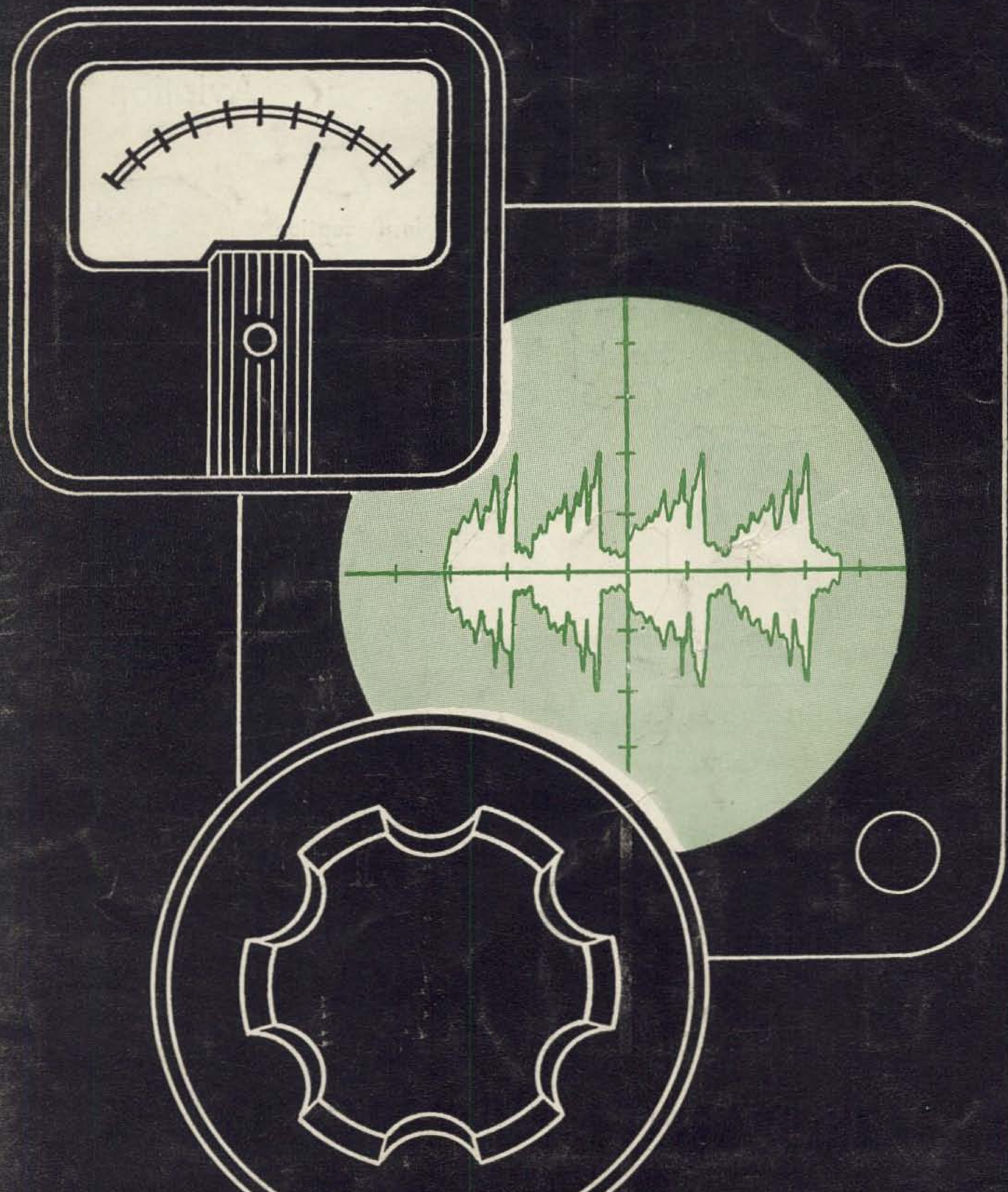
January 1962
37¢

73



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WE WISH YOU A HAPPY NEW YEAR

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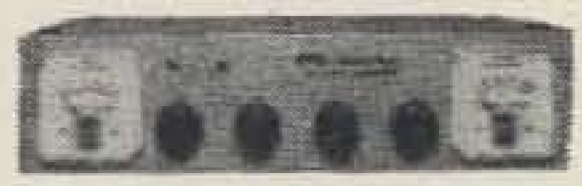

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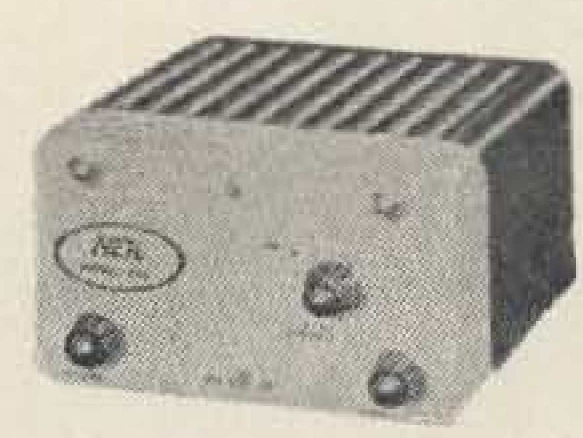

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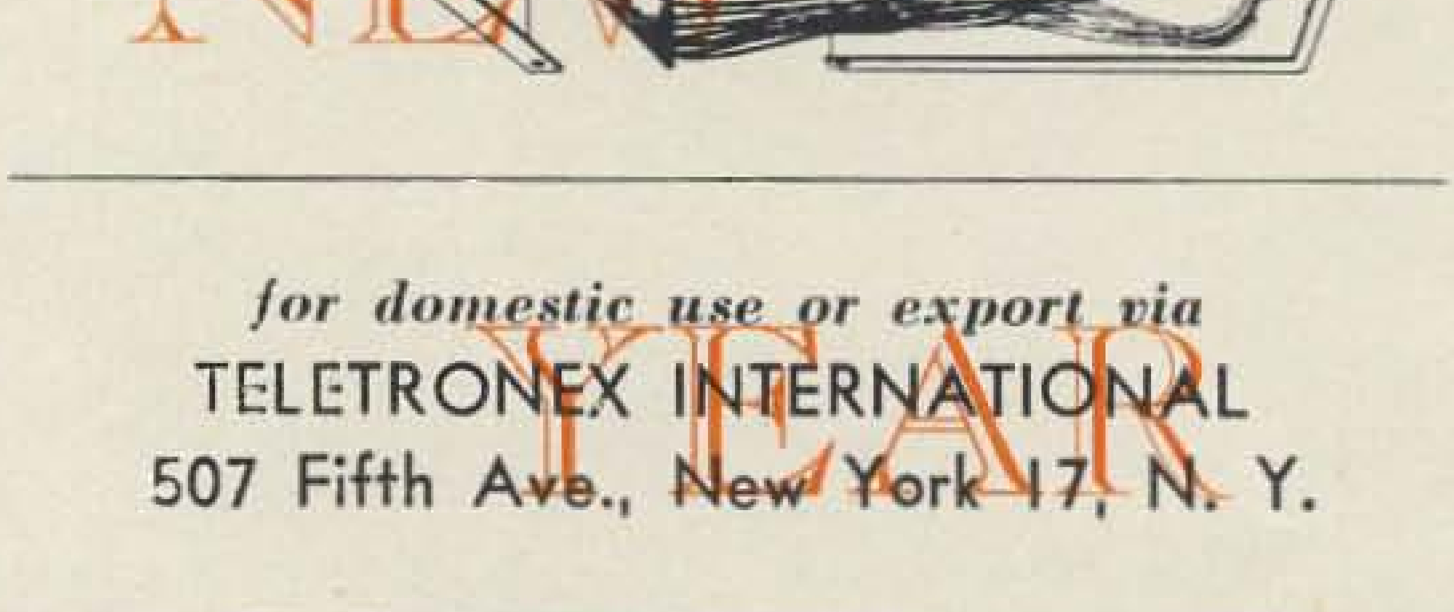

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RIVER CAMPUS STATION ROCHESTER 20, N. Y.

73 Magazine

January 1962 • Vol. II, No. 1

1379 East 15th Street—Brooklyn 30, New York

Wayne Green W2NSD—Editor, etcetera

Phone: DE 6-8880

CONTENTS

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Misc. & Short Items:

73 Magazine is published monthly by Amateur Radio Publishing, Inc., 116 Main Street, Norwalk, Connecticut. Please note that the address of the business office where you are to send all correspondence, subscriptions, submitted articles, etc., is at the top of this page. The telephone number is there too and we dare you to try to get it from the phone company. Subscription rates, while covered rather completely in the regular subscription ad, are: U.S.A. and possessions, APO, FPO, Canada and Mexico; one year for $3.00, two years $5.00, three years $7.00. Foreign: one year $4.00. Second Class postage paid at Norwalk, Connecticut. Printed in the U.S.A. Entire contents copyright 1962 by Amateur Radio Publishing, Inc. Postmaster: Please send form 3579 to 73 Magazine, 1379 East 15th Street, Brooklyn 30, New York.

. . . de W2NSD

. . . never say die

While I must admit to liking being agreed with, there is a negative side to the situation: Suppose I get accustomed to a diet of compliments and shy away in the future from anything that might tend to be irritating? Then where will you be? It gets pretty monotonous every month wagging your head up and down as you read an insipid editorial. Wouldn't you rather run in to the XYL, magazine in hand, and say, "Look what this nut Green wrote this month!"

This is not to suggest that you needle me either, for I can safely brag of some of the most delicate feelings in the entire publishing industry and I may stop writing altogether if attacked. You should always remember that if I chance to write something that you disagree with that I admit that most of the time that I'm talking through my hat and that no one really takes me seriously.

So, in the spirit of fun and irresponsibility let's see where we left off last month.

The November discussion of conventions brought in quite a bundle of mail, and all of it in agreement with my suggestions. Some of them backed up my contentions with facts and figures. I'm not suppressing the opposition, there just hasn't been any.

The December spiking of the anti-communist warmongering of the Anti-Communist Amateur Radio Network snowed me with agreeing letters, official and personal. I was surprised to find so many fellows in high places read the editorial and then put themselves on record that way. It bodes good for the country. Maybe we'll last longer than I think.

Positive action is better than negative. Make it your business, whenever you are in contact with a DX ham or operating where DX hams can hear you, to be as polite as possible. Show an interest in something other than a QSL card. Ask about ham conditions there, and about what he does, etc.

Have you written about the reciprocal licensing bill yet? I hate to be a bore about this, but I *know* what a difference this is going to make when we are back in Geneva discussing ham allocations.

Newsstanding 73

Not being completely content with remaining the third magazine in a three magazine market, we have had visions of improving our lot. The foundation was laid last December when we arranged with a small national newsstand distributor to find out whether 73 would sell on the newsstands. We knew from past experience that the best we could hope for was a 65% sale and that most publishers are quite content with 50%. We offered up 3000 copies a month, not really expecting anything but our worst fears to be realized.

The first issue sold 75%, and from there the percentage rose as high as 92%, averaging about 80%. There was obviously no question about 73 being a good newsstand seller. Next we faced the problem of financing a substantial newsstand expansion. This was difficult for there is a three month wait before any money starts coming back. This is not an inconsiderable figure when you add up the cost of even a cautious start of 20,000 extra copies per month times three. Financing was finally arranged (I watched sorrowfully as K2GZO drove off in my 1959 Porsche).

This step increases our circulation from the present 40,000 to between 55,000 and 60,000, depending upon the newsstand percentages. Such a rise in circulation puts our present ad-

CONTRACT

UNBREAKABLE IRREFUTABLE IRON-CLAD

ALL ye present, be it known that the Undersigned, being of passably sound body, mind and wind, doth this day agree to embark on the profitable practice of peddling his wares, services, or any recognizable agglomeration thereof, in a gazette called "73."

THE publisher of this pot-boiler (sheet), heretofore, herenow, and hereinafter known as Wayne Green, doth assure me that I would be Sorely Vexed, Ill Humoured and Bereft of Reason if I failed to Advertise my sundry wares, services, or any agglomeration thereof in his rag which he describes variously as a Journal of Great and Rare Charm and Refreshing Impertinence. He doth further allege that it has the virtue of having an Abundance of Readers.

BE IT therefore known that I hereby firmly state and attest to my unshakable decision to advertise in said publication, published by said publisher, six or twelve times during the Year of Our Lord 1962 (A.D.), unequivocably. The scrivening proprietor of this sheet piously assures me that the more times my wares are presented in a year, the greater amount of pelf will accrue to me. He also assures me that this agreement cannot be broken unless I Change My Mind, wherein said pelf will quickly unaccrue and serious doubts will be muttered about the editorial offices of said publication as to the continued sound mind of the agree-ee.

QUAKINGLY, in witness thereof I do hereinunder give my legal signature or mark which shall make this instrument legal and binding on myself and/or the company or corporation which I represent.

Date: ____________________
(Careful, we have a calendar too)

Signature ____________________
Pseudonyms will avail you naught.

——Six times.
——Twelve times.

Company ____________________

LAFAYETTE RADIO
WORLD WIDE STATION FOR AMATEUR EQUIPMENT

THE LAFAYETTE HE-30
Professional Quality Communications Receiver

99.50

- TUNES 550 KCS TO 30 MCS IN FOUR BANDS
- BUILT-IN Q-MULTIPLIER FOR CROWDED PHONE OPERATION
- CALIBRATED ELECTRICAL BANDSPREAD ON AMATEUR BANDS 80 THRU 10 METERS • STABLE OSCILLATOR AND BFO FOR CLEAR CW AND SSB RECEPTION • BUILT-IN EDGEWISE S-METER

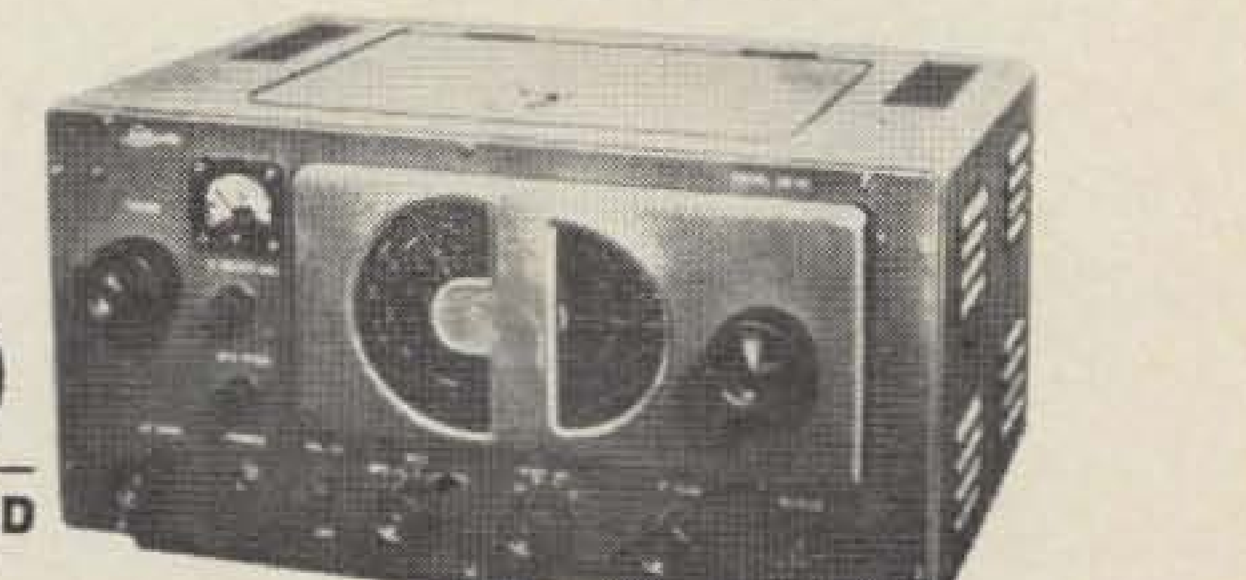
Sensitivity is 1.0 microvolt for 10 db, Signal to Noise ratio. Selectivity is ± 0.8 KCS at —6db with Q-MULTIPLIER. TUBES: 6BA6—RF Amp, 6BE6 Mixer, 6BE6 OSC., 6AV6 Q-Multiplier—BFO, 2-6BA6 IF Amp., 6AV6 Det-AF Amp. ANL, 6AQ5-Audio output, 5Y3 Rectifier.

TOP VALUE COMMUNICATIONS RECEIVER

NO MONEY DOWN

KT-200WX in Kit Form **64.50**

HE-10 WIRED AND TESTED **79.95**



• SUPERHET CIRCUIT UTILIZING 8 TUBES AND RECTIFIER TUBE • BUILT-IN "S" METER WITH ADJUSTMENT CONTROL • FULL COVERAGE 80-10 METERS • COVERS 455KC TO 31 MC • VARIABLE BFO AND RF GAIN CONTROLS • SWITCHABLE AVC AND AUTOMATIC NOISE LIMITER

The Communications Receiver that meets every amateur need—available in easy-to-assemble kit form. Signal to noise ratio is 10 db at 3.5 MC with 1.25 microvolt signal. Selectivity is —60 db at 10 kc, image reflection is —40 db at 3 MC. Tubes: 3—6BD6, 2—6BE6, 2—6AV6, 1—6AR5, 1—5Y3.

New! LAFAYETTE HE-45 DELUXE 6-METER TRANSCEIVER

- Highly Sensitive Superheterodyne Receiver Section for 50-54 Mc
- Effective Series Gate Noise Limiter
- 3-Stage, 12-Watt Transmitter with 2E26 Final
- Illuminated Panel Meter for Plate Current and "S" Readings
- Pi-Network Transmitter Output
- Built-in 117 VAC and 12 VDC Power Supplies
- Push-To-Talk Ceramic Microphone

Provides maximum convenience and flexibility in either mobile or fixed operation.

NO MONEY DOWN

LAFAYETTE HE-50 10-METER TRANSCEIVER
Similar to above except for 10 meter operation **109.50** MADE IN U.S.A.

LAFAYETTE HE-34 SWR AND FORWARD POWER METER 16.95

- Reads SWR and Relative Power Output up to 1 KW
- For Continuous Use in 52 Ohm Lines
- Switch Selects SWR or Forward Power—No Reversing Necessary
- Highly Compact—Only 2½x5x2½"

The ideal aid in adjusting beams, trap antennas, matching networks, etc., or for tuning transmitters for maximum output.

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NO MONEY DOWN

39.95 2-For-78.88

- 9 Transistors plus Diode and Thermistor
- Transmits and Receives up to 1.5 Miles
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- Uses Inexpensive Penlight Batteries
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☐ Send FREE 1962 Catalog 620 featuring the full line of Lafayette Amateur Equipment
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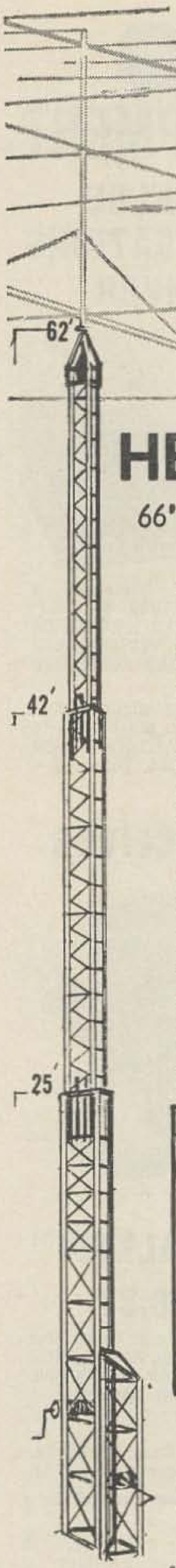
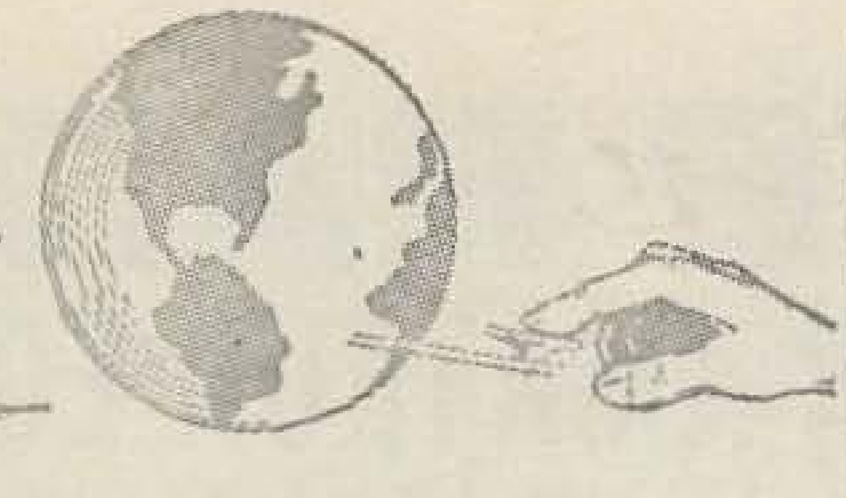




THE WORLD AT YOUR FINGER TIPS with "66"

HERCULES 66

66' —THE MAGICAL HEIGHT

There is a world of pleasure and peak performance awaiting the amateur at the magical height of 66'.

The Hercules "66" puts you in this area of optimum performance and is designed to *keep you on the air in winds up to 60 MPH!* Unbelievable but true . . .and best of all, *No Guys!*

This super tower is designed to support the heaviest beams or stacked arrays. See chart below.

LOAD	HEIGHT	WIND
4 el. 20M	66ft.	70
4el. Duo-band	66ft.	70
6 el. Tri-band	66ft.	70
STACKED ARRAYS		
2 el. 40M	72ft.	60
6 el. Tri-band	63ft.	60
3el. 10M full	77ft.	60
3 el. 15M full	70ft.	60
3 el. 20m full	63ft.	60

TORBZ 66-3G $985.00

Price includes Tilt-over post and worm gear drive winches. Mast extra.

2" O.D. MAST

1 Beam 8ft.OD x .156 wall $15.00
2 Beams12ft.OD x .156 wall $21.00
3 Beams 20ft. OD x .250 wall $55.00

E-Z WAY TOWERS, Inc.

P.O. BOX 5767 TAMPA 5, FLORIDA

vertising rates into a state of advanced decay, for they are based on 20,000 circulation. With regret we therefore announce a small increase in our ad rates, effective January 1, for all firms not on formal signed contract at the old rates.

Promotions

Some of our promotional ideas have been applauded by the advertisers and I thought you might be interested in seeing some of them. You see, I have to fill in between my monthly cajolling phone calls to advertisers with something to help keep us in their mind. Last year prospective advertisers received a 7" x 10" envelope. The paper inside, when opened up, was 68" x 48" and said in great big letters, "PLEASE FIT 73 IN YOUR 1961 AD BUDGET." We made this by cutting out a stencil the same size as the paper and then spraying paint on press sheets from the printer. The whole operation cost us about $10 for the paint and postage. It was impressive enough so one prospective advertiser said later that he wasn't going to advertise with us because he knew what it must have cost to put out a thing like that and he didn't want to spend his money with people that would waste it.

This year we sent out dart sets with special printed targets. This cost us a little more, but not much. Here, somewhat reduced, is the target.

We followed up the dart game with a special contract form. This was made a little more interesting than the run-of-the-mill contract to point up the new and higher ad rates which go into effect January 1st. The printer had a ball running this one off for us. As a matter of fact, I talked Head Man Hauser into writing the flowery prose for me.

(Turn to page 84)

your choice of 2 GREAT EICO® TRANSMITTERS...

designed by Hams... for Hams...

to the highest Ham standards

90-WATT CW TRANSMITTER* #720
Kit $79.95 Wired $119.95
*U.S. Pat. #D-184,776
"Top quality"—ELECTRONIC KITS GUIDE
Ideal for veteran or novice. "Clean" 90W CW, 65W AM-phone with EXT plate modulation. 80 through 10 meters.

60-WATT CW TRANSMITTER #723
Kit $49.95 Wired $79.95
"Compact; well-planned layout. Clean-sounding, absolutely hum-free carrier; stable." — ELECTRONICS WORLD.
Perfect for novice or advanced ham needing low-power standby rig. "Clean" 60W CW, 50W AM-phone with EXT plate modulation. 80 through 10 meters.

TRANSISTOR CODE PRACTICE OSCILLATOR #706
Complete with battery Select variable tone, flashing light, or both together. Phone jack for private use. Efficient speaker: clean loud signals.
Kit $8.95 Wired $12.95

New! CITIZENS BAND WALKIE-TALKIE #740
Complete with rechargeable battery and charger. 9 transistors, 1 diode. Full superhet. U.S. made.
Kit $54.95 Wired $79.95

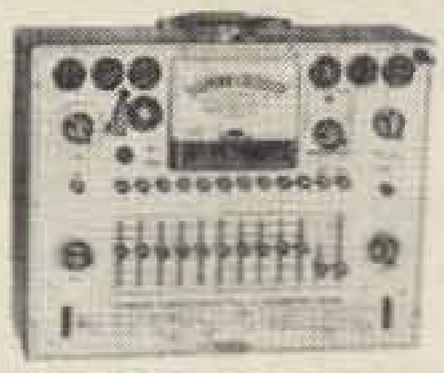
CITIZENS BAND TRANSCEIVERS
Superhet; prealigned xmitter osc; match different antennas by variable "pi" network. Single & multi-channel models.
From Kit $59.95 Wired $89.95

HIGH-LEVEL UNIVERSAL MODULATOR-DRIVER #730
Kit $49.95 Wired $79.95
Delivers 50W undistorted audio for phone operation. Can plate-modulate transmitters having RF inputs up to 100W. Unique over-modulation indicator. Cover E-5 $4.50.

GRID DIP METER #710
Kit $29.95 Wired $49.95
Includes complete set of coils for full band coverage. Continuous coverage 400 kc to 250 mc. 500 ua meter.

PEAK-TO-PEAK VTVM #232 & exclusive *UNI-PROBE®
Kit $29.95 Wired $49.95
VACUUM TUBE VOLTMETER #221
Kit $25.95 Wired $39.95
*U. S. Pat. No. 2,790,051

DC-5MC LAB & TV 5" OSCILLOSCOPE #460
Kit $79.95 Wired $129.50
5" PUSH-PULL OSCILLOSCOPE #425
Kit $44.95 Wired $79.95



DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666
Kit $69.95 Wired $109.95
TUBE TESTER #625
Kit $34.95 Wired $49.95

RF SIGNAL GENERATOR #324 (150kc-435mc)
Kit $26.95 Wired $39.95
TV-FM SWEEP GENERATOR & MARKER #368
Kit $69.95 Wired $119.95

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3300 NO. BLVD., L.I.C. 1, N. Y.
Export Dept., Roburn Agencies, Inc. 431 Greenwich St., N. Y. 13, N. Y.

73-1
EICO, 3300 N. Blvd., L.I.C. 1, N. Y.
☐ Send free Catalog & name of neighborhood distributor.
☐ Send free "Short Course for Novice License." ☐ Send 36-page STEREO HI-FI GUIDE: 25c enclosed for postage & handling.

Name..........
Address..........
City.......... Zone.......... State..........
Add 5% in the West.

ENGINEERS: Excellent career opportunities in creative electronics design. Write to the Chief Engineer.

from

davco

Model DR30 Communications Receiver

An outstanding high-performance receiver designed specifically for maximum communications effectiveness in amateur applications. Sensitivity of better than 1.5 uv ; premium RF stage and low-noise mixers produce results comparable to tube-type receivers costing much more. Double conversion: xtal-controlled first oscillator; first (variable) IF at 2.5-3.0 mc.; second IF at 455 kc. for excellent image rejection. Precision tuning oscillator has encapsulated Hi-Q toroidal L components, temperature compensation, amplifier-buffer stage and separate voltage supply for maximum frequency stability. Combination of transformers and ceramic transducer elements in second IF provides excellent selectivity characteristic for hi-fi AM and SSB, easy net operation and, with DQ-1 Q-multiplier, fine CW reception; 2.1 kc. mechanical filter provides maximum usable selectivity for SSB and exalted-carrier AM reception even under the most difficult band conditions. More than adequate audio output for mobile or fixed use. Convenient tuning rate and control arrangement for maximum operating ease and comfort. Provides injection voltages from high (xtal) conversion oscillator and xtal BFO-carrier generator, and mechanical filter, for use with DT20 transmitter-exciter. Reliable high-quality components throughout. Designed to the standards of discriminating SSB operators, yet also the perfect buy for Novice CW and for fixed and mobile AM operation.

DR30 receiver complete with crystals and mechanical filter $289.50

DR30a same as DR30 but less mechanical filter and BFO-carrier generator crystals. Ideal for most AM use and, with DQ-1, Novice CW $229.50

Step-up kit—converts DR30a to DR30 .... $ 62.00

DQ-1 Q-multiplier unit. Contains effective Q-multiplier, AC supply for DR30, speaker, battery holder for portable use. Thin-line design; may be permanently attached to receiver or used elsewhere $36.00

FEATURES

- covers ham bands 80-10 meters, plus **calibrated** coverage of any three 500 kc. segments for Citizens' Band, MARS, SWL, etc. with accessory crystals or VHF with converter.
- standard-equipment 9.5-10 mc. WWV band also covers popular SWL band.
- built-in crystal calibrator with front panel correction.
- 50 kc. overlap eliminates bandswitching in operating DX portion of 10 meters.
- crystal-controlled **and** variable BFO for upper and lower sideband and for CW reception.
- built-in Conelrad monitor, independent of receiver tuning. Switch selects BC listening and tuning or momentary monitoring of pre-chosen BC station.
- separate diode and product detectors.
- S-meter, AGC; ANL; illuminated dial.
- fully transistorized.
- modular construction.
- American-made.

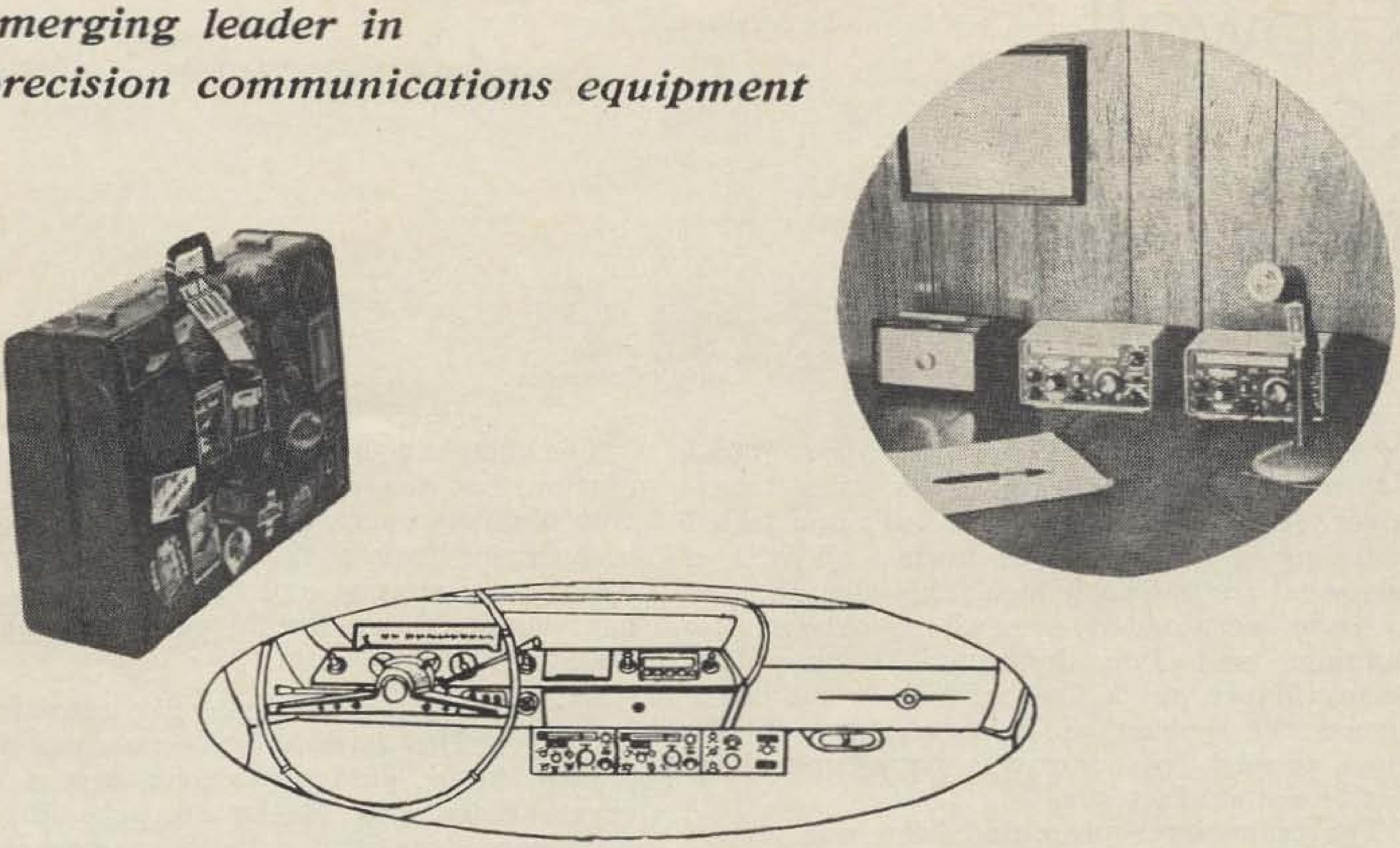
Size 7½" long, 5" deep, 4" high.

Order today or write for free brochure

davco *electronics company*

113 Norwood Avenue · **Asheville, North Carolina**

emerging leader in
precision communications equipment



The most exciting new product line in years!

Built with extreme precision; designed with space-age techniques. Good basic engineering has combined with imaginative creativity to provide superlative performance, unmatched flexibility, and designs years ahead in concept. The davco units are a joy to own, a proud investment and effective communications devices. Conceived and produced with one goal: to provide the best and most versatile equipment available, specifically for use by amateurs in today's amateur bands.

Davco DT20a SSB exciter-transmitter

Fully bandswitching, capable of approximately 20 watts SSB output, 8 watts AM. Ideal for portable or mobile operation or driving higher powered linear amplifier. Uses 2.1 kc. mechanical filter for maximum sideband suppression; carrier suppression of 40 db or more. Built-in VOX; speech processing for increased talk-power. Uses minimum of operating adjustments while retaining maximum application flexibility. Separate compact AC and 6-12 volt DC supply. Designed to complement the Davco DR30 receiver in every respect. Separate VFO, or Transceiver operation with frequency control from DR30 receiver when desired. Sideband generation at 455 kc. An extremely versatile, advanced-design unit built to the same standards as the DR30. Provides a clean emphatic signal which assures good communications from home or car, or while traveling. Transistorized; tube-type final. Available January 1962.

DT20a complete exciter-transmitter $345.00

DT20 exciter-transmitter. When used with DR30 receiver, provides all functions of complete transmitter including independent VFO frequency control, but uses mechanical filter, carrier generator, and high frequency conversion oscillator of receiver $215.00

Davco DA100 linear amplifier

The DA100 linear amplifier, when driven either by the DT20 or by the DT20a, provides approximately 120 watts SSB or 50 watts AM. Like the DR30, the linear amplifier is designed for mobile, home station or portable operation and is built to the highest performance specifications. Available February 1962 Price to be announced.

Complete Station

A complete station consisting of the DR30, DT20 and DA100 provides 120 watts of SSB and 50 watts AM on all bands 80-10 meters; dual or transceiver frequency control; VOX operation; highest quality receiving performance; many other features for less than $700. It may be purchased all at once or you may replace your present station a unit at a time. When used for mobile operation, battery drain for the amount of output is at a new low & your passengers will appreciate the small size of the units. Fits even compact and imported cars. For DXpeditions, college, hotel or resort use the high performance and sturdy construction make the Davco units your most logical choice For home station use, the attractive styling, pleasant grey-black color scheme, and small dimensions of the combination permit use in rooms where older, more bulky equipment is undesirable.

Davco guarantees the workmanship and components of its units for a period of one full year See brochure for complete guarantee.

Write for complete brochures giving fully detailed information on the DR30 and on other units as they become available. Time-payment information sent on request. Prices, finishes and specifications subject to change without notice or obligation.

Dial (Area Code 704) 253-8340

davco *electronics company*

113 Norwood Avenue · **Asheville, North Carolina**

Kilowatt SSB Transceiver

Paul Barton W6JAT
14666 Berry Way
San José, California

About two years ago Jo Jennings W6EI and his gang,[1] began work on a transceiver. Numerous models were built and tested including a transistorized model, all with a somewhat similar basic idea. This idea appears to have germinated somewhere between Jo Jennings and Don Johnson. At one time, Denny Moore put a fine printed circuit board kit on the market as an aftermath of this same project. His interests have since been sold to a manufacturer.[2]

The transceiver presented here was one of the inbetween models and was designed and built by Rudy Stefenel, W6QW. While Rudy was off finishing up his college work, the unit was slightly modified by Bert Newkirk, WΦRYG/6.

