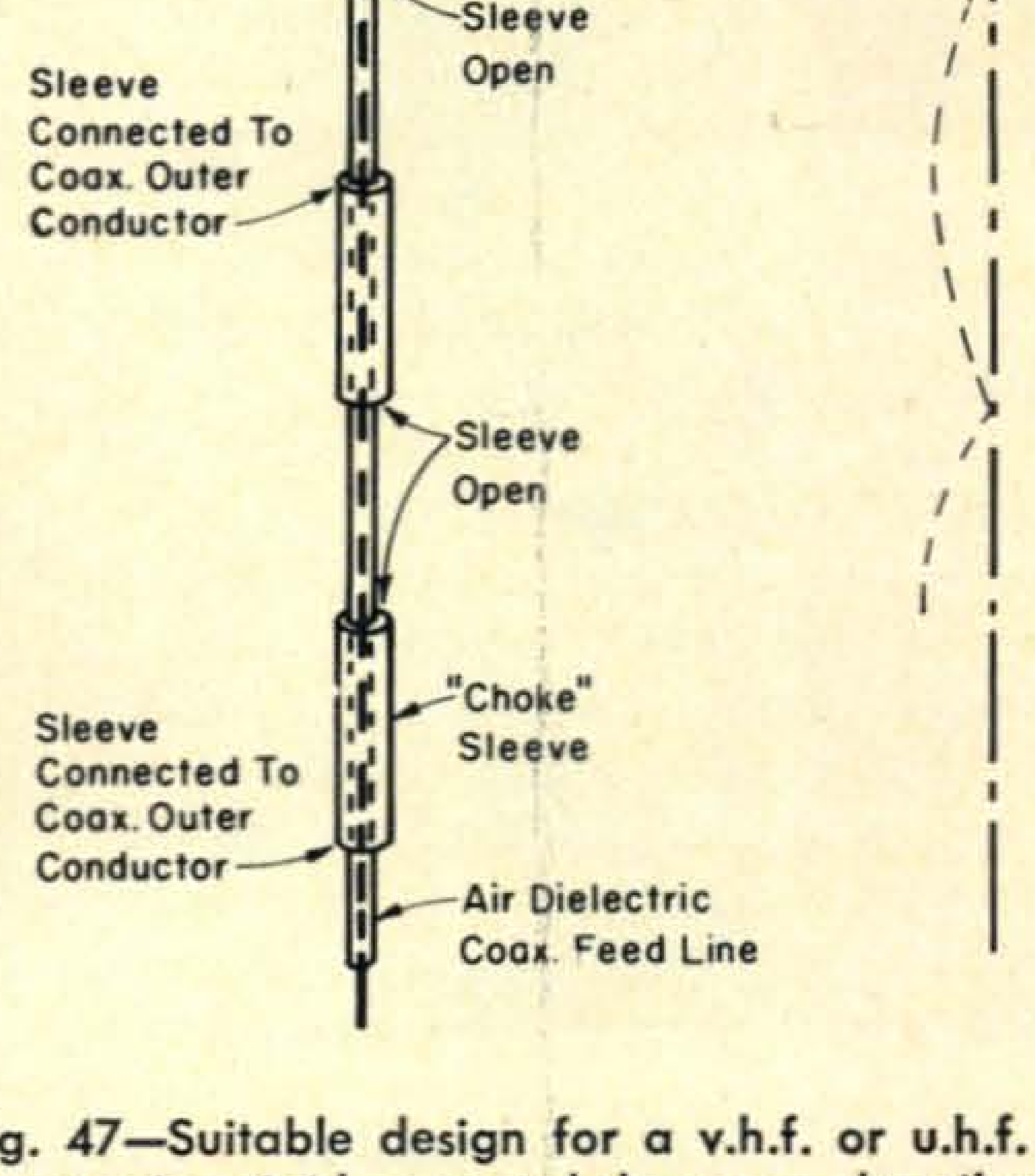


Fig. 47—Suitable design for a v.h.f. or u.h.f. colinear using rigid coax and sleeves as described in the text.

Improved Carrier Suppression for the HX-20

My home station uses a Heath HX-20 as an exciter and is followed by a home brew linear amplifier. The HX-20 was designed primarily for mobile use but is also an excellent exciter for the home station. As can happen in electronic equipment, after about a year of service, the carrier suppression circuit developed a quirk. It began to require about 45 minutes to an hour warm up before it could be adjusted for maximum suppression. It was still possible to adjust the balance potentiometer and capacitor for an estimated 40 to 50 db of carrier suppression, but only after waiting this inconvenient amount of time.

Much time was spent attempting to find the part or parts at fault. In the nulling circuit the fixed and variable capacitors were replaced, then the encapsulated twin diodes, followed by the resistors. When all parts in the nulling circuit had been replaced without positive results, the carrier generator circuit was attacked; the tube, capacitors and resistors were changed one at a time with identical results. Even moving the crystal away from the heat generated by the oscillator tube did not help. The time was ripe for a completely different approach.

About this time I read about broadband double balanced mixers made by Ultramatic Systems Laboratory in Sunnyvale California. One use of these versatile units is used as a balanced modulator in an s.s.b. exciter. They are unbelievably small, the case of the UM-1 being about one tenth of a cubic inch and this small space encloses two toroid transformers and four diodes in a ring type balanced modulator. As this unit seemed to be perfect for my use, it was ordered from Ultramatic.

* 536 W. Hillsdale Street, Inglewood, Calif. 90302.

Transistorized Oscillator

While awaiting delivery a transistor oscillator circuit was breadboarded and the diagram of fig. 1 shows what evolved. The UM-1 requires an input of 2 volts peak to peak in a 50 ohm circuit. This was obtained with a supply voltage to the 2N697 of 10 volts. The HX-20 also requires a somewhat lower r.f. voltage for the frequency spotting circuit. The r.f. voltage obtained from the upper end of the 330 ohm resistor fills the bill. The 2 volts peak to peak is fed into the LO terminals of the UM-1, audio from tube V_{1B} through RFC_1 in the HX-20 is fed into the IF terminal and double sideband output is obtained at

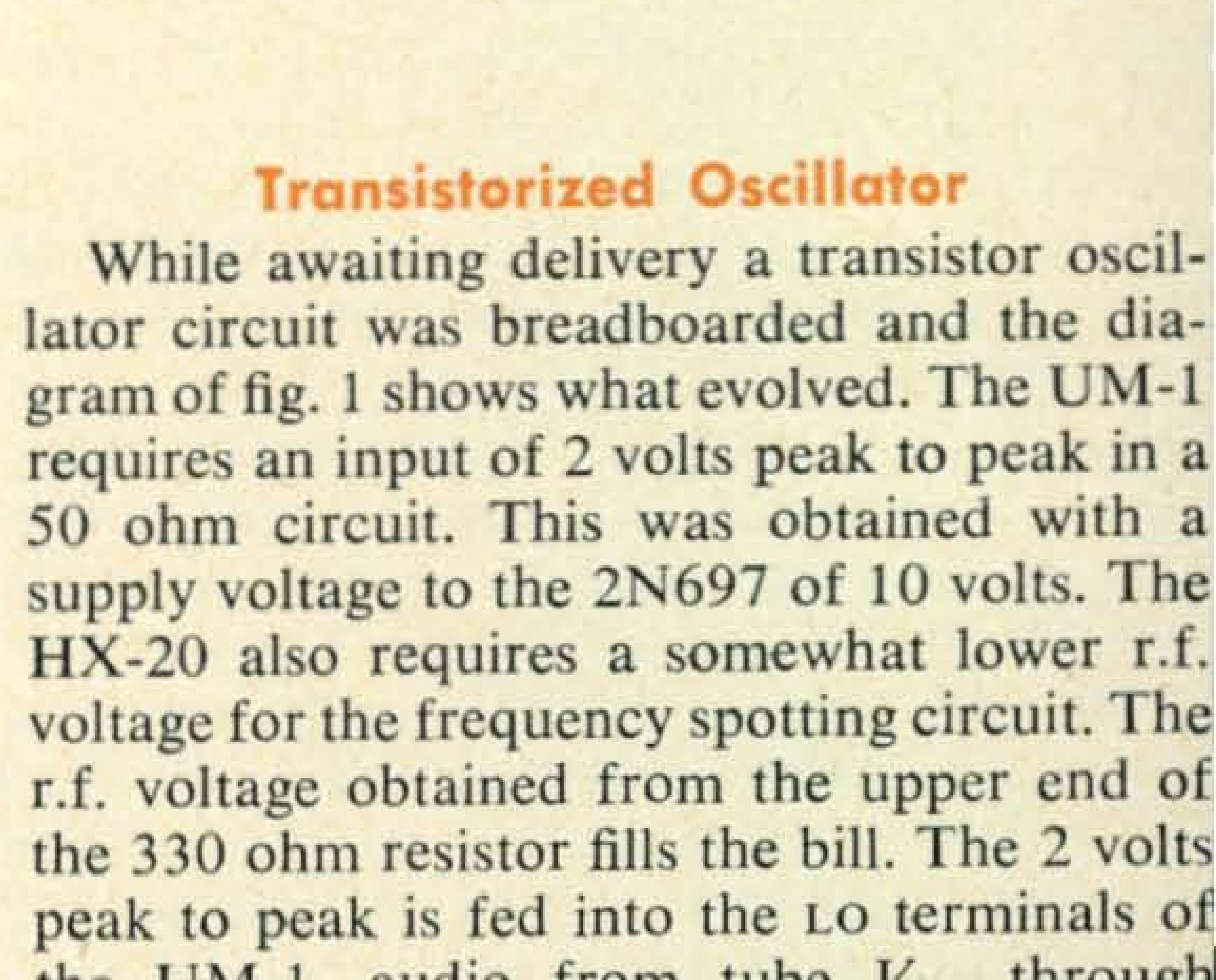
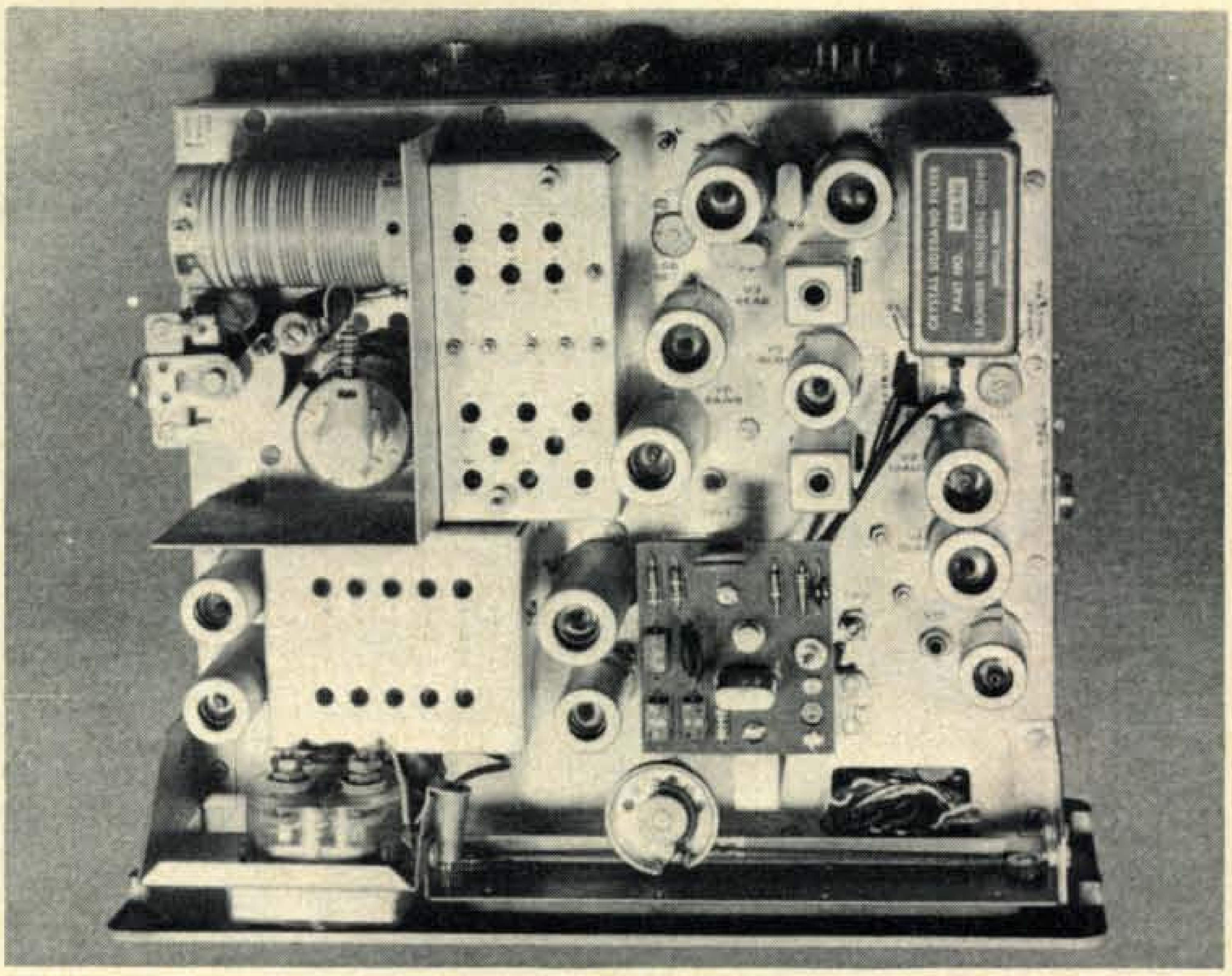


Fig. 1—Circuit of the transistorized oscillato mounted above the HX-20 chassis and the powe supply mounted below. Coax A connects to the LC input terminals of the UM-1 under the chassis an coax B connects to the HX-20 coax with red pair on it formerly connected to the junction of R_{14} an R_{15}. All capacitors are in mmf unless otherwis noted and all resistors are ½ watt.

C_1—40 mmf (a 50 mmf with 2 rotor plates removed
CR_1, CR_2—1N3254.
CR_3—10 V, 1 watt zener diode, 1RZ1110 or equi

See page 142 for New Reader Servic

Top view of the Heath HX-20 showing the location of the new crystal oscillator board.



the RF terminals. The double sideband output is fed into the filter input terminals in the HX-20. The lower level r.f. for the frequency spotting circuit is connected to the coax lead that formerly was connected to the junction of R_{14} and R_{15} of the HX-20.

Installation

The transistor oscillator was mounted on a 2 by 3 inch piece of phenolic board and supported above the chassis by two brackets. The two coax lines were run through the hole in the chassis formerly occupied by the socket for crystal Y_1. Capacitors and resistors associated with the vacuum tube carrier generator V_{2B} and the resistors, potentiometer, twin diodes and capacitors in the carrier nulling circuit were removed and the UM-1 was mounted in a portion of that space and securely grounded to the HX-20 chassis.

Adequate grounding was found to be vital in obtaining the last 6 db of carrier suppression. The bus was grounded in two places, each ground connecting to one of the brackets which hold the transistor oscillator chassis above the HX-20 chassis. If only one of these grounds is connected the residual r.f. carrier voltage is about double that with both grounds connected.

Either a chassis mounting or a printed circuit mounting UM-1 is available from the manufacturer. The chassis mounting type was ordered so that it might be grounded solidly to the HX-20 chassis.

It is very important that the manufacturer's advice regarding heat be followed; use very little heat when soldering leads to the pins. Clip a heat sink on each pin and make the connections quickly. One does not treat a fifteen dollar component lightly.

Crystal

The crystal in the carrier generator of the HX-20 was unsuitable for use in the transistor oscillator due to the higher capacity across it that caused it to oscillate at too low a frequency. This frequency was measured in the breadboard layout and this information and the crystal were delivered to Texas Crystals Co. They set their test oscillator's capacity so that the crystal oscillated at that frequency and then ground a new blank that oscillated at the required frequency of 4990 kc in the circuit with that amount of capacity. This crystal worked very well when the oscillator was installed in the HX-20.

Power Supply

Several methods of supplying power to the oscillator were considered and a half wave

[*Continued on page 126*]

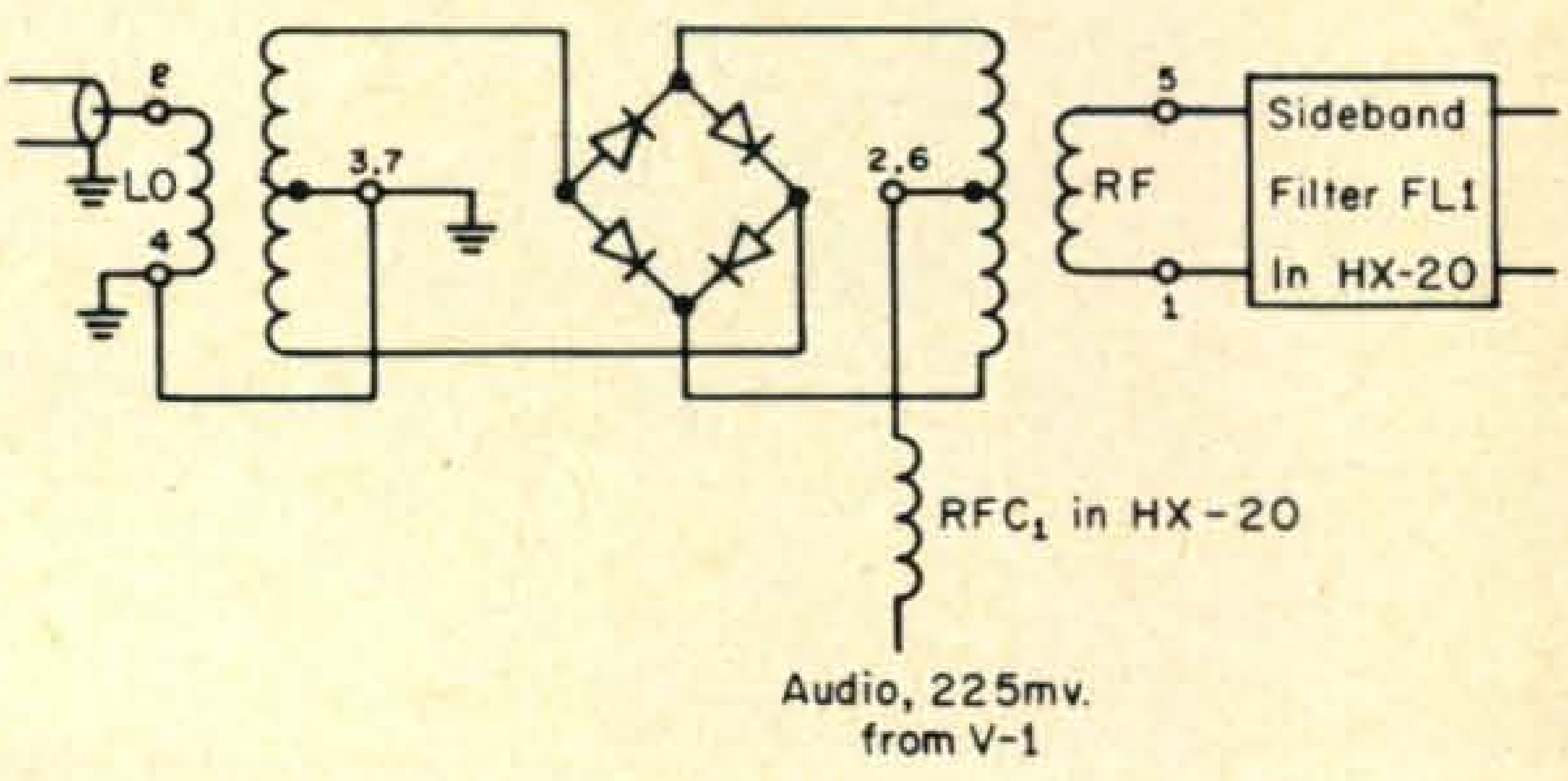
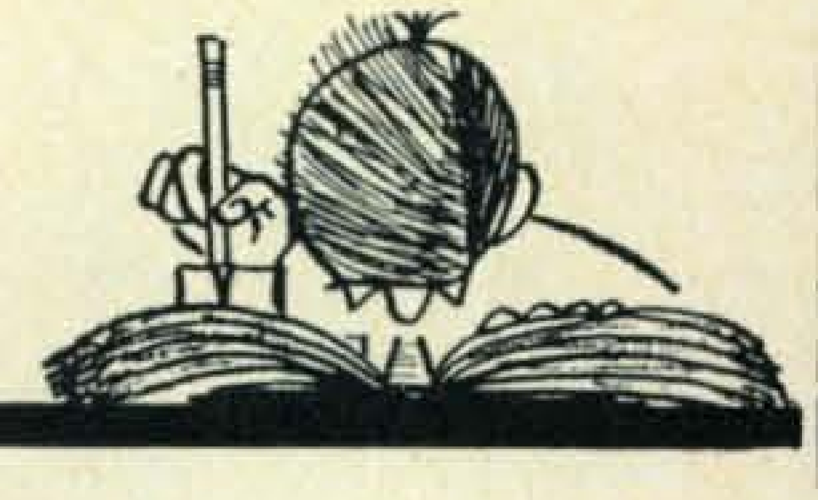
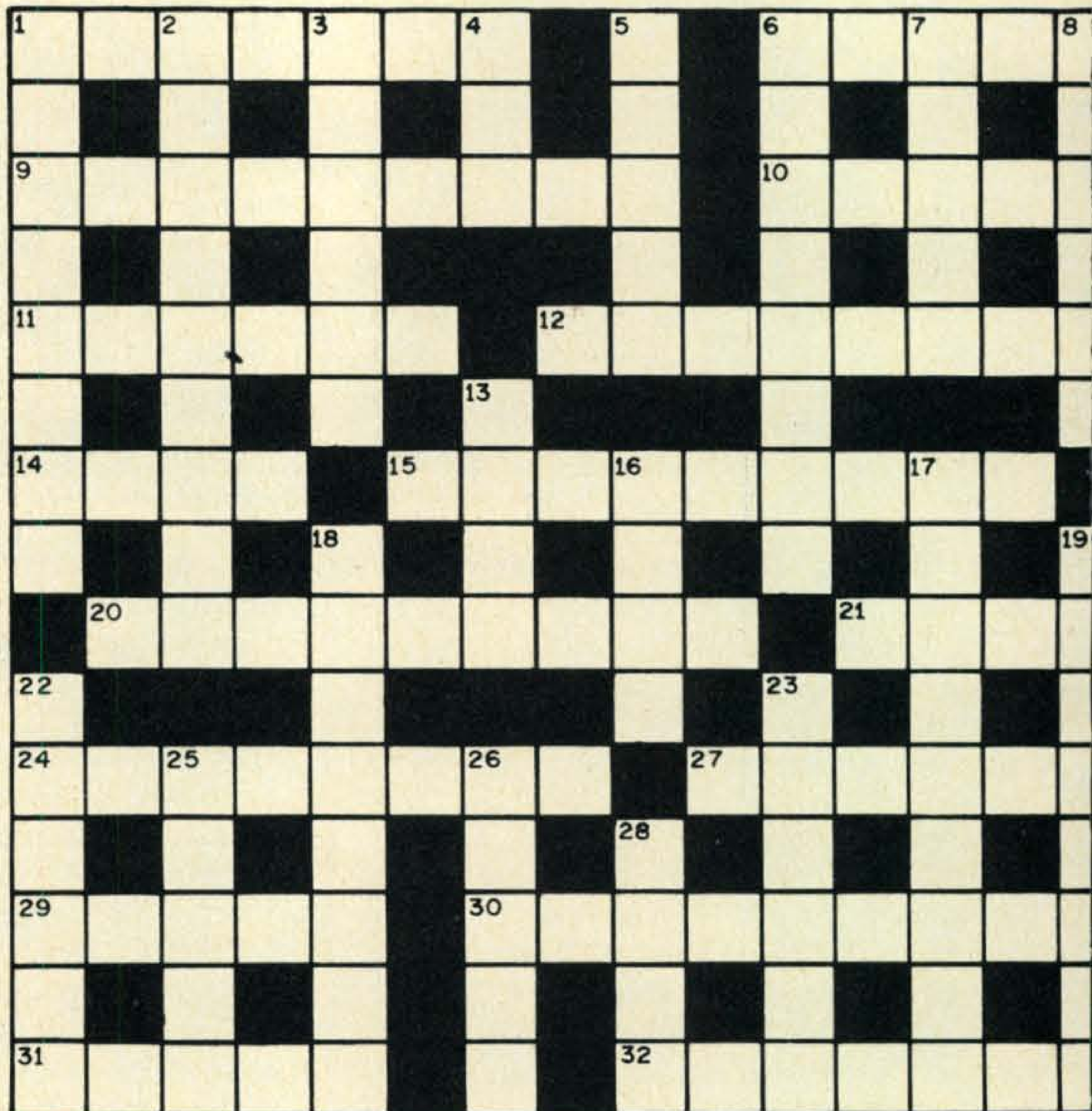


Fig. 2—Circuit and connections of the UM-1 double balanced mixer placed under the chassis of the Heath HX-20.

CRANIUM QUERIES





ACROSS

1. Revolving plates mounted at the front of television cameras carrying two or more lenses.
6. A British long-range hyperbolic navigational system operating in the 70- to 130-kilohertz frequency band.
9. Separated from other conducting surfaces by a nonconductive material offering high resistance.
10. A type of gas, sometimes called Noble gas.
11. The voltage reference point in a circuit.
12. A protective device used to provide a bypass path directly to the ground and deflect lightning discharges.
14. A coating that forms on iron exposed to air and moisture.
15. An electron tube containing two triodes in the same envelope.
20. An amplifier which has an essentially flat response over a wide frequency range.
21. Highest point.
24. The difference in impedance between a load and its source.
27. The insulating jacket that fits over the cone of metal-cone television kinescopes.
29. The Greek letter representing the word ohm.
30. A trigonometric function.
31. Looking forward to with expectations.
32. A speaker intended to reproduce the very high frequencies.

DOWN

1. To start action in another circuit, which then functions for a certain length of time under its own control.
2. The receiving component of an interrogator- . . . .
3. The area of antenna containing the electric field.
4. To place a storage device in a prescribed state.
5. A device which detects large changes of temperature overhead by the amount of sound returned and patterns formed.
6. A device used to prevent a disc from slipping on a turntable.
7. Sometimes called peak value; the maximum absolute value of a function.
8. Changes or modifications.
13. Glass or metal shell of a vacuum tube.
16. The general character of reproduced sound as it affects the human ear.
17. The decrease in the value of a variable quantity.
18. In electrolysis, the quantity of a substance deposited in a given time in proportion to the current.
19. The stage in a re ceiver in which de modulation take place.
22. Even in surface.
23. A rim or lip on waveguide sectio which allows prope coupling an matching.
25. The motion of a electron beam ove the screen of th cathode-ray tube
26. One complete posi tive or one com plete negative alter nation of an alter nating current.
28. A prefix used t identify electro static units in th cgs system.

Answers appear on pag 128.

A 700 Watt P.E.P. Dummy Load (for about $2)

BY FLOYD FELLOWS,* WA8ZJH

So you up and got yourself a transmitter or a transceiver that puts out a lot more than one hundred watts—and you want a dummy load to keep you off the air while tuning up. Here is a simple inexpensive job.

Every once in a while the surplus market comes up with non-inductive resistors at a price that will give you an inexpensive dummy load. But then, as most, you keep missing the bargains. A short while ago I got about the last of some 25 watt resistors. It took four to get 100 watts at a 50 ohm impedance match. They are no longer available and besides, the wattage capacity is a bit on the low side.

In a recent check-up, some non-inductive resistors have been discovered in good quantity. Better yet, they are rated at 50 watts and with their 344 ohm individual value, take seven to produce the desired approximate 50 ohm transmitter requirement. Seven units means a wattage value of 350 steady or 700 watt equivalent p.e.p.

These surplus resistors are put up "seven in a bag" and can be obtained from John Meshna, Jr., 19 Allerton St., Lynn, Mass. 01904, price $1.75 postpaid. That's a plug for John, but when you're there with something that can't be found elsewhere, the plug becomes your special favor. Price-wise, you can't match the item and they're made by one of the well-known manufacturers.

These resistors are on a ceramic core and have a baked enamel covering, so the construction is the best. Probably will stand a substantial overload. The individual resistors are only 2" long, 1" wide and about ⅜" thick and are supplied with metal mounting "ears" at each end of the resistor. Seven of the resistors with their 700 watt p.e.p. rating, when assembled, take up a space of 2" high, 3" wide and 2" thick.

* 1673 Cedar Avenue, Apt. 209, Cincinnati, Ohio 45224.

Assembly

In looking at the resistors it first appears that they could be grouped by bolting together, using the metal ears. However, the spacers on the ears set the resistors further apart than necessary. By removing the ears and assembling as described, a more compact dummy load will result. The electrical connections will be shorter and, no doubt, will give better r.f. characteristics.

To assemble your prize resistors into the dummy load, you merely group them four on one side and three on the other. The lugs of the resistors all face each other as shown in the illustrations.

Before making the soldered resistor assembly, you should make up the cable attachment on which the resistors will be mounted. Secure a 4" length of RG-8 cable. Do not use RG-11 or RG-58 as physical stiffness is desired for holding the completed dummy load. Attach a PL-259 connector to one end of the cable by usual methods. Standard cable instructions can be found in many places, the Handbook for one. The other end of the 4" cable should have its outside jacket removed for about 1¼". Unravel the ground braid, leaving the center conductor insulation. Cut this insulation back about 1" to a length of bare conductor for resistor mounting. Tin the center conductor so that all strands are smooth and like a single conductor. Make sure the center conductor will slip easily through the holes in the resistors' connection lugs. If, for some reason, the holes will not take the RG-8 center conductor, ream or drill out the lug holes.

Note the illustration of fig. 1 showing the completed assembly. Assemble the seven resistors, using their top lugs to arrange four resistors on one side and three resistors on the other side. Bend the lugs as required to keep the resistors fanned out and the lugs close to each other. When positioned, solder the

See page 142 for New Reader Service

lugs to the RG-8 center conductor.

Now take a length of bare copper wire or a piece of RG-8 center conductor from another RG-8 scrap and insert this into the bottom lugs of the seven resistors. A piece of wire about 2" long will do. Solder the bottom lugs onto the conductor and leave about 1" free at the cable end. Space the bottom lugs the same as the top lugs. When the bottom soldering is complete, bend up the free end of the conductor so it will line up with the shield from the RG-8 cable. Trim the shield to the proper length and wrap it around the conductor soldered to the bottom lugs of the resistors. Solder the connection and you have completed the dummy load.

Performance

We use a dual antenna transfer switch so that the transceiver can be coupled with the antenna or the dummy load. This makes it easy to switch off the air and into the dummy load for tuning.

The s.w.r. appears to be excellent as the 80-10 meter maximum was less than 1.1 to 1. On several of the bands it was almost 1 t o 1. You will find you can tune up and then when you switch from the dummy load to your antenna, only a very minor adjustment will be needed, if any at all.

Enclosures

Now that you have made the simple "open" style model, you can dress up the dummy load by putting it in an enclosure. Instead of the PL-259 connector, you will need an SO-239 plug and a small metal box. We found a steel box about 3" × 2½" × 2" which will hold the group of resistors nicely. Figure 2 and the photos show how the resistors can be housed. As will be seen, the leads to the resistors can be kept really short.

When using this enclosed dummy load, it will probably not overheat even though it's enclosed, provided you do not keep it loaded for any great length of time. As a matter of fact, any of the new transceivers should not be held in the tune-up position, which means that the dummy load probably has more life potential than your final. Should you wish, however, you can drill a number of ⅛" holes in the box enclosure for the resistors, which will permit a flow of cooling air. Put the holes in the bottom of the side sections and the top, so there can be a flow of air.

Oil Cooling

As a final arrangement to get the highest possible loading on the dummy resistors, the oil approach can be worked out. You can probably load your linear into the following arrangement without trouble, if you use judgment, since the resistors have a steady load rating of 350 watts. On a short time basis and with a cooling medium, such as mineral oil, a 1000 watt load can be carried. This, of course, is 2000 watts p.e.p.

To keep the items small, and at the same time take advantage of the short time loading procedure, a pint-size can arrangement was selected for the oil immersed version (fig. 2). You can obtain an empty press-on lid paint

[*Continued on page 128*]

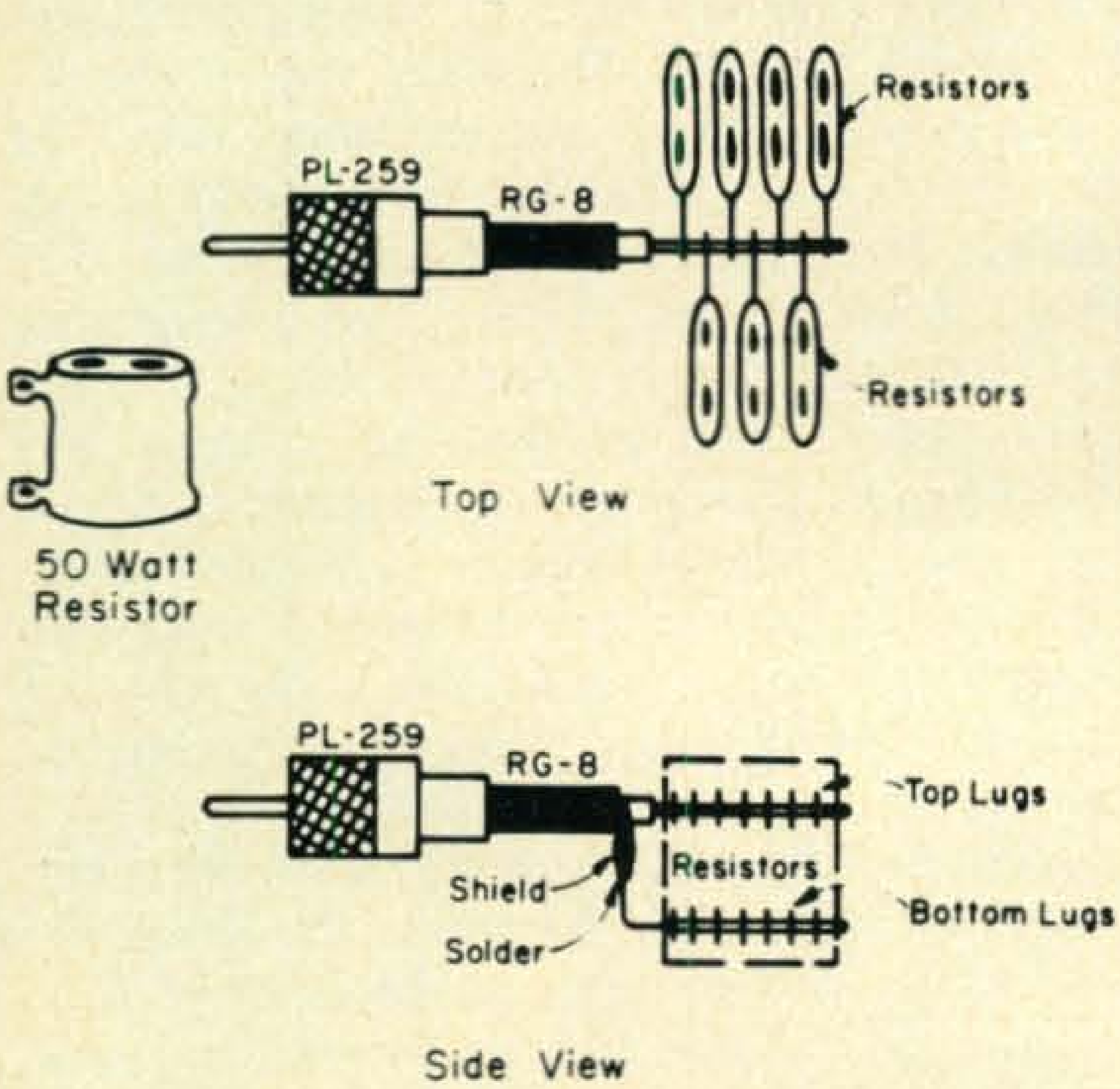


Fig. 1—Arrangement of the seven resistors as placed on the end of a short length of RG-8 to form a 700 watt p.e.p. dummy load.

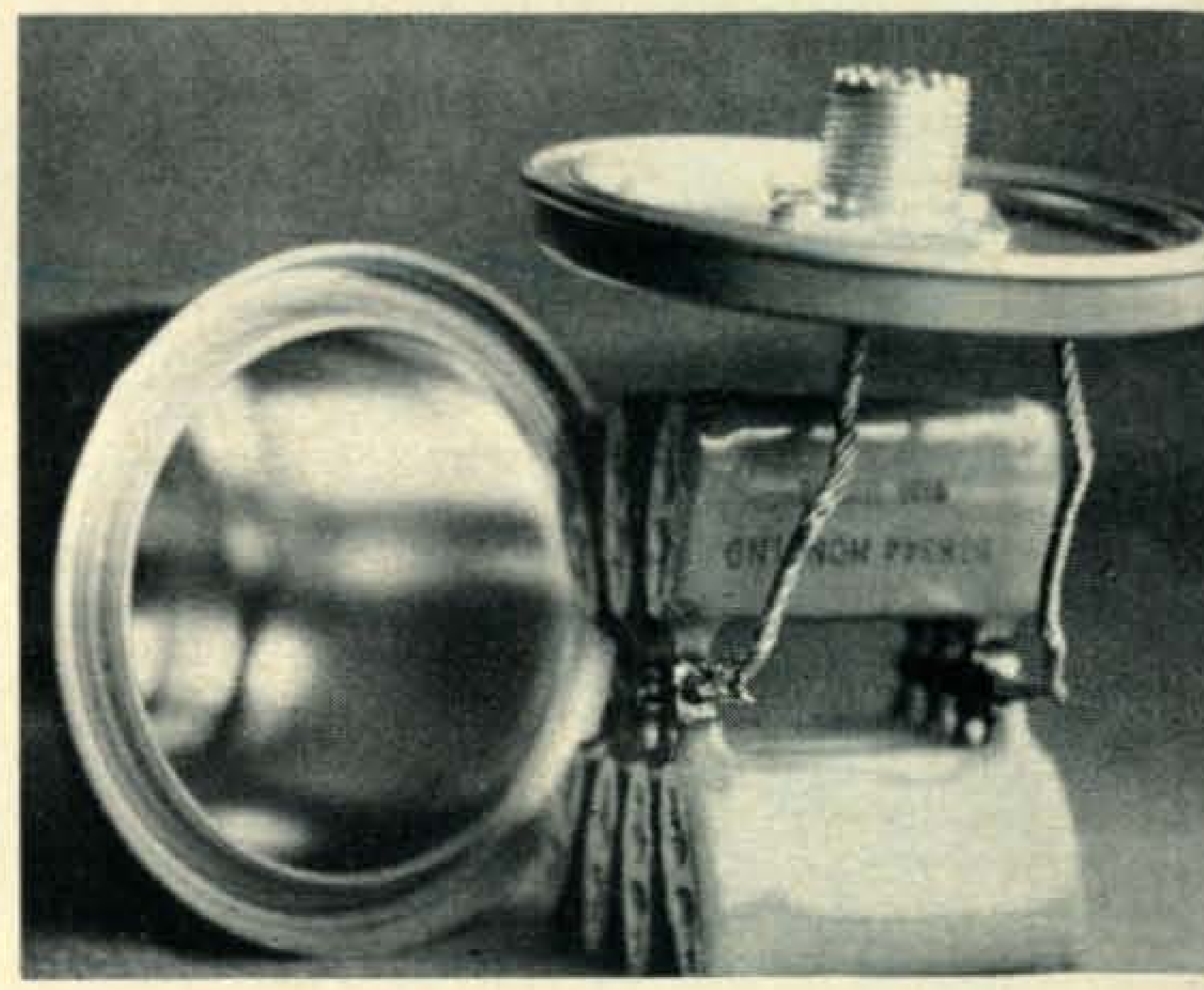


Fig. 2—The dummy load resistors mounted in a case or can for oil.

See page 142 for New Reader Service

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.

First of all, it's got a shake-proof sleeve clutch that folds over when you want to garage it.

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.

It's also strong enough to take a knock without bending. And the turnover mast is a hefty ⅝" solid rod of highly polished, heat-treated aluminum.

We've also done away with the old-fashioned plastic shrink tubing and sealed the lightweight precision-wound coils in an indestructible epoxy-fiberglass sleeve. (Which is a distinctive white that'll add to the beauty of your car.) And, all fittings are heavy chrome-plated brass.

The new Ham Cat combines higher Q with wider bandwidth performance, without using a lossy-heat generating coil like the others use. So it not only looks beyond your wildest dreams, it works beyond them, too.

It's also designed on a nominal 52 ohm impedance so you don't have to have any special matching. (Any length coax will work.)

The Ham Cat mobile ham antenna is at your Hy-Gain dealer (he's the best one under the sun) right now.

And it's there at a price all the others are charging for half of what you get in this antenna.

And that's the real beauty of it.

ELECTRICAL

- Nominal 52 ohm impedance—no special matching device needed.
- Widest bandwidth, highest power handling —Vs.—heat drift ratio available.
- Lowest VSWR in any mobile available.

MECHANICAL

- Turn-over mast is hefty ⅝" dia. solid rod of highly polished heat-treated aluminum.
- All connections are standard ⅜-24 thread.
- Mast folds over, swivels, and turns over. You can mount it on bumper deck. In addition, this flexibility makes it easy and simple to change coils.
- Coil and tip rods are a one-piece assembly. Coil diameters are constant, only lengths change.
- Shake-proof sleeve clutch facilitates quick band changeover and fold over for garaging.

THE Ham caT MOBILE HAM ANTENNA FROM HY-GAIN

HY-GAIN ELECTRONICS CORPORATION
N.E. Highway 6 at Stevens Creek
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THE MOST ADVANCED ANTENNAS UNDER THE SUN

AT LAST!

2 METER FM TRANSCEIVERS

SPECIALLY FOR *HAMS*

FULLY TRANISTORIZED – NO TUBES

Operates on — 117 VAC — 12 Volts DC — Or Optional Internal Batteries — Separate receiver and transmitter 3 channel operation —Self-contained 3 x 5 speaker — Strong fiberglass Epoxy printed circuit boards — Power supply even regulates and filters on 12 VDC operation — cannot be damaged by Reverse Polarity — 21 transistors — 14 diodes — Double conversion crystal controlled receiver with 3 full watts of audio output and better than . 3μV sensitivity (12 DB SINAD) — Transmitter and receiver may be ordered in either wide or narrow band at no extra charge (wide band supplied unless specified) — Small size 8"w x 3½"h x 9½"d — Light Weight - Less than 4½ lbs — True FM receiver not a slope detector — Dynamic microphone input with push to talk — Built in 117 VAC power supply — Simply plug in proper power cable for either 117 VAC of 12 VDC operation — Transmitter power output 4 watts minimum.

Complete with one set of crystals on 146.94, 117 VAC and 12 VDC power cables, less microphone and antenna $285.00

Extra crystals (transmit or receive) $7.00

Microphone w/plub $18.00

Internal NI-CAD battery and charger $47.00

ICE

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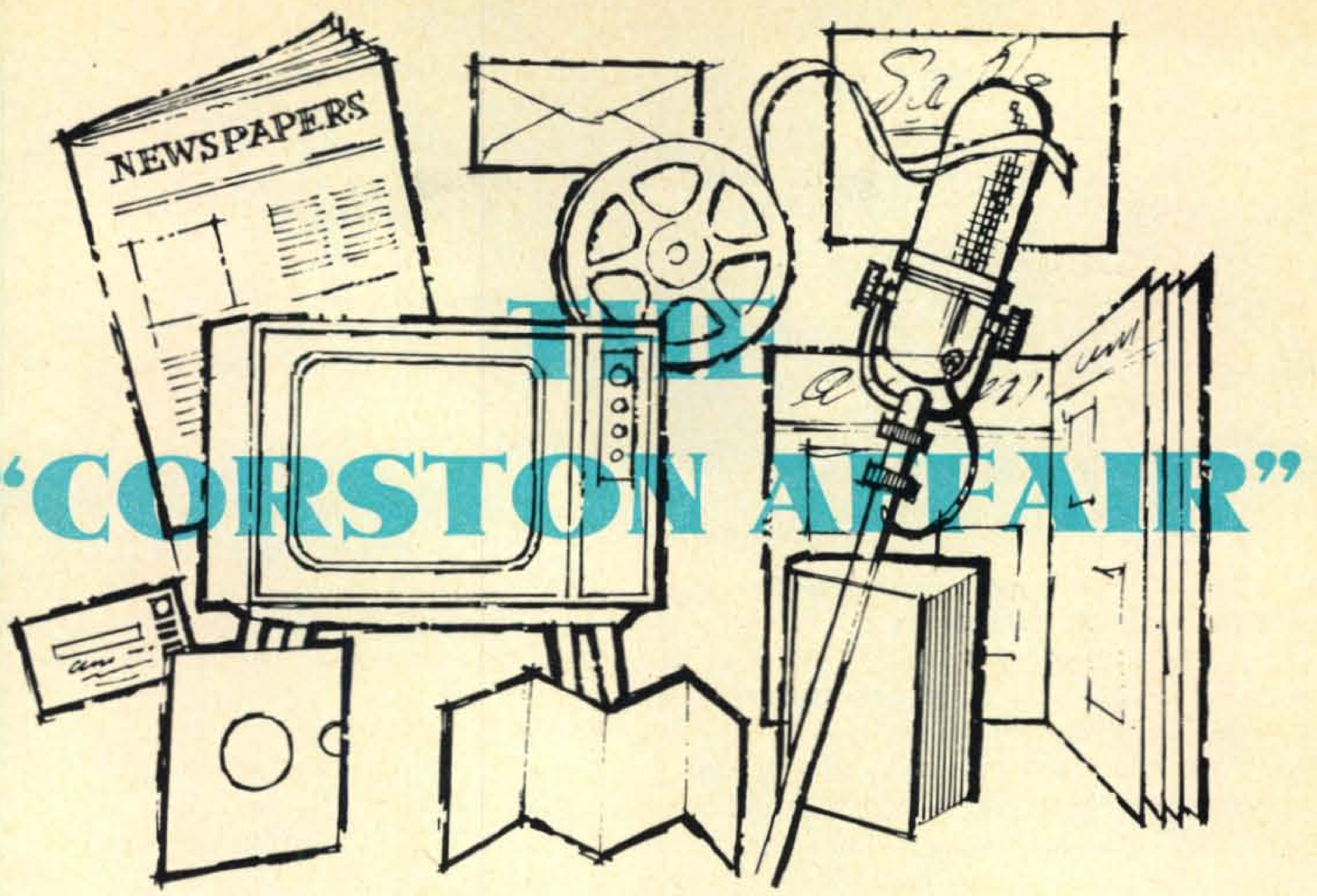


THE "CORSTON AFFAIR"

BY SYLVIA MARGOLIS*

SHE sat there in the chair, quite dead, her husband living in the same room, eating and watching TV for five days. On the fifth day he went to the police, apologized for disturbing them on a Sunday and said he thought there might be something wrong with his wife. When they asked why he hadn't called them earlier, he said he didn't want to make a fuss, not in front of the neighbours!

It happened, it really did, in London, recently!

Not in front of the neighbours; sweep it under the rug; pretend it's not there and it might go away. Sometimes, though, things that we'd prefer to hide won't stay hidden and there is hell to pay. Not only do the neighbours get to know, but so does the world, thanks to the Press, may its shadow increase!

One of my terms of reference as Public Relations Officer of the Radio Society of Great Britain is to maintain at least a balance of understanding with the Press. Nevertheless, the week we don't have to endure the backlash of some sensational news item featuring a radio amateur is a good week.

Newspapers thrive on strife. *Man pats dog* is dull. *Man bites dog* is news. When a radio amateur resolves an emergency call, we might, if we are lucky, get a garbled half-inch on the back page. Let a ship's drunken radio operator hamper air-sea rescue, the way it happened when the Aer Lingus plane went down off the coast of Ireland, and all the papers, even the good ones screech HAM HOAXES RESCUE PLANES. By the time the truth emerges, the news is stale and no Editor will bother to retract. Yet the damage to the image is done.

That's one of the reasons R.S.G.B. appointed me, a kind of chunky, greying Lucille Ball character, as their first P.R.O. I can blow my top at Editors with less risk of a punch on the nose than a man could. It's my pride that there isn't an Editor's Secretary in London who hasn't been instructed NEVER—repeat NEVER—to let that nutty woman from the Radio Society within arms' length of her boss!

My worst enemy is TVI. The Tennessee Valley Indians strike more terror into my vulnerable heart than could any painted, whooping Sioux or Apache. TVI makes news as surely as man bites dog. Regularly I receive newspaper cuttings gloating over a local fracas between a radio amateur and his neighbours. I appreciate—I really do appreciate—the marvellous way in which our darling, *darling* R.S.G.B. members support me by

*95 Collinwood Gardens, Clayhall, Ilford, Essex, England.

Approaching the show-down.

sending in these reports, but the TVI incidents are a nightmare, because the answer to the problem is that there is no answer to the problem. Most TVI cases concern the irresistible force and the immoveable object. Only too often the radio amateur is anything but irreproachable in his installation and operation, just skimming within the law's technical requirements but, beyond that, never willing to concede a kilocycle, let alone an inch, to his neighbours.

All I can do is to send the newspaper our "Bug Letter," deriving from the tale of the woman who wrote to the railroad company to complain that she had found a louse crawling on the train seat. Back came a profuse apology, rather spoilt because the stenographer had forgotten to detach her boss's pencilled instruction:

Send usual bug letter.

Our Bug Letter is authoritative and *appaled* that a radio amateur should be accused of so-and-so and such-and-such. Radio amateurs, it proclaims, are a responsible body of citizens, who have worked hard to pass their exams. Would they, it asks, with plaintive rhetoric, risk losing their precious licenses by antisocial behaviour? Did not the public, it queries, horrified at any display of public ignorance thus indicated, did not the public know of the service rendered to the community by radio amateurs in disasters? And of the contribution made to technological progress made by my altruistic, public-spirited, dedicated, clean-living radio amateurs.

It's a beautiful Bug Letter and one of which I am proud. Cute kookies, R.S.G.B. to appoint such a Bug-Letter Compiler as their P.R.O.!

Whether or not the Bug Letter has any effect we don't know. It does no harm, although it rarely does good, except for once, in February, 1968, when we hit the headlines so hard it spattered off the fan. And, in an overpopulated country the size of Britain, there's no place you can hide and not get splashed.

The first newspaper cuttings plopped onto the mat, a trickle that was to become a torrent. Next day there was a pile of letters, some of them accompanied by members' comments, ranging from:

"Disgraceful, madam! Can you not do something to stop this calumny?"

to the colloquial, but just as vivid:

"Sort 'em out, Sylv!"

"RUMPUS OVER RADIO CHAT TO AMERICA . . . . ."

they chortled. So what was wrong with a radio chat to America? It showed conditions were good. Not contacting America, now, that would be something to worry about.

"ANGRY TV VIEWERS REJECT ASSURANCE. . . . ."

"VILLAGE HITS BACK AS RADIO HAM IS CLEARED. . . . ."

"RADIO HAM'S VOICE GOES OUT ON TV . . . . ."

A medal, they should give him, not complaints, considering the standard of TV programmes.

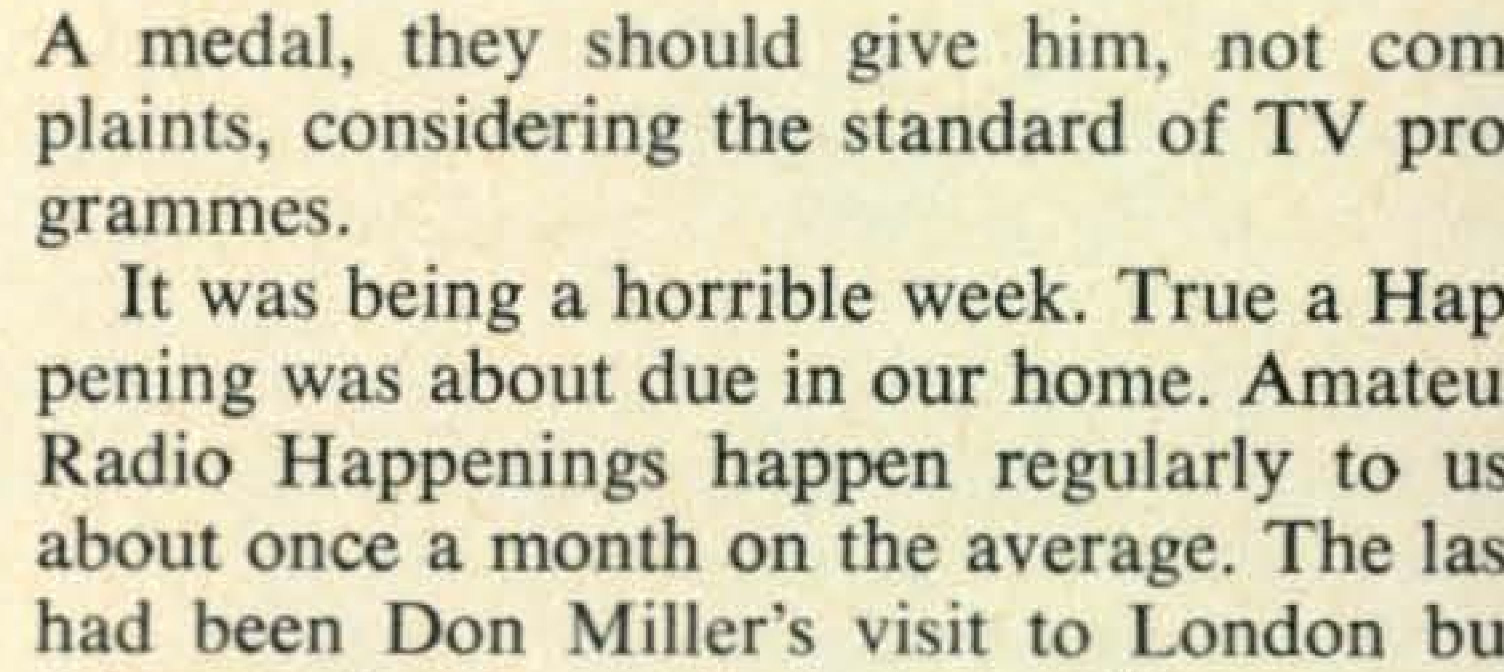
It was being a horrible week. True a Happening was about due in our home. Amateur Radio Happenings happen regularly to us, about once a month on the average. The last had been Don Miller's visit to London but this wasn't going to be so enjoyable.

Came the final insult:

"RADIO HAM HOGS THE TV. . . . ."

Funnee-ee!

It was an insult because it appeared not in a local paper, but in a national Sunday paper, one with a penchant for finding people in beds where they shouldn't be and bits of corpses set in cement. Nevertheless its circu-



Landscape that has changed little in 200 years.

See page 142 for New Reader Service

lation topped one million, which meant that one million people who liked to read about other people's sleeping arrangements and cement-set components could now enjoy a tale of rape and mutilation, the mutilation of amateur radio's image in Britain.

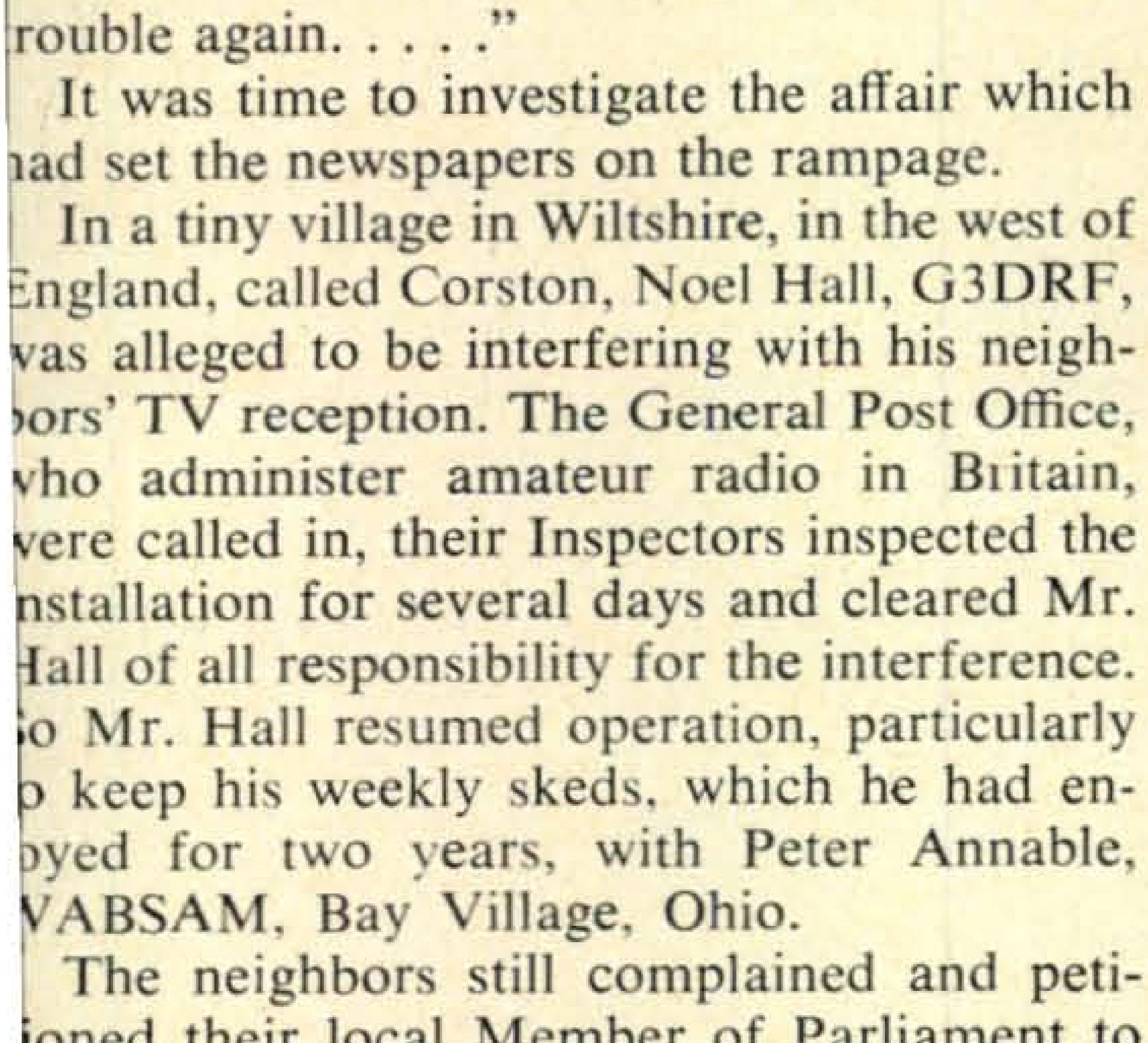
I called the Editor (this was before they put the ban on me in Fleet Street) and suggested he was a lying, odiferous, misbegotten, constipated, politically unreliable, morally questionable, puppy-kicking offspring of a female dog. We discussed this premise for a while, until I told him what to do with his newspaper and he told me what to do with R.S.G.B.'s 14,000, influential, newspaper-reading members, all of them.