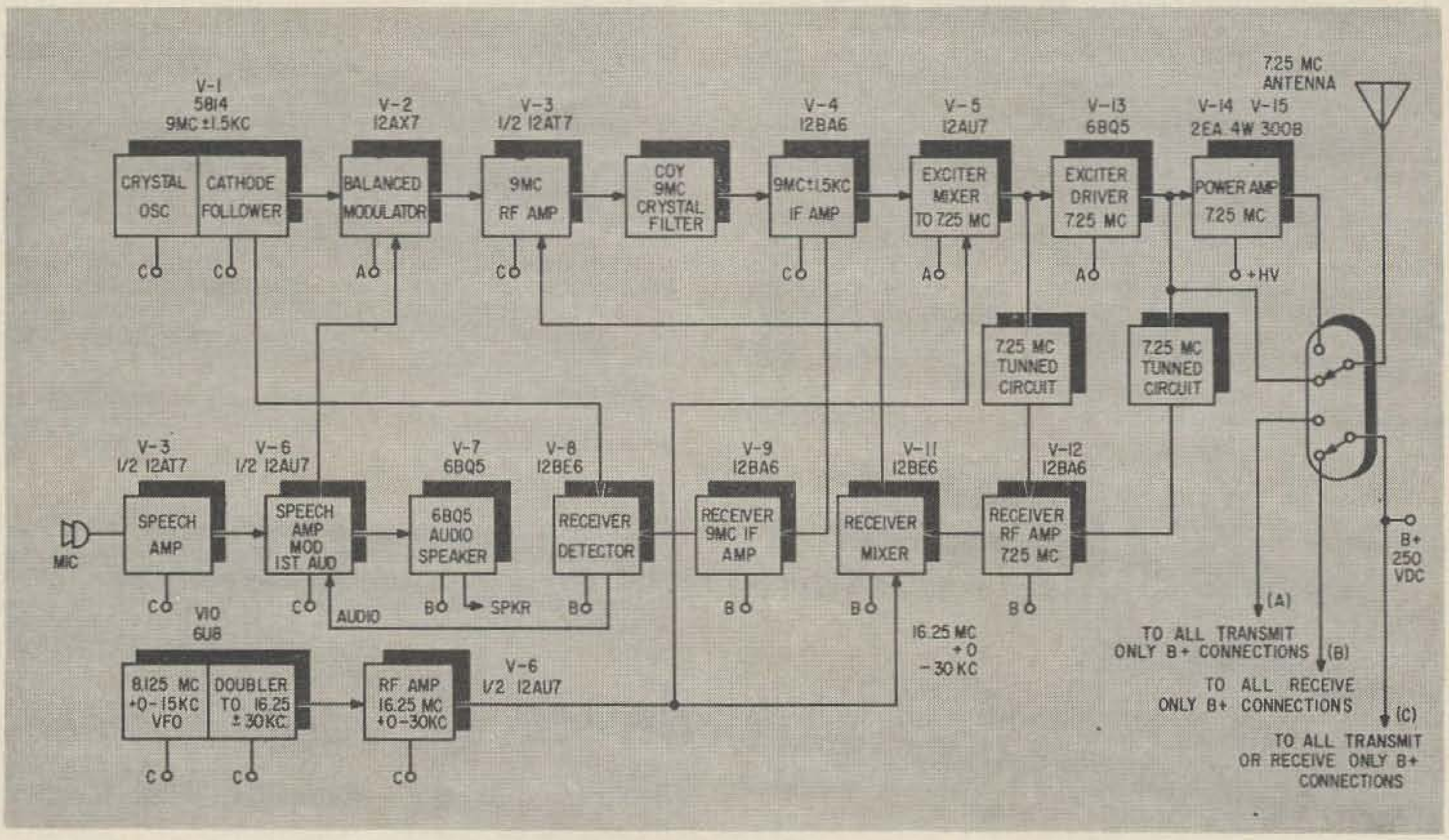
This unit, although a prototype, is a working model that has seen quite some hours of successful service on the air.

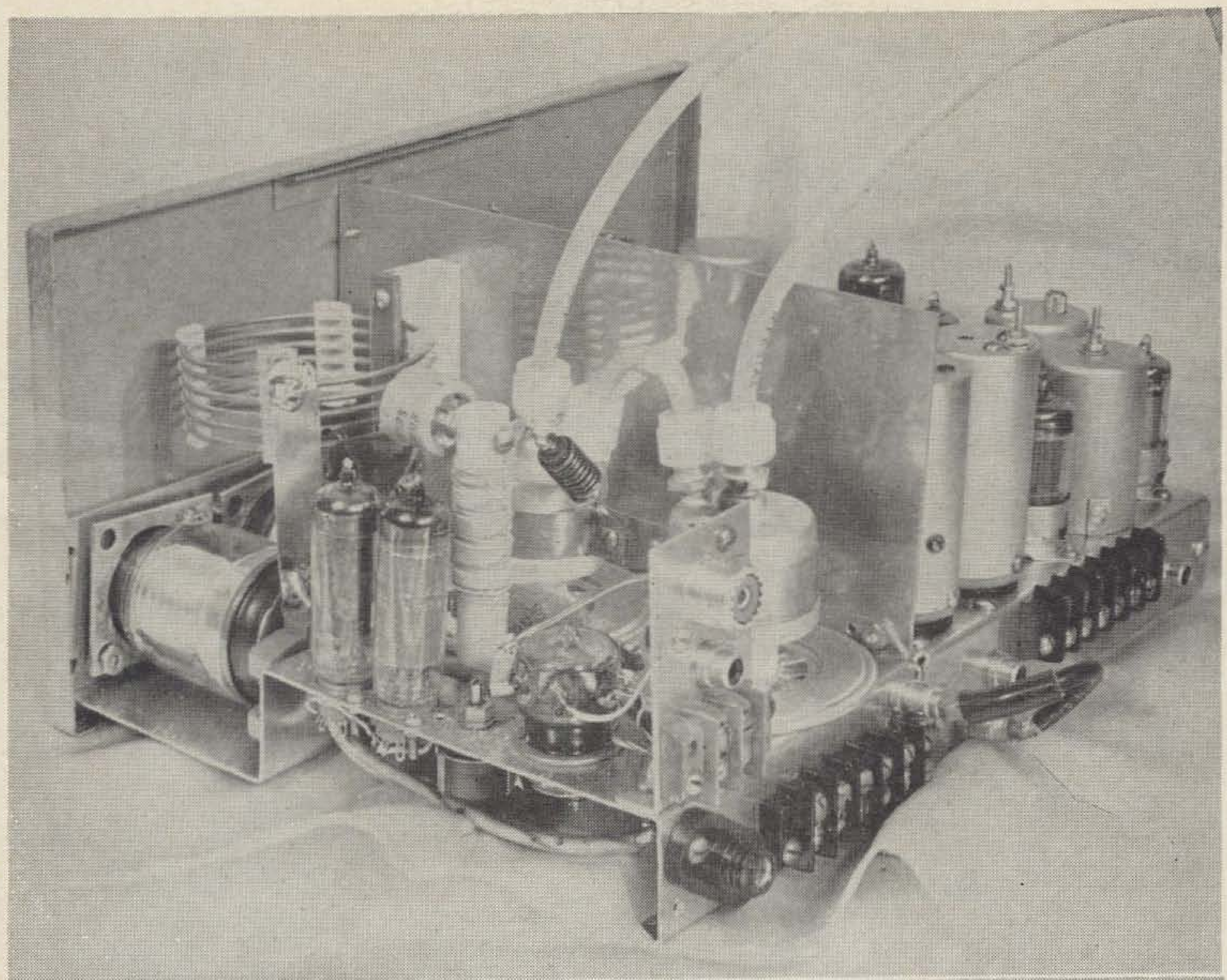
This transceiver was tailored for a specific job, forty meter mobile, which simplifies things somewhat by not requiring bandswitching or even a wide frequency coverage within the band.

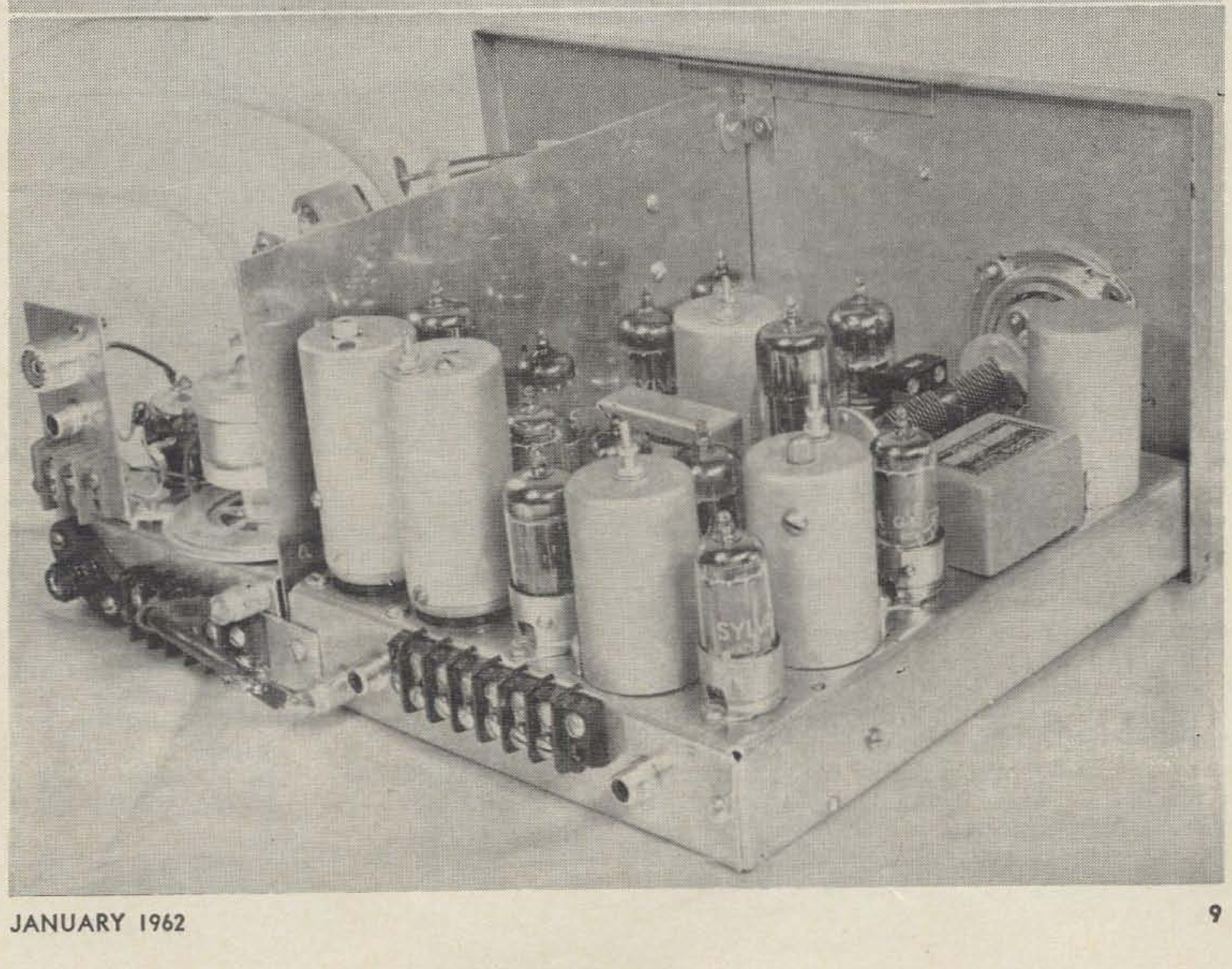
The filaments are connected for 12 volt operation, but the unit could be modified for 6 volt filament operation easily. It is meant to be operated from a 12 volt transistorized kilowatt power supply, and thereby makes a very neat compact and highly effective mobile installation.

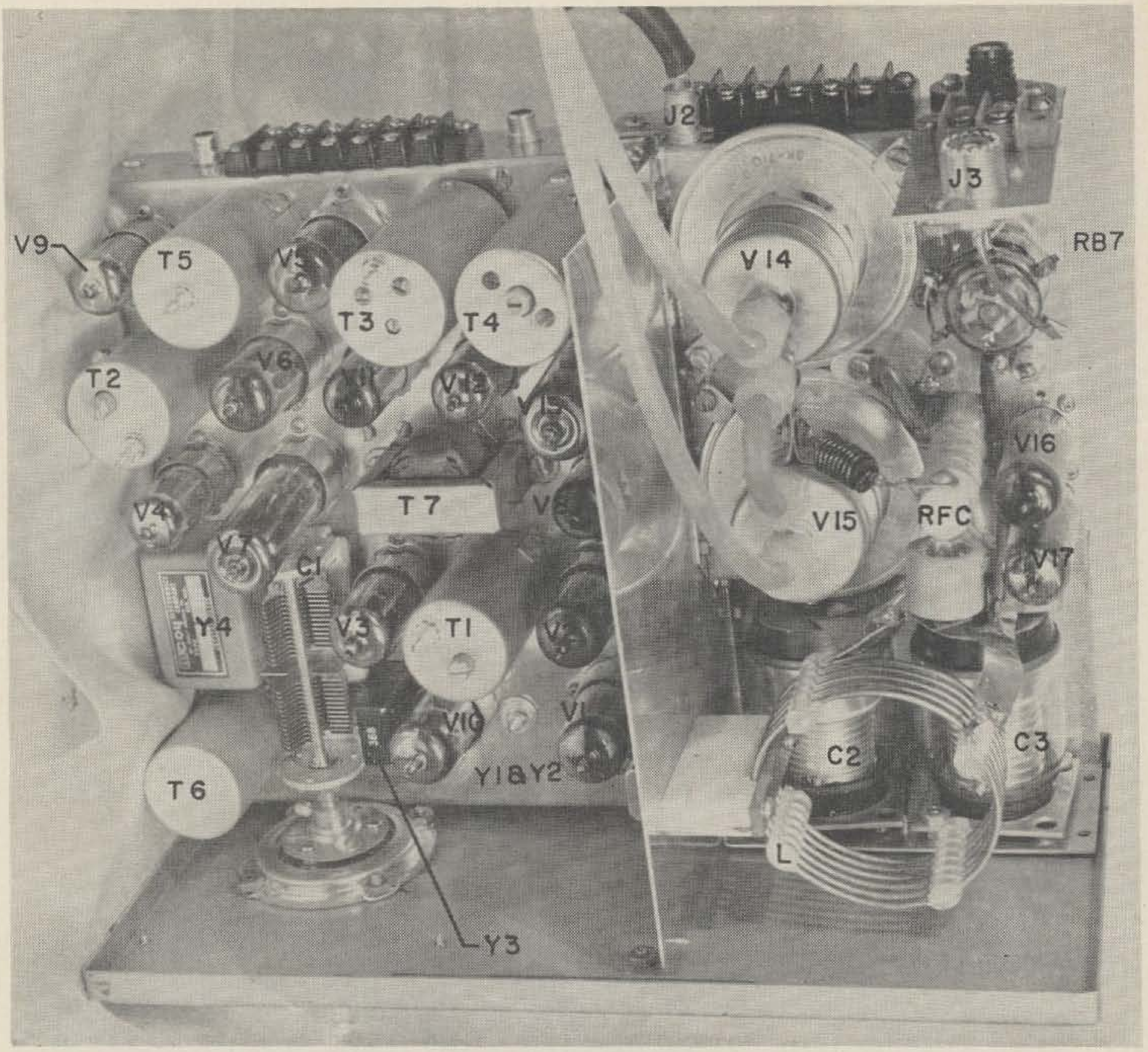
The receiver is surprisingly sensitive and selective. The selectivity is obtained by the crystal filter. This transceiver uses a McCoy crystal filter. (See McCoy ad, page 30.) There are several excellent articles on crystal filters available.[3]

The sensitivity is partially the result of a simple circuit, including what could be called single conversion. Converters are noise generators so, although necessary, the fewer the better for low noise level. Band switching and moving parts such as tuning condensers can easily generate noise, so eliminate them if possible. This transceiver is only meant to cover 20 kc, so only the high frequency oscillator is variable from the panel. All other tuning adjustments are set and left alone.









The high frequency oscillator is common to both transmitter and receiver. It is a "rubber crystal" circuit, good for 10 kc variation. The rubber crystal gives sufficient stability for mobile single side band work. The transceiver covers 30 kc in the 40 meter band.

The transmitter is a 9 mc crystal filter rig ending in a conservative KW of SSB power.

The final has two 4W300B, Eimac water cooled 4X250B tubes. Eimac also makes this tube with a 12 volt filament.

The water cooling is normally taken care of with a gallon copper tank and an electric fuel pump.

The T-R switch transfers the antenna from receiver to transmitter and simultaneously switches the plate voltage from the receiver to the exciter. It is a Jennings DPDT RB-7 vacuum switch.

Referring to the block diagram, thtre is a tuned circuit between the driver (V-13) and the final that is also used as the input tuned circuit of the first rf amplifier of the receiver (V-12). Likewise there is a common tuned circuit that tunes both V-13 input or V-11 input. Using coils common to two circuits saves space and works satisfactorily. Also, if it is desired to change bands, a pair of plug-in coils at this point would change the entire exciter and receiver to another band. Of course the final tank coil would have to be changed also. If space is not as important, separate coils for transmitter and receiver circuits could be used here.

7.25 mc signals from the antenna go through the 1st rf amplifier (V-12). Then it is mixed with the 16.25 mc VFO voltage in V-11 to an *if* frequency of 9 mc and amplified and filtered through the *if* amplifier tubes V-3 and V-4, and the McCoy 9 mc crystal filter. After further amplification at 9 mc through V-9, the signal is detected to audio in detector V-8. V-8 receives a heterodyning signal from crystal oscillator and cathode follower V-1 that is 1.5 kc either higher or lower than *if* frequency according to whether it is high or low sideband to be received. Then the audio signal is amplified in V-6 and V-7 to loudspeaker volume.

The SSB exciter begins with a 9 mc plus

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"Have been using this rig for less than a month and all ready have worked twenty or more states on six meters. It is equally good on two meters. Get wonderful reports up and down the coast of California . . ."

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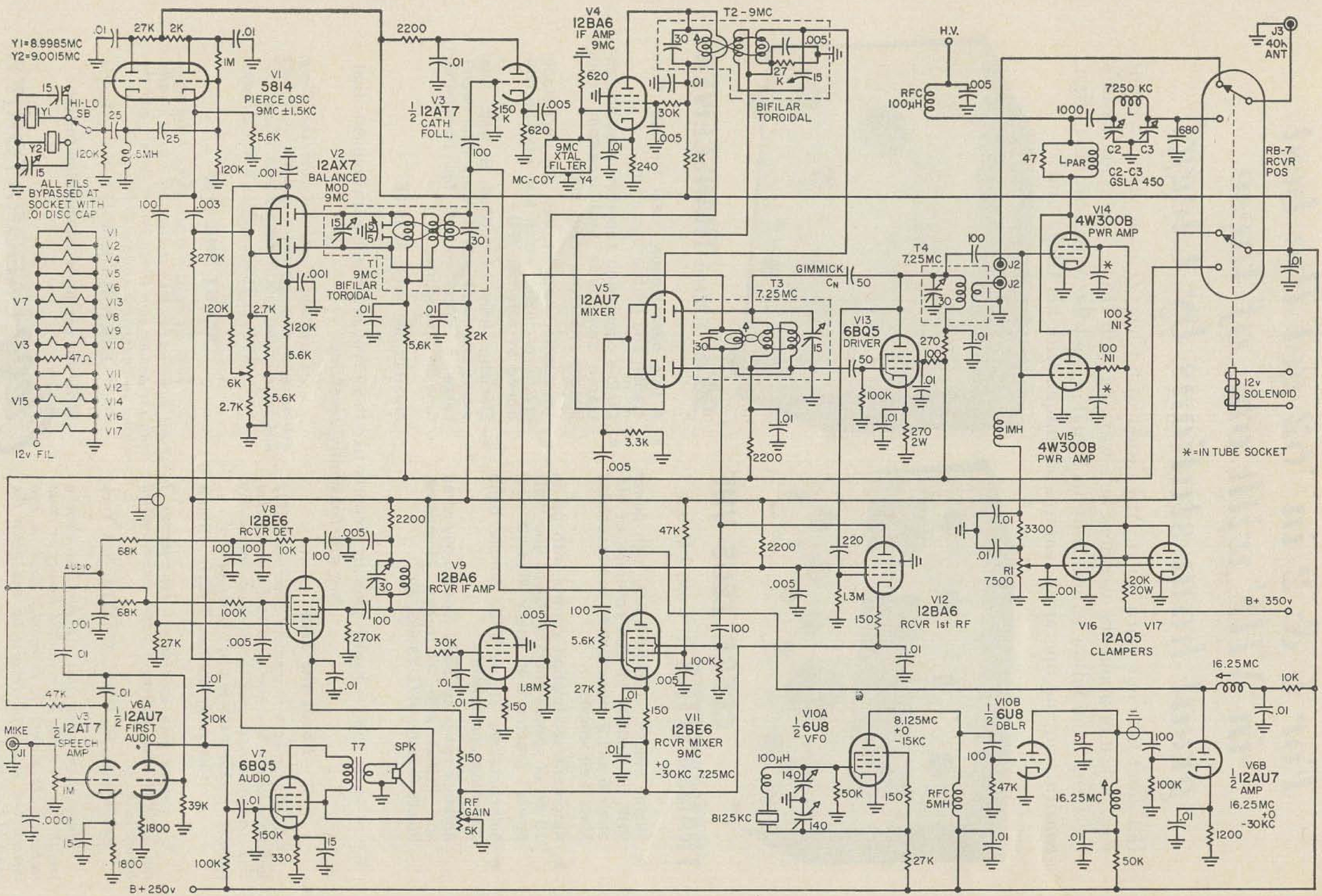

Y1=8.9985MC
Y2=9.0015MC
V1 5814 PIERCE OSC 9MC ±1.5KC
HI-LO SB
ALL FILS BYPASSED AT SOCKET WITH .01 DISC CAP
12v FIL
V2 12AX7 BALANCED MOD 9MC
T1 9MC BIFILAR TOROIDAL
1/2 V3 12AT7 CATH FOLL.
9MC XTAL FILTER
MC-COY Y4
V4 12BA6 IF AMP 9MC
T2-9MC
BIFILAR TOROIDAL
H.V.
RFC 100μH
7250 KC
L
C2 C3
C2-C3 GSLA 450
47 LPAR
J3 40h ANT
RB-7 RCVR POS
V14 4W300B PWR AMP
T4 7.25MC
J2
GIMMICK CN
V5 12AU7 MIXER
T3 7.25MC
V13 6BQ5 DRIVER
100 NI
V15 4W300B PWR AMP
12v SOLENOID
*=IN TUBE SOCKET
IMH
V8 12BE6 RCVR DET
AUDIO
V9 12BA6 RCVR IF AMP
V12 12BA6 RCVR 1st RF
R1 7500
20K 20W
B+ 350v
V16 V17 12AQ5 CLAMPERS
16.25MC
MIKE J1
V3 1/2 12AT7 SPEECH AMP
V6A 1/2 12AU7 FIRST AUDIO
V7 6BQ5 AUDIO
T7
SPK
RF GAIN 5K
V11 12BE6 RCVR MIXER 9MC +0 -30KC 7.25MC
V10A 1/2 6U8 VFO
8.125MC +0 -15KC
8125KC
100μH
RFC 5MH
V10B 1/2 6U8 DBLR
16.25MC
V6B 1/2 12AU7 AMP 16.25MC +0 -30KC
B+250v

or minus 1.5 kc crystal oscillator. High or low sideband is selected by the crystal here. This signal is fed into the balanced modulator V-2, which is modulated with the speech amplifier, ½ of V-3 and ½ of V-6. The output of the balanced modulator is double sideband suppressed carrier, which is fed into the 9 mc amplifier, ½ of V-3. Then one side band is filtered out in the McCoy crystal filter and further amplified as SSB voltage through V-4. The mixer V-5 converts the 9 mc *if* signal to output frequency 7.25 mc, with the 16.25 mc voltage from the VFO, and its doubler (V-10) and amplifier ½ of V-6. The output of the mixer V-5 is amplified through the driver stage V-13, then further amplified through the power amplifier V-14 and V-15.

The final is a conventional class B clamp tube linear. This type linear has proven to be nearly as linear as a good triode type amplifier and much easier to drive.

The amplifier's static linearity is adjusted at R_1. Connect a 45 volt battery across R_1 with a switch or key in series with the battery. Apply plate and filament voltage to the amplifier. No excitation. Observe the plate idling current of the final amplifier. Key the battery across R_1 and adjust the arm of R_1 until the plate current remains the same with or without the battery across R_1. Now the clamp tube will be releasing screen voltage to the final so as to keep a constant ratio of screen grid voltage to fixed bias voltage.

The clamp tube linear amplifiers are somewhat self limiting in plate power if the load is not sufficiently heavy, or if over excited. Under this condition the tube will draw screen current and drop the screen voltage which in turn limits the plate current, and saves the tube from being destroyed. However, it will distort.

A screen current meter is useless in this type circuit. A screen voltmeter should be used instead. As excitation is increased, the screen voltage (and plate current) will increase to the point of limiting. Adjust load and excitation until proper plate current is obtained at the point of limiting. Check for efficiency. It should be not less than 65% at point of limiting. Improper setting of R_1 will result in poor efficiency.

The input and output condensers of the pi net of the final amplifier are Jennings Type GSLA 45Φ. The 68Φ mmfd padding condenser across the output condenser C_8 is a mica. The plate rf choke is wound on a half inch diameter insulating rod (fiber glass, in this case) of #26 manganan resistance wire.

RF transformers T-1, T-2 & T-3 are torroidal bifilar wound shielded transformers. They are wound on powdered iron torroid forms from Arnold Engineering Company. The primary of each transformer is link coupled to the secondary. The added tuned circuit give better selectivity.

The VFO coil T-6 is a critical element. A quartz crystal has the electrical equivalent of a large inductance in series with a small capacity. These two are series resonant at the crystal frequency. By adding inductance in series with the crystal, the frequency of the crystal may be lowered. But this added inductance must be high Q, and the crystal must be very active; otherwise the crystal will lose control and the oscillator will be self excited. This oscillator can be moved more than the 15 kc shown, but the further it is moved, the more it has the characteristics of a self excited VFO instead of a crystal controlled oscillator.

The tube line up and circuit of the VFO, doubler, and amplifier, bring up a large question mark to an experienced eye. However, many hours and much changing of arrangements were done before this was settled on. The best proof is that it works. . . .W6JAT

---

[1]Don Johnson, W6AAQ; Rudy Stefenel, W6OQW; Dick Currell, K6IHS; Denny Moore, W6MHP; and several others.

[2]Cabral Motors, Inc., 51 Victory Lane, Los Gatos.

[3]QST Jan. 1961, Surplus Crystal HF Filters.

QST Jan. 1959, Mobile SSB Transceiver.

QST Mar. 1960, SSB Exciter Circuits using beam tube 7360.

QST Oct. 1960, Hi Freq. Crystal Filters SSB.

Lifer No. 6

Dear Wayne,

You would be happy to learn that as Lifer Number Six, you have awarded a life subscription to a 73 year old steeplejack presently under contract to install TV antennas on the Empire State Building, and who is better known in the trade as "No Belt Johnston," and finally who has not had a heart attack in the last six months.

Unfortunately this is slightly in error as I'm presently 27, and rarely climb my 60 foot tower. I became interested in Ham radio while studying at Yale University and received my ticket soon after graduation while in the Air Force. I am active on 2 thru 20 meters using partially home-made and partially commercially made equipment.

As a rated FAA Commercial Pilot I believe that I qualify for your requirement as a test pilot, because every flight is a test to see what happens when I hit the ground in what is known as "a controlled crash."

Dick Johnston K1QJD

Rotate that Tower

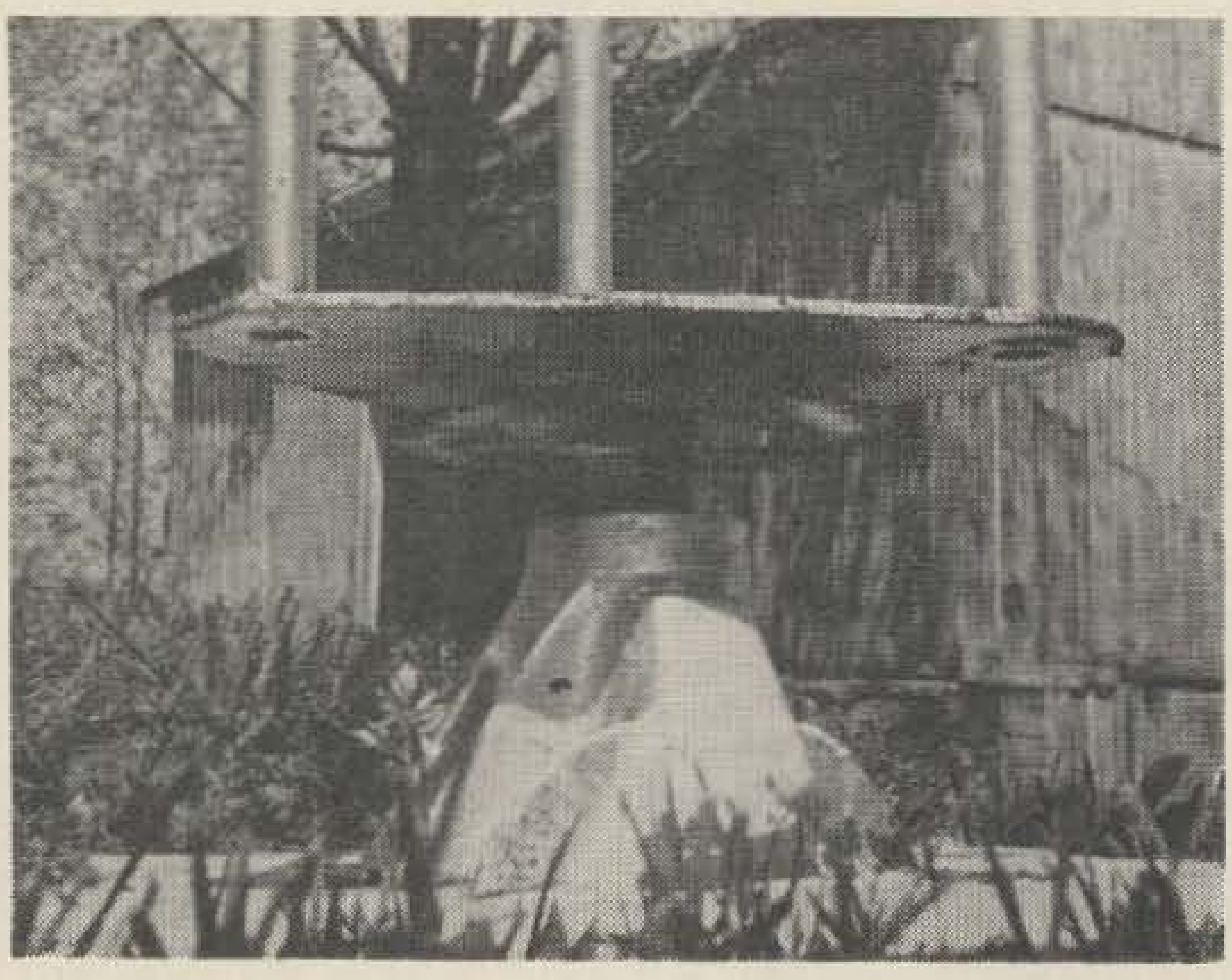
W. S. Baker K2LZF
Box 291, R. D. 1
Greenfield Center, New York

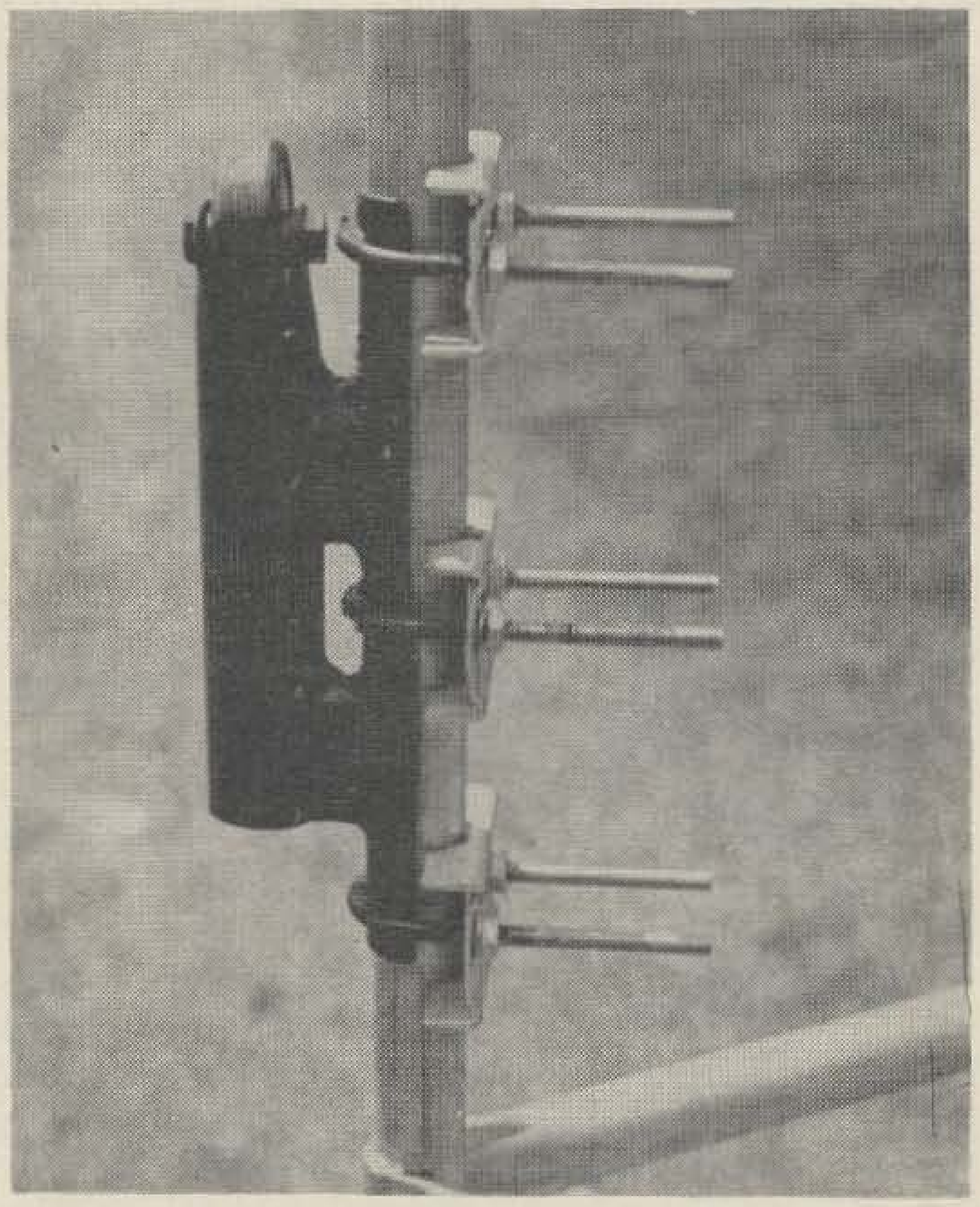
Photos by Edward Valmare K2EVJ

FULL utilization of a tower is realized only when the entire structure is rotated. When the tower is rigidly guyed it is necessary to place all antennas above the tower on rotating tubing. This limits the number of antennas which may be put up and places great demands on the tubing and rotator. To avoid these problems and allow stacked antennas, large H-frames, etc., the obvious answer is to rotate the tower. Impossible, you say? It might seem so, but like most antenna projects it is easier than you first think and becomes easier in the doing. If you do some scrounging and rigging you can rotate that presently inert tower.

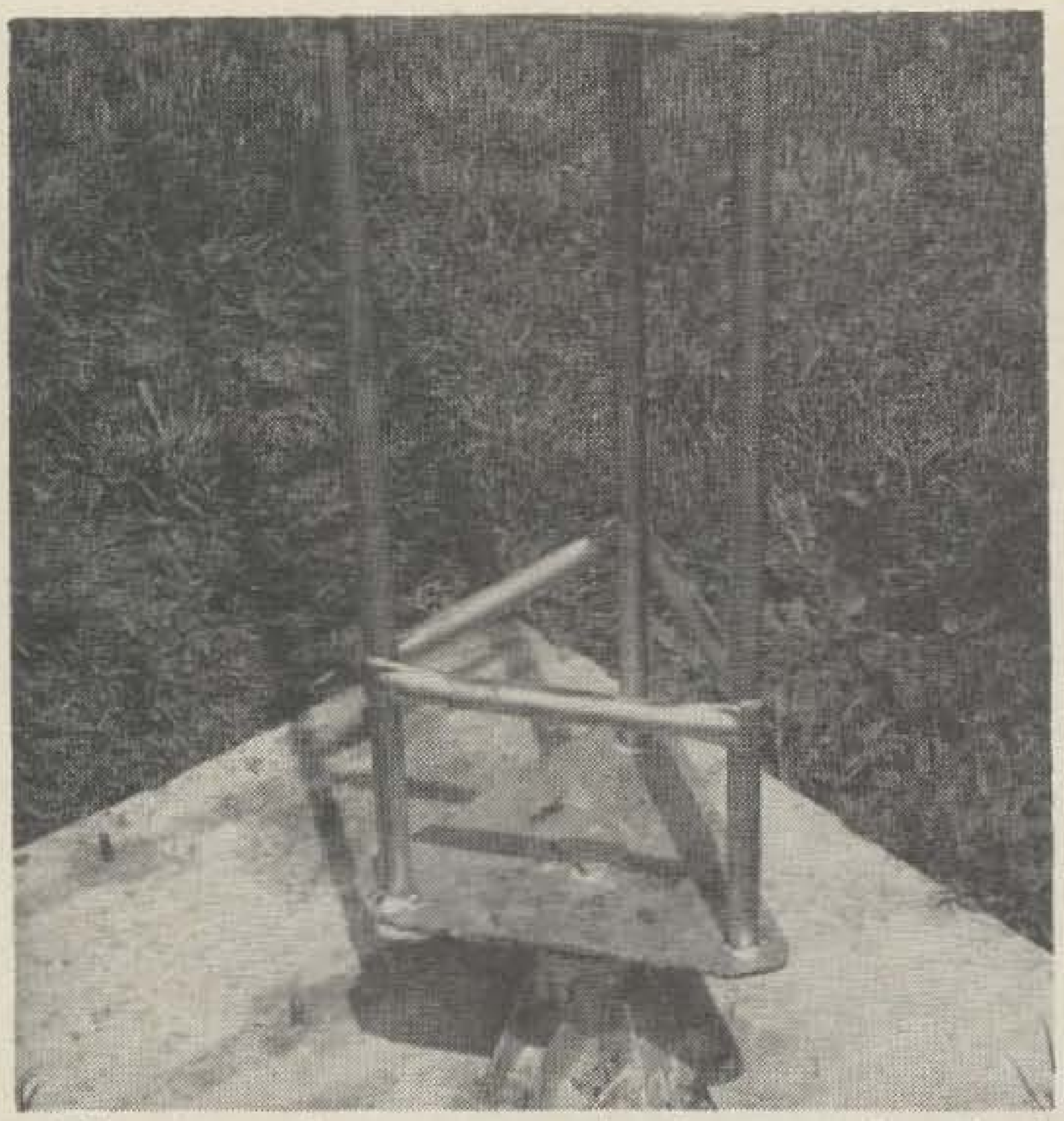
There are two ways to execute any project of this sort: You can engineer the dickens out of it, make engineering drawings, and add tolerances. It will cost like it too. Alternately, you can fashion it, and diddle as the project evolves. This latter method is the one expounded here, and is the only practical one for the individual with limited resources. In line with this attitude, this article should be read for ideas, with copious references to the pictures. This will not be a description blueprinted down to the last measurement, since your attempt will bring to the project different skills and sources than did mine.