A neighbour stopped me in the street, a neighbour with whom we'd had a degree of debate concerning my husband's fundamental and her front end. "That's a fine rumpus one of your lot has started, down in Wiltshire," she commiserated, "Now, I'm sure your husband wouldn't mind having another look at our TV. We seem to be getting trouble again. . . . ."

It was time to investigate the affair which had set the newspapers on the rampage.

In a tiny village in Wiltshire, in the west of England, called Corston, Noel Hall, G3DRF, was alleged to be interfering with his neighbors' TV reception. The General Post Office, who administer amateur radio in Britain, were called in, their Inspectors inspected the installation for several days and cleared Mr. Hall of all responsibility for the interference. So Mr. Hall resumed operation, particularly to keep his weekly skeds, which he had enjoyed for two years, with Peter Annable, WA8SAM, Bay Village, Ohio.

The neighbors still complained and petitioned their local Member of Parliament to bring the matter to the attention of the Postmaster General in the House of Commons.



The village center.

15th century cottage on right, modern home on left. Note dry-stone walls, local specialty which pioneers took with them and used the skill in some New England villages.

Such publicity we needed like we needed a hole in our heads and it was at this stage that the national papers began to take a gleeful interest in what became known as the "Corston Affair."

The Postmaster General replied to Mr. Daniel Awdry, M.P., that Mr. Hall's amateur radio station was installed and operated within the strict technical requirements laid down by the G.P.O. The cause of the Corston Villagers' poor TV reception was the inability of the sets to reject unwanted signals.

You understand that and so do I and so do all those special people called radio amateurs. But how do you convince the owner of a new, $200 TV set that it's badly designed, badly engineered and that he has two strikes against him from the start, because he has chosen to live in an area with a notoriously poor level of received TV signal. Rather accuse an Englishman of paying insufficient attention to personal hygiene than of being an undiscerning shopper.

So the villagers of Corston, unsatisfied with the M.P.'s reply, prepared to petition their Parish Council to have Mr. Hall put off the air. They did something else, too. They sent Mr. Hall's family to Coventry.

Now, in a city or a suburb, if your neighbours won't talk to you and if their children refuse to play with your children and pick on them at school, it doesn't matter a lot. There are plenty of other neighbours and other children. In a village the size of Corston, it's no joke. Mrs. Hall, a sensible, well-adjusted woman, had been on tranquilizers for two weeks. So thin is the veneer of civilization, so fragile the restraining bonds of social nicety, that it takes only a radio ama-

Home of G3DRF, the center of the "Corston Affair."

teur and his transmitter to reduce otherwise splendid citizens to the level of squabbling crows. The situation had ceased to be amusing, a small storm in the teacup of a pretty, Wiltshire village. The situation had ceased to be pretty at all.

The Bug Letter appeared in several papers and several people read it, including one of the Corston complainants, a retired farmer called Walter Denly. Mr. Denly wrote to his local paper, the *Swindon Evening Advertiser:*

> " . . . If Mrs. Margolis can prove to our satisfaction that the interference is not due to the amateur transmitter G3DRF, I will be pleased to donate £20 to the National Institute for the Blind. . . ."

It was Fort Sumter!

I called Mr. Hall, long-distance, with a list of questions about his equipment, antenna, antenna feed, operating conditions, TV receiving conditions. His answers were promising, apart from his description of the TV signal. Corston is in a fringe area, about 80 miles from the nearest TV transmitter, set in a ring of hills, with little more than 100 μv from any of the programmes, about 50% of what it should be. A passing car caused the signal to fade and a low flying aircraft could obliterate it altogether.

I called Jack Etherington, G5UG, an R.S.G.B. Council Member and Chairman of the Society's TVI/BCI Committee. There wasn't time, not at 7 cents a minute, to ask why his Committee had let the Corston Affair escalate to its present unseemly level, but just to ask his co-operation. If we took up Denly's challenge and travelled 100 miles to Corston the next day, would he meet us there, to support the venture? He would.

I drafted the help of my husband, remembering how, when he was once asked what it was like to be married to me, he replied: "Interesting, but exhausting!"

Would he take me to Corston next morning—it was a Saturday—and, with his vast experience of sorting out TVI, help me win £20 for the charity? He wasn't too happy at first, but I made him see things my way.

I sent a telegram to the *Swindon Evening Advertiser:*

> ACCEPT DENLY'S CHALLENGE IF YOU WILL PROVIDE REFEREES.

Two hours later the Editor replied—O.K. Then I sent Mr. Denly a telegram, one which gladdened my heart, even if it did cost the Society a dollar:

> ACCEPT CHALLENGE. ARRIVING NOON SATURDAY WITH RESEARCH TEAM.

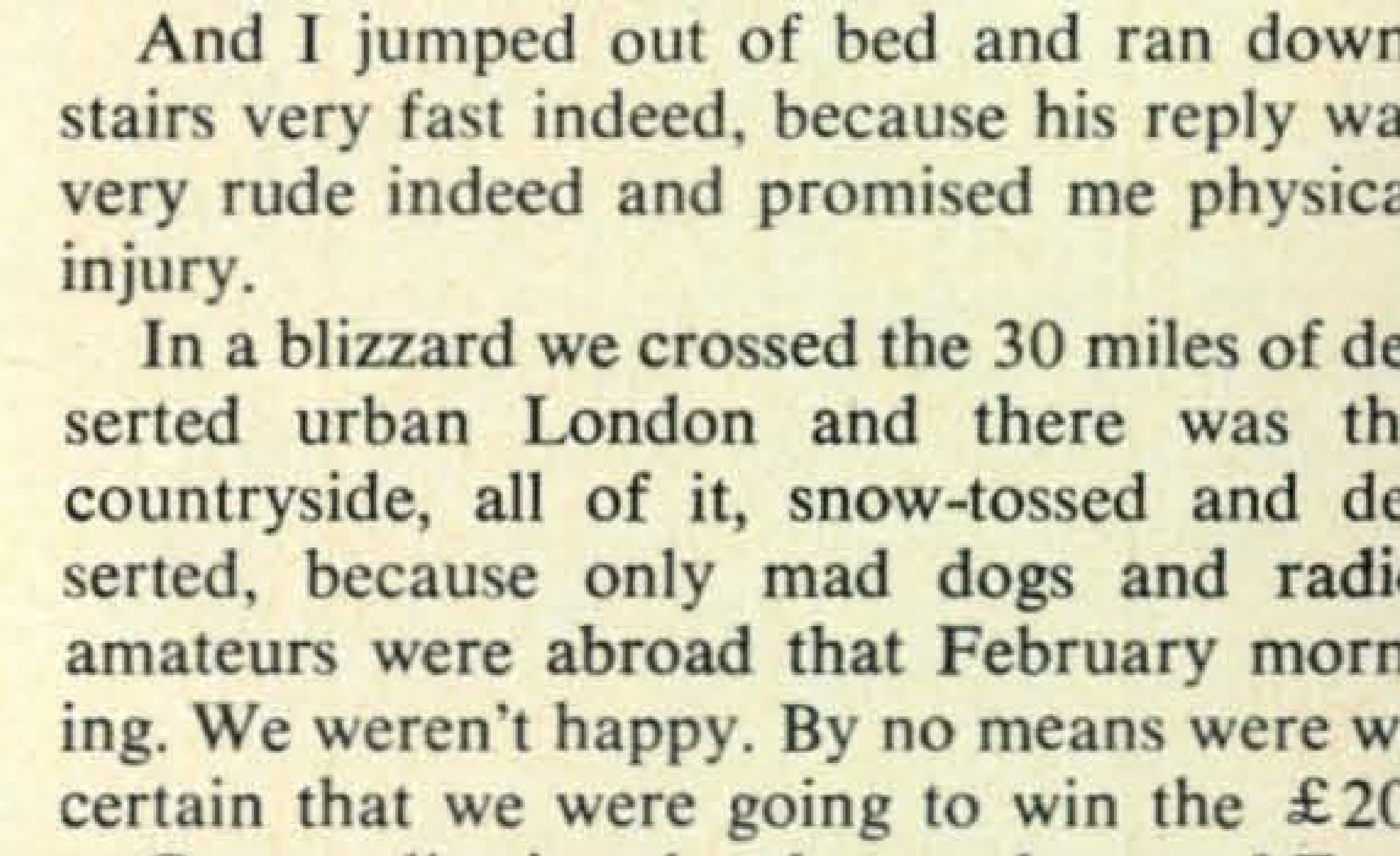
To arrive at noon we must leave home at 7 A.M. At 6 I prodded my husband. He grunted.

"Rise and shine, darling," I coo-ed, "It's time to get up and drive to Corston and it's snowing and are you *still* glad you took up amateur radio as a hobby?"

And I jumped out of bed and ran downstairs very fast indeed, because his reply was very rude indeed and promised me physical injury.

In a blizzard we crossed the 30 miles of deserted urban London and there was the countryside, all of it, snow-tossed and deserted, because only mad dogs and radio amateurs were abroad that February morning. We weren't happy. By no means were we certain that we were going to win the £20.

Corston lies in a lovely, rural part of England, unspoiled, racing country where you don't grumble if you are held up by a string of prancing, priceless horses as they cross the road in front of your car, where villages revel in names like Wootton Bassett and Clyffe Pypard. Sometimes we came to a vista that can't have changed in 200 years



G5UG, R.S.G.B. Council Member, in foreground with G3DRF, at the rig that caused the trouble.

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and, for a happy moment, we could imagine time had stopped, until we remembered the reason for our journey, which was as 20th century as could be.

Country people say good day to strangers. Nobody said good day to us, as we drove into Corston, because there wasn't a soul to be seen in the village. It was like *High Noon*, everybody cowering indoors. Only the flutter of a curtain betrayed the eyes that were watching us. The cluster of cars round Mr. Hall's home made it look even more like *High Noon*, as if we had arrived at a lynching party. Would there be a length of coax from the beam, the crack of vertebrae, the spasmodic kicking, then nothing, no more DX? It might mean we'd never know the end of the Don Miller story.

We had more than a feeling that we weren't welcome, brash, sophisticated Londoners, come to take the pants off one of Corston's respected senior citizens. Only a dog came to sniff at us, then greet us in the dog's traditional way, against the car.

Five reporters were drinking coffee in Mr. Hall's living room, being given a crash course in amateur radio by Jack Etherington, a cool customer, who knew exactly what he was talking about and exactly how to put it over to the Press.

We got the show on the road. Two reporters came with me over to Mr. Denly's house. Two stayed with Mr. Hall at the transmitter. The Press photographer commuted between the two houses. My husband stationed himself at Mr. Denly's TV with one 28.5 walkie-talkie. My son, G3UML, with the other walkie-talkie, stayed with Mr. Hall.

Noel Hall put out a test transmission. Nothing happened on Mr. Denly's screen. He was instructed to up the power, up-up-up, as high as it would go. Nothing happened to Mr. Denly's screen, but the front end blew out of one of the walkie-talkies. The referees declared themselves satisfied that Noel's transmitter did not cause interference to Mr. Denly's TV. So did Mr. Denly. He was really a very sweet old gentleman.

Then he asked if we would investigate the case of another neighbour. We agreed, but only as a favor. The challenge concerned only Mr. Denly's case.

The other neighbour knew it all. It was his children who had first sent the Hall children to Coventry. The research party, including the referees, watched as Mr. Hall put out a transmission. Some slight interference ap-

"Now, I want a good, clean fight. . . ." Author Sylvia Margolis with the protagonists in the "Corston Affair," Noel Hall, G3DRF, on the right.

peared on the Wise Guy's screen.

"Let's try a filter," suggested my husband. With the filter the interference disappeared and Wise Guy's jaw dropped. "That's that, then," said one of the reporters, "I'll just be in time to catch the evening edition."

Suddenly Wise Guy's 12-year-old son yelled, excitedly:

"DADDY! THERE IT IS, DADDY! HE'S AT IT AGAIN, DADDY!"

Unfortunately for Daddy, Mr. Hall had left his transmitter and was standing there, right beside us, in Wise Guy's living room. A heavy truck had passed the house and Wise Guy's TV picture had faded and flickered with its passing. Wise Guy looked down on his spawn and said, coldly, but not as coldly as I would have put it:

"Go up to your room and stay there!"

We seemed to have solved the problem of what had caused most of the trouble in the Corston Affair.

Back at Mr. Hall's house, Jack Etherington put the case succinctly and unequivocally to the Press and the complainants.

Noel Hall was entirely within his rights in operating his station. As a concession, and only as the concession of an English gentleman to his neighbours, he had replaced his quad antenna with a beam at great cost and trouble. Mr. Denly was satisfied and would pay the £20 to the Royal National Institute for the Blind. Wise Guy would fit a filter to his set. The Press referees rushed off to their typewriters.

We sat around, eating hot dogs for lunch, that never tasted better. What a wonderful hobby amateur radio was! How we all enjoyed it! And how lucky, how very lucky, we had been that day!

[*Continued on page 132*]

TRAPLESS TRAP DIPOLES

BY JOHN J. SCHULTZ, *W2EEY/1

By using transmission line sections as stub elements, multiband dipoles can be created which perform basically the same as lumped-constant trap antennas but are far easier and less expensive to construct. Various examples of such multiband dipoles are presented as well as sufficient detail so the reader can apply the idea of stub switching to more elaborate antenna arrays.

TRAP-type dipoles have been around for some time now and their operating characteristics fairly well established. By using a umped resonant parallel circuit, decoupling as well as loading and electrical shortening of the dipole is accomplished so that it resonates on a number of harmonically related requencies. The inductor and capacitor used for the resonant circuit must be lowoss (high Q) components both in order to void power loss in the elements themselves nd also to produce effective decoupling of ections of the antenna at those frequencies vhere the parallel circuit resonates. The high Q makes the frequencies where the parallel ircuit resonates, as well as the entire anenna, quite sharp and the band of frequenies over which the s.w.r. is low is usually estricted to either the c.w. or phone porions of each band, and not the entire band.

The antenna described in this article does ot overcome the bandwidth restriction of the onventional lumped-constant type of dipole. It is not possible to overcome this andwidth restriction as long as a convenonal wire dipole is employed where the atio of the wavelength to the diameter of he wire elements used remains high. However, the multiband type of dipole described n this article does have a number of advanges over the conventional trap dipole. The "trap" elements, or stubs, are lengths of normal transmission line. They are inexpensive as well as easy to adjust. There is no construction problem and no problem of providing a waterproof enclosure for the "trap" elements. A basic antenna may be easily modified with a minimum of expense if one wishes to change the band coverage.

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General Operation

The action of a conventional lumped constant dipole is illustrated in fig. 1. At the resonant frequehcy of the parallel resonant circuit in each leg of the dipole the end elements are effectively isolated from the center

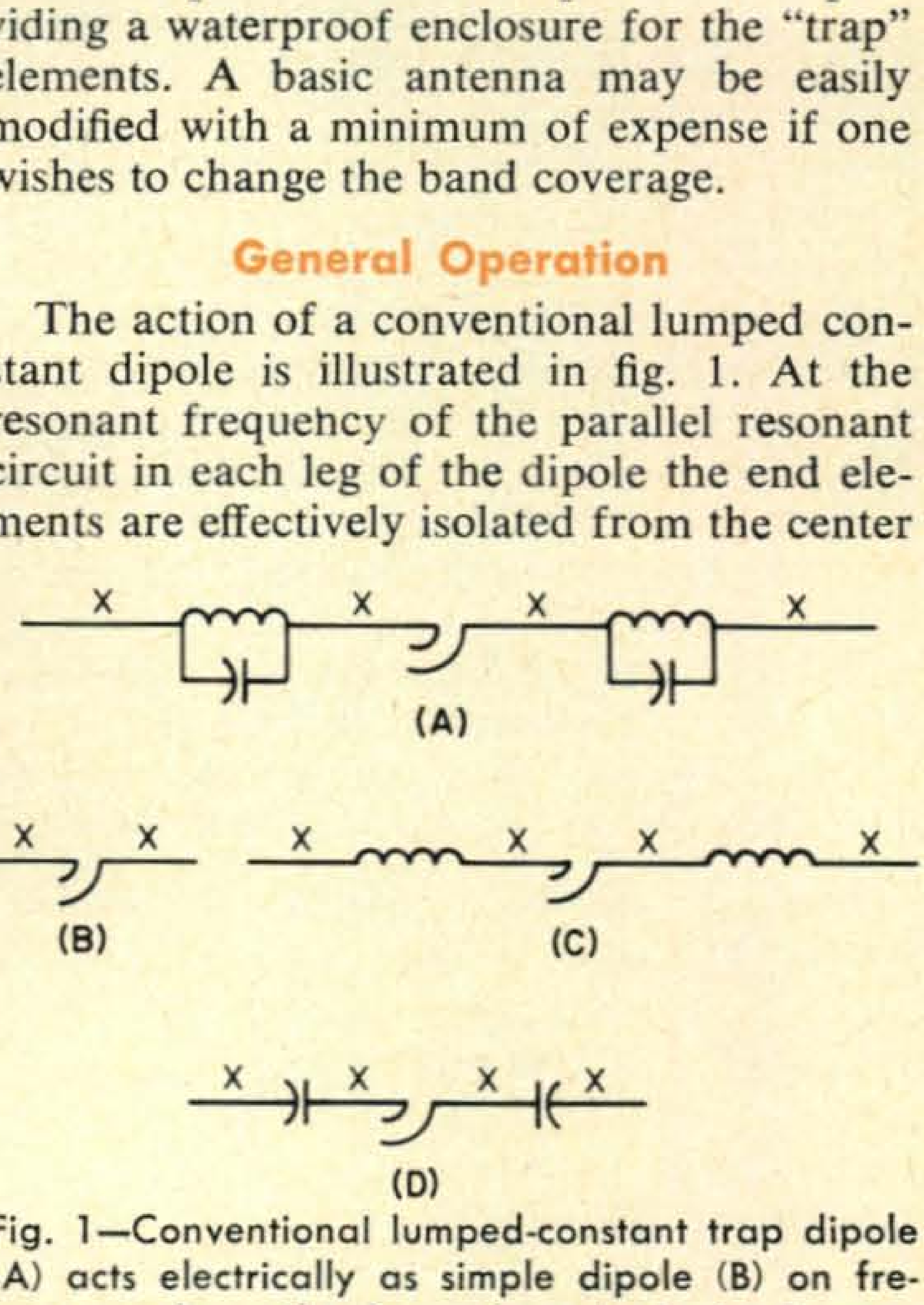

Fig. 1—Conventional lumped-constant trap dipole (A) acts electrically as simple dipole (B) on frequency where the lumped-constant circuit resonates, loaded dipole (C) on lower frequencies and shortened dipole (D) on higher frequencies.

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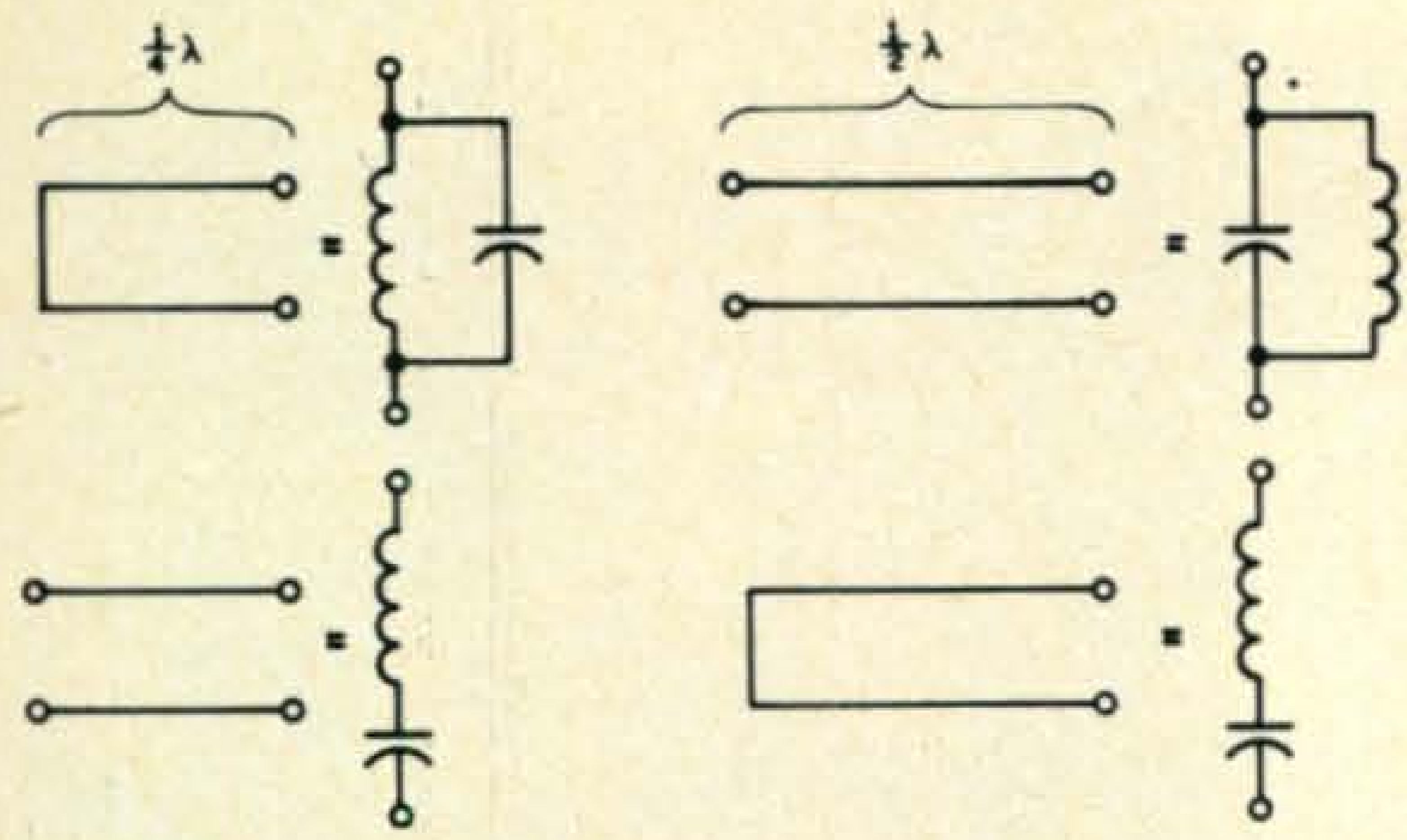

Fig. 2—Equivalents of closed and open circuited ¼ and ½λ lines.

sections. The center sections form a conventional ½λ dipole. At lower frequencies, the lumped constant parallel circuit presents an inductive reactance and acts as a loading inductor in each leg of the antenna. The amount of loading inductance is not great and the overall length of the antenna (about 100 feet on 80 meters) is hardly much less than a conventional ½λ dipole on the lowest frequency band used. On frequencies higher than those of the natural resonant frequency of the parallel resonant circuit, a capacitive reactance is presented and the antenna appears electrically shorter than its physical length. The capacitive reactance of the parallel resonant circuit plus the physical length of the wire elements is chosen so overall antenna resonance occurs in the desired frequency ranges.

The "trapless" type of multiband antenna depends for its operation on a somewhat similar but more simple type of resonant circuit action, as illustrated in fig. 2. Transmission lines themselves, of any impedance or type, can act as resonant circuits composed of equal inductive and capacitive reactive elements when their length is either ¼λ or some multiple thereof. Figure 2(A) shows both a closed and an open ended section of a ¼λ (or odd multiple thereof) transmission line. The closed or shorted section at its terminal acts as a parallel resonant or high impedance circuit, in effect an open

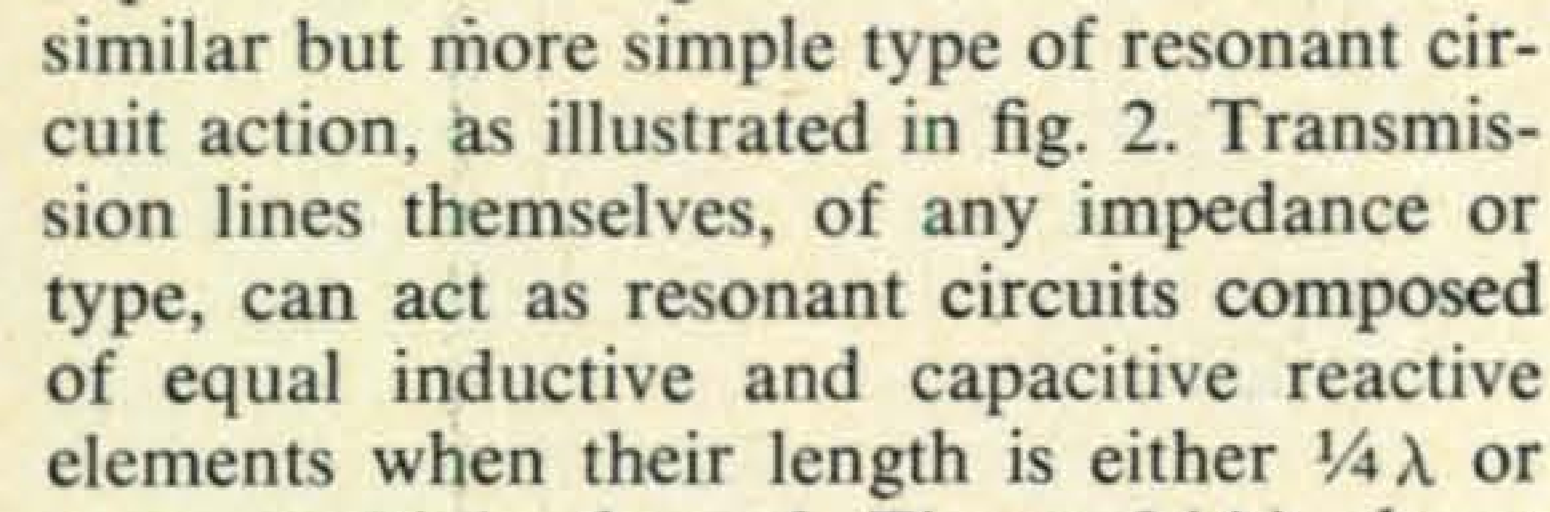

Fig. 3—Trapless dipole for operation on 80 and 40 meters.

circuit. The open ended section reflects at its terminals the opposite effect of its termination—a series resonant low impedance or short circuit. Figure 2(B) demonstrates the terminal conditions presented by an opened ended and closed ended ½λ (or even multiple thereof) transmission line. The terminal conditions are an exact reflection of the termination of the transmission line section. That is, an opened ended termination will reflect the equivalent of a parallel resonant or high impedance circuit. A closed or shorted termination will reflect the equivalent of a series resonant or low impedance circuit.

As a ¼ wavelength of transmission line is used at different frequencies, which are in harmonic relationship to its ¼λ frequency, it can be used to act as either a closed or open switch depending upon its termination. An automatic switch action, dependent upon the harmonic frequency used, can thus be created using a single length of transmission line. The "trapless' dipole uses this idea to alternatively switch in and isolate various sections of a dipole antenna to achieve overall antenna resonance in a number of bands. The inductive or capacitive reactance properties of a ¼λ transmission line when it is operated off a frequency related to its ¼ wavelength and which can be utilized in a manner similar to a lumped constant trap is not employed. The small reduction in overall length of an antenna at its lowest frequency of operation is not worth the careful adjustment of stub length such a mode of operation entails.

An 80/40 Trapless Dipole

Figure 3 shows one application of the idea of stub switching as applied to a dipole operating on 80 and 40 meters. Actually, the idea is applicable to any dipole operating on 2 bands where the lowest frequency is about half of the higher frequency band. The flat top elements of the dipole are each cut to ⅛λ on 80 meters (length in feet equal to $114/f_{(mc)}$). The elements can either be cut exactly to the operating frequency desired or a few feet longer than necessary if the antenna is to be pruned to frequency as described later. The stub element is cut to ¼ on 80 meters (length in feet equal to 228/$_{(mc)}$) and shortened by the velocity factor of the line used.

For standard 75 ohm twinlead, the ¼ length is reduced by 0.68, and for standar

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300 ohm twinlead, the ¼λ length is reduced by 0.82. The author has tried both of these lines as stub elements and there appears to be little difference between them in performance. Probably the 300 ohm line would be better when high power is used. Theoretically, any type of transmission line, including coaxial cable, should be usable as long as it is cut to ¼λ, taking into account its velocity. Although coaxial cable may be satisfactory electrically, its heavy weight compared to twinlead would probably complicate antenna construction.

The operation of the antenna is relatively simple. On 80 meters, the open-ended ¼λ stub sections reflect a short circuit between the flat-top portions of the antenna and each side of the dipole acts as a ¼λ long element so that the entire antenna is simply a ½λ dipole. On 40 meters, the ¼λ stub sections become ½λ long. The open-ended termination of the stub is reflected to the antenna flat-top as an effective open circuit and the portions of the flat-top are isolated from each other. In effect, an insulator has been placed between the flat-top sections. The center two sections are each a ¼λ long on 40 meters and the antenna performs as a simple ½λ dipole.

For more exact tuning of the antenna, the various elements which are effective on each band can be cut as desired. On 80 meters, the two outer ⅛λ elements can be cut as desired to peak performance on a given frequency. On 40 meters, the inner two elements can be varied to peak performance on that band. The stub length may prove too long for many installations where antenna height is restricted. In those cases, the stub should be formed with its end in a loop rather than allowing it to touch the ground. This may necessitate some adjustment of the stub length for the lowest s.w.r. on each band, although generally tuning will not be affected unless a third or more of the stub is looped together.

This type of antenna is only usable on 2 bands as is seen when 20 meter operation is considered. On 20 meters the stub sections, cut to ¼λ on 80 meters, become a wavelength long. Being a multiple of ½λ, they reflect an open circuit between the flat-top elements of the antenna and the effect is a wavelength long dipole on 20 meters which will not efficiently couple to the low impedance transmission line used.

The Tri-band Dipole

An interesting tri-band application of the stub decoupling or switching idea is possible when a dipole for 40, 20 and 15 meters is constructed. Figure 4 shows the basic dimensions of the antenna. The flat-top consists of four sections, each being about ¼λ long on 20 meters. The stubs are ½λ long on 20 meters, again taking care to account for the velocity factor of the transmission line used. The feedline can be any low impedance 50 to 75 ohm line, the same as for a normal single band dipole.

On 40 meters, the ½λ stubs become ¼λ long and since they are open-ended they reflect an effective short between the flat-top sections. The flat-top sections combine to produce the correct length for a conventional 40 meter dipole. On 20 meters, the ½λ stubs being open-ended reflect an effective open circuit between the flat-top sections. The center two flat-top sections form a conventional 20 meter dipole. On 15 meters, the ½λ stubs become ¾λ long. The stub action can be visualized by considering the stub as composed of a ½λ and ¼λ section. The ½λ section reflects the same impedance as its termination. The ¼λ stub section being open-ended reflects a short circuit across the flat-top sections of the antenna. When the flat-top sections thus combine the antenna is a 3/2λ dipole on 15 meters or simply a 40 meter ½λ dipole operated on its third harmonic.

The only possible disadvantage to the operation of this antenna on 15 meters is that the horizontal radiation pattern on 15 splits into a cloverleaf pattern instead of being directly broadside to the antenna as it is on 40 and 20 meters where the effective dipole length is ½λ.

The outer two ¼λ elements can be varied in length to peak up resonance at a desired frequency on 40 meters. On 20 meters, the inner two elements can be varied slightly in length. Pruning the stub length can also

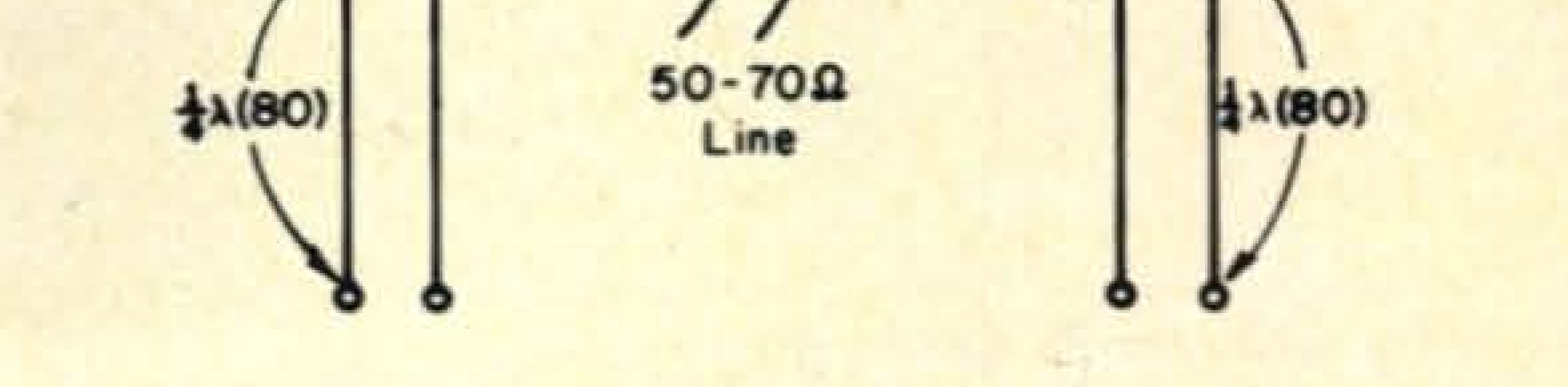

Fig. 4—Tri-band trapless antenna operates as ½λ dipole on 40 and 15 meters and as 3/2λ dipole on 15 meters.

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improve resonance conditions. All the adjustments will interact somewhat so the s.w.r. must be rechecked on each band after each adjustment until the desired set of conditions is found. Normally, the antenna would be elevated sufficiently so that the ½λ stubs can simply be left to hang downward from the flat top portions. The open ends of the stub should be sealed with antenna lacquer for weatherproofing and also to improve the insulation between the end points.

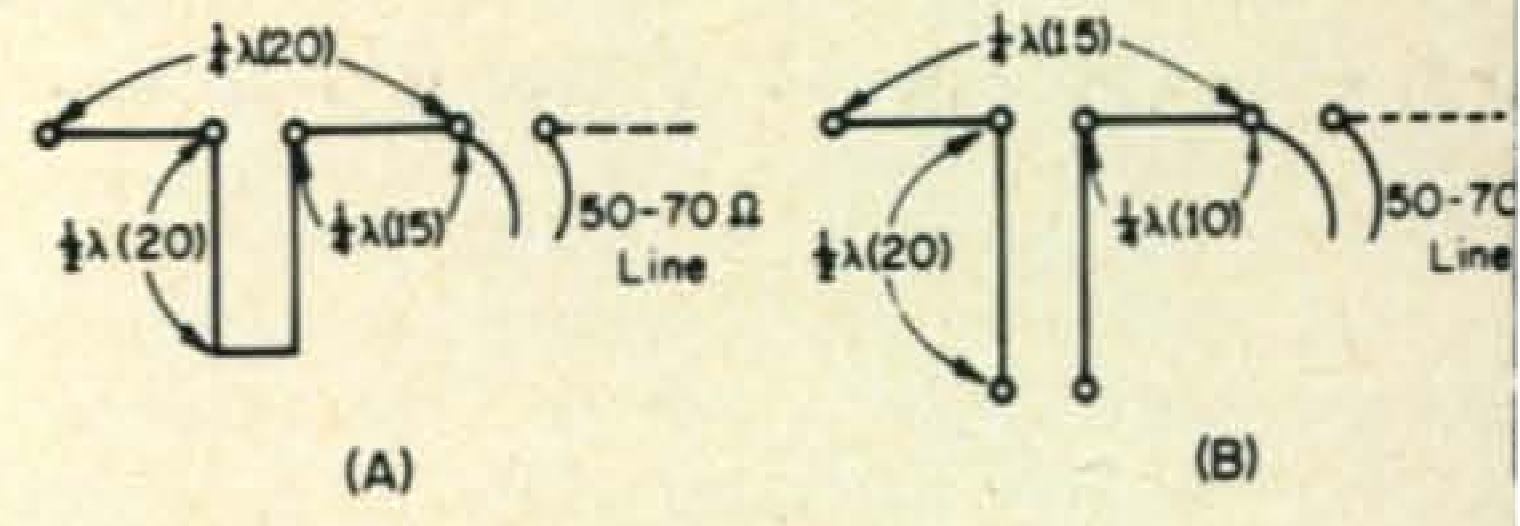


Fig. 5—Dual band antenna at (A) operates on 2 and 15 meters; antenna (B) on 15 and 10 meter Only one side of each antenna flat-top length i shown.

Other Trapless Dipoles

The idea of using stubs for multiband antennas can also be extended to models for 20 and 15 meters as well as 15 and 10 meters. Figure 5(A) shows a design for 20 and 15 meters. On 20 meters, the ½λ closed-end stub reflects a short circuit to the antenna flat-top which then forms a regular ½λ long dipole. On 15 meters, the stub becomes ¾λ long. The half wavelength of the ¾λ length produces no impedance change; the remaining ¼λ sections transforms the closed-end termination into an open circuit between the flat-top sections. The inner two flat-top sections form a ½λ long 15 meter dipole.

The action of the 15/10 meter antenna shown in fig. 5 (B) is basically the same. The ½λ stub (½λ on 20 meters or a wavelength on 10 meters) which is open-ended, joins the flat-top antenna sections on 15 meters and insulates them on 10 meters.

Conclusions

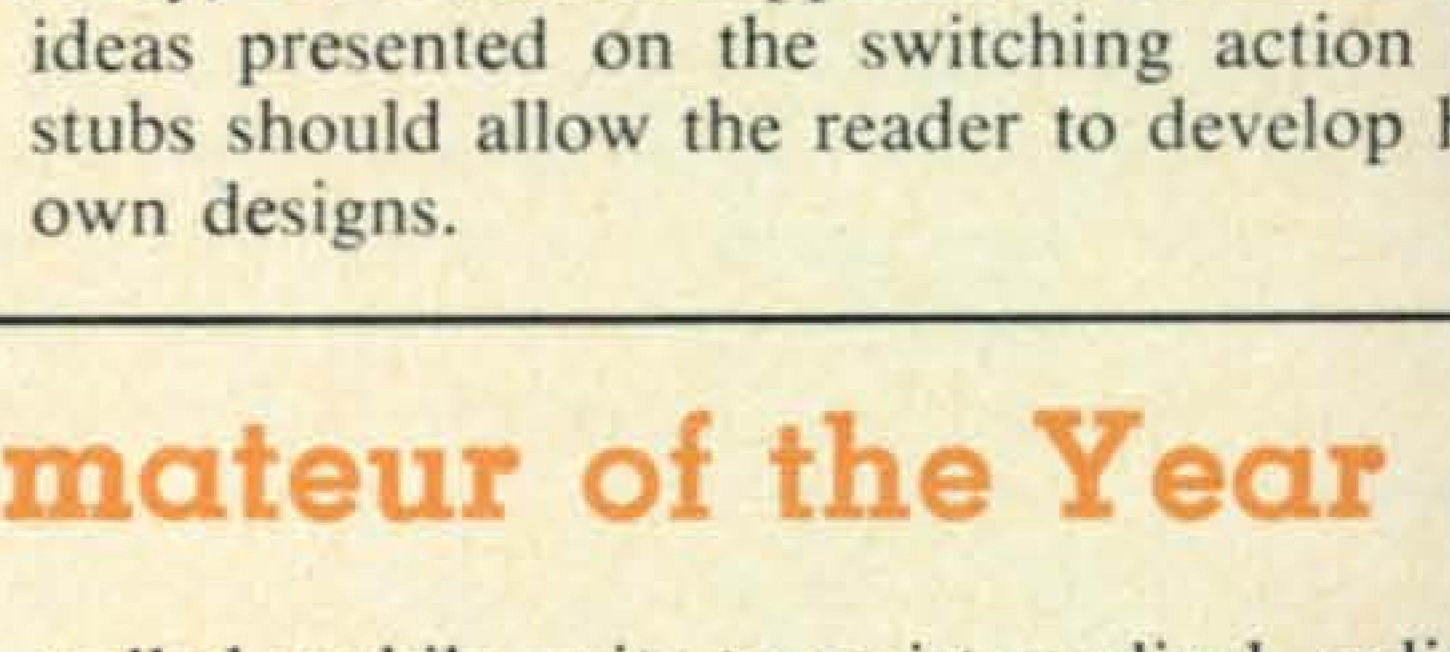
The value of trapless dipoles for multiband use on the upper h.f. bands becomes somewhat debatable since generally it is jus as easy to wire two dipoles in parallel. On th lower h.f. bands, placing dipoles in paralle can create some awkward construction prob lems as well as becoming unsightly and ex pensive if high strength wire is used. Th trapless (or trap dipoles, for that matter have the advantage of producing a neate installation but with the disadvantage o sharper resonance in each band. For some one interested in just c.w. or phone operatio on each of several bands, efficient multipl band operation can be obtained, but if on is interested in covering completely the c.w and phone portion of each band a conside able decrease in antenna efficiency will r sult and it might well be better to consider different antenna type or separate dipoles.

Finally, the idea of using stubs can b applied to other forms of antennas besid dipoles, to produce a multiband directi array, for instance. Application of the bas ideas presented on the switching action stubs should allow the reader to develop h own designs.

WA9BYF Illinois Amateur of the Year

THE Third Annual "Illinois Amateur of the Year Award" was presented to Donald Demik, WA9BYF of Oak Lawn, Illinois at the "34th Hamfest—Sesqui '68" of the Hamfesters Radio Club at Santa Fe Park, Willow Springs, Illinois, Southwest of Chicago.

Mr. Demik was instrumental in setting up an emergency communications network for the local hospital and other medical and public safety agencies in the South Suburban Chiacgo area. He devoted many hours to giving talks to radio clubs and service groups on radiation effects and what to do in case of fallout conditions in the area. During the tornado disaster in the Chicago suburbs last year, he manned his station at home and controlled mobile units to assist medical, poli and rescue workers a well as the Americ Red Cross.



The Third Annual Amateur of the Year Aw being presented to Donald Demik, WA9BYF (l at the 34th Annual Hamfest of the Hamfest Radio Club, Chicago, by the club's preside Joe Poradyla, WA9IWU.

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The Ins and Outs of Good Soldering

BY JESSE L. MEREDITH,* W7CCG

The fine art of soldering for the newcomer and old timer.

SOLDERING is the basis of modern day electronics; without this art there would be a problem, to say the least. Yet, throughout the field of amateur radio there is a great ignorance in regards to what is or is not reliable soldering. With the number of kits available to the amateur fraternity and the number of home brew projects undertaken, it would seem that some sort of definitive information should be published for the benefit of all.

Sure, I know, you've been soldering for years and no one has ever complained, least of all yourself. But, did you ever have trouble with some project you built or experience a ratty joint that didn't look so good? Have you ever wondered why some joints look nice and shiny or others are dull and scraggly? After a period of time did the performance of some piece of equipment deteriorate?

The information to be imparted in this article is taken from sources that are very much involved in quality and reliability of solder joints.[1] True, the extent to which these techniques are utilized or needed in ham radio are really not as great; but, by reading, assimilating, and using these methods anyone should be able to build a better piece of electronic equipment. If one is willing to invest two or three hundred dollars in a kit or parts, it makes sense to want to know the best way to glue the stuff together and make sure it works.

Soldering Irons

I would venture to say that the standard soldering tool around a ham shack is a soldering gun of from 100 - 250 watt capacity. This well established tool is indeed a necessary adjunct; but generally speaking, it has no business being used on the construction of a receiver, transmitter, signal generator, or heaven forbid a transistor project.

There are some instances where you just cannot get along without a gun or a heavy soldering iron. I am thinking, for instance, of soldering outdoors in cool weather on some sizeable piece of metal such as an antenna assembly, where the very volume of metal involved represents a large heat sink. In this application knowing how to solder can mean the difference between a successful antenna or just a so-so project.

Some means of controlling heat in a soldering iron is an essential; the need for this will become clear as soldering techniques are discussed. Now available in almost all electronic stores are small speed control fixtures which are nothing more than s.c.r. voltage control devices that are used as heat controls for soldering irons. This heat control does not have to be a heavy duty gadget as the power controlled is not large.

A small pencil soldering iron of 25 - 35 watt capacity is an essential for doing proper work on electronic gear. Looking through catalogs, it can be seen that there are several companies making these now. I would recommend an iron that has easily exchangeable tips. It is a convenience to be able to replace worn tips easily, change sizes, or to remove pitted or corroded tips. Also, it is much better to have a relatively large base area at the butt of the tip than a small cross sectional area. This factor will present a large heat transferring area to the tip. This assures that the tip itself will not drop below proper operating temperature as heat is transferred to the

* 2834 Natalie Avenue, Las Vegas, Nevada 89109.
[1] NASA and MIL-SPEC Soldering Techniques.

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solder and metal being soldered.

Soldering Tips

There are various types and sizes of soldering iron tips available. For normal use a chisel shaped tip about ⅛" across is recommended a 1/16" tip is also handy to have around for very fine work. I have settled on a ⅛" plated, iron-clad tip which is used for almost everything. The plated iron-clad tip will last much longer than a copper tip if treated properly and is not the trouble that a copper tip can be. A copper tip must be constantly cleaned and filed to produce a good working surface. The plated tip, if handled correctly, is very easy to keep in good operating condition as there is very little oxidation and it is not subject to erosion.

Of the tips available the screw-driver or chisel shaped tips are the most practical to use. Round tips do not give the immediate heat transfer that is necessary for good soldering. The diamond shaped tips are in the same category as far as heat transfer is concerned. The flat surface is really a must to give rapid and even heat transfer.

A word about plated tip care is appropriate here. Never touch a file to a plated tip; it will damage the plating and the tip will become useless. If the tip should become rough, use a very fine grade of emery paper, and touch the tip very lightly with it. The plating is thin and won't stand much abrasion.

If you have a threaded tip use the manufacturers recommended "goop" on the threads to prevent corrosion and increase the heat transfer. If you have a set screw holding the tip in place, the same thing applies to the screw.

Soldering Accessories

A large hand held magnifying glass, about 4", is an extremely useful soldering aid. To the naked eye a soldering joint may appear good; under the mangnifying glass defects will appear.

A factor you should consider, and make provisions for, is good lighting on your work area. A flooding flourescent unit will give an even light on your work. Any real good light, however, is satisfactory.

A small bottle, an ounce or two, of liquid rosin flux is needed. I would recommend Kester formula #1544 only, as it is *non-corrosive* and has only one application. It is for *removing* solder. This will be discussed later. You will find many kinds of liquid flux available in hardware stores. *Don't* use them. The labels will say the fluid is non-corrosive, but on what? Concrete? These fluxes will work fine, but a short time afterward a chemical reaction will occur and ruin your work. It's hard enough to do the job right, don't ruin it.

The next item, I know, is going to cause a few raised eyebrows. You need a small bottle of 190 proof alcohol. No, I'm not an advocate of tipling while soldering, although you may feel like it at times; this is for cleaning of residual rosin from joints. To go along with this, a small acid brush is also needed. The straight high grade alky can usually be obtained at a liquid store. This must be grain alcohol and not the wood derivatives which leave an unwanted residue.

Hand Tools

The use of proper hand tools cannot be overemphasized in soldering. For instance, a small pair of diagonal cutters is needed. The ordinary cutters will not cut cleanly but will chop through leaving about a 90° diagonal cut across the wire. The cutters you need produce a straight across flush cut.

Small needle nose pliers are always needed around a ham shack for soldering or bending but you need *round-jaw* pliers for bending leads in order not to knick them.

Small heat sinks are always needed, particularly for diode or transistor work.

If you really want to become a fanatic about your soldering, I suggest you also obtain what is called an "Anti-Wicking" tool. More about this one later.

A pair of good toe-nail clippers is also a handy tool. It makes an excellent right angle clipper on printed circuit boards and gives a straight clean cut.

Solder

Up to this point I have not even mentioned solder, and for good reason. It deserves examination and explanation of its own. Solder is an alloy of two or more metals that have relatively low melting points. For common electronic use solder is a combination of tin (Sn) and lead (Pb). Other metals found in various solders are silver (Ag) and antimony (Sb). In various percentages these metals can be combined to form what is known as a eutectic (u-tek-tic). A eutectic is defined as an alloy that has one sharp melting point and no plastic range. In other words, the change

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from solid to liquid state, or the reverse, is instantaneous. Ordinary electronic solder is an alloy of tin and lead in percentages which you will find labeled 30/70, 50/50, or 60/40, and so on. This means, for instance, that 60/40 solder is composed of 60% tin and 40% lead. The ideal electronic solder is composed of 63% tin and 37% lead, which is a true eutectic. If you will refer to fig. 1, you will find a chart of the various solder combinations for tin and lead. You will note that at the 63/37 point there is no plastic range. At the 40/60 point there is a plastic range of over 100° *F*. What does this mean? If we were using a 60/40 solder, the change from true liquid to solid state is very rapid. If we were using 40/60 solder, the liquid would not solidify for an appreciable length of time. Not only this but obviously the components being soldered are going to be almost 100° *F* hotter in order to achieve a soldered joint. In working with diodes or transistors this could induce failures due to prolonged heat.

Why the difference in solder? Price and useage are the prime factors. Fixing a leaky automobile radiator is obviously a different problem than soldering a diode in place. To solder a large surface such as a car radiator it is necessary that the solder not solidify as soon as the heat source is moved off the areas. Therefore, a different combination is logical.

Impurities in the solder represent a refining problem. Some solders are reclaimed from old beer cans, and what have you. I would recommend using only products from one of the reputable companies as you need relatively pure solder for electronics work. Also, from the above it is easy to see that nothing less than a 60/40 solder should be used. It is possible to buy 63/37 solder, but it is more expensive and really not needed as 60/40 is quite adequate. I do not recommend any other combination for electronics work.

Solder Flux

Do not try to use anything except *rosin* core solder. Do not let someone talk you into using an off brand solder as the flux will probably be corrosive and the metal full of impurities that will cause nothing but trouble. The old paste soldering flux? Chuck it in the garbage can. If you should need some flux, use the liquid.

The multicore solder is the best for electronic work as the flux tends to flow more evenly.

Solder Gauges

Solder comes in various diameters or wire gauges; it can be had in almost any diameter from a #34 wire gauge up to #16 gauge. I would suggest at least two sizes be obtained, a roll of #18 gauge for heavy work and a roll #22 or #24 for light, fine work. If you are working with small diodes or transistor leads you only need a little dab so the fine solder is needed. Trying to get that little bit with #18 gauge solder is hard: The opposite is true too; trying to solder a couple of #14 wires with size #28 solder is also difficult.

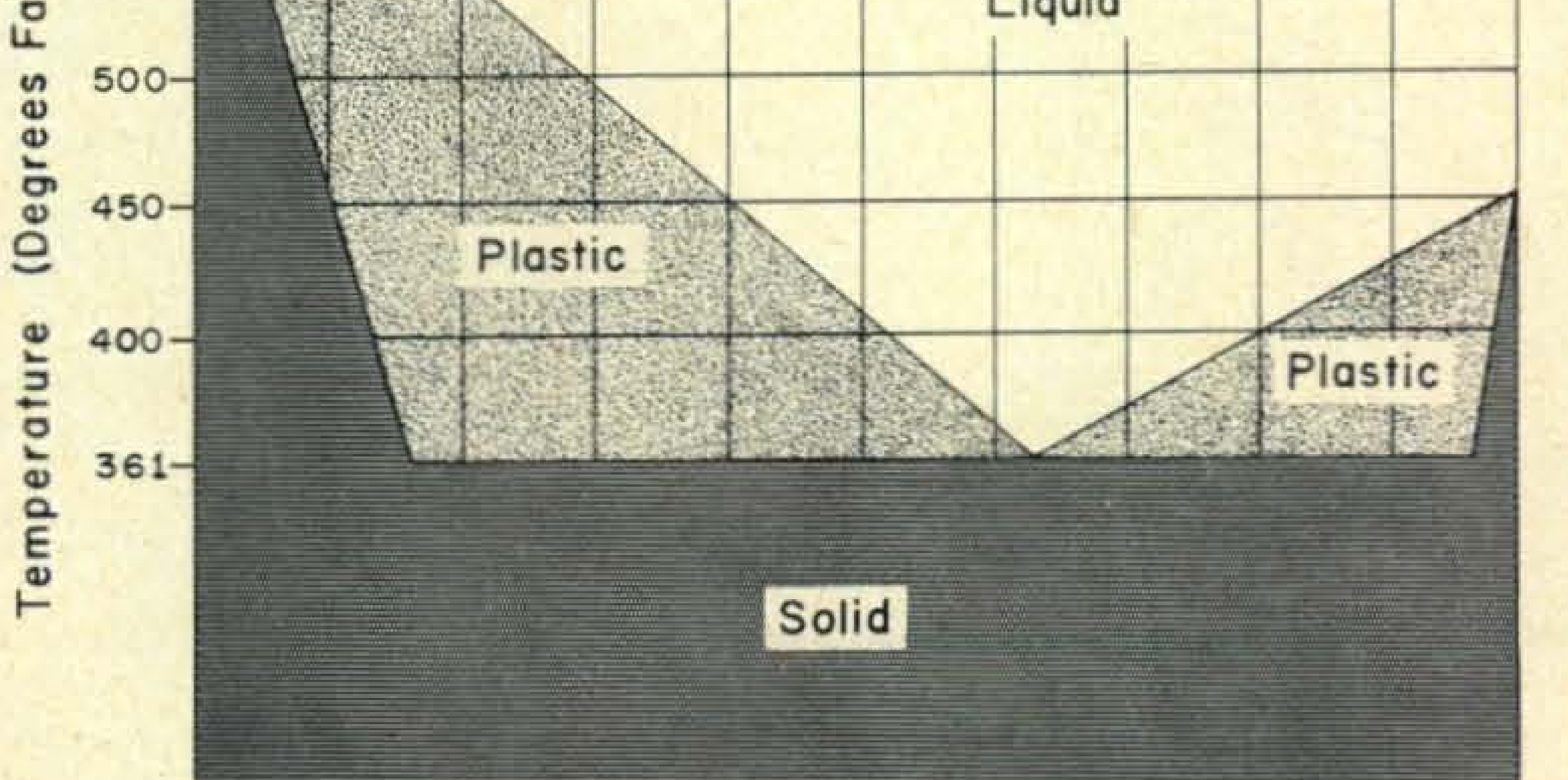

Fig. 1—The above chart depicts the change of solder from solid to plastic to liquid at different temperatures for different combinations of tin and lead. Solder with a 63/37 mixture has no plastic range.

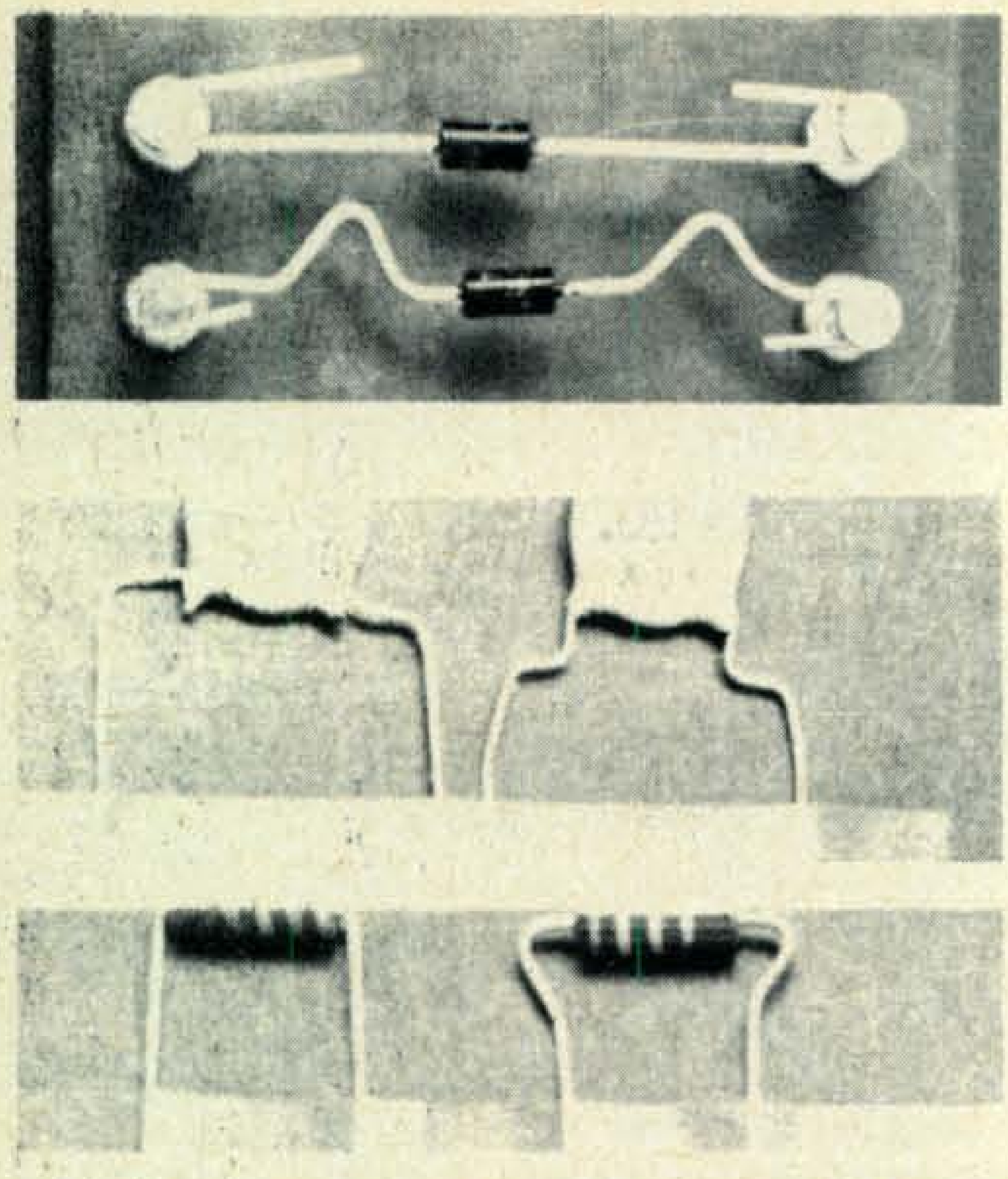

Fig. 2—The resistor and capacitor on the left illustrate incorrect component lead positioning. The top diode is also incorrect as it provides no strain relief.

Handling of Components

A primary consideration that should be given to any electronic component part is proper mounting. Any piece mounted to a solid connection point, whether it be wire, resistor, capacitor, or what not, should be provided with a strain relief of some kind.

Take a small half watt resistor as an example, and refer to fig. 2 which shows examples of strain relief. The common practice is to take the resistor and bend the leads directly at the body. You have immediately generated a tremendous strain on the joint at the body of the resistor introducing a possible fracture point. The resistor is manhandled into its mounting and brute force is used to clamp it into position. Now we apply

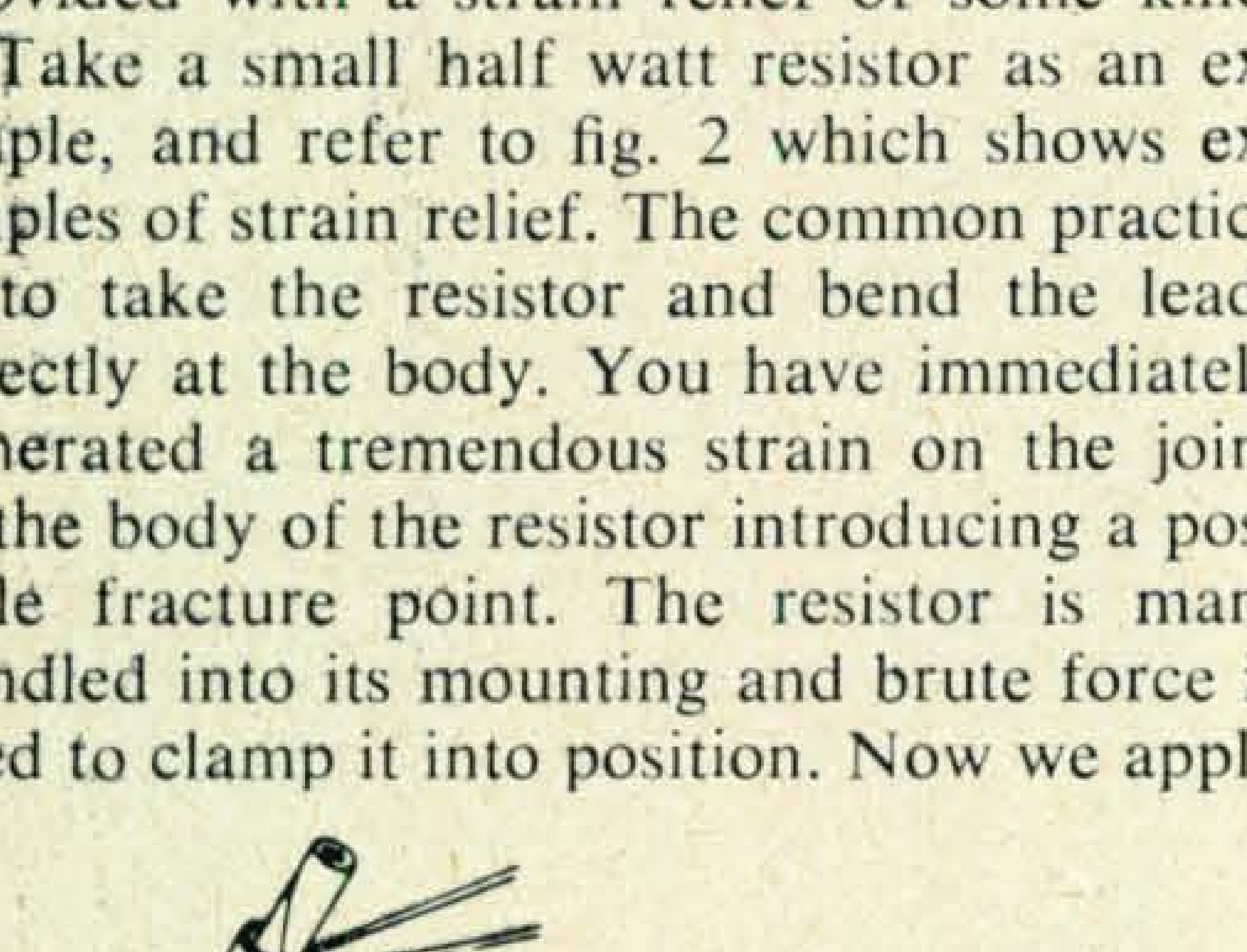

Fig. 3—Construction and use of an antiwicking tool. This device prevents solder from flowing up the stranded wire under the insulation.

a terrific jolt of heat from the soldering iron introducing expansion coefficient factors and more strain. Is it any wonder that you will experience trouble in a circuit?

Take the magnifying glass and look closely at the end of a resistor that has its leads bent directly at the body. You may see fractured plastic at the base of the lead. What has happened to the internal contact to the resistive material? Let's take a ceramic capacitor as an other example. Bend a lead sharply at the base. Notice any cracked ceramic material? This leaves an opening for moisture to enter, as well as possibly injuring the internal connections.

The photograph of fig. 2 gives illustrations of proper strain relief for components. Even though this procedure adds time to your job, you are increasing the reliability of your work.

Wire Preparation

Preparation of wires for use is also an important factor in good soldering. A wire should always be tinned before soldering into a circuit. This tedious process is a necessity to insure proper flow of solder around a joint and the wire for complete contact. In tinning a wire lead, the iron is applied underneath the wire and the solder stick is touched to the contact point of wire and iron. As the solder melts, the iron and solder are moved up the lead fairly rapidly to cover the full exposed area to be tinned. Remove the iron and solder quickly at the end of the operation. The secret is applying the heat and solder evenly over the tinned length once. Tinning the wire too heavily will make it extremely hard to bend correctly.

If a stranded wire is not tinned properly, when you bend it you will experience what is called "bird-caging." The wire strands will separate out and break loose from each other.

A flow of solder up the wire under the insulation is known as "wicking." Wicking of solder up a wire will introduce a stiffened area in the wire that may put a strain on some part or it may roll back the insulation due to heating of the plastic material. An *antiwicking tool,* shown in fig. 3, is used to prevent flow of solder up the strands underneath the insulation.

Wire Stripping

A word about stripping insulation off of wires at this point seems proper. The normal type of wire strippers found in a ham shack

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are the two-blade pliers type in which the cutting edge is adjustable. If you are not careful several of the wire strands will be cut or solid wire will be badly knicked. The type of strippers that have an adjustable rotating cam that is preset for all sizes of wire is recommended.

The proper operation for stripping is to makes the cut with the tool, pull the insulation back with the tool for a quarter inch or so, and then remove the insulation by hand, using a rotating motion in the direction of the lay of the wire strands.

Proper insulation spacing on a wire is rather simple. The insulation should be approximately the diameter of the wire back from the solder joint.

The Soldering Process

To begin with you should have a good clean area to work in. Remove all excess junk, or what have you, from the working area. The less frustration you have the better you will do.

Check the iron tip. If you have a copper tip, remove it, and using a very fine file, take off the oxides and dress up the working surface. Get a clean sponge, and turn on the iron. Set the voltage control about 70%.

Take your diagonal cutters and snip off a length of solder 6 to 8 inches long. This is a solder stick and is the easiest way to handle solder and while it is a little bit wasteful, if is not to the point of excess.

Wet a sponge thoroughly, not sloppy wet but good and damp. The sponge is used in this manner: Just before making a solder connection wipe the tip lightly and quickly across the sponge, both sides; then apply directly to the work.

Temperature

A bad solder joint can be readily attributed to poor technique and improper use of the iron. The proper temperature of the iron is of prime importance. Emperical testing has shown that at a temperature between about 370° *F* an 450° *F* solder flux is very active. Above 550° *F* the flux activity begins to degenerate until there is very little fluxing action at around 800° *F* to 900° *F*. The normal type iron (including the gun) will rise well above 700° *F*.

When excessive temperature is applied to surfaces to be soldered several things can happen singly or in combination. Since a good solder joint depends a great deal on purity in the solder material, any contaminants introduced will interfere with proper bonding. Copper contaminants will appear at high temperatures; slag will be found, rosin residues will be present, very little fluxing action will be present to induce the metallic bonding of solder to the surfaces, and some metals will become resistant to bonding at higher temperatures.

The granular structure of the solder is dependent upon heat and rate of cooling. A solder that has been excessively heated and cooled rapidly will exhibit a coarse grainy appearance rather than the bright, shiny, and smooth look.

Too low a temperature in soldering is also deterimental as the bonded strength can be much less, even by a factor of two or three.

All of this boils down to the necessity of soldering at proper temperature, 450° to 550° *F* and having the proper iron with enough thermal capacity to bring the joint up to temperature quickly. A variable temperature control device is a necessity because not all joints require the same amount of heat to bring them to the proper temperatures.

As soon as melting temperature is reached, tin the tip well by applying solder liberally. Wipe off the excess solder and flux residue with rags. After each soldering operation, use the rag and wipe the tip clean. Re-tin the tip whenever it needs it. Don't try to make a connection unless you have a clean, shiny, properly tinned tip.

Lugs and Pigtails

Some parts are supplied with silver plated leads (pig tails) or lugs. The tarnish which is ever present *must* be cleaned off before attempting to solder these. Use the lead cleaning tool (shown in fig. 4) on wire leads and scrape them several times. On socket lugs or odd shapes it is advisable to use a very fine sand-

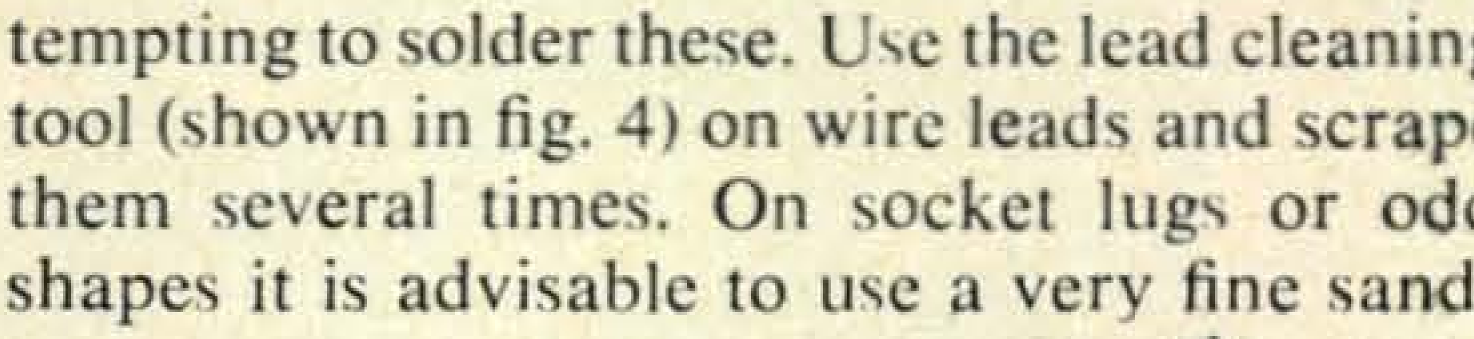

Fig. 4—Shown above is a lead cleaning tool and the proper method of cleaning a component lead before soldering.

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paper. Be sure to clean the residue away before attempting to solder; if you don't, your solder will become contaminated and possibly destroy the work.

Soldering

Referring to fig. 5, note that the iron is applied first, as equally as possible, to lead and terminal. Touch the solder stick at this point and as soon as it melts, move the solder evenly and smoothly over the whole area to be covered. Make sure the solder melts and flows as you move the stick. When you have covered the entire area, lift the solder stick first and then the iron smoothly, directly, away from the work. Replace the iron in its holder and put the solder down. As soon as the solder has solidified take your acid brush dipped in alky and clean the flux off briskly as described in the next paragraph. If you have done it right, you have a beautiful, shiny clean joint. Simple? Well, yes, after you get the hang of it.

Alcohol Cleaning

The removal of excess flux after soldering a joint is a must for good work. While rosin flux is by itself not a conductor it is a hydroscopic material. That is, the flux will tend to absorb moisture giving rise to the possibility of component failure or degradation of circuit characteristics.

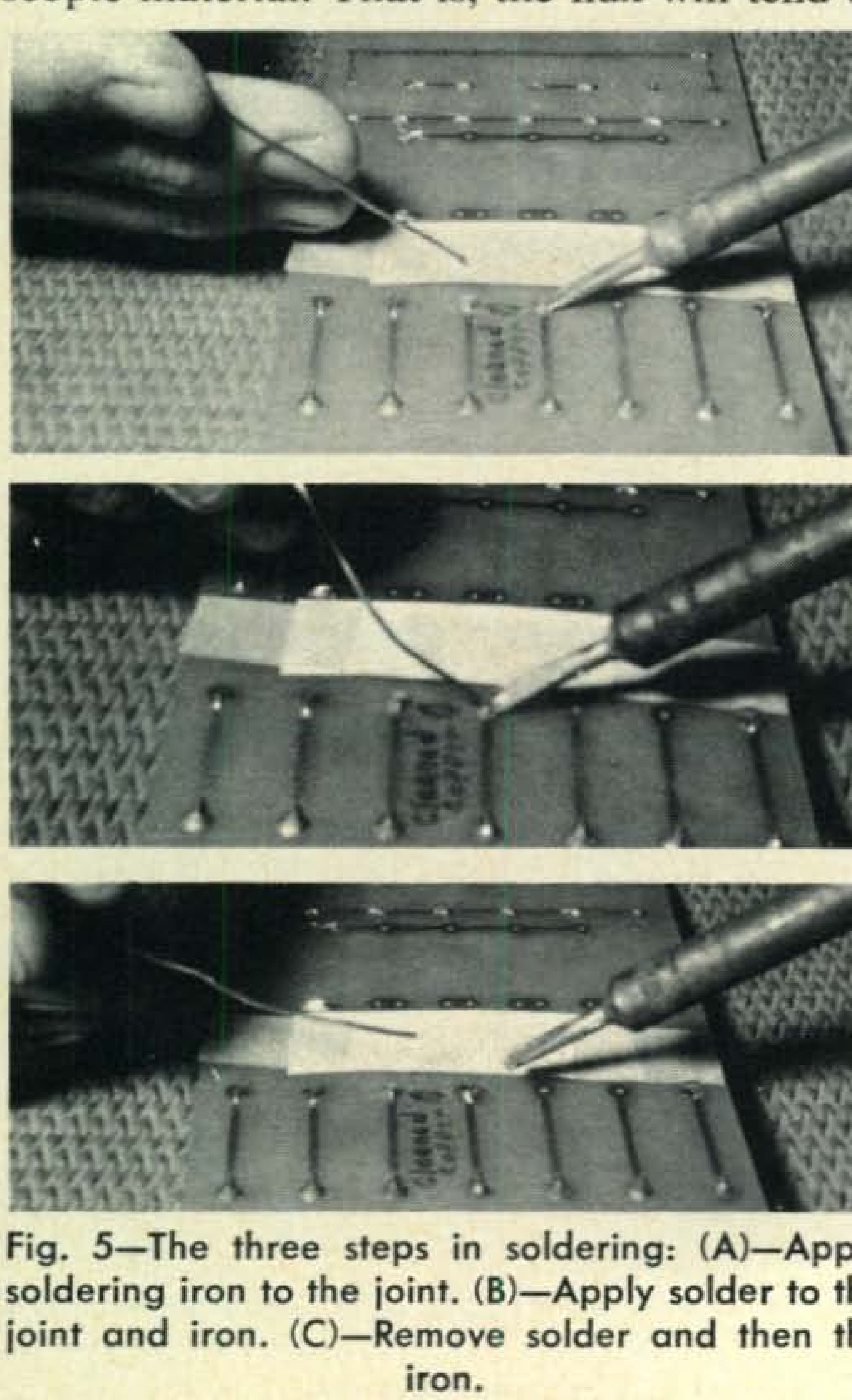

Fig. 5—The three steps in soldering: (A)—Apply soldering iron to the joint. (B)—Apply solder to the joint and iron. (C)—Remove solder and then the iron.

In the requirements for proper material a bottle of 190 proof grain alcohol was listed. I will modify this statement somewhat. While 190 proof material is the best, you can substitute vodka for this. Don't use rubbing alcohol, though, as it leaves an undersirable residue and will not clean properly.

To utilize the alcoholic liquid properly, when you have finished soldering a joint, dip the acid brush in the alcohol and scrub the joint vigorously with it as shown in fig. 6. Apply as much alcohol as needed to remove all the flux residue. Then take a paper tissue and dry up the excess alcohol. You will have beautiful clean solder joint if you have applied the iron and solder correctly. If you have not done a good job of soldering it becomes immediately apparent when you wash the flux away.

Solder Removal

Now that we know how to apply solder to a joint, how do we remove solder from a connection after a goof or for a circuit change? The process is simple. To begin with, take a piece of standed wire about 6" long, 20 gauge or so, and strip off the insulation for about 4". That's right, take it all off except about 2" that will act as a handle and prevent burned fingers. Now bend about 1" of the end in a slight hook and dip it in that small bottle of liquid flux. Now we are ready to get rid of the solder on whatever joint we are working on. Touch the end of your rosin dipped wire to the joint. Lay the iron tip on top of the wire and wait until the unwanted solder melts. All of a sudden the melted solder will *wick* up the standed wire like going into a vacuum cleaner. Remove the iron and wire and snip

Fig. 6—Scrubbing a solder connection with alcoho[l]. Note the special alcohol container that requires pumping action.

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off the solder impregnated end. Bend and dip the wire in the flux again and just keep repeating the process until all the solder is gone. Then use brush and alcohol to clean the area.

Component Removal

If you are working on a printed circuit board and wish to remove a component follow this method to prevent lifting a pad off the board or breaking the foil. After the solder is wicked off the lead involved, take your cutters and position them squarely against the board and snip off the lead where it projects through and is bent over onto the foil area. Now pull the component loose from the other side by pulling *down* and away from the foil. The foil will still be intact and board undamaged. Never heat the joint and push up on the lead; you will probably lift some of the foil off the board in the heated condition.

Printed Circuit Board Soldering

Printed circuit board soldering can be a very pleasant, satisfying chore if handled properly. If proper precautions are not observed, the process can produce nothing but a disaster. Big selling points in printed circuit work are ease of assembly, ease of soldering, and reliability of circuit. Everyone of these points can be negated in the soldering process without even half trying. Most of the kits today involve at least one printed circuit board; therefore, the proper technique becomes very important.

Preparation

Most kit circuit boards are plain etched copper foil with no gold plating or pre-dipped solder coating on the foil. Copper, when exposed to atmosphere, oxidizes leaving a thin coating of oxide on the copper foil. Any excess oxide present in the soldering process will interfere or prevent proper bonding of the solder to the metal.

What to do? Lay the printed circuit board on the work surface face up; take an eraser shield and typewriter eraser in hand. See fig. 7. Place the shield over a terminal that is going to be soldered; now scrub it thoroughly with the eraser until the copper is bright and shiny. Take a piece of bus wire that will fit through the hole and poke out all the residue. If you don't clean out the hole after erasing over it, the eraser residue will bubble up into the molten solder and completely ruin the joint.

Some printed circuit boards have a gold plating over the copper circuitry. Great! But not so good for soldering. The adhesion factor between gold and solder is much less (a factor or two) than can be achieved by soldering directly to clean copper. If you want the best job, again you take an eraser and shield and scrub off the gold until clean copper is exposed. Some gold plating is 0.020" thick, and it takes a good bit of work to get through it. A draftsman's electric eraser is a big help here.

Scrub the number of contacts that can be soldered in an hour or so, clean out the debris and then go to work. The exposed copper will not oxidize this rapidly.

Next, take the parts to be mounted and start bending the leads properly for fit and strain relief. Insert one part at a time and bend the leads partially onto the foil area to be soldered to. Use your clipping tool to cut the leads to the proper length. Use a nylon bending tool so as not to nick the leads or damage the foil and bend the leads down onto the copper foil.

A lead should be bent onto the copper directly parallel with the foil as shown in fig. 8 (L). It should be snipped at the point where the pad ends. The lead should not be angled off or left partially upright. If the lead is off track and bent onto the foil area, it should be at right angles to the foil and clipped ex-

[*Continued on page 138*]

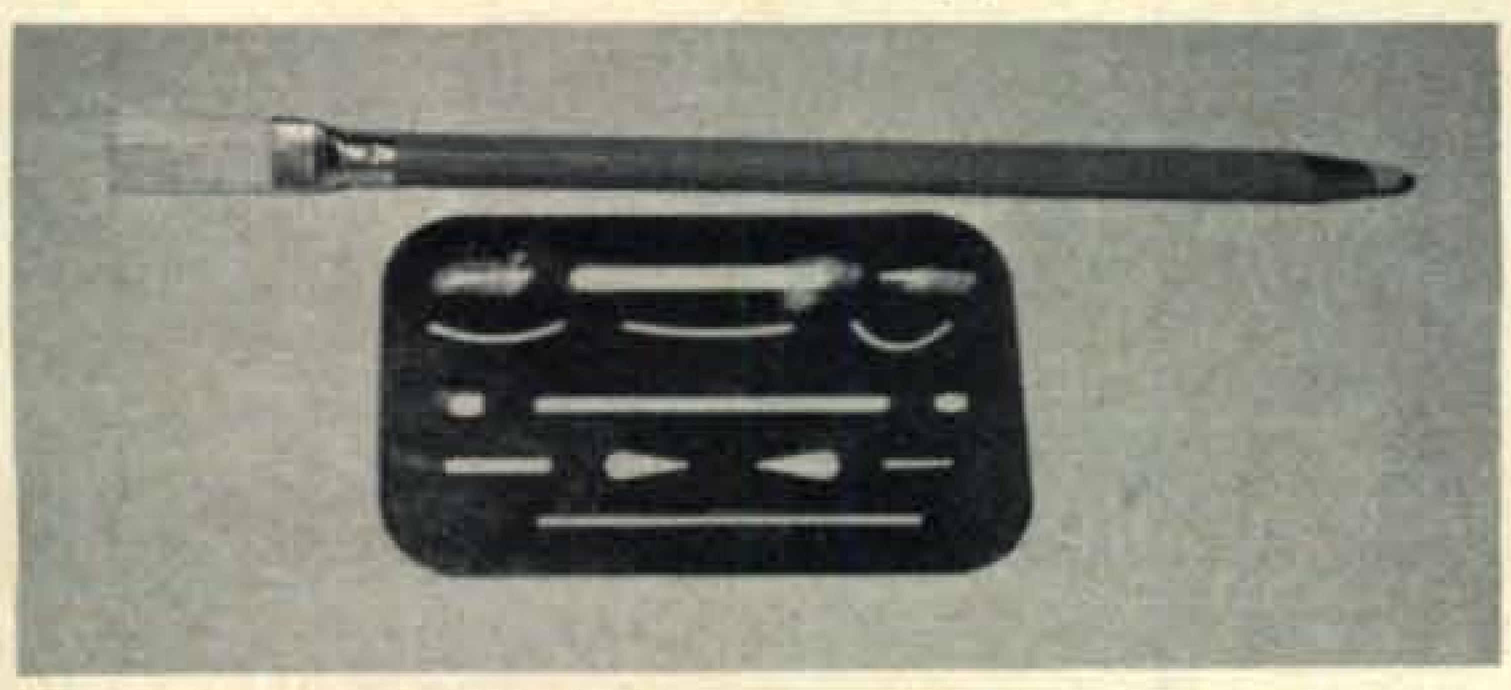

Fig. 7—Eraser shield and typewriter eraser used to clean the foil on printed circuit boards.

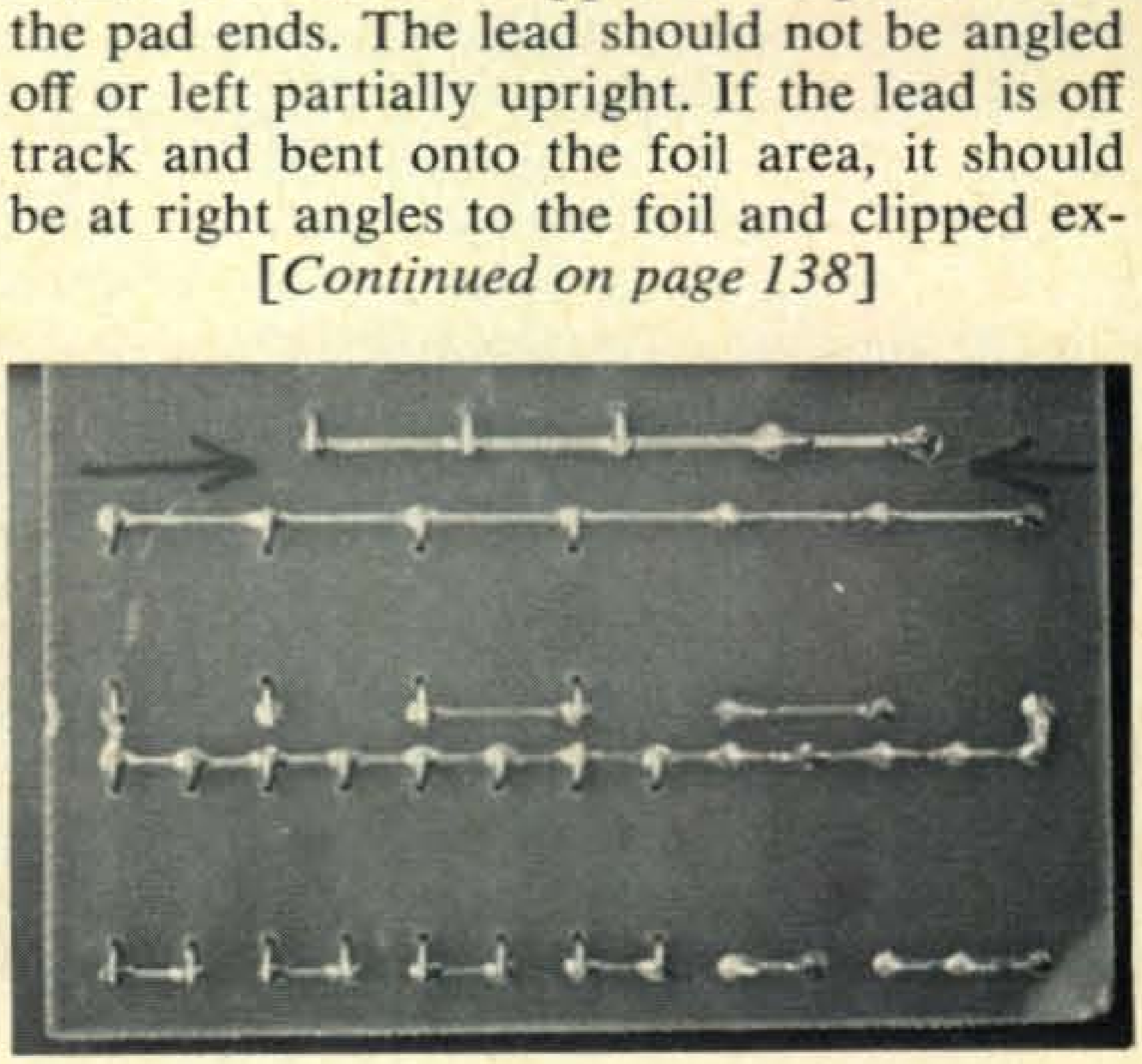

Fig. 8—Illustrations of on track component mounting (R) and on track component mounting (L).

The Hammarlund HQ-215 Solid-State Communications Receiver.

CQ Reviews: The Hammarlund HQ-215 Solid-State Communications Receiver

BY WILFRED M. SCHERER,* W2AEF

THE solid-state gear that has become available to the radio amateur largely is restricted to accessories or gadgets. Little has been produced or is new in the line of solid-state receiving and transmitting equipment.

It is, therefore, gratifying to see Hammarlund come up with the HQ-215 Solid-State Communications Receiver using modern technology and offering the advantages gained by the use of transistors for stable, dependable, durable, cool and instant operation along with low power consumption.

It is a high-quality product employing a proven conversion scheme and basic lineup with sound solid-state circuitry and the incorporation of features that provide convenience and ensure excellent performance in meeting the various and stringent needs of today's communications techniques as well as coping with the problems incurred on the crowded bands.

The HQ-215 is designed primarily for operation on the 3.5-28 mc amateur bands for s.s.b., a.m., c.w. or RTTY with full band coverage in 200 kc segments. It also is provided with eleven additional range positions for optionally selected 200 kc segments between 3.4 and 30.2 mc.

Three degrees of selectivity provide a bandpass of 0.5, 2.1 or 6 kc, obtained with mechanical filters which may be selected for any mode of operation. The set is supplied with just the 2.1 kc filter; the others are optional plug-in accessories. Upper or lower sideband may be selected for s.s.b. on any range and no retuning is required when sidebands are switched. A tunable rejection-notch filter, which is calibrated to ±6 kc, rounds out the i.f. selectivity system. Front-end selec-

* Technical Director, *CQ*.

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tivity is obtained by a tunable preselector which is calibrated for the amateur bands. It also has a 0-10 logging scale for the other optional ranges.

A single v.f.o. tuning range of 200 kc is used for all frequency segments. The dial scale, which at first appears to be a slide-rule type, is on a large-diameter drum that rotates behind an elongated window. A scale length of 20" is obtained thereby with calibrations in 1 kc steps spaced about ⅛" apart. Calibrated *numerals* are at each 10 kc point from 0-200 kc.

Tuning is accomplished with a high-ratio drive system that covers only 10 kc with one revolution of the tuning knob. A recess in the knob face allows it to be rotated with one finger. Rapid excursions thereby may easily be made to any part of the range.

The hairline fiducial is mechanically adjustable to move to the left or right for accurate indexing to frequency. A built-in crystal calibrator provides 100 kc reference points and a feature is that the antenna input is removed when the calibrator is switched on, thus eliminating on-the-air QRM during calibration.

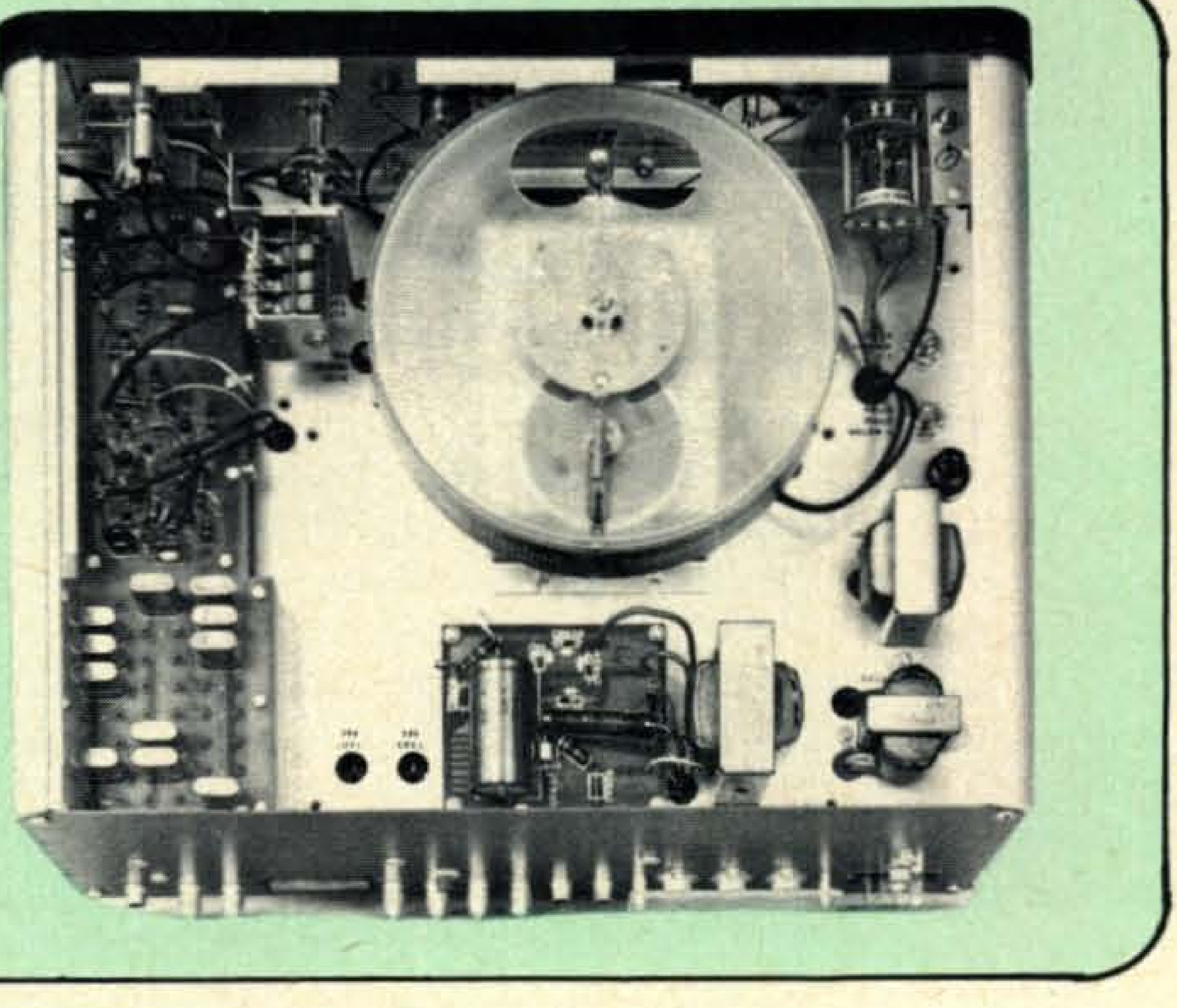
A handy feature is a separate tunable b.f.o. which is calibrated in six steps to ± 3 kc. It is automatically engaged when the mode switch is set for c.w. and thus allows the c.w. operator to obtain the most desirable pitch for peaking up the audible signal as needed under the prevailing reception conditions and in accordance with the selectivity in use. It also may be used to advantage with RTTY.

A crystal controlled b.f.o. is used for s.s.b.; however, either b.f.o. may be used for any mode with the alternatives of listening to c.w. when the mode switch is set for l.s.b. or u.s.b., or of listening to s.s.b. with the switch set for c.w. The latter provides additional flexibility for s.s.b. reception in that the reinserted-carrier frequency may be placed at any desired point along the filter skirts to alter the resulting low-frequency a.f. response or unwanted-sideband suppression.

A special detector is furnished for s.s.b., c.w. and RTTY and an envelope detector is used for a.m. Included is a noise limiter for a.m. only. Either slow or fast a.g.c. may be selected. The S-meter is illuminated, and a dimmer control is furnished for this and the dial lamps.

The receiver may be muted through a phono jack on the rear of the set where such jacks also are provided for the antenna, 3.2 ohm output for a speaker and 500 ohm out for other a.f. use. In addition, there are h.f. heterodyning-oscillator and v.f.o. outputs for possible transceive operation with a transmitter. There is no b.f.o. output, but if needed, this may be wired to a spare jack of which there are three. A ground post is included too. A headphone jack is on the front panel.

A built-in power supply operates from 110/220 v.a.c., 50/60 c.p.s., with a power consumption of only 19 watts. Operation also may be had directly from a 12 v.d.c. supply



Top view of the HQ-215. The dial drum is at upper center. At its left is the preselector tuning capacitor and along the left of the deck is the r.f. front-end module with the h.f. crystals. The power-supply module is at bottom center. The tunable c.w. b.f.o. is built in a modular metal framework at upper right corner.

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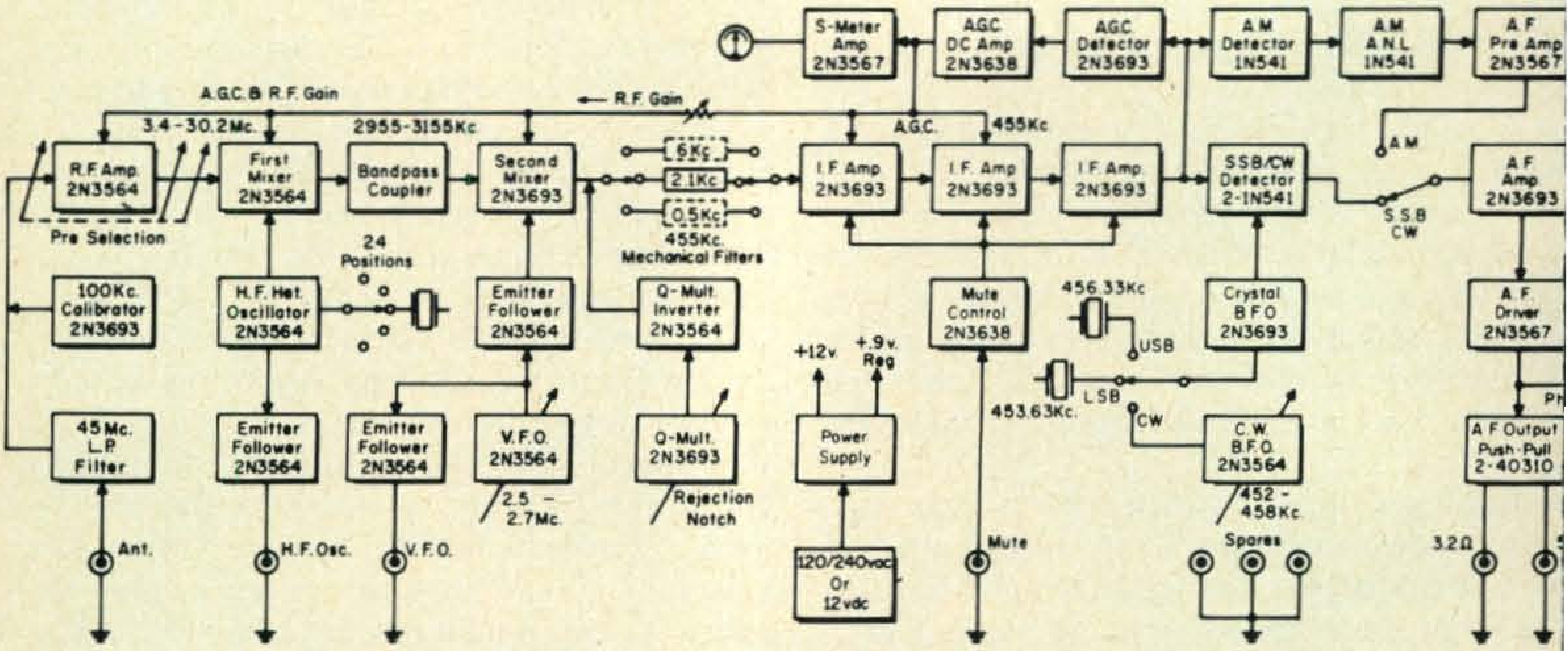

Fig. 1—Self-explanatory block diagram for the HQ-215. Special details are given in the text.

(neg. ground) simply by plugging in a different power cable equipped with a multi-terminal plug wired for the particular source. A change between 110 and 220 v.a.c. is similarly handled. No internal rewiring of the set is needed.

When a 12 v.d.c. source is used, reverse-polarity protection is provided by a thermal circuit breaker. When this trips, the panel lamps flash to call attention to the situation.

Technical Details

The HQ-215 employs 26 silicon bi-polar transistors, 13 diodes and 2 zener regulators. No special transistors are involved, but rather, they are low-cost types that are readily available.

Double conversion is used as shown in the block diagram at fig. 1. The 3.4-30.2 mc signals are heterodyned with a crystal controlled oscillator to produce a variable i.f. of 2955-3155 kc which in turn is mixed with a 2.5-2.7 mc v.f.o. to produce a 2nd i.f. of 455 kc. Coverage is thus provided in 200 kc segments for which the heterodyning-crystal frequencies are equal to 3.155 mc *plus* the lowest frequency of the desired band segment.

Since field-effect transistors have been widely acclaimed as having certain advantages over bi-polar types, the question might arise as to why the bi-polar ones are used instead in the front end of the HQ-215; however, it might be noted that the FET's are not necessarily a cure-all and while they may have merit in some respects, other problems can arise with them. Besides, by proper design and circuit parameters, the bi-polar types ca be made to provide performance comparab to the FET's as shown later with the HQ-21 tests.

Certain front-end problems can be mi mized by improved selectivity. In the HQ-21 this is accomplished with a triple-tuned pr selector with one impedance matched tun circuit at the r.f. input and two such circui between the r.f. stage and the mixer. Caref attention to the gain distribution between th various stages of the set also is a contributi factor to optimum performance.

A 45 mc low pass filter at the antenna inp minimizes the possibility of spurious-sign production from nearby TV stations due mixing with oscillator harmonics. This ca be experienced even with vacuum-tube jo using the same conversion scheme.

The r.f. and mixer stages operate in a co mon-emitter configuration with the heter dyning-oscillator output fed from a low i pedance winding to the mixer emitter. Th oscillator output also goes to the base of emitter-follower isolation stage that feeds th h.f.o. output to a rear-panel jack for extern use.

The 1st and 2nd mixers are coupl through a quadruple-tuned 2955-3155 bandpass circuit the output of which is tapp for optimum impedance matching to the ba of the 2nd mixer. The v.f.o. signal also is i jected at the mixer base and is obtained fro an emitter-follower driven from the v.f. emitter. Another emitter-follower feeds th v.f.o. signal to a jack for external use. Th

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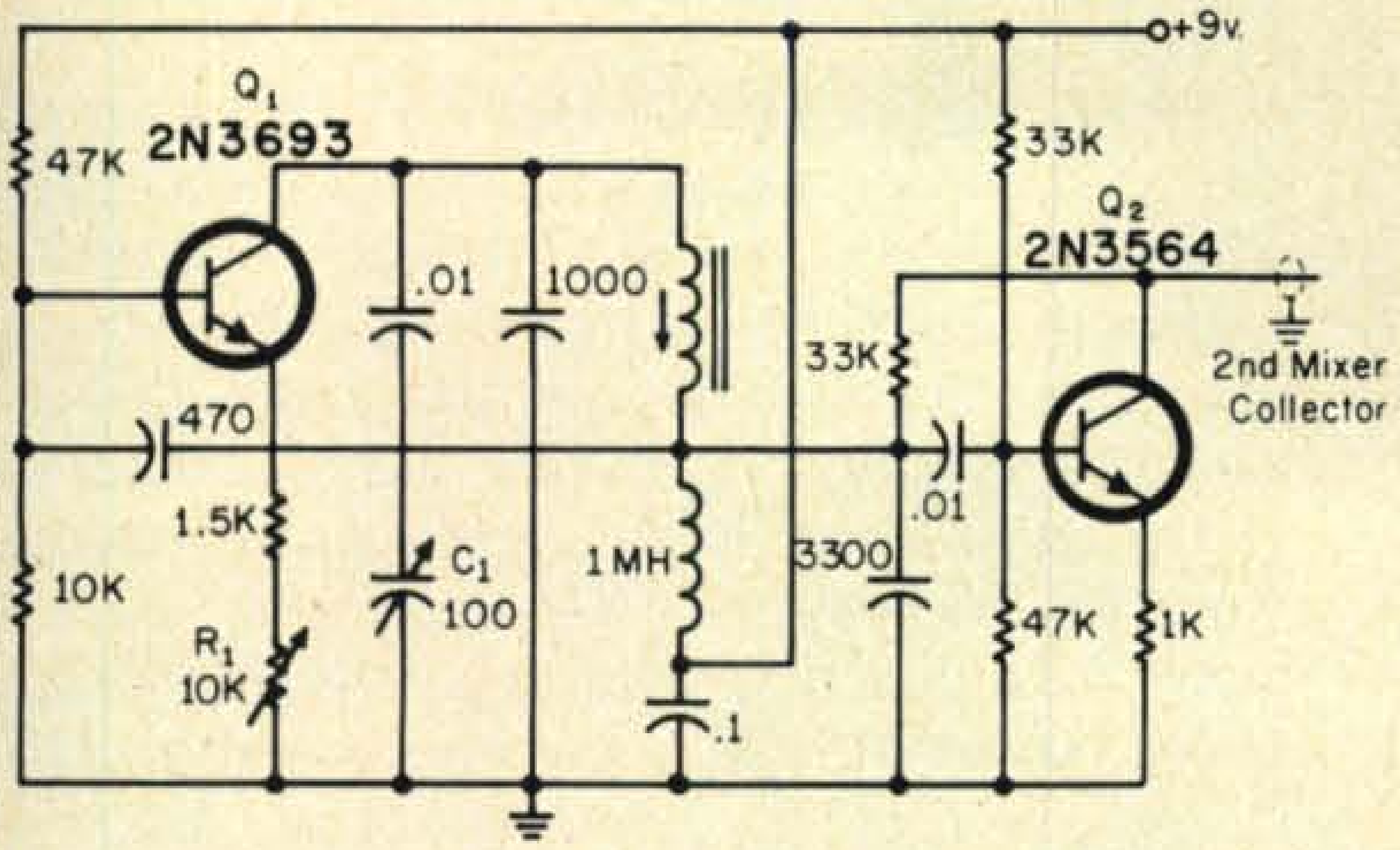


Fig. 2—Circuit for variable-notch filter used in the HQ-215. Transistor Q_1 functions as a Q-multiplier to provide a sharp peak which is inverted to a notch by Q_2. The notch frequency is moved by C_1 and the notch depth is adjusted by the feedback control R_1.

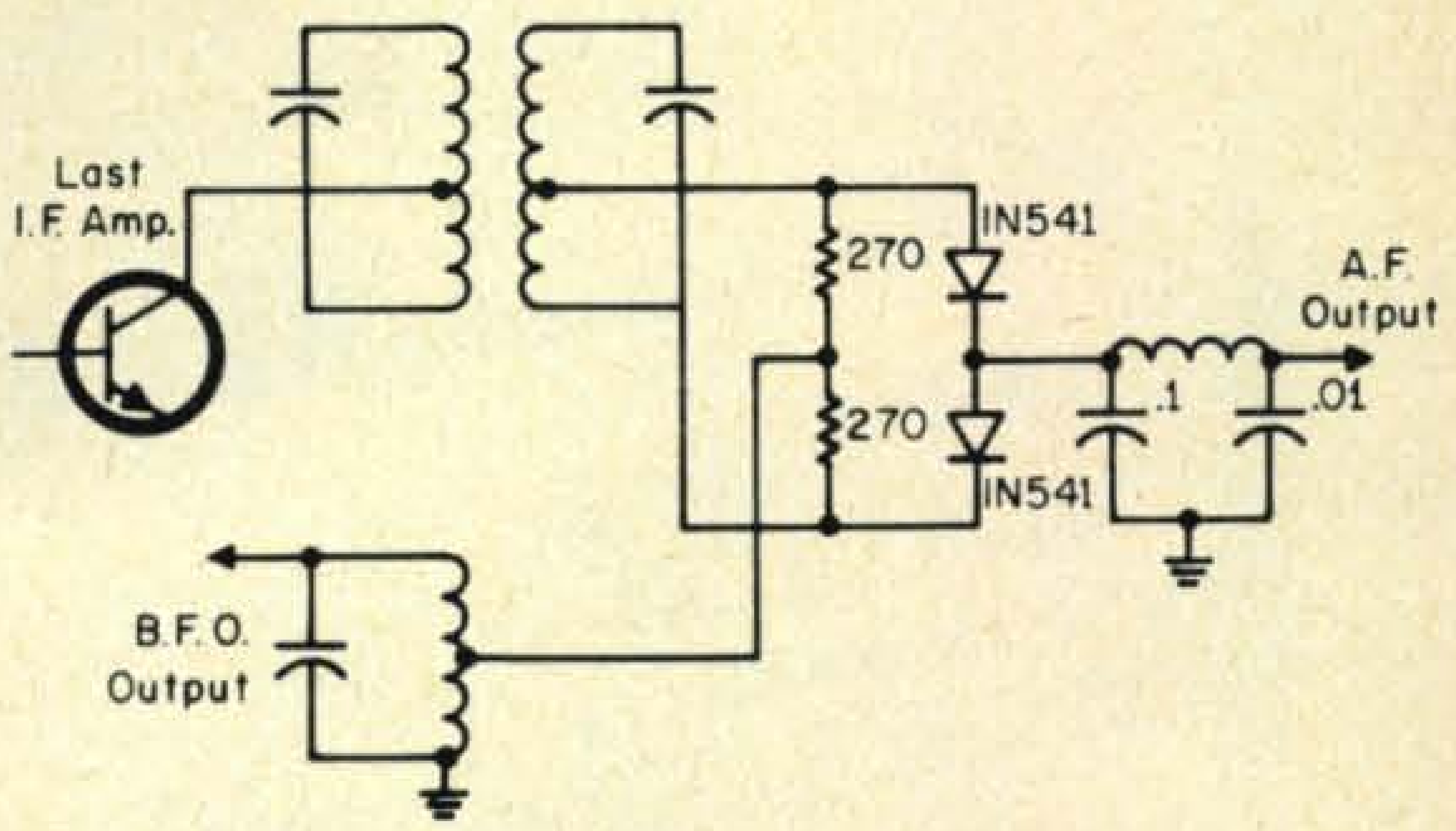


Fig. 3—Balanced-demodulator circuit used for s.s.b./c.w. detector in the HQ-215.

v.f.o. itself functions in a Colpitts-type circuit.

The 455 kc output of the 2nd mixer is coupled through one of the three mechanical filter positions to the i.f. chain consisting of three common-emitter stages. The rejection notch filter also is connected across the mixer output and it is an active setup consisting of a Q-multiplier using one transistor for raising the circuit Q and a second transistor for inverting the Q-multiplier peak to a notch. The circuit is shown in fig. 2.

The i.f. output is applied to two diodes operating as a balanced demodulator that serves as a product detector and, as mentioned at other times, it is one of the best we've experienced for the purpose. The circuit appears at fig. 3.

The crystal controlled b.f.o., which provides the reinserted carrier for the demodulator, employs the crystal in its base circuit. When sidebands are changed, crystals are switched and the v.f.o. is compensated in frequency at the same time with a padding inductance switched by a diode.

When the tunable c.w. b.f.o. is used, its output is fed to the base of the crystal-oscillator transistor with the crystals disconnected. This transistor then serves as a buffer amplifier that enhances the stability of the variable b.f.o.

The a.g.c. voltage and the r.f. gain bias is fed to the base of the stages controlled thereby.

A unique setup is the muting system which consists of a transistor used as a series gate to cut off the supply voltage for the three i.f. stages. This is described at fig. 4.

Construction

The mechanical construction, as well as the electrical, and the components used in the HQ-215 are most impressive. The set depicts quality throughout and must be seen to really be appreciated.

The panel and chassis are of iridized heavy steel with the chassis deck supported between

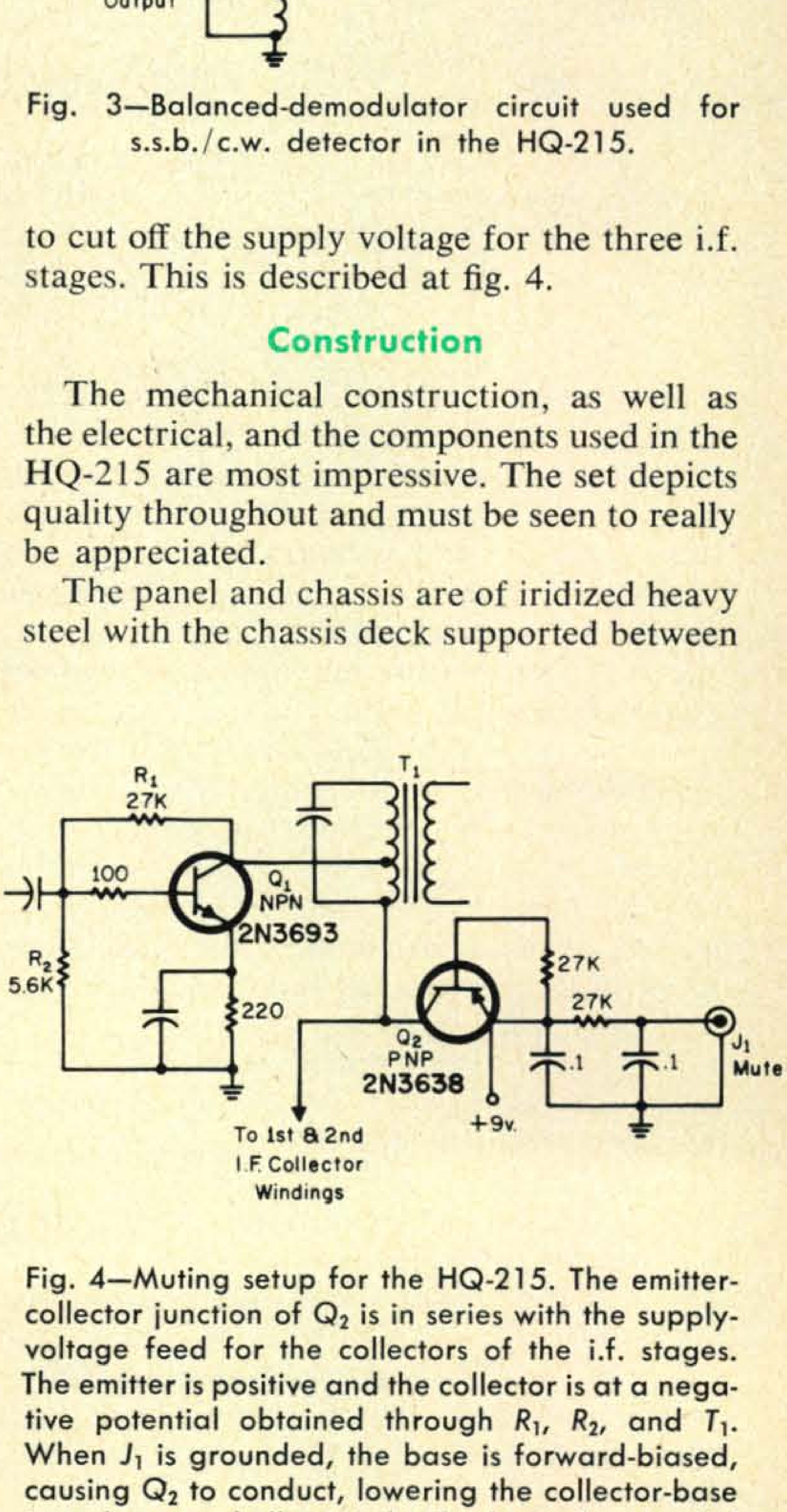
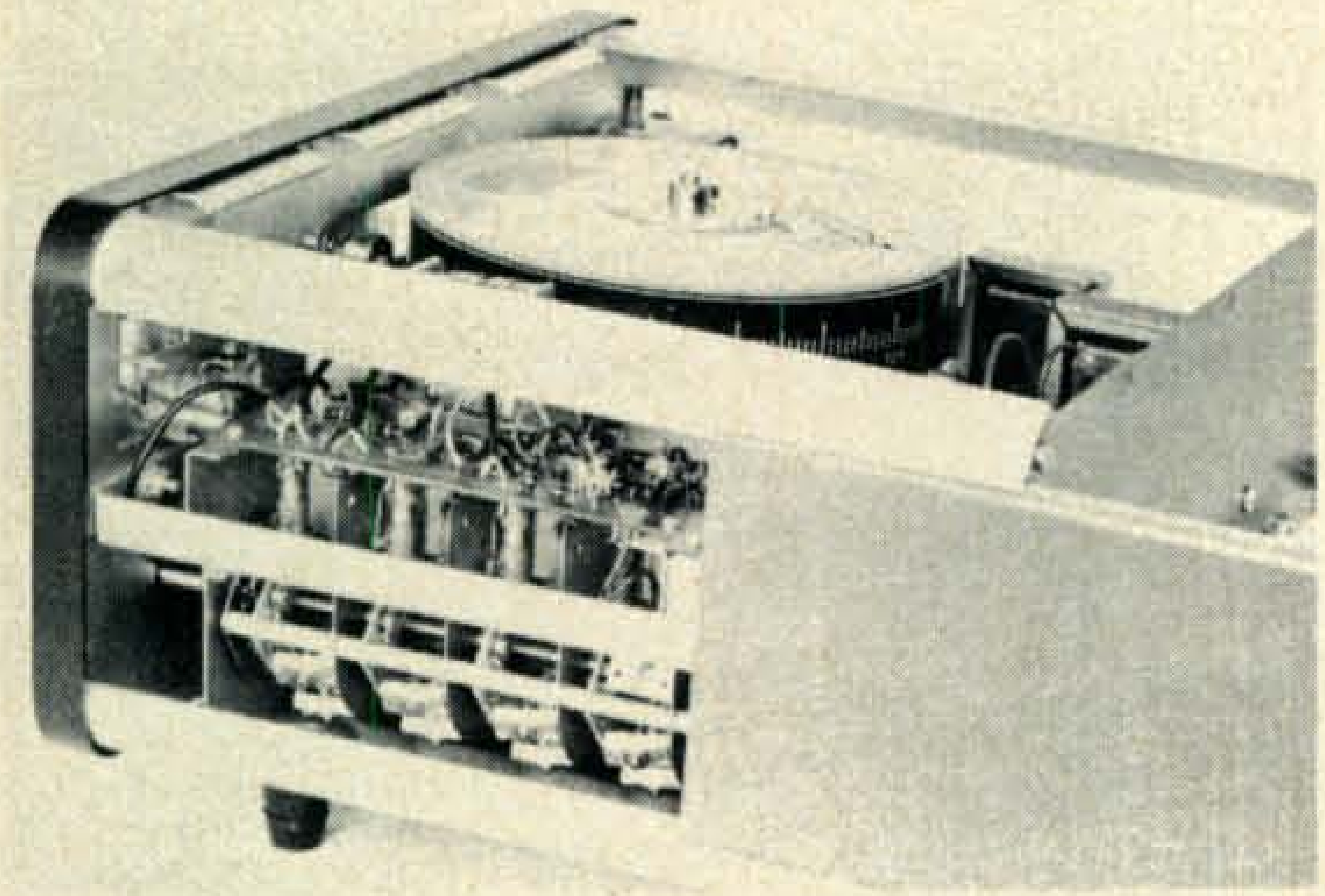


Fig. 4—Muting setup for the HQ-215. The emitter-collector junction of Q_2 is in series with the supply-voltage feed for the collectors of the i.f. stages. The emitter is positive and the collector is at a negative potential obtained through R_1, R_2, and T_1. When J_1 is grounded, the base is forward-biased, causing Q_2 to conduct, lowering the collector-base impedance and allowing the 9 volt supply potential to be applied to the collector circuits for the i.f. stages. When J_1 is ungrounded, Q_2 is biased to cutoff, thus effectively removing the supply voltage from the i.f. stages and muting the receiver. Any external control circuit must provide normally-closed contacts (on receive) one of which is grounded. Independent use of the receiver requires a shorted plug at J_1.