The project divides itself into three parts for consideration: 1. The rotating base, 2. the rotating guy ring, and 3. the wheel holders which attach to the tower. The principle is to guy to the ring in which the tower runs on roller skate wheels. The rotating base is the pinion bearing housing from an old car. A



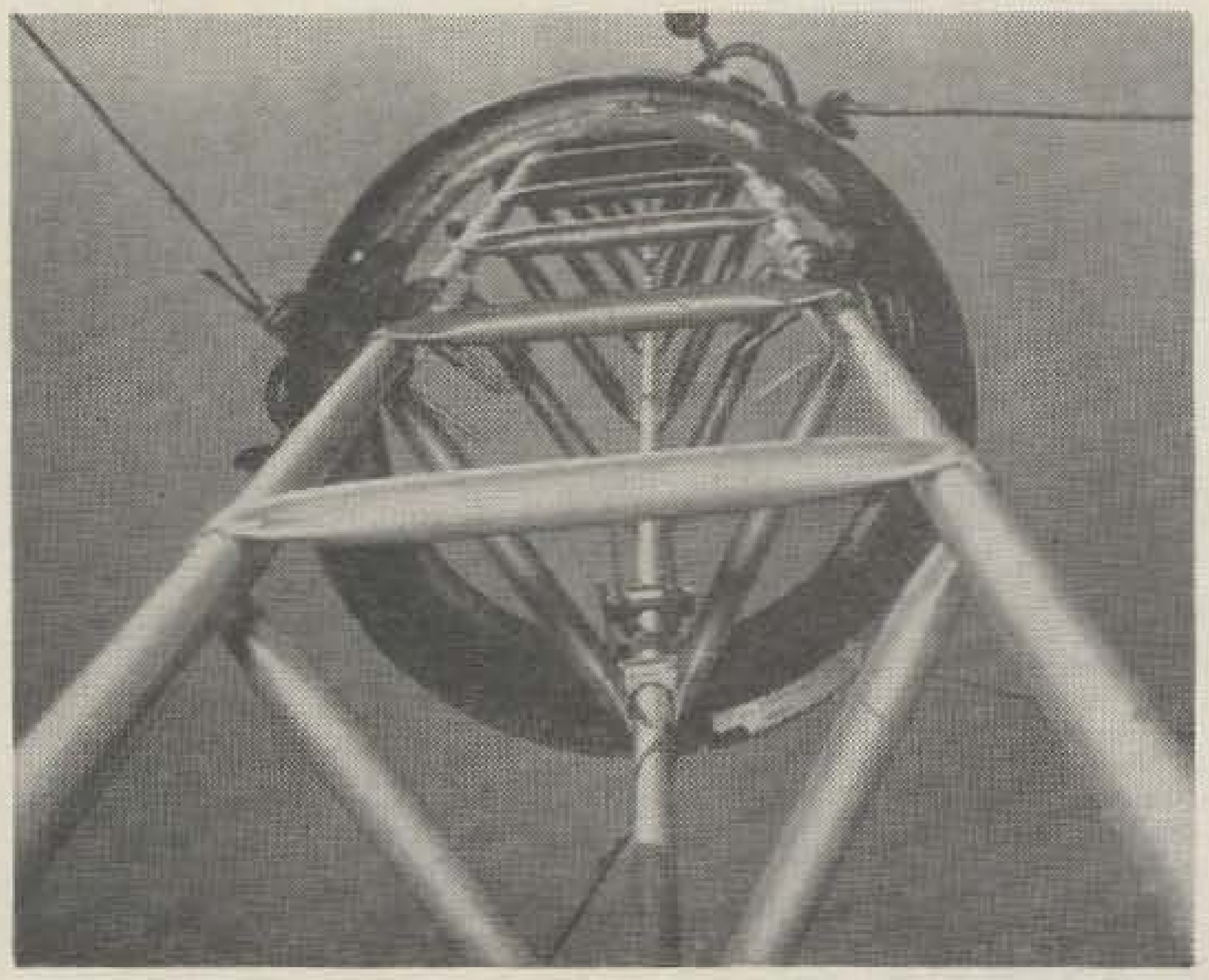


1955 Mercury rear end was used here; you use what you can find. In the course of operation of a car this bearing is subjected to tons of force applied in the same manner as the tower bears on it here. The tower's weight appears modest by comparison. The base of the tower was modified to run on the bearing by welding the three legs to a piece of boiler plate. The tower legs should be kept open to the bottom to allow moisture to escape. The center of the bottom of the flat base was determined, and two concentric pieces of pipe were welded into place. The inner, smaller piece of pipe goes through the pinion bearing to keep the tower from hopping off the base. The larger, outside piece of pipe is selected to run on the face of the bearing. A bicycle sprocket is brazed onto the outer pipe just below the boiler plate tower base. The rotator, a prop pitch motor, also has a sprocket welded to it, and the tower drive is applied through bike chain. The prop pitch motor has its own mount off to one side of the bearing base. The bearing base is set several inches in concrete with threaded rods screwed into the tapped holes in the frame. These project several feet down into the body of the concrete.



The guy ring was made from a five inch high, eighteen inch diameter section torched out of an old hot water boiler which was selected for minimum internal wall pitting. This gives you quite a good circle which your welding source would be driven to distraction or high prices to fashion from flat stock. A top rim was welded into place, leaving a fourteen inch hole for the tower to project through. The inside of this face is the running surface for the roller skate wheels. I suggest that all welding of the ring be done by the electric arc process. It heats the material adjacent to the weld less, and leaves it stronger and less deformed. Small loops of steel rod were bent into loops and the ends welded to the top surface of the ring. These are the guy points.

To allow flexibility and to avoid weakening the tower, the wheel carriers were not welded to the tower. Three roller skate wheels mounted in fixtures which clamp to the vertical legs take up the vertical component of force. A set of wheels running in the horizontal plane to take up this component was not used in the interest of simplicity. As long as the guy angles are reasonably flat this simplification



does not seem to be harmful. The horizontal force bears on the bolt heads which hold the roller skate wheels in their carriers. The rubbing of these bolts against the inside of the ring might make necessary their replacement every few years. Even so the tower runs quite freely with very little binding as long as the guys are kept somewhat loose. They tend to grow taut in cold weather.

The actual wheel carriers are made from slotted and halved pieces of electrician's metallic tubing (E.M.T.). The portion of the holder which is clamped to the tower leg is half circle of one inch diameter e.m.t. with television U-clamps brazed to it to go around the tower leg. The wheel holder itself is a short length of tubing cut out at one end to allow insertion of a roller skate wheel. The tabs left after the cut-out, or ears, are drilled to hold the bolt which is to be the axle for the roller skate wheel. Short pieces of e.m.t. are hammered into ovals and then brazed into place between the carrier and the tower clamp to complete the assembly. Washers placed between the bolt heads and the wheel holder can serve to take up the distance between the bolt head and its running surface, the inside of the ring. A gap of at least one quarter of an inch should be left between the bolt heads and the ring to allow easy rotation. The bolts used should be good quality steel. The entire wheel carrier assembly is brushed to remove the borax residue of the brazing process, and the entire fixture is given a coat of rust inhibiting paint.

The tower was erected with several sets of temporary guys, and then the wheel holders and rings were installed. Notice the six guy principle used to keep the ring from turning as the tower rotates. When completed, the rotating tower stands ready to have antennas sprinkled up and down it. Credit for the basic concept of tower rotation presented here goes to Jud, K2CBA. . . . K2LZF

Letter

Gentlemen:

I always like the "Staff" articles as they are informative and often call attention to some idea that was presented in a book or periodical not available here unless it gets purchased. Heaven forbid that. I am magazine poor already.

I was very much interested in the new mixer circuit presented in 73 for Oct. '61 on page 32. I must admit I was quite dubious about it but I went ahead and changed my 75A4 1st mixer to a 6BK7B using the idea presented in the article. My voltages were 250 and 75, with a cathode resistor of 100 ohms. The new mixer was quieter, and had more gain according to the s meter and signal calibrator. I estimate at least a 10 db gain over the 6BA7, with a lower set noise.

I do not anticipate changing the 2nd mixer as the 6BA7 circuitry gives a handy method of controlling the set gain independently of the IF stages, and besides, the 2nd mixer isn't very noisy.

To say I am pleased with this new mixer, would be an understatement.

M. C. Smith W6GMC

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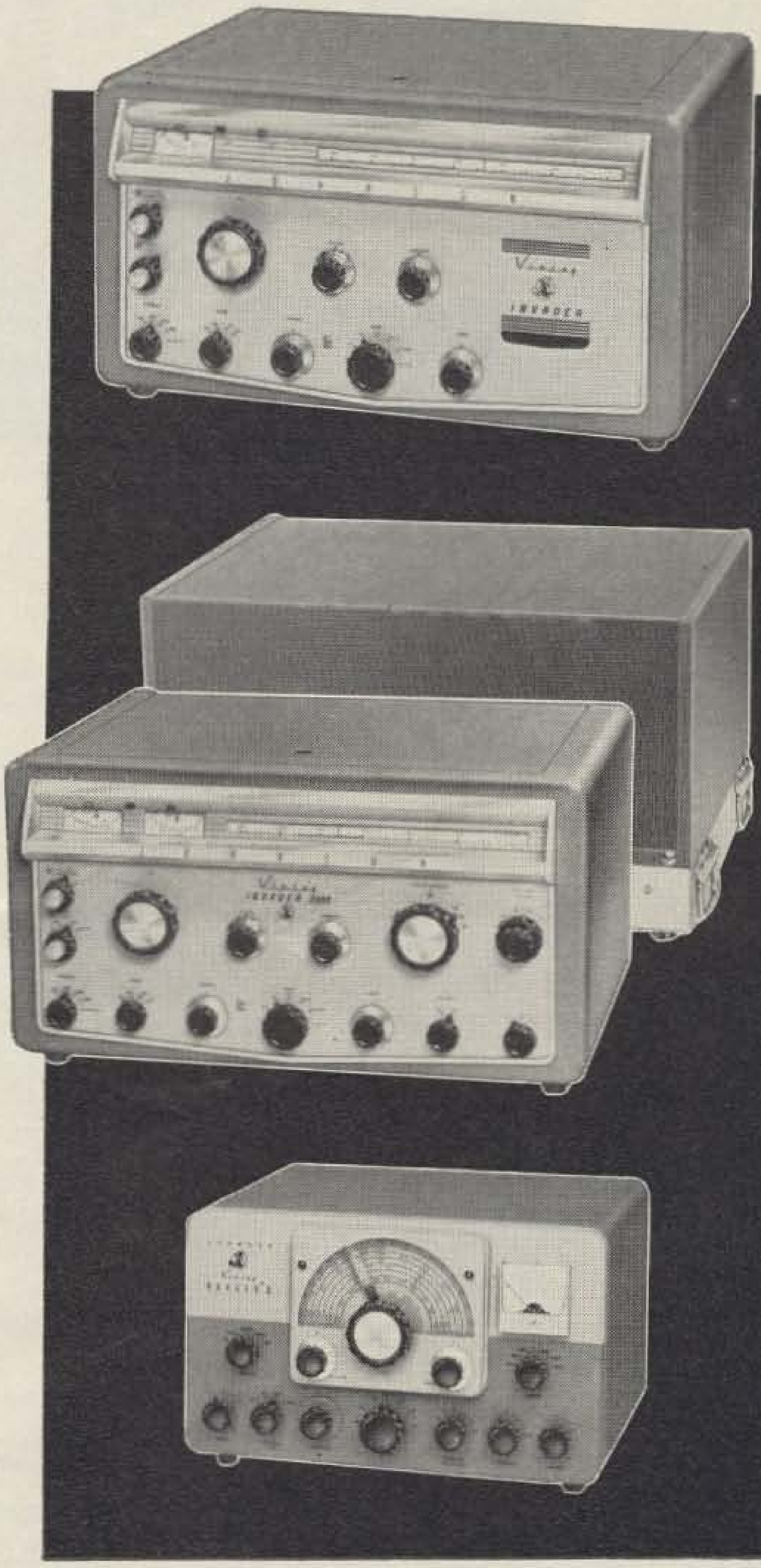

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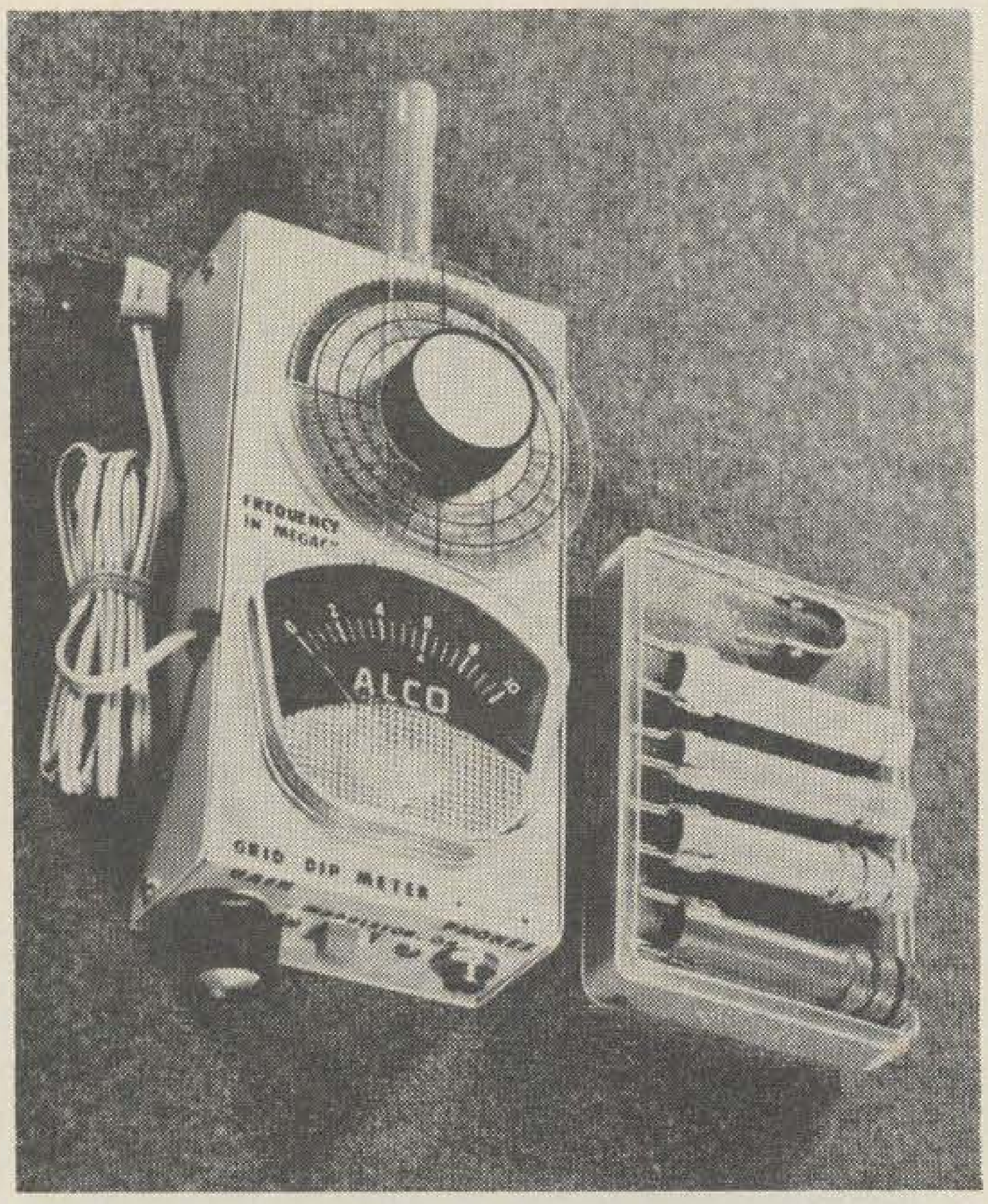


There is no difficulty in reading the meter of this compact instrument.

73 Tests the Alco GDM-1 Grid Dip Meter

Roy E. Pafenberg W4WKM
316 Stratford Avenue
Fairfax, Virginia

"Q" meter, L-C meter, crystal activity tester, HF-VHF signal generator, field strength meter, modulation quality checker and absorption wave meter. . . . If this sounds like a whole lab full of equipment, then wait one. This is only a partial listing of the functions that a good grid dip meter will perform and we haven't even touched on its primary area of usefulness, that of determining the resonant frequency of "cold" tuned circuits and antennas.

However, the ALCO Model GDM-1 grid dip meter is a cut above other equipment in its price range; that is if you can find one to compare it with. This is a completely wired, tested and calibrated instrument which sells for $36.95, amateur net. Features not found in some other instruments include internal AM modulation, color coded dial and coils, adjustable index for precise calibration and a large, easy to read, plastic case meter. How come all of this for $36.95? Well, it is an imported instrument, made in Japan, and is being sold as a direct mail item by ALCO Electronic Products, Inc. of Lawrence, Mass.

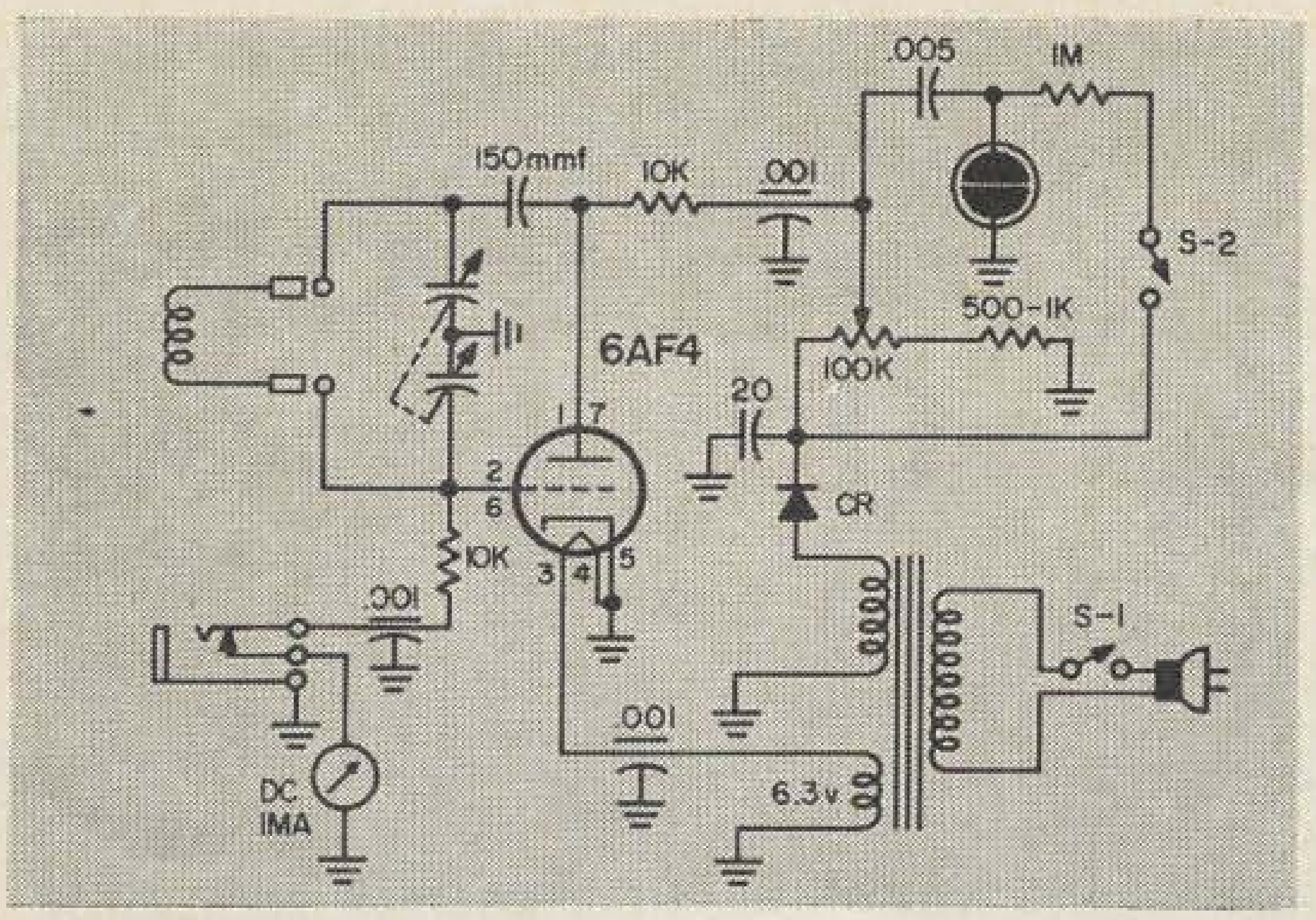
The GDM-1 covers the range of 1.5 to 300 mc using 6 sturdy, color coded coils which plug into a standard crystal socket mounted on the front of the case. The coils are stored in a cushioned, heavy plastic box. The instrument is housed in an attractive, heavy gauge brushed aluminum case measuring 6½" x 3¼" x 1½". The case has a substantial heft and a nicely shaped for easy one hand operation. Control designations are neatly silk screened for ready identification. Hardware is nickel plated brass and machine screws are used instead of the sheet metal screws often encountered in lower priced equipment.

The six color coded scales are nicely laid out on a 3" diameter, serrated edge, plastic dial and an adjustable index scale is provided for precise calibration of any given range. The dial mechanism includes a friction device for smooth operation and the dial extends beyond the right side of the case for easy, vernier effect, tuning.

Internal AM modulation is provided and may be selected by a slide switch mounted on the back end of the case. This feature simplifies use of the instrument as a signal generator. The tone is rich in harmonics and enables identification of the grid dip meter signal in a welter of heterodynes. A phone jack is provided for monitoring purposes and good results are obtained with the instrument in either the oscillating or non-oscillating mode.

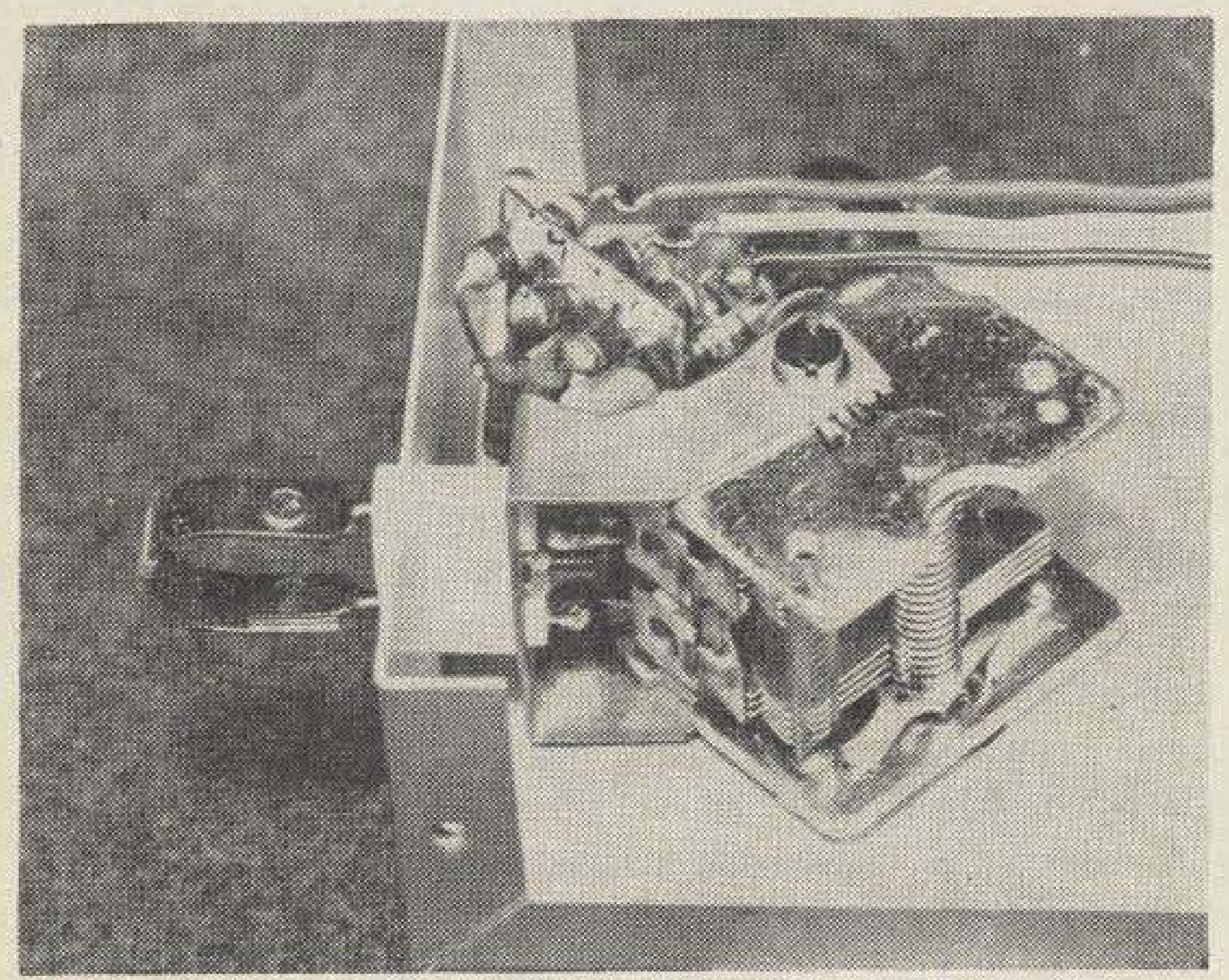
Study of the schematic diagram will disclose nothing really new in circuitry, although the AM modulation capability is an additional and very useful feature not found in many other instruments. The circuit is a conventional ultra-audion oscillator using a split stator tuning capacitor. A milliameter is connected in the grid circuit and the plate voltage is made adjustable to control the magnitude of oscillation. This permits setting the grid current to the optimum point on the meter scale. When the grid dip meter coil is coupled to a circuit tuned to the oscillator frequency, it will absorb power. This loss of energy results in a decrease in the magnitude of oscillation and is indicated by a reduction in grid current. Therefore, by tuning the instrument for a dip on the meter and reading the frequency from the dial, the resonant frequency of the external circuit is quickly determined.

The modulator uses a neon lamp in a relaxation oscillator circuit and produces a pleasing tone. The power supply is conventional, using a selenium rectifier with a line isolation transformer and a 20 mfd filter ca-



pacitor. This simple circuit reduces hum to an acceptable level. The requirements placed on the meter used in a grid dip meter are quite demanding. The meter pointer should not shift with rapid changes in position or orientation but, at the same time, should respond quickly to small changes in current. In the GDM-1, the movement characteristics seem ideally matched to the requirements of the instrument and the large plastic case meter with its white on black scale is easy to read from all angles.

Performance of the GDM-1 leaves little to be desired. The thin profile of the instrument case, coupled with the "long reach" coils that are used on all execpt the highest frequency band, makes it easy to get into inaccessible areas. When the instrument is grasped in the hand, the serrated frequency dial falls under the thumb for easy adjustment and true "one hand" operation. The most outstanding feature



The secret of the outstanding performance of the instrument is in this well engineered oscillator assembly.

of the ALCO instrument is the absolute freedom from spurious responses. Also, with the exception of the lowest frequency range, grid current is uniform across the dial. On the lowest frequency coil, there is a gradual falling of grid current as the low end of the dial is approached.

The secret of this performance is shown in the close-up photo of the rf section. All circuit elements are constructed as a compact sub-assembly which results in essentially zero length leads. RC filters using ceramic feedthrough capacitors give extremely good circuit isolation of all external leads. The effectiveness of this decoupling is enhanced by the use of a copper plated sub-assembly chassis which gives low resistance grounding of the critical circuit elements.

The instrument gives good performance as a crystal activity checker and as a crystal controlled signal source. Crystal activity is indicated on the meter. Crystals from 200 kc to 20 mc were tested and all oscillated strongly. This and many other applications, including those listed in the lead paragraph, are covered in the instructions. The "Mimeographed in Japan" instructions will get plenty of use and really should be published in more permanent form. Those interested in pursuing the subject further are referred to the excellent book, "HOW TO USE GRID DIP OSCILLATORS," by Turner. This book is available from 73's own Radio Bookshop for a nominal $2.50.

In the instrument tested, no deficiencies were noted which affected the performance. One point, however, deserves mention and possible correction in production. In all except the RF sub-assembly, which is excellent, the assembly and wiring techniques are slightly below commercial instrument standards. This is a minor point but a couple of terminal strips, a foot of lacing twine and ten minutes longer on the production line would turn the present aggregation of lead mounted components and point-to-point wiring into a "MIL Spec" creation.

Without a doubt, the ALCO GDM-1 grid dip meter is a bargain on todays instrument market. The GDM-1 should have considerable appeal to the amateur who likes his test equipment factory wired and calibrated. Even if you construct no equipment, the utility of a grid dip meter in antenna and trap adjustment more than justifies the purchase. In addition, you as the proud owner of a shiny new instrument will find you have friends you never knew you had. . . . W4WKM

Photo: Morgan S. Gassman, Jr.

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Bill Ashby K2TKN
Director of Service Engineering
Cornell Dubilier

Rotors

ONE beneficial effect that TV has had on amateur radio has been to provide several good brands of antenna rotors at reasonable cost. As Director of Service Engineering of one of these companies, I have seen the amateurs adapt these units successfully into a service for which no thought was given during design. All successful TV rotors have been developed to orient a TV antenna and to be produced in large volume at the lowest possible cost—period. The fact that tens of thousands of these rotors are in daily use by amateurs, twisting the tail of tri-banders, quads, VHF Christmas trees, etc., is a verification of their ability to increase the usefulness of a product far beyond the imagination of the original designers.

This brings up an important point. Letters of inquiry from amateurs to manufacturers about such products fall into two broad categories—first, those who commend our design and suggest that we incorporate certain improvements in future productions—second, and by far the majority, those who loudly proclaim our incompetence in design, manufacture, advertising, distribution, etc.; for they can see some deficiency from the ideal in their rotor system operation. To my knowledge, no reputable TV rotor manufacturer has ever claimed that their TV rotors would be entirely suitable for amateur usage, yet somehow many purchasers feel that a manufacturer of a product must make provision to individually custom design the entire antenna-rotor-tower system, insure trouble-free operation, and outperform all competitive products.

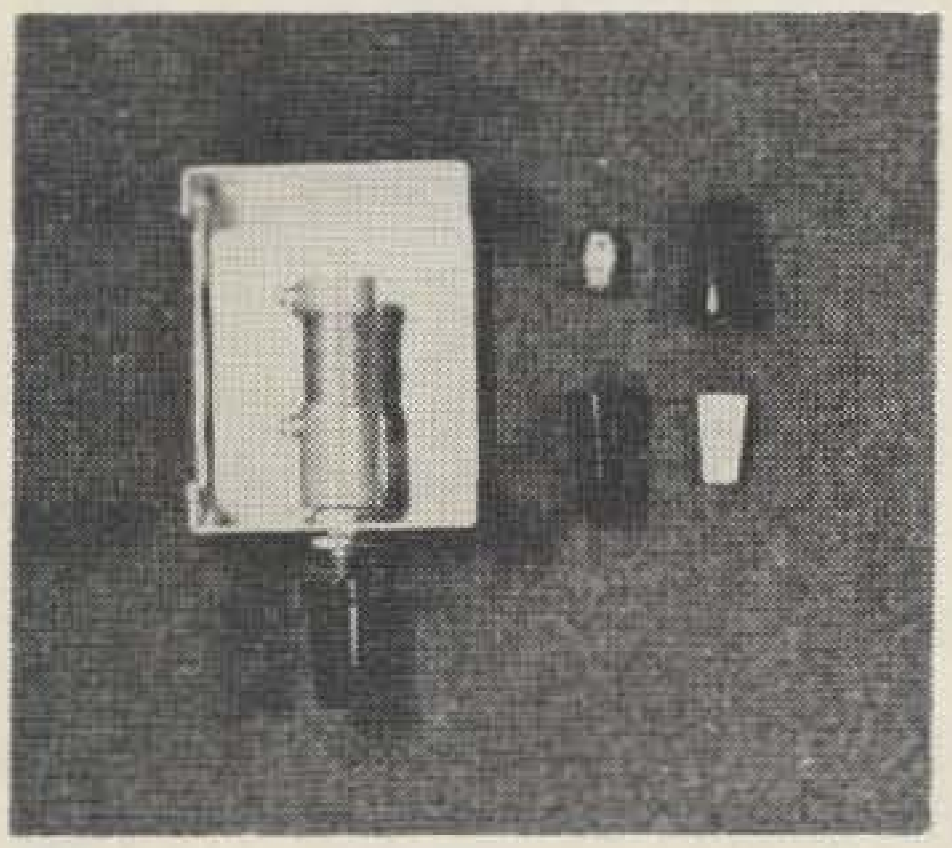
As a manufacturer, I should answer this type with a form letter stating that the product was not designed for this usage, but as an amateur and knowing of the multitude of highly successful installations by others, I can only stack up this mail and answer each as best we can, passing along a hint or kink developed by another amateur for this product.

The assumption by many that a manufacturer knows more about his own product than anyone else is based on wishful thinking. A manufacturer knows how to build and sell—only the satisfied customer knows that product's best usage and limitations. The fact that you paid $36 for a CDR AR22 rotor does not mean that you must keep it a deep-dark secret that it goes out of sync when the wind blows the quad around. No possible amount of amateur complaint letters (500 would be staggering) would cause us to change a TV rotor built for another purpose and manufactured 1000 units at a time. Write the letters—the accumulative effect may eventually help, but meanwhile inquire on every contact if any helpful hint may be known about this particular problem. You will be amazed at reactions from other amateurs. Usually a large sigh of relief, and your contact then explains he has been having similar problems but didn't want to admit it. Then it starts, and by the end of the QSO much useful info has passed both ways. You will find a wealth of expert technical information available 24 hours a day, with a fraternal desire to honestly help, that few manufacturers even understand and could not buy for any amount of money. Also the technical fake stands out like a sore thumb. This is the "expert" who has read all the ads, can expound by the hour why *his* particular equipment (purchased at a discount from a "secret friend" at the plant) excels any possible other product's operation. His only real technical information ends at the bottom of a full page ad.

On the other hand I personally know of several amateurs who have never soldered a single wire to another, but know more about what a CDR AR22 rotor cannot do, what it will, proper mechanical installations, correction of normally encountered faults, have a service bulletin and knows what it says, have noted down in their file that a letter to Bill Ashby K2TKN CDE—50 Ave. "L"—Newark, N. J. will eventually get an answer, and that any part needed for repair of any CDE rotor is in stock at their rotor plant CDE—118 E. Jones St., Fequay Springs, N. C.—"Att John Sumner" and a letter by air-mail to him gets you that part C.O.D. in a day or so—and—if you get desperate, pack any CDE TV rotor and control box securely, ship prepaid to John, his crew will completely rebuild, inspect, and check out the rotor and return same within a few days if you enclose a check for $7.50, which pays for all labor and parts, etc. HAM rotor rebuild—$17.50.

All the above is well known by many amateurs that you have been talking to all this time in all parts of the world. When you state that your "Brand X" "Whangen banger No. 3" is not working—the other guys will not consider that you are waging a personal feud with "Brand X" company—they will usually be able to help with some info, possibly that this seems to be usual, and that you had better start trading up to a product designed for your application—which may help to make you a wiser if poorer amateur. Try calling "CQ—AR22 rotor information only" on 20 SSB and your receiver will lift off the table from "klank—klank—klank" as the VOX's kick off on the AR-22 systems turning your way to help, declaim, and commiserate with you. You may be pleasantly surprised how easily this apparently serious problem may be cured. All you have to do is get on the air and start making noise. Enough of this sort of thing and there will be fewer complaints about stereo-typed QSO's and considerably wiser purchasing by many amateurs. My comments above are about rotors, but hold just as true with any commercial products and the opinions are shared by most manufacturers. . . . K2TKN

Solderless Connectors Double As Control Knobs



Electrical solderless connectors, of the insulated type, are a readily available source of attractive, functional control knobs. These insulated fittings are available in two general types and a wide range of sizes which make them ideal for use with those odd size control shafts.

The photograph shows exploded views of the two common types, one with a coil spring insert and the other with a threaded brass bushing which is fitted with a set screw for completing the connection. The coil spring insert will thread tightly on threaded shafts such as are used on slug tuned coils. The set screw type is available in a number of sizes and is ideal for use with smooth shafts of odd dimensions. The photograph also shows one of these fittings installed on a slug tuned coil. The versatility of these connectors makes it worthwhile to stock a range of sizes to meet those unusual knob requirements.

. . . W4WKM

Photo: Morgan S. Gassman, Jr.

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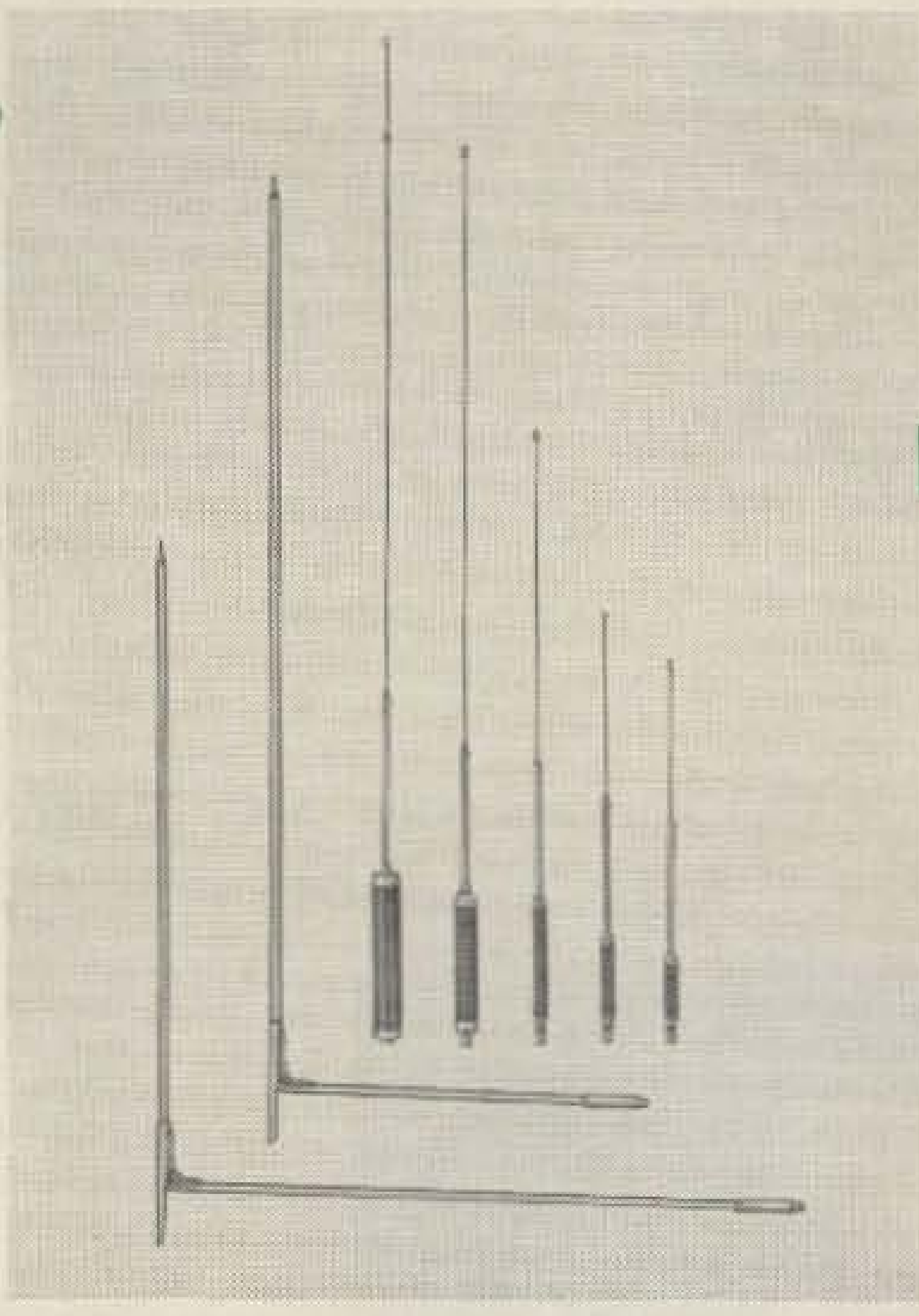

Buy only what you need—one mast and the resonators for the bands you work.

The 54-inch fold-over, heat treated aluminum mast allows the resonators to be interchanged conveniently in seconds. This feature also makes it possible to lower the assembly to clear openings in garages, carports, or low overhanging obstructions. When opened to full height, the two sections of the permanently hinged mast are rigidly held in place by a shake-proof sleeve clutch arrangement.

One mount . . . one feed line . . . one mast and a selection of resonators enable the "ham" to operate mobile with unprecendented results on any of the five popular bands. "Hams" who have field-tested these antennas are enthusiastic about the results they get out of their mobile rigs regardless of the equipment they use or the bands they work.

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Total antenna length varies between 75″ and 97″ to cover all bands.

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RM-10	10 Meter Resonator	Amateur Net **$ 5.95**
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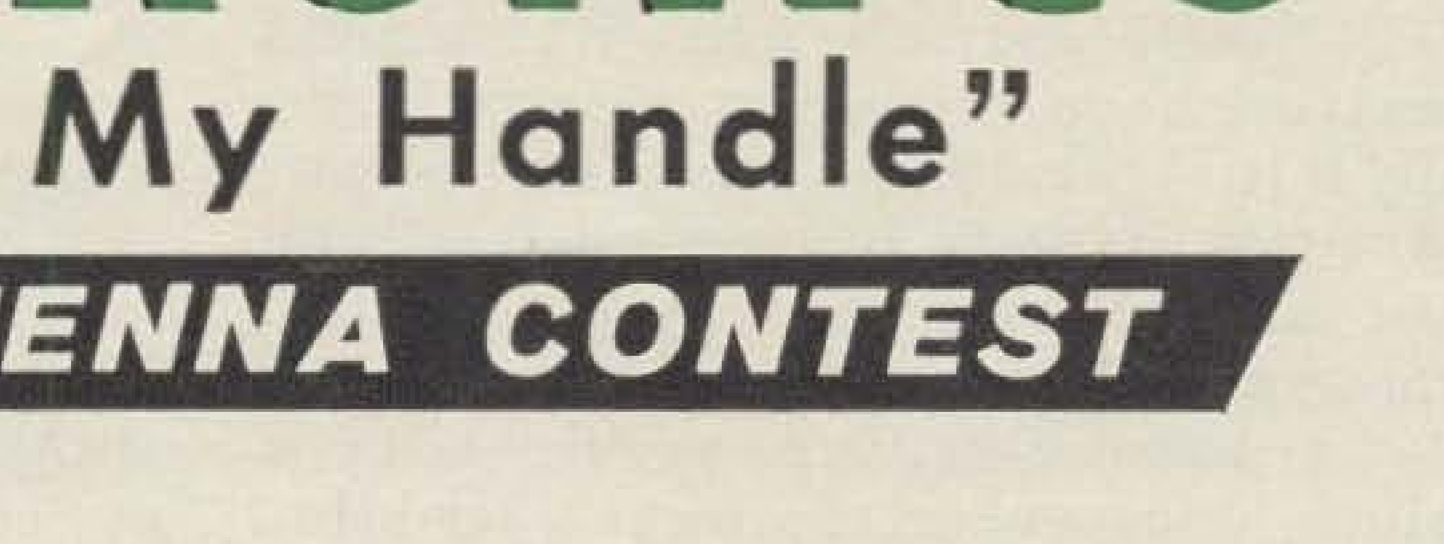

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Entry blanks and contest rules available at electronic distributors. If your distributor doesn't have entry blanks ask him to get them or write us and we will send them to you.

Nothing to buy! Contest closes March 1st, 1962.

NEW-TRONICS DIVISION 3455 Vega Avenue Cleveland 13, Ohio

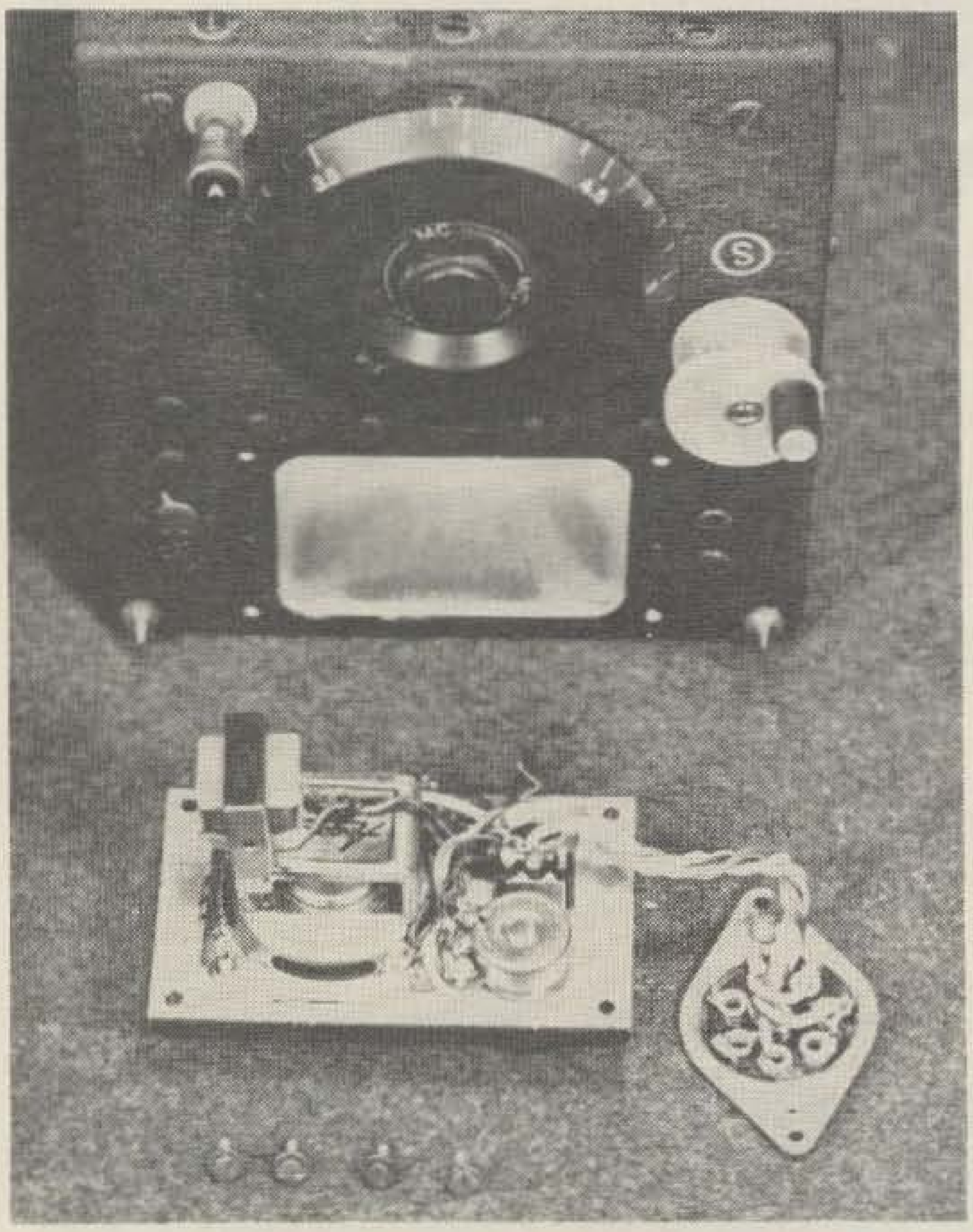
Command Set Speakers

Roy E. Pafenberg W4WKM
316 Stratford Avenue
Fairfax, Virginia

Photography by: Morgan S. Gassman, Jr.

THE SCR-274-N and AN/ARC-5 Command Set receivers have enjoyed great popularity since their initial availability after the war. Large quantities of these receivers are still on the market and are priced very reasonably. While numerous amateur conversions have been developed for these receivers, provision of a self-contained loudspeaker has been a problem. Considering the components available when these receivers were designed, they are marvels of compact construction and there is very little free room for added parts.

Modern speakers and transformers have been drastically scaled down in size to meet the requirements of the transistor radio manufacturers and their production has proven ideal for Japanese industry. As a consequence, a wide variety of "Made in Japan" miniature audio components are available at very reasonable prices. Lafayette Radio stocks many of these items and their line, for ease of identification, is cited in this article. Other firms stock similar products although their advertising does not indicate as wide a selection.



Seeing is believing. The blank control panel from the front of the receiver mounts the speaker, line matching transformer, phone jack, RF gain control and BFO switch.

Lafayette speakers which are suitable for installation in Command Set receivers are listed below. All of these units are very reasonably priced, selling for $1.49 each. The square speakers are better suited for this application since they all have the conventional flange with 4 mounting holes while the round speakers require additional mounting hardware:

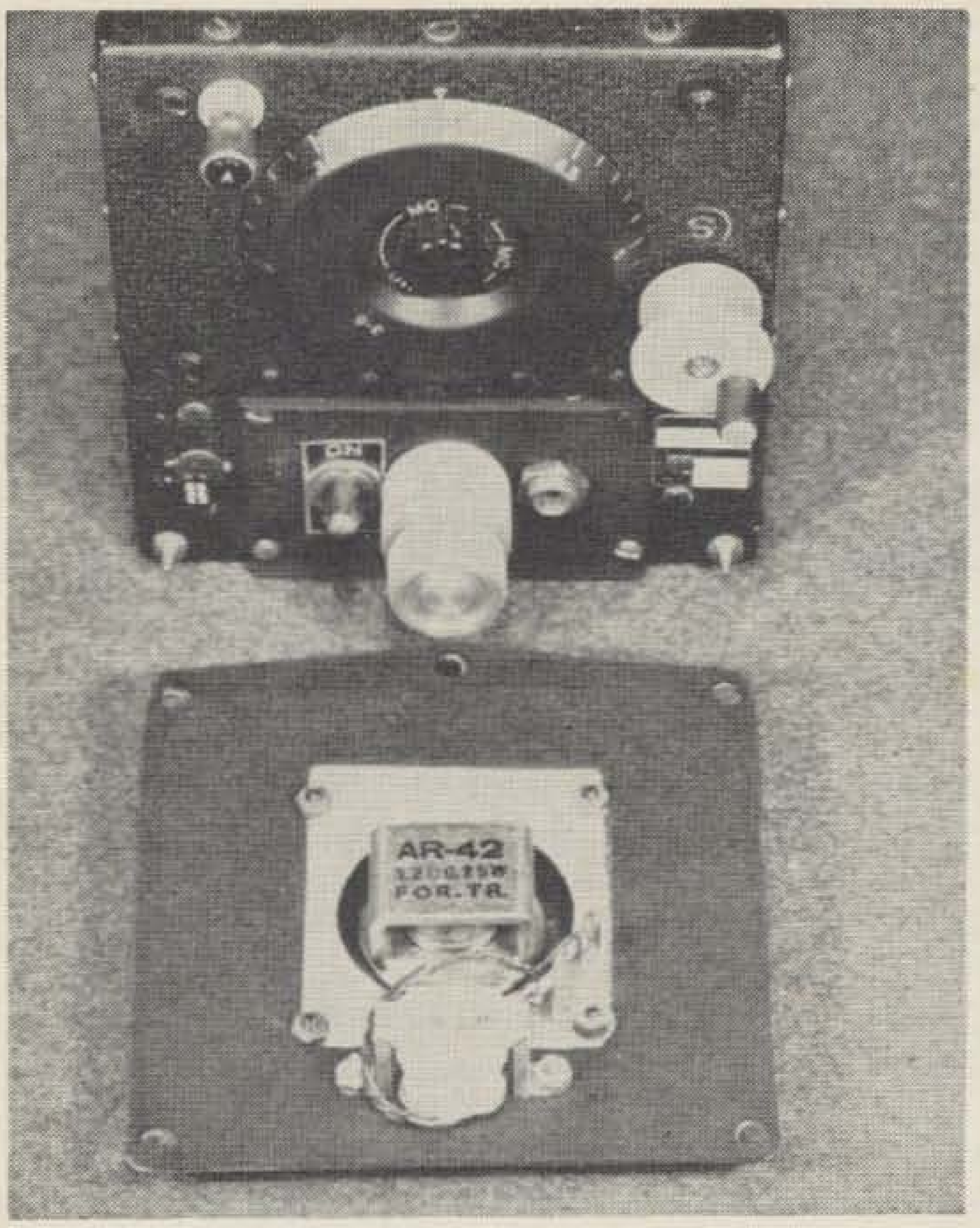
Type	Size	Style	V.C. Impedance
SK-61	1½"	Square	10 Ohms
SK-189	2"	Round	8 Ohms
SK-190	2¼"	Round	8 Ohms
SK-191	2½"	Round	8 Ohms
SK-65	2½"	Square	3.2 Ohms
SK-66	2½"	Square	10 Ohms

The first requirement for satisfactory speaker operation from the Command Set receivers is to obtain a reasonable impedance match between the output tube plate and the speaker load. The output impedance of the Command Set varies with type and model. Early SCR-274-N receivers were supplied with a single 4,000 ohm output winding while later production equipment incorporated an additional 300 ohm tap. The AN/ARC-5 and the postwar aircraft Radio Corporation Type 12 receivers were supplied with a single 300 ohm output winding.

Two courses of action are open. The original output transformer may be replaced with a plate to voice coil unit or a line to voice coil transformer may be connected to the audio output of the receiver. The latter method is probably best since it retains an output impedance suitable for headphone operation.

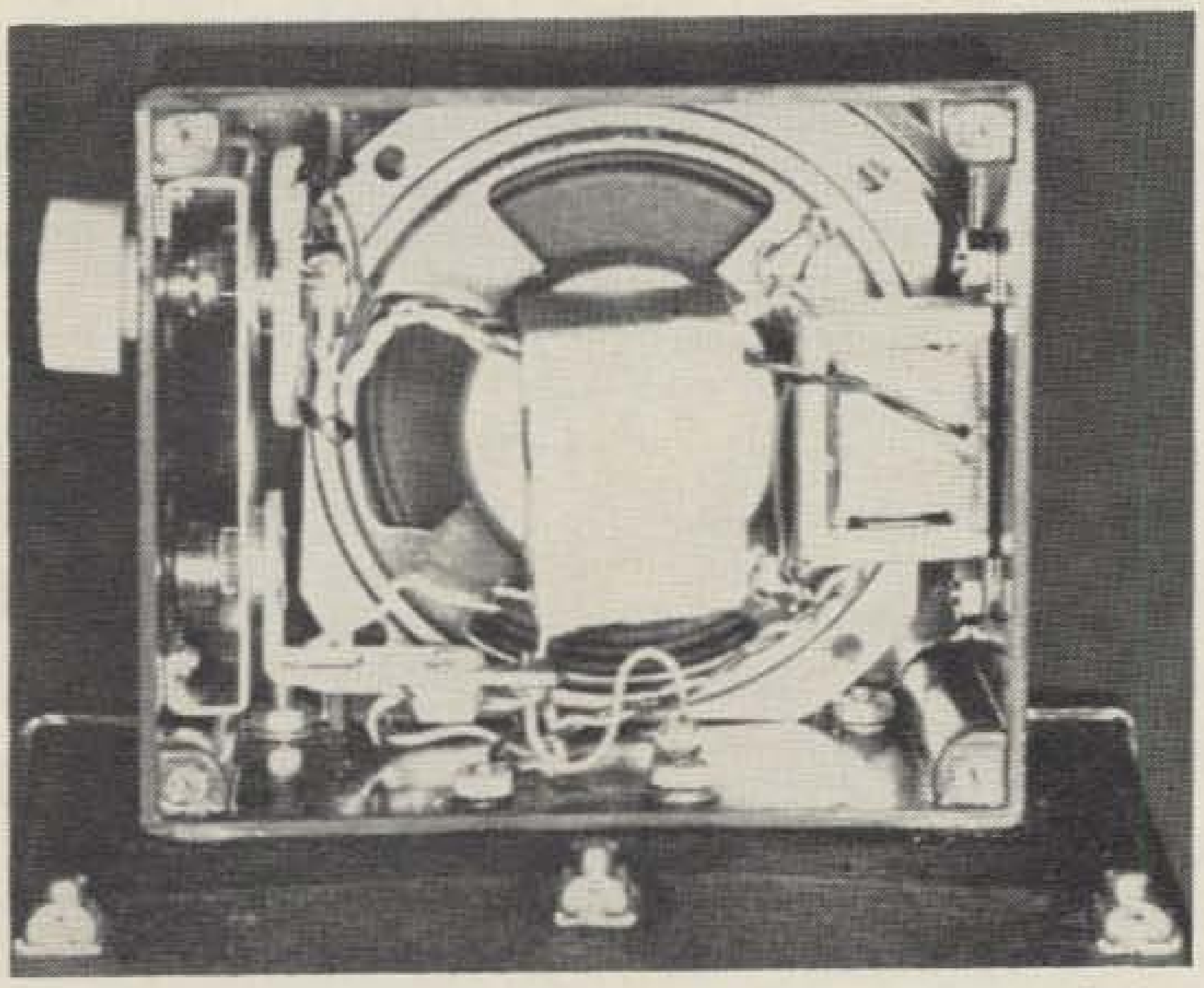
Miniature transformers, at reasonable prices, are among the imported items and these may be used as line matching transformers. The following chart lists the output impedances of the Command Set receivers, the more common voice coil impedances and suitable matching transformers. Once again, Lafayette part numbers are given. It should be remembered that transformer impedances listed are nominal values and that the turns ratio is of primary concern. While an exact match is not always possible, a reasonable match is obtained in each case.

Receiver Output Impedance	Voice Coil Impedance	Type	Design Impedance
300 Ohms	3.2 Ohms	AR-121	300 to 3.2 Ohms
300 Ohms	8 Ohms	TR-109	400 to 10-11 Ohms
300 Ohms	10 Ohms	AR-139	250 to 8 Ohms
4,000 Ohms	3.2 Ohms	AR-135	4,000 to 3.2 Ohms
4,000 Ohms	8 Ohms	AR-134	4,000 to 8 Ohms
4,000 Ohms	10 Ohms	AR-134	4,000 to 8 Ohms

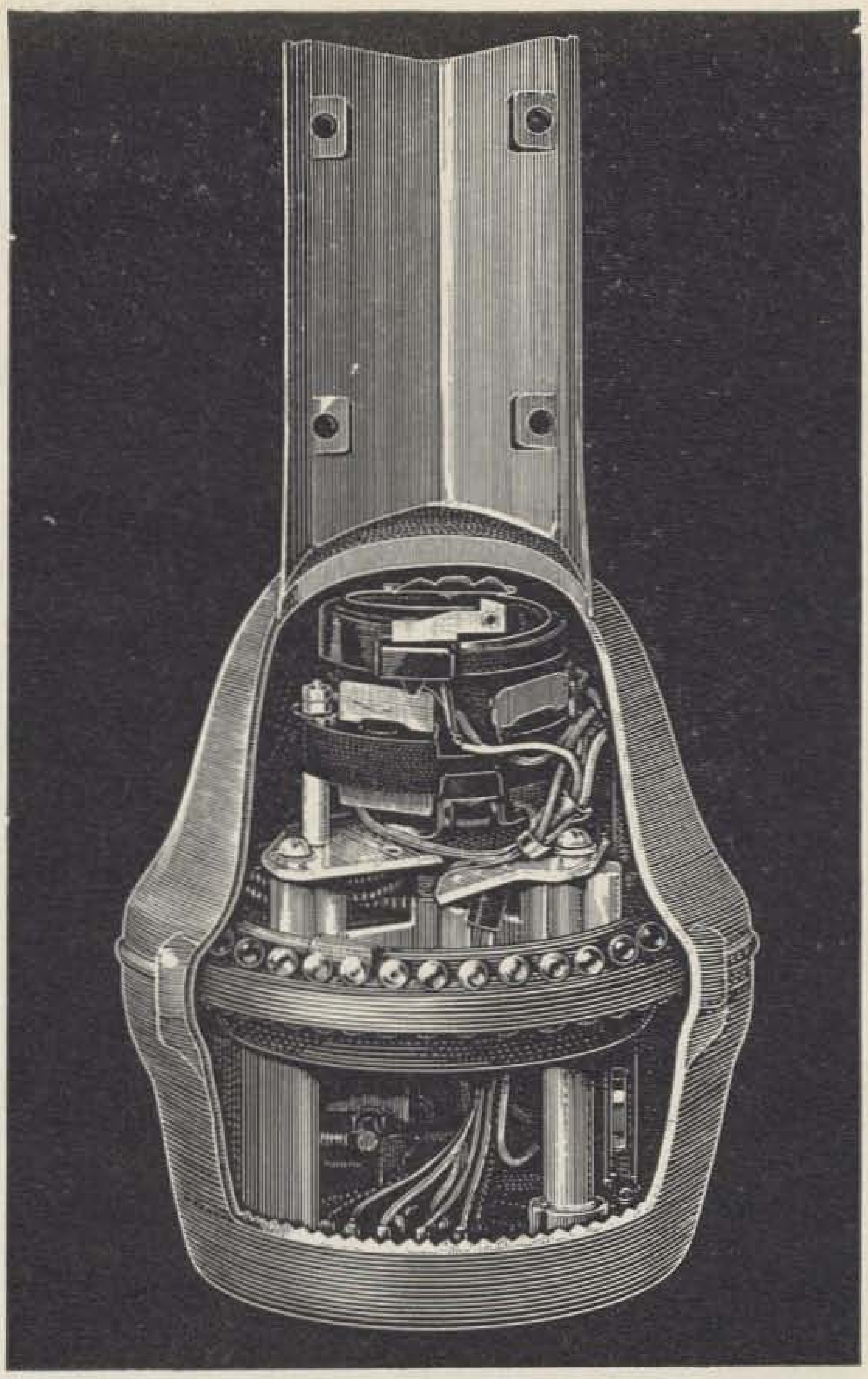


A 2½" PM speaker and miniature line matching transformer fits on the tube access cover plate of the Command Set receiver. Speaker grill is the insert from a dime store, plastic flower pot.

A remote loudspeaker unit, designed for use with TV sets, provides a good solution to the Command Set speaker problem. The unit shown in the photographs is a Lafayette Model SK-145. The compact plastic case measures 4" x 2⅞" x 1¾", excluding mounting feet and controls. The unit contains two 20 ohm speaker level controls and a 2½" square, 8 ohm voice coil, PM speaker. Also included is a 25', three conductor cable which is not used in this application. Audio quality is surprisingly good and



The compact, Lafayette Radio remote TV speaker is modified to include audio gain control, phone jack and line matching transformer.



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the unit is certainly worth the $3.88 asked.

In the receiver shown, the usual power supply modification is the only change made. The standard FT-260-A local control panel, or home brew equivalent, is installed and the SK-145 unit mounted to the top of the receiver. Remove the mounting feet; mark and drill the top of the receiver, using the mounting feet holes as a template. Drill an additional ¼" hole to clear the audio lead. Ground connection is made to a lug mounted under one of the hold-down screws. Determine the impedance of the Command Set audio output and select a suitable transformer from the chart. Mount the transformer on the side of the case as shown in the photograph. Remove the bottom audio level control and install a standard, normal through phone jack in the hole. Wire the unit as shown in Figure 1, extending the lead to the proper tap on the Command Set output transformer. BFO switching and rf gain control functions are provided by the FT-260-A control panel and audio level control is provided by the original SK-145 speaker level control. This arrangement is very simple and permits a "minimum" modification of the receiver.

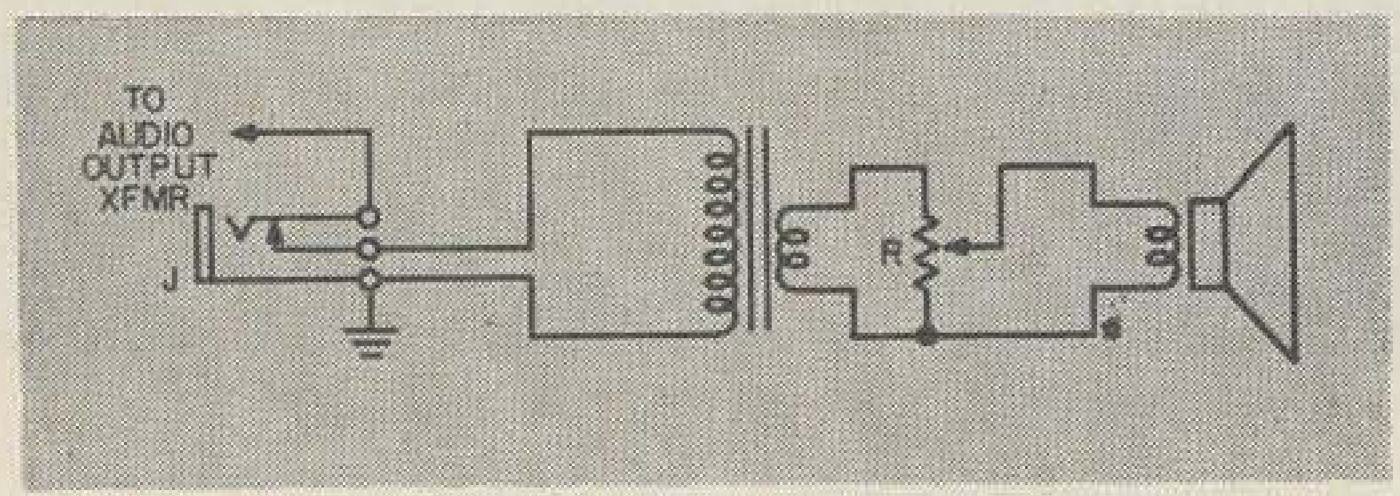
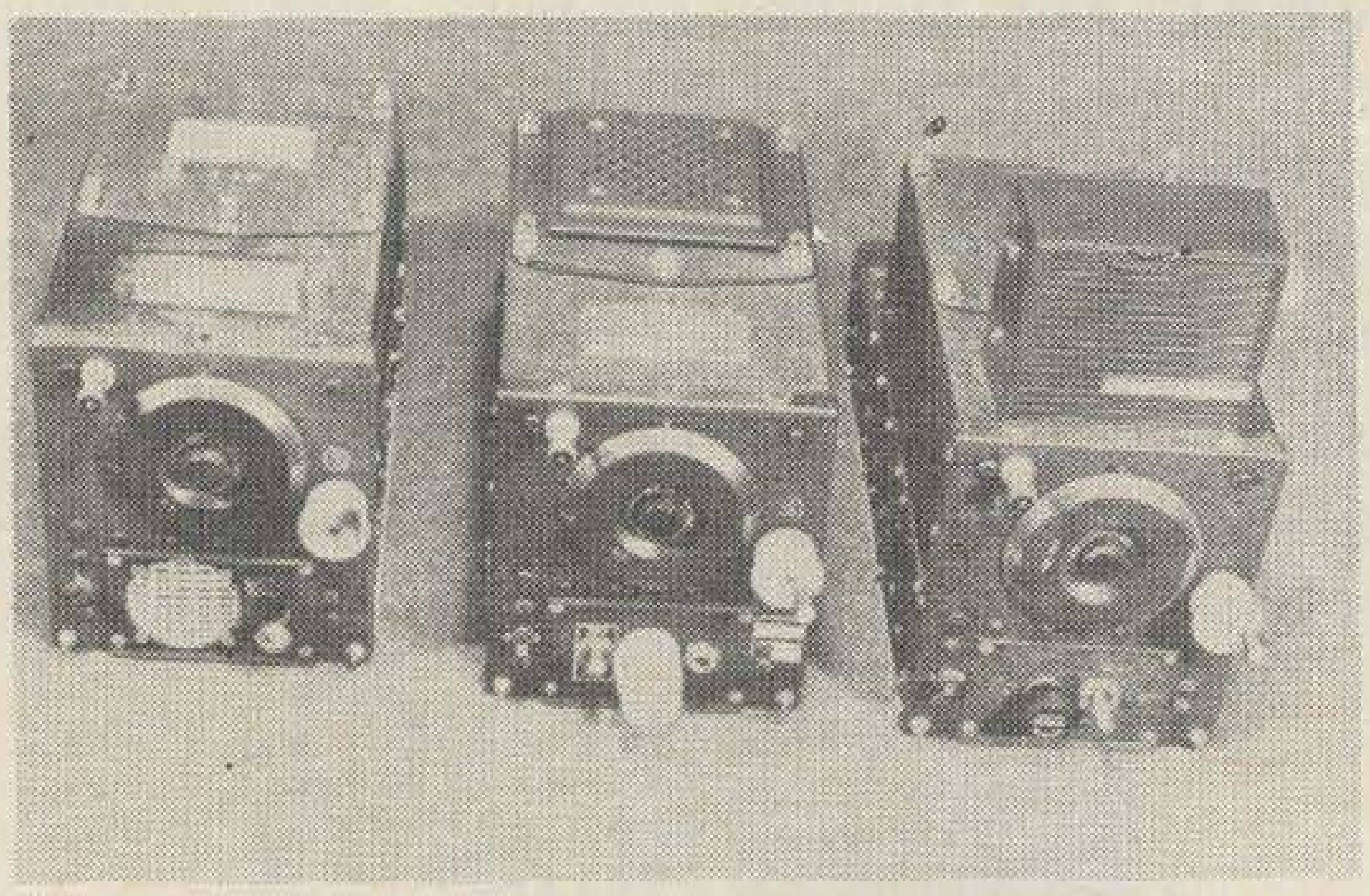


Fig 1. Revised wiring of the Lafayette SK-145 speaker for use with Command Set receivers.

The FT-230 (MX-21/ARC-5 in the AN/ARC-5 receivers) plug-in filler panel on the front of the Command Set receivers is an ideal location to mount one of the miniature speakers. In the SCR-274-N receivers, the audio output is available at the front connector. In the AN/ARC-5 receivers it is necessary to run a lead from Pin 2 of the rear connector to Pin 4 of the front connector. By careful parts selection and layout the 1½" square speaker, line matching transformer, BFO switch, phone jack and rf gain control may be installed on the


Three good answers to the Command Set speaker problem are presented in this group of these popular surplus receivers.

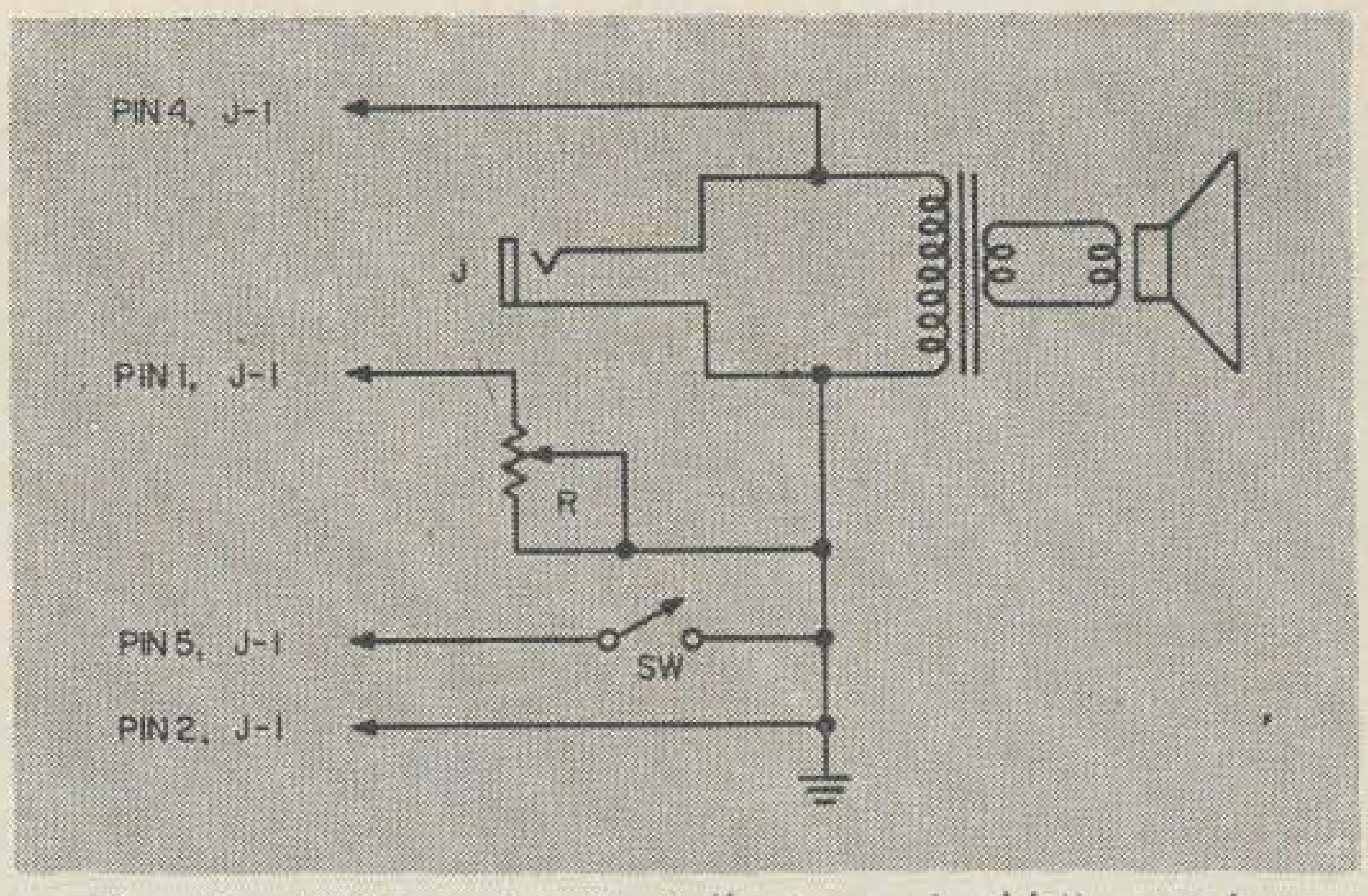


Fig. 2. Wiring for installation of 1½" speaker in Command Set receiver local control filler panel.

pane. Note that the cover of the FT-230 panel is removed along with the posts which support the connector. 2" leads are left between the panel mounted components and the connector to permit reassembly.