View of the HQ-215 with one of the side panels partially pulled out of the support slots, indicating the excellent accessibility provided.

a front sub-panel and a rear panel. Heavy metal supports between the corners of the two panels have slots throughout their length to allow top, bottom and side panels for the cabinet to be held securely when they are inserted into the slots. This I-beam type construction achieves excellent rigidity and at the same time permits any one of the cabinet panels to be easily and conveniently removed for ready access during maintenance work.

Modular type construction is used internally for various portions of the set with assembly on glass-epoxy printed-circuit boards. Any module can be quite easily removed, explicit instructions for which are given in the manual, as is complete data on servicing and alignment.

The v.f.o. circuit board is installed in a metal box along with the tuning capacitor This box is mounted above the chassis deck with the capacitor's shaft protruding vertically. A large spring-loaded gear on the shaft is driven by a smaller gear which is attached to a 7-inch-diameter rugged-plastic drum on the face ofwhich is the dial scale with a total length of 20". The dial drum in turn is string-driven around its periphery by the tuning-knob shaft which has a weighted flywheel on it.

The size of the set is 6¾" × 5¾" × 14" (H.W.D.) and it weighs 21 pounds.

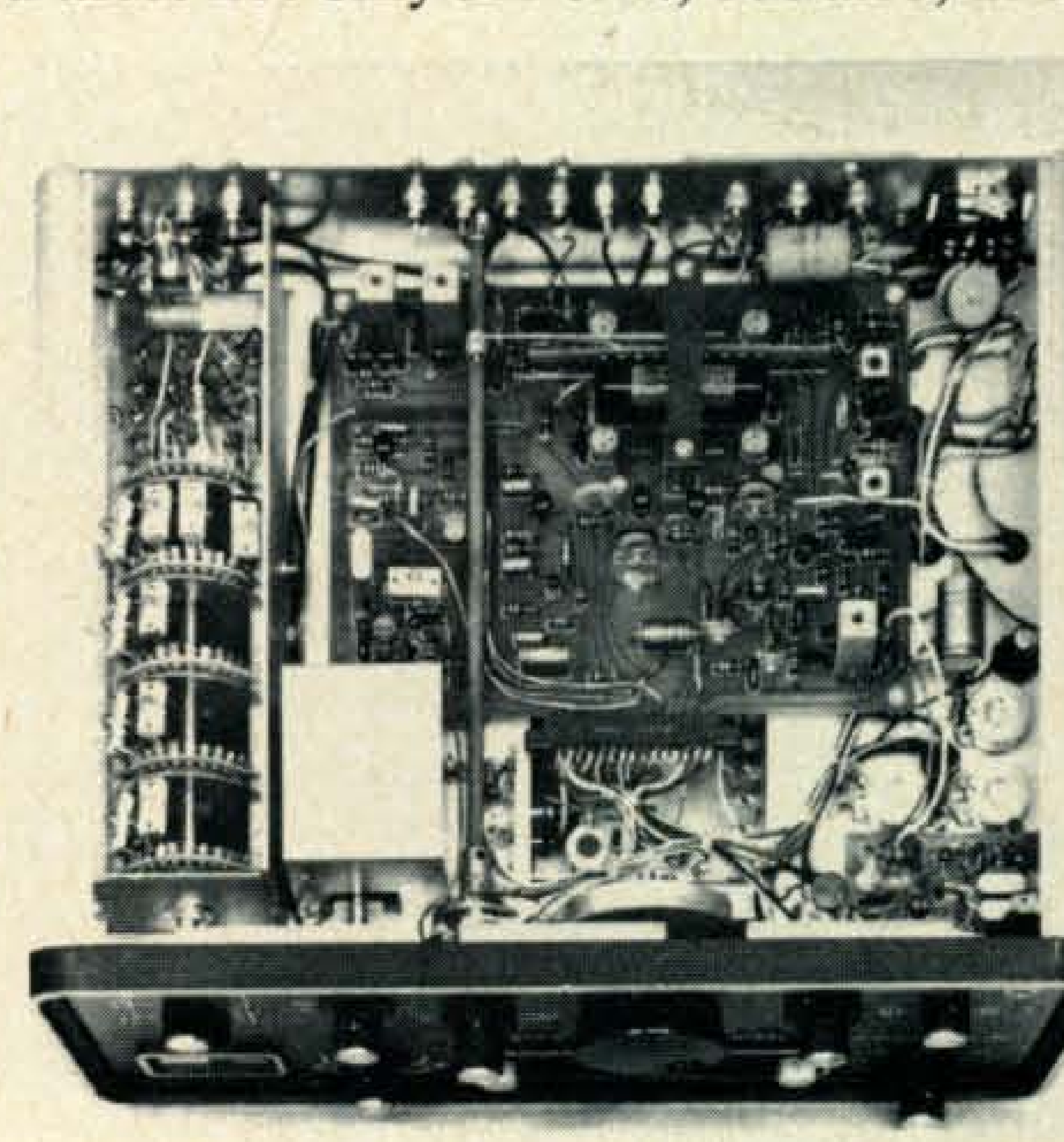
Operation and Performance

The HQ-215 is a dream to handle. The tuning setup is velvet smooth and has a solid feel to it; in fact, the ruggedness of the entire set is such that provides the realization that you're handling an honest-to-goodness piece of equipment.

With only 10 kc covered with one turn of the v.f.o. knob, tuning s.s.b. signals is a snap. The dial scale is well illuminated with white markings against a black background which eliminates light-glare and the frequency is easily determined by adding the dial reading to the band-segment frequency shown at the bandswitch position. Although this switch has a solid detent, it rotates easily. The other knobs, some of which are concentrically arranged, are of a convenient size and are knurled for easy manipulation.

The model made available to us was a standard one equipped with only the 2.1 kc filter. The overall response on s.s.b. signals provided more comfortable and pleasant-sounding voice quality than usually experienced and the a.g.c. action was real smooth along with a particularly flat a.f. output level. In spite of the narrow bandwidth due to the 2.1 kc filter, good intelligibility was experienced with a.m. signals. The rejection notch is extremely sharp and attenuates little of the desired passband. Because of our noisy location, we missed an s.s.b./c.w. noise silencer on the set. Such an accessory would be nice for a future item.

The tunable c.w. b.f.o. was found to be a good asset not only for c.w., but also, as men-



Bottom view of the HQ-215. The main board is at top center, under the connector for which may be seen part of the v.f.o. section. The bandswitch is at the left. The crystal b.f.o. and the balanced-demodulator module is at lower right corner. The shaft running upwards at left of center is part of a control link that operates a sliding-switch affair for the filters at the top.

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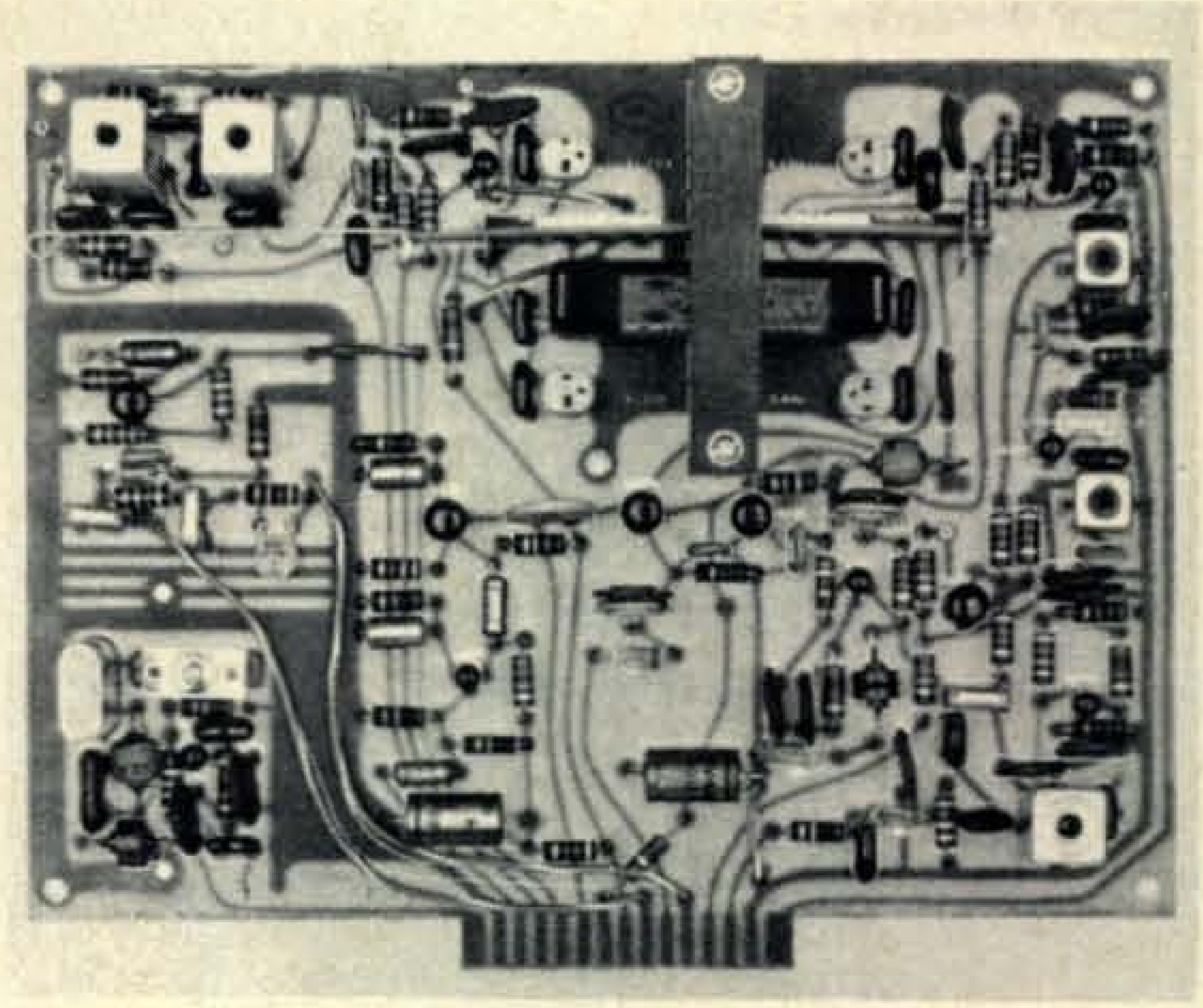

The main circuit board which has been removed from the HQ-215 to show how the printed-circuit runs may be seen through the glass epoxy as viewed from the component side of the board. A similar view is shown in the manual and is a convenience for use if service work is needed. This module contains the 2nd mixer, i.f. and low-level a.f. stages, a.m. detector, a.n.l., muter, a.g.c. system and the calibrator. The protrusion at the bottom edge slides into a connector for power and control circuits. Critical circuits are connected with flexible wire or small coax snapped onto pins at various points. The dark oblong object near top center is the 2.1 kc mechanical filter. The accessory filters plug into the transistor-type sockets nearby.

tioned earlier, can be useful for s.s.b. as well, particularly for obtaining the optimum a.f. response in cases where the optional 0.5 kc filter might be used under adverse band conditions.

Measurements

The measured performance of the HQ-215, compared with the specifications, was as follows:

S.S.B./C.W. SENSITIVITY (rated at 0.5 μv for 10 db S + N/N): 0.1-0.2 μv, depending on band. A.M. SENSITIVITY (rated at 1 μv for 10 db S + N/N): 0.2-0.4 μv with 30% modulaion at 400 c.p.s.). IMAGE REJECTION (rated better than 40 db): 85-65 db, depending on band. I.F. SIGNAL REJECTION (not rated): 60-59 db, depending on band, at 3055 kc; over 00 db at 455 kc. INTERNAL TWEETS (not ated): less than 0.2 μv equivalent input sigal, except 0.5 μv at 3690, 3810 and 21420 c. BAND-TO-BAND GAIN (not rated): within db, except 7 mc was +12 db (referred to 4 mc). S-METER (rated for 50 μv at S-9): -10 μv, depending on band. SELECTIVITY: ame as rated for mechanical filter with 2.1 c bandpass and 2:1 shape factor. UNWANTD-SIDEBAND SUPPRESSION (not rated): 45 db t 500 c.p.s., 53 db at 1 kc, 64 db at 2 kc. EJECTION NOTCH (rated at —40 db): —50 b. A.G.C. CHARACTERISTIC: within rating of 0 db a.f. output change with 2-20,000 μv 80 db) r.f. input change. A.G.C. SLOW-REEASE TIME (rated at 2 sec.): 1 sec. from S-9 -40 db signal.

FREQUENCY STABILITY (rated at less than 00 c.p.s. per hour and ±1 kc plus crystal stability over ambient range): Starting cold at 68 deg. *F.* ambient, average drift for all bands was 700 c.p.s. after first hour, 150 c.p.s. during the next hour and 100 c.p.s. or less per hour thereafter. With ±10% line-voltage variation (not rated): less than 2 c.p.s. No frequency instability was noted under stress of vibration. The frequency readout is approximately 250 c.p.s. SCALE ACCURACY (not rated): within 400 c.p.s. at any 10 kc point after indexing at center of band.

CROSS MODULATION: This is a subject often misunderstood by amateur operators and one that is confused with desensitization and the production of spurious signals due to overload. The latter two are the most usual occurrences. Since we've yet to see a standard set of specifications for these characteristics, at least for amateur gear, our evaluations were made on a comparative basis against a commercial receiver using FET's and with a number of vacuum tube jobs. The results are as follows:

With the HQ-215, an undesired signal, removed 10 kc from a 1 μv desired signal, could be raised 35 db higher in level, than with the FET-equipped receiver, for a given degree of desensitization as indicated by a specific decrease in the level of the desired signal. With the undesired signal displaced by 100 kc, the desensitization with both receivers was on a par. Similar comparisons with various vacuum tube sets produced results ranging from 15 db poorer to 5 db better.

The overload level, resulting in spurious signals, was comparable for both solid-state receivers and equivalent to the relative com-

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parisons given for desensitization with the vacuum-tube receivers.

With all the receivers, meaningful measurement of actual cross modulation was not obtainable, because of excessive desensitization as a result of the high signal levels needed to produce the cross modulation.

A special version of this receiver also is available for the short-wave listener. It is the HQ-225, supplied with only the 6 kc filter for a.m. and all crystals for s.w. broadcast bands which include three WWV frequencies. As with the amateur-band model, other selected band segments may be had by the installation of the appropriate heterodyning crystals.

Because of the high-quality workmanship, performance, flexibility and the available selected bands between 3.4 and 30.2 mc, either one of these receivers should find applications in the commercial or military communications field as well as for the amateur or s.w.l.

The HQ-215 is priced at $529.50 with 2.1 kc filter and all amateur-band crystals, except for the 10 meter band where a crystal is supplied for only the 28.5-28.7 mc segment. The HQ-225 s.w. broadcast version is $569.50 with a 6 kc filter and the required crystals. These are products of the Hammarlund Manufacturing Company, Incorporated, 73-88 Hammarlund Drive, Mars Hill, North Carolina 28754.

—W2AEF

That Extra Input

BY ALLAN S. JOFFE,* W3KBM

How to add a high level audio input circuit to that high gain a.f. amplifier.

IN this day and age of progress and modernity most ham audio systems have a need for more than one input. The days of "mike only" went out with the advent of the tape recorder and the phone patch. Naturally the mike channel is a point of high gain as the mike is a low level piece of apparatus but a tape recorder output or phone patch lash up is generally too hot to be fed into the mike input.

Many pieces of equipment have inputs for both low and high level devices but, as always, some do not. If the low level input signal is applied by a pentode it is possible, with a simple change, to modify the stage to accept a high level input signal. The circuit of fig. 1 shows how simple the changes are. The circuit and component values came right out of the RCA tube manual. The tube used must have a suppressor grid that is available for direct connection as can be seen from fig. 1.

About ten millivolts of signal applied to the control grid produced about one volt of signal across the plate resistor for a stage gain of approximately 100.

If the audio generator is now shifted to the suppressor grid and the audio v.t.v.m. is once again made to read one volt across the plate load, you will find that the input signal has to be increased to some 200 Millivolts (roughly a 26 db decrease in input sensitivity), a value that makes for a reasonable high level input. Naturally both the mike input and the high level input may be used simultaneously as a mixing system as the occasion demands. ■

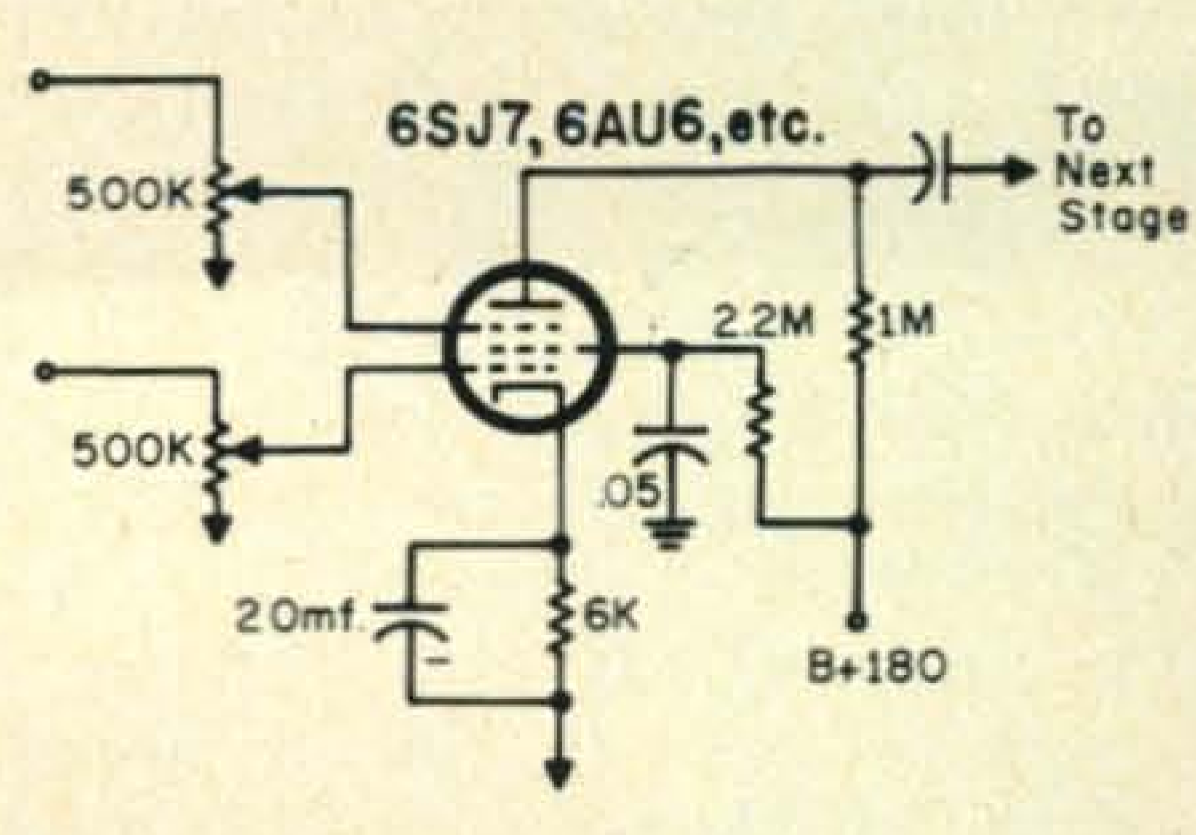

Fig. 1—Addition of a ½ meg gain control in the suppressor grid circuit permits the use of the high stage with a high level input signal such as that from a phone patch, tape recorder or a carbon mike.

* 531 E. Durham Street, Philadelphia, Pa. 19119.

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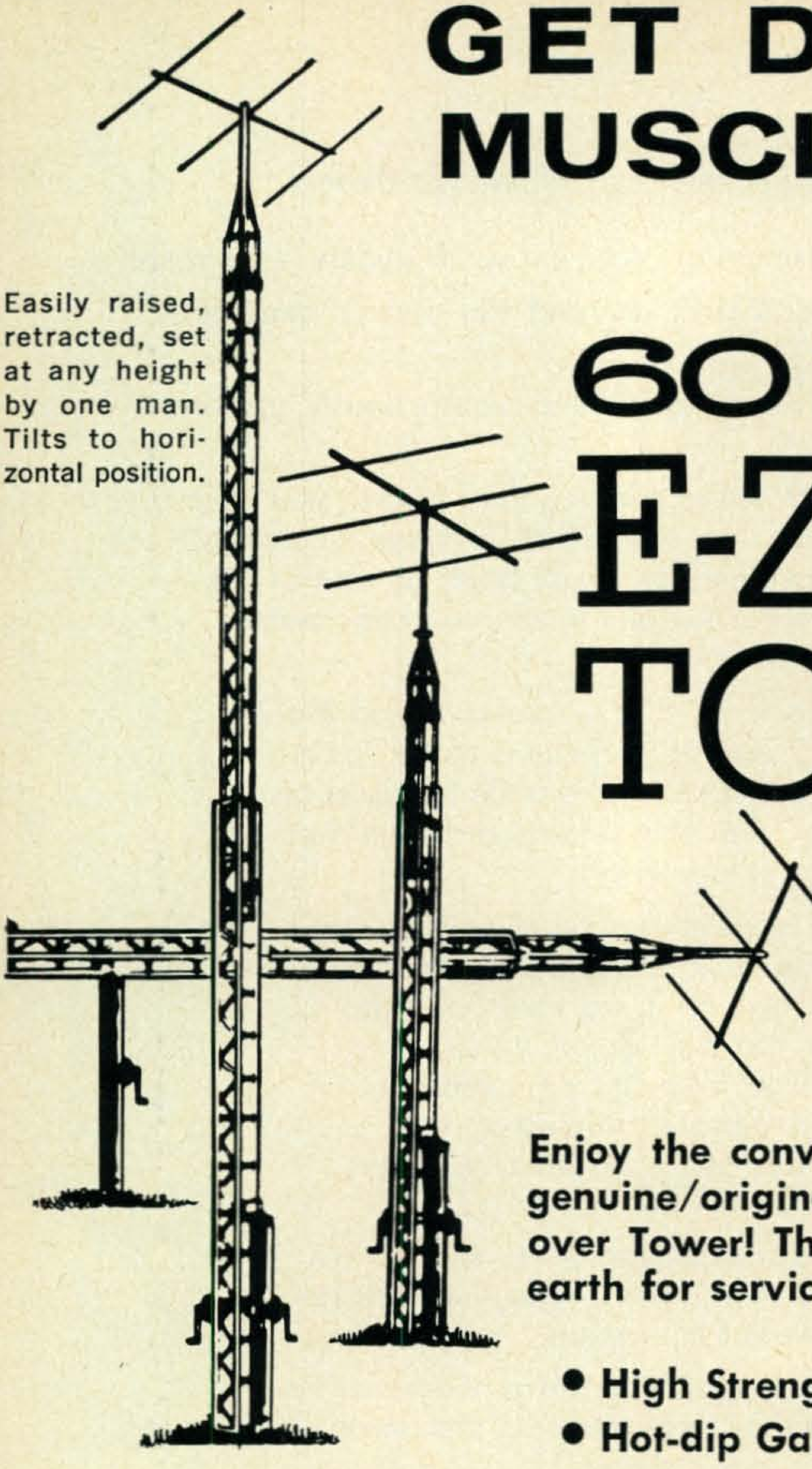
GET DX MUSCLE



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C.W. Tranceive Operation With The Drake T4 and The R4A

BY DONALD L. SCHLIESSER,* WA6UFW

HAVING a passion for DX and for DX contests causes one to constantly evaluate the station, its flexibility and ease of operation. I have a Drake T4, two R4A's and have been frustrated, being a c.w. operator, not to be able to transceive while operating c.w.

In the Drake gear, when on c.w. the carrier appears about 1.2 kc lower than the receiver is listening, when transceiving with the receiver p.t.o. Needless to say, this presents a problem in a contest!

Looking at the schematic of the T4/T4X/T4XB exciter, one finds that in c.w., the 5.645 kc carrier oscillator, V_{1A}, is shifted slightly by the addition of a 10 mmf capacitor, C_1, to put the carrier in the passband of the lower sideband filter.

To be able to transceive on c.w., two things must be accomplished; 1) The carrier oscillator must be shifted enough so that the signal will pass down the center of the i.f. strip, and, 2) The R4A/R4B receiver must have a variable b.f.o. Another thing of importance is not to destroy the resale value of either piece of gear by extra holes in the cabinet, *etc.*

Modification

The steps to follow are these: First, remove capacitor C_1, located in the left hand back corner underneath the chassis of the T4. With the unit upside down and the front panel to the front, the capacitor is on a coil form used as a tie point.

* 3160 Fairmede Drive, Richmond, California 94806.

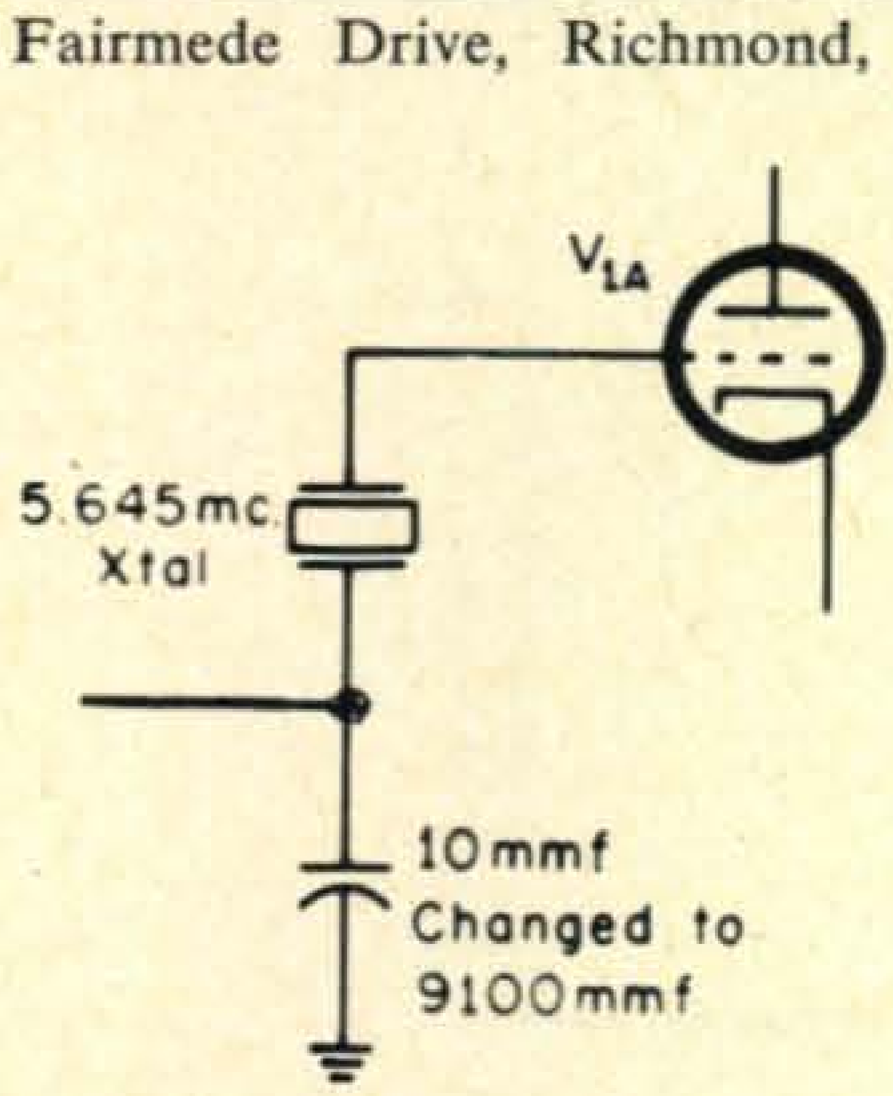

Fig. 1—The carrier oscillator of the T4X/T4XB/T4 shifted by changing the 10 mmf capacitor to 9100 mmf.

Add a 9100 mmf capacitor in place of the removed 10 mmf as shown in fig. 1. I used a ceramic capacitor of good quality. Check to see that the T4 output is now zero beat when the receiver p.t.o. is used as control. Use another receiver and a calibrator checkpoint to be sure that the transmitter output is the same as the receiver frequency. If it is off slightly, vary the value of the 9100 mmf until zero beat is attained.

This completes the change in the transmitter. No change will occur in s.s.b. operation because the added capacitor is automatically shorted out in the s.s.b. position.

You will notice that in c.w. the gain control on the T4 will have to be turned up more than before to get the same output. The reason is that now the carrier is centered between the two side-band filters and they act as a slight attenuator. My T4 put out 150 watts into a wattmeter/dummy load before and output is still 150 watts after the change —the gain pot is at about ¾ instead of ½.

Now the T4 is transmitting exactly on the frequency of the R4A receiver. If you listen to a c.w. signal at about 1 kc audio output, the T4 will again be zero beat, but now it will be 1 kc off of zero beat to the signal you are listening to—because it is transmitting exactly zero beat to where the receiver is tuned.

Variable B.F.O.

The next step is to make the R4A receiver b.f.o. variable. Referring to the R4A schematic, Q_6, a 2N3394, is the b.f.o. (See fig. 2.) The frequency of the b.f.o. is determined by T_{11}, a variable coil, and C_{168}, a 180 mmf capacitor (among others). By removing C_{168} and replacing it with a 100 mmf variable in parallel with an 80 mmf fixed capacitor, a variance of plus or minus 1 kc can be achieved.

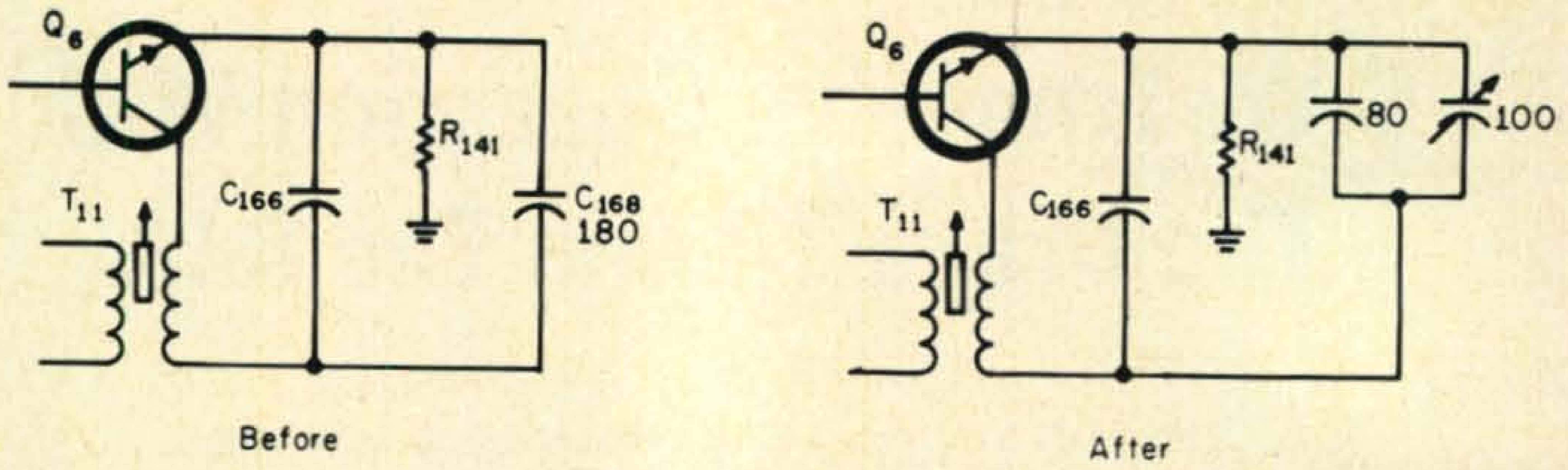

Fig. 2—To make the b.f.o. circuit of the R4A/R4B variable, C168 is replaced with a combined fixed-variable combination shown above.

In order to leave the appearance of the receiver intact for resale, I removed the phone jack on the front panel of the R4A and did not remove the wiring. Simply tape over the jack to prevent it shorting out and push it out of the way under the chassis.

The variable capacitor must be insulated from ground, so I used an APC-100 variable which has a two screw mount and both stator and rotor remain insulated. Again, in order not to drill holes, I used the bracket shown in fig. 2. After folding, you will notice in the R4A there is a slot in the sub-panel behind the hole vacated by the phone jack. Slide the aluminum over the sub-panel and mark the center hole for the capacitor through the phone jack hole in the front panel. Now it can be removed, and the two mounting screw holes for the capacitor can be located. Mount the capacitor loosely on the aluminum fold. Now slide the fold over the sub-panel lip and tighten the screws holding the capacitor. This will hold the aluminum fold on the sub-chassis.

For the adjustment shaft use a hollow plastic dowel which just fits over the capacitor shaft and is long enough to extend through the front panel. If needed, a shaft can be made out of any plastic dowel and glued to the capacitor shaft if necessary, but it must be an insulated shaft.

To complete the wiring, solder an 80 mmf capacitor in parallel with the variable and use a piece of two conductor wire to go between the board (where the original 180 mmf capacitor was removed) and the new variable. The distance is about 4 inches.

To readjust the receiver set the variable at half capacitance and follow the 50 kc oscillator alignment instructions on page 32 of the R4A book. This procedure only takes about 5 minutes.

In c.w. operation, zero beat the calibrator signal at any checkpoint, and adjust the variable b.f.o. capacitor to the tone you like to listen to c.w. From then on every time you tune in a c.w. station, you will be transmitting on the same frequency you are receiving him.

Operation

When you want to operate transceive on s.s.b., all you have to do is put the variable capacitor back to half capacity, (I have a white dot on the shaft and one on the panel which I line up), and you will be back to normal for s.s.b. transceive.

To use earphones now that the earphone jack is gone, I have built a switching panel which takes the speaker output of the receiver and switches either to phones or speaker. My earphones plug into this external panel.

This system will work with the R4A/R4B and T4/T4X/T4XB. The results have been great for me. It sure is nice to tune in a station and call him on c.w. without having to spot the transmitter! I figure it will make the difference of 100 more contacts in the next c.w. contest with the time savings.

The R4 Receiver uses a tube type b.f.o. and I did not research that schematic. The same principle may be followed to make the R4 b.f.o. variable.

Drop me a card if you do this modification and let me know how you like it. ■

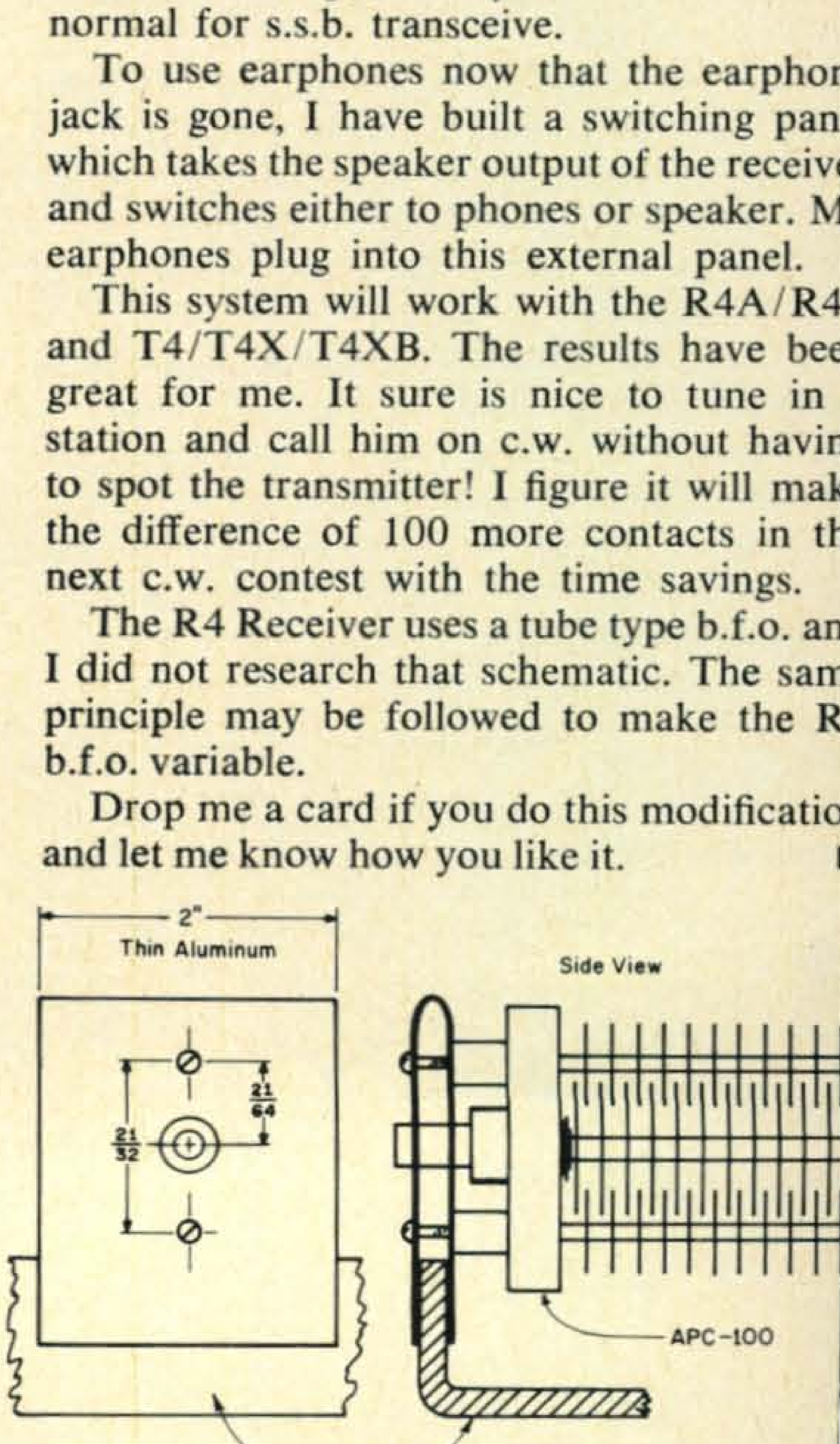

Fig. 3—Simple mounting bracket for b.f.o. tuning capacitor.

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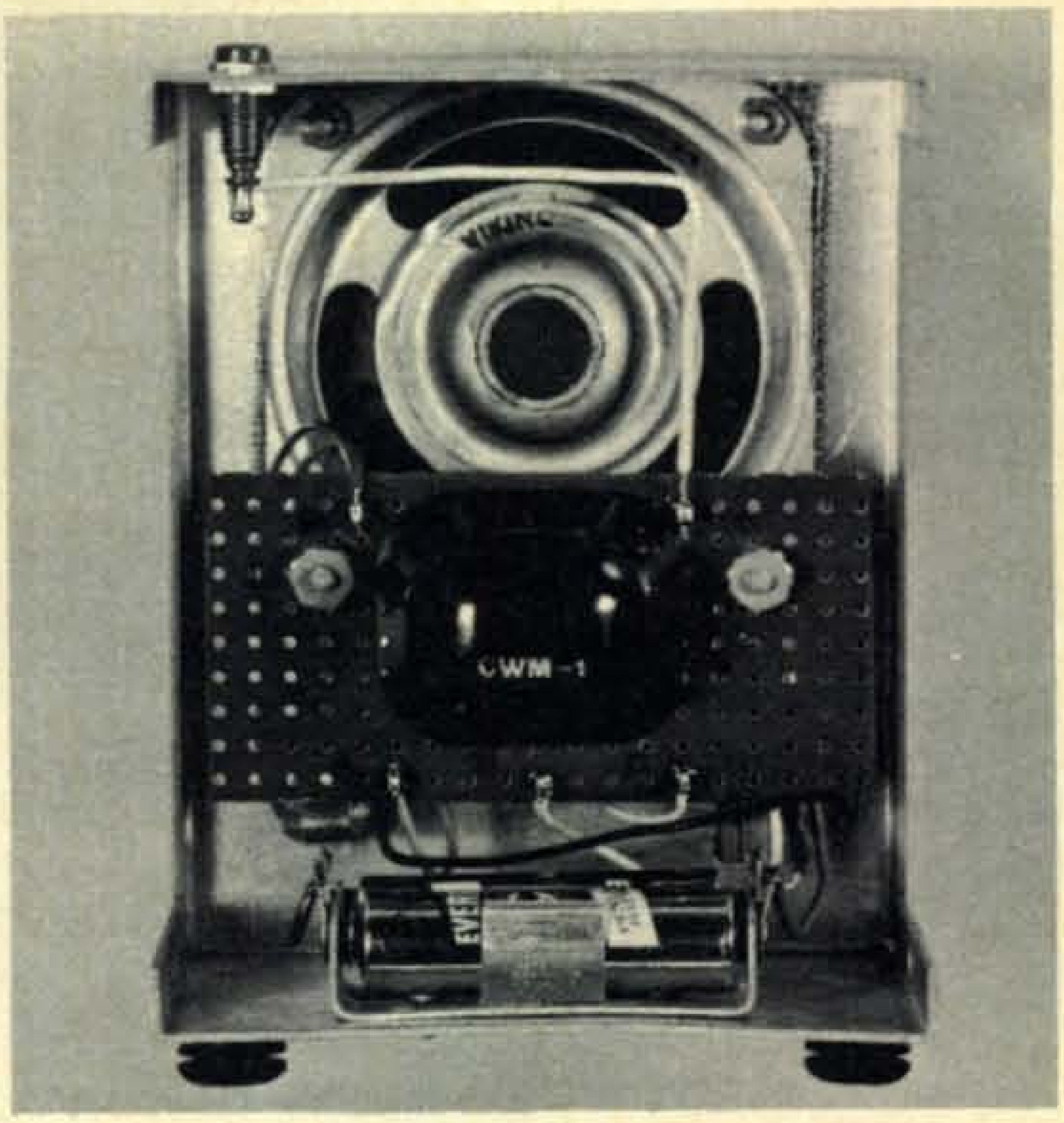
Front view of the completed r.f. actuated keying monitor mounted in a 3×4×5 aluminum Minibox.



Rear view of the r.f. actuated keying monitor shows the location of the module and the battery holder.

AN R.F. ACTUATED KEYING MONITOR

BY JAMES I. RANDALL*

HERE is a simple, but highly efficient c.w. keying monitor any Ham operator can build in four hours at a cost of less than $10.00. In addition to giving you the sound of your fist when you are on the air, it can also double as code practice oscillator. Completely self contained in a 3×4×5 inch aluminum Minibox, the monitor is powered by two Penlite cells and requires no connection to your key, transmitter or the power line. Just place it in the vicinity of your rig, plug in a short length of hook-up wire for an antenna and you're in business.

There are two approaches to monitoring c.w. transmissions. The first is to use your key to turn an audio oscillator on and off so that a tone is produced every time you press the key. This is a simple solution and it serves a purpose, but it has the disadvantage that it does not actually sample your transmission. A better idea is to use a device which is actuated by the r.f. energy it picks up from your transmitter. The monitor described makes use of a newly developed electronic module which contains all the circuitry necessary to make a sensitive, r.f. actuated keying monitor. All you have to do is add a speaker, battery and antenna. Some of the newer modules are not listed in the current Lafayette Radio Electronic Catalogue, but are available at the many Lafayette Associ-

[*Continued on page 127*]

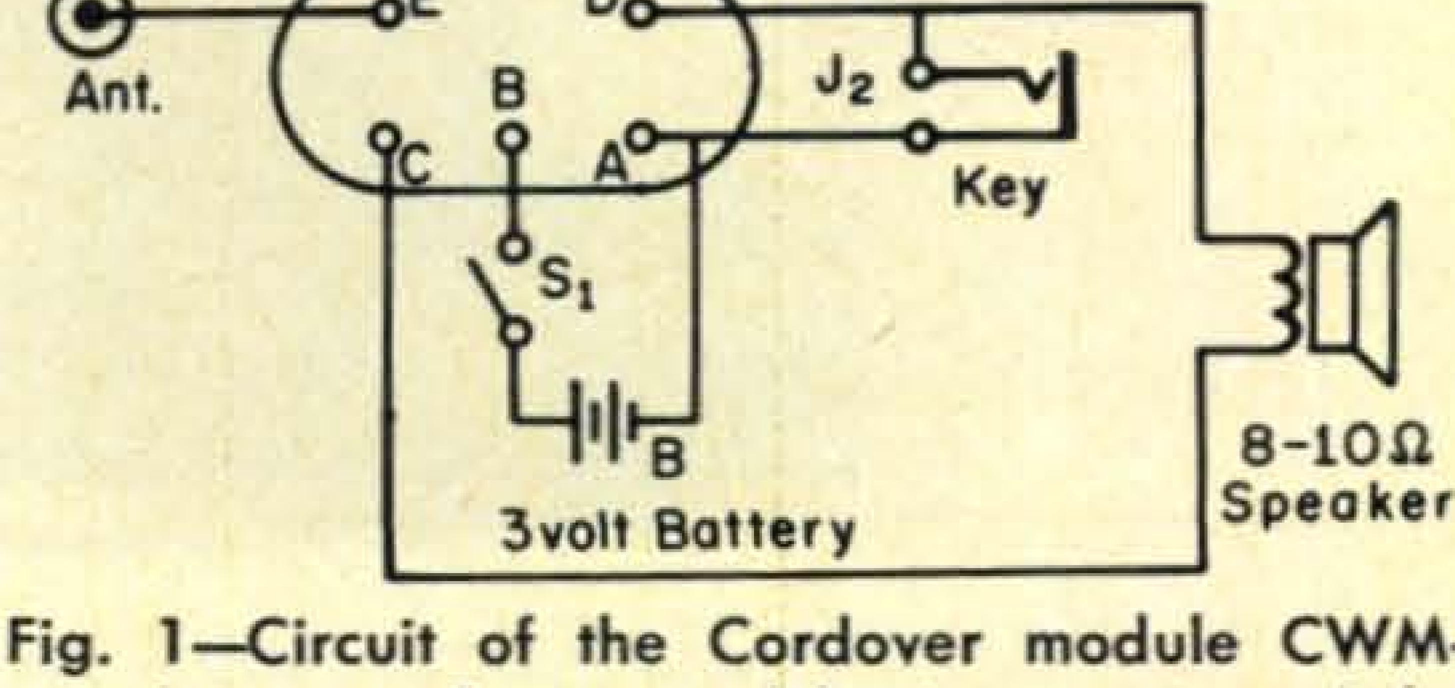


Fig. 1—Circuit of the Cordover module CWM-1 wired as an r.f. actuated keying monitor. A key plugged into J_2 permits its use as a code practice oscillator.

* 723 St. John's Road, Baltimore, Maryland 21210.

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HOW TO MAKE FIVE MILLION
(points, that is)

BY JOHN H. THOMPSON,* W1BIH

PICTURE a luxury hotel on a forty-acre tract stretching a mile along a coral cliff overlooking a Caribbean, with three separate stations and six knowledgeable contest operators with amateur experience totalling 200 years. That, fellow amateurs, is the formula for running up five million points in the *CQ* World Wide DX contest.

Actually, the story begins long before the 1967 *CQ* contest. Back in 1963, a group from the Connecticut Wireless Association flew down to St. Maarten and operated PJ5ME from Vince's (PJ2ME) shack for one weekend of the ARRL c.w. contest and three years later repeated the performance, making some 4500 contacts in one weekend. At that time thought was given to activating a station in the Caribbean area for a one-weekend contest and, to us, being primarily c.w. operators, the CQ W.W. DX C.W. contest seemed a natural.

Since U.S. contacts from South America count 3 points, a site further south than the Caribbean area around St. Maarten seemed desirable. When we learned that an America amateur, Chet Brandon, PJ3CC (also KP4 AEQ), had a hotel (the Coral Cliff) o the island of Curacao, just off the coast o Venezuela, this seemed to be the spot an discussions were started with Chet on 2 meter ssb. We learned that his hotel-base station was available to visiting amateu with a minimum of red tape.

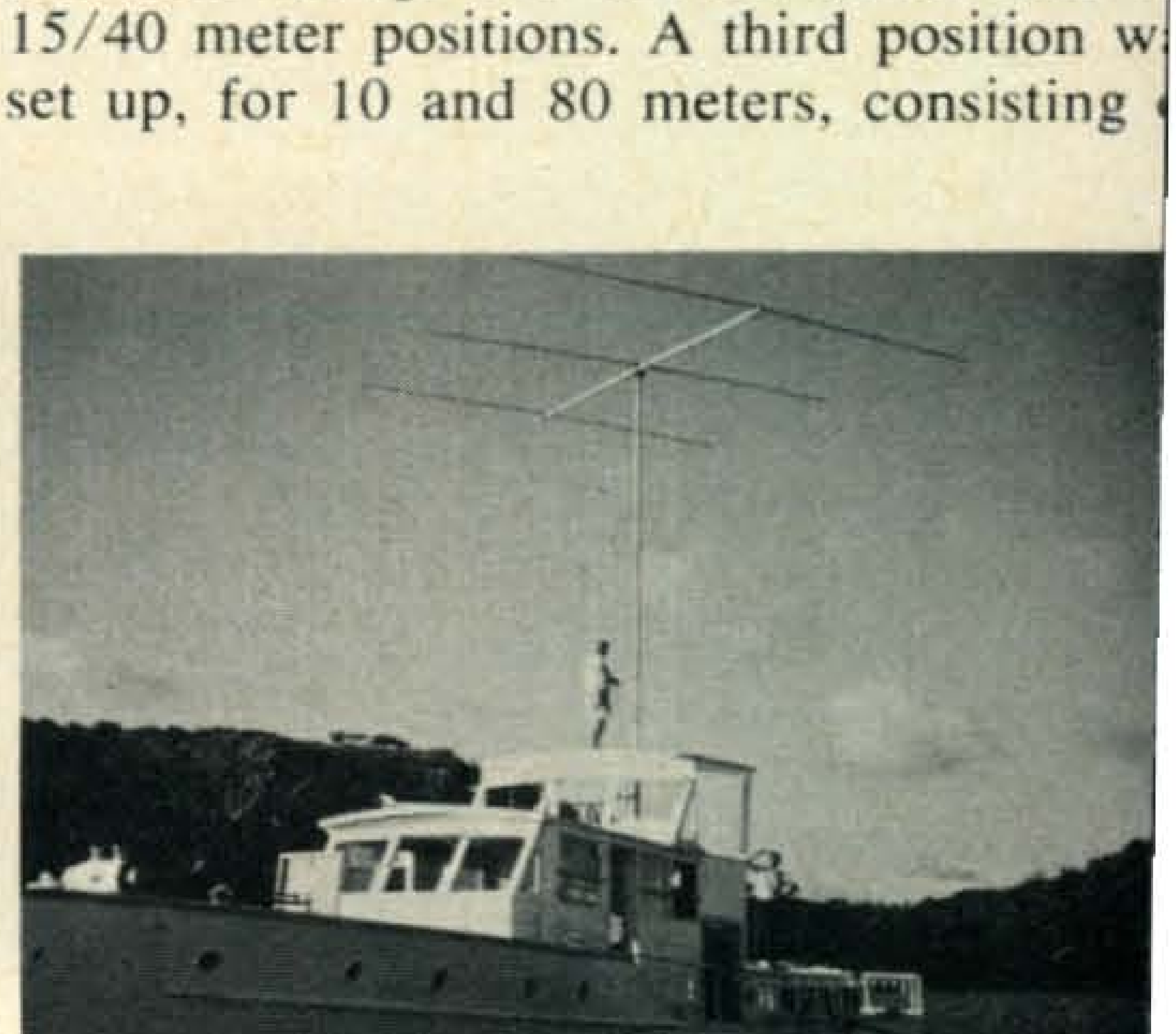
Contact was made with Vic Clar W4KFC, top ranked contest man, and h was agreeable to the idea, so it became joint venture of the Potomac Valley Radi Club and the Connecticut Wireless Associa tion.

Six operators finally participated: Le Chertok, W3GRF, Roy Fosberg, W1T Bill Grenfell, W4GF Al Rousseau W1FJ W4KFC and W1BIH.

The Collins KWM-2 and 30L-1 at the pe manent PJ3CC location were supplement by another KWM-2 and 30L-1 and tw 75S-3B receivers we brought in to give tw identical set-ups for the 20 meter and t 15/40 meter positions. A third position w set up, for 10 and 80 meters, consisting

* P.O. Box 1, Torrington, Conn. 06790.

The "crew" at PJ3CC, Curacao, just prior to the 1967 CQ W.W. DX C.W. Contest. From l. to r. W1TX, W1FJJ, W1BIH, W4GF, W3GRF, W4KFC, and Chet, PJ3CC.



A 15-meter beam was erected atop a beac yacht. PJ3CC mans the feedlines.

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'aking their turn at two of the rigs are W1TX (left) operating the 10-meter position from the com-
'ort of a hotel room. W1FJJ (right) roughs it on 15 and 40 from the cabin of the beached yacht.

. CE 200V transmitter and very broad tun-
ng Eddystone receiver.

Chet Brandon, our host (not a contest
an himself), went all out to assist us and
e constructed, tuned and erected hand-
otatable 3-element beams or 10 and 15
eters and dipoles for 40 and 80 to supple-
ent his only permanent antenna—a long
ire that was used on 20 meters with ex-
ellent results.

The three stations were set up about 700
et apart, with 15 and 40 meters being in
e cabin of a permanently beached boat,
gh and dry in the coral near the water's
ge, 20 meters was operated from the hotel
creation room, and 10/80 meters in a room
the far end of the hotel.

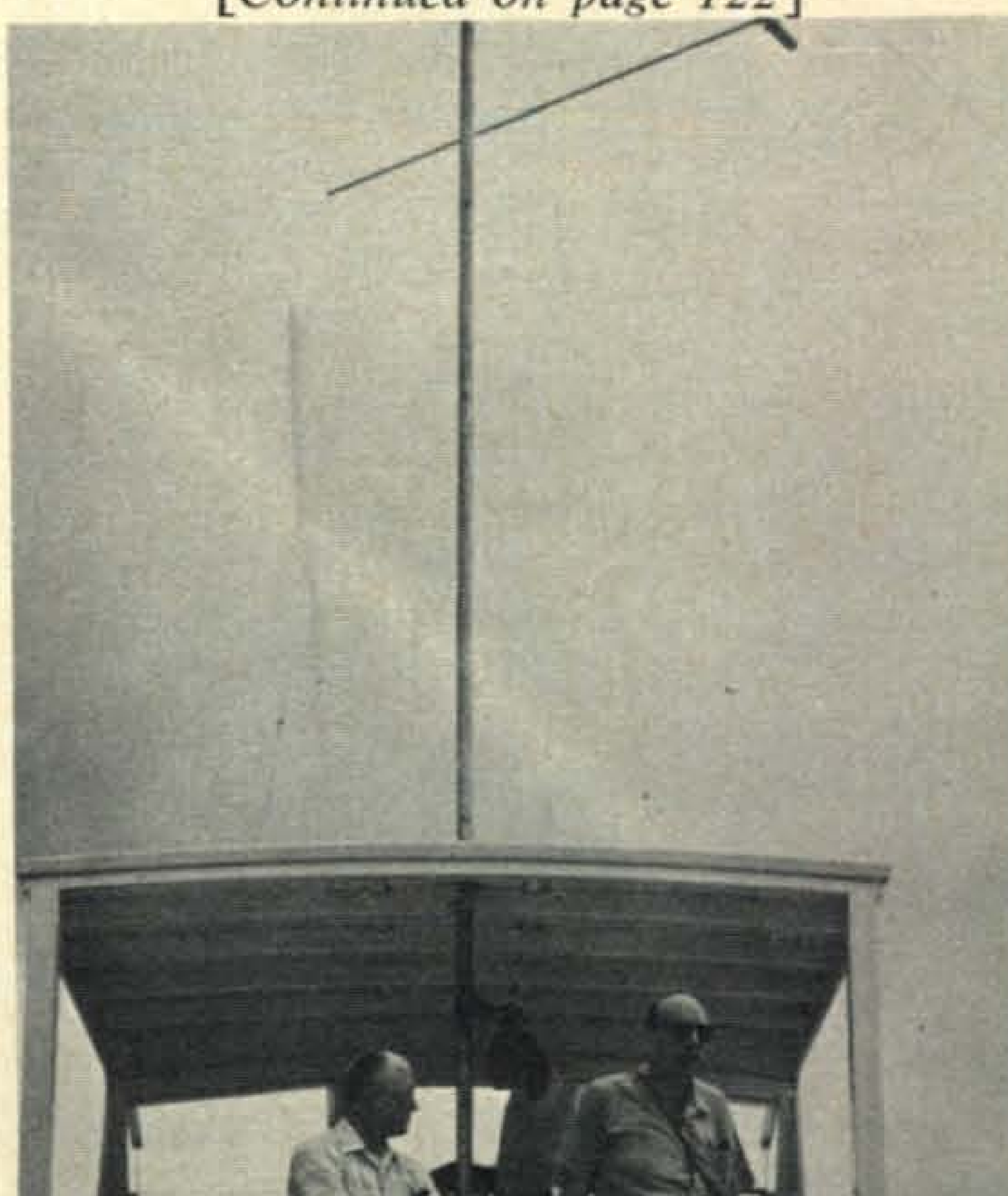
Customs difficulties were encountered in
r freighting in the KWM-2 and 30L-1,
t Chet worked things out with the authori-
s, posted a $300 bond, and had the equip-
nt at the hotel waiting for us. Further,
th Chet's help, all equipment was installed
d antennas erected in ample time and an
ur before the start of the contest found
eating a leisurely dinner by candlelight
d commenting that this was a far cry from
ARRL field day!