The line matching transformer should be selected from the chart and soldered to the speaker frame. The miniature S.P.S.T. toggle switch and rf gain control make this compact layout possible. The switch, another imported item, is available from ALCO Electronic Products Inc. of Lawrence, Mass., while the potentiometer is available from Lafayette and other sources. No drawing of the panel is supplied; lay out the parts with zero clearance and "hole move" until it all fits. It is not impossible, the photographs prove this! Wire the unit as shown in Figure 2 and you are in business.

Probably the best scheme of all has been saved until last. A 2½" square speaker may be mounted on the clip-on top cover of the receiver. The SK-65 (AR-42) speaker fits nicely if the threaded knob is removed from the center *if* transformer and the speaker mounted using ⅜" spacer posts. A suitable protective grill is installed over the speaker. The assembly shown in the photographs used the plastic insert from a dime store flower pot. A suitable line matching transformer is installed in the area above the 12SR7 tube and the leads terminated on a terminal strip secured by one of the speaker mounting screws.

The receiver shown in the photographs was extensively modified and the front plate mounts a concentric shaft, combination ac switch, rf and af gain control, normal through phone jack and BFO control switch. The ON-OFF switch plate is an aluminum foil, pressure sensitive item which is available from ALCO at 12 for 25¢.

The speaker mounting methods described in this article are truly practical. The completely self-contained feature is convenient and serves to reduce the hay-wire in the shack. While Hi-Fi is not one of the characteristics of these installations, the techniques used enhance the value of the Command Set receivers.

. . . . W4WKM

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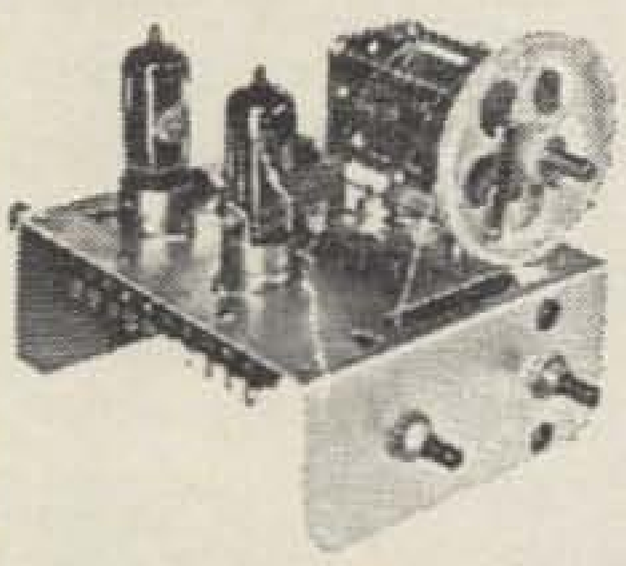

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Mod. 4/104, 4/102 or 4/103 less tubes and xtal, each $29.95

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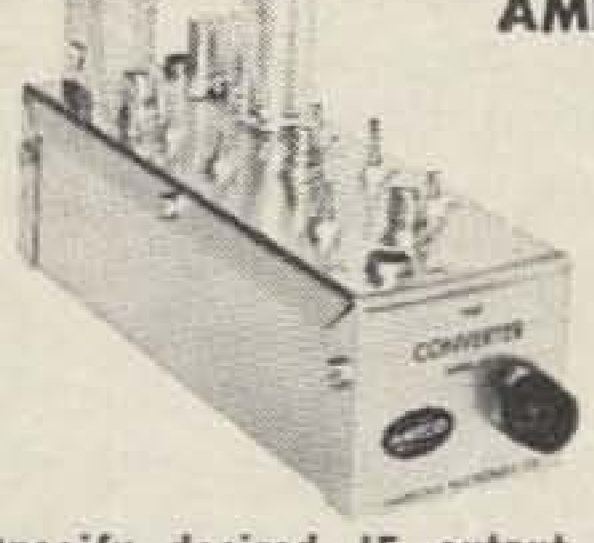

Choice of separate models for 50, 144 or 220 mc bands. Output frequency easily changed for present and future requirements. Three RCA 6CW4 Nuvistors used, two as RF amps, one as mixer with 6J6 oscillator. Noise figure: 2.5 db for 50 mc model, 3.0 db for 144 mc, and 4.0 db for 220 mc model. Image, spurious and IF rejection better than 70 db. Power required: 100-150 V @ 30 ma, 6.3 V @ 1 amp.

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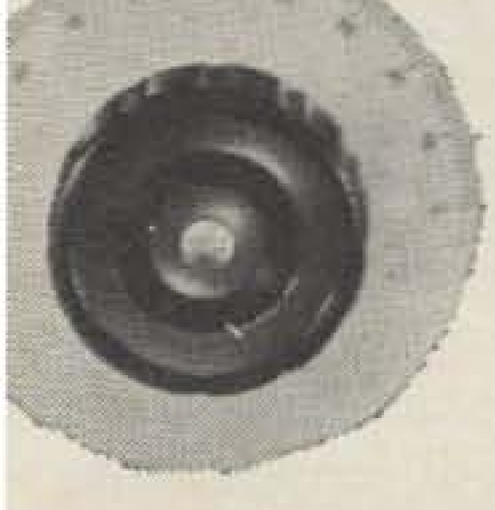

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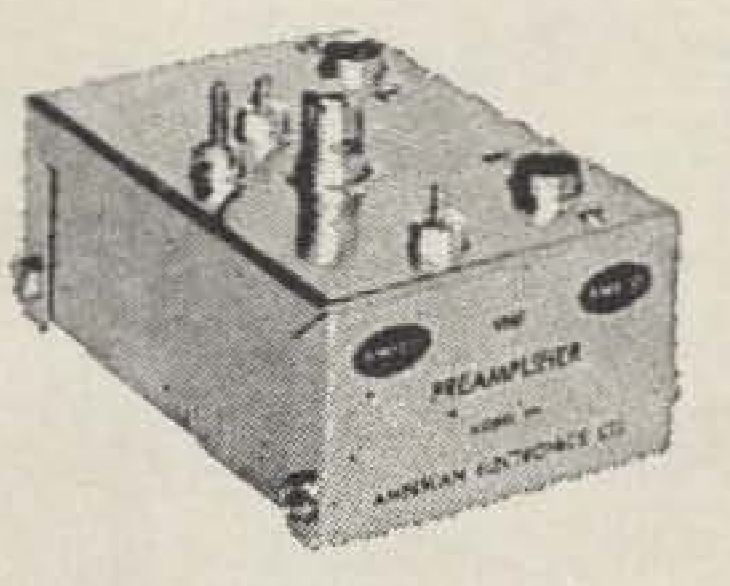

FOR 50, 144 or 220 mc. Over 20 db gain plus a lower noise figure, 2 tuned ckts, 6CW4 Nuvistor completely neutralized. Noise figure is 2.5 db @ 50 mc, 3.0 db @ 144 mc and 4.0 db @ 220 mc. Power requirements: 100-150 v. @ 8 ma, and 6.3 v. at .13 amps. Specify frequency desired.

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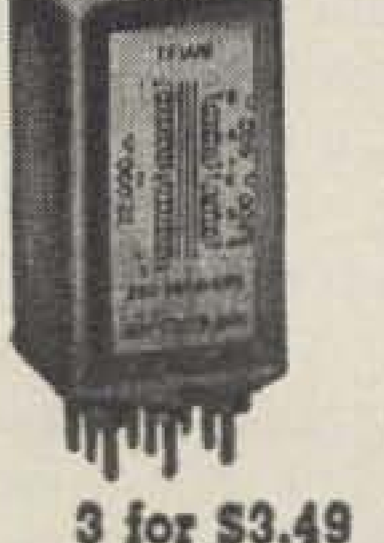

Same as used in W2EWL SSB Rig — March 1956 QST. Three sets of CT windings for a combination of impedances: 600 ohms, 5200 ohms, 22000 ohms. (By using center-taps the impedances are quartered.) The ideal transformer for a SSB transmitter. Other uses: interstage, transistor, high impedance choke, line to grid or plate, etc. Size only 2" h. x 3/4" w. x 3/4" d. New and fully shielded.

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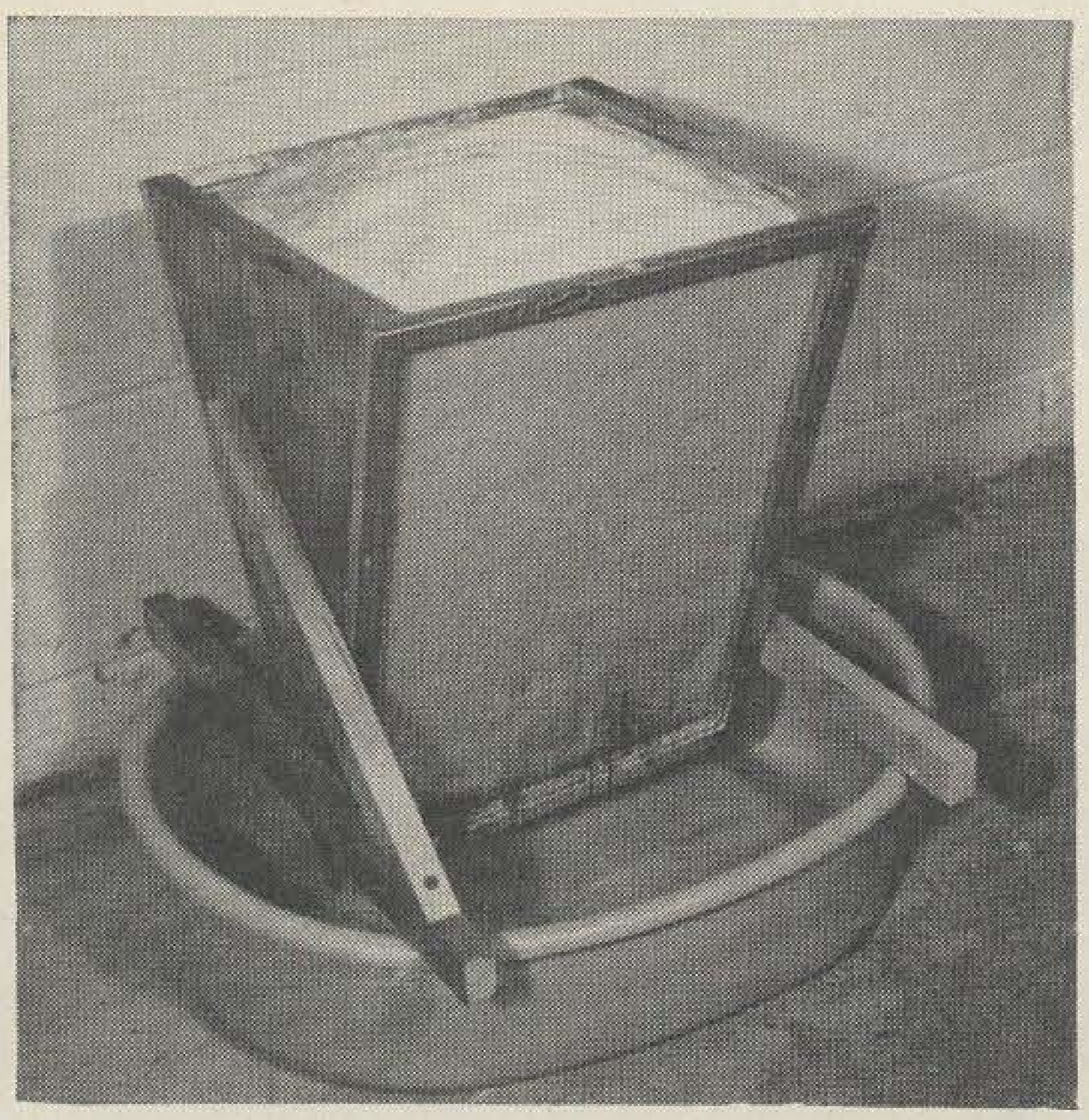
Chase That Dampness

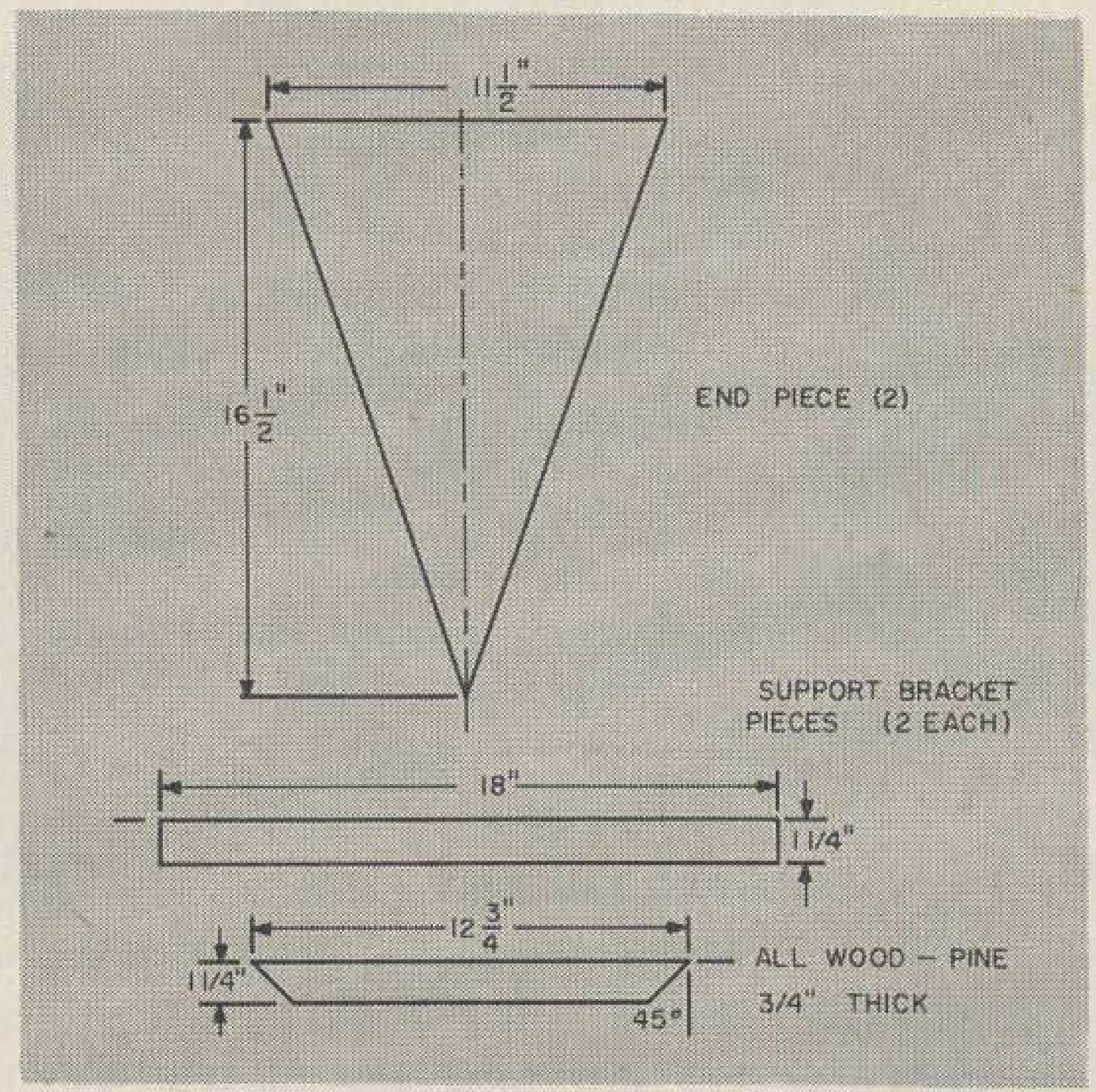
Photo by Jack Bohland Richard Genaille K4ZGM

DAMPNESS is a problem that most hams and experimenters have had to face or will face at some time or another during the course of their careers. As anyone who has ever had to replace costly electronic components can tell you, the price of keeping a shop or ham shack dry is well worth it in the long run considering the effects of high humidity on almost anything that can be found in a shop. Not only electronic gear is damaged but valuable publications, tools and countless other items as well.

When discussing the problem with others having moisture troubles the talk invariably gets around to wishing that one could afford a dehumidifier or better yet, a completely air conditioned home. In most cases, the use of mechanical dehumidifiers is out of financial reach. Many who give up in despair do not realize that for a few dollars one can rig up a fairly decent chemical dehumidifier and keep it going for a considerable period of time without additional expense. This article proposes to describe a simple system, in use in the author's basement shop, which can be tailored to suit ones needs and which has helped the author to keep his basement humidity to a reasonable percentage. The system is not nearly as perfect as a mechanical system might be but it can help to keep things under control until you can make the plunge to a more expensive means.

The unit shown in the photograph was constructed in very little time from scrap lumber and some "do-it-yourself" aluminum from the hardware store. As can be seen, two small aluminum screens were fabricated from the "do-it-yourself" aluminum hardware and screen wire and screwed to the two end pieces of wood. The support brackets keep the "V" shaped trough supported above a 20 quart wash basin. The size of the unit can be adjusted by the builder in order to accommodate larger or smaller drain basins. The chemical used in the unit is calcium chloride ($CaCl_2$) which has a great affinity for water. Calcium chloride can absorb its weight in water in a short time. The author paid approximately $4.50 for a one hundred pound sack which lasted for about three months. The time that this chemical will last depends upon how many units one has installed and, of course, how humid the basement becomes during rainy or humid weather. As the calcium chloride absorbs moisture it dissolves and drips into the basin. The salt solution in the basin should be emptied from time to time, preferably in a gutter. As can be imagined, the heavily con-





centrated calcium chloride solution can wreak havoc on lawn, plants and shrubbery. The author has used the solution along a fence to kill weeds and tall grass and on a dirt drive to keep the dust down. The high concentration of the solution keeps it from drying up for some time thus preventing dust from rising. Emptying the residue down the basement drain should be avoided due to possible chemical reaction with the house plumbing. The chemical dehumidifier should be kept filled with the calcium chloride for best results.

Don't wait for humidity to cause you trouble in your "ham" shack or shop. A small investment in time and money to build a chemical dehumidifier similar to the one described to chase that dampness may be one of the wisest investments that you have ever made.

. . . W4ZGM

PARTS LIST

1. 120' OF No. 12 COPPERWELD WIRE
2. 2 TELREX 40 METER TRAPS (3KW40MT)'
3. 4 HIGH VOLTAGE INSULATORS
4. TELREX "BALUN" (MODEL ADB/321)

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1st ORDER OF PROCEEDURE, CUT THE COPPERWELD WIRE INTO 7 LENGTHS. (2) PCS. 31'-6" LONG (THE 40 M. SECT.) (2) PCS 21'-6" LONG (THE 80 M. SECT.), (2) 5' LONG, AND (1) 4' LONG.

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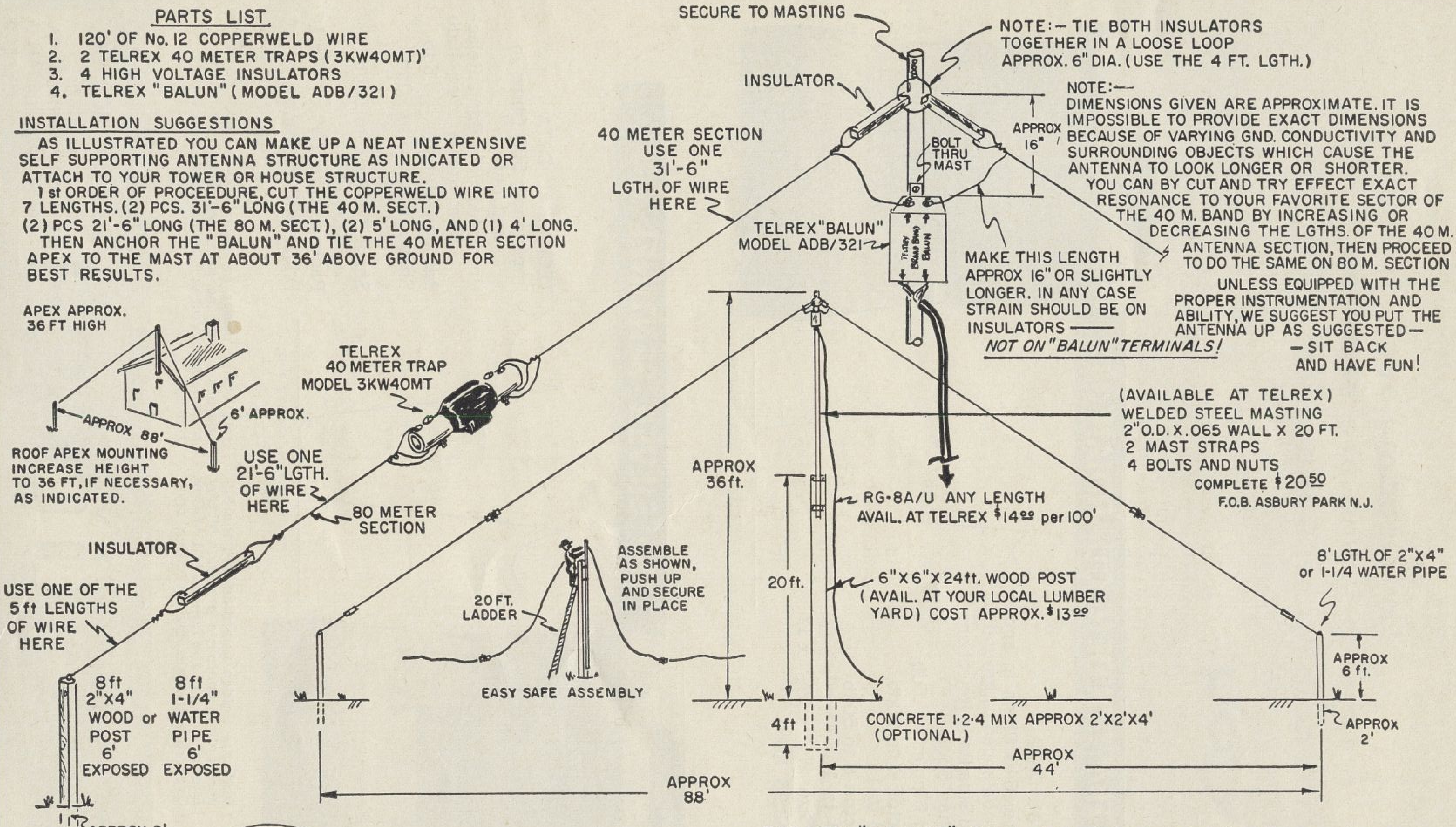

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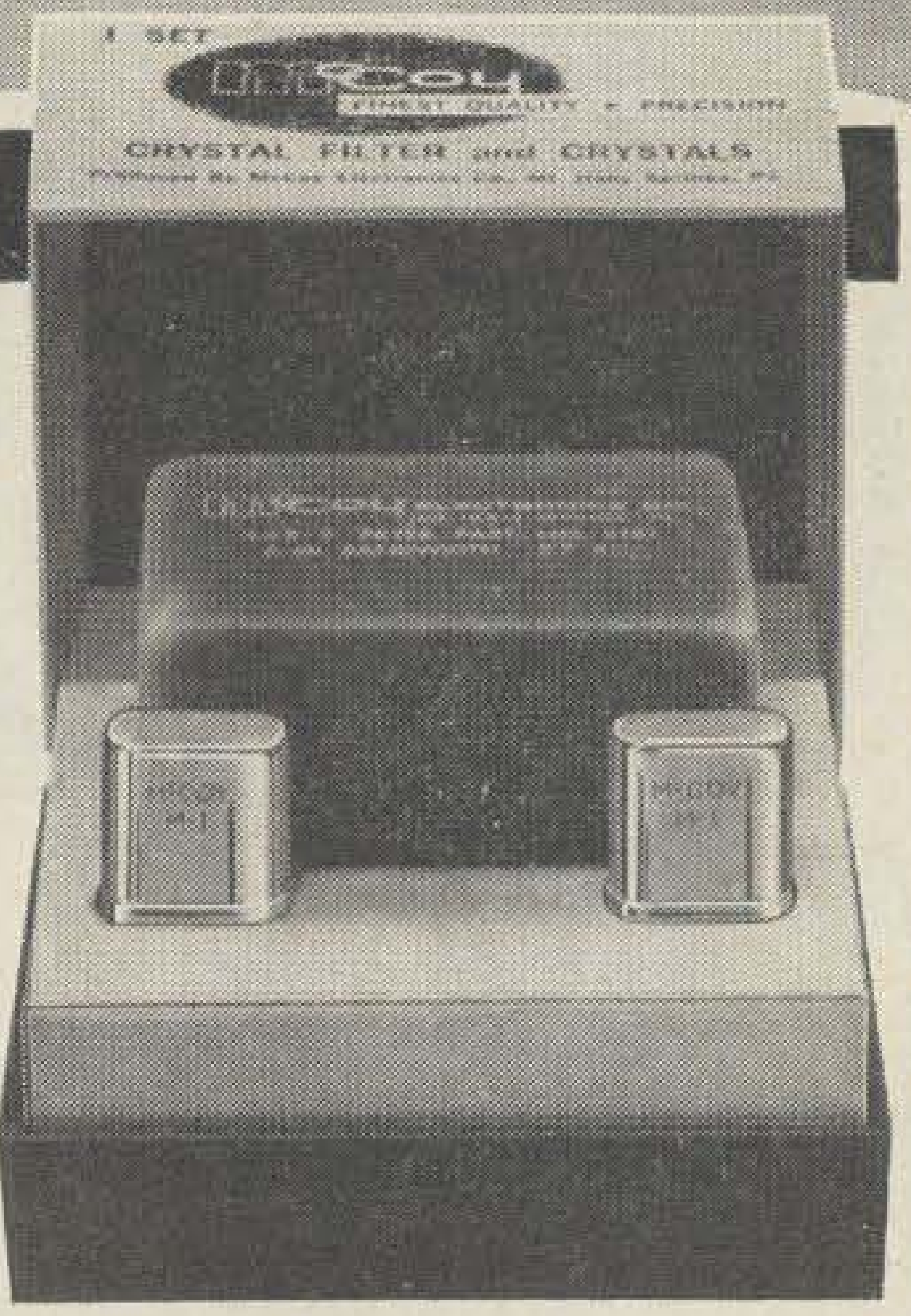

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TECHNICAL DATA
Impedance: 640 Ohms in and out (unbalanced to ground)
Unwanted Side Band Rejection: Greater than 55db
Passband Ripple: ± .5db
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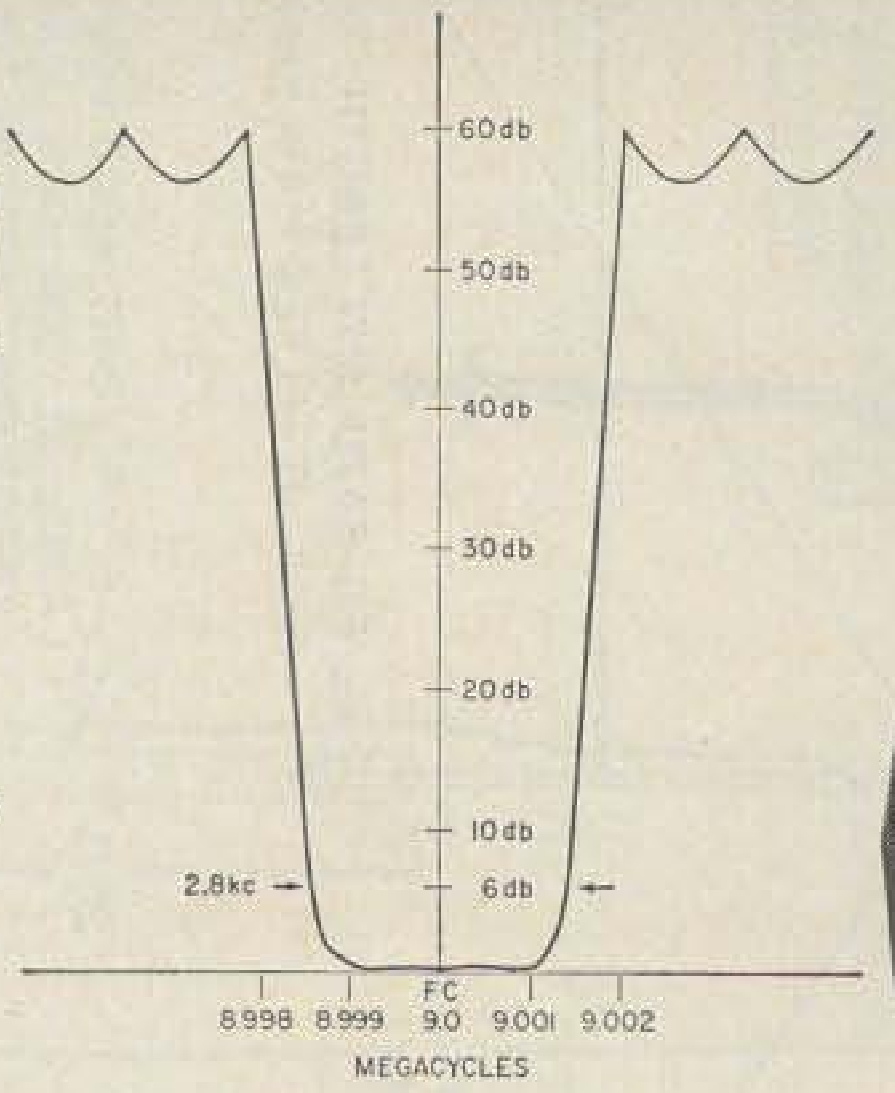
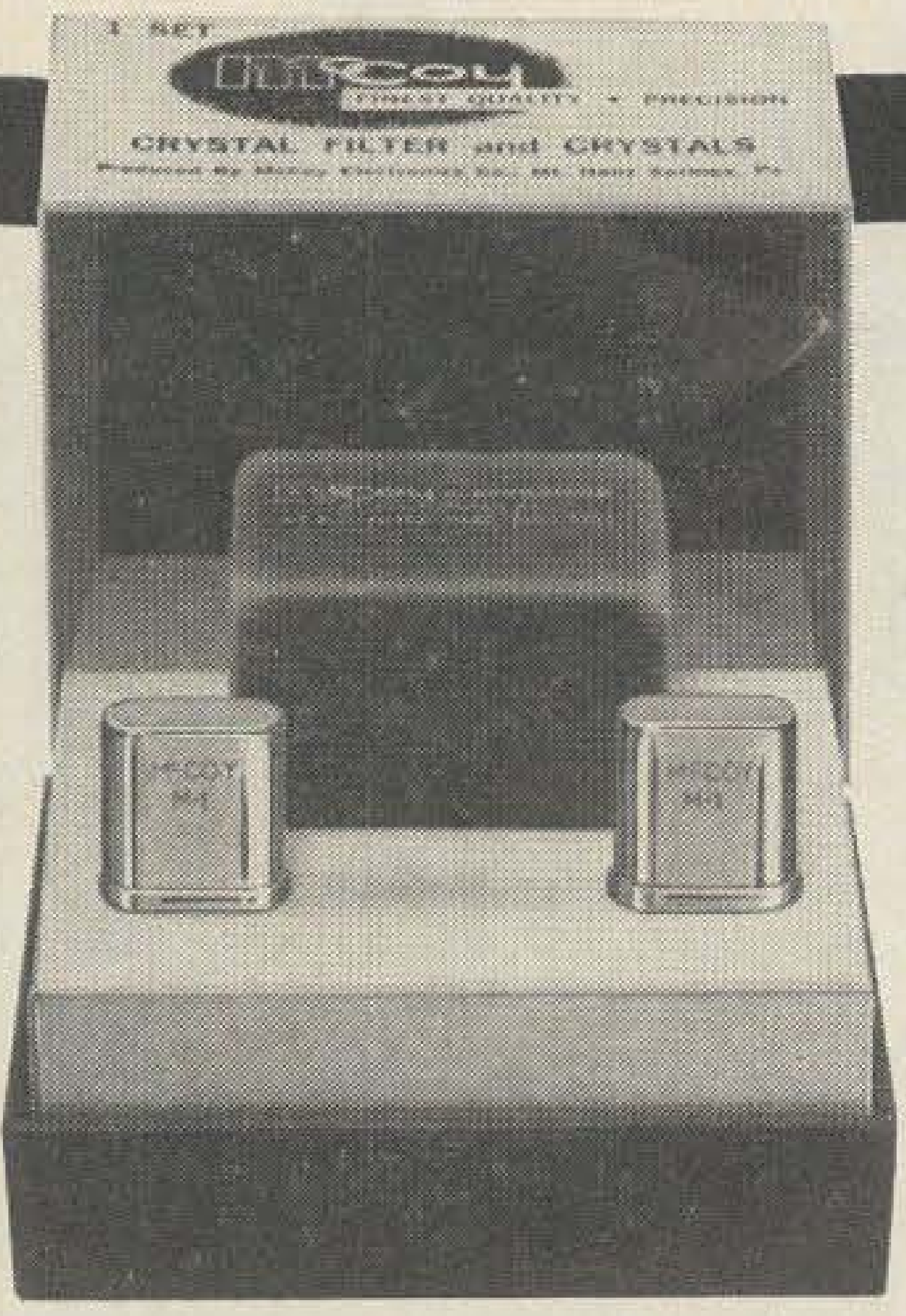
Price: $42.95 Each





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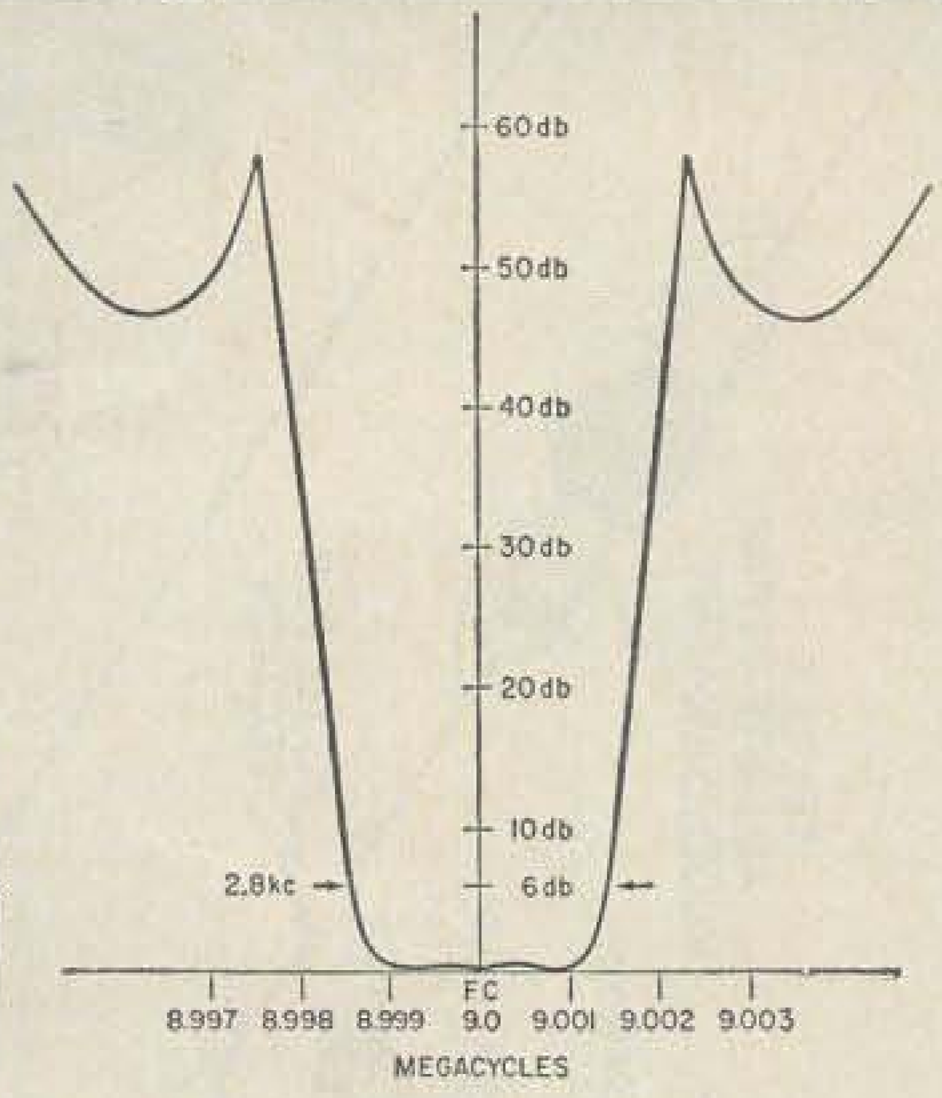

TECHNICAL DATA
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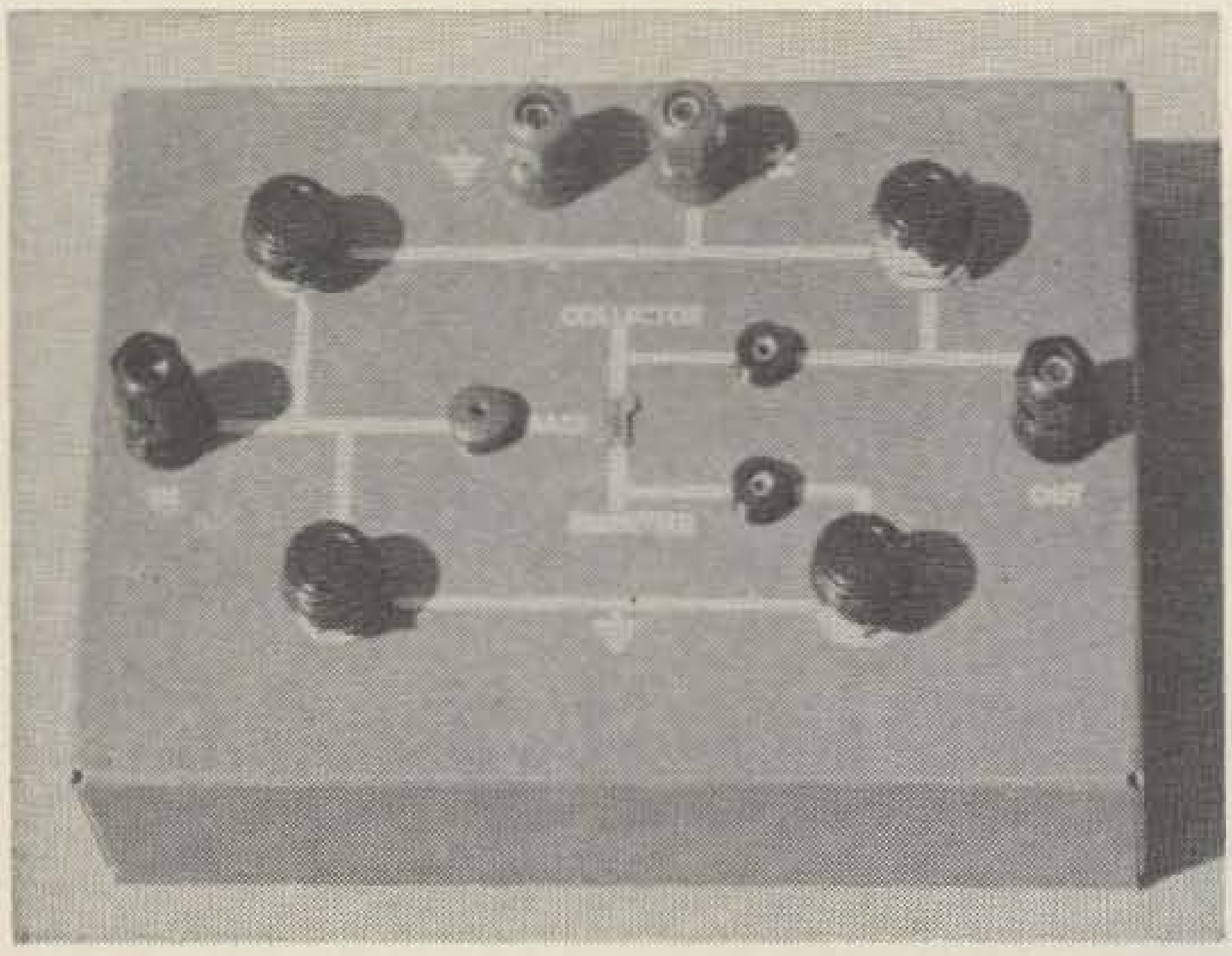


Transistor Analizer

Don Wherry W6EUM
2121 Grandview Drive
Camarillo, California

If you are like the majority of we electronic mortals you're aware that the science of electronics is rapidly leaving you far behind, with probably, your area of most rapid fossilization in the field of solid state devices. There are three possible approaches to this dilemma; (1) close up shop and go to school, (2) ignore the entire thing and hope it will go away, and, (3) do something about it at home. Approach number one has its merits, but most of us have become accustomed to eating and would like to continue the habit, also a lot of us have become attached to the XYL—albeit in a somewhat detached manner. Approach number two is easy but its success seems a little in doubt at the moment. Approach number three brings us to the subject of this article.

It frequently has been the lot of Joe Blow ham, service man etc. to, of necessity, determine the operating parameters for a familiar transistor in a new application, or perhaps even more often a new or different transistor in a known circuit. It has also been the lot of a few of us to fall heir to a transistor for which we have no available literature. To all of these categories the unit illustrated will probably furnish an answer.

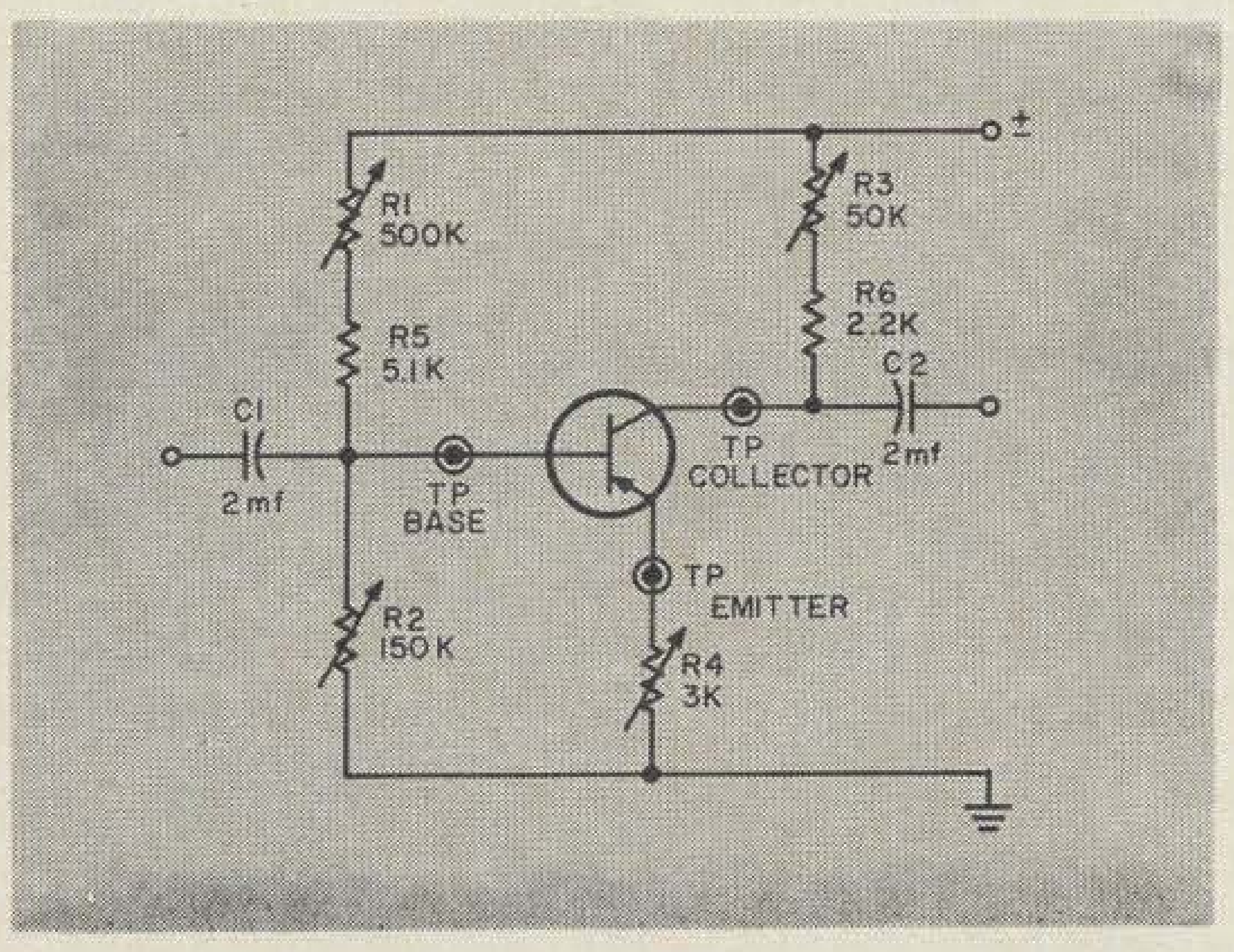
An examination of the circuit diagram of Fig. 1 will show it to be transistor "hook up" in the usual grounded emitter configuration. The feature that makes this unit valuable is the presence of variable resistances in each transistor lead. This feature allows a wide range of base currents, collector load values, etc., to be adapted to any given type of transistor. All these parameters can be calculated I know—but can you do it? Especially if you have no data sheet for the transistor you are holding in your hand.

Lets take a typical case. You have a solid state device in your possession which has 2N000 printed on the side and you can find no information on it what-so-ever. You want to use it in a preamplifier circuit for your tape recorder let's say. First, you don't even know if it's a NPN or a PNP. Well, to find out, you should remember one thing—the base of a three terminal transistor is biased in the forward direction, in other words the base-emitter direction will have low resistance to current flow when a voltage is applied with the correct polarity. Don't put an ohmmeter on the device to measure this resistance, such action can easily ruin a good transistor. The easiest way to do this is as shown in Fig. 2. This is a 1½ volt flashlight battery, a resistor and a meter with a one milliampere or greater sensitivity, your bench multimeter with its 100 microampere scale is fine. With the transistor base and emitter placed across the test terminals the reverse bias polarity will show very little or no current flow through the circuit while the correct, or forward, polarity will show a current flow of approximately the same value as if the test terminals were shorted. Let's say that with the base going to the plus side of the battery the maximum current is indicated on the meter. This means that the base is a "P" or the transistor is a NPN, collector N, Base P, emitter N. If the base is to the negative end of the battery for maximum current flow the base is a "N" or the transistor a PNP. The small arrow shown on the transistor emitter lead in a solid state circuit diagrams always points towards the negative potential. If the transistor is a PNP which operates with the negative potential on the base the arrow will point towards the base, while if it is a NPN with the positive potential on the base it will point away from the base.

Now since the base is biased in a forward direction and the collector in the reverse direction our NPN transistor must have the positive side of the battery to the collector or "hot" terminal of the test unit, with the negative going to the grounded side. Our next question is a sticker—how much voltage do we put on the transistor? There is no real good answer for this if you have no information at all on your 2N000, however let's start with a 7½ volt C battery and see how we do.

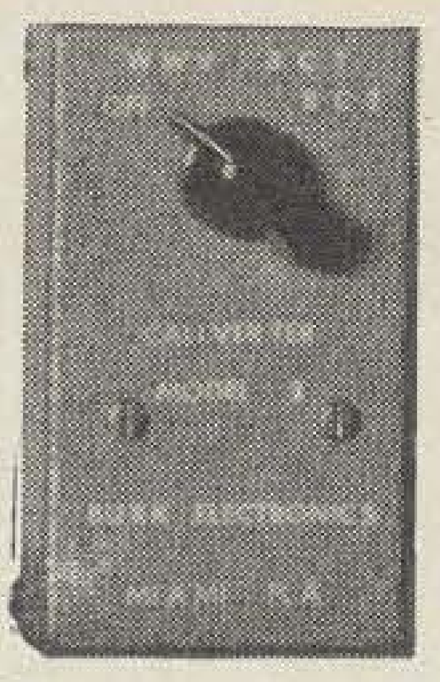
Turn all potentiometers in a full clockwise direction, plug in the transistor, connect the battery with the minus going to the ground, connect your af generator to the input and your oscilloscope to the output. I might say right here that you should have an oscilloscope of some kind to do any work with transistors. Those little solid state devices can turn a perfectly good sine wave into the nicest square wave you ever saw. Beg, borrow, steal or even buy a scope if you want to work with transistors.

Now that we are all connected, apply about 10 millivolts from the af generator into the tester and look at your scope. You probably will see a very badly distorted wave shape if anything at all. Start turning R1 counterclockwise until the tester output cleans up into a good sine wave. You will find that some



1—Wire all potentiometers for full resistance in circuit when in counterclockwise position viewed from top.
2—Use non-polarized condensers for C1 and C2 as the supply voltage will change from plus to minus depending on transistor type.
3—TP—Test Points.

combination of R1 and R2 will give a nice undistorted output. If it doesn't, look for a bad transistor socket connection or a new transistor. Assuming the transistor is good and you have a good output you will notice that the gain goes up as R4 is turned counterclockwise out of the circuit. This is normal and represents a parallel situation to an unbypassed cathode resistance in a vacuum tube



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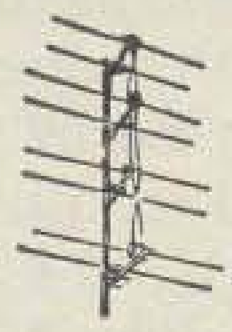

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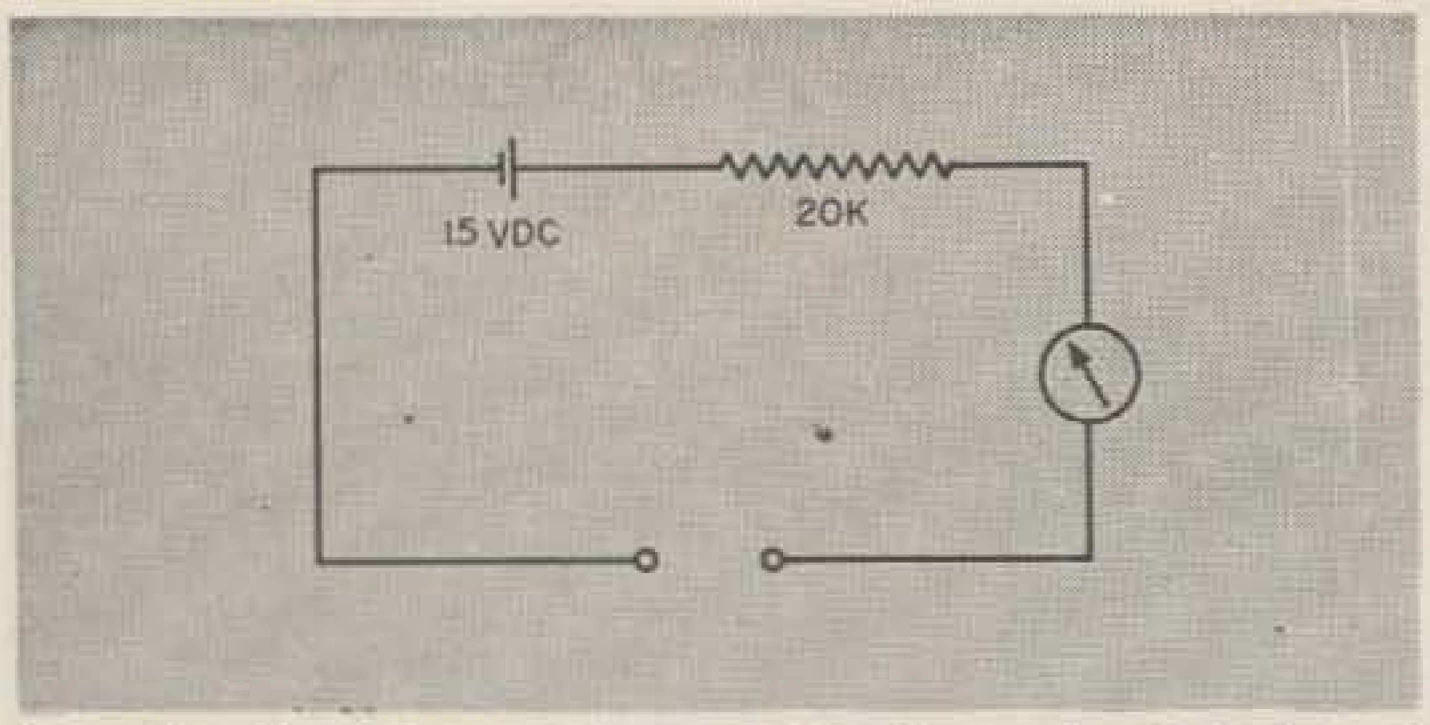


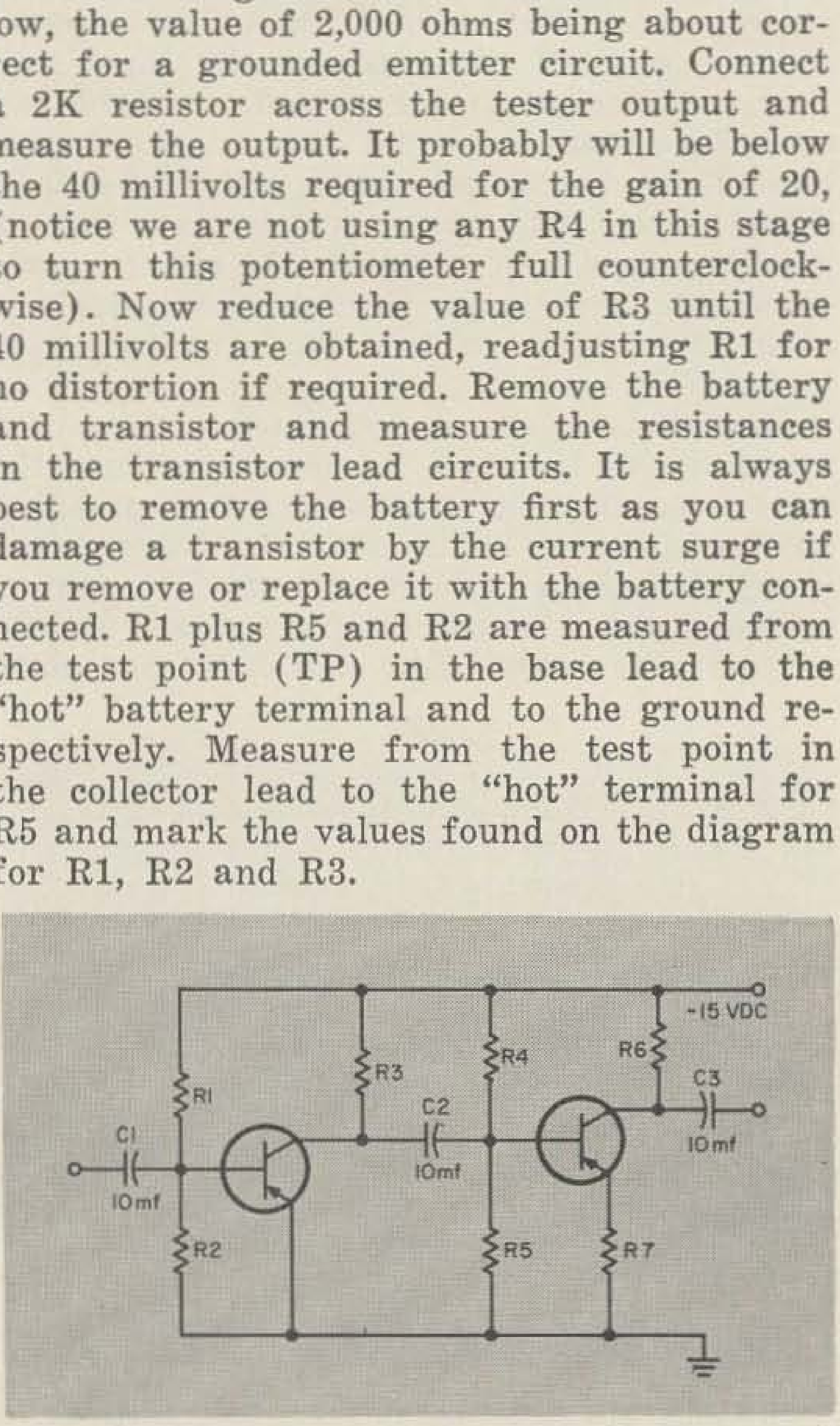
circuit. By the proper adjustment of R1 and R2 this R4 resistance can be turned completely out of the circuit. By now, with R3 clockwise, R4 counterclockwise and R1 and R2 adjusted properly you probably have a gain of at least 100—ten millivolts in, and one volt out.

Now since transistors are really current, and not voltage amplifiers you should load this stage with the impedance you are going to use. If it's going into a tube circuit with a high value of grid resistance this is not so important, however if its load is to be of a relatively low value, place a resistor of this value across the tester output and then adjust R3 for maximum output—readjusting R1 and R2 if necessary to prevent distortion. You will notice that as your external load resistor goes down in value you must also go down in value with your collector (R3) load resistor to maintain the stage gain. This is analogous to a vacuum tube where a low mu tube such as a 12AU7 with its low plate load resistor is used when power is desired in the output and a 12AX7 with its high plate load resistor is used when only a voltage gain is desired. Care must be taken as you reduce the collector load resistor that you don't exceed the maximum collector current for the particular transistor used, however with the test circuit as shown in Fig. 2, this situation is not at all likely to happen.

By now you have arrived at some definite conclusions, no doubt. First; the base bias, it should be called current instead of voltage, is relatively critical for a given set of conditions, but the exact value of R1 and R2 is not at all critical, as long as the correct ratio is observed. As a general statement, if your stage is operating in a high temperature environment, or the transistor has a high collector current it is well to keep R2 resistance relatively low, say around 5K or so, and adjust R1 as required. However, if the operating conditions are OK then R2 can be of any value up to an open circuit with R1 again adjusted for correct base current. Two; R4 acts like the cathode resistor of a tube circuit, i.e., it is degenerative when not bypassed, thereby allowing higher inputs without overloading the stage, but in so doing it reduces the gain. Three; R3 can be of high value when the stage has a high impedance load but must be reduced as the stage load impedance is reduced.

Now let's go through a two stage amplifier for your tape recorder head output for an example of how this tester can help you. The circuit is shown in Fig. 3. Let's say your head puts out 2 millivolts and you want an output of one volt from your amplifier. This represents a voltage gain of 500. Let's aim for a gain of 20 in the first stage and 30 in the last which will give us the 500 with a little to spare.

Connect your transistor, known or unknown, into the test unit as previously described and adjust R1 and R2 for proper base current (bias). Now since this stage feeds another transistor stage the load resistance is rather low, the value of 2,000 ohms being about correct for a grounded emitter circuit. Connect a 2K resistor across the tester output and measure the output. It probably will be below the 40 millivolts required for the gain of 20, (notice we are not using any R4 in this stage so turn this potentiometer full counterclockwise). Now reduce the value of R3 until the 40 millivolts are obtained, readjusting R1 for no distortion if required. Remove the battery and transistor and measure the resistances in the transistor lead circuits. It is always best to remove the battery first as you can damage a transistor by the current surge if you remove or replace it with the battery connected. R1 plus R5 and R2 are measured from the test point (TP) in the base lead to the "hot" battery terminal and to the ground respectively. Measure from the test point in the collector lead to the "hot" terminal for R5 and mark the values found on the diagram for R1, R2 and R3.



Now replace the transistor and battery and apply 40 millivolts to the input and again adjust for correct base current as shown by an undistorted output. As this will be the output stage of your preamplifier and you will be feeding the high impedance input of your main amplifier which uses tubes, the input impedance probably will be around 500K. Use this 500K ohm resistance value for the tester load, and after R1 and R2 are adjusted for proper base current, measure your output. You will probably have an excess of one volt. If so, turn R4 clockwise, putting resistance into the circuit, until the output drops to the desired one volt. Now remove the battery and transistor, measure the resistance values and you are all set to build the amplifier. Your input and interstage coupling condensers should be large as indicated because of the low input impedances of the transistors, otherwise you will lose gain, especially at the low frequencies.

You now have a transistor amplifier "designed" without even knowing, at the start, if your transistors were NPN or PNP.

This amplifier is a simple circuit to design and I have described a simple "tester." You can make a tester as complicated as you wish by adding meters to the various element legs, provisions for external loads of various kinds, such as transformers, etc. Even provisions for applying feedback circuits if desired. I think, however, that this tester as is, will get us started on the right track and especially it will allow us to use our old transistors which we may have on hand and for which we have no data.

It's simple and cheap to build—go to it.

. . . W6EUM

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Here is an easy way to tap polystrene, lucite, or plexiglass so often used to support coils and rf carrying components. Drill a hole slightly smaller than the screw to be used, fasten the screw on a "self holding" screwdriver and heat over a flame. The screw will then neatly cut the threads. Be careful, though, not to get it too hot. . . . W7INX

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To adapt the smaller pin (.05) HC/6U to the larger (.093) pins, slip the pins from an old octal tube over the pins on the crystal. The pins can be soldered to make it permanent but do not use excess heat.

. . . WA2INM

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SOME time ago the author described a simple break-in system which was easy and cheap to construct, relatively simple to install, and had *no* relays.[1]

However, after considerable on-the-air operation, one or two shortcomings of the system became apparent, and it was decided that these would have to be corrected.

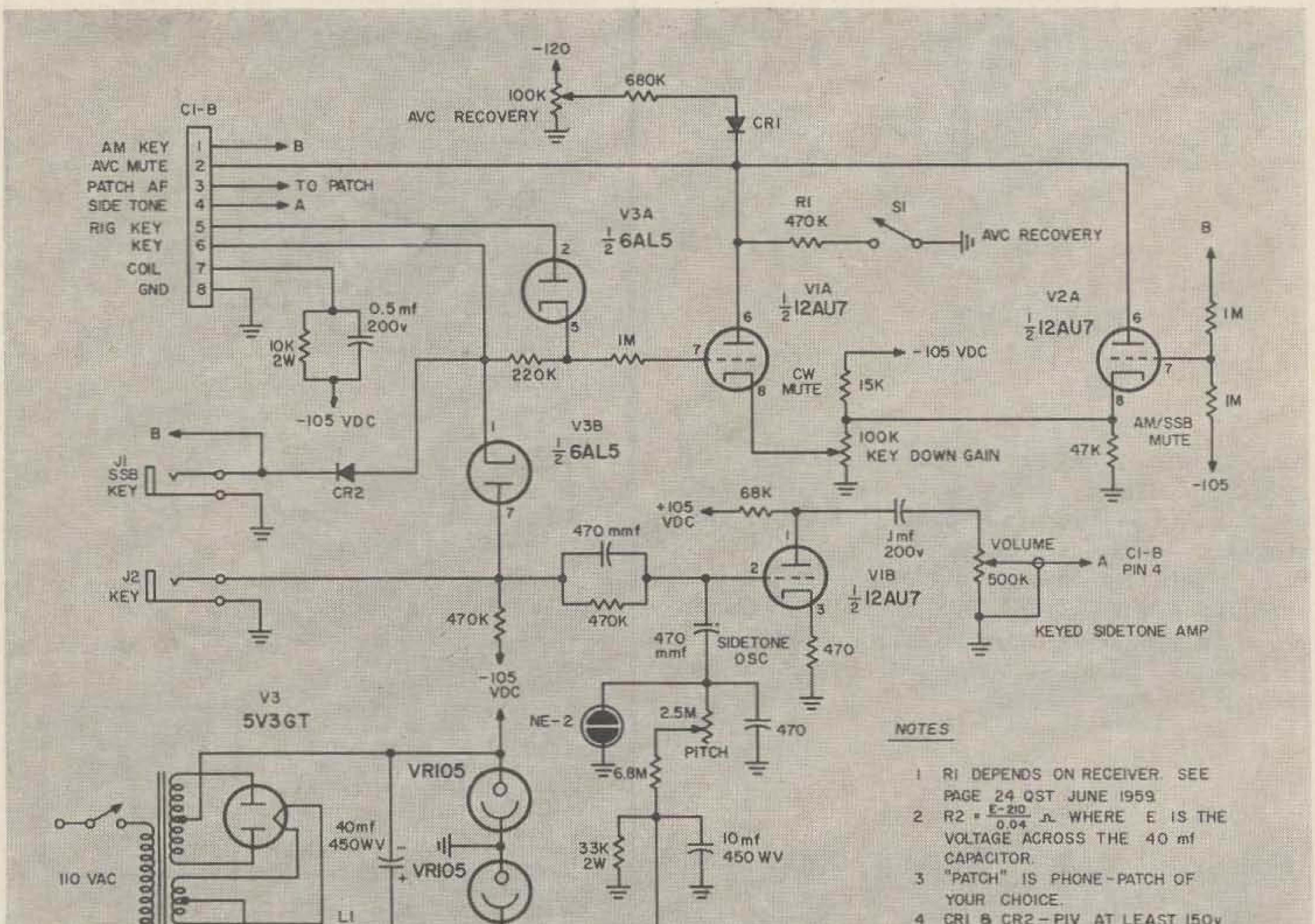
The principal source of trouble was the electronic TR switch. Lack of reliability (too-often replacement of the tube), coupled with poor weak signal performance on the higher bands, indicated that the TR switch would have to go, even if a relay would have to be substituted.

The second bothersome point was that the sidetone oscillator was slightly "clicky" when keyed, and did not have a particularly "listenable" tone. Modification of this circuit, then, was also indicated.

In the earlier unit the key down gain was variable for all modes of emission, so that on AM or SSB the control had to be turned to minimum gain. The addition of a switch allowed this to be taken care of more easily, but still left something to be desired. Thus a third modification provides full muting on AM and SSB, but left the key down gain variable on CW. In addition the sidetone had to be turned off manually on AM and SSB. This was made automatic in the new unit.

As with the earlier version, the revised system was applied to a Heathkit Apache transmitter and a Hallicrafters SX-100 receiver. The adaption of the system for use with other combinations of equipment will be discussed later.

To replace the TR switch a small light relay was chosen and used as a TR relay. The schematic of the associated circuitry is



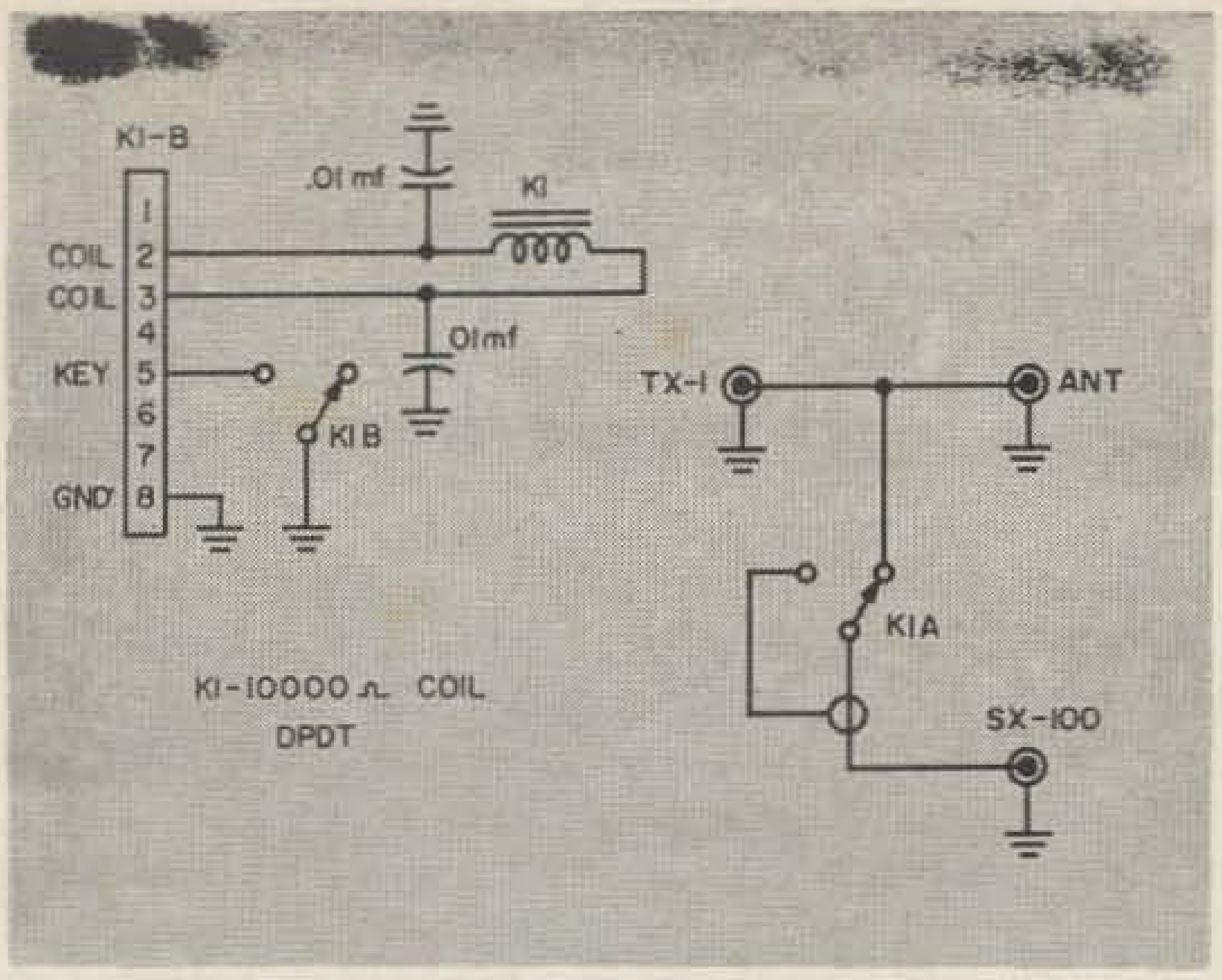


Fig. 2

shown in Fig. 2. In the system here all of this circuitry is mounted in a small minibox which is fastened to the back of the transmitter with self-tapping screws. The box is located near the output connector on the rear apron of the rig. Where this box is placed is not critical, but it should provide a shielded enclosure around the relay for best results. In this vein, if it has not already been done, it would be well to replace the input connector to the receiver with a coax fitting.

Figs. 2 and 3 are the schematic and inter-unit cabling diagrams respectively. On CW the circuit is keyed at key jack J2. The NE-2 Sidetone Oscillator runs continuously and the key removes the blocking bias from the keyed sidetone amplifier, allowing the output to be fed to the receiver. Diode V3B allows the key action to be fed to the rest of the circuit on CW, but prevents keying of the monitor on AM and SSB.

Closing the key also grounds the plate of the diode V3B, bringing its cathode up to approximately ground potential. This removes the −105 volts of bias from that point, allowing V1A to conduct, muting the receiver to an extent determined by the cathode voltage, which is set by the key down gain control. In addition the coil circuit to the relay is closed, operating the relay. In addition to removing the receiver input from the antenna and grounding it, the second contact grounds pin 5 of connector K1-B (Fig. 2). This is the line marked "Rig Key," and grounds the key line in the transmitter and removes protective blocking bias from the final and modulators. Diode V3A insures that the receiver stays muted until the relay opens.

CR3 prevents receiver muting when the transmitter power is off, and CR4 prevents the spotting circuitry in the transmitter from keying the blocking bias on the final and modulators.

On AM either the internal or the remote plate switch is used as a transmit-receive

[1]—Horwitz, "Simplified Break-in Control," p. 24, QST, June, 1959.