Our experience in the contest certainly
utes any arguments that c.w. is a lost art,
e 5405 contacts having been made in
48 hour period. Duplicate contacts
lled 211, leaving a net of 5194.

Amazing to the operators was the seem-
y inexhaustible reserve of stations waiting
ontact us. The pile-ups were tremendous
imes. For example, W1FJJ averaged 91
tacts per hour for 5 straight hours on 15
ers—and this was after the contest was
along. W3GRF worked 110 an hour
the first 3 hours on 20 meters. A handicap
was the unavailability to us of the lower 10 kc of each band. Another handicap was the lack of a selective receiver for 10 and 80 meters. We also regretted that 160 meter operation was not permitted.

As with any operation of this type, troubles developed, but fortunately they did not put us off the air for any appreciable length of time. Vic, operating 40 meters, had a piece of coax fail—25 minutes later the

[*Continued on page 122*]



Again at the 15-meter position, W4GF and W4KFC discuss strategy while PJ3CC again mans the feedlines.

A 40 METER LINEAR—
PROVIDES THE MOSTEST FOR THE LEASTEST

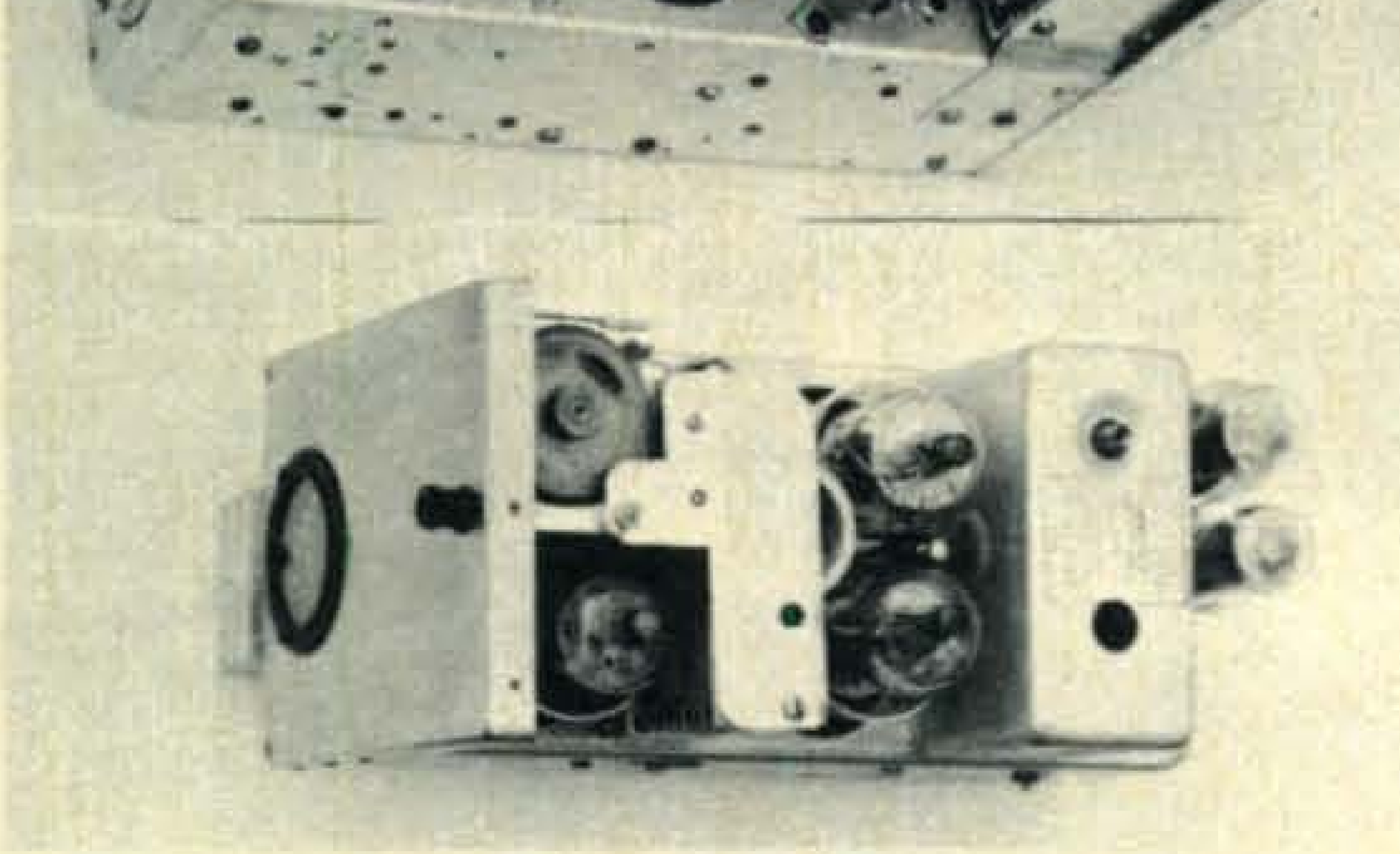
BY LARRY WALROD,* VE7BRK

This linear-driver combination for mobile use is built on a BC-458 chassis and uses many of its components. It can operate with as litle as one fourth of a volt drive and produces 125 to 150 watts of output.

WE HAVE noticed BC-458 transmitters advertised for as low as four dollars (in lots of 50) so there must still be a number available on the surplus market. The single unit price of around five dollars is a dandy bargain, whatever purpose any customer might have in mind for the equipment. We probably have a lot of nerve, however, to call our modified unit a command set after what we did to it.

We wanted to obtain a linear amplifier for mobile use which would operate from a 12 volt d.c. source and would produce the most output for the least expenditure. Before working on the linear, however, we had to decide what we needed for plate voltage supply and the Heath HP-13 mobile power supply came to our attention because it delivered 750 volts, 300 volts and 32 volts bias (with a little modification) and was rated at 300 watts in s.s.b. service. The price, too, of around sixty dollars came within our budget so we decided to run three 1625s in class AB_2 from this supply.

* Nasuli, Malaybalay, Bukidnon, Phillipines.



Top views of the completed 40 meter linear with and without the shield.

The Heath supply, by the way, is a dandy piece of gear; it is small, light, ruggedly buil and supplied with automatic reset circui breakers and with ample connecting cables for most applications.

Initial Preparation

The BC-458 set needs to be almost com pletely stripped for this project. The onl things left in the set were the two 1625 tub sockets, the three octal tube sockets and th plate tuning inductance although this, too was removed for modification. The fron panel was stripped of everything includin rivets and bolts so it would be simple to moun a new panel to cover up all of the holes.

Circuit Planning

We planned to use this linear amplifier afte a very low powered transistorized transceive Since class AB^2 ampifiers are driven into th grid current region, a very considerable po tion of the available drive power must b applied to swamping resistors to maintai linearity. It was felt, therefore, to be exped ent to incorporate drivers into the final ampl fier chassis which would have an output in th range of several watts to supply this pow requirement. Provision was made also to a just the overall gain of the combination meet varying needs that might be encoun ered. This was done by inserting a 5K pote tiometer in the cathode line of the first drive

Instead of having the plate tuning capacit below the deck as in the original design, v

See page 142 for New Reader Servi

moved it up to the top so that all the plate circuit components would be above the chassis and all the grid circuit components would be below. After removing the tuning capacitors from below the chassis there was room to mount a third 1625 socket at one side near the front.

Layout Details

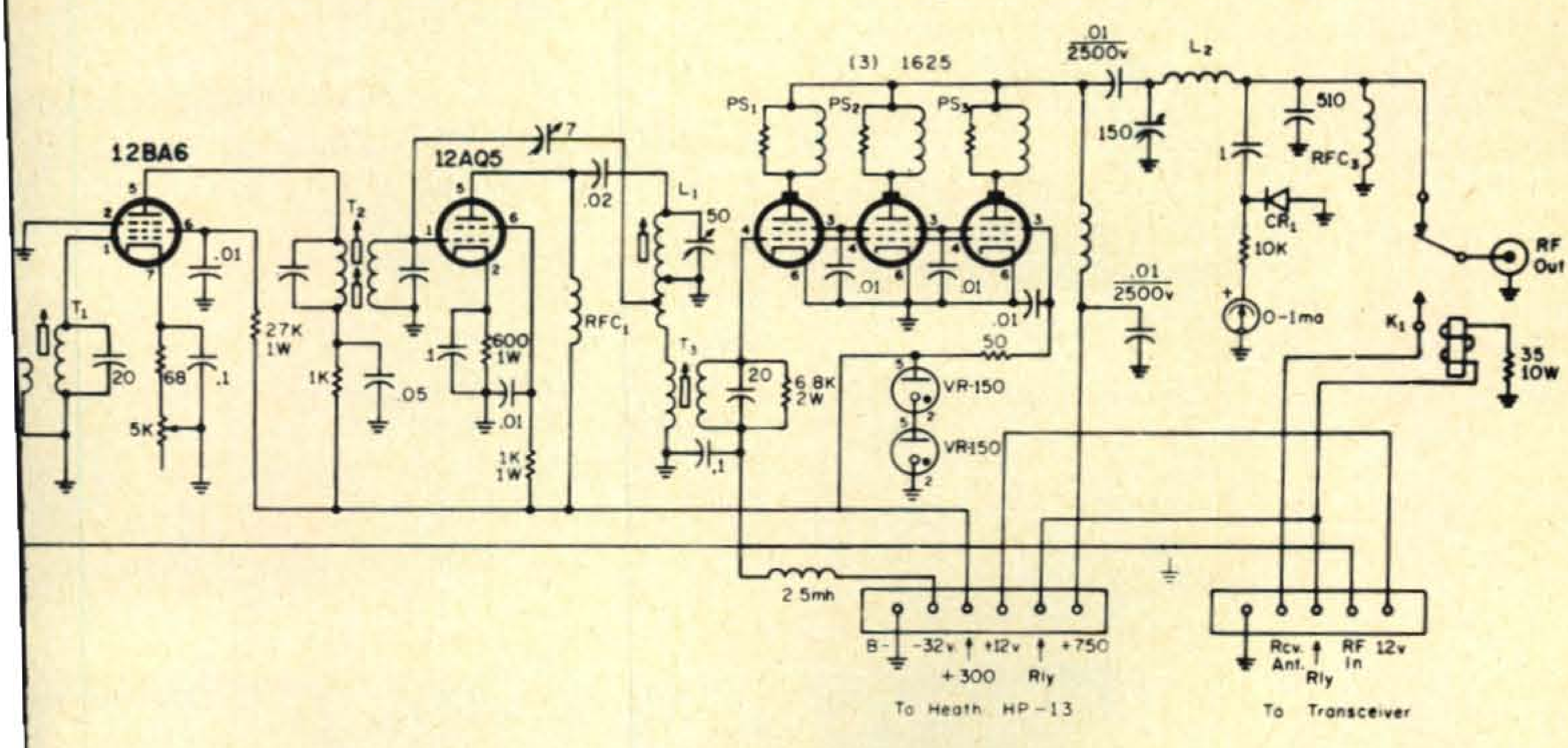
One of the original tuning capacitors with attached vernier was mounted vertically near the front of the chassis in such a manner as to allow the tuning shaft to protrude out through the front panel. This capacitor was mounted with the aid of a piece of 16 gauge aluminum fastened to the bottom of the capacitor and to the side of the chassis. This aluminum strip had to be bent just after it protruded from the chassis side so that, when finally in place, the cover could slide in behind the front panel in the original manner. The cover had to be notched, though, so it would fit over the capacitor mounting strip just where it came up from the chassis.

A flat head screw was recessed into the front panel and run through the side plate of the capacitor to further stiffen the mounting. The screw was installed before the front panel so it would not be visible in the finished product.

An additional 50 mmf air trimmer was parallelled across the plate tank variable and installed beside the tank inductance. This would not be necessary, though, if this unit were to be used only on 40 meters as there is sufficient capacity in the variable to tune over the required range and still maintain proper tank Q. The rigidity of this installation was increased by the use of a bracket connecting the two capacitors. This bracket also proved to be a handy place to install the plate blocking capacitor.

After installing the new panel, an 0-1 ma meter was added in the lower section and connected to read the amplifier output. Note that only 1 mmf is needed to connect this circuit to the output to get a near full scale indication on the meter.

The 1625 grid tuning inductance, being wound on a slug tuned form was mounted on a U bracket in between the tube sockets and link coupled to the driver output stage. The



g. 1—Circuit of a 40 meter linear and driver ing a BC-458. Full output can be achieved with little as ¼ volt of r.f. drive. All capacitors with lues one or more are in mmf unless otherwise ted. Capacitors with values of less than one are mf. Resistors are ½ watt unless otherwise noted. capacitors are rated at 600V unless otherwise marked.

$_1$—Any r.f. type diode 1N34, *etc.*

-Rewound BC-454 b.f.o. coil, 26 t., #26 e. apped at 1st and 4th turn. Form is ⅜" dia ¾" ong ferrite rod.

L_2—Pi net coil wound on original BC-458 form as explained in the text.

PS_1, PS_2, PS_3—Original BC-458 Suppressors-9t #26 e. on 50 ohm ½ w. composition resis.

RFC_1, RFC_3—2.5 mh

RFC_2—2.5 mh at 250 ma.

T_1—Rewound transistor type i.f. transformer. 30 turn secondary and 4 turn primary, #40 e. wire.

T_2—Rewound ¾" × ¾" 455 kc i.f. transformer. 24 turn pri. and 24 turn secondary. ⅜" apart, #40 e. wire. Original capacitors used.

T_3—⅜" slug tuned form, 30 t. secondary, 4 t. primary, #35 e. wire.

driver stages were mounted in the space originally occupied by the v.f.o. and positioned in such a manner as to permit the original shield to be replaced.

Two VR-150 regulator tubes were mounted in the rear section to stabilize the amplifier screens. The rear apron of the chassis was drilled to accept a 6 prong tube socket[1] (for voltage supply), a 5 prong socket (for r.f. input and receiver antenna output), and a coaxial chassis connector for r.f. output.

Adjacent to this connector, inside the chassis, a 12 volt a.c. antenna relay was installed. An a.c. relay was used due to the fact that we thought we might at some time be using this amplifier on a.c. supply. This, however, necessitated inclusion of a dropping resistor in the relay coil line for d.c. operation and this can merely be shorted out if necessary. Thirty-five ohms was sufficient to reduce the coil current to a satisfactory value. We used a 50 watt resistor here but a 10 watt one is large enough.

The links on the driver final coil and the final grid coil were placed and adjusted to deliver as much of the driver power as possible to the final grid circuit. For improved insulation, the 750 volt line inside the chassis was run with 50 ohm coaxial cable.

The original tank circuit coil was removed and rewound with number 14 copper wire so that all the grooves in the form were filled. This added three more turns to the original arrangement. The original output link coupling was discarded in favor of a fixed loading capacitor at the base of the coil to ground. An r.f. choke was then necessary across the loading capacitor for safety reasons. Otherwise a shorted blocking capacitor could cause the antenna to assume the full plate potential.

[1] A 6 prong *male* plug should be used here for safety so no voltages will be exposed. *Editor.*

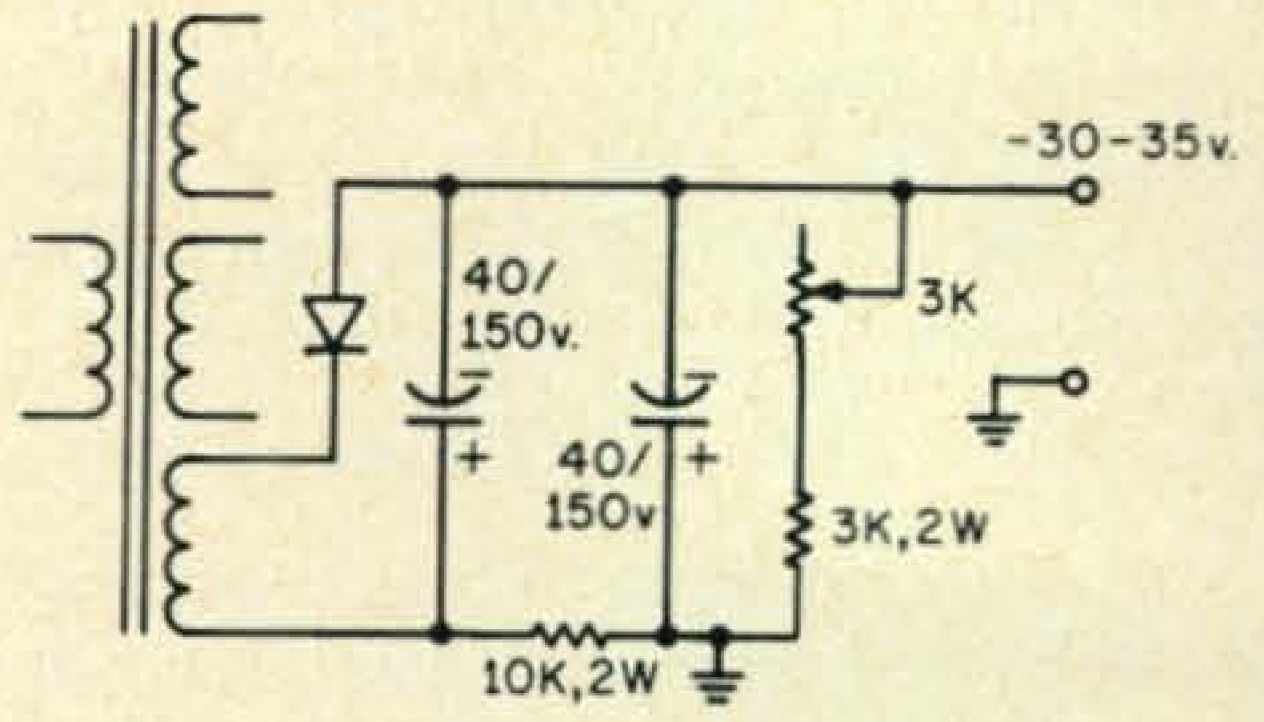


Fig. 2—Modification to the Heath HP-13 to provide —32 volts for bias.

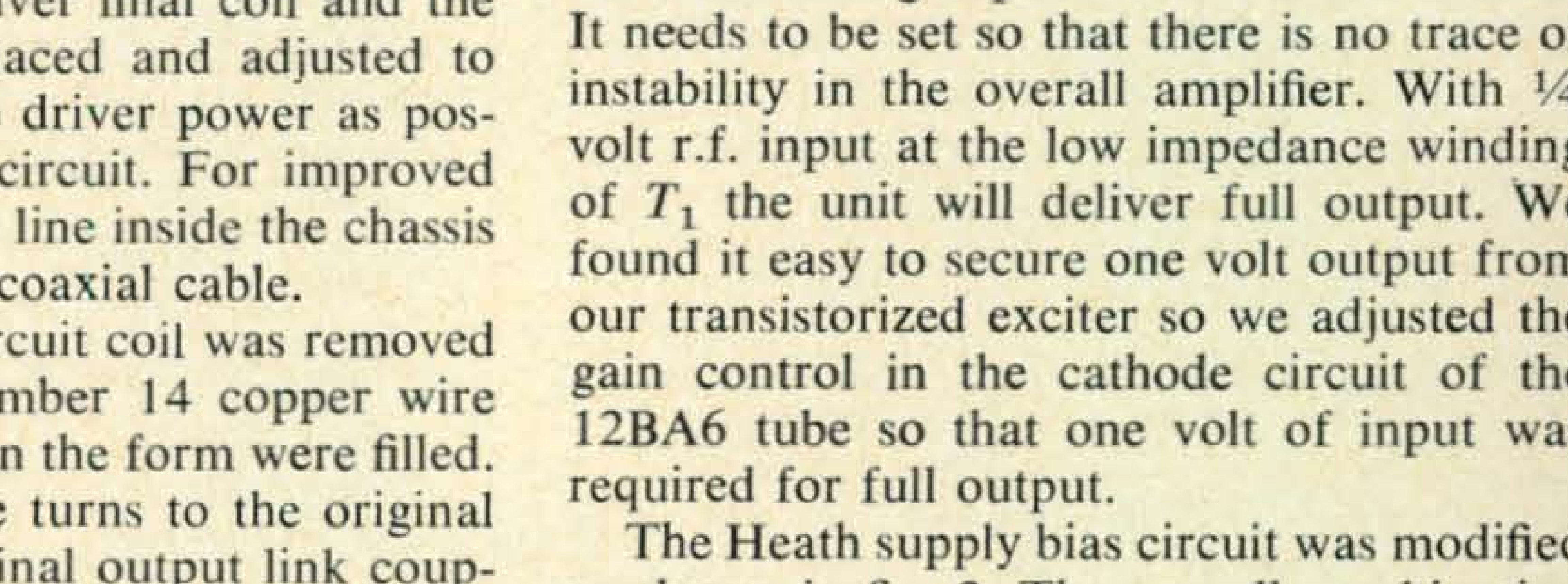
Operation

Very little needs to be said about the adjustments but perhaps one critical point is the neutralizing capacitor in the driver final. It needs to be set so that there is no trace of instability in the overall amplifier. With ¼ volt r.f. input at the low impedance winding of T_1 the unit will deliver full output. We found it easy to secure one volt output from our transistorized exciter so we adjusted the gain control in the cathode circuit of the 12BA6 tube so that one volt of input was required for full output.

The Heath supply bias circuit was modified as shown in fig. 2. The overall combination didn't work too badly with this arrangement. It was found, however, that the transistorized converter was sometimes a bit sluggish in starting due to the fact that lack of bias on the final tubes when the converter was first

[*Continued on page 127*]

Bottom view of the 40 meter linear shows the grid input transformer, T_3, mounted between two 1625 sockets. The large resistor is in series with the antenna relay.



DX

BY JOHN A. ATTAWAY,* K4IIF

IN recognition of outstanding contributions to DX, Stewart S. Perry, W1BB, has been elected to the *DX Hall of Fame* Aug. 16, 1968.

As a result of the most recent balloting by the *CQ* DX Award's Advisory Committee, Mr. 160 Himself, Stew Perry, has been chosen as the third recipient of the ultimate DX award. This honor is bestowed only upon those individuals who have contributed to DX more than they have received, and whose contributions have *stood the test of time*. Earlier recipients are Gus Browning, W4BPD, and Jack Cummings, W2CTN.

Stew Perry, W1BB, has devoted many thousands of hours over an interval of a half-century to the encouragement of DX activities on the 1.8-2.0 mc band. The July, 1968 issue of *CQ*, page 67, contains an excellent article by W2EQS detailing his activities. For many years he has single-handedly published a *160 Meter DX Bulletin* which he circulates to interested parties all over the world largely at his own expense. The high-point of his career was reached during this past year when he organized the very successful Trans-Atlantic and Trans-Pacific 160 Meter DX Tests which resulted in trans-oceanic contacts for many top band enthusiasts. Contacts between the far east and North America extended from Japan well into the Central USA. During this same season W1BB succeeded in working several new ones in South America and became the first amateur in the world to complete 2-way QSOs with 100 countries on 160 Meters, a truly memorable accomplishment establishing a new landmark in amateur radio. *CQ* is proud to welcome this great amateur and fine gentleman to the DX Hall of Fame.

Contest Month

Remember, this is the month of the *CQ* Worldwide DX Phone Contest, the biggest phone DX affair of the season. It is the week-end of Oct. 26-27. Your editor plans to be on again from the Caribbean for the 4th consecutive year.

For you prefix chasers the VK/ZL Oceania Contests, phone Oct. 5-6 & c.w. Oct. 12-13, offer a good chance to rack up that Oceania endorsement sticker on your WPX certificate. The RSGB 28 mc phone contest and 7 mc c.w. contest are good times to look for band endorsements. Complete details on these contests may be found in Frank Anzalone's Contest Calendar for this and the preceding 2 issues.

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

DX Hall of Fame member, Stew Perry, W1BB, surrounded by his famous 160 Meter station with which he has worked 100 countries on top band.
(Photo Courtesy W1DQF, XYL de W1BB)

DX Hall of Fame

Gus M. Browning, W4BPD
Nov. 1, 1967

John M. Cummings, W2CTN
Mar. 23, 1968

Stewart S. Perry, W1BB
Aug. 16, 1968

S.S.B. DX HONOR ROLL

VK3AHO	318	W2BXA	304	XE1AE	294	MP4BBW	270
W9ILW	315	G3AWZ	303	K1IXG	289	G3NUG	270
W2TP	313	G6TA	303	K8RTW	288	K8ONV	270
G3FKM	313	W3DJZ	303	W9EXY	286	W2MJ	267
W3NKM	313	W4PAA	301	W1LLF	282	G2PL	266
WA2RAU	313	KP4CL	301	W6UOU	282	W6YMV	265
WA8AJI	312	5Z4ERR	301	W3KT	282	G2BVN	264
TI2HP	312	W4QCW	300	K4OEI	280	G3DO	261
DL9OH	310	W8EVZ	300	K4HYL	277	DL3RK	261
G8KS	310	W8PQQ/		W7DLR	277	W4LRS	260
WA2IZS	309	W8BT	299	DL1IN	276	W6WNE	260
W2RGV	309	W4SSU	299	HB9TL	276	WA2EOQ	259
W4OPM	309	I1AMU	299	W4HUE/		PJ2AA	258
W5KUC	308	K2MGE	297	W4IC	276	K1SHN	257
K6CYG	308	W2VCZ/		PZ1AX	275	W6BAF	254
W2ZX	307	K2DX	296	W6RKP	274	K6CAZ	254
K4TJL	305	W2FXN	294	K9EAB	274	PAØSNG	252
WØQVZ	305	W3MAC	294	W2LV	271	K6LGF	251
						W1AOL	250

See page 142 for New Reader Service

Presentation of the first DX Hall of Fame plaque to Gus Browning, W4BPD, at the 1968 Dayton Hamvention. Bob Thibert, W9ARV, CQ DX Committeeman from the Northern Illinois DX Association awards the plaque while another famous DXer, W2GHK, beams approval.

De Extra

WPX—The DX Award Popular With The DX Stations: Whenever we examine a list of stations qualifying for a prominent DX Award we are accustomed to finding an abundance of WK calls. For example, the August DXCC listings showed 61% U.S. and 39% foreign applicants. This is logical because there are far more licensed stations in the U.S.A. than in all the rest of the world combined. However, *CQ*'s WPX Award is an exception to this 'rule.' A survey of the applicants reported in the DX Columns from October, 1967 through August, 1968 shows 134 DX stations but only 105 U.S. stations including a KP4 and a KR6. Why this should be we do not know, but this particular award receives much more attention from our oversea's brethren in both new certificates and in endorsement stickers. It is particularly popular in eastern Europe and the Soviet Union.

The country breakdown for the 134 DX applications is as follows: USSR—23, Czechoslovakia—18, Sweden—12, Germany—9, Venezuela—8, Poland—5, England—5, Netherlands—4, Norway—4, Italy—4, Austria—3, Switzerland—3, France—3, Portugal—3, Angola—2, Uruguay—2, Argentina—2, Japan—2, Honduras—2, Hungary—1, Columbia—1, Morocco—1, Greece—1, Congo—1, Australia—1, Kenya—1, Geneva—1, Denmark—1, Tanzania—1, and Yugoslavia—1.

In the U.S. the breakdown between call areas is as follows: W4—24, W9—17, W2—17, W6—12, W5—10, W1—8, W8—5, W3—4, WØ—4, W7—2, KP4—1, and KR6—1. Again no explanation is proposed, just the facts.

The Award's Program

WAZ: July was a good month with 36 new award's authorized. The final tally as of Aug. 1 was 15 s.s.b., 17 c.w./phone, and 4 phone. The winners and their certificate numbers were as follows:

WAZ S.S.B.: CX9CO–570, WA6AHF–571, VE8BB–572, VK3ZE–573, DL8LH–574, CT1BH–575, VK3XO–576, WB6GOV–577, VK3SM–578, WA5BYV–579, DL8NU–580, DJ7JC–581, WAØOAI–582, W6MEM–583, W9QLD–584.

WAZ C.W. Phone: K2PXX–2466, WA2PXI–2467, VE2AFC–2468, DL5JJ–2469, DL1EQ–2470, DL2WF – 2471, YO3CR – 2472, DL1MD – 2473, DM2BJD–2474, WA1ERM–2475, WA5JSI–2476, KØGJD/6 – 2477, W8NAN – 2478, K6IC – 2479, K4YFQ–2480, W6MEM–2481, K5LNN–2482.

WAZ–Phone: CX9CO–384, YV4QG–385, KR6RB–386, W6MEM–387.

WPX: As reported in the September column we now have a new WPX Manager. His name and QTH are Howard W. Kelley, Jr., K4DSN, 6563 Sapphire Drive, Jacksonville, Florida 32208. Howard is a newscaster for Channel 12 in Jacksonville. If you need the complete rules for WPX just send Howard a self-addressed, stamped envelope and he will provide you with rules and application blanks.

The new WPX winners this month are:

WPX C.W.: DJ4XA–866, W1ETV–867, K4GRD–868, DL1LD–869.

WPX S.S.B.: LU2CF–350, YV4UA–351, K5TGT–352, KH6FQB–353, K6PUR–354.

WPX Mixed: DJ4XA–172, K6SDR–173.

WPX Phone: VK3ZE–157, W6NAT–158, W9BGX–159.

Those qualifying for endorsements were the following:

Continent–Africa: DL9OH. Asia: DL9OH. Europe:

Bart, PY7AKW, of St. Peter & St. Paul's Rocks fame at his home station. Bart says that all QSLs for PYØSP and PYØDX received at the Brazilian DX Club's P.O. Box 842 in Recife have been answered.

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DL9OH. Oceania: DL9OH.
Band–14 mc: VK3ZE, LU2CF. 21 mc: W9BGX. 7 mc: SP6FZ.
Mode–Mixed: K1SHN-700, DJ4XA-500.
S.S.B.: W8FPM-350, LU2CF-300, W9BGX-300, W4DQD-300, VK3SM-250.
C.W.: HB9TT-600, DJ4XA-450, YU1SF-400, DL1LD-400, W2NEP-350.

The WPX Manager now has endorsement stickers for 750-1000 prefixes. Those of you who have qualified for these higher endorsements should send Howard an s.a.s.e. with a request to check your record for same.

WPNX: Our new WPNX Manager, K4GRD, is doing a great job in interesting novices in this award. In one month he has authorized two new certificates which compares very well with the three in the previous year. The complete rules for WPNX were published in the DX column of the August, 1968 issue. Reprints can be obtained by sending a self-addressed, stamped envelope to Bob Norman, K4GRD, P.O. Box 524, Lakeland, Florida 33802.

The latest WPNX winners are:

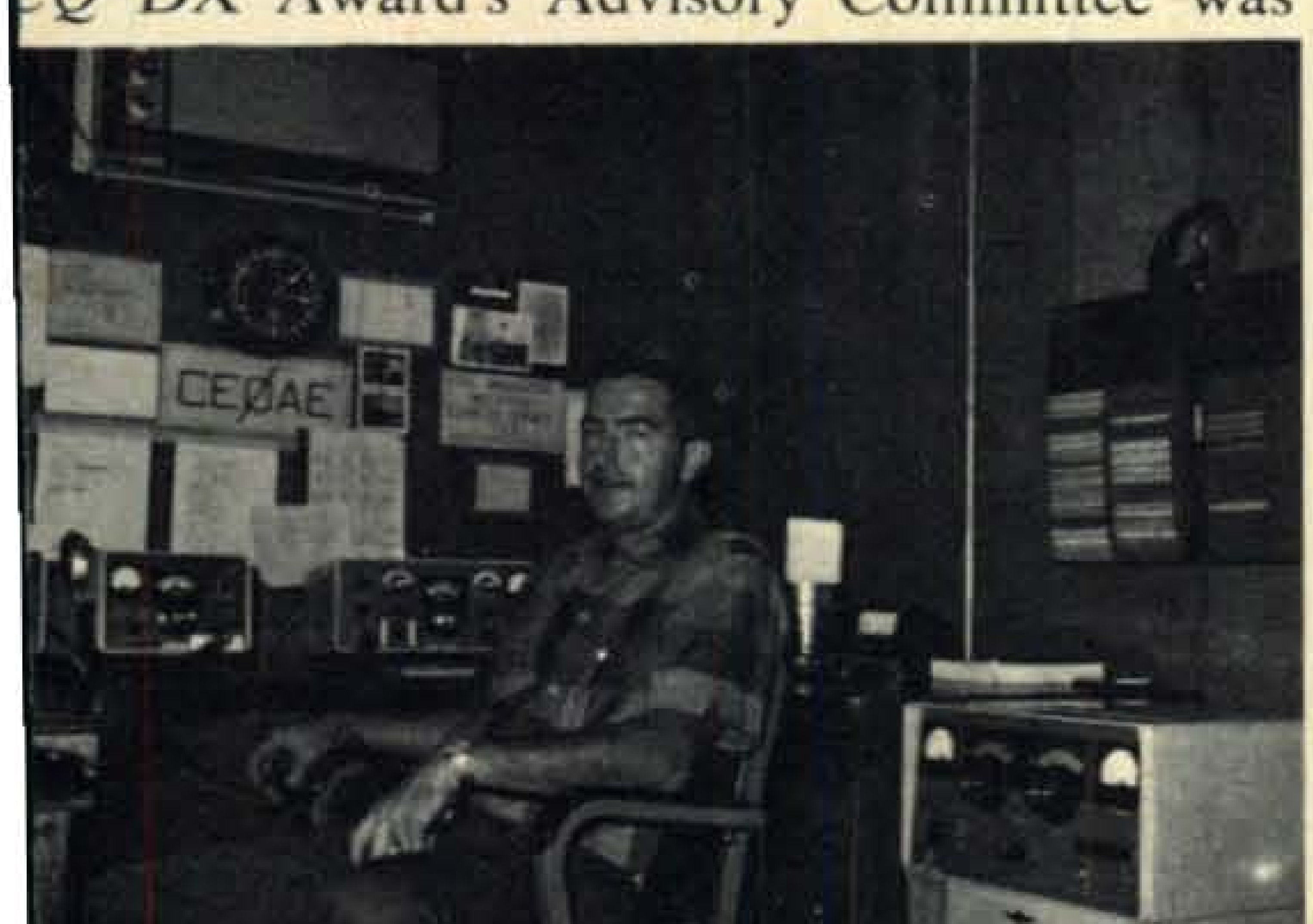
Wilberta Longwell, WN7IRD 4
David Beachy, WN9VMQ 5

S.S.B. DX Awards: Complete rules for these awards were given in the DX column in the September, 1968 issue. Reprints may be obtained from the S.S.B. DX Awards Manager, Mrs. Louise Rippe, W8HDB, 3785 Susanna Drive, Cincinnati, Ohio 45239.

There are 4 new winners of the 100 Countries certificate and 3 new winners of the 300 Countries certificate. No one qualified for the 200 Countries certificate. The calls and certificate numbers are:

100 Countries: VK3ZE – 514, VK3AMK – 515, DJ9ZB–516, W5TXN–517.
300 Countries: G3FKM–32, W3DJZ–33, WA2IZS–34.

In response to popular demand the new *CQ* DX Award's Advisory Committee was polled with regard to formulating our own countries list for the S.S.B. Awards. The voting was five in favor of a new list, four against, and one so highly qualified that it must be considered neutral. This certainly is not a clear cut opinion so no immediate drastic change is contemplated. The Committee will begin work on a new list, but each country will be carefully considered and no list adopted until a large part of the committee are in agreement.



Clark, CEØAE, one of the ops who have given many a happy DXer a new one from Easter Island.


Karl, OK2BLG, a 20 year old electronics student at the University in Brno, Czechoslovakia. Karl is chasing the USA-CA Award with 75 watts to a long-wire antenna. He has contacted over 500 U.S. stations in 40 states, but laments that his QSL return is less than 20%.

"Where's Danny?"—Here's Danny

Several letters have been received over the past year asking the present whereabouts of the incomparable Danny Weil, VP2VB/MM. The following letter recently received from Danny will bring you up to date.

"As you can see by my QTH I am way out in Seguin, Texas, far from the sea. I have been here since January 5 of this year. Formerly I worked as a Research Engineer in Corpus Christi for about 16 months, but when I received an offer of a much better salary I naturally jumped at the chance to better myself. Right now we are trying to get a new house built just outside the city limits.

"This seems like as far as one can get from the sea, and my work is really way out compared to what I was accustomed. As you know I am basically an instrument designer and have spent most of my life in really fine precision work. Now, however, I work for a steel mill. I design all sorts of junk for the manufacture of steel, and in this job it isn't plus or minus micro inches, but plus or minus 6 inches . . . HI!

"One day I hope to be back on the air

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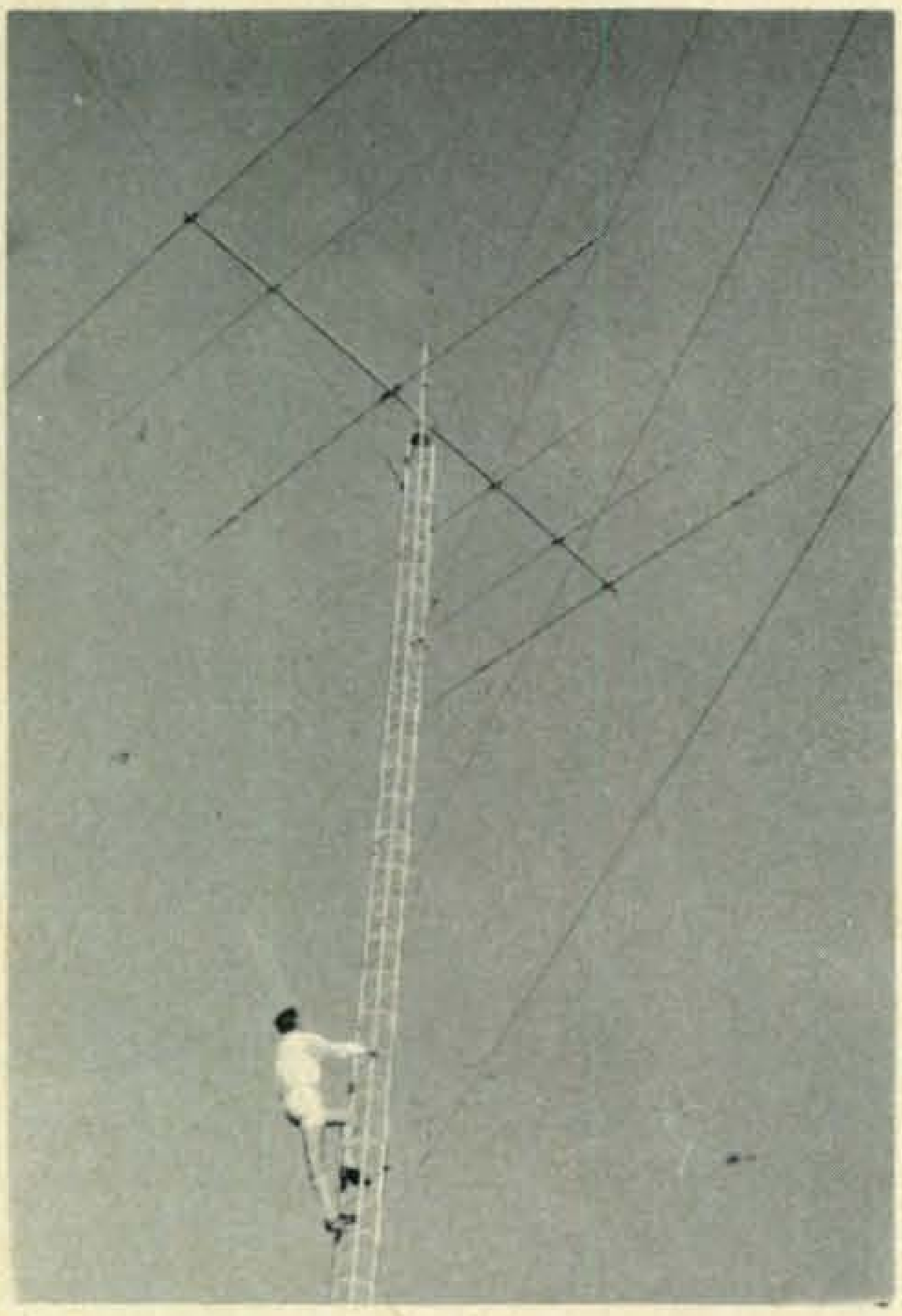

Ulli Dehning, 7P8AR, making an inspection of the 6-element beam at his Maseru, Lesotho QTH. QSL this famous DX station via Dan Whitsett, W4BRE, 1207 Locust Avenue, Huntsville, Alabama.

again, but with many more pressing things to do it may be a while yet. I still keep in fairly close touch with Hal, K5JLQ, who keeps me up on the latest developments in DX. I wrote to Lloyd Colvin some time ago, but I guess like a lot of other people he just doesn't have the time or inclination to write. Seems that the only way to maintain any sort of contact with the ham fraternity is via a rig, no rig, no contacts.

"Will write again one day when there is more news."

73 & 88,
Danny & Naomi, VP2VB/MM

The Southern California DX Club (By W6NJU)

(This is the 2nd of a series of informational stories on DX clubs. We would be happy to receive information for a similar story on your club.)

The Southern California DX Club was founded in 1949 by 35 prominent DXers interested in promoting DX in W6 land. The first meetings were in Compton. The present club has 75 members, howeve, this doesn't adequately show its as the current clubs in San Diego, Orange County, and the San Fernando Valley are offshoots of this original club giving a sizable DX contingent in the Southern California area.

The SCDXC and NCDXC jointly sponsor the annual Fresno DX Convention which ranks among the best in the country. Also, the Club's idea of DXer of the year, begun back in 1955, has been used in some form across the country by other DX clubs.

Club members must have either DXCC or WAZ and usually are quite active in DX contests. Several members are on the DXCC Honor Roll. The Club publishes a monthly bulletin for members with the current editor being WA6GLD.

Current officers are W6FW, W6FRZ, W6DQX, and W6EJJ. The Club meets at 7 P.M. the first Thursday of each month at Cliftons Cafeteria, 648 South Broadway, Los Angeles.

New Italian Call Areas

According to the latest news from I-land the old system of strictly I1 calls except for special events is on the way out. Under the new arrangement the number of the prefix will determine the location of the station according to the following scheme:

I1—Special services
I2—Milan
I3—Venice
I4—Bologna
I5—Florence
I6—Bari
I7—Naples
I8—Reggio Calabria
I9—Piedmont
IØ—Rome

The Italian Islands will continue to use the figure 1. For example; IS1, IT1, etc.

South African Checkpoint

South African DXers may now have cards for WAZ and the S.S.B. DX Awards checked by Mr. J. G. Gerryts, ZS1VA, Awards and Certificate Manager, South African Radio League, P.O. Box 3911, Cape Town, South Africa.

New Southern California CQ Committeeman

Gary Stilwell, W6NJU, is now the Southern California DX Club representative on the *CQ* DX Awards Advisory Committee. As such he has the authority to check QSLs for WAZ and the S.S.B. DX Awards. Gary has been chasing DX for over 15 years during which time he has held the offices of

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President, Director, and Treasurer in the SCDXC, and has edited the club bulletin. He holds WAZ and is on the DXCC Honor Roll.

Here and There

Here are a few items from the DX Bulletins which may still be useful by the time this reaches you. Remember though, the best place to get up-to-date DX information is from your local DX association bulletin. Always support your local bulletin. The names and addresses of the principal bulletins were given in last month's DX column.

AP5, West Pakistan: Fida, AP5HQ, is active on 15 meter c.w. (21050 kc) and 20 meter c.w. (14016 kc).

BY1, China: BY1F was active on 14001 kc c.w. working JA and other Pacific stations. QSL anyone?

CE9, South Shetland Islands: CE9AT makes this island group available on 14065 kc c.w.

CR8, Portuguese Timor: CR8AH frequents 21200 kc a.m. at 1700 GMT.

DX, DXpedition Man: Gus Browning, W4BPD, is VERY anxious to be *rare* DX again. All he needs is a sponsor. Anyone interested?

EAØ, Fernando Poo: At this writing only EAØAH is acceptable for DXCC credit. Jose frequents 21 mc s.s.b. around 21280 kc at 2000 GMT. When conditions are good he also operates on 10 meter s.s.b. at 28600 kc.

FB8, Amsterdam & St. Paul Islands: FB8ZZ has been reported on 14010 kc at 1135 GMT.

FO8, Clipperton Island: FO8CV on 14020 kc says that he is a French scientist on the island.

Here are 2 of the big signal generators from the Marshall Islands. Left—Bill Theeringer, W8PEY/KX6GH; and right—Jim Melville, WA1EJM/KX6FU.

Prominent Canadian Dxer Ron Hesler, VE1SH, of Sackville, New Brunswick, and XYL Donna. How does he get any DXing done with a beautiful doll like her around?

FPØ, St. Pierre: FPØ is the new prefix now being issued to visitors on the island.

FW8, Wallis Island: FW8RC, Robert, is frequently found 14245-265 kc around 0500 GMT. Thursdays and Fridays seem to be the best days to find him.

IP1, Pantelleria Island: IP1BPD counts only as Italy, sorry!!

JW2, Svalbard: JW2AP is active on 20 meter c.w. 14034 kc is said to be a good frequency.

KA2, Iwo Jima: It is reported that U.S. amateurs on Iwo are now using KA2 calls.

KD6, Daito Jima: This island, located 600 miles from Saipan, may count as a new one due to KD6AA operation.

LG5, Norway: LG5LG is a special Norway station. It is the first and only station to use the LG prefix.

LZØ, Bulgaria: This rare prefix was activated by LZØWYF from the World Youth Fair in Sofia.

PY, Fernando de Noronha: PY7QBG/K8WNU will be on from the island for about a year. He expects to be active on 14 and 21 mc s.s.b. between 2000 and 2400 GMT.

UZØ, Siberia: UZØEA recently activated this rare new prefix from Sakhalin Island.

VP5, Caicos Islands: VP5CB operates on 21350 and 14210 kc s.s.b.

VR1, Ocean Island: VR1L is the only station active. He frequents 14175 kc and tunes above 14200 for U.S. DXers.

VR4, Soloman Islands: VR4CR is fairly active on 20 meter c.w. around 14040 kc.

VR6, Pitcairn Island: VR6TC still has his skeds on Tuesdays, 21350 kc at 2100 GMT and Wednesdays, 14225 kc at 0600 GMT.

VS5, Brunei: VS5MH is reported on 14300 kc around 1500 GMT.

Larry Linville, W7DH, of Portland, Oregon. Larry is a recent WAZ winner.

WB9, U.S.A.: WB9ILL at the Illinois Sesquicentennial Celebration was the first WB9 station to be licensed.

WF∅, U.S.A.: WF∅ITU was a legitimately licensed special station in Colorado, and the one and only prefix of its kind.

YB, Indonesia: YB is said to be the new prefix for visiting operators in Indonesia. Better not work it though, it's still banned for W.K.

9K2, Kuwait: 9K2CB (John) and 9K2CC (Bud) show up regularly around 21360 kc between 1800-2100 GMT. Occasionally they are reported on 20 meters.

9N1, Nepal: Father Moran, 9N1MM, continues to be active on 20 meter s.s.b. around 14215 kc.

9V1, Singapore: Ceril, 9V1CN, operates 14175-200 kc s.s.b., but never tunes above 14205. Therefore best call him just on our side of the line.

QSL Information

AP2AR—To Arifur Rahman, 36 Purana Paltan, Dacca 2, East Pakistan.
AP2MR—Via VE3ACD.
CE9AT—c/o CE3ZN.
CE∅AE—To Box 37, APO, New York, N.Y. 09339.
CR5SP—Via D.O.T.M. (W2GHK).
CR6EW—c/o W5QPX.
CR6KT—To P.O. Box 289, Sodabandeira, Angola.
CR9AK (Aug. 2-5, 1968)—H.A.R.T.S., P.O. Box 541, Hong Kong.
DL5AO—CMR Box 456, APO, New York, N.Y. 09684.
EP2DA—Via W2MXB.
F5LQ—c/o WB6TEE.
F∅CV—Via Year in France Program, 14, rue du Quatre-Septembre, 13 AIX-EN-PROVENCE, France.
FB8XX—To FR7ZD.
FG7XJ—c/o W5QPX.
FG7XY—Via REF.
FM7WI—Via REF.
GB2OHE—To G3PVO.
GB2BSE—c/o G3IRM.
HC1TB—Tom Brigham, 460 Westminister Ave., Haddonfield, N.J. 08033.
HC8RS—Via SM5EAC.
HI3JHV—P.O. Box 1167, Santo Domingo, Dominican Republic.
HI8IBC—To K9GZK.
HL9KK—c/o WA3JUF, 1278 Laurel Ave., Warminster, Pa 18974.
HP1AC—Via LPRA Bureau, Box 9A-175, Panama 9A, Republic of Panama (Not via W2CTN).
HP∅A—To LPRA Bureau (see HP1AC).
IT7GAI—c/o IT1GAI.
JX7RR—Via LA7RO.
KB6CZ—c/o K4MQG.
K7HTZ/LX—CMR Box 456, APO, New York, NY 09684.
KH6CXP/YB1—c/o Box 179, Waimanalo, HI 96795.
KH6EDY (June 8-15, 1968)—Via KH6GLU.
MP4DAT—To G3USK.
OA4JR—c/o WA∅NJB.
OZ2X—Via WB6TEE.
PX1CW—c/o P.O. Box 86, Zarragossa, Spain.
PX1KT—To F3KT.
PY7APS/∅—To PY7APS (PY7AKW does not have the logs).
SK2AZ—Via SM5BHX.
SK5AJ—c/o SM5AD.
SK7AX—P.O. Box 24, Waggeryd, Sweden.
SM7WI/OY—Harry Akesson, Vitmaragatan 2, Vasteras, Sweden.
SM7TE—To K6KQN, 738 Washington St., San Francisco, CA 94108.
TA1AV—c/o SM∅KV.
VK9KS—Via W1YRC.
VP2DA—To VE3GCO.
VP2ME—c/o W3KAU.
VP2MK—Via W8EWS.
VP2VO—To VE3ACD.
VP5CB—c/o K3NAU.
VR1L—Via K6UJW.
WA3DVO/Barbados—Everett C. Bollin, 2029 East Lanvale St., Baltimore, Md. 21213. (Not via K4QIN).
WB9ILL—Via K9IDQ.
WF∅ITU—c/o ITU, ESSA, Box 8032, Boulder, Colo 80302.
YN4JAB—To W5QPX.
YU3TXT—Via WB6UJO.
YV5CIL—c/o WB6TEE.
ZC4GM—To W2CTN.
ZL5AA—Via ZL2GX.
3V8AA—c/o F5OJ.
4U1ITU—Box 6, Geneva 20, Switzerland.
5R8AF—To K7HCD.
6Y5CB—Via VE3DLC.
7P8AR—c/o W4BRE.
8P6AH—To VE3DLC.
8P6BX—Via VE3DLC.
9L2SL—c/o K4MQG.
9N1MM—To W3KVQ.
9Q5EB—Via WA8PWZ, 653 W. 27th St., Holland Mich. 49423.
9U5HI—c/o WA2CRD, 3950 Blackstone Ave Bronx, N.Y. 10471.

73, John, K4II

See page 142 for New Reader Servic

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

October	5-7	California QSO Party
October	5-6	Massachusetts QSO Party
October	5-6	C.A.R.T.G. (RTTY) Contest
October	5-6	VK/ZL/Oceania Phone
October	12-13	VK/ZL/Oceania C.W.
October	12-13	RSGB 28 mc Phone Contest
October	12-13	IARU Region II Contest
October	16-17	YLRL Anniv. C.W. Party
October	19-20	Boy Scout Jamboree
October	19-20	WADM C.W. Contest
October	**26-27**	**CQ WW DX Phone Contest**
October	26-27	RSGB 7 mc C.W. Contest
November	2-3	Okinawa (KR6) Contest
November	2-3	Teenage QSO Party
November	6-7	YLRL Anni. 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**
December	7-8	CHC International C.W.
December	14-15	CHC International SSB
January	18-19	Louisiana QSO Party
January	**25-26**	**CQ WW 160 C.W. Contest**
January	24-26	Old Old Timers QSO Party

California QSO Party

Starts: 2000 GMT Saturday, October 5
Ends: 0200 GMT Monday, October 7
Mailing deadline November 8th, logs go to: John F. Minke, WA6JDT, 6230 Rio Bonito Drive, Carmichael, Calif. 95608

Massachusetts QSO Party

Starts: 2300 GMT Saturday, October 5
Ends: 0500 GMT Monday, October 7
Mailing deadline November 4th, logs go to: MIT Radio Society, W1MX, Box 558, 3 Ames Street, Cambridge, Mass. 02139

RTTY Sweepstakes

Starts: 0200 GMT Saturday, October 5
Ends: 0200 GMT Monday, October 7
Logs must be received before November 30, and go to: C.A.R.T.G., 85 Fifeshire Road, Willowdale, Ont. Canada.

* 14 Sherwood Road, Stamford, Conn. 06905.

VK/ZL/Oceania DX Contest

Phone–Oct. 5-6 **C.W.**–Oct. 12-13
Starts: 1000 GMT Saturday
Ends: 1000 GMT Sunday
Logs go to: NZART Contest Manager, Box 489, Wellington, New Zealand, and must be received before January 20, 1969.

RSGB 28 mc Phone Contest

Starts: 0700 GMT Saturday, October 12
Ends: 1900 GMT Sunday, October 13
Mailing deadline October 28, logs go to: R.S.G.B., H.F. Contests Committee, 35 Doughty Street, London, WC1, England.

IARU Region II Contest

Starts: 0001 GMT Saturday, October 12
Ends: 2359 GMT Sunday, October 13
This is a new one that will be organized by a member country each year, and held on the nearest week-end to October 12th.

The object being for stations in Region II (North and South America) to work stations in this area and with countries outside. Stations located outside Region II may work *only* countries in Region II.

[*Continued on page 98*]

The OF5SM team, winners of the Radio Club Venezolano Trophy, in last year's Phone contest celebrating the victory at a barbecue held at the home of Peter and Carola Tigerstedt. L. to R.—OH2ER, OH5SE, OH5TM, OH2HN, OH2TH, OH5VY, OH5NW, OH5SM/Carola, OH3PC, OH2BCP, OH2BO, OH2WI, OH5NQ/Peter. (Missing is OH2BR.) Who will be the 1968 winner?

Contest Calendar [*from page 95*]

Contacts are not permitted between stations in the same country, cross band or mode, or between stations outside Region II.

Exchange: RS/RST report followed by a progressive contact number starting with 001.

Points: Contacts between Region II stations, 1 point; between Region II stations and others, 3 points; outside and Region II stations, 6 points.

Scoring: Total number nf countries worked on each band multiplied by total QSO points.

Awards: Top scorers, both single and multi-operator stations, in each country. Also the two absolute winners in Region II and outside areas. Phone and c.w. are separate contests.

Include a summary sheet with your log, listing all scoring information, the category and your name and address in BLOCK LETTERS.

Logs must be in the hands of the committee before the end of the year. This year they go to: IARU Region II Secretary, Box 4097, Lima, Peru.

WADM C.W. Contest

Starts: 1500 GMT Saturday, October 19
Ends: 1500 GMT Sunday, October 20

Mailing deadline November 15, logs go to: Radio Club of DDR, P.O. Box 30, 1055 Berlin, German Democratic Republic.

Complete rules for all the preceding contests were covered in last month's CALENDAR.

Boy Scouts Jamboree

Starts: 0001 GMT Saturday, October 19
Ends: 2359 GMT Sunday, October 20

This is the 11th Jamboree-on-the-Air for the Scouts, and in the future will be held on the third full week-end in October.

The activity has been thoroughly covered in Scout magazines around the world, and therefore will not be repeated here.

All authorized frequencies and modes may be used. This is not a contest but participating certificates will be issued to all those sending in a report.

They may be sent to the individual National organizations, or directly to the Boy Scouts World Bureau, Att: L. J. Jarrett, Commonwealth Bldg., 77 Metcalfe Street, Ottawa 4, Ontario, Canada.

YLRL Anniversary Party

C.W.–Oct. 16-17 **Phone**–Nov. 6-7
Starts: 1800 GMT Wednesday
Ends: 1800 GMT Thursday

This one has been around for a long time its the 29th anniversary party for the YL's Only contacts between YLs are permitted, on all bands but not on net frequencies.

Exchange: QSO nr., RS/RST and ARRL section or country. (Only *one* contact with each station.)

Points: 1 point per QSO between stations in ARRL sections, 2 points if its with a DX station. DX stations score 1 point for contacts with other DX stations, 2 points if its with a station in an ARRL section. (Stations outside ARRL sections are considered DX.)