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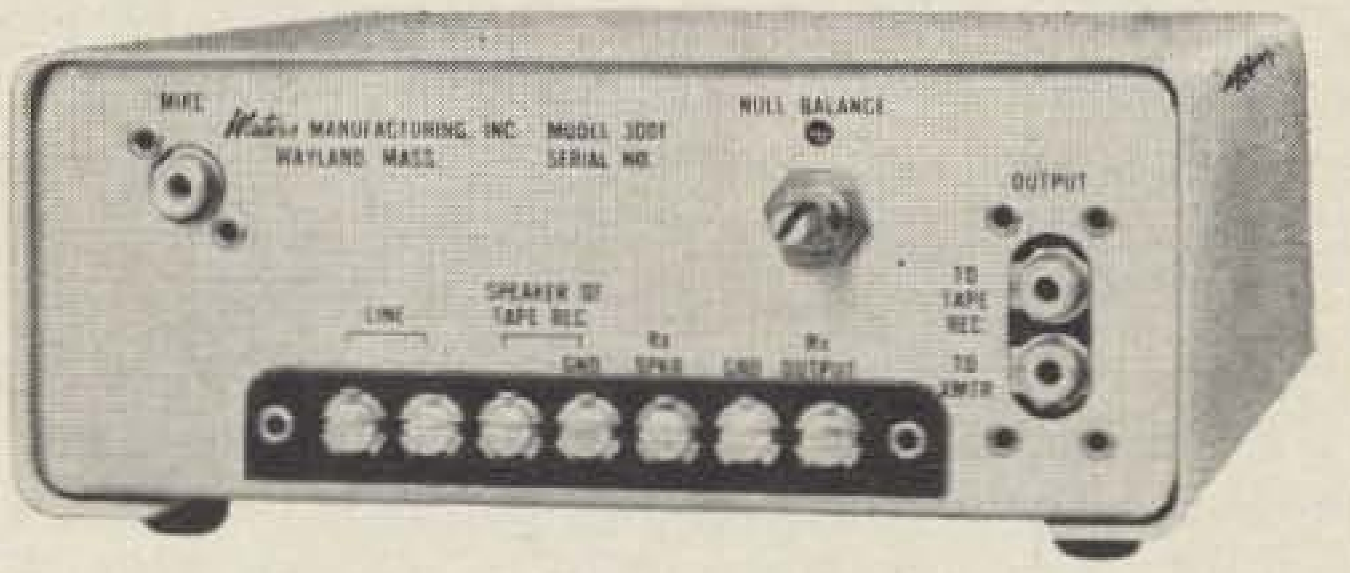

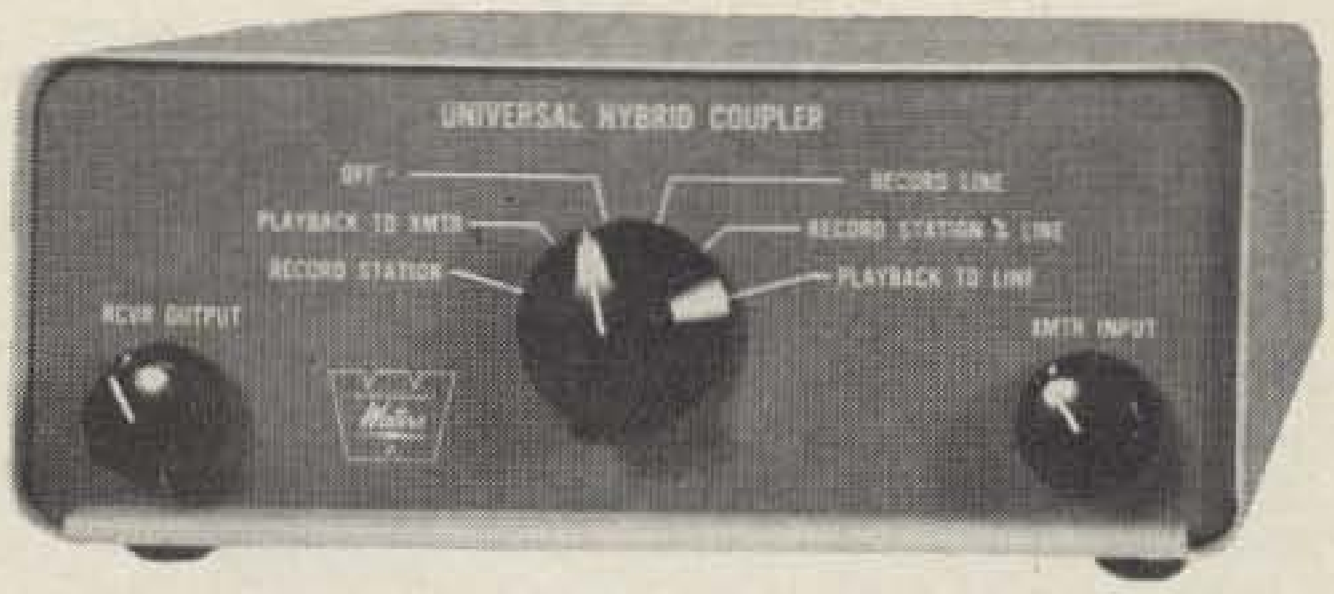

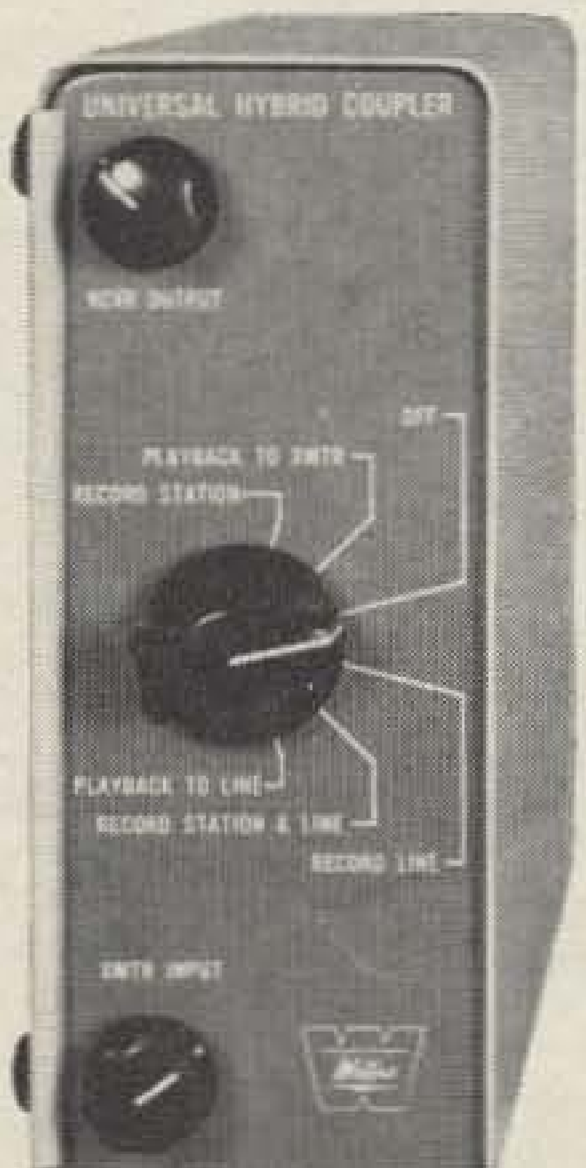

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switch. When the switch is on the internal relay in the Apache is activated, and grounds the line at TX-1-B. This is the AM key line, and when grounded it keys the relay and the CW muting circuit through CR2. However, it also keys the AM/SSB muting circuit V2A which overrides V1A and provides full muting. The final and modulators are normally biased to cutoff to protect them, and these are keyed on through Pin 5 of TX-1-A, which is the original accessory socket on the rear apron of the transmitter.

On SSB the lead from the VOX relay in the SSB exciter is plugged into J2. When this is keyed to ground the antenna relay and the muting circuits behave as on AM.

CR1 is used to partially clamp the AVC line to a bias slightly greater than that expected for a very large signal. In effect CR1 helps the receiver recover very fast for strong signals, and speeds up the recovery considerably for weak ones. Switch S1 provides fast recovery for all signals, but reduces AVC action when it is closed.

All of the silicon diodes could be replaced by 6AL5's or equivalent. However CR3 and CR4 are wired right into the plugs at which they are shown in Figure 3, so if this convenience is desired then silicons will have to be used at this point.

Figure 4 shows the internal modifications to the control circuitry in the Apache. The first modification, which is not directly concerned with break-in, but which is shown in Figure 4A for the sake of completeness, concerns the addition of a relay to enhance spotting operation. With a TR switch or relay the amount of signal supplied by the Apache VFO is extremely strong at the receiver input, so that it is sometimes difficult to hear the station being zero-beat through the VFO. Whether or not this is necessary will depend on the particular transmitter used, as will whether or not contact K_{1a} is needed.

Relay K_2 in Figure 4 is the original 110 vac relay in the Apache. Note that the contacts and coil connections have been rewired. The relay does not operate at all on SSB or CW, but only on AM. The contacts at TX-1-B are used to key the break-in circuitry on AM. Be sure to notice that the lead from the plate switch has been *disconnected* from the key line, so that the TR relay actually keys the rf. This is part of a rather complex interlocking arrangement that protects the receiver from receiving a dose of 150 watts of RF and prevents the modulators from operating without load or the finals without drive. If for any reason the break-in unit should fail to operate, the TR relay would not key the transmitter, keeping the modulator and final biased off through the bias key line. (This protection does not, of course, protect against failure of some component in the transmitter itself, such as the driver tube.)

Figure 4B shows the modifications to the rest of the control circuits. The keying half of the plate switch is disconnected, as mentioned above. Pin 5 of the accessory socket is now active on AM and SSB, when it is used to key the final and modulator. On CW the spotting relay keeps the final (the modulator is off because K2 does not operate, removing screen voltage) on except when the spotting switch is pressed. This allows spotting to be accomplished on CW without turning off high voltage. Note that Pin 1 (remote key on AM) is now connected to the internal key line on all modes. Keying is *not* done through the transmitter key jack, which would defeat the protective features of the system by applying full power to the receiver input. The system is keyed through J2 on Figure 1.

It might be well to point out that jack SX-100-A is the original accessory socket on the SX-100 receiver with certain pins removed from their former circuitry and reconnected. The steps to take here should be fairly obvious for those who are using SX-100's, and similar terminals should be made available on other

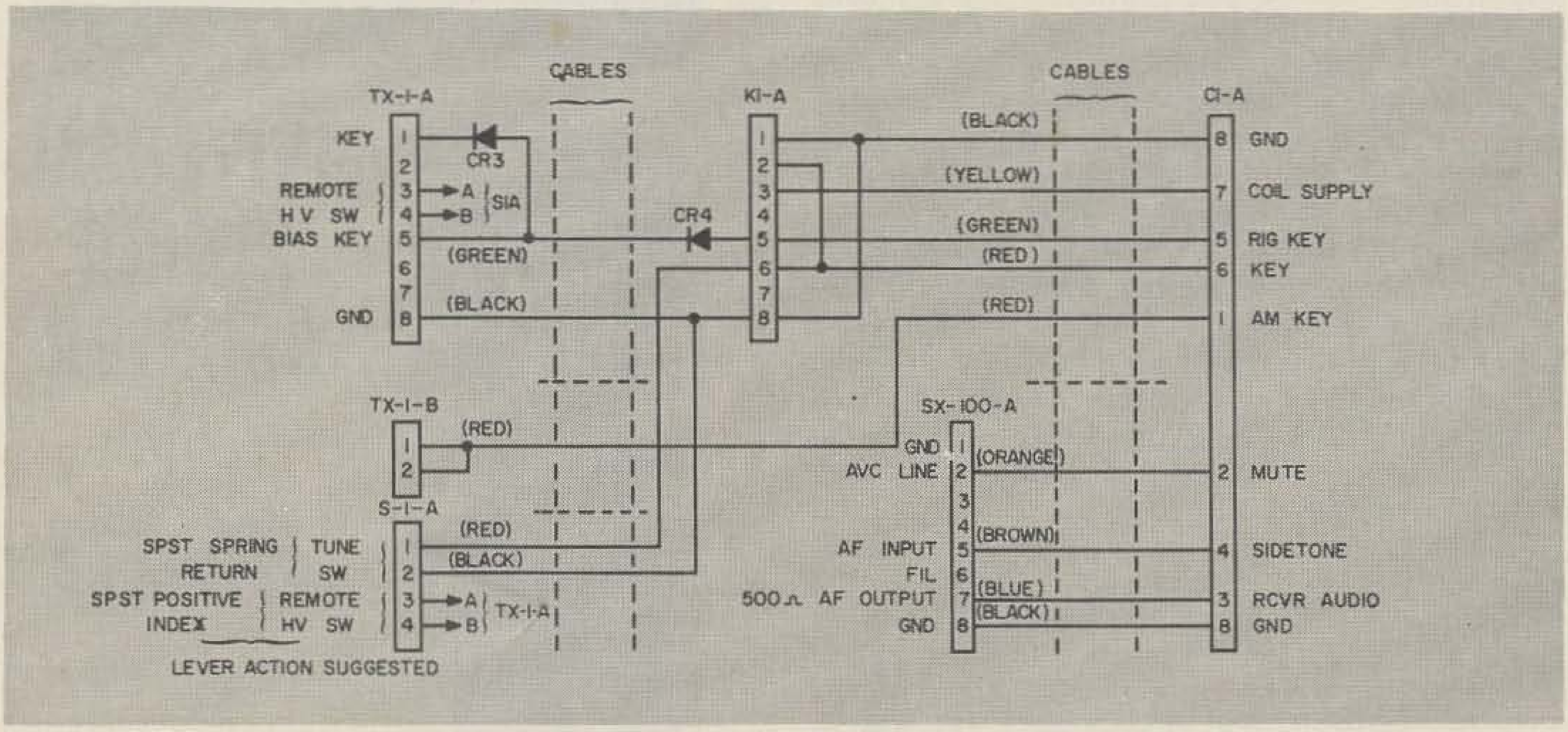
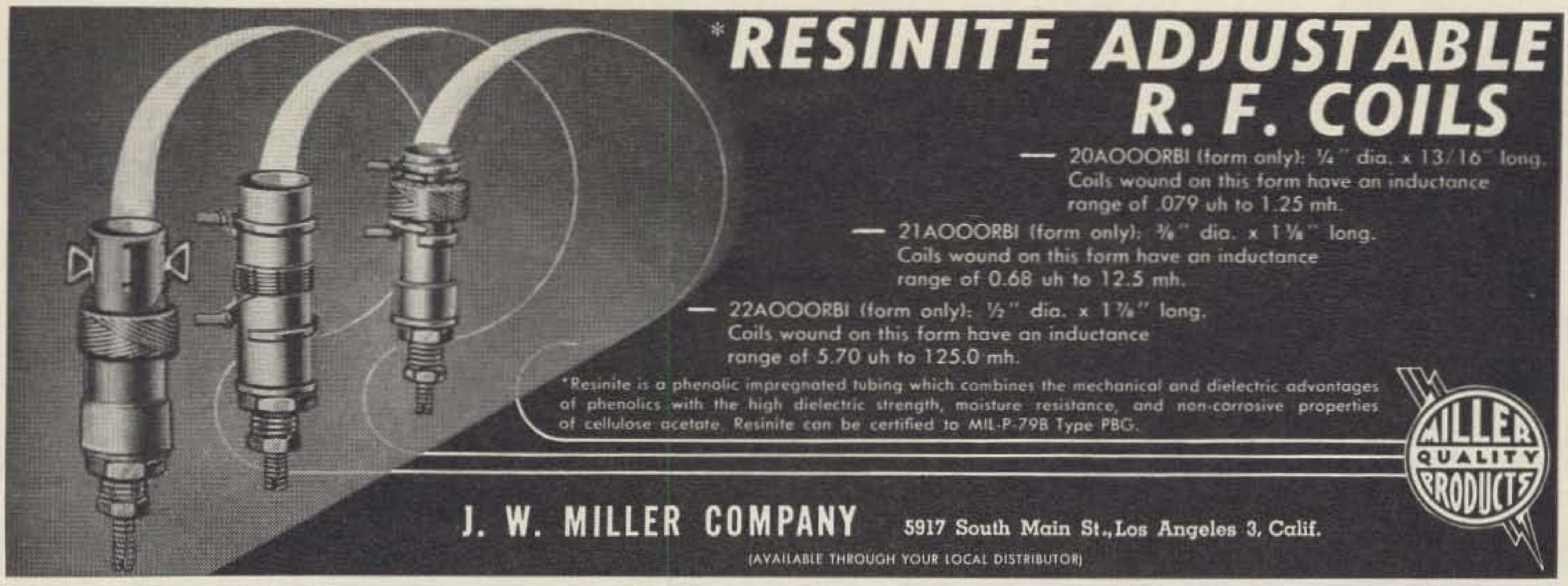


Fig. 3



receivers.

The 500 ohm AF output is for the phone patch which is built into the same box here at W4HBO, and has nothing to do with break-in. However, in the interest of station neatness this lead may just as well be bundled with the others into one neat cable. The lead af input is connected through a 220K to the grid of the last of stage in the receiver.

This unit may be relatively easily adapted to other transmitters. If the rig is not keyed by the grid-blocked method, then the addition of a keyer tube will be necessary. Suitable circuits for keyer tubes have appeared in the Radio Amateur's Handbook, as well as other publications, and will not be discussed here.

The modifications to the mode switch will, of course, depend on the particular rig, and the circuitry involved. However, the principle involved is as follows: On CW pressing the spotting switch should apply full bias to cutoff the final and driver, and if necessary, remove screen or screen and plate voltages from the driver. On AM spotting will normally be done with high voltage off. In my unit the spotting switch is inactive with high voltage on, on AM. The modulators and final must be biased to cutoff on AM if the high voltage is turned on but the keying circuits fail to operate.

This unit has been developed over about a one year period, and at this writing has been in operation in its final form for several months. Although the writer does not claim perfection by any means, this system does provide smooth and reliable break-in operation, as well as tying together station control functions on AM, SSB, and CW. It certainly was well worth the time and effort involved in building it. . . . W4HBO/2

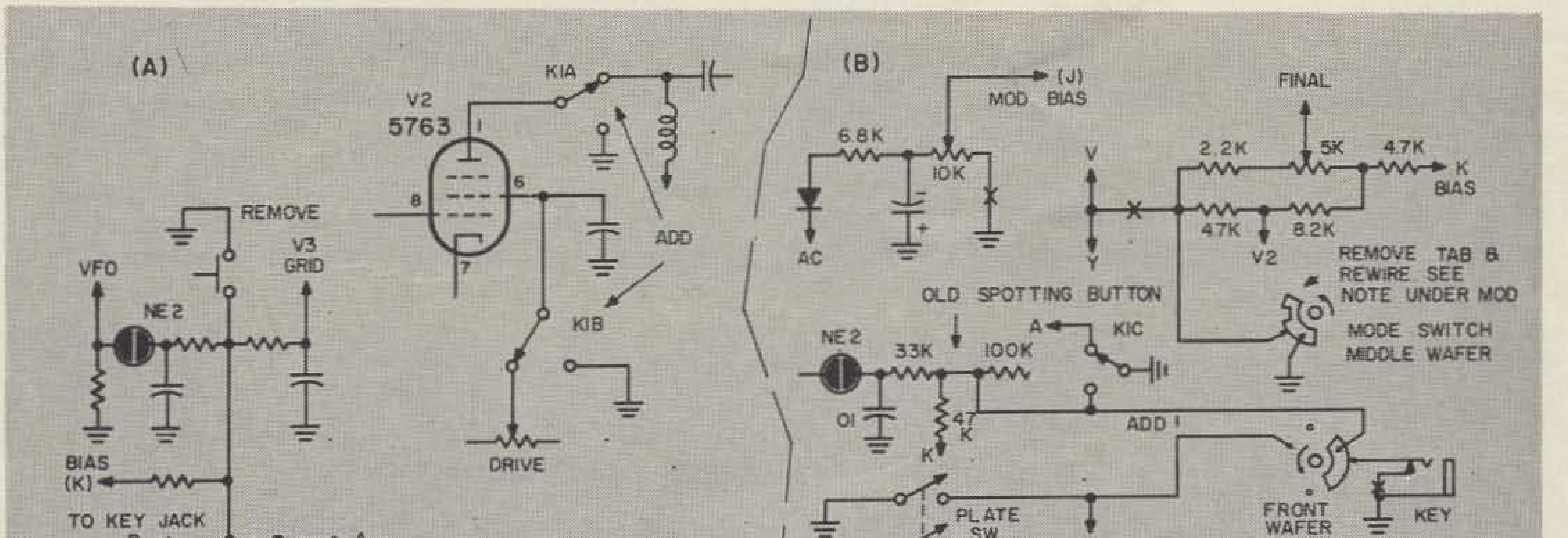


Fig. 4

Amateur Moonbounce on 1296 mc

Some practical aspects

Don Goshay W6MMU

QUITE a few years have passed since the amateurs first closed the two way earth-moon-earth path. The early efforts were centered around 144 mc, since at that time, this was the only amateur band for which satisfactory equipment existed. Even with one kilowatt transmitters, large antennas, and the best receivers, a return signal from the moon was, and still is, marginal.

Now, as well as then, it was known that much better results could be obtained by going higher in frequency. The 1215—1300 mc band seemed like a good bet for a long time, but sufficient power was not available, either from unstable or crystal controlled sources. At the other end of the circuit, commercial and particularly amateur receivers, had not reached a degree of perfection sufficient to generate much interest in 1215—1300 mc work. Further, most amateurs had not yet become on speaking terms with the king of microwave antennas, the parabolic reflector.

In 1961 the situation has vastly improved in all phases but one. Before discussing hardware, however, let us turn our attention to the two way path loss equation of Figure 7 for a moment. If the equation is arranged properly, it yields significant facts to the amateur interested in Moonbounce work.

Stripping the above equation of its mathematical cloak, it shows that the received signal is:

1. Directly proportional to the fourth power of the dish diameter,
2. Inversely proportional to the square of the wavelength,
3. Directly proportional to the transmitted power.
4. Inversely proportional to the fourth power of the distance between the earth and the moon.

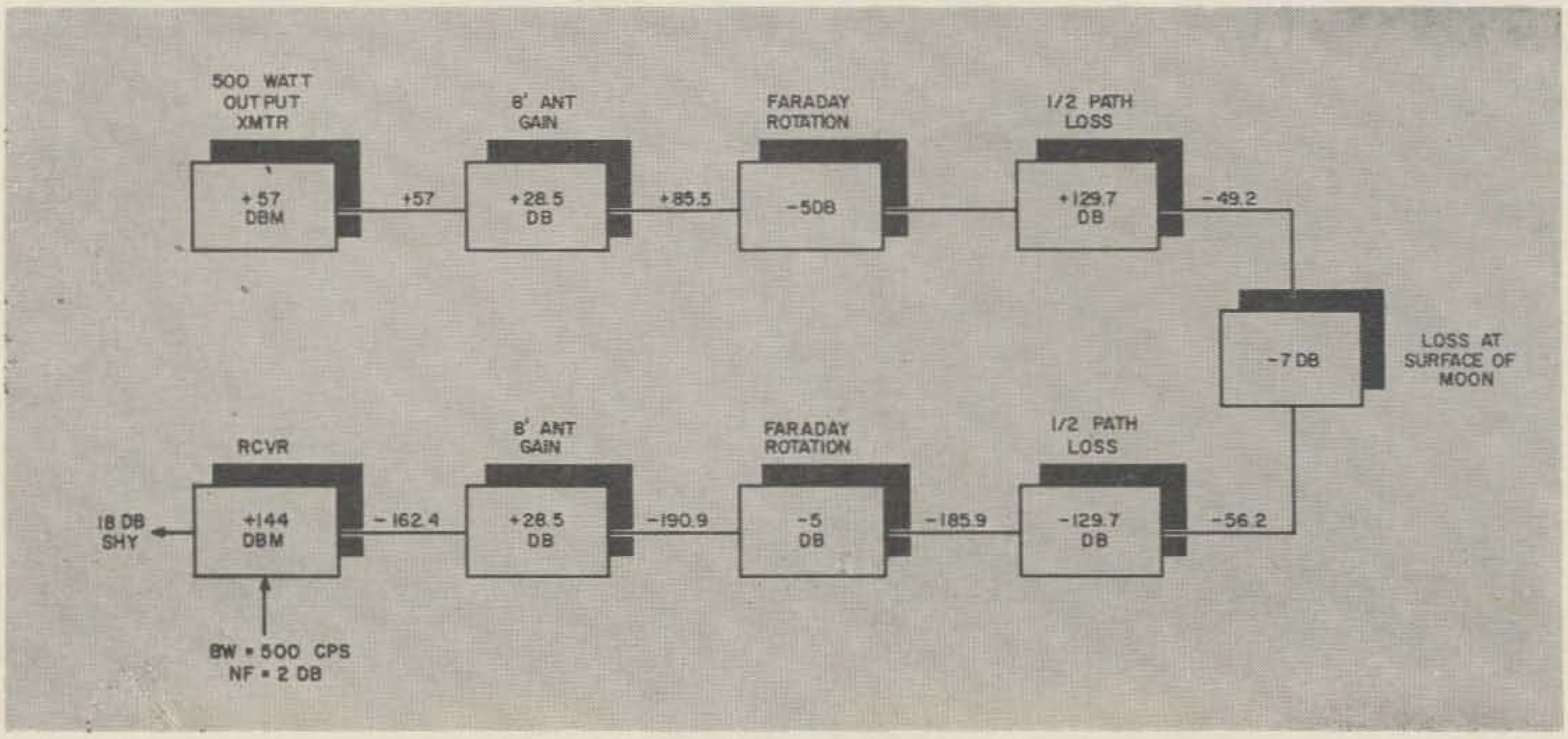
Figure 1 is a block diagram of a complete

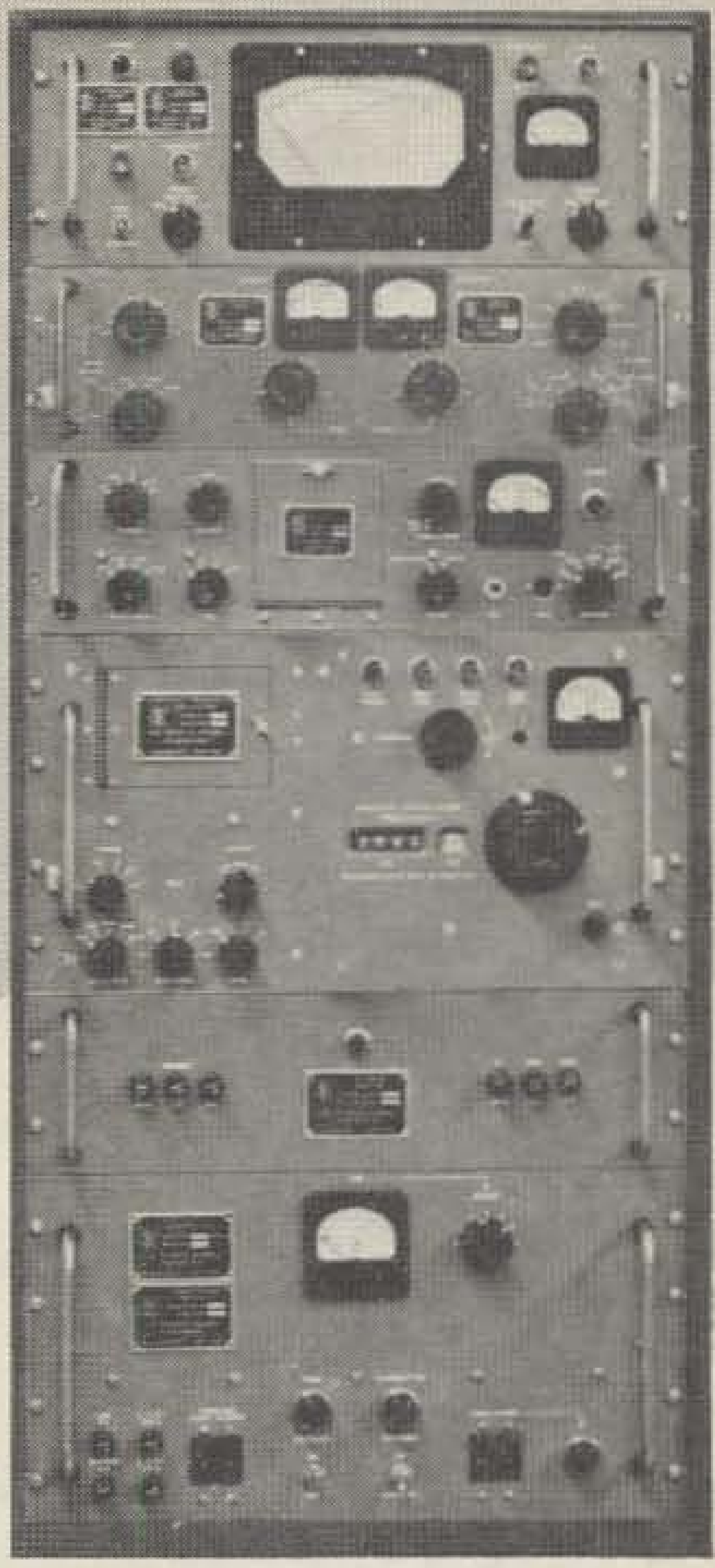
Figure 7

The ratio of the power received to the power transmitted, assuming the moon to be a perfect reflector, and no Faraday polarization rotation, is:

$$\frac{P_R}{P_T} = \frac{\pi^2 D^2 d^4}{1024 \lambda^2 R^4}$$

Where $\pi = 3.14$; D = Diameter of the moon; d = Diameter of the parabolic reflector; λ = wavelength; and R = distance to the moon, all in compatible units (the equation may be easier to work with when inverted). Aperture efficiency of the dish is assumed to be 50%.





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As the path loss equation shows the received signal to be proportional to the fourth power of the parabolic reflector diameter, this area is the most vulnerable to improvement. An 18 foot dish has 7 db more gain than an 8 foot one, both going and coming. This would reduce the deficiency discussed earlier to only 4 db. However, an improvement such as this does not come about without the expenditure of considerable care and effort. Holding the necessary mechanical tolerance becomes more difficult on larger dishes. The overall tolerance should be no more than ± 9/16 inch deviation from a true parabolic curve over the entire surface. The larger dishes are necessarily heavy, and require a well thought out rotating system. The aiming requirement for large dishes is further complicated by the fact that the beam becomes narrower as the dish diameter is increased. Figure 2 gives the significant characteristics of a number of dish sizes. The 1 db beamwidth is significant, as this becomes 2 db for a two way path. If a signal is "nip and tuck" with the noise under optimum conditions, it will be 2 db below the noise when the antenna is oriented at the 1 db point. Therefore, a smaller dish is better than a large one that is aimed inaccurately.

Also given in Figure 2 is the time for the moon to travel from the center of the beam to the 1 db point. This gives one an idea of how alert the operator must be if manual tracking is used. For any dish 8 feet or larger, a telescope attached to the rotator is essential.

$$\text{MEAN ANGULAR VELOCITY OF MOON} = 15\ \frac{\text{DEGREES}}{\text{HOURS}} = 1/4\ \frac{\text{DEGREES}}{\text{MINUTE}}$$

$$\text{3 DB BEAMWIDTH} = \sqrt{\frac{30{,}400}{\text{DIRECTIVITY}}}$$

$$\text{1 DB BEAMWIDTH} = \frac{\text{3 DB BEAMWIDTH}}{1.74}$$

$$\text{1/2 DB BEAMWIDTH} = \frac{\text{3 DB BEAMWIDTH}}{2.35}$$

$$\text{GAIN} = 10 \log .65\ \frac{\pi^2 D^2}{\lambda^2}$$

Figure 2

Diameter	Gain, DB	Beamwidth, Degrees 3 DB	Beamwidth, Degrees 1 DB	Time, Minutes Center To 1 DB	Directivity
2 Feet	16.4	27.0	15.0	30	44
4 Feet	22.5	13.0	7.5	15	178
6 Feet	26.0	8.7	5.0	10	400
8 Feet	28.5	6.5	3.8	7.6	710
10 Feet	30.4	5.3	3.0	6.0	1,100
12 Feet	32.0	4.3	2.5	5.0	1,580
14 Feet	33.4	3.7	2.1	4.1	2,180
16 Feet	34.5	3.3	1.9	3.8	2,810
18 Feet	35.5	2.9	1.7	3.4	3,550
84 Feet	48.9	.63	.36	.7	77,500

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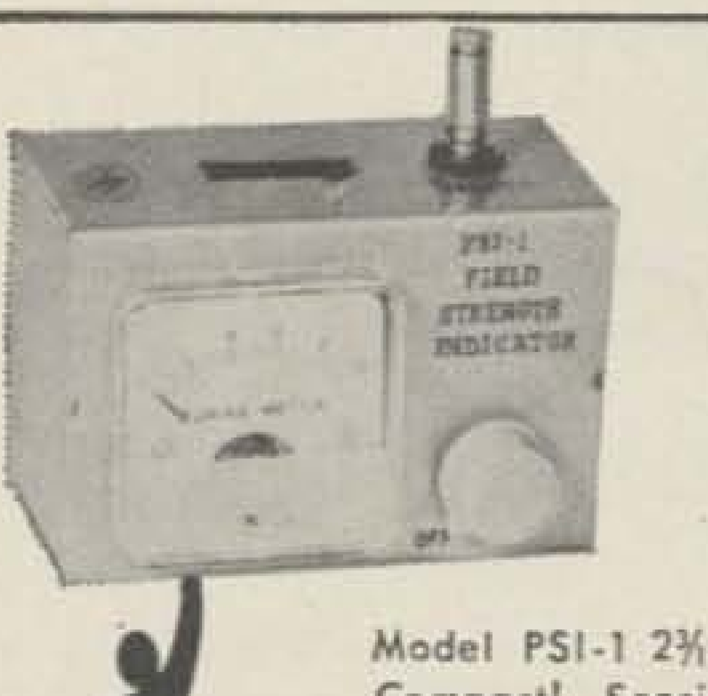

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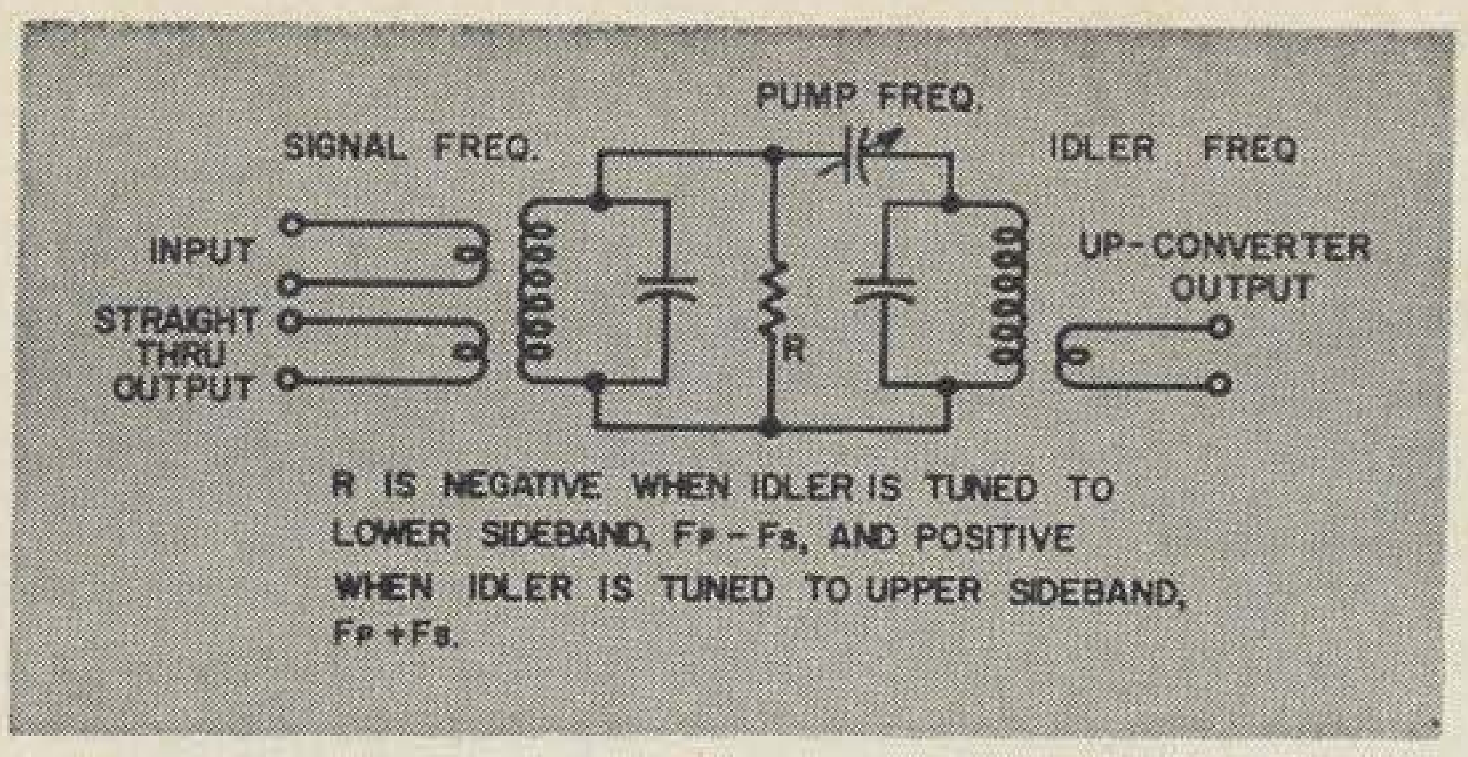

Fig. 4

Amateurs wishing to construct their own reflector would do well to consider focal lengths somewhat greater than usually found on dishes available through surplus channels, as tolerances are a little easier to hold and slightly more gain may be had with increased focal length. Plane parabolas similar to the one appearing in a recent QST article seem of limited value, as the driven element for this type of unit is exceedingly complex. The focal length of a parabola may be determined quite closely from the following relationship:

$$f = \frac{(\text{diameter})^2}{16\ (\text{depth})}$$

The numbers given in Figure 2 indicate that the biggest job may well be in the construction or acquisition of a suitable rotating system, especially if the antenna is large. The Two Meter and Down Club was fortunate in locating an SCR-584 Radar Pedestal on the surplus market. This pedestal has extreme rigidity, is well built, and weighs 2400 pounds. The six foot dish made a nice cradle for carrying the eight foot reflector, now in use. A larger dish will be substituted if and when one becomes available. The system is presently being aimed with a war surplus 8 power telescope with illuminated cross hairs. Four miniature solar cells have been purchased for incorporation in the eyepiece at the proper point. With the solar cells, we hope to drive a dc amplifier which in turn will energize two Teletype relays. The Teletype relays will actuate four heavy duty relays, which in turn will cause the proper motor to turn in the proper direction to keep the antenna beam on the moon.

Since the received signal is inversely proportional to the square of the wavelength, best results are obtained by going to as high a frequency (as short a wavelength) as we can. This upward trend in frequency is limited by the amount of stable power we as amateurs can generate at increasing frequencies, and by our ability to build sensitive and stable receivers. The compromise presently seems to be 1296 mc.