Scoring: Multiply total QSO points by the total number of ARRL sections and/or countries worked for final score.

There is an additional low power multiplier of 1.25 for c.w. stations using 150 watts input or less and s.s.b. stations with 300 watts P.E.P. or less.

Awards: Certificates to the top scorers in each district and country. Gold cups, one for the highest c.w. score and one for the highest phone score. The Corcoran Award to the highest combined c.w. and phone score (These three awards for YLRL members only.) Two Arlie Hager, W4HLF awards one for the highest combined c.w. and phone score from North and Central America, and one for the rest of the world.

Logs must be received before December 9th and go to: Claire E. Bardon, W4TVT 2238 Morgan Lane, Dunn Loring, Virginia 22027

R.S.G.B. 7 mc Contest

C.W.–Oct. 26-27 **Phone**–Nov. 9-10
Starts: 1800 GMT Saturday
Ends: 1800 GMT Sunday

Its the world working the British Isles on 7 mc. (G, GC, GD, GI, GM, GW) C.W. and Phone are separate contests, and only single operator entries are acceptable.

Following rules are for overseas stations.

Exchange: RS/RST report plus a progressive 3 figure QSO number starting with 001.

Scoring: Contacts with British Isles stations vary in point value according to the location of the DX station. If in Europe, 5 points North America, 15 points. Africa, Asia and South America, 25 points. Oceania, 50 points.

In addition a bonus of 50 points may be claimed for the first contact with each B.I. country/numeral prefix. (*i.e.* G2, GC3, GD- and *etc.* max of 36 possible.)

Awards: 1st, 2nd and 3rd place certificates to the three leading overseas stations.

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There is also an s.w.l. section. Only British Isles stations in contact with an overseas stations are to be listed, scoring is same as above. Awards also same as above.

Logs must be postmarked not later than November 25th and go to: R.S.G.B., H.F. Contests Committee, 35 Doughty Street, London, WC1, England.

Okinawa (KR6) Contest

Stars: 0000 GMT Saturday, November 2
Ends: 2359 GMT Sunday, November 3

This activity was organized to provide an opportunity for stations all over the world to work Okinawa.

Use all bands and modes, single or multi-operator. Only one contact per band and mode with the same station.

Exchange: RS/RST report plus a progressive contact number starting with 001.

Scoring: Each QSO will have a point value as follows: If on 80 m—4; 40 m—3; 20 m—1; 15 m—1; 10 m—2. Total QSO points from all bands is your final score. (No multiplier.)

Awards: Certificates to the top scorer in each country and W/K district. A special Trophy to the highest score by a non-KR6. (Distance will be the deciding factor if a tie.)

A detailed log and summary sheet is requested, with all pertinent information, your name and address in BLOCK LETTERS and the usual signed declaration.

Logs go to: Okinawa A.R.C., Contest Committee, APO San Francisco, Calif. 96331. Mailing deadline November 15th.

OK DX C.W. Contest

Starts: 0000 GMT Sunday, November 10
Ends: 2400 GMT Sunday, November 10

This is an international contest so don't confine your operation to working OK's only.

Use all bands, 1.8 thru 28 mc, c.w. only. Single operator stations may compete on a single band or all bands, multi-operator stations on all bands only. (Club stations are considered as multi-operator.)

Exchange: Five figures, RST plus two figures indicating the number of years the operator has been active in amateur radio. (i.e.: active since 1948, 57920. Multi-stations will give years station has been licensed.)

Scoring: One point for each QSO, 3 points if it's with a Czech station. The multiplier is determined by the number of prefixes worked on each band. (WPX list.) Final score, the total QSO points multiplied by the sum of prefixes worked on each band.

Awards: Certificates to the top scorers in each country and each category.

Use a separate log sheet for each band and show in this order: Date/time in GMT station worked, number sent/received, QSO points and prefix. (First time worked only.) Include a summary sheet showing the scoring and other pertinent information. Your name and address in BLOCK LETTERS, and a signed declaration that all rules have been observed.

Contest contacts may be applied for the "100 OK Award" (working 100 Czech stations) and the "S6S" Award (worked all continents) with endorsements for individual bands. A written application must be submitted with your log.

Logs go to: The Central Radio Club, P.O. Box 69, Prague 1, Czechoslovakia, postmarked no later than December 31st.

1968 CQ World Wide DX Contest

Phone

Starts: 0000 GMT Saturday, October 26
7 P.M. EST Friday, October 25
4 P.M. PST Friday, October 25
Ends: 2400 GMT Sunday, October 27
7 P.M. EST Sunday, October 27
4 P.M. PST Sunday, October 27

C.W.

Starts: 0000 GMT Saturday, November 23
7 P.M. EST Friday, November 22
4 P.M. PST Friday, November 22
Ends: 2400 GMT Sunday, November 24
7 P.M. EST Sunday, November 24
4 P.M. PST Sunday, November 24

Country Prefixes

Here is the latest complete list of numerical country prefixes, courtesy of Geoff Watts' *DX News Sheet*. Some of these will probably be popping up during the contest:

2A-2Z United Kingdom, 3A Monaco, 3B-3F Canada, 3G Chile, 3H-3U China, 3V Tunisia, 3W Viet-Nam, 3X Guinea, 3Y Norway, 3Z Poland, 4A-4C Mexico, 4D-4I Philippines, 4J-4L U.S.S.R., 4M Venezuela, 4N-4O Yugoslavia, 4P-4S Ceylon, 4T Peru, 4U United Nations, 4V Haiti, 4W Yemen, 4X Israel, 4Y Int. Civil Aviation Organization, 4Z Israel, 5A Libya, 5B Cyprus, 5C-5G Morocco, 5H-5I Tanzania, 5J-5K Colombia, 5L-5M Liberia, 5N-5O Nigeria, 5P-5Q Denmark, 5R-5S Malagasy Rep., 5T Mauritania, 5U Niger, 5V Togo, 5W Western Samoa, 5X Uganda, 5Y-5Z Kenya, 6A-6B United Arab Rep., 6C Syrian Arab Rep., 6D-6J Mexico, 6K-6N Korea, 6O Somali, 6P-6S Pakistan, 6T-6U Sudan, 6V-6W Senegal, 6X Malagasy Rep., 6Y Jamaica, 6Z Liberia, 7A-7I Indonesia, 7J-7N Japan, 7O South Yemen, 7P Lesotho, 7Q Malawi, 7R Algeria, 7S Sweden,

[*Continued on page 126*]

Propagation

BY GEORGE JACOBS,* W3ASK

THE 1968 *CQ* World Wide DX Contest will be held on the following dates[1]:

PHONE SECTION: 0000 GMT October 26—2400 GMT October 27

C.W. SECTION: 0000 GMT November 23—2400 GMT November 24

Continuing the practice of the past seventeen years, this month's PROPAGATION column will be devoted to a special forecast for use during the 1968 Contest.

According to Frank Anzalone, *CQ*'s Contest Editor, last year's propagation forecasts were "right on the nose" for both the phone and c.w. sections. As forecast, normal to above normal conditions occurred during the phone section (Oct. 21-22), with excellent DX openings, while normal conditions were observed during the c.w. section (Nov. 25-26), with good DX openings. New record-high scores were established during the 1967 Contest, and new champions were crowned.

As good as propagation conditions were during last year's Contest, they are expected to be even better this year, barring the development of any sudden radio storms during the 1968 Contest periods.

Taking into account last year's "hits", the score for the thirty-four phone and c.w. section Contest propagation forecasts made during the past seventeen years stands as follows:

Highly accurate: 26 times
Fairly accurate: 5 times
Inaccurate: 3 times

Sunspot Cycle

The Federal Swiss Solar Observatory at Zurich reports a monthly mean sunspot number of 97 for July, 1968. This results in a smoothed sunspot number of 102, centered on January, 1968. As of that date, the present sunspot cycle was still increasing in intensity.

* 11307 Clara Street, Silver Spring, Md. 20902.
1 See page 98 of *CQ*, August, 1968 for contest rules and additional information.

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for Oct. 1-Oct. 31 (black) and Nov. 1-Nov. 15 (green

	Forecast Rating & Qual			
Days	(4)	(3)	(2)	(1)
Above Normal: 1, 15-16, 20, 22, 28, 9, 11-12.	A	A-B	B-C	C
Normal: 2, 4-6, 12-14, 17, 19, 21, 23-25, 27, 29, 1-2, 8, 10, 13, 15.	A-B	B-C	C-D	D-
Below Normal: 3, 7, 9, 11, 18, 26, 30, 3, 5, 7, 14.	C	C-D	D	E
Disturbed: 8, 10, 4, 6.	D	D-E	E	E

HOW TO USE THESE CHARTS

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

1—Enter Propagation Charts on following pag under appropriate band and distance or geographic area columns. Read predicted times of band openin at intersection of both columns.

2—Following each predicted time of band openi is a forecast rating which indicates the relati number of days the band is expected to open duri each month of the forecast period. The higher t rating, the more frequent the opening, as follow (4) band open more than 22 days each month; (between 14 and 22 days; (2) between 8 and days; (1) less than 7 days.

3—With the forecast rating noted above, start wi the numbers in parenthese at the top of the "La Minute Forecast" appearing above. Read down t table for a day-to-day forecast of propagation co ditions in terms of Above Normal (WWV rati higher than 6); Normal (WWV rating 5-6); Belo Normal (WWV rating 4); Disturbed (WWV rati less than 4). The letter symbols (A-E) descri reception conditions (signal quality, noise and fadi levels) expected for each day of the month a have the following meanings: (A—excellent openi with strong, steady signals; B—good opening, mode ately strong signals, little fading and noise; C—fa opening, signals fluctuating between moderate strong and weak; D—poor opening, signals general weak and considerable fading and noise; E—po opening, or none at all.

4—This month's DX Propogation Charts are bas upon a transmitter power of 250 watts c.w.; 5 watts s.s.b., or 1000 watts d.s.b., into a dipo antenna a quarter-wave above ground on 160 a 80 meters, a half-wave above ground on 40 and meters, and a wave-length above ground on 15 a 10 meters. For each 10 db gain above these referen levels, reception quality shown in the "Last Minu Forecast" will improve by one level; for each 10 loss, reception will become poorer by one level.

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

6—The Eastern USA chart can be used in the 2, 3, 4, 8, KP4, KG4 and KV4 amateur call area The Central USA Chart in the 5, 9, and Ø area and the Western USA Chart in the 6 and 7 area The Charts are valid from Oct. 15, through Dec. 1 1968, and are prepared from basic propagation dat published monthly by the Institute For Telecommun cation Sciences And Aronomy of the U.S. Dept. Commerce, Boulder, Colorado.

There is some disagreement among the e perts as to the level of solar activity that expected during the 1968 Contest period The Environmental Science Services Admi istration (ESSA) of Boulder, Colorado for casts declining solar activity with a smoothe sunspot number of 99.5 for October and 98 for November. The Swiss Federal Observ tory forecasts 107 for October and 106 f November, while a specially programme

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mputer study comes up with 115 for both onths.

The experts are in agreement, however, at solar activity during the 1968 Contest riods will be at least somewhat higher than e 94-96 level observed during last year's ontest. This means that the general level of X propagation conditions expected during is year's Contest should be about the same, slightly better than last year.

CQ has chosen a smoothed sunspot numr of 110 upon which to base the propagan forecasts appearing in this month's colnn.

General Forecast

Barring any sudden radio storms develop- g during the Contest periods (check the ast Minute Forecast" appearing at the beming of this column), conditions during e 1968 Contest are expected to be at least newhat better than they were last year, and tter than they have been for any Contest ce 1959. The following is a band-by-band nmary of general propagation conditions it are expected to occur during the 1968 ntest.

0 Meters: Good-to-excellent openings are exted to almost every area of the world during the light and early evening hours. Openings to rope and those in a generally easterly direction uld peak around noontime, while those to South erica and Africa are expected to peak during early afternoon hours. Optimum conditions on band to the Far East, Australasia, Southeast a, etc. are expected during the late afternoon early evening hours. During most of the dayit hours it will probably be a toss-up between and 15 meters for the best DX band honor.

5 Meters: Excellent world-wide propagation conons are predicted from shortly after sunrise ough the early evening hours. For each geophical area of the world, conditions are expected peak about an hour or so after the peak has urred on 10 meters. During the late afternoon early evening hours, 15 meters is likely to be optimum band for DX openings in southerly and sterly directions.

0 Meters: Generally good-to-excellent DX opens are forecast to one area of the world or another this band, almost around-the-clock. Optimum nditions should take place for an hour or two owing sunrise, and during the late afternoon and ly evening hours. Excellent openings are preted for the late evening and early morning hours southern and tropical areas.

0 Meters: The band should begin to open for from a generally easterly direction during the e afternoon and early evening hours. Openings uld become more numerous during the hours of kness, with stronger signal levels. Signals from a erally westerly direction are expected to peak rtly after sunrise, just before the band closes for . During most of the hours of darkness, it may a toss-up between 40 and 20 meters for optimum DX propagation conditions to many areas of the world.

80 Meters: Some fairly good openings are forecast to some areas of the world during the hours of darkness and the sunrise period. Peak conditions should occur around midnight on signals arriving from an easterly direction, and again shortly after sunrise for signals arriving from the west and south.

160 Meters: DX openings to some areas of the world should be possible during the hours of darkness and the sunrise period. Because of signal absorption and the low power levels used on this band, openings at best are expected to be weak and noisy.

For a more detailed circuit-by-circuit forecast refer to the *DX Propagation Charts* appearing on the following pages. Instructions for the proper use of these *Charts* are given in the box following the "Last Minute Forecast" at the beginning of this column.

Contest Work Plans

The *DX Propagation Charts* on the following pages show the times that each amateur band 10 through 160 meters is expected to open for DX from the United States to the major areas of the world. The information contained in the *Charts* can be easily reorganized into operational work plans, or schedules, to serve as guides during the contest periods. Experience during previous contests has shown that such plans can be extremely useful in piling up a large number of contacts with a minimum of wasted time.

The following work-plan is an example of what can be devised from the data appearing in the Charts, if *single-band* operation is planned during the Contest. It shows, for each three hour period throughout the day, the areas of the world for which, in this example, 20 meter propagation conditions are expected to be optimum (a rating of 3 or higher in the *Charts*). A Western QTH has been chosen for this example, but similar plans can be devised for Central or Eastern locations, and for the other bands.

Sample Single Band Work Plan
20 Meters; Western USA QTH

Time (PST)	Areas To Which Openings Should Be Optimum
00-03	South Pacific, New Zealand, Australasia, Antarctica
03-06	Nothing really optimum. Some South Pacific, New Zealand and Australasian signals, and a few South Americans, but a good time to catch up on some sleep
06-09	All of Europe, Eastern Mediterranean and Middle East, Far East and Asia, South Pacific, New Zealand, Australasia, and northern and central South America
09-12	Some European, Far East and northern South America. A good time to take a break for breakfast

12-15	Most of Europe, Eastern Mediterranean and Middle East, west, central and south Africa, northern and central South America
15-18	All of Africa, Far East, South Pacific and New Zealand, northern and central South America
18-21	West, central and south Africa, Far East and Asia, South Pacific and New Zealand, all of South America
21-00	South Pacific, New Zealand, Australasia, central and southern South America, Antarctica

The following is a typical *multi-band* operational work plan devised from the propagation charts for an Eastern USA QTH. The plan shows the times and bands when propagation conditions are expected to be optimum to various areas of the world, for each two hour period throughout the day.

Sample Multi-Band Work Plan
Eastern USA QTH

Time (EST)	*Optimum Band*	Areas To Which Band Expected To Be Open
00-02	40	Most of Europe, Eastern Mediterranean and Middle East, most of South America, some Africans, and a possible Antarctican
02-04	20	Not very much on any band. Some South Pacific, New Zealand and Australasia, a few Asians and Far East, some southern South American and a possible Antarctican. A good time to catch up on some sleep
04-06	40	South Pacific, New Zealand, Australasia, some north and central South Americans, a few Asians and a possible Antarctican
06-08	20	Most of Europe, South Pacific, New Zealand, Australasian, most of South America, Asia, Far East, and a few Africans
08-10	10	Most of Europe, Eastern Mediterranean and Middle East, most of South America, some Africans, and a few Asians and Australasians
10-12	15	All of Europe, Eastern Mediterranean and Middle East, some South Americans, some Africans, and a few Asians, South Pacific, New Zealand and Australasians
12-14	15	Most of Europe, most of Africa, most of South America, some Eastern Mediterranean and Middle Eastern
14-16	15	All of Africa, and South America, some South Pacific, New Zealand and Australasian, a few European and Asians
16-18	20	Most of Europe, Eastern Mediterranean and the Middle East. All of Africa and South America
18-20	15	All of South America, South Pacific, New Zealand and Australasia, Far East, some Asians and a few Africans and Antarcticans
20-22	20	Most of Africa, a few Europeans, Far East, some Asians, South Pacific, New Zealand and Australasia, all of South America, some Antarcticans
22-00	20	Far East, South Pacific, New Zealand, Australasia, Antarctica, all of South America, and a few Africans and Asians

Radio Storms

The forecasts in this column are based on *normal* propagation conditions expected with a sunspot level of 110. If actual conditions during the contest should turn out to be *above normal*, DX openings on 10, 15 and 20 meters are likely to be somewhat better than shown in the *Charts*. On the other hand, if radio storms should develop, resulting in *below normal or disturbed* conditions, fewer openings will take place on these bands. During radio storms, conditions on 40, 80 and 160 meters also generally become erratic, and under certain conditions openings may be poorer than shown in the forecasts, while under other storm conditions they may actually improve.

If a radio storm should develop during the contest, circuits passing through or near the auroral zones will probably become weak, fade considerably, or may even black out entirely, depending on the severity of the storm. During certain types of storms, while east-west propagation becomes poorer, north-south openings improve. During other types, the entire h.f. spectrum may black out completely for several minutes to several hours.

During a radio storm, concentrate on working east-west openings during the daylight hours, and north-south openings during the evening and early morning hours. A "Last Minute Forecast" for the phone section of the contest, made at press time (early September), appears at the beginning of this column. A similar forecast for the c.w. section will appear in next month's column.

Up-To-The-Minute Contest Forecasts

Regretfully, the Environmental Science Services Administration (ESSA) has discontinued providing up-to-the-minute general propagation forecasts by telephone, as was done during previous years from the Ft. Belvoir, Va. and Anchorage, Alaska field stations. Propagation broadcasts have also been dropped from station WWVH, Hawaii.

Short-term forecasts (up-dated every six ours) continue to be broadcast, however, rom station WWV, now located at Ft. Colns, Colorado. Be sure to check WWV for ne latest propagation information *during* the ontest. WWV broadcasts general propaation information on 2.5, 5, 10, 15, 20 and 5 mc twelve times every hour. The data is ansmitted at 4½ minutes past the hour, nd is repeated every five minutes thereafter. Given in slow Morse Code, the transmissions onsist of the letters N, W or U, followed y a number between 1 and 9. The letters esignate propagation conditions *at the time* f broadcast, as follows:

N—Normal propagation conditions

U—Conditions unstable or erratic, signals subject to fading and noise

W—Radio storm in progress, conditions below normal or disturbed

The numbers designate propagation conitions forecast for the *following six-hour* eriod, as follows:

1. Useless; 2. Very Poor; 3. Poor; 4. Poor-to-Fair; 5. Fair; 6. Fair-to-Good; 7. Good; 8. Very Good 9. Excellent.

If, for example, propagation conditions are ormal at the time of broadcast, but are exected to peak during the late evening hours ours, WWV would transmit N 3 in Morse ode.

V.H.F. Ionospheric Openings

Meteor-scatter openings are likely to occur n the v.h.f. amateur bands during the twoay *Orionids* meteor shower, which is exected to peak during the last evening hours f October 20.

There is a slight possibility of some *F*-layer nd trans-equatorial scatter openings on 6 eters between the United States and South merica during October. The best time to heck for *F*-layer openings is from about an our before to about an hour after noon. he optimum times for the scatter openings re the early evening hours, shortly before nd just after sundown. Propagation favors e southern tier states for these 6-meter penings, but some may extend considerably rther north.

During October, auroral-scatter propagaon on the v.h.f. bands is most likely to occur hen h.f. radio conditions are disturbed or elow normal. Check the "Last Minute Foreast" appearing at the beginning of this colmn for the days that are expected to be in ese categories during the month.

Post Mortem

More radio amateur DX activity takes place in more parts of the world during the *CQ* World Wide DX Contest than at any other time. For this reason, the Contest offers an excellent opportunity to check the accuracy (or inaccuracy) of the *CQ* predictions. Reports received from previous contests have contributed considerably to improving these forecasts from year-to-year. Any comments or observations concerning this year's Contest forecast would be appreciated. Comments may be sent directly to W3ASK, the Editor of this column.

C.w. Contest Forecast

The *Propagation Charts* appearing in this month's column are valid for *both* the phone and c.w. periods of the Contest. *Be sure to retain the Charts for use during next month's c.w. period.* The *Charts* appearing in next month's column will contain Short-Skip forecasts. Short-Skip propagation data for October appeared in last month's column.

Good luck in the Contest!

73, George, W3ASK

OCTOBER 15 - DECEMBER 15, 1968

Time Zone: EST (24-Hour Time)

Eastern USA To:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	07-08 (1) 08-09 (2) 09-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	04-06 (2) 06-08 (4) 08-09 (3) 09-12 (2) 12-13 (3) 13-15 (4) 15-17 (3) 17-21 (2) 21-00 (1) 00-02 (2) 02-04 (1)	16-17 (1) 17-18 (2) 18-20 (3) 20-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 19-21 (1)* 21-23 (2)* 23-01 (3)* 01-02 (2)* 02-03 (1)*
Northern Europe & European USSR	07-08 (1) 08-10 (2) 10-12 (1)	07-08 (1) 08-11 (3) 11-13 (2) 13-14 (1)	04-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-14 (3) 14-15 (2) 15-21 (1) 21-23 (2) 23-00 (1)	18-20 (1) 20-01 (2) 01-02 (1) 20-01 (1)*
Eastern Mediter-ranean & Middle East	07-08 (1) 08-10 (2) 10-12 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (4) 11-12 (3) 12-13 (2) 13-15 (1)	06-10 (1) 10-13 (2) 13-14 (3) 14-16 (4) 16-19 (3) 19-21 (2) 21-23 (1) 23-01 (2) 01-03 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 20-00 (1)*
West & Central Africa	07-10 (1) 10-13 (2) 13-15 (4) 15-16 (3) 16-17 (1)	06-10 (1) 10-12 (2) 12-13 (3) 13-16 (4) 16-18 (3)	04-05 (1) 05-07 (2) 07-13 (1) 13-15 (2) 15-16 (3)	18-22 (1) 22-01 (2) 01-03 (1) 00-03 (1)*

	10 Meters	15 Meters	20 Meters	40/80 Meters
		18-19 (2) 19-21 (1)	16-19 (4) 19-23 (3) 23-00 (2) 00-02 (1)	
East Africa	07-09 (1) 09-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	06-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-19 (3) 19-20 (2) 20-22 (1)	07-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-23 (3) 23-01 (2) 01-03 (1)	20-23 (1) 23-01 (2) 01-02 (1) 23-01 (1)*
South Africa	07-09 (1) 09-11 (2) 11-13 (4) 13-15 (3) 15-16 (2) 16-17 (1)	06-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-17 (3) 17-18 (2) 18-19 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-20 (4) 20-23 (3) 23-01 (2) 01-02 (1)	18-19 (1) 19-22 (2) 22-23 (1) 19-21 (1)*
Central & South Asia	08-10 (1) 17-19 (1)	07-08 (1) 08-10 (2) 10-11 (1) 17-18 (1) 18-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-12 (1) 18-20 (1) 20-23 (2) 23-02 (1)	18-21 (1) 06-08 (1)
South-east Asia	09-10 (1) 10-12 (2) 12-14 (1) 17-20 (1)	09-10 (1) 10-12 (2) 12-14 (1) 14-16 (2) 16-18 (1) 18-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-13 (1) 18-23 (1)	05-07 (1)
Far East	08-10 (1) 17-18 (1) 18-19 (2) 19-20 (1)	08-10 (1) 17-18 (1) 18-20 (3) 20-21 (2) 21-22 (1)	16-18 (1) 18-21 (2) 21-23 (3) 23-04 (2) 04-07 (1) 07-09 (2) 09-12 (1)	04-08 (1) 05-07 (1)*
South Pacific & New Zealand	10-12 (1) 12-14 (2) 14-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	08-09 (1) 09-12 (2) 12-16 (1) 16-18 (2) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	17-19 (1) 19-22 (2) 22-00 (4) 00-03 (3) 03-04 (2) 04-06 (1) 06-07 (2) 07-09 (4) 09-11 (2) 11-13 (1)	00-03 (1) 03-07 (3) 07-09 (1) 03-04 (1)* 04-06 (2)* 06-08 (1)*
Austral-asia	08-09 (1) 09-11 (2) 11-12 (1) 14-16 (1) 16-18 (2) 18-20 (1)	08-10 (1) 10-13 (2) 13-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-22 (1)	06-07 (2) 07-10 (3) 10-12 (2) 12-14 (1) 17-19 (1) 19-21 (2) 21-02 (3) 02-04 (2) 04-06 (1)	03-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)*
Northern & Central South America	07-08 (1) 08-09 (3) 09-11 (4) 11-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-14 (3) 14-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	07-09 (4) 09-11 (3) 11-14 (2) 14-16 (3) 16-21 (4) 21-01 (3) 01-03 (2) 03-05 (1) 05-07 (2)	18-19 (1) 19-21 (3) 21-03 (4) 03-05 (2) 05-06 (1) 19-21 (1)* 21-03 (2)* 03-05 (1)*
Brazil, Argentina, Chile & Uruguay	06-08 (1) 08-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	06-07 (1) 07-10 (2) 10-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	06-09 (2) 09-11 (1) 14-16 (1) 16-17 (2) 17-19 (3) 19-00 (4) 00-02 (3) 02-04 (2) 04-06 (1)	20-23 (1) 23-04 (2) 04-06 (1) 23-04 (1)*
McMurdo Sound, Ant-arctica	17-19 (1)	06-09 (1) 15-17 (1) 17-20 (2) 20-22 (1)	16-18 (1) 18-21 (2) 21-02 (3) 02-04 (2) 04-06 (1) 06-08 (2) 08-09 (1)	00-06 (1)

* Predicted times of 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.

Time Zones: CST & MST (24-Hour Time)

Central USA To:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-13 (1)	06-07 (1) 07-10 (2) 10-12 (3) 12-13 (2) 13-14 (1)	05-06 (1) 06-08 (3) 08-12 (2) 12-14 (3) 14-18 (2) 18-20 (1)	17-18 (1) 18-20 (2) 20-22 (3) 22-00 (2) 00-02 (1) 19-20 (1)* 20-22 (2)* 22-00 (1)*
Northern & Central Europe & European USSR	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	05-07 (1) 07-09 (2) 09-11 (3) 11-12 (2) 12-14 (1) 16-18 (1) 18-20 (2) 20-22 (1)	18-20 (1) 20-23 (2) 23-01 (1) 20-23 (1)*
Eastern Mediter-ranean & Middle East	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	06-08 (1) 08-11 (2) 11-13 (3) 13-15 (2) 15-17 (1) 20-22 (1) 22-01 (2) 02-03 (1)	18-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
West & Central Africa	07-09 (1) 09-12 (2) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-22 (3) 22-01 (2) 01-04 (1) 04-06 (2)	17-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
East Africa	08-10 (1) 10-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	07-10 (1) 10-13 (2) 13-16 (3) 16-18 (2) 18-19 (1)	06-14 (1) 14-17 (2) 17-19 (3) 19-21 (2) 21-23 (1)	20-00 (1) 21-23 (1)*
South Africa	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (2) 15-16 (1)	06-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-19 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-23 (2) 23-02 (1)	18-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
Central & South Asia	07-10 (1) 18-20 (1)	06-10 (1) 10-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-18 (1) 18-21 (2) 21-23 (1)	06-08 (1) 18-20 (1)
South-east Asia	09-10 (1) 10-12 (2) 12-13 (1) 15-16 (1) 16-18 (2) 18-20 (1)	08-09 (1) 09-12 (2) 12-16 (1) 16-18 (2) 18-20 (1)	06-07 (1) 07-10 (2) 10-14 (1) 18-19 (1) 19-21 (2) 21-22 (1)	04-07 (1)
Far East	15-16 (1) 16-18 (3) 18-19 (2) 19-20 (1)	08-10 (1) 15-16 (1) 16-18 (2) 18-19 (3) 19-20 (2) 20-21 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (1) 16-18 (1) 18-20 (2) 20-22 (1)	02-03 (1) 03-06 (2) 06-09 (1) 02-04 (1)*
South Pacific & New Zealand	11-13 (1) 13-15 (2) 15-17 (3) 17-18 (2) 18-20 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	11-17 (1) 17-18 (2) 18-20 (3) 20-23 (4) 23-02 (3) 02-04 (2) 04-06 (1) 06-07 (2) 07-09 (4) 09-10 (3) 10-11 (2)	23-01 (1) 01-06 (3) 06-07 (2) 07-08 (1) 00-02 (1)* 02-06 (2)* 06-07 (1)*
Austral-asia	08-09 (1) 09-11 (2) 11-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-16 (1) 16-17 (2) 17-19 (3) 19-20 (2) 20-21 (1)	07-08 (2) 08-10 (3) 10-12 (2) 12-14 (1) 20-22 (1) 22-01 (2) 01-03 (3) 03-04 (2) 04-07 (1)	02-04 (1) 04-07 (2) 07-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*

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

Time Zone: PST (24-Hour Time)

Western USA To:

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

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Q AND A

BY WILFRED M. SCHERER,* W2AEF

Last month's Q & A COLUMN was somewhat curtailed due to limited available space, so this time we'll dispense with the introductory dissertation and get right on with the questions and answers.

I.F. Alignment with Hallicrafters SX-115 and SX-117 Receivers

QUESTION: I should like to align my Hallicrafters SX-115 receiver that has a 50.75 kc i.f. which the alignment instructions say is a critical frequency. What is the cheapest way I can obtain an accurate 50.75 kc signal?

ANSWER: Such a signal won't cost you a nickel, inasmuch as the i.f. alignment of the SX-115, and also the SX-117, can be done without an external signal source as follows:

1 – Set the receiver controls for 80-meter band, full r.f. gain, a.v.c. on, notch off, selectivity at 0.5 kc, crystal calibrator on, function switch at u.s.b. for s.s.b./c.w., b.f.o.-pitch near dial zero, a.f. gain near maximum, headphones plugged in.

2 – Apply power and tune in calibrator to zero beat at any 100 kc point.

3 – Switch to l.s.b. If other than zero beat is heard, alternately readjust b.f.o. and retune receiver for zero beat while switching between u.s.b. and l.s.b., until a point is reached where an accurate zero beat is maintained when the sideband positions are switched back and forth, without returning the receiver.

4 – Set the function switch for u.s.b. and index the receiver dial so that it reads zero when the receiver is tuned to zero beat with the calibrator signal. With the SX-117, index to the nearest dot on the vernier dial.

5 – With the switch in *upper*-sideband position, tune the receiver 0.75 kc (¾ dial division) *lower* in frequency (clockwise on vernier dial). On the SX-117 the dots on the vernier dial are 1 kc apart at 3600 kc.

6 – A 50.75 kc signal will now appear at the input to the 50 kc amplifier and the four i.f.-transformer windings may now be properly aligned by tuning them for a peak indicated on the S-meter.

7 – Switching to the *lower*-sideband position and tuning the receiver 0.75 kc *higher* than the receiver-dial zero, should again peak up the signal at this point.

8 – In other words, the calibrator signal should peak up at 0.75 kc either side of the receiver-dial zero, depending on which sideband is used.

9 – Retune the receiver for zero beat and if needed, loosen the b.f.o.-pitch dial and reset it so that it is positioned with the zero calibration at the panel index.

10 – This completes alignment of the i.f. strip and the b.f.o.

11 – Slightly better unwanted-sideband suppression may be obtained by aligning at 51 kc instead of at 50.75 kc, in which case the foregoing steps should be conducted tuning the receiver 1 kc either side of zero beat, instead of 0.75 kc.

12 – Following this, turn off the calibrator and adjust T8 (top slug) at the 3rd-conversion oscillator, so that the background noise is the same level on either sideband.

After the whole job is completed, the pitch of the background noise (no other signals) should sound the same on either sideband.

Plate-current Meter for Plate-Voltage Readings

QUESTION: I built a 1 kw linear, but have been unable to find any literature on how to use a plate-current meter to measure the plate voltage. I'm using a 500 ma meter. How can it be used and switched in or out for plate-voltage readings?

ANSWER: A 500 ma meter is not practical to use for a voltmeter application. It will draw too much current from the power source and will require a very high-power multiplier resistor. You should use a 0-1 ma meter with a multiplier resistor (1000 ohms × desired full-scale voltage reading). For Example: for 5000 v. full scale, $R = 1000 \times 5000 = 5{,}000{,}000$ ohms or 5 megohms.

To measure current, insert a 10-ohm resistor in series with the load and measure the voltage drop across it. The current then is $I = E \div R$. To set up the arrangement, from $E = R \times I$, determine the voltage drop across the resistor at the desired full-scale current for the milliammeter. For 500 ma full-scale, this will be 10 × 0.5a. = 5 volts. Use the meter as a 0-5

* Technical Director, *CQ*.

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oltmeter across the resistor with the multilier determined as indicated earlier. Thus, it hould be 1000 X 5 (volts) = 5000 ohms. This hould include the meter resistance which will e about 100 ohms for a 0-1 ma meter.

The circuitry and method for switching the neter may be found in fig. 5. Be sure the witch is sufficiently insulated for the applied oltage.

You can check the accuracy of the m.a. etup by temporarily inserting your 500 ma neter in series with the load and seeing if both neters read the same.

Apartment Antenna

Here is an interesting suggestion for an ntenna that can cope with certain installaon restrictions. It is submitted by Raphael oifer, K2QBW. Many thanks, Raphael, we ope it will help fellow amateurs who may ave similar difficulties.

"Moving to a new QTH this past winter, I an into an antenna problem which I'm sure ust have confronted many of the gang: how o put up a vertical antenna which will work ffectively using neither ground mounting (no igging by order of landlord) nor rooftop adials (violation of local fire laws).

"The solution: chimney-mount the antena so that it clears all obstructions and use a hysical counterpoise to make up "the other alf of the dipole" which would otherwise be mulated by the ground system. A length of our-conductor motor cable was prepared by utting each conductor to quarter-wave ength on one of the bands covered by the ntenna (in this case, a 20-15-10-meter trap ertical—Hy-Gain 12AVQ), soldering the conuctors together at the top and fastening to he vertical's ground terminal. See fig. 6. The arallel-monopoles counterpoise system thus onstructed was run straight down the mast nd chimney using stand-off insulators.

"What I then had, electrically, was a 3-band ertical dipole with the top half consisting of he self-supporting trap vertical and the botom half of the parallel-monopoles system. atisfactory loads were obtained using RG-58/U on 10, 15, 20 and (surprise) 40 neters with no trouble encountered in workng VK, JA and the like of the three higher ands using 175 watts.

"I would certainly not recommend this rrangement to replace a ground-mounted ertical system using two dozen radials under rigated peat moss, but it does work and takes p virtually no space."

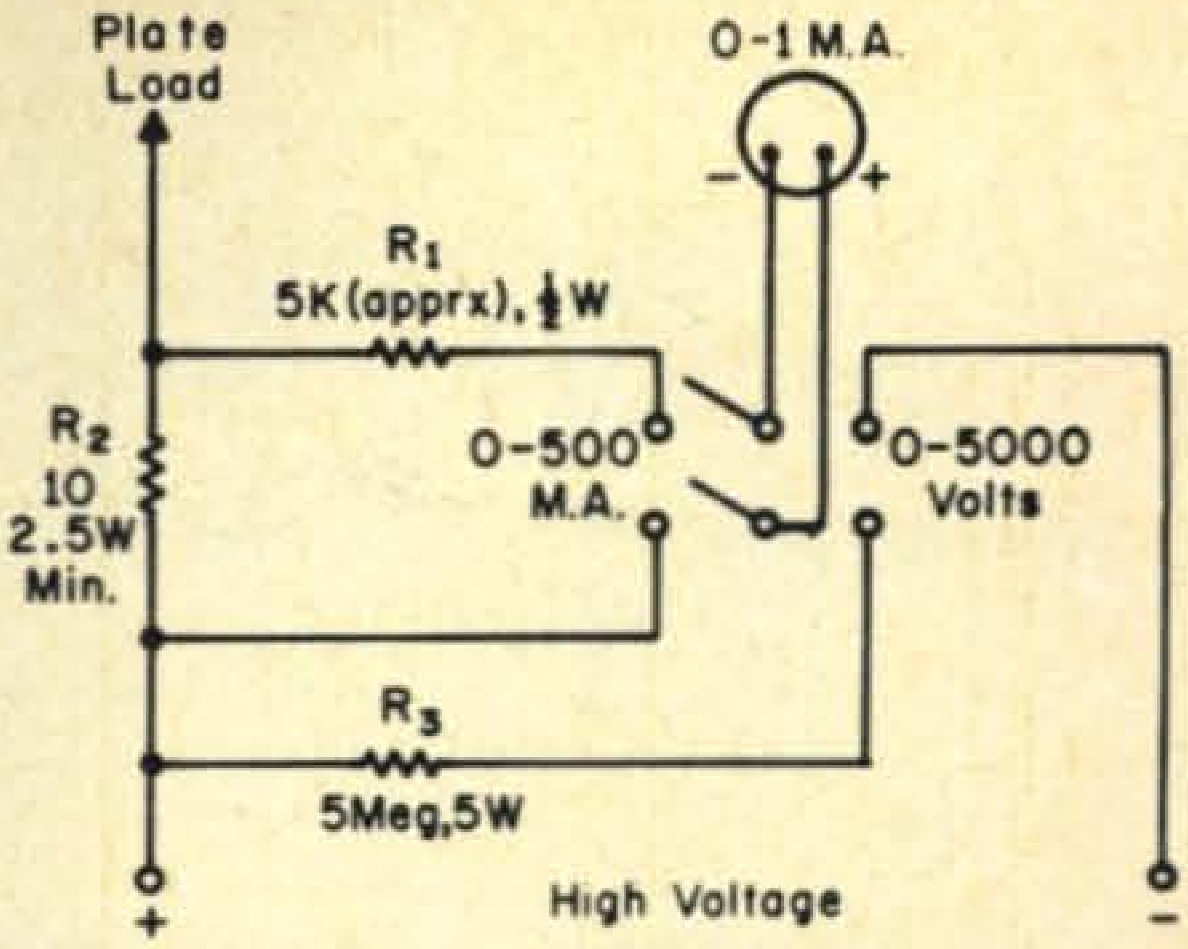

Fig. 5—Method of using a 0-1 ma meter for reading either plate current up to 500 ma or plate potential up to 5000 volts. With full-scale current R_2 should be 2.5 watts minimum, but may be only 2 watts with currents less that 450 ma. R_3 may consist of five 1-mge, 1-watt resistors in series.

80-Meter SSB Exciter to Higher Bands

QUESTION: Can you design a set of transistorized multiplier stages to cover the 40-10 meter bands with the 80-meter transistorized s.s.b. exciter described by I1TDJ on page 54 of Feb. '68 *CQ*?

ANSWER: Frequency multiplication cannot be used with s.s.b. What is needed for conversion to a higher-frequency band is heterodyning with a mixer. For instance: mixing the 3.5-4 mc signals from the above exciter with a 10.5 mc crystal-controlled oscillator signal will produce a sum of 14-14.5 mc at the mixer output. Difference frequencies also will occur at 7-6.6 mc, but these will be attenuated by the 14-14.5 mc tuned circuits which follow the mixer.

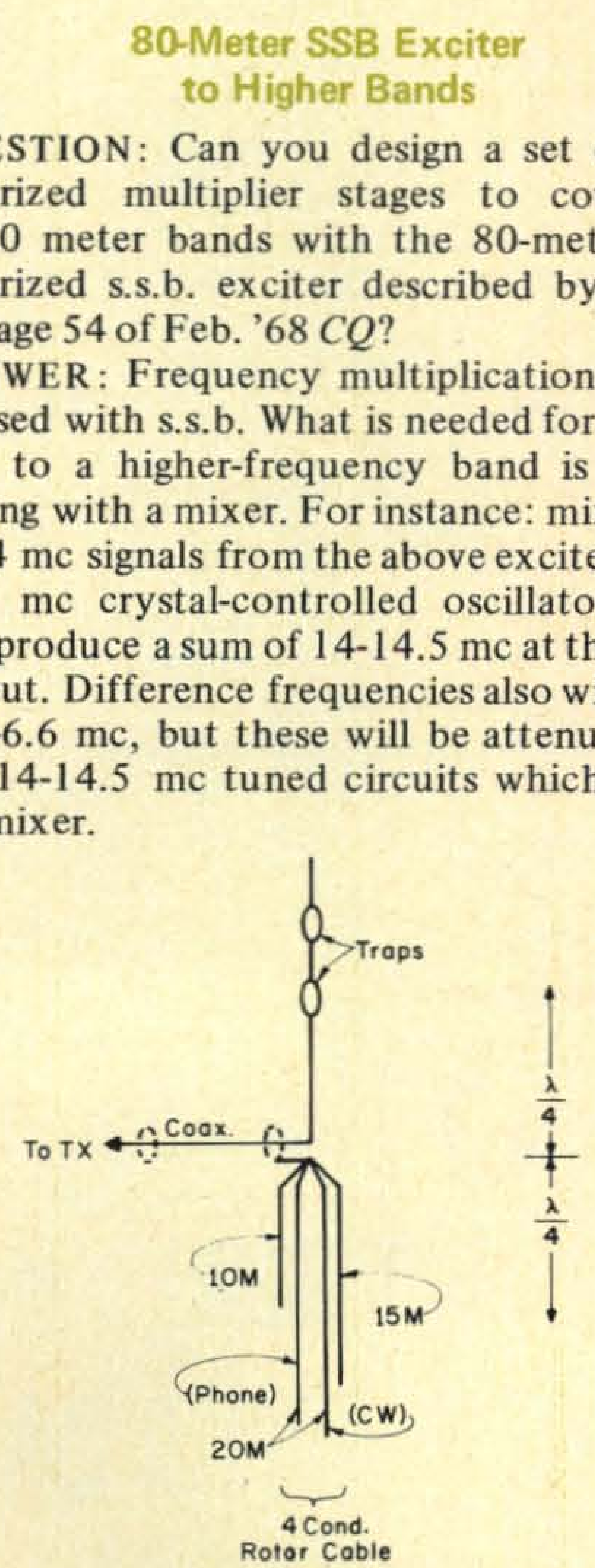

Fig. 6—Simple space-saving system of erecting a counterpoise system for a multi-band vertical antenna system, using four conductor rotor cable. Standoff insulators may be used to keep the cable aligned and prevent swinging.

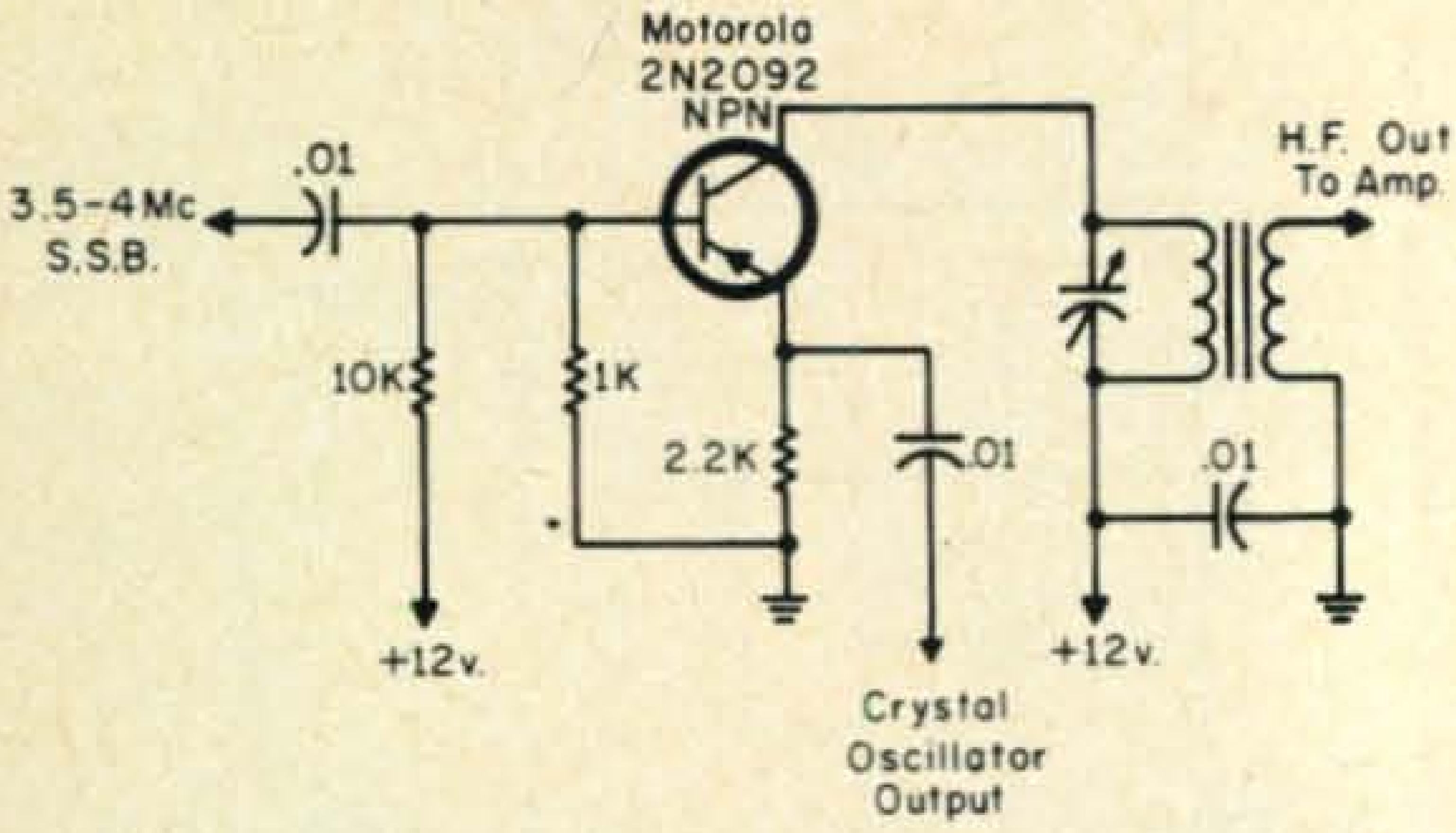

Fig. 7—Solid-state mixer for converting 3.5-4 mc s.s.b. signal to higher-frequency band.

For the 21 mc band you'd mix with a 17.5 mc crystal, for 28.5 mc with a 25 mc crystal. Operation on the 7.0 mc band with a 3.5 mc mixing crystal is not suggested, because of the direct harmonic relationship between the 3.5 mc crystal and 7 mc. In this case you use a 11 mc crystal and extract the difference frequencies. The v.f.o. tuning will be backwards and the sideband positions reversed on this band.

Suggested circuit for a solid-state mixer is shown in fig. 7.

Improving V.H.F. Sensitivity of Knight-Kit G.D.O.

QUESTION: Can improvements be made on a Knight-Kit 6-30 G.D.O. for increasing the sensitivity on the 105-300 mc range? There is insufficient grid current especially around the 2-meter portion of the range. Allied's solution was a new inductor, but it did not help.

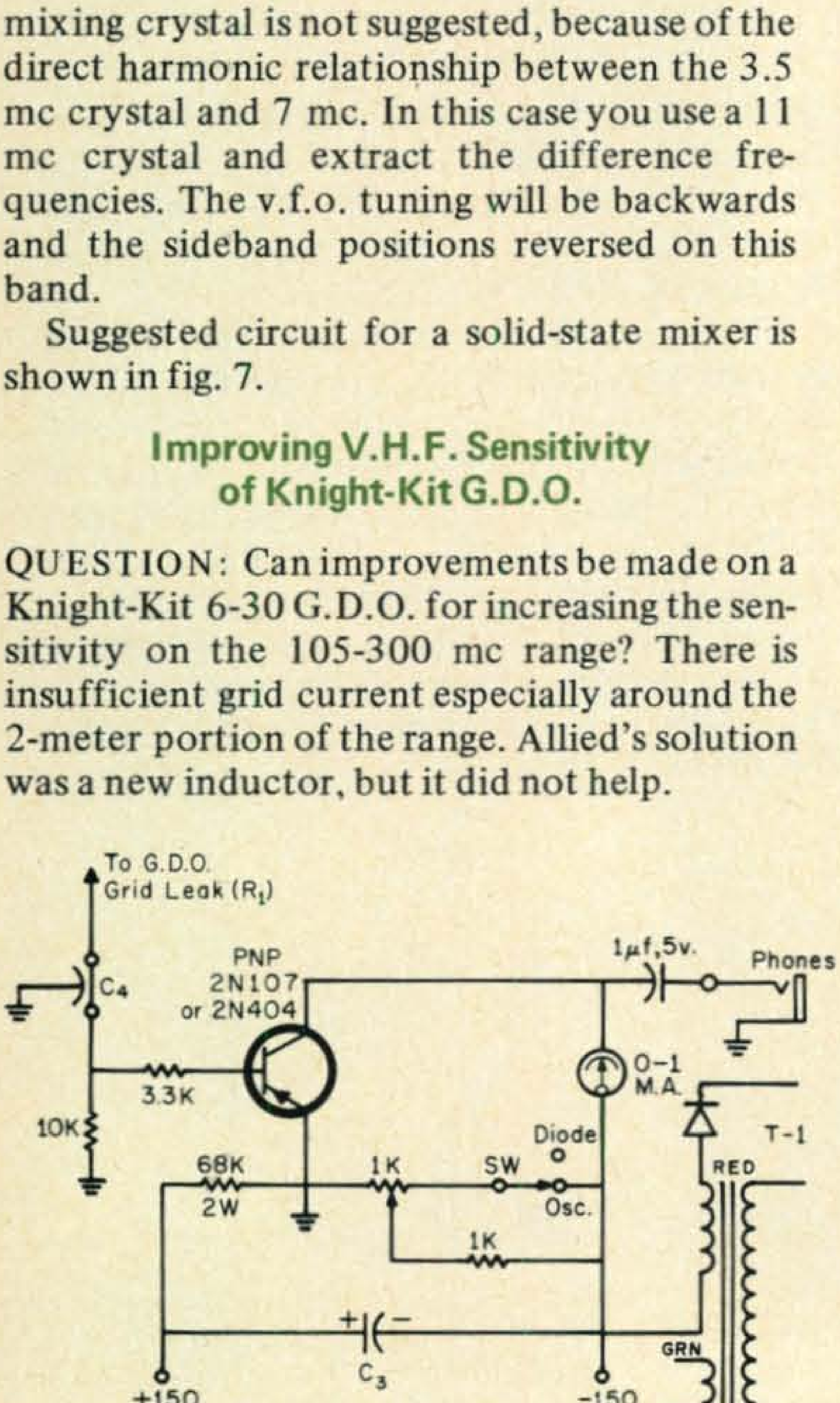

Fig. 8—Transistor d.c. amplifier for increasing meter sensitivity on Knight-Kit 6-30 g.d.o. Original components are marked with an asterisk. The B-minus must be lifted above ground. To do this, remove the negative lead of C_3 from ground and also remove the red lead of T_1 from ground. Connect these two leads together and wire into circuit as shown above at -150 v.

ANSWER: In respect to improving the Knight G.D.O. sensitivity in the v.h.f. range, one or more of the following suggestions should help:

1. Reduce the grid leak, R_1, to 4.7 K.
2. Try another 6AF4A. These tubes deteriorate quite easily.
3. Raise the plate potential by installing a voltage doubler in place of the half-wave rectifier.
4. Change the meter to a 200 μa job.
5. Install a transistor d.c. amplifier for the meter as shown in fig. 8.
6. A new inductor would help only if it had considerably higher Q than the present one. With the latter, make sure the contacts on both the inductor and the instrument are tight and clean.
7. If you're mainly interested in the 2-meter band, make a slightly longer inductor (like the present v.h.f. one using a wide strap) so that 144 mc falls near the 200 mc calibration on the 105-300 mc scale. Less tuning capacitance will then be needed around this frequency, the circuit impedance will be higher and better oscillation with higher grid current should be experienced. The total range with the new inductor will be about 70-200 mc.

Corrections

At fig. 2 for the Heathkit HW-100 Review on page 48 in the August '69 issue, the top end of the doupling capacitor below R2 should be shown connected to the top end of R2 instead of to the bottom end. The same error appears at fig. 2-17 in the Heathkit Manual.

At fig. 3 for the same review, the base of Q2 should be shown connected to ground.

At fig. 2 in the Q & A Column on page 97 of the September '68 issue, the polarity of the d.c.-supply source across the potentiometer should be shown reversed. The footnote on page 98 should have read " . . . . . CQ *Sept.* '67, page 81."

We'd like to thank those who unselfishly forwarded or offered manuals on the Harvey-Wells TBS-50 gear to meet the needs of several readers as mentioned in the August Q & A COLUMN. It certainly is gratifying to find fellow amateurs interested in helping others!

Vy 73, Bill, W2AEF

THE awards PROGRAM

BY ED HOPPER,* W2GT

THE October, "Story of The Month" about David Short, W5PWG, as written by Dave!

David S. Short, W5PWG

"My Grandfather once said to my Father, 'Don't take up radio my son, it's not here to stay—just a fad'. Thus my story begins when Dad graduated from Cornell as a Landscape Engineer in 1929. Shortly thereafter, they moved to the beautiful Genesee Valley country of Western New York where I arrived on the scene in late June of 1934. Dad managed, however, to keep carefully hidden in a dusty corner of the family library an ancient book titled *Radio Telegraphy* which had been written by some obscure eccentric. This book was to be the key to my future and introduced me to the strange new world of spark-gaps, odd looking antennas, and strange coils of wire. The book was only of passing interest until one day, while listening to our huge up-right four-band Zenith, I noticed that by matching the thumps with the figures in the book, I was able to make sense out of it, thus teaching myself my first feeble bits of code. Upon noticing the strange behavior of their son, my parents quickly whisked me off to the local ham doctor, W2QBY, who was more than happy to cure my disorder by showing me the bug and a BFO.

"Obtaining a ham license in a small town such as Nunda, New York (Livingston County), was not quite as easy then as it may be now. On that fateful day in the fall of 1951, I gathered my courage and hopped a ride on a farm truck for the 60 mile trip to Buffalo and my first examination. I think the old stern Radio Inspector took pity on me because of my tender age, the long trip, and my inability to quit shaking long enough to send 13 w.p.m.

"While waiting for the ticket to come in the mail, I came down with two bad cases of nerves, one sprained ankle from hanging antennas, and as luck would have it, the ticket and a case of the mumps arrived on the same day. Good thing I only got a Class B at the time, because I could hardly talk. My first QSO using W2GRH was with the old timer of the town, W2QBY. My first out-of-state QSO was with a station in Ashland, Pa., W3OBJ. Through the friendly help of W2RSR, W2KLY, W2KKY, and W2SMM, who constituted the Nunda Amateur Radio Club, I quickly became initiated into the ham fraternity.

"In the spring of 1952, I went back to Buffalo—more confident this time—and passed my Class A examination just a few months before incentive licensing went down the drain.

"Shortly after that, I packed my clothes and headed for the Valparaiso Technical Institute and the technical training which was to set my future. W9SAL was the amateur radio station at the Institute and probably on

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

Dave, W5PWG, exW2GRH, ex W4SKI.

the air more than any radio station of this type had a right to be. However, operating W9SAL had its advantages. When desperately in need of some extra money, I alerted the whole east coast for a patch into Nunda. Schedules with W2RSR, W2FHS, and God bless his soul, W2OY, helped me out on numerous occasions.

"After graduating from Valparaiso with an Applied Radio Engineering Certificate in hand, I took my first job with Goodyear Aircraft Corporation in Akron, Ohio. It was in Akron that I got my first real taste of Field Day, one from which I never quite recovered.

"From Akron I enlisted for the draft, and quite naturally ended up at Fort Knox, Kentucky. After completing basic, I hoped for a two-year stint with MARS, but instead was sent to a school for radio operators. Due to my prior experience with c.w., I passed the whole course within one week and spent the remaining weeks teaching the course. My spare time was spent at K4WBG, where I was put to good use NCS'ing the Kentucky MARS Net, using a souped-up BC-610. The next school was the communications school at Fort Knox, then I was transferred to Fort Steuart, Georgia. Fortunately, I was not assigned my speciality as commo man in the 710 Tank Battalion, instead they assigned me to the 170th RCAT detachment. Our job was to build, launch, and fly Radio Controlled Aircraft targets for anti-aircraft practice. During one week, while flying for the 75 mm Sky Sweepers, 89 targets were downed by direct hits which was some sort of a record and still stands, as far as I know. While at Fort Steuart, W2GRH/4 passed out a few confirmations for Liberty county, Georgia. These are rare, and I wonder if any of the County Hunters might have one of them.

"From Fort Steuart, I went back to Akron, Ohio and Goodyear Aircraft. There I married Ann Reeves, whose father had just completed 37 years with the Goodyear Tire & Rubber

CT1LN, Paul, recipient of #2 USA-CA to Portugal.

Company. We soon became the proud paren of four children—three boys and one gi The oldest boy enters the sixth grade this fa

"Shortly after our marriage, we moved Orlando, Florida, and I took a position wi the Martin-Orlando Company with whom am still employed as Senior Test Conduct with the Pershing Modification Group at Fo Sill, Oklahoma. But this is getting ahead the story, somewhat.

My desire to stay in Orlando was an in mediate tip-off to my supervisors to transf me to El Paso, Texas and WSMR in Ne Mexico. Thus W2GRH was operating po able five and I received my first certificat W.A.E. or Worked All El Paso (endorsed a 10 meter phone). As an avid QSL'er, I hop no one was left out on an El Paso, Tex county confirmation. After returning Florida, a new call was requested and W4SK was quick to dominate the scene as Ole Sk Kin. Later in 1962, I was again transferre this time to Lawton, Oklahoma, and Fort Si A few years later, another call was requeste and in the spring of 1967, W5PWG was r ceived.

"Serious county hunting didn't come f me until the fall of 1963. I attempted to kee up with the side band gang on c.w. but fin ing it was a losing battle, I soon joined the 4 meter s.s.b. group on 7225, and had a ba calling into the net on a.m. When I couldn reach them with a.m., I would fire up th 4-250 at 1 kw input and make their speake rattle.

"Later I sold my modest 32V3 and 75A for a Swan 350 which I am presently usin and it did very well on my many mobilin trips around Oklahoma with Leo, WA5AE and John, W5OYG. We passed out almo every county in the state, except those in th pan handle.

"Ah, those were the days when count hunting was just beginning with such famou county hunters as Otts, Vic, Leo, Joe, Gen Bertha, and many many more. The SS equipment sure helped and the county tot started climbing rapidly and at the present have around 2645 confirmed. Truthfull county hunting has been a very rewardin experience and established many friendshi for me that will endure through-out the re of my life. It has brought me to a focal poi of looking for the unusual, from DX to traffi handling and that rare something you fe when a fellow or group calls you by name.

"Of course, my stiffest competition com

See page 142 for New Reader Servic

from that Old Yellow Goat—W5OYG, who is, without a doubt, the best NCS the county hunters have, he is truly remarkable and some 15 counties ahead of me.

"Among my somewhat dubious achievements are CP-25, WAS, WAC, A1-Op, full member of ARRL, IEEE and the Masons. Also QSL manager for Tony, YV5AGD, Ana Maria, CP4DI and Curt, CP4DA.

"I would like to offer my services to any DX station in any way possible to help them locate and obtain county confirmations. I am presently sending mobile reply cards out for Tony, YV5AGD. Tony fills them out and sends the whole batch to me and I send the cards to the stations he has worked. When I receive the confirmations, I gather them together and send them back to him on a regular basis. He now has over 1200 confirmations. If any DX station is interested in this type of service, they can write to me for additional data.

Thanks again, Ed, for the real fine articles you write each month. Glad to see more fellows writing to you and expounding on their activities, keep up the swell work. David S. Short, W5PWG, 4828 Williams, Lawton, Oklahoma 73501." *(Yes, Dave did such a fine job with HIS story, I felt I could NOT improve it, Ed.)*

Letters

John, WA8YSQ, writes: "Here is my application for USA-CA-500, I am looking forward to receiving that fine looking award.

I wonder if my application sets any precedence, if you'll notice it is signed by three county hunters all from the same city and all have over 2000 counties." (It sure did! Application certified by Harry, K8KOM; Walter, W8NXN; and Robert, W8UPH. They as well as John are all from Toledo, Ohio).

Bob, WA3EHE/HL9UM, writes: "Just finished your column in June *CQ,* takes awhile to arrive here in the PX. I was pleased to read that Vic, WØGYM reached the magic 3079 plateau and that many other friends are moving along so well. About two years ago when I returned from Germany, Dave, W5PWG introduced me to the County Hunters and I've been at it since. Dave and I made a few trips in Oklahoma and Texas last year to help out some of the gang, and although the trips were tiring, they were most enjoyable. When I got my orders for here, I went mobile back to Pennsylvania and with my 12 year old daughter helping with the log, I had about 190 contacts. While home I made some trips around Eastern Pennsylvania, passing out some more counties.

At the present time I have 999 counties confirmed and anxious to pass the 1000 mark. Just received my Korean license and hope to be on the air in less than a week. I'll be working from the rare and exotic Yanju County.

You might pass my address to your readers in the event I owe someone a county or two. I'll reply quickly to any cards received. Looking forward to next April when I can chase counties from home." Major R. A. Pissott, WA3EHE/HL9UM, HQ I CORPS (GP) IG, APO San Francisco, California 96358.

Awards

Utah Counties Award: Sponsored by the Utah Amateur Radio Club, Inc., of Salt Lake City, Utah, is available to any licensed radio amateur who can submit evidence of two-way radio contact on amateur frequencies with the required numbers of the 29 counties in the State of Utah. The following is the number of counties -worked, needed- the first figure is number needed for Award and second number needed for a silver seal endorsement and a gold seal endorsement will be issued to any one working all 29 counties. Utah and bordering states (Nevada, Idaho, Wyoming, Colorado, New Mexico and Arizona) need 20 and 25. All other states west of the Mississippi need 10 and 20. All others need 5 and 15. Only contacts made on or after January 1, 1968 are valid. The certificates are issued free of charge, compliments of the Utah Amateur Radio Club, Inc., but postage for the return of QSL cards or other evidence submitted as proof of contacts, is required. Applications for the award should be mailed to: Gaylord A. Buchanan, W7EVK, 1485 So. Sneddon Drive, Sandy, Utah 84070.

Honeywell Amateur Radio Club Certificate: Available to any radio amateur who contacts

Utah Counties Award.

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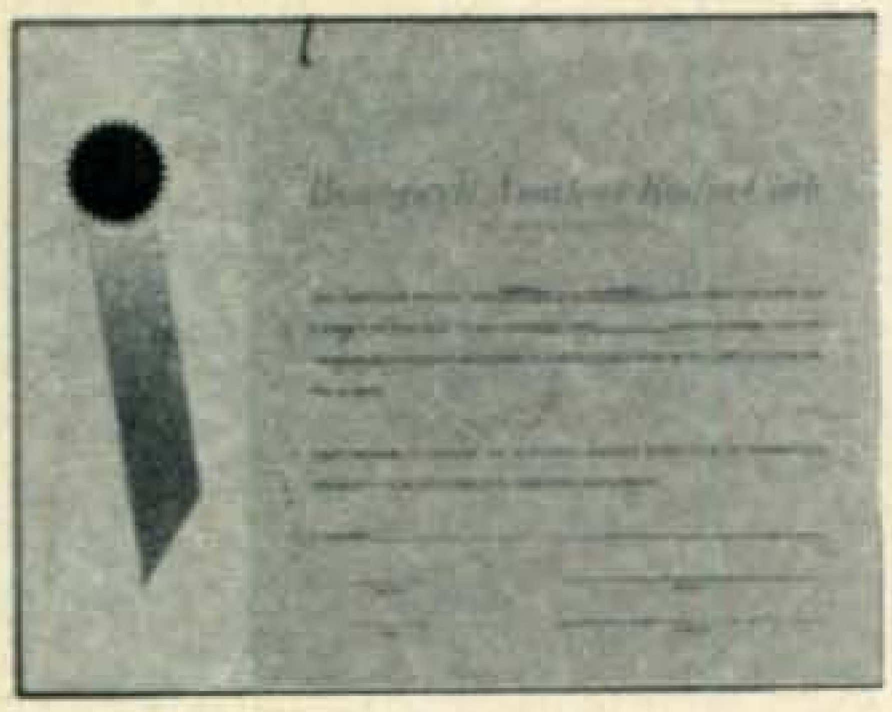

Honeywell ARC Certificate.

ESK Amateur Radio Award.

Worked All OY Award. ►

ten (10) radio amateurs who are employees of Honeywell, Inc. Honeywell radio amateurs are located in almost every U. S. State and in many countries around the world including Canada, England, France, Germany, South America, Australia and Japan. Contacts must be after January 1, 1967. Applicants must submit a list of their contacts with complete name, call letters and address. The Honeywell Amateur Radio Club holds a QSO party about the middle of March every year and is usually on the air every Saturday at 1600 GMT during the winter and 1500 GMT during the summer, the station call is WA∅NLP. Applications should be sent to: Honeywell, Inc., 2701 Fourth Ave., So., Mail Station G10276, Minneapolis, Minn. 55408.

The WAOY Award: The Worked All OY Award is issued by F. R. A., F∅ROYSKIR RADIOAMAT∅RAR, to commemorate the foundation of the Faroese National Amateur Radio Society, and to support activity on the amateur bands. The award is available to any licensed amateur for contacts made after April 11, 1965. All bands from 3.5 to 28 mc may be used c.w. or fone. Crossband contacts and c.w. to fone contacts are not accepted. Fone contacts can be made on either a.m. or s.s.b., and one award will be issued for each mode, c.w. and fone.

There are two sets of rules, one for European amateurs and one set of rules for all other amateurs:

Applicants need these points:

	Class I	Class II	Class III
Europeans	35	25	15
Non-Europeans	20	15	10

Scoring is as follows: European stations: One point for each FRA-member-station on each band. The club-stations, OY6FRA and OY6NRA count two points. NON-European stations: One point for each FRA-member-station worked on 28, 21, and 14 mc, two points on 7 and 3.5 mc. Points being double on all bands for contacts with the club-sta tions, OY6FRA and OY6NRA. Applicant must list all claimed contacts, have list veri fied by another licensed amateur and mail to Awards Manager, Foroyskir Radioamatorar Box 184, 3800 Torshavn, Faroe Islands. B sure to enclose 10 IRCs, or equivalent, t cover expenses. Any decision made by th FRA-committee will be final, and the FRA committee will, if or when necessary, modif these rules.

ESK Amateur Radio Award: Sponsored b the ESK Amateur Radio Club and issued fo contacts made after May 25, 0000 hour GMT, 1968. All four stations listed on th award must be contacted—VE5WL, VE5HV VE5GN, and VE5VE. Applications shoul be sent to: VE5GN, Box 10, ESK, Saskatche wan, Canada.

Notes

At the fine suggestion of Bertha, WA4 BMC, I will list the few easy rules for USA CA. There is NO time limit on contacts, n band nor mode restrictions and QSLs for an call *YOU* ever had are valid. Your *first* appli cation must be made using a USA-CA Recor Book obtainable direct from *CQ* for $1.25 And as there is NO time limit, list City/town in place of date and it you do NOT desir any special endorsement, if you do NOT lis band and mode, you will receive an award fo mixed operation. Realizing the difficulties o mobile operation, I am NOT strictly enforc ing the rule requiring the name of the city town of operation.

The 2nd CW-County Hunter QSO Party of the week-end of 27th July was obviously a GREAT SUCCESS!! I was most pleased that, for a change, I had a little available time and did have much fun although I made only 89 QSOs and I was greatly surprised to find that only 14 of these were USA-CA members,

[*Continued on page 132*]

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AN OPEN APOLOGY TO ALL DXERS

Several months ago we began to advertise the latest addition to CQ's book line entitled "DX Handbook," by Don Miller, W9WNV. Since that time we've received thousands of orders from eager hams and dealers alike. To date, we have not yet delivered a single copy.

The reasons for the delay are numerous. For one thing, we just didn't realize how complex and detailed this book was going to be. For another, we've been experimenting with a new typesetting device which we feel will make the book neater in appearance and easier to read. And for a third, much deserved summer vacations by CQ staff members added to the delay.

The DX Handbook will definitely go to press early in October and will be ready for delivery during that month. It will be the finest authority on the subject ever published — an absolute must for every ham's library. We wish to apologize to our readers and distributors for the long delays and assure them that their patience will be rewarded by a masterpiece of writing and editing. And we wish to urge readers that have not yet done so to place their orders quickly to enable them to get in on the first print run.

The price for the DX Handbook is $5.00.

VHF TODAY

BY ALLEN KATZ,* K2UYH

SEVERAL years ago (back in the old VHF column) we predicted that amateur TV activity would increase profoundly due to the availability of inexpensive transistorized TV cameras. That prediction is one that did not come true. A look at the adds at the back of this and other radio journals will show that TV cameras are less expensive now than ever, and just the presence of these adds indicate that someone must be buying them. Yet there has been little, if any, increase in ATV operation.

The fact is that there is no lack of ATV video activity, but there is a significant lack of ATV radio activity. The vast majority of amateur television camera owners do not show the knowledge or incentive to put these devices on the air. The novelty of close circuit operation soon wears off and the net result is nil.

Recently we had the opportunity through our membership in the East Coast VHF Society to put together several v.h.f. exhibits at the Garden State Amateur Radio Exposition. Among these exhibits was one devoted to amateur television. It was put together with the help of Marty, WB2SZW; John, WB2ICY; and Don, WB2UMF; whom incidentally publish a small magazine devoted entirely to amateur TV called *A5*. This magazine should be of particular interest to present and prospective TV enthusiasts![1] The exhibit consisted of an operational amateur TV station in the 432 mc band which was kept in constant two way video and audio communications with one of several other participating ATV stations (WA2WEB, K2ALX and W2CQH). The parallel voice channel was on two meters for flexibility, however for regular amateur communication purposes having the audio on the same carrier as the video is probably superior.

Although the booth was designed for the general public, it caused quite a stir among licensed amateurs, particularly those of the closed circuit variety. They expressed disbelief at the distances over which TV communication was possible and questioned how such was accomplished. The answer was simple . . . the use of high power, 100 watts or better, (not 6J6 oscillators), low noise converters, and properly designed antennas. Our advice to these fellows was to get on 432 mc voice (or c.w.) first, then go on TV. With this approach, one can learn how to make a u.h.f. system work and even more important what amateurs are already on 432 ATV, instead of shooting around in the dark.

The booth also evoked much interest from v.h.f.'ers already on the 432 mc band. Very few if any had ever seen two way amateur TV communications. To be able to hear and see at the same time is a thing you have to experience to appreciate. They too were interested in the problems of the addition of

* 66 Skytop Road, Cedar Grove, N.J.

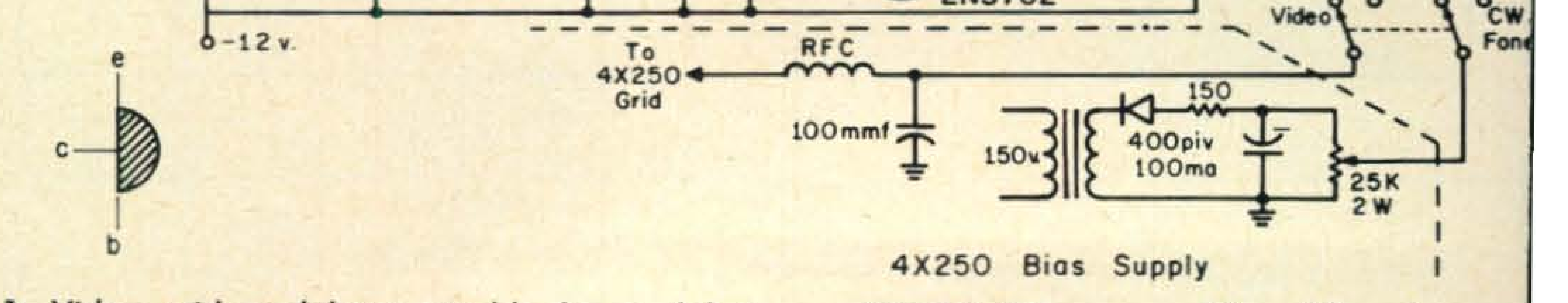

Fig. 1—Video grid modulator suitable for modulating a 4CX250 432 mc amplifier. All resistors are ½ watt; values are in ohms. Capacitors are in mf unless otherwise noted.

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SURPLUS sidelights

THE new breed of surplus these days is beginning to show up in a number of outlets—traditional government surplus stores, plus scrap dealers' yards and in the excess and discard heaps of the hundreds of small electronics firms which have sprung up in the last ten years. For the experimenter and amateur, a little digging can pay high dividends in glamorous equipment whose sophisticated applications can be turned to good use in the shack.

Now that the transistorized and even integrated-circuit computer components are coming on the surplus market, a host of home computer projects become feasible. Electronic adding machines, and those capable of other useful functions may be put together out of computer junk. Computer tape decks are a hot item in surplus, and the millions of transformers, chokes, relays and racks being discarded in obsolete computers are flooding the component market.

But in the communications line, the computer revolution is being felt directly. Using logic techniques developed by computer designers, electronics engineers now manipulate RTTY impulses, c.w., and even voice, converting, changing speeds, regenerating and reading, all in solid-state, super-reliable chips, packed into units which generate little heat and occupy a fraction of the space of the old electronics of the 1950's.

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

Fig. 1—A typical commercial military SelCall unit manufactured by Pulse Communications Inc.

Though some of this is old hat to design engineers, to the surplus gang the logic equipment is often new and puzzling, though its usefulness is easily demonstrable.

Though the ways in which communicators may use the new logic technology are many, consider three: conversion of voice (analog) signals to digital form for transmission as "bits" much like RTTY signals, with great signal-to-noise ratio improvement; conversion of Morse (c.w.) signals to Baudot (RTTY) code for automatic reception and hard, plain-language copy, and selective calling on amateur RTTY nets.

The digitalized voice method of communication has long been known to advanced engineers, particularly those in organizations such as the National Security Agency, (NSA), C.I.A., Defense Communications Agency, etc. The "vocoder" was an early scramble-type encoder for secure voice communications using digital techniques. So successful was the mode that the Pentagon's master plan for communications provides for eventual conversion of all DOD traffic to digital, under an expanded AUTODIN system.

Digital communications, consisting of a stream of high-speed pulses (pulse code modulation is another term for it) is easily encoded, easily regenerated, and offers bandwidth advantages over other modes. To borrow a description from *AutoCall*, one method of generating digital voice modulation might be to set up a number of filters for frequencies throughout the voice range. By rectifying the signal at each filter, and attaching it to a segment on a rotating distributor the voice signal could be converted into a series of d.c. pulses. At the receiving end an

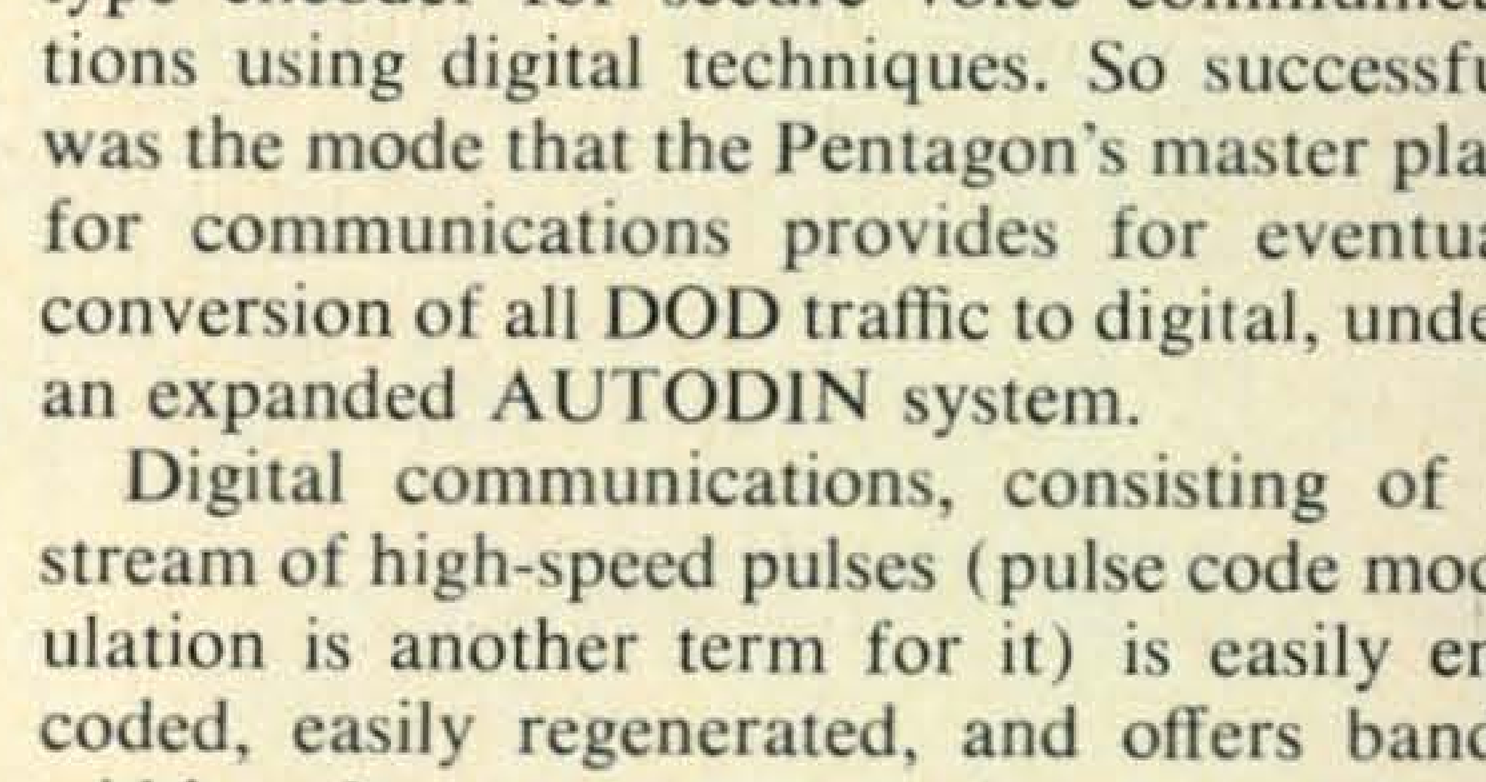
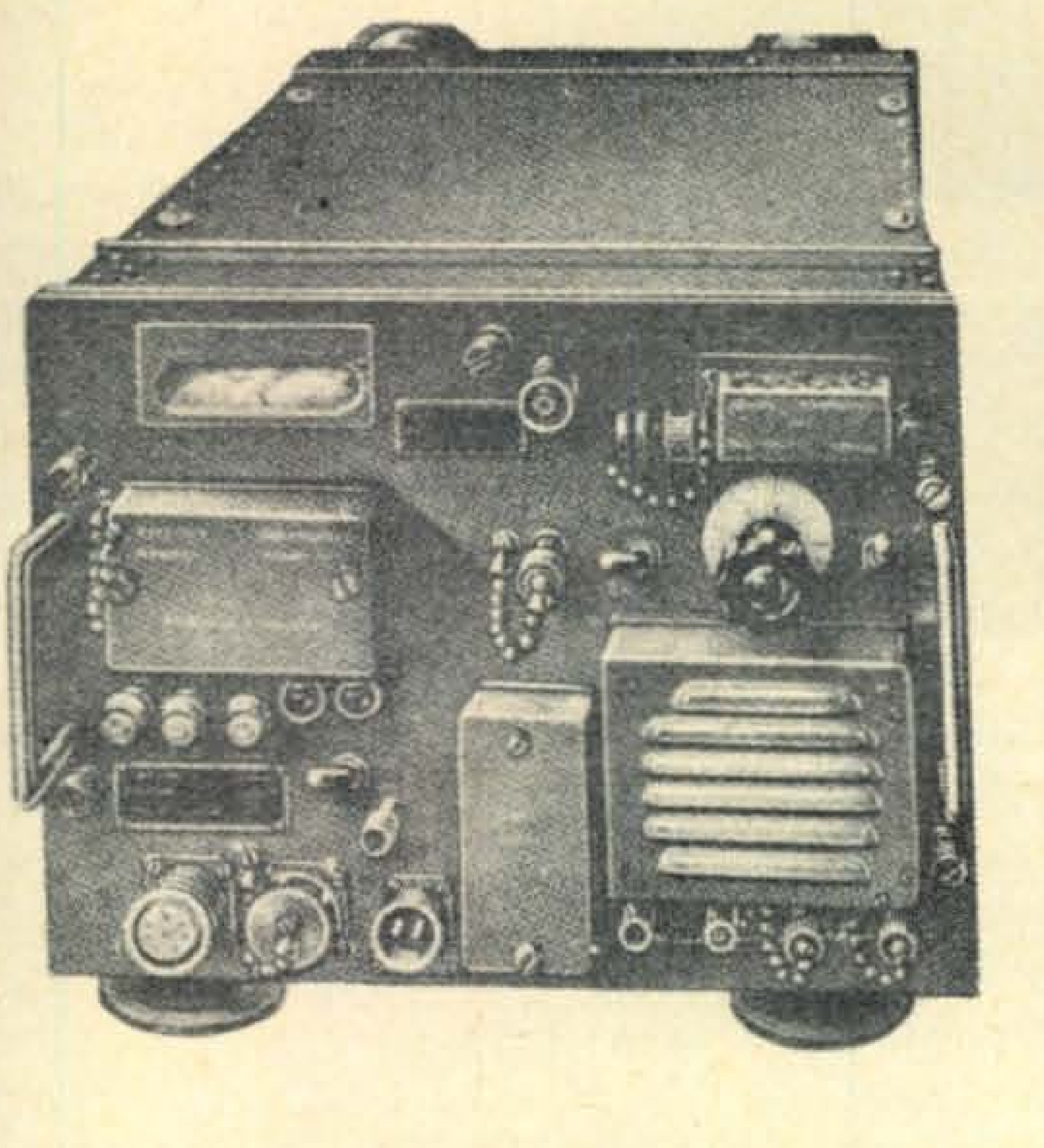


Fig. 2—A transistorized keyer that will adapt th tone output of the DEN-35 directly to a 60 m RTTY loop. Note: Q2 may have to be mounted o a heat sink. Adjust power supply voltage for re quired line voltage.

See page 142 for New Reader Servic



MOON BOUNCE EQUIPMENT

Here is a gem for all you fellows interested in moon bounce. These units are brand new in original crates. They operate on 115 V 60 cycle too, which makes getting them on the ham band much easier.

Here is what you will get from Uncle Milty of *SELECTRONICS* who is all heart.

In Case #1 (not shown)

Radio Receiver Transmitter & Power Supply
- RT-265/UPX6 which operates on 115 V 60 cy. and includes the power supply for the system.
- The transmitter frequency range is 990 to 1040 mc. variable and crystal controlled (2 crystals included). A slight modification of the 3 silver-plated cavities and a change of crystals will put it in the ham band. The transmitter power output is 1.5 KW peak from a 2C39A final amplifier which when converted to a c.w. signal will give you a respectable power output at 52 ohms impedance.
- The transmitter also includes two other 2C39A's as tripler and driver and a 3E29 as modulator plus all other operating tubes.
- The receiver sensitivity is —80 dbm at 52 ohms input impedance and covers the frequency range of 1080 to 1130 mc. Also easily converted to the ham band.

In Case #2 (not shown)

1 coder-control, interrogator
Set KY-99/UPX-6.

In Case #3

Instruction books
All Cables
Antenna AT-344/TPX-21 and cable adapter (this is a discone antenna).

ALL UNITS ARE BRAND NEW AND INCLUDE ALL NECESSARY OPERATING COMPONENTS AND TUBES.

Shpt. wt. approx. 300 lbs.

PRICE: $150.00

ENCLOSED RELAY RACKS

We have just received a nice assortment of used relay racks. All racks are standard for 19" wide panels and the clearance behind the panel is 14⅞."

PANEL SPACE (19" W X)	PRICE	PANEL SPACE	PRICE
8¾	$2.95	26¼	$5.50
10½	3.50	31½	7.50
12¼	3.95	42	9.95
21	4.95	42	11.95

THIS IS A FALL SPECIAL

SORENSON "RANGER" Regulated DC Power Supply

MODEL 600B

SPECIFICATIONS:
- Output voltage range: 0-600 VDC
- Output current: 0-500 ma
- % Regulation Line: ± .25%
- Load: ± .25%
- Ripple (Max. RMS millivolts) 3
- Fil. Supply: 6.3 VAC @ 15A.
- Bias Supply: 0.150 VDC
- Internal Impedance: 2 Ohms
- Cabinet Size: 17" W x 14⅞ d x 10½ H.

EXCELLENT, CLEAN CONDITION

Net Wt. 85 lbs.

PRICE: $59.95

TDA-2 RTTY — TEST SCOPE

The Stelma Telegraph Distortion Analyzer type TDA-2 is a self contained portable unit designed to measure bias and distortion of telegraph start-stop signals. Distortion is indicated by vertical pips displayed in a rectangular pattern on the face of a cathode ray tube. Measurements can be made while the machine is operating. Measurements can be made of circuits operating at 60, 75 or 100 OPM on 20 or 60 ma. neutral circuits or 30 ma. polar circuits. Distortion measurements from 0 to 50 percent with an accuracy of plus or minus two percent can be made. No special skills required to make measurements after a few minutes practice. See your distortion, then adjust and watch it disappear.

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other distributor could activate audio oscillators at the appropriate frequencies which would reproduce the original signal.

For transmission, the "voice" signal would be a stream of on-off pulses. As may be easily seen, such pulses lend themselves readily to scrambling, speed changing, and regeneration. It is inherently far simpler to build a regenerator to recognize the absence of or presence of a pulse, even under noise conditions, than to amplify voice communications without introducing distortion.

Manipulation of the bits in digital, *i.e.* binery computers becomes readily possible, leading, eventually, to conversion of voice messages to machine-printed copy or vice versa.

Vocoders and other digital modulation equipment is showing up now, and advanced amateurs should be on the lookout for it.

Manipulation of Morse is in some ways more difficult than handling voice, for while current digitalized voice work is aimed only at reproducing the voice signal on the far end of the communications circuit, advanced equipment is now available to read Morse and convert it to teleprinter copy. The speed and spacing variations in hand-keyed Morse especially, is a challenge to Morse-Baudot conversion.

To my knowledge two Morse to Baudot converters are currently available, built by RCA and Fredericks Electronics Corp. Neither is a common item on the surplus market, but a few are around and the knowledge that such units exist could be useful.

I have been fortunate enough to obtain a Frederick model 670B, a Morse-to-teleprinter converter designed to handle speeds from 3 to 300 words per minute.

The —B model was a special, never made

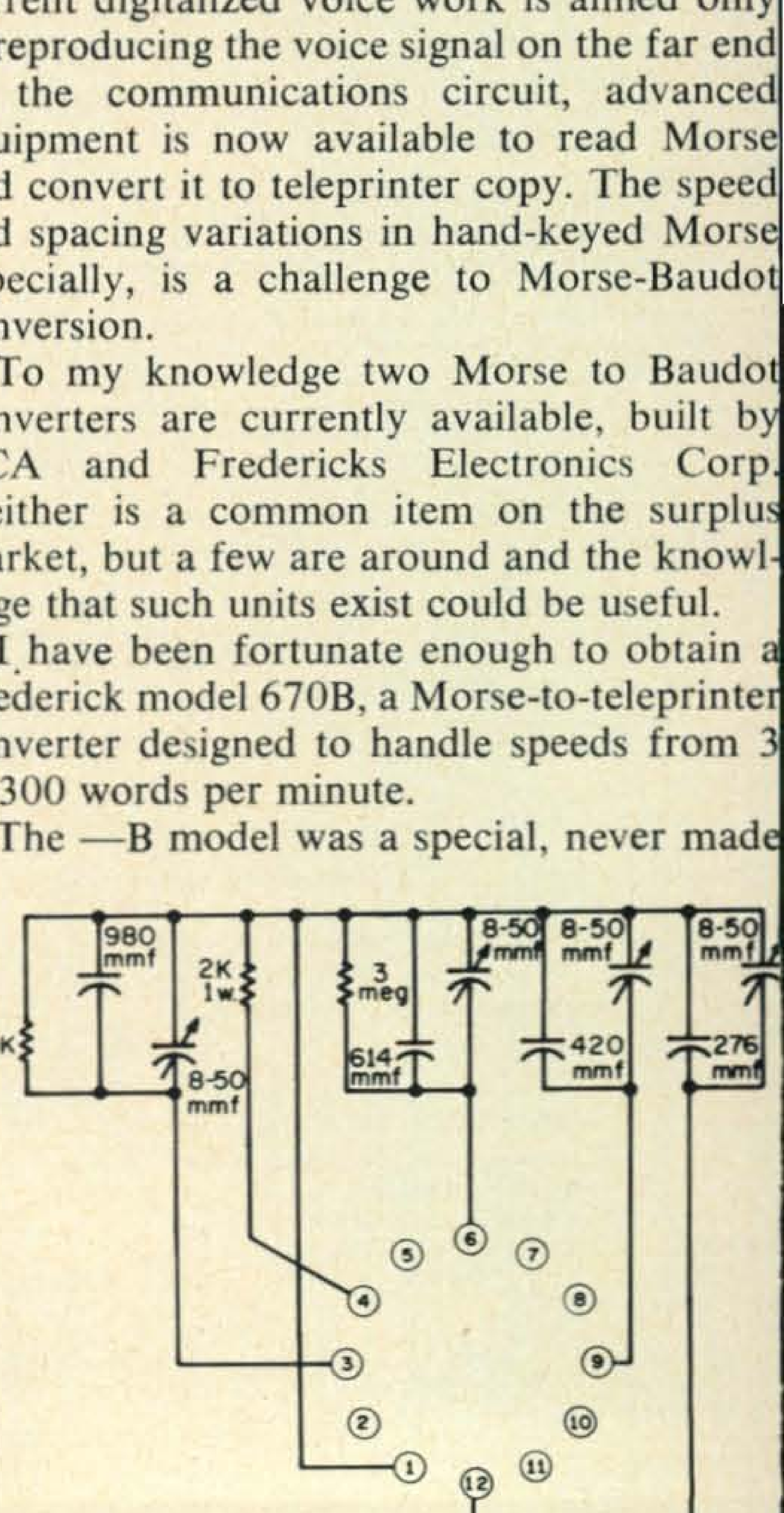

Fig. 3—The 850 c.p.s. filter for the DEN-35.

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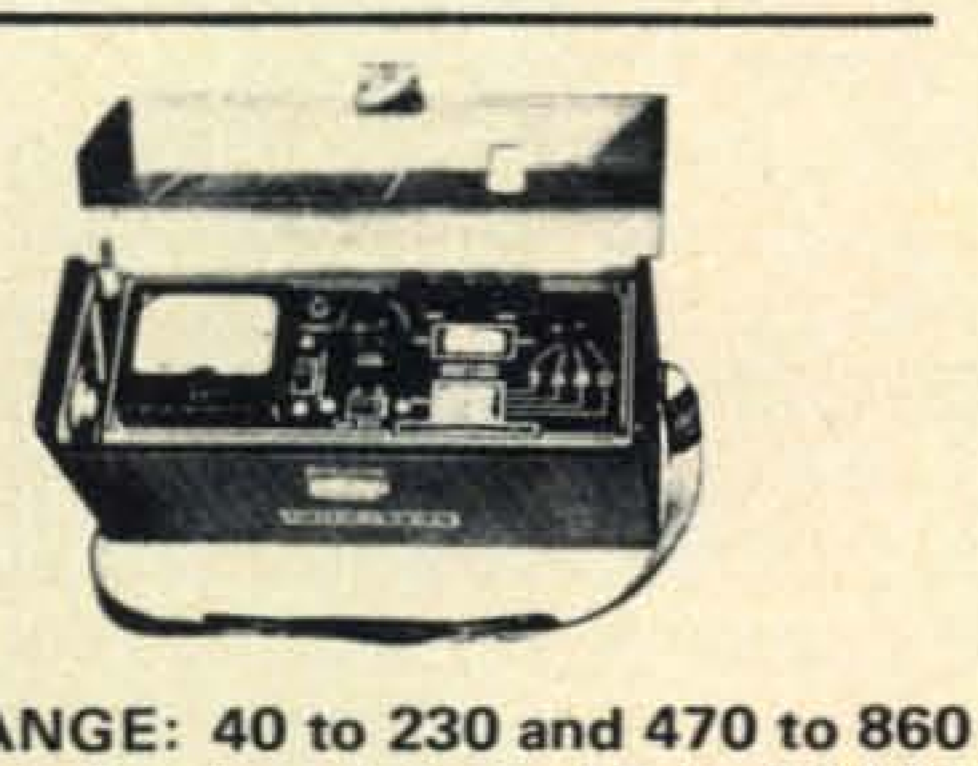

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Fig. 4—The #202 motor control unit also manufactured by Pulse Communications Inc., of Alexandria, Va.

in quantity, but the 670-A, which handles speeds from 10 to 50 w.p.m. in Morse, has been made continuously for the last four years for commercial and military customers, and a few may appear in surplus one of these days. These units are neat, gray-paneled modules, designed for 19 inch rack mounting, 5¾ inches high. They take 115 volt a.c. power, and circuit input is standard 60 ma d.c. loop. Normally they are keyed through a typical audio or IF type converter which is tuned to key on the Morse. A TT/L type converter would be set on Mark-Only to receive Morse, and its loop output fed to the 670 unit.

The output of the converter would be a typical start-stop 7.42 unit, 5-level teleprinter code. The 670 keys the output loop, but does not supply d.c. loop current internally.

Speeds for the output side may be selected by strapping rear-panel connections, or a rotary switch may be used to offer 60-67-75-100 w.p.m. teleprinter output if desired. The change is made in the unit by altering an R-C oscillator circuit which times the output register of the 670.

The 670 is very simple to operate, but its internal circuitry is very complex. This is one place where tinkering is just plain foolish. Magnetic cores are used in memory circuits, and they are very fragile indeed if played with, though they are quite reliable if left alone.

The Morse to Baudot conversion is accomplished with the assistance of a time computer which takes a short interval to identify the spacing and "fist" and to synch on to the Morse signal, thus the device generates garble when first fed a signal. When the incoming signal is identified as a dot or a dash by the time computer, binary signals are fed—a zero for a dot and a one for a dash—to a binary register. When a complete Morse character is stored, the following space generates a transfer pulse which places the character in a translation matrix where it is converted to Baudot code. The character is then read out into a buffer storage unit. From storage (which adjusts for speed and character length differences) the character is read out into a parallel-to-serial converter as a teleprinter signal.

Non-printing functions such as line feed, carriage return, spacing, upper and lower case, etc. are generated within the 670 and inserted at the proper points in the buffer storage unit.

Amateurs have adapted logic circuits to selective calling on RTTY nets, notably in the SelCall unit designed by Tom Lamb, K8ERV, and Bill Malloch, WA8PCK, and written up in the May issue of *RTTY JOURNAL* last year. This device was an outgrowth of some Bell System gear which Bill works with, but is much simpler and easier to use. The SelCall accepted d.c. RTTY loop signals, converting the serial signal to parallel form. It is then read in decode gates, using integrated circuit logic. Of course one's call is set up in the unit to operate a relay, turning the printer on when identified by the SelCall.

The same operation is used in a number of commercial units, built by Western Electric, Frederick, Stelma, and others. Fig. 1 shows a typical Commercial/Military SelCall unit made by Pulse Communications Inc., of Alexandria, Va. This, the model 415, has more functions than the amateur version. It will recognize an open line and shut down the printer, will answer back to show that there is a tape message ready to be sent, and it will control a transmitter-distributor, starting and stopping a message remotely. Of course this is generally used on land-lines, but one Pulse Com application was for Air France, on several West Indian islands, where radio transmitters were automatically keyed by the selective calling device.

The mode of operation involves reading the d.c. signal coming in, converting it to parallel form, reading it for code sequences operating appropriate relays, and regenerating a serial signal for the printer.

Another PulseCom unit—one more commonly found in surplus channels, is the #20[illegible] motor control. It does not use logic circuits but has a time device which recognizes mark to-space transitions, and, if the line is either open or idle (closed) for an appropriate period the control will activate a relay t[illegible]

See page 142 for New Reader Servic[illegible]

shut down the primer motor. The #202 is a small green box, usually attached to the printer. It has only a loop input connection, an a.c. cord, and a controlled a.c. receptacle into which the printer motor is plugged. See Fig. 4. Timing may be selected by strapping in different resistors, with delays of from 40 seconds to 20 minutes from idle open line to shutdown. I find that the shorter the time-out the better I like it.

I have received quite a bit more data now on the DEN-35 unit which I described as a "mystery" set in the July column. Bert Littlehale, WA1FXS, offers a transistor keyer to adapt the tone output of the DEN-35 directly to a 60 ma RTTY loop (Fig. 2). The design offered is rather similar to the output circuit in some of the Frederick Electronics equipment, and aside from the high priced keying transistor (Q_2), ought to be something whipped up in a few minutes from the junkbox.

I have other data on the unit, from helpful readers, some of whom wish to remain anonymous. In sum, they report that the DEN-35 is a better straight FSK converter than the well-known, highly-regarded CV-89/URA-8.

Conversions of the DEN-35 should include the substitution of a conventional bandpass input filter designed for a 2000-3000 c.p.s. passband. As it is, the unit is set up for an input in the 4000-7000 c.p.s. area, rather higher than most amateurs use, and not really very selective. You can simply unplug FL-1 and FL-2 for wide-open operation, as removal of the filter cans (octal based) allows a jumper to bypass their sockets. These are rectangular and hold-down screws must be removed.

Width of the incoming shift is selected by plug-in filters in the base of the converter. Diversity selection is made before the discrminator, so only one filter is needed there. The DEN-35 (AFSAV-35D is about the same) comes with nine filter cans for shifts from 225 to 1125 c.p.s., but these may be missing. Fig. 3 is a diagram of the 850 c.p.s. filter. The plug-in contains *only* capacitators and resistors, as the diagram indicates. The inductors are in the converter and are not changed. These cans use 12-pin bases, by the way. ■

VHF [*from page 114*]

A5 to their system capabilities. For this case there is little difficulty. On the receiving end, it involves only the addition of a second con-

See page 142 for New Reader Service

verter to shift the 432 mc signal down to the frequency of a conventional TV set. The low noise preamps presently being used in the station converter can be placed in front of a modified u.h.f. TV converter in many cases to fill this need. On the transmitting end, besides the camera, all that is needed is a video modulator.

At Expo desire was expressed in seeing construction details of a high power video modulator. To answer this request we present the circuit shown in figure 1. This circuit was originally developed by Greg, K2ALX and modified to fit our personal needs. The circuit is straight forward, conshould be good for values both above and weekend. We use the unit to modulate a 4CX250 at about 150 watts, however it should be giod for values both above and below this power level. Another good feature of this video modulator is that all transistors can be purchased for under 10 dollars. We built the modulator on a 5 × 7 × 2 inch aluminum chassis which we attached to the rear of our 432 mc amplifier. Transistor sockets were not used in the construction; instead all transistors were mounted across the tie points except the output transistor which must be mounted through the chassis on a heat sink. The 12 volt and 150 volt supplies should be well-filtered and it was found advantageous to be able to adjust the levels of both these supplies.

To adjust the video modulator, connect the modulator to the transmitter. Apply 12 volts and bias to the modulator. Supply video from camera and adjust bias control for proper final plate current and output. Adjust video gain and d.c. restoration for best picture quality. An oscilloscope connected to a monitor receiver or directly to a diode pickup on the transmission line may be helpful for this adjustment. Although there is some interaction between controls, we found adjustment easy and the modulator worked the first time voltage was applied to it.

73, Al, K2UYH

[1] Information about *A5 Magazine* can be obtained by writing to *A5 Magazine*, 150 Delong Ave., Dumont, N.J.

5,000,000 Points [*from page 85*]

fault had been traced and a new piece installed. Roy had a fuse blow in the 200V while operating 10 meters but Chet located

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a replacement and Roy was back on in short order. The VOX time delay in the 200V started performing erratically about midway in the contest and an awkward hand switching maneuver became necessary when going from transmit to receive.

As the contest progressed Chet urged us on and promised us champagne if we made 5000 contacts. It was right after this promise that Al hit his 91 per hour average for 5 hours at the 15 meter position. And Chet delivered the champagne when, battered and weary, at the conclusion of the contest we sat down to a dinner featuring the exotic Indonesian dish of nassie goreng.

Our final score, subject to checking by the *CQ* contest committee, was 5,527,788 points from 5194 contacts and a 357 multiplier. Most productive band was 20 meters with 1590 contacts, followed by 15 with 1553. Ten meters was good for 962, 40 for 898, and 80 for 191.

Curacao is one of three Dutch islands in this area, known as the "ABC" islands of Aruba, Bonaire and Curacao and officially called Netherlands Antilles. During contacts made in the week following the contest (about 1000, mostly on s.s.b.), many worked expressed ignorance as to where or what Curacao was and it is hoped our operation has helped to correct this situation.

A big advantage of the Coral Cliff hotel on Santa Martha bay on the southwest coast of the island, was the facilities available to our XYLs while were were operating. Excellent swimming, snorkeling, boating, bird watching, beachcombing and accessibility to the famous shopping capitol of Willemstad kept them happy without us. Probably the biggest advantage though was the presence of Chet Brandon, just about the most accommodating host one could ask for. Chet, a physicist by profession, has a well-equipped workshop with complete machine shop facilities. No problem was too great for him and when trouble occurred he had it fixed in short order.

Vic Clark, unable to bring his XYL because of school-age children at home, QSO'd her (she is WA4PAE) and she wished him "Happy Anniversary," it being their 26th wedding anniversary. "I had trouble responding to that," Vic commented later.

To sum it up: great place, great host great hamming and, of course, great contest ■

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HX-20 [*from page 49*]

voltage doubler was used that obtained it input from the filament 6.3 volt circuit. Th voltage doubler provides just enough outpu to cause the zener diode to draw 23 ma an deliver 10 volts to the oscillator, which draw 3 ma. The oscillator develops very close to volts peak to peak output across a 47 ohr resistor when it is supplied with 10 volts d This r.f. voltage is specified for the UM-1 it is combined with audio from V_{1B} and pr duces double side bands with suppressed ca rier at the proper level for the filter inpu

Carrier suppression after installation of th equipment is estimated to be in the range 40 to 50 db. A check for flat topping with pulsed two tone generator revealed beautif sine waves with well defined "X's" at the axi Enough drive is available to produce the sam output as was developed by the original ci cuit. On the air checks by other hams ha revealed that the quality is excellent. No when I wish to operate the rig it is inde a pleasure to turn on the a.c. and have insta carrier suppression. There are no potentio eters or capacitors with interlocking adjus ments. The only adjustment that can be ma or is necessary is to set C_1 for best carri suppression and leave it.

Contest Calendar [*from page 99*]

7T-7Y Algeria, 7Z Saudi Arabia, 8A-8I Indones 8J-8N Japan, 8O Botswana, 8P Barbados, 8Q M dive Is., 8R Guyana, 8S Sweden, 8T-8Y India, Saudi Arabia, 9A San Marino, 9B-9D Iran, 9E- Ethiopia, 9G Ghana, 9H Malta, 9I-9J Zambia, Kuwait, 9L Sierra Leone, 9M Malaysia, 9N Nep 9O-9T Democratic Rep. of the Congo, 9U Burun 9V Singapore, 9W Malaysia, 9X Rwanda, 9Y- Trinidad & Tobago.

Editor's Notes

It doesn't seem possible but here it is, ti for another one. And what's more this is o 20th anniversary. It was back in 1948 th Herb Becker, W6QD and Larry LeKashm W2IOP announced the first CQ World Wi DX Contest. It was not until 1955 that I g in the act. (Holy! Mackeral! Have I been d ing this for 13 years?) In reading about it the August 1948 *CQ*, it was interesting note that basically the contest has chang very little from the original rules. Herb a Larry certainly did a magnificent job wh they drew up the original set of rules.

This year's rules were in last month's iss with a brief run-down in the August CALE DAR.

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Remember we use the ARRL country list and the WAE country list for Europe. The latter was listed in the WAE contest rules in the July CALENDAR.

All scores will be published in the results, so be sure to send in your log, even if you did not put in the required 12 hours of operation to the eligible for an award.

You are expected to score your log and check for duplicate contacts and multipliers. Re-copied logs must be in their original form with duplicates crossed out and scoring corrections made.

Official log and summary sheets and Zone maps are available. (s.a.s.e. to *CQ*.) You can make up your own log sheets, 40 contacts to the page, and enter the Zone and Country multiplier only the first time it is worked. Use a separate sheet for each band. The summary sheet is very important, follow the ample in last month's issue.

Be sure to check W3ASK's PROPAGATION Column, George has a pretty high average.

Good luck, 73 for now, Frank, W1WY.

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inear [*from page 77*]

witched on, caused the final to draw too much current. The Heath HP-13 power supply starts a little more reliably if the amplifier is supplied with 32 volts battery bias. Actually the power supply does hesitate a bit if it is switched on to a fairly heavy load but it has not failed to start yet. One result of this situation is that the receiving end of the circuit hears quite a "thump" just as the transceiver is switched on to transmit. This is not evident with a battery bias supply.

If anyone can think of any way to get more mobile output for any less expenditure, I would like to hear about it. This unit is being used in a light aircraft for air-to-ground communications over some very rough flying country and the results are satisfactory. ■

---

eying Monitor [*from page 83*]

te stores, and other radio stores throughout the country. The writer's module was purchased from "Lafayette Radio Electronics Associate Store", 2014 N. Charles St., Baltimore, Maryland, at a cost of $3.50. Each module is supplied with an instruction sheet with a block diagram like the one shown in Fig. 1.

Construction

The first step in constructing the keying monitor is to select the components to be used with the module. Just about any speaker with an 8 or 10 ohm voice coil will do. A 3 inch Viking speaker with an 8 ohm voice coil was used but if the builder happens to have a 2 or 2½ inch transistor radio speaker on hand, this will serve the purpose just as well. A 3 volt battery supply was used in preference to the 1½ volts recommended by the manufacturer because the increased voltage gives a little more output. With a 1½ volt supply, the standby current is 80 microamp and the operating current is 10 milliamps, while with 3 volts, the standby current is 95 microamperes and the operating current 15 milliamperes. In either case, the Penlite batteries should last a long time. If you plan to use the monitor as a code practice oscillator also, it is a good idea to include a key jack on the front panel using a type of connector that mates with the plug on your key or bug.

The Minibox was first cut and drilled, then it was given three coats of Krylon spray paint, after which the lettering was put on with dry transfers. Three coats of clear Krylon spray are then used to finish off the box. Half inch rubber grommets cemented to the bottom of the box make good feet to prevent scratching table or desk tops. The module was mounted on a piece of terminal board using push in clips to make the connection.

Use

To check the operation of the keying monitor turn it on and plug a key into J_2. If a tone is heard in the speaker when the key is pressed, the monitor is wired properly and working. The pitch of the audio tone may be raised by putting a 500 ohm pot in series with the positive side of the battery and terminal *B* on the module but the audio output will be decreased somewhat by the added resistance.

For an r.f. pickup antenna, solder a 6 or 8 foot length of #20 plastic coated hook-up wire to a phone tip plug, and this into J_1. If you are running 200 watts or more on c.w., the chances are that you can hang the pick-up antenna anywhere in the general vicinity of your transmitter and the monitor will work. For lower powered rigs, either wrap a couple of turns of the pick-up wire around your transmission line, or make a small loop out of it and lay this loop over the tank circuit of your transmitter. The keying monitor is very sensitive, highly reliable and should provide years of useful service. ■

Dummy Load [*from page 52*]

can at your hardware dealers, or you can clean out a can which you have around with only a few dribs of paint left. Make sure the can is clean.

Drill the necessary holes in the cover to mount an SO-239 plug. Use enough heavy copper wire to attach the resistor group to the SO-239 and allow the resistors to be located close to the bottom of the can, when the cover is tightly in place. The photo shows the arrangement used.

As a safeguard we drilled a ⅜" hole in the can cover and put in a small cork which fit reasonably tight. The purpose of this is to provide a vent should you decide to "cook" the resistors and "boil the oil". Should pressure develop, the cork will act as a safety outlet.

With the resistors attached to the SO-239 plug, fill the can with mineral oil about three-quarters full and put the cover into place. If you wish, you can put the can in your refrigerator and cool the oil before you use the dummy load. This will give you about the maximum loading possible before it warms too much.

Hope you enjoy this project, as you can do everything with the simplest of tools and no workshop facilities. We know—we live in an apartment—and have our shack and workshop (???) in a walk-in clothes closet. ■

Puzzle [*from page 80*]

T	U	R	R	E	T	S	■	S	■	D	E	C	C	A
R	■	E	■	P	■	E	■	O	■	R	■	R	■	L
I	N	S	U	L	A	T	E	D	■	I	N	E	R	T
G	■	P	■	A	■	■	■	A	■	V	■	S	■	E
G	R	O	U	N	D	■	A	R	R	E	S	T	E	R
E	■	N	■	E	■	B	■	■	■	P	■	■	■	S
R	U	S	T	■	D	U	O	T	R	I	O	D	E	■
S	■	O	■	F	■	L	■	O	■	N	■	E	■	
■	B	R	O	A	D	B	A	N	D	■	A	C	M	
S	■	■	■	R	■	■	■	E	■	F	■	R	■	
M	I	S	M	A	T	C	H	■	S	L	E	E	V	
O	■	W	■	D	■	Y	■	S	■	A	■	M	■	
O	M	E	G	A	■	C	O	T	A	N	G	E	N	
T	■	E	■	Y	■	L	■	A	■	G	■	N	■	
H	O	P	E	S	■	E	■	T	W	E	E	T	E	

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Cage Antennas [*from page 18*]

horizontal types. Figure 6 gives the dimensions of one model that should be effective from 15 through 2 meters as shown by the Smith graph plot of fig. 7. Similar antennas can be dimensioned to cover other bands. The only problem with the vertical one is something common to all similar types and that is that the radiation angle increases with frequency. So while the antenna gives fine low radiation angle omnidirectional coverage on the lower frequency bands, it does not do this on the higher bands where it is equally desired.

Placing a reflector behind the vertical antenna with about 0.12λ separation produced about 6 db gain. However, because the reflector separation remained fixed as the antenna was operated on different frequencies, the bandwidth of the antenna became greatly restricted. The input impedance went through large variations with frequency as did the radiation pattern with the front-to-back ratio becoming very poor at the upper frequency limit of the vertical antenna. Because of these complications, no practical model for a broad-band directive vertical antenna could be developed.

Conclusions

The experiments conducted by the RCAF were probably the most extensive yet done on the high-frequency application of conical antennas. While not all the data developed has been presented here, the author believes that enough has been given to enable anyone interested in this type of antenna to plan a design to suit his needs. In spite of its somewhat greater constructional complexity, the broad band conical antenna offers many advantages of narrow-band antennas with separate transmission lines, switching arrangements, *etc*,, for general purpose amateur usage. ■

Current Overload [*from page 40*]

equipment. Aside from different basic means of circuit interruption, there are also protection devices available which operate on the same principles as discussed in this article but which have added features such a flags or blinking lights to indicate an open circuit. However, the basic fuse or breaker action must be chosen using the same considerations outlined in this article. ■

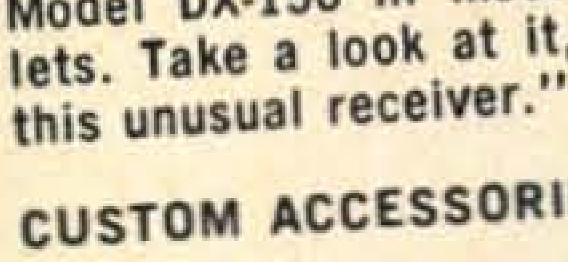
See page 142 for New Reader Service

No, we're not lazy! It's just that "Popular Electronics" (Dec. 1967) tells the DX-150 story so well.

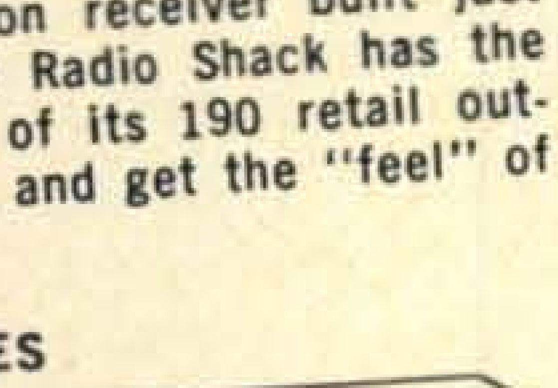
Reprinted Without Editing

"What may be the first really noteworthy advancement in communications receivers is wrapped up in the new Radio Shack imported DX-150. Featuring continuous coverage from the top of the AM broadast band (535 kHz) to the bottom of the 10-meter band (30 MHz), the DX-150 is a single-conversion superhet with a tuned r.f. stage, two i.f. stages, full-wave product detector for SSB/CW reception — and it's 100% solid state. Selling at $119.95, the DX-150 has the flexibility of a communications receiver that a ham or SWL is used to buying for $175-plus. To rattle off a few more "features": there is a front panel antenna trimmer, fast or slow a.v.c. attack, a cleverly concealed built-in monitor speaker, plenty of calibrated bandspread, and noise limiting in both the i.f. and audio stages. Because of the solid state circuitry, the usual warm-up drift expected with a tube-type receiver is virtually absent here. And, although the DX-150 is primarily a base station receiver with a 117-volt a.c. power connection, it can be operated from an outboard d.c. power supply consisting of only 8 D-cells. Radio Shack claims that the receiver will operate for 100 hours — continuously — using only the d.c. supply. Ideal for Field Day and emergency work! The proof of the pudding so far as any communications receiver is concerned is how well it works "on the air" At POPULAR ELECTRONICS, the DX-150 was hooked up to a 125-foot long-wire antenna and tuned across the AM broadcast band. Needless to say, the S-meter was pinned on just about every single channel, and the audio quality with Radio Shack's voice-selective speaker (extra, $7.95) was crystal-clear. Tuning .the band between 1.55 and 4.5 MHz, your reviewer got a chance to appreciate the comfortable handling on SSB reception. Going a little higher (4.5-13.0 MHz), the 25- and 31-meter bands were "alive" and signals appeared to leap out of the air — possibly and on the CB frequencies, the DX-150 could hold its own against a usually regarded as a lack of sensitivity, that wasn't the case with the DX-150. On the top band (13-30 MHz), the sensitivity still seemed high; and on the CB frequencies, the DX-150 could hold its own against a dual-conversion receiver built just for CB work. **Summary:** Radio Shack has the Model DX-150 in most of its 190 retail outlets. Take a look at it, and get the "feel" of this unusual receiver."

CUSTOM ACCESSORIES



12 VDC Power Set



Matching Speaker

And only Radio Shack has this 119.95 receiver!

Thousands of hams and swl's have discovered that Radio Shack's Realistic DX-150 is truly the "breakthrough" full coverage receiver of 1968. It's the 100% solid state receiver that *banishes forever* tube failure, tube heat, tube drift, and — thanks to its built-in 117V/12V supply — your dependence upon AC current when power fails or on field day. The brilliant DX-150 is NOW IN STOCK in every one of Radio Shack's over 200 stores.

CAVEAT EMPTOR

Since DX-150 is certain to be the world's most imitated communications product, we advise our readers that "solid state" on a receiver is not necessarily indicative of selectivity, sensitivity and "feel." The DX-150 is built to $200-$300 performance specifications; its modest $119.95 price tag simply designates the extent to which we have sacrificed traditional markup to establish REALISTIC as a quality line! P.S. — DX-150 is a hefty 14 lbs., with a 12¼" dial, extruded 11-control front panel, and 14¼x8¼x6½" in size. It's just the picture that's little! Our no money down policy makes the pain little, too!

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Please rush me the item I've checked below. Dept. XO
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☐ FREE 1968 Catalog ☐ Matching Speaker, 20-1500, $7.95
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★ **PLEASE include your ZIP code number on all correspondence** ★

Sylvia [*from page 59*]

The snow had stopped and the sun came out. We drove slowly through the village, on our way home. People walking about, children and dogs playing. We stopped the car, to take a photo of the church "Good day!" said the Vicar.

"A very good day to you, Vicar! I replied.

It was, too. ■

USA-CA [*from page 112*]

so perhaps I'll be getting a rush of applications—Hi.

Our good friend and County Hunter, John, K4BAI left May 14th for a 13 month tour of duty in Korea and is now active as HL9KQ. I am sure he would be pleased to hear from his County Hunter friends, write: Capt. John T. Laney, III, Hq., 2nd Inf. Divn., Office of the Staff Judge Advocate, Box 11, APO, San Francisco, Calif. 96224.

"Amateur Radio and the County Hunters lost a good friend when Pappy, WA9AJF passed on, due to a severe heart attack August 10. Read his "STORY" page 93 of November 1966 *CQ*".

A note from K6KQN, Vincent Chinn, 738 Washington St., San Francisco, Calif. 94108 to state that as of 6/16/68 he is QSL manager for an avid County Hunter, Ken, SM7TE. He requests that all QSL cards include *COUNTY* and be sure to send s.a.s.e.

Michael, W4NDX tells a nice story about how to be DX, as he operated in the Independent County Hunter Net on 14,336 kc from a 'rare' county, in the August issue of ham radio. How was your month? 73, Ed., W2GT.

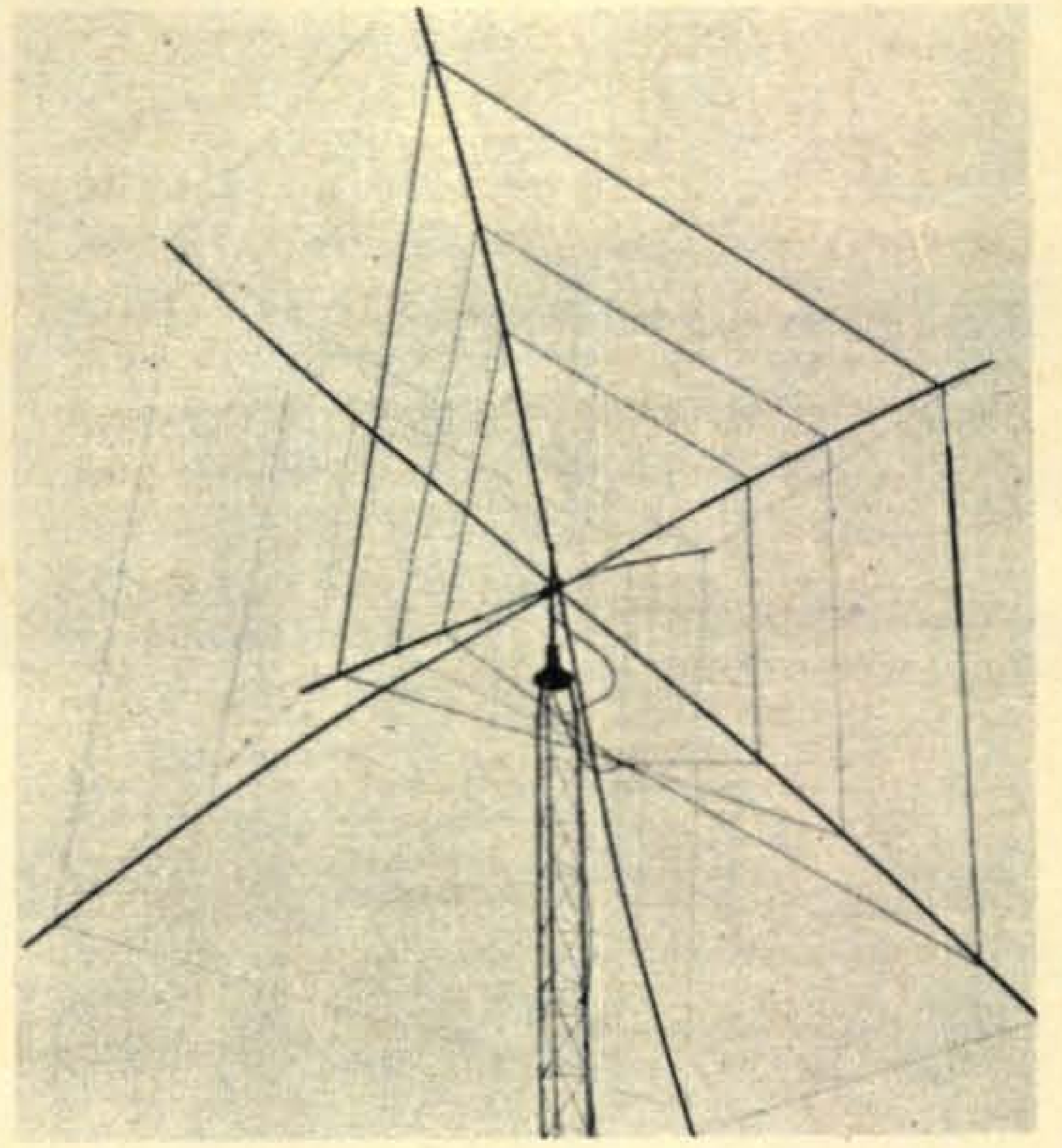
Signal Souper [*from page 34*]

to position 3 and advance the SENSITIVITY CONTROL until the neon lamp lights. Now back off the control until the neon goes out. The neon lamp is now in a condition ready to be triggered by an audio signal. If the B plus voltage is around 175 volts it may not be possible to actually fire the neon lamp with the SENSITIVITY CONTROL. In this case advance it to the maximum position. The S-S is now ready to operate.

With the SELECTOR SWITCH in position 1 the receiver operates normally and the S-S is bypassed. Carefully tune in a weak signal and turn the SELECTOR SWITCH to position 2. Now advance the REGEN. CONTROL until the

See page 142 for New Reader Service

Why the Reginair 321 Quad is Important to You!



WE'VE MADE NEW IMPROVEMENTS

Present day transceiver and transmitter designs require an antenna match with as flat a resonant response as possible. In the olden days a typical 500 watt rig required a relay rack and 500 pounds of gear. The physical spacing and voltage parameter of the tank circuits were such that one never worried about VSWR; indeed, that term had not yet been coined! Flash over and mismatch were laughed at and tolerated.

What a difference today! In a table top box scarcely 1½ cubic feet and weighing less than 50 pounds we find a modern sideband transmitter and receiver thrown in as well. Take a good look at the components: fixed capacitors smaller than ½ a postage stamp; a loading capacitor with .005 inch spacing; and transmitting tubes that are in reality TV horizontal outputs. These, then, are what you find. Do you wonder then why the manufacturer tells us we must operate into loads of 2.5 to 1 or better? Do you wonder then why the factory says to tune up in less than 30 seconds? Is it a surprise to you to find that new finals are required so quickly? Good engineering tells us that at 2.5 to 1 we have 20% of our forward power coming back to stay as circulating current and heat.

The danger comes into the picture because the average ham can't or won't confine his operation over that narrow spectrum where his antenna is in resonance and where his VSWR is less than 2.5 to 1.

Sure–new SSB designs are in the works: transceivers whose receivers will have variable selectivity; whose transmitters will use better tubes; rigs that can take more guff. But can you wait that long or afford that much money?

There is an alternative now–in fact, two choices. You can either be more mindful of the frequency tolerances of your setup, or better still, you can obtain one of our *Reginair Quads.* This is the only commercially available product that gives three-band operation with one 52 ohm feed line and absolutely guaranteed low, low VSWR over the entire 10, 15, and 20 meter bands.

Our new quad is constructed of all aluminum, each section insulated from the others. The hub of the quad is a virtually indestructible acrylomitrile butadiene styrene (ABC) which can withstand salt water and the atmosphere for years and years.

The quad is furnished complete with easy-to-understand assembly instruction, at only $89.95 FOB Harvard, Mass. Study the box score and see if this antenna isn't the answer to your operating and maintenance problems. You might even find that DXing can be fun now that you are hearing the rare one.

Forward gain over dipole	**5.9 db**
Forward gain over isotropic dipole	**8.0 db**
Front to back ration	**.25 db**
VSWR over 28-29.7 MHz; not more than	**1.5:1**
VSWR over 21-21.45 MHz; not more than	**1.5:1**
VSWR over 14-14.35 MHz; not more than	**1.5:1**
Maximum RF input	**2 kw**
Maximum mast dimension	**1¾" dia.**
Wind resistance	**4.5 sq. ft.**
Feed line	**52 ohms**
Outside dimensions	**18'x18'x12'**
Turning radius	**9½'**
Net weight	**35 pounds**
Shipping weight	**40 pounds**
Designed for 100 mph winds; ½ inch radial ice	
Frontal lobe	**75°**
Standard model price (FOB Harvard)	**$89.95**

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Woodchuck Hill Road, Harvard, Mass. 01451

"Helping Hams to Help Themselves"

signal increases. Retune the signal slightly to make sure it is peaked. A different peaking frequency may be chosen by changing the PITCH CONTROL switch. For maximum peaking and selectivity advance the REGEN. CONTROL until it is just under the point of oscillation. When the signal has been satisfactorily tuned in and peaked, turn the SELECTOR SWITCH to position 3. The signal should now trigger the neon lamp. The volume control on the S-S may now be adjusted to any desired volume without any background noise or interference. Tuning in a weak signal and running up the volume control on the S-S can result in quite a dramatic effect.

The operation of the DUAL SWITCH has been explained earlier.

Miscellaneous

Construction, wiring and parts layout are not critical. The *high* impedance winding on the Regeneration Transformer (T_1) is used as the primary, and the *low* impedance winding as the secondary. As in any transformer feedback circuit, if oscillation does not occur, reverse the leads on one of the windings. If a transformer other than a Triad A-31X is used then R_3 and C_6 *may* have to be changed for optimum operation.

The REGENERATION CONTROL can be advanced further without going into oscillation when the SELECTOR SWITCH is in position 3. This means the control must be backed off slightly when returning to position 2. There is a certain minimum signal strength below which the S-S will not operate properly. This will become readily apparent after short experimentation, and can be usually overcome by turning up the gain on the receiver slightly. ■

Vertical Antennas *from page 47*]

face. A shorted stub of air dielectric coaxial line of ¼ wave electrical length will be very close to an actual physical ¼ wavelength. However, considering the outer surface of the sleeve only as an antenna, because of its considerable diameter and low L/D ratio it should be shorter than a physical ¼ wave to be ¼ wave resonant. Thus an apparently irreconcilable fact exists, which is that a ¼ wave section of sleeve cannot be ¼ wave long, yet it should be for proper phase reversal. To assure satisfactory operation under this condition, the inner diameter of the sleeve should be much greater than the outer diam-

See page 142 for New Reader Service

OW... these great combinations from ARROW!

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e Model 410C Frequency Con- l Unit, designed for full cover- e of 80, 40, 20, 15 and 10 eters, is intended for fixed sta- n operation and plugs directly o Model 500C. It may also be ed with Model 350C. Eight nges, 500 kc each, 5 kc cali- ation.

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• 18 Isaac St., Norwalk, Conn. 203 – 838-4877

• 225 Rte. 46, Totowa, N.J. 201 – 256-8555 eter of the antenna conductor itself.[52]

A vertical colinear array should be so configured that it presents a suitable feedpoint impedance for connection to coaxial line either directly or through a simple matching network. One would not want to attempt to feed the bottom end of a ½ wave section directly, for example, for the impedance would be very high and hard to match. Bottom section lengths of ¼ wave or ⅜ wave, however, are of reasonable feedpoint impedance and can be easily matched. In the Mark III[51] a ¼ wave bottom section was used which was grounded and fed by the "gamma match" method as shown in fig. 46. Thus the antenna should be designed to consist of a number of ½ wave sections, over a bottom section of something less than a ½ wave for ease in feeding. If the antenna is to be self-supporting as was the Mark III, the grounded base design is an excellent idea, for it eliminates the problem of base insulation. With the coaxial sleeve design, other circuits such as lighting lines can be run right up inside the mast itself without worrying about isolation.

As with the Franklin Antenna, the tuned circuit isolation method and the coaxial sleeve method are both frequency sensitive. Since they depend on tuned circuit resonance and shorted stub resonance for phase reversal, a frequency change of more than five percent or so would be expected to degrade performance and cause considerable v.s.w.r. at the feed point.

Five percent would be adequate for coverage of the 7, 14 and 21 mc bands, but it would not be adequate for the entire 28 mc band, nor could one cover from 3.5 to 4 mc without readjustment of tuned phase reversal circuits or stub lengths. To sum it up, the vertical colinear array, since it depends on accurate ½ wave phase reversals, is not a multi-frequency antenna. It is excellent for a narrow band of frequencies, but it is not easy to readjust for frequency changes.

Part VI

The next in this series of articles will deal with broadband vertical antennas of various configurations. We use many of these at our Naval Communication Stations, because our frequency plans must be extremely flexible to allow for variations in propagation and distance to areas of desired coverage. In the past few years we have started using some special types on ships as well.

[*to be continued*]

See page 142 for New Reader Service

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Soldering [*from page 71*]

actly even with the far side of the copper area as shown in fig. 8 (R).

If a lead is not bent down to the foil area it should be clipped off about 1/16" above the copper. This method is a perfectly reliable way of construction but is just harder to handle and solder as when you turn the board over the component may fall out. Incidentally, this method makes a component removal far easier as is obvious.

One rule you should always follow is to clip your leads to length before soldering. By doing this you will completely cover any bare copper when soldering.

Soldering Techniques

Place the tip of the iron flat against the wire lead and foil and touch the solder to this point. As the solder melts, the solder stick is drawn smoothly around the cut end of the lead and back down the opposite side. Make sure enough solder is deposited to cover the area properly; lift the solder and iron smoothly directly away from the joint. Allow the solder to set and cool. Take the acid brush and scrub the joint with a liberal amount of alcohol to get rid of the rosin residue; wipe dry with a tissue. Be sure to inspect each joint as you complete it.

Printed Circuit Boards

A word about printed circuit boards is appropriate here. There are many different grades of printed circuit etching materials ranging from the impossible to the ultimate, as used in Mil Spec. or NASA Spec. work. The better kit manufacturers use a grade in the middle. Cost is a great factor in this selection. The best boards are the fiberglass base with the copper foil adhered by expensive processes. The phenolic cloth base and then the paper base boards are next in line.

Applying too much heat to the foil of a cheap board will almost invariably "lift" the foil off the board proper. A good grade of board will permit a measure of heat to be applied several times before failing. In any case the application of extreme high heat, such as can be achieved with a soldering gun, will break the bond between board and foil. Never hold an iron on printed circuit materials for extended periods of time. If you are botching the job it is better to stop, let the board cool, and start all over again.

Soldering to Terminals

Proper soldering to terminals is a matter of mechanics after you have mastered the soldering application techniques. One of the first things to forget is the old habit of wrapping a lead completely around a terminal. It is not needed to achieve a good solder connection, and can well interfere with achieving a good bond between terminal and wire surface. A tightly wrapped wire can very easily prevent the proper flow of solder between the coils of wire. Not only that, but when it comes to removing a component, a wrapped connection can be extremely difficult to get loose.

Examine the turret terminal first. This is shown in fig. 9. Note the method of attaching the lead. You tin the lead, bend it to shape around the terminal, cut it square across and then solder it.

If you are going to solder more than one lead to a terminal, get all the leads placed first and then solder the whole gaggle in one operation. By doing this you assure an even joint of homogeneous composition. If you solder by stages, it may turn into a joint that is separated by rosin layers or has contaminants layered in somewhere.

These same principles apply to the lug terminal or bifurcated terminals as shown in fig. 10. ■

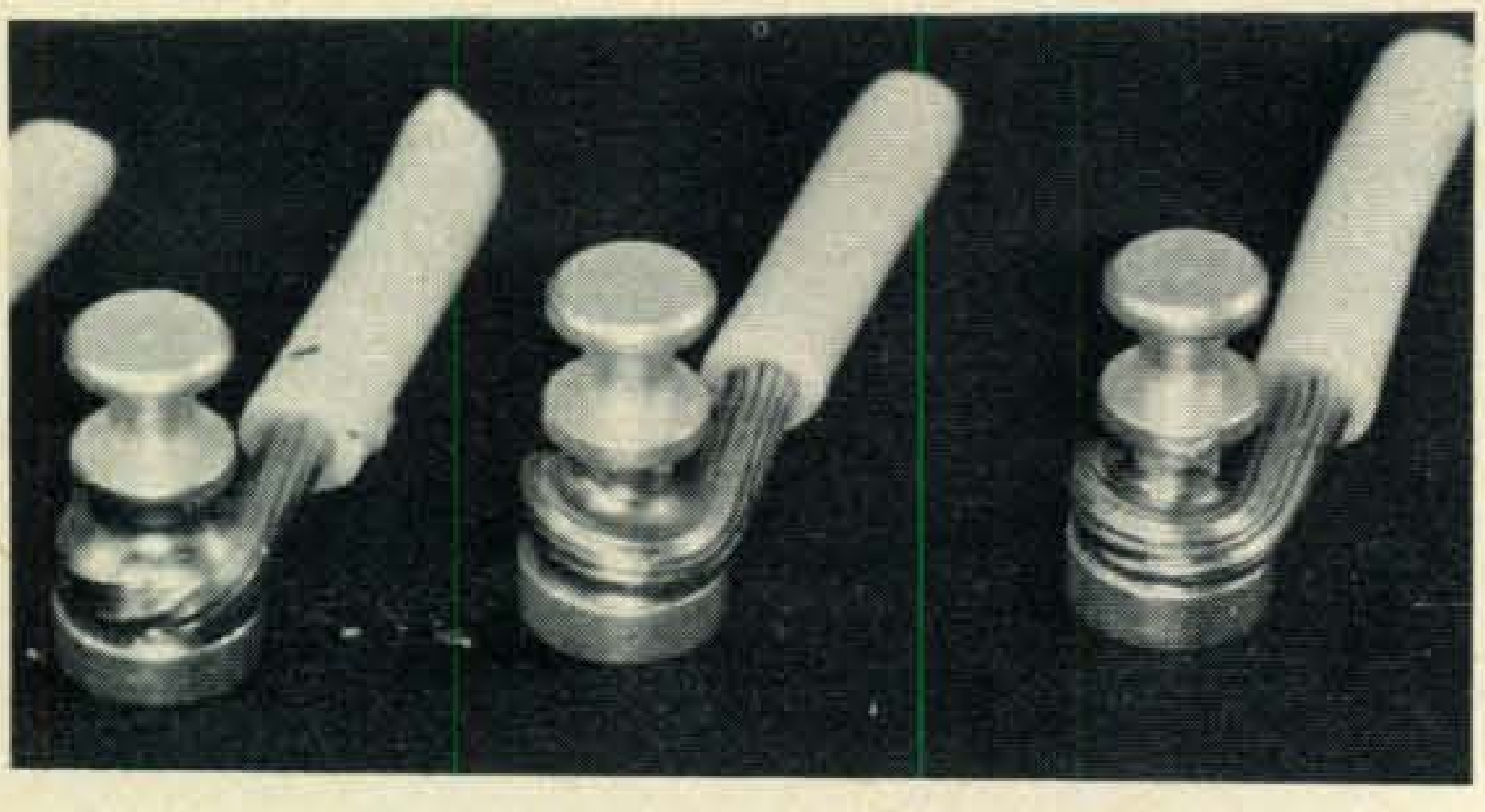

Fig. 9—Method of connecting to turret terminals. (L) Too much solder; (R) Too little; (C) Correct.

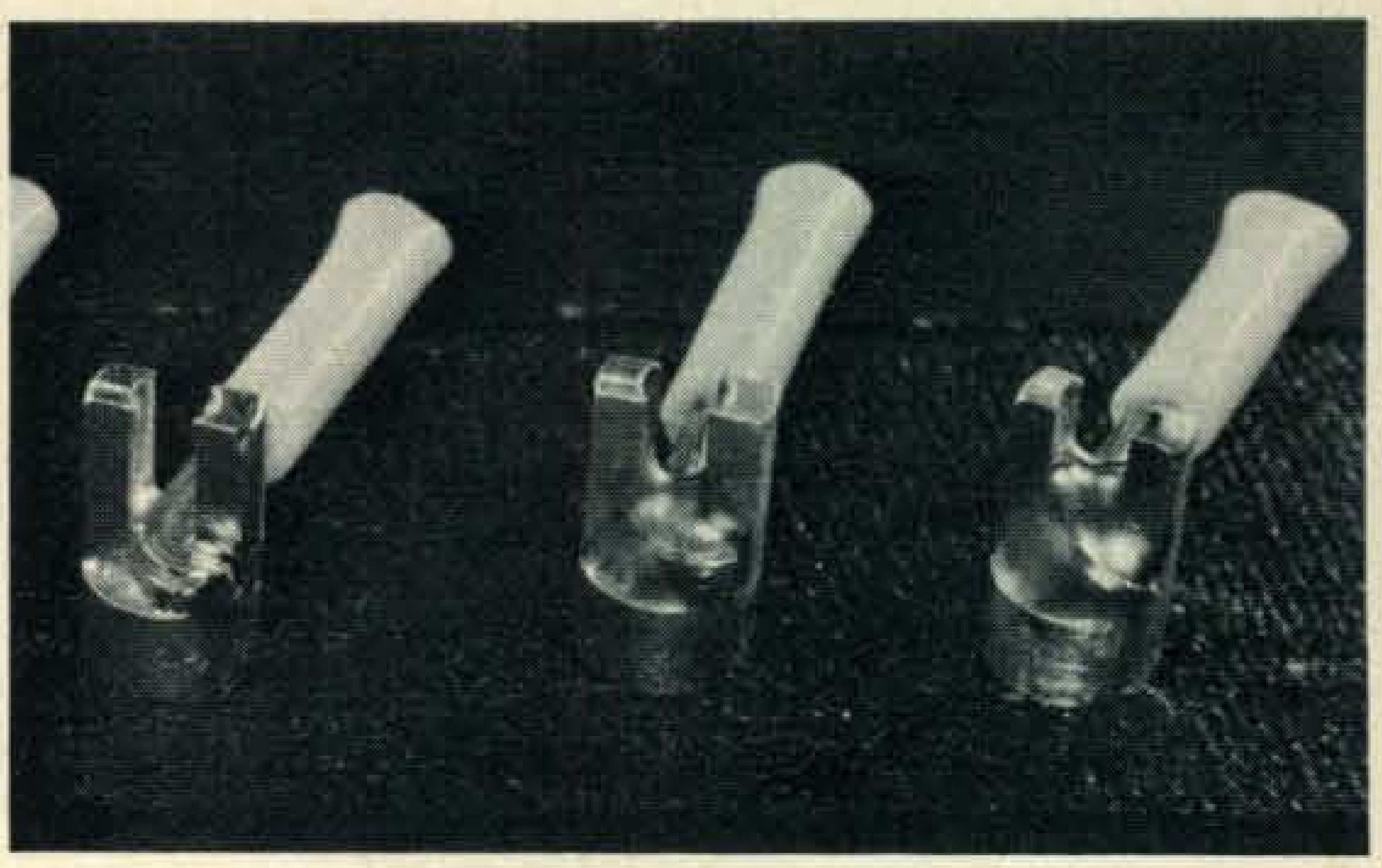

Fig. 10—Bifurcated solder lug. (L) Too little solder; (R) Too much solder; (C) Correct.

See page 142 for New Reader Service

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WANTED: A Motorola Uni-channel D or Sensicon G receiver strip for lo-band operation. Unit with "L" bracket is preferred. Schumacher, 12030 Washington Blvd., Apt. D, Los Angeles, Cal. 90066.

FOR SALE: HQ180C with speaker-make offer. Excellent cond. Wells Chapin, 2775 Seminole Road, Ann Arbor, Michigan 48104.

WANTED: Vibroplex Deluxe or Presentation. P. Powell, 100 McGee, Borger, Tx. 79007.

FOR SALE: HP522B rackmount 120KC. Digital counter, Excellent condx. Book. $225. FOB. Capt. Bohart, 1610 Shasta Dr., Colorado Springs, Colo. 80910.

SELL: HI-37, $185; 75A3, $235; Johnson Valiant $95; Lafayette HE30 $60; Lampkin 105B, $130; J. Wasiewicz, 4230 NW 10th St., Pompano Beach, Fla. 33063.

WANTED: QST, CQ and 73 mag. Good cond. Wide band scope, late model preferred. Model 28 rtty equip. 2 mtr. FM equip. unmodified. M. Jabara, 1354 Elm St., Plymouth, Mich. 48170.

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FOR SALE: Eico 753 SSB Xcvr, Eico 751 AC supply, and Eico 7117 Keyer. WAC, WAS, DX 120 with this rig. Highest offer. M. Carroll, 1836 So. Woodhaven Dr., Baton Rouge, La. 70815.

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SALE: Heath 10-21 Scope. demod. probe, Lafayette audio generator. $50. W. Karl, 24 Mill St., Cooperstown, N.Y. 13326.

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WANTED: Old battery receivers of the twenties as well as book magazines, parts, etc. E. Rasmussen, 164 Lowell St., Redwo City, Cal. 94062.

FOR SALE: Four crystals for operation of transm. or transc. quiring 5 mc crystals for crystal-control operation. $3 each. Ollodort, 1908 Vascones Dr., Hacienda Hgts., Cal. 91745.

WANTED: Manual or Schematic for DZ-2 direction finder. Chapman, 1367 Villa Rd., Brimingham, Mich. 48000.

WANTED: First issue of Ham Radio magazine, also Jan. '61 mag. J. Becker, 2435 Birchwood Lane, Wilmette, Ill. 60091.

KENNEDY Model 281 short-wave receiver. Will swap for Grebe generative receiver. IT. Turner, 301 Sabin St., Kalamazoo, Mi 49007

WANTED: CQ '46 Feb. also QST before '30. E. Guimares, 17 End Ave., Middleboro, Mass.

VHF'ERS Need '61, '62, '63 VHF'er magazine; need March 6-UP mag and all '65 issues; Need Dec. '61 The VHF Amate mag & Jan. '62 to July '62 also; VHF Horizons need Nov. ' Help Please. D. Etheredge, 12040 Redbank St., Sun Valley, C

FOR SALE: Eico 753 with SSVFO 2nd 751 power supply $1 National 270 SSB receiver like new $110. D. Platsis, 2161 Man Pl., Santa Clara, Cal. 95050.

SALE: Fair price T-60, NR-10B, Globe 755, Control Panel, a more. Contact. B. Molnar, 214 Cumberland Ave., Masontov Pa. 15461.

6N2 EICO 730, AC supply: All/$120. DX-100 w/Rtty FSK: $ Heath 5" scope. $20. TA-33Jr Triband Beam: $35. R. Johns 505 So. Elmwood, Waukegan, Ill. 60085.

FOR SALE: Brand new Collins 455KC mechanical filter 3.1 bandwith, type 455J31, serial 10P2 $30. J. Thomsen, 8280 T nessee Ave., Clarendon Hills, Ill. 60514.

ELECTRONIC KEYER for sale. EICO 717 with chrome plated de Vibro-keyer. Wired ready to go. New and under warranty. $ FOB. Jerome Kavanaugh, 283 E St., San Bernardino, Calif. 924

COMPLETE Amateur servicing. Kits wired tested. J-J Electroni Canterbury, Conn. 06331.

SELL HQ-180AC receiver $250 firm or trade for Heath SB-4 P. Herndon, 2212 NW 40th, Lawton, Okla. 73501.

FOR SALE: Galaxy 300, FB, $125. Will ship. WAØTOC, 1022 L St., Alexandria, Minnesota 56308.

FOR SALE: SX100-$180, DX60 $50, T150A $80, BW381 Electro TR switch $40, EV729 Mike with stand $10. All mint condx w manuals, Novice crystals and extra tubes. Complete pack $320. Carl Porter W1ZLX, 19 Penniman, Braintree, Mass. 021 843-9418.

MINT SB-300 CW&AM. Filters, speaker, $250. SB-400 $290, b $500. W6TRU, 5226 Vickie Dr., San Diego, Calif. 92109.

WANTED: HRO-500, state particulars first letter. W9FQX, 76 McGuire Ave., Klamath Falls, Oregon 97601.

FOR SALE: Knight T60 $35; Halli S120 Rcvr. $35; Like new Q-m $12; Also Want 6 and 15 meter coils for HRO-50. Chuck V 1207 Lockbourne Ave., Columbus, Oh. 43206.

FOR SALE: PL-172 new; one 4-200A. Unusual, make offer. CV Rtty converter $50. D. Morris, 5301 W. Highland Ave., Phoen Ariz. 85031.

FOR SALE: HW-12 with homebrew power supply and parts dynalab 40 and 20 conversion kit. $100. D. Halbakken, P.O. B 615, Fertile, Minn. 56540.

WANT TO BUY: Kits and factory made unworkable equipment t needs work. State make and models in first letter and c dition. G. Tate, 7 Artillery Rd., Taylors, S. C. 29687.

FOR SALE: Automatic CQ sender for use with inexpensive t recorder. Metal detector will sell or trade for good antenna. Coggins, 7235 Hunters Brance Dr., NE. Atlanta, Georgia, 303

SELL: Ameco TX-62 mtr with new spare final $100. Hammarl HQ110C $100. DK60GZC Dow Key relay as bonus if purcha together. Manuals for all. W. Meleske, 786 Grand Terrace A Baldwin, N.Y. 11510.

PROFESSIONAL Scope Heath op-1 for sale, also RCA WA- Audio Signal Generator. Want Model 28ASR or 32ASR. R. M delson, 27 Somerset Pl., Murray Hill, N.J. 07971.

FOR SALE: Gonset Communicator III, 6 meter. Excellent con $125. Granco FM Broadcast tuner, 115 volt. $10. P. Ballin 1331 Concord Ave., NE, Massillon, Ohio. 44646.

See page 142 for New Reader Servic

TY Typewriter Late, used, good condition. Underwood. All caps. 4.50 FOB Hathorne, P.E. Boniface, 13 Hazen, Hathorne, Mass 937.

LLINS Mobile fixed station complete. KWM-2 with 136B-2 noise nker; PM-2 supply; MP-1 supply; 351D-2 mobile mount; DL-4 d; MM-2 mike, factory new, never used, in original cartons. ced under dealer cost at $1396. Moudy, RT2, Box 60, 11-E, no, Texas 75074. Call 214-995-2382 for more info.

W integrated circuit keyer. Fully self completing. Built in AC pply and keying monitor. Ready for operation. $64.95. 200 cle plug in CW audio filter. 6DB gain. $24.95. Northwest mera Repair, 3119 Arcade Bldg., Seattle, Wash. 98101.

ROC Fourth annual National fun convention hosted by Southern vada ARC January 8-12, 1969, Hotel Sahara's new Space Contion Center. $12.00. Advance Registration accepted until uary 1, 1969, regular registration at door. Ladies program in n the Beachcomber. Technical seminars; ATV FM, MARS, RTTY, WA, WCARS-7255, WSSBA meetings. Golf and Bridge Tournants. SAROC registered participants entitled to special room e $10.00 plus room tax per night single or double occupancy, mittance to cocktail parties, technical seminars, exhibit area, tel Sahara's late show, Sunday Safari Hunt breakfast (equal any banquet—ask any SAROC veteran.) SAROC brochure planned November mailing QSP QSL card for details. Please send parate checks for accommodations and registration now if like to W7PBV c/o SAROC, Hotel Sahara, Las Vegas, Nevada 109.

ATH MARAUDER SSB Transmitter and Manual. In excellent dition. Shows no wear. Will personally deliver within 200 mile ius or ship in continental U.S. for $165 cash. DX-60, clean, 0.00. Jonn Randolph, 1690 Airways, Jackson, Tenn. 38301.

NTROL PANEL LETTERING (on Aluminum Foil) 5¢ word. Stamp call brings sample! SAMCO, Box 203, Wynantskill, N.Y. 12198.

L: SB-200 with spare finals $200. SB-400, $275. Make an er. SASE. Jim WB6MQE.

W!! Amazing New Invention makes automobiles theft and mper proof, for only $7.95! Protects car, contents, accessories. e brochure. Write today. International Distributors, Box 38-C, Monroe, Lousiana 71201.

KHZ Calibrator Markers from your 100KHZ calibrator; simply; te. Electronic parts list, cleaning up, send S.A.S.E. WØKPZ, 1038, Boulder, Colo. 80302.

SALE: Lafayette code oscillator and semi-automatic bug, both ether for $10.00; Also 14AVQ vertical antenna and roof mount, ether, not used, for $30,00. NEED instruction book for Mars 20 keyer, will borrow or buy. R. Nicodemus, RD#8, Greensg, Pa. 15601.

ST SELL new stereo equipment for school expenses. All ipment is new in factory sealed cartons. Sony 250-A (cost 5.) $100., Dual 1015 changer and base (cost $97.45) $70., en AT-400 40 watt stereo amp (cost $139.95) $95.00. All this new equipment in factory sealed cartons, full warranty. Used ateur Equipment Galaxy V $255, AC power supply $50. HQ-C $129., Heath TX-1 Apache $50., New Hy-Gain 14AVQ in facsealed box $30. New heavy duty self supporting 40 foot er $65. Martin Mitchell WA5HTF, 2128 B 70th Street, Lubbock, as 79412.

SALE: Drake 2B and 2BQ used very little $180. HT40 90 Watt ttr $40 or best offer. Vibroplex bug; best offer. Phone 201--5299. WB2GZL, 191 West Street, Closter, N.J. 07624.

SALE: Heathkit HX30 SSB Xmtter $140, HA20 Linear $50. ti-Elmac: AF68A Transciter, $185, PMR8 Receiver $130, 070 Pwr. Supply $40. Hammarlund HQ145 Receiver $100. eco 6M Converter $30, 2M Converter $30., Converter Pwr. pply $5. Lloyd Nelson, 1715 Hilton Ave., Apt. D. Findlay, Ohio 40.

THKITS: Experienced kit builder in Benton Harbor, Mich. a will build your Heathkits. J. Isham, 712 Marvin Ave., St. eph, Mich. 49085.

NTED: One UE572A tube in good cond. No substitute. L. ner, 2213 Sunland Ave., Las Vegas, Nevada 89106.

SALE: Plans & specs 40' crank up tower for under $40. Send P. Schelter, 1007 Janlee Dr., Burkburnett, Tex. 76354.

37 for Sale: Orig. owner, mint cond. Hear on air Sats. 1930Z, 70± 2.W7ZMG. Pick up only. $220. P. Holmes, 9733 Comanche ., Chatsworth, Cal. 91311.

SALE: Collins Mech Filter Type F455F05, 455 kc, BW 500 les. $10. California perforated cabinets 5½ wide, 8½ high, inches deep with panel. $5 ea. E. Marriner 528 Colima St., olla, Calif. 92037.

SALE: SX-111 DX-40 and SWR Bridge. In Good Shape. Write price. Leon Kirschemann, P.O. Box 633, Regent, No. Dak. 50.

SALE: Wheatstone oiled 15/32" Perforator tape for Bohme ipment. P. Lemon, 3154 Stony Point Rd., Santa Rosa, Cal. 01.

NTED: *OLD* Battery operated radios of the early 20's. Need have tubes or be in working condition. State price. D. Kenzie, 1200W Euclid Ave., Indianola, Iowa. 50125.

SELL Model 15 RTTY Model 14 TD, Model 14 Typing Reperforator. Package for $110. Pickup only. Sell TD and reperforator separate and ship FOB. WA4RGL.

ANTENNA EQUIPMENT: Vesto HPX-100-foot self supporting tower, $770. Telrex 20M546 5-element optimum spaced 20 meter beam, $385. Telrex A2675RIS rotator (with Telrex mast and cable, less control box.) $330. F.O.B. St. Louis, Missouri. G. Grothen, 90 Florissant Park Dr., Florissant, Missouri 63031.

WANTED: HRO-50 "A" coil, and VLF coils for Early HRO. Sell HRO-60 "A" coil, $15. R. A. Keuler, 331 Saratoga St., Chilton, Wisc. 53014.

DX AWARDS LOG—This 150-page book just published giving number and type of contacts needed for over 100 major awards for hams and SWLs by clubs world-wide includes cost and how and where to apply. Individual logs provided for each award to keep complete record of contacts and confirmations. Required over two years to prepare. Most complete and up-to-date source of DX Awards available. $3.95 postage paid ($4.95 foreign). The McMahon Co. (W6IZE), 1055 So. Oak Knoll, Pasadena, California 91100.

GONSET 6M 220 Watt Linear $70. Home brewed 6m exciter $20. Telrex 6MSR 11 element spiralray $50. Topaz transistorized 300 watt power supplies. C1OWDG $40, 300 XL $50. Kupfrian p.s. 12vdc-300vdc, 150 vdc $27. Clegg Thor VI w/6a.c. p.s./modulator, $149. Motorola 30D on 6AM w/transistorized modulator $25. Gonset #3012 (152-162 M.C.) #3011 (40-50 M.C.) tuners @ $15. FM-SCA background music adapter $35. Specially made Hy-Gain 6M center mounted chrome plated 2-ring halo w/23" chrome mast for body mounting $30 (XYL will love). Globe matchbox $8. Shielded ignition coil $20. 12AVQ $15. All F.O.B. Richard M. Jacobs, WAØAIY, 4941 Tracy, Kansas City, Missouri 64110. 816-HI4-1968.

SB-301, SB-401, Electronic keyer, Microphone, lowpass filter, Dummy load for $500. Steve Scott, Box C-6287, Lowry AFB, Colorado 80230.

WRL's used gear has trial-terms-guarantee! G28—$129.95; Comm II, 6 meter—$89.95; SR46—$94.50; HW12—$89.95; HW22—$89.95; SB33—$199.95; Galaxy III—$189.95; Galaxy V—$289.95; Galaxy V Mk 2—$329.95; Galaxy 300—$159.95; AF68—$69.95; HX50—$199.95; RME6900—$149.95. Hundreds more—free "blue book" list. Write WRL, Box 919, Council Bluffs, Iowa 51501.

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

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

QSL's — BROWNIE-W3CJI — 311 Lehigh — Allentown, Pa. 18103, Samples 10¢ with catalog 25¢.

PROTECT Radio gear with a warning sticker that reads "WARNING PROTECTED BY LECTRONIC ALARM SYSTEM" Same as supplied to commercial burglar alarm companies, 2" x 3½", yellow/green vinyl applies instantly without water to windows in mobile unit or operating shack. Also ideal for the back door of your house or basement windows. Money back if not satisfied 3/50¢ or 6/$1.00, prepaid. Order today from: CESR, 4 Parish Court, Stony Book, N.Y. 11790.

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HEATH SB-400, factory inspected, used only 10 hours, $275. Hammarlund HQ-180, exc. cond., $225. Deliver 50 miles or FOB. Hoshal, Box 191, Aberdeen, Md. 21001.

HEATHKITS: Experienced kit builder in Benton Harbor area will build your Heathkits. J. Isham, 712 Marvin Ave., St. Joseph, Mich. 49085.

WANTED: Old Battery operated radios of the early '20's. Need not be in working condx. State asking price. D. McKenzie, 1200 W. Euclid Ave., Indianola, Iowa.

CLEANUP: SSB-VHF-UHF gear excess my needs. Zeus, Bird, Test sets, 60-1296. List, Stamp. Spitz, 1420 S. Randolph St., Arlington, Va. 22204.

WANTED: To Trade-I need two 450mhz fm transmitter strips. I have two Motorola P-9020, 152-174Mhz. Transmitter strips. Very clean and unmodified. K. Seil, 66 Sharon Drive, Rochester, N.Y. 14626.

See page 142 for New Reader Service

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This Form Expires October 31st

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- ☐ Barry Electronics
- ☐ Cleveland Institute of Electronics
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Sirs:

Please send me information on the products and services which I have checked above.

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Advertiser's Index

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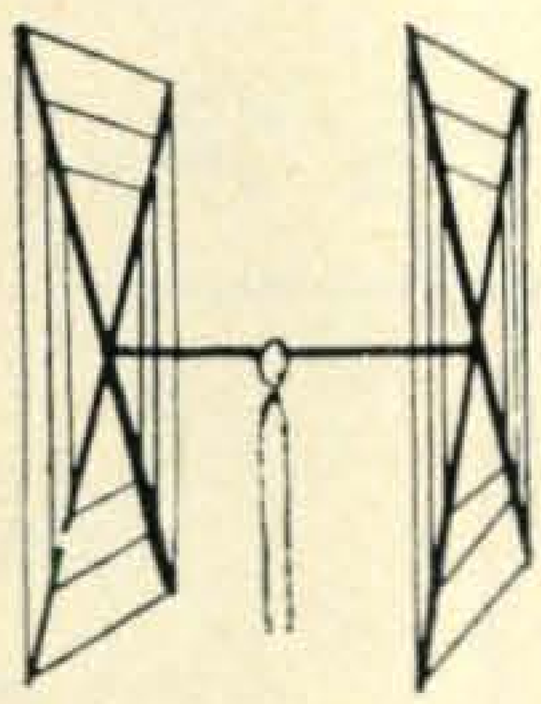
Worked 42 countries in two weeks with my Gotham Quad and only 75 watts... W3

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
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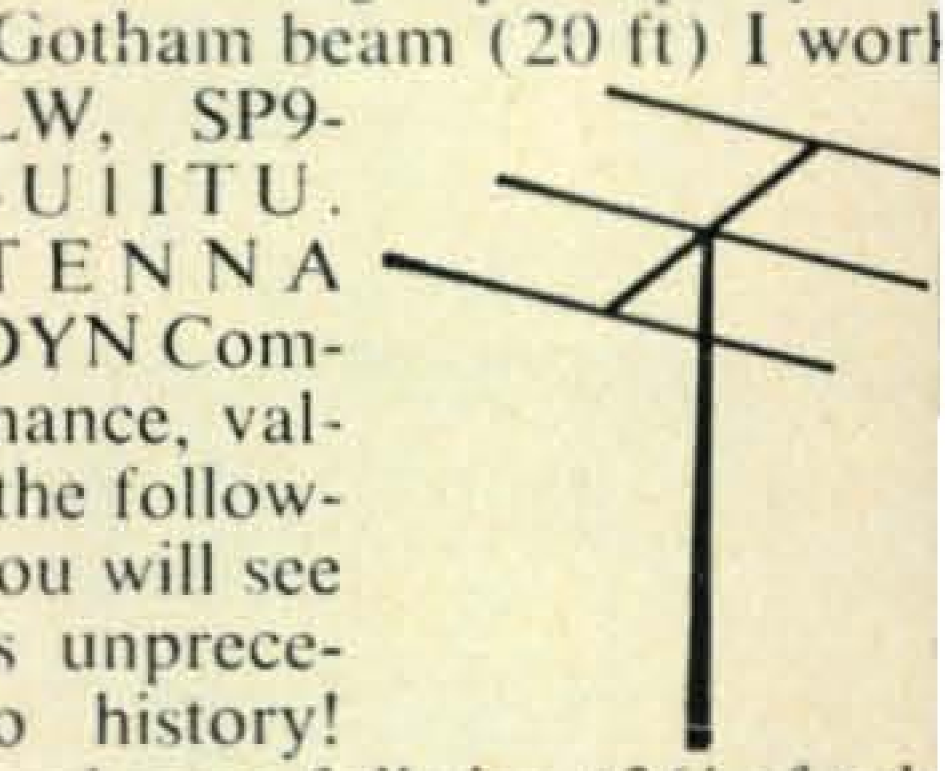
(all use single coax feedline)

BEAMS

The first morning I put up my 3 (ment Gotham beam (20 ft) I work 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 tub for *each* 20 meter element, for instance); solutely complete including a boom and all ha ware; uses a single 52 or 72 ohm coaxial fe line; the SWR is 1:1; easily handles 5 KW; and 1″ alumnium alloy tubing is employed maximum strength and low wind loading; beams are adjustable to any frequency in band.

2 EL 20	$16	4 EL 10	$
3 EL 20	22*	7 EL 10	
4 EL 20	32*	4 EL 6	
2 EL 15	12	8 EL 6	
3 EL 15	16	12 EL 2	
4 EL 15	25*	*20′ boom	
5 EL 15	28*		

ALL-BAND VERTICALS

"All band vertical!" asked one skep "Twenty meters is murder these days. Let's you make a contact on twenty meter phone v low power!" So K4KXR switched to twe using a V80 antenna and 35 watts AM. Her a small portion of the stations he work VE3FAZ, TI2FGS, W5KYJ, W1WOZ, ODH, WA3DJT, WB2FCB, W2YHH, V FOB, WA8CZE, K1SYB, K2RDJ, K1M K8HGY, K3UTL, W8QJC, WA2LVE, Y MAM, WA8ATS, K2PGS, W2QJP, W4J K2PSK, WA8CGA, WB2KWY, W2IWJ, V KT, Moral: It's the antenna that counts!

FLASH! Switched to 15 c.w. and worked K 1KN, KZ5OWN, HC1LC, PY5ASN, FG7 XE2I, KP4AQL, SM5BGK, G2AOB, Y CLK, OZ4H, and over a thousand other stati

V40 vertical for 40, 20, 15, 10, 6 meters	$14
V80 vertical for 80, 75, 40, 20, 15, 10, 6 meters	$16
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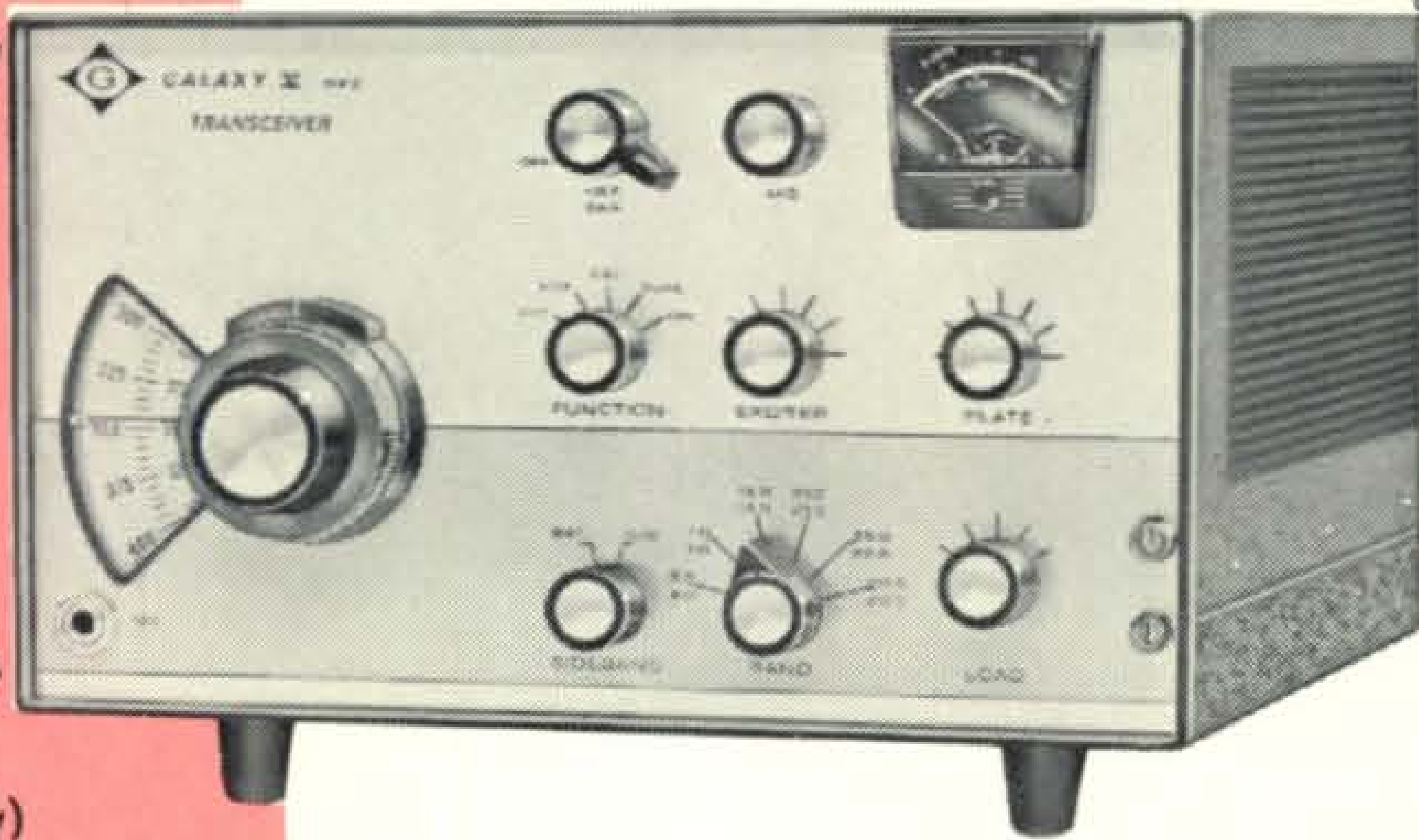

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GALAXY V MARK 3 500 WATT TRANSCEIVER

$420.00 Less Accessories

($22 Monthly)

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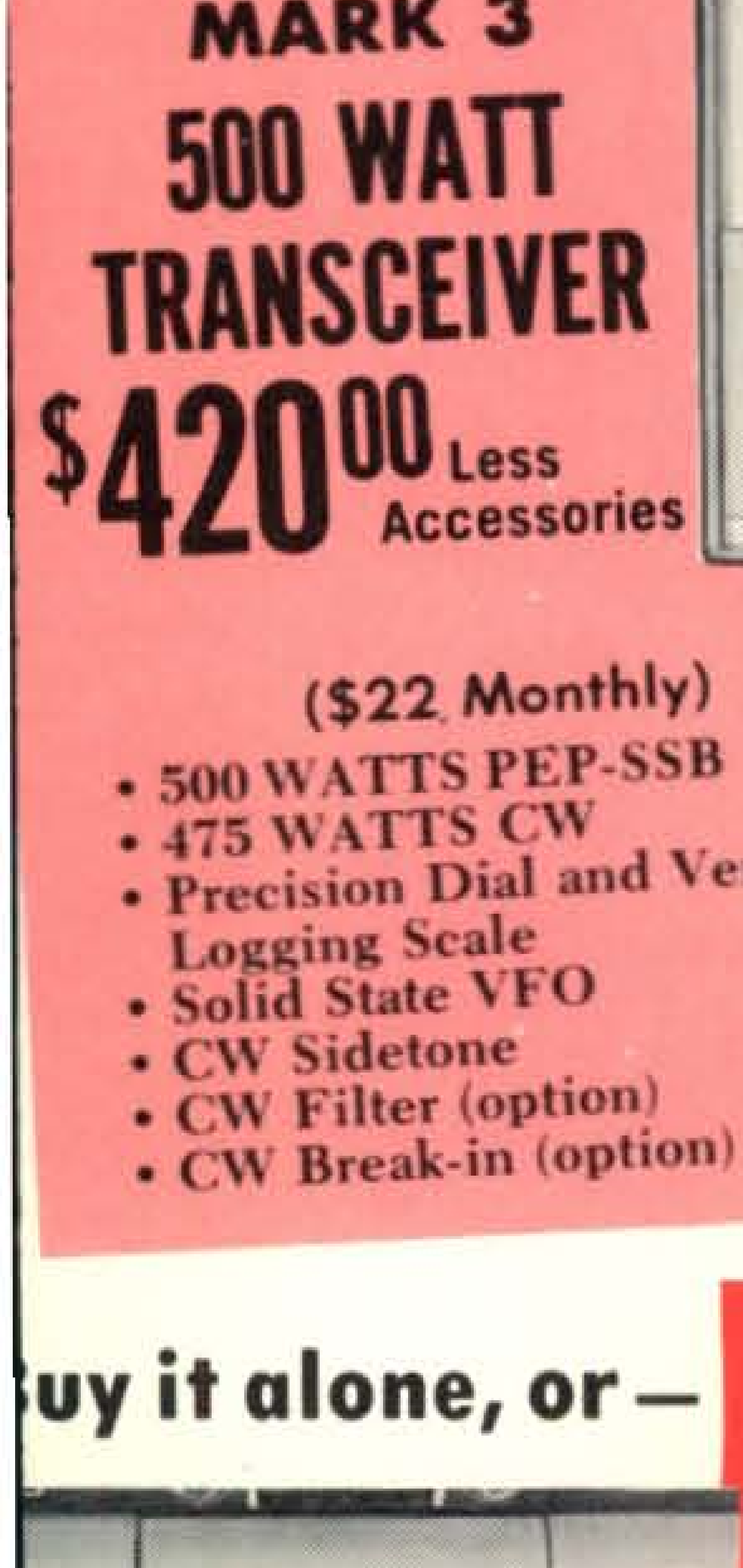

■ A deluxe Mobile Station — includes the new G1000DC mobile supply, New-Tronics "Hustler" antenna system, bumper mount, mini-mobile speaker, all plugs and cables.

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—OR, BUY IT AS A FIXED STATION PACKAGE

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Order No. ZZMA67 **$615.00**

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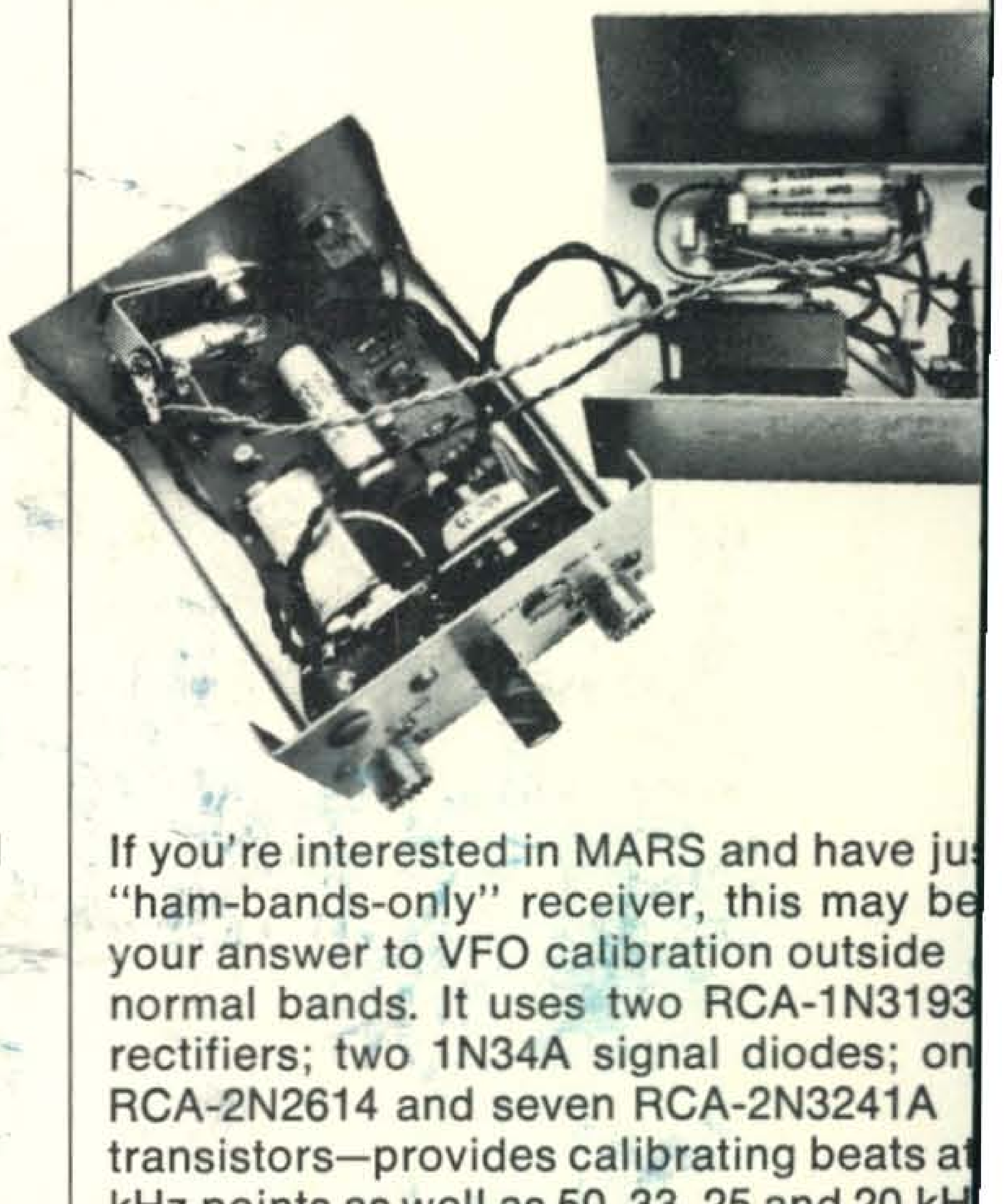
All listed RCA devices are available from your RCA Industrial Semiconductor Distributor

Build this VFO calibrator



If you're interested in MARS and have ju
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transistors—provides calibrating beats a
kHz points as well as 50, 33, 25 and 20 kH
Handy, too, for calibrating test equipme

Look in August 1967 QST or write RCA,
Commercial Engineering, Section F-15-
Harrison, New Jersey 07029 for August
"Ham Tips." RCA Electronic Componen
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