A great challenge for amateur enthusiasts is offered in the field of receivers, particularly in parametric amplifiers and detector circuitry. While the principles of parametric amplifiers have been covered sufficiently well for now,

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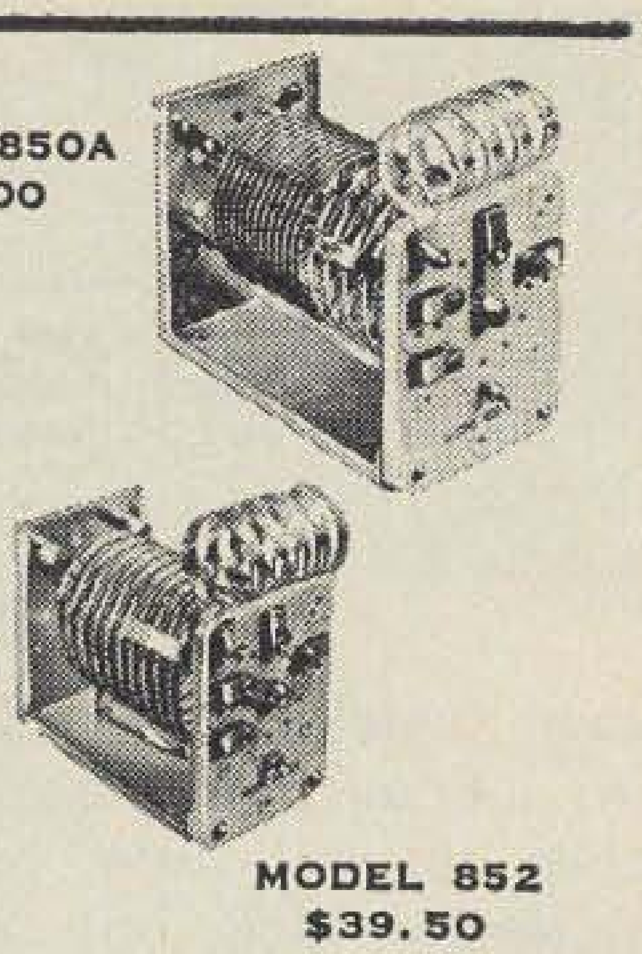

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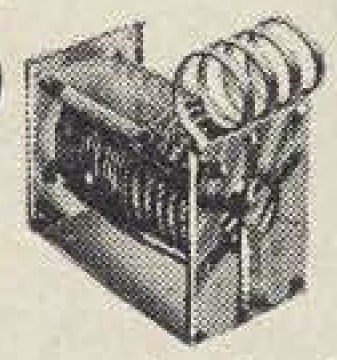

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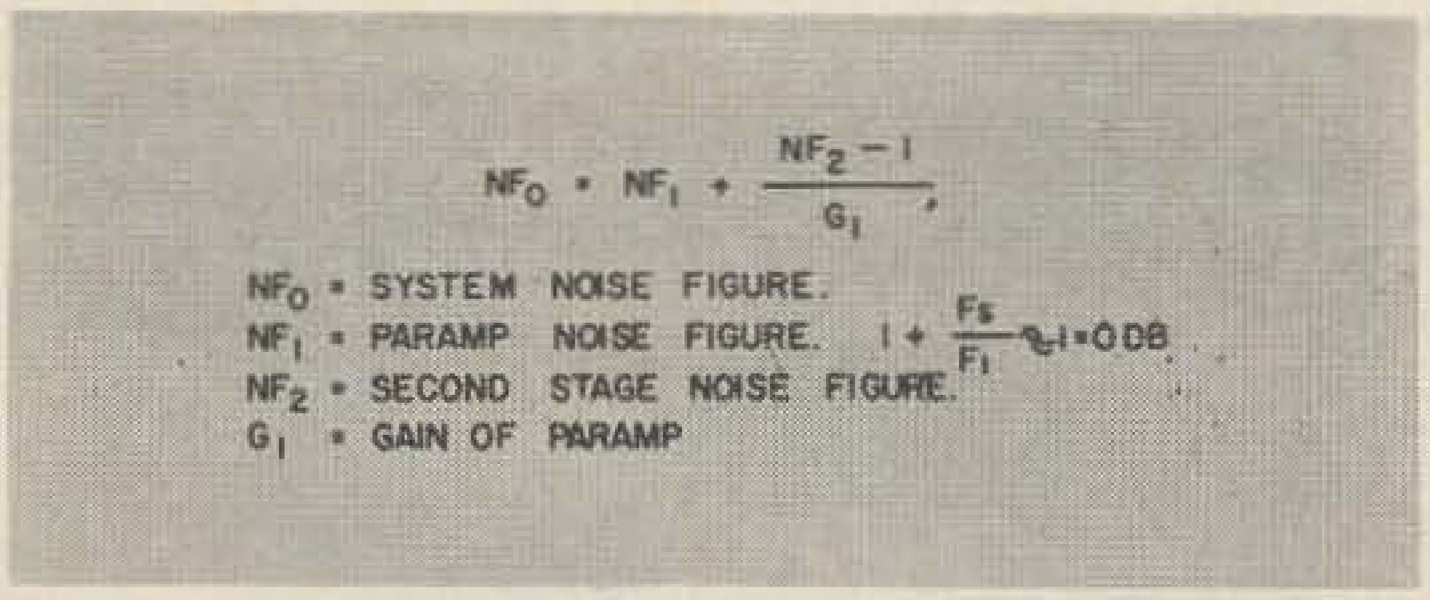

Fig. 5

good workable hardware is non-existent as far as can be determined. Several of the available designs have been tried. All have been made to work, but none work without considerable tinkering. None are relibale. This is a field that requires the teamwork of the electronic wizard and the mechanical genius with access to some machine shop facilities. Technique, rather than theory, needs to be developed.

Figure 3 is a summary of characteristics of the different types of parametric amplifiers often mentioned in the literature.

Figure 4 shows the equivalent circuit of a paramp. The class within which a particular amplifier falls depends upon from which terminals the output is taken, which sideband is selected by the right hand tank, and the pump frequency.

Figure 5 gives the classical SYSTEM noise figure equation. The point to notice here is that, ideally at least, the paramp contributes no noise whatever, and that the overall noise figure depends upon the noise figure of what succeeds the paramp, divided by the gain of the paramp. For best results, therefore, the remainder of the system must have a very low noise figure; *OR*, the paramp gain must be quite high. It is for this reason that the USB up-converter (Figure 3) has limitations, as its gain is much less than the LSB or straight through systems, and low noise figure stages to back up the paramp are hard to achieve at the upper sideband frequency.

The LSB up-converter has received little attention by amateurs to date. Since at least one commercial manufacturer has utilized this system, it must possess some merit. With the straight through amplifier, the *frequency* stability of the received signal is preserved. This is not the case with either up-converter configurations. With up-converters, the stability of the amplified signal is that of the pump oscillator, which in most cases, is some sort of self excited oscillator. However, if the amplified signal is again mixed with a portion of the pump oscillator output, the *frequency* instability factor is cancelled, and a stable signal results at the same frequency as the input signal. Such a system is that of Figure 6.

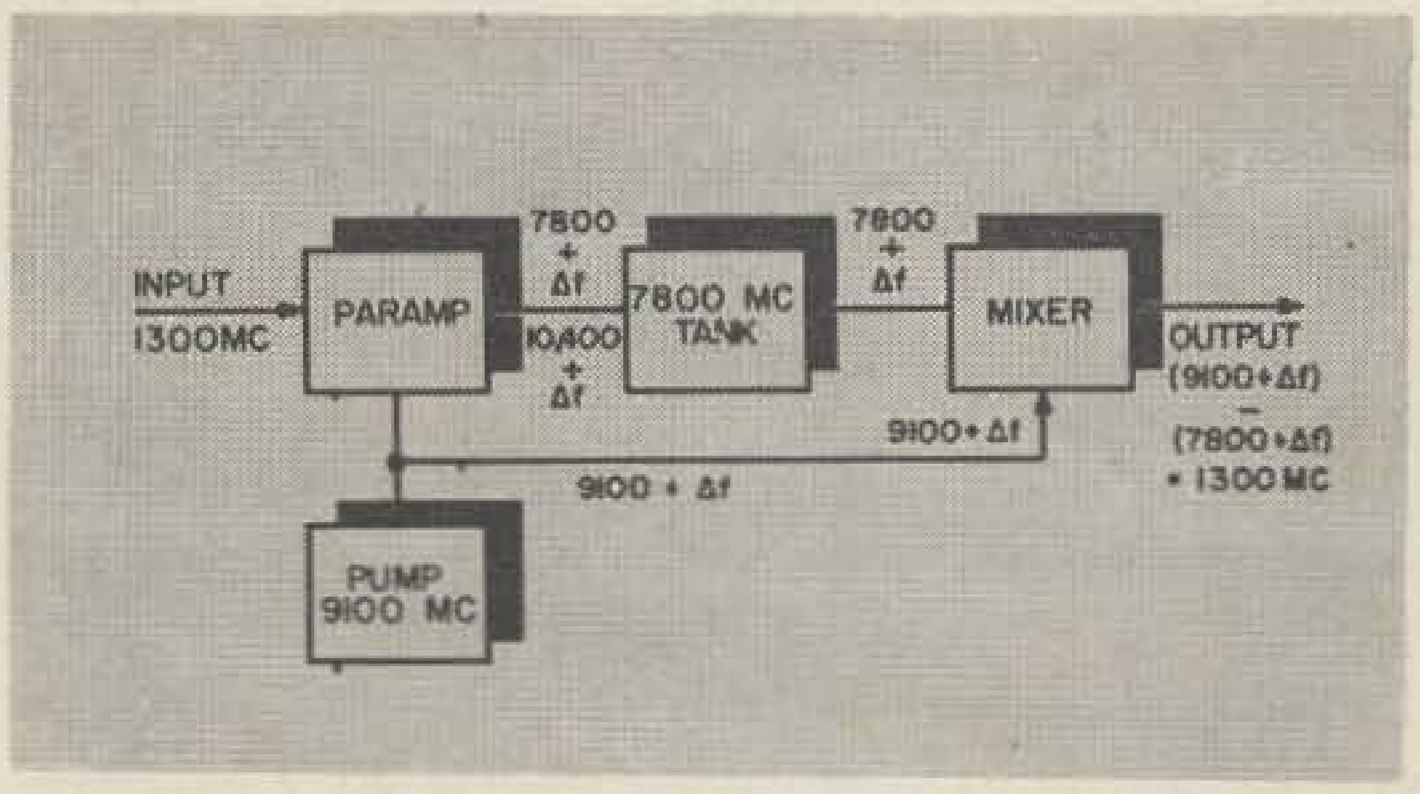

Fig. 6

Fig. 3

Type of Amplifier	Output Freq.	Idler Tank	Stability	Gain	Noise Figure	Note
Straight Thru Amp	f_s	f_p-f_s	Unstable	Theoretically No Limit	$1 + \frac{f_s}{f_i}$	1
USB Up-Converter	$f_p + f_s$	Not Required	Stable	$\frac{f_i}{f_s}$	$1 + \frac{f_s}{f_i}$	2-4
LSB Up-Converter	$f_p - f_s$	Not Required	Unstable	Theoretically No Limit	$1 + \frac{f_s}{f_i}$	1-4
Degenerate Amplifier	f_s	Not Required	Unstable	Theoretically No Limit	$2 (1 + \frac{f_s}{f_i})$	3
Down-Converter	$f_r - f_p$	f_s-f_p	Stable	$\frac{f_s}{f_i}$ (Loss)		3

1. These types are termed negative resistance or regenerative. Their gain is limited in practical cases, to that which can be obtained without oscillation.
2. USB = "Upper Sideband"; LSB = "Lower Sideband."
3. The last two types are of little interest to amateurs, and are included here for completeness.
4. While the idler tank is not required for these versions, the equivalent is generally used for the sole purpose of rejecting the unwanted sideband, or, passing the desired one.

f_p=Pump Frequency
f_i=Idler Frequency

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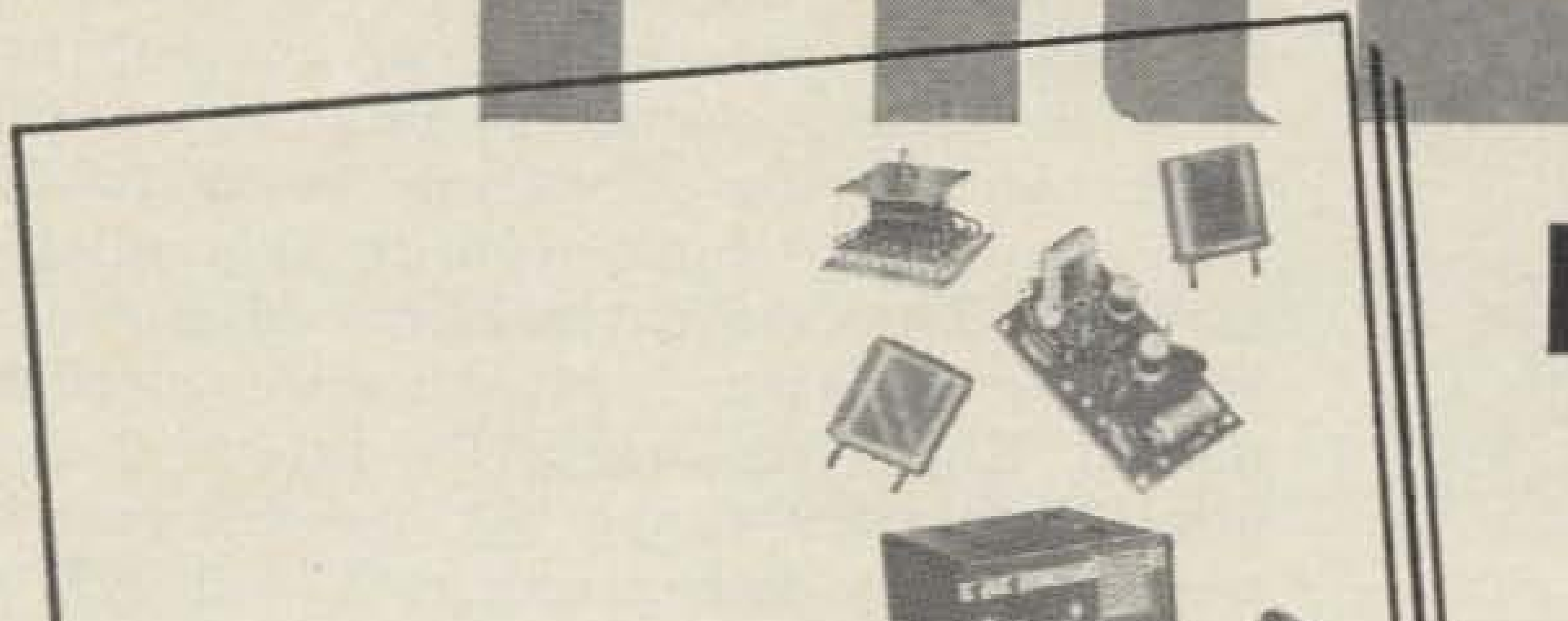

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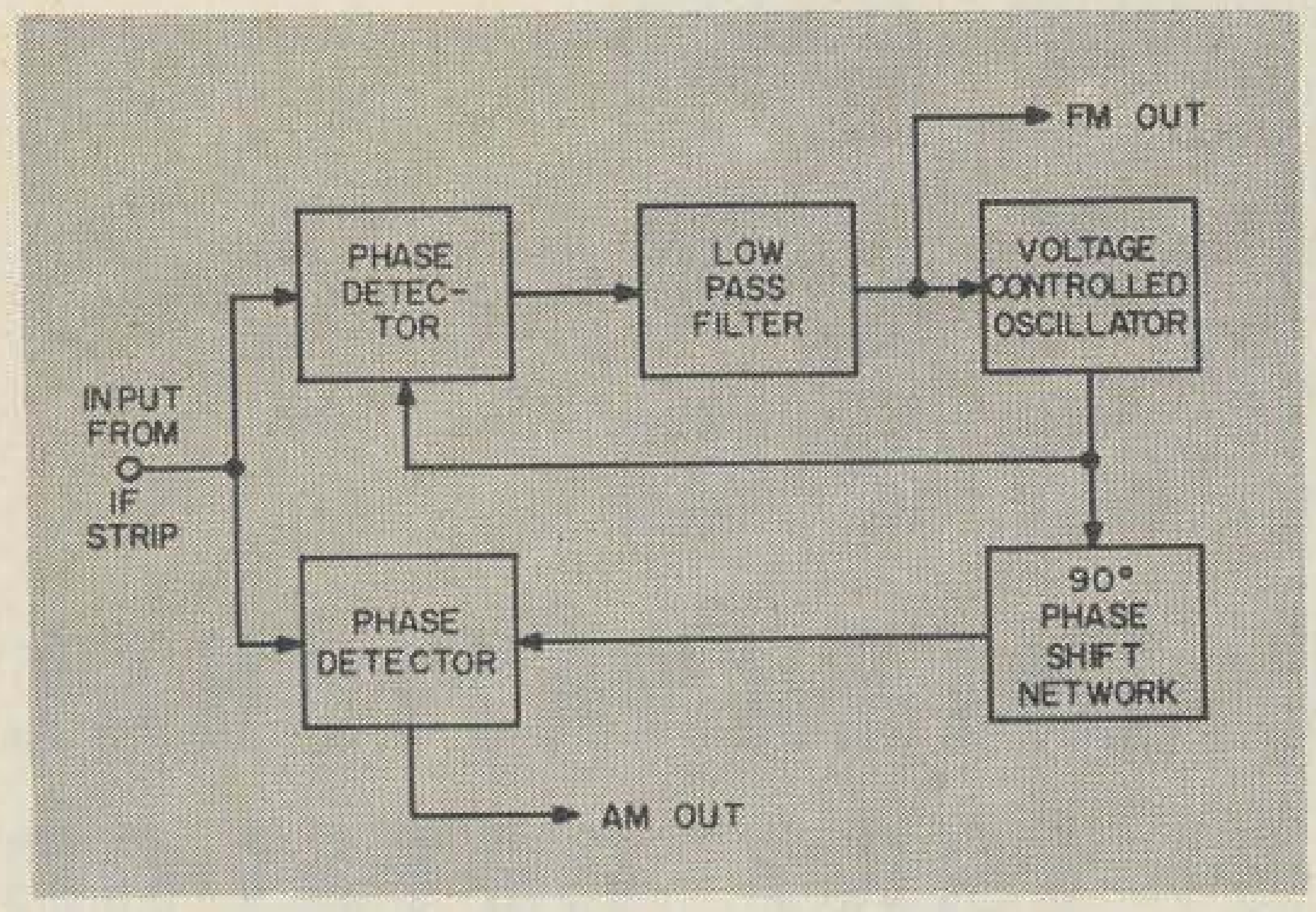

Fig. 8

The merits of the many types of detector circuits have been argued for years by the dc men, and most of those arguments apply to our problem. There is one type of detector, however, that is quite different. This is the so-called phase coherent detection system. There are several forms of this circuit, but probably the most useful will be the one shown in block form in Figure 8. Briefly, this circuit allows one to reduce his effective bandwidth almost as much as he pleases, provided slower and slower ICW keying rates can be tolerated. A 5 cps effective noise bandwidth can be achieved without undue difficulty using this system. This reduction would give 20 db improvement in receiver sensitivity, without changing the *if* strip. If the phase detector system is handled properly, there is little increase in frequency stability requirements as would be associated with the same bandwidth accomplished by the more orthodox methods. This system is especially suited for slow FSK when receiving signals from another station via the moon.

So far, each point we have touched upon has been one which the most eager of amateurs can bring under control. Perhaps the real obstacle is in transmitter power which in a general sense lies beyond our control, in that suitable devices cannot be built in one's backyard. Amplifying Klystrons seem to be the real answer, but none seem to be available for 1296 mc. The celebrated Eimac-Microwave Associates "Amateur" Moonbounce circuit employed Klystrons originally intended for another frequency range. At one kilowatt input, the output is discouraging. The 1 KW FCC power limit is obviously no drawback as long as no means of exceeding it exists.

Vacuum tube systems appear to be impractical at this frequency if any great amount of power is involved. Discussions have frequently revolved around the prospect of reducing frequency from 1296 to 1215 mc to take advantage of improved vacuum tube efficiency. However, the increased path loss resulting from the wavelength squared factor of the path loss equation at least equals (or exceeds) any advantage gained from that approach.

In conclusion, it might be said that the day of the ingenious, patient experimenter has finally returned in amateur radio. You cannot (yet) buy most of the things needed out of a catalog or at the corner HI FI store. The 1961 amateur now has the opportunity and challenge that faced his counter part of the twenties and thirties to devise his own hardware and improve upon it, thereby advancing the state of the art. . . . W6MMU

Stabilizing Mobile Oscillators

Bud Copping
P. O. Box 111
Lakeshore, California

HERE is a circuit which I feel should be incorporated in all Mobile 12 volt transmitters, receivers, and transceivers, whether home-brewed or commercially conceived. It can be added to existing equipment fairly easily, using three or four small components. Most well-designed communications equipment supplies regulated voltage to the screen and plate of any self-excited oscillator, such as VFO, LO, and BFO. However, this is only half the story. The oscillator heater voltage should also be regulated, certainly in mobile gear. The "12 volt" supply can vary from 10 volts (idling at a stoplight at night with the lights on and the rig energized), to 15 volts during daytime highway travel. This variation can effect more than a 2 to 1 power dissipation change in an oscillator heater (considering it a fixed resistor). The resulting cathode temperature change will vary the tubes Gm and interelectrode spacing. This can drive an otherwise stable oscillator 'ape.'

In these days of single-sideband (the author's mode of operation for the past ten years), and VHF mobile work, etc., such a condition can take all the joy out of mobileering. There also is an important safety factor involved. No driver should have to fight drifting equipment and today's traffic at the same time.

Following is a simple circuit, which for about $4 to $6 will allow only 1/10 of a volt change at the oscillator heater, even if the supply should swing between 9 and 17 volts!

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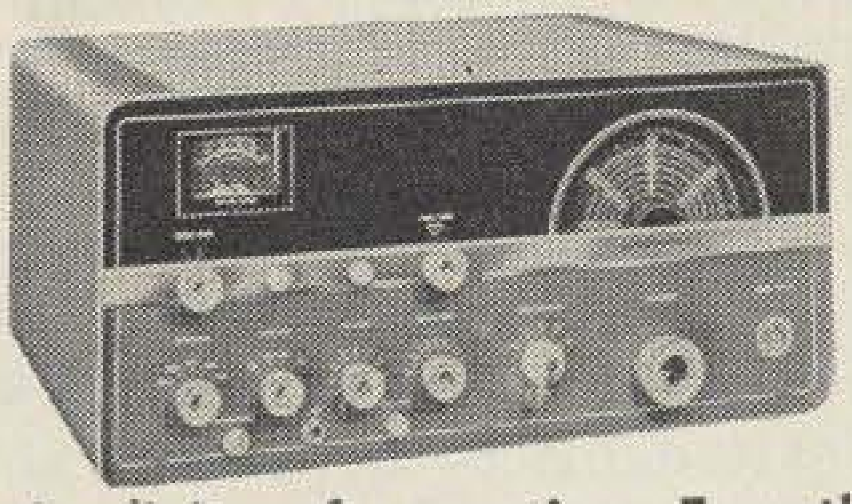

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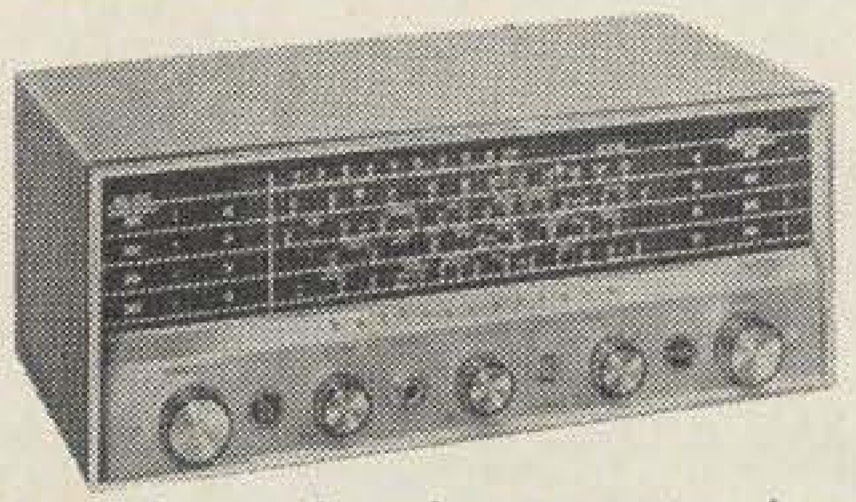

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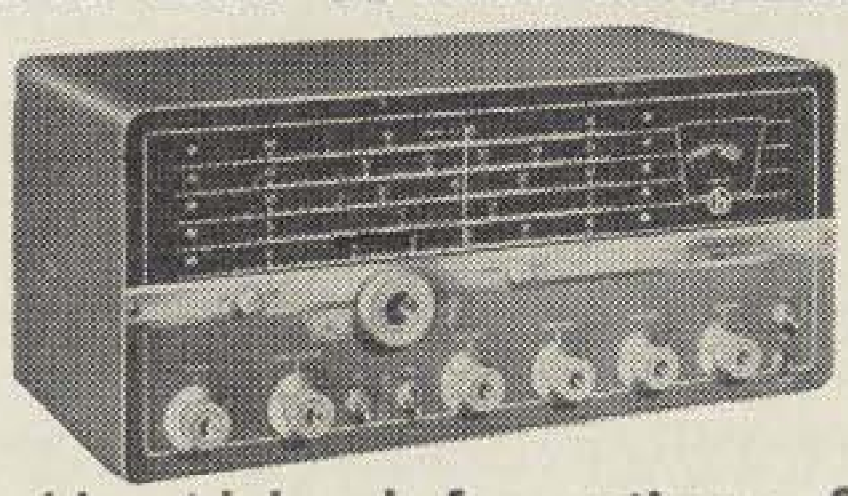
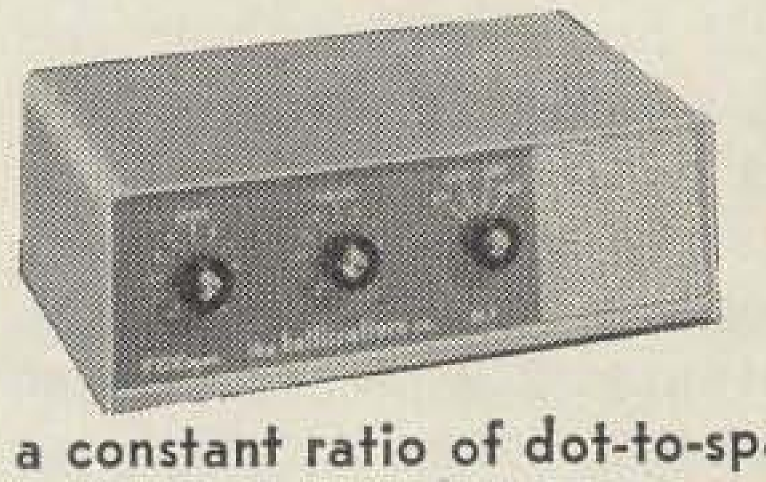
MODEL SX-140.

This ham-band only receiver has a beautiful lighted full length slide-rule dial and covers 80-40-20-15-10-6 meters. The controls are: Function Off-Standby-AM-CW-SSB; Phone Jack (disconnects speaker); Band Selector; Calibration Oscillator; RF Gain; Automatic Noise Limiter; Selectivity control which varies IF selectivity on AM and BFO on CW and SSB; Audio Gain; Antenna Trimmer; Calibration Reset; Main Tuning; and all this in only 14 lbs. **$124.95**



MODEL SX-111.

Dual conversion ham-band receiver tuning 80-40-20-15-10 meters. Selectable sideband for optimum SSB reception; 100 kc calibrator; T-notch filter for removing QRM; bandspread almost the width of the receiver for each band; and dozens of other features. **$279.50**



MODEL HA-4.

"T.O. Keyer." For the CW man who wants perfection. This is a transistorized keyer which features a constant ratio of dot-to-space-to-dash over the entire speed range of 8-18 wpm and 18-50 wpm. A high voltage transistor is used to key the transmitter. **$59.95**

MODEL HT-41.

Kilowatt linear amplifier. Designed to operate with HT-37, this linear will match any exciter delivering from 20 - 100 watts. Runs 1000 watts PEP on SSB, 800 watts on CW and 400 watts on AM phone. **$395.00**

R-48 SPEAKER.

Designed to match any of the Hallicrafters receivers. 5½" x 7½" speaker, 3.2 ohms. Has a Fidelity Switch which selects full fidelity response or voice frequencies for communications. **$19.95**

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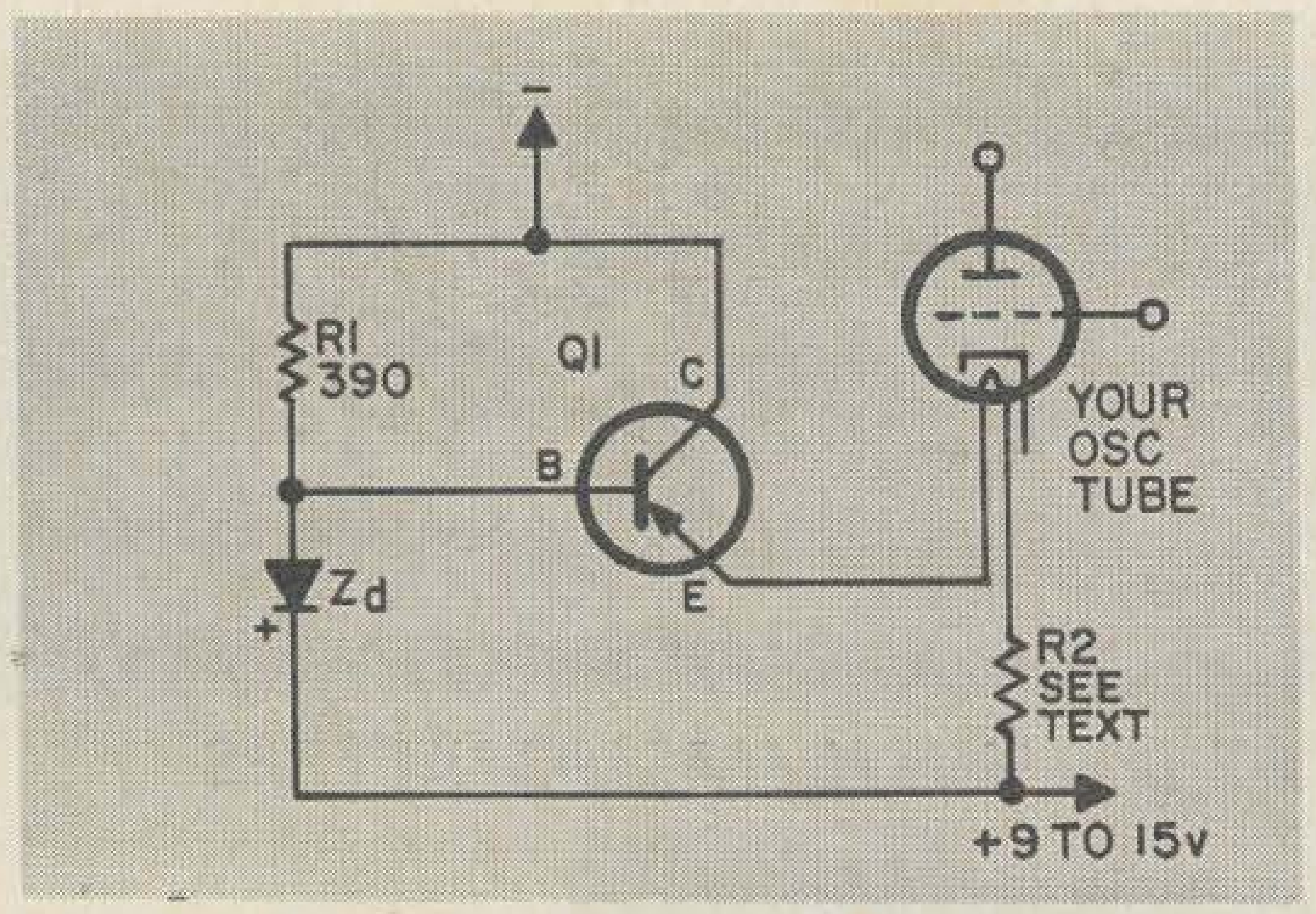


it). Target value is 6.5 to 6.6 volts, which would allow replacement of R2 with a wire. A lesser voltage will not allow 6.3 volts at the tube. A higher voltage will require use of R2 in the circuit.

2. A power transistor with a high Beta (above 50) will give excellent regulation, but most any unit should suffice.
3. In Negative-Grounded automobiles, bolt the transistor directly to a metal heat-sink such as a cool part of rig's chassis, with only a film of Silicone grease between (this grease not essential at these dissipations). With positive ground, transistor case must be electrically insulated with a mica or anodized-aluminum insulator available with the transistor. Also insulating shoulder washers must be used at the screws to prevent grounding the case. A lug is then used against the case to provide a connection to the collector. If no cool area is available, mount the transistor on an outboard heat-sink fabricated of ⅛" aluminum of at least 12 square inches area, exposed to ventilation. Lead length is not critical.
4. A 10 or 20 ohm pot. can be used as R2, and adjusted to give the desired heater voltage at the oscillator tube socket (6 volt tube plugged in). The pot. can then be measured and a fixed resistor substituted for it. A 2 watt rating should handle the higher current heaters.
5. It may be necessary to lower the value of R1 (but do not go below 82 ohms). This due to the use of a fairly high zener voltage, a very low Beta transistor, a high current tube load, or a combination of these factors. R1 must be low enough to supply adequate base current and some zener current, and high enough to keep zener within ratings.

Some features making this circuit a 'Natural'—

1. At these voltages, zeners exhibit excellent voltage/temperature stability and low dynamic impedance. This affords good regulation.
2. Most any power-type transistor should work, due to low voltage requirement and grounded collector configuration which eliminates IcO problems.
3. In negative grounded automobiles, case is bolted directly to chassis for negative collector connection and the best heat transfer.
4. A wide range of 5 and 6 volt tube types can be stabilized. Two or three 150 ma. heaters can be paralleled to include 2 or 3 separate oscillators with the same regulator. These could be receiver local oscillator, BFO, and transmitter VFO (all 6 volt).

Caution: Use a small hot iron when soldering semi-conductors, and apply heat very briefly. Observe all polarities carefully. Leave the pigtail leads full length if possible. Do not apply ac to this circuit.

This device will soon see service in a home-brew mobile 75 meter SSB transceiver, combined with CB circuits. With this circuit, you will enjoy a conversation piece; a hybrid rig. This infers that you have flavored your vacuum tubes with *semi-conductors!* A magic word these days. See you on '75.' **. . . W6FIR**

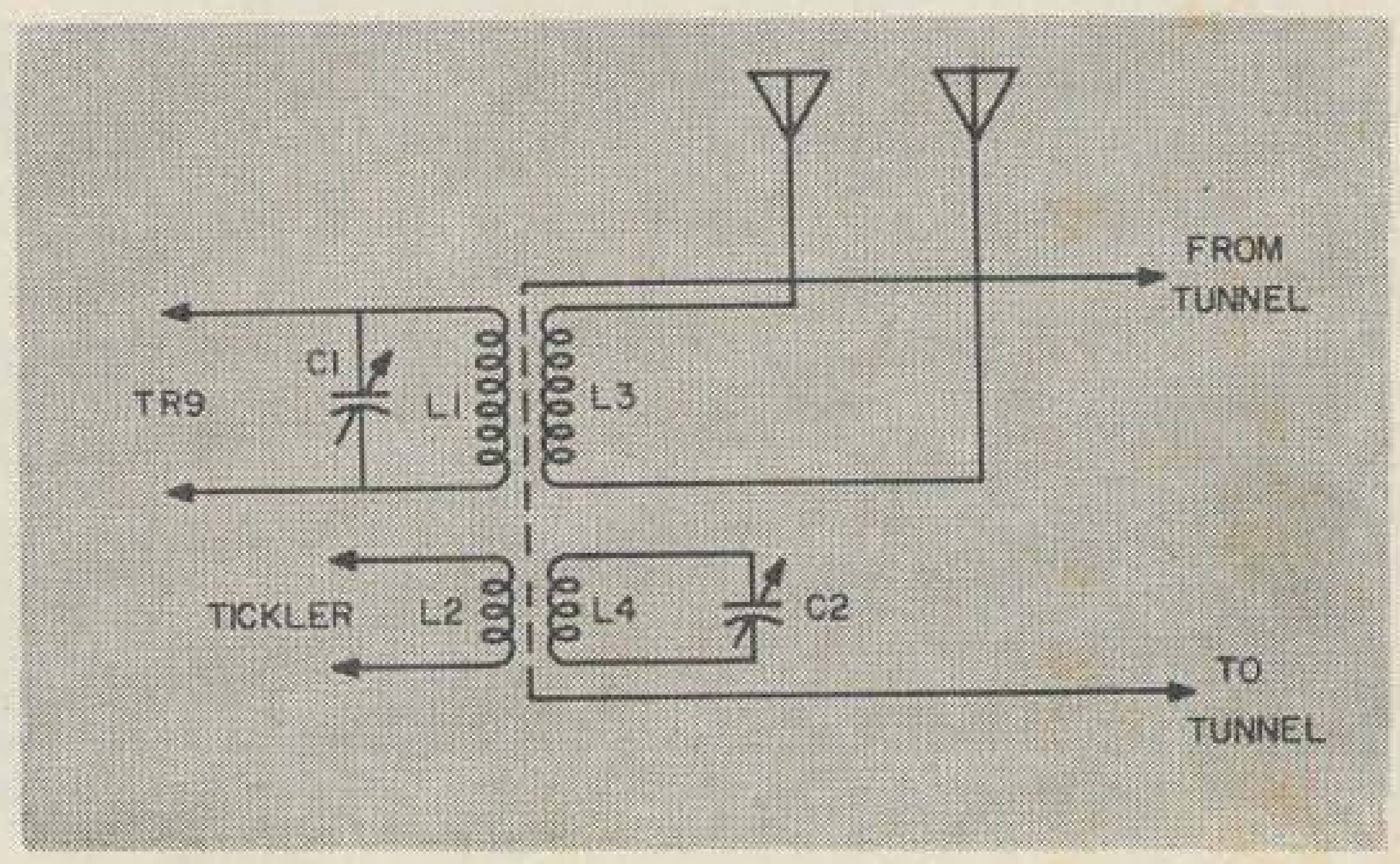
Parts

Q1—PNP Power type Transistor such as Motorola 2N1544, 2N1360, 2N669.
R1—390 ohm ½ Watt Resistor. Ohmite etc.
R2—Value selected to match obtained Zener Diode to desired tube type. See text.
Z1—1 Watt 6.5 to 9.0 Volt Silicon Zener Diode such as Motorola 1N3016B (6.8 volt 5% type) or 1N3017 7.5 volt 20% type).
V1—Your oscillator tube or tubes (see text)
Caution: Do not use a 12 volt heater tube here. Substitute a 6 volt type equivalent for your existing 12 volt tube.

AN IMPROVED TANK AND ANTENNA CIRCUIT FOR THE PORTABLE KW TRANSISTOR XMTR

Wretched Earhart K7NTE
1312 Heather Lane, S.E.
Salem, Oregon

After constructing the Coward Portable KW Transistor Xmtr[1] considerable difficulty was experienced with the tank and antenna circuits. In the first place the tank circuit heated up so much, the copper conduced the heat back to TR9 and caused a failure in the unit. Secondly it was found that



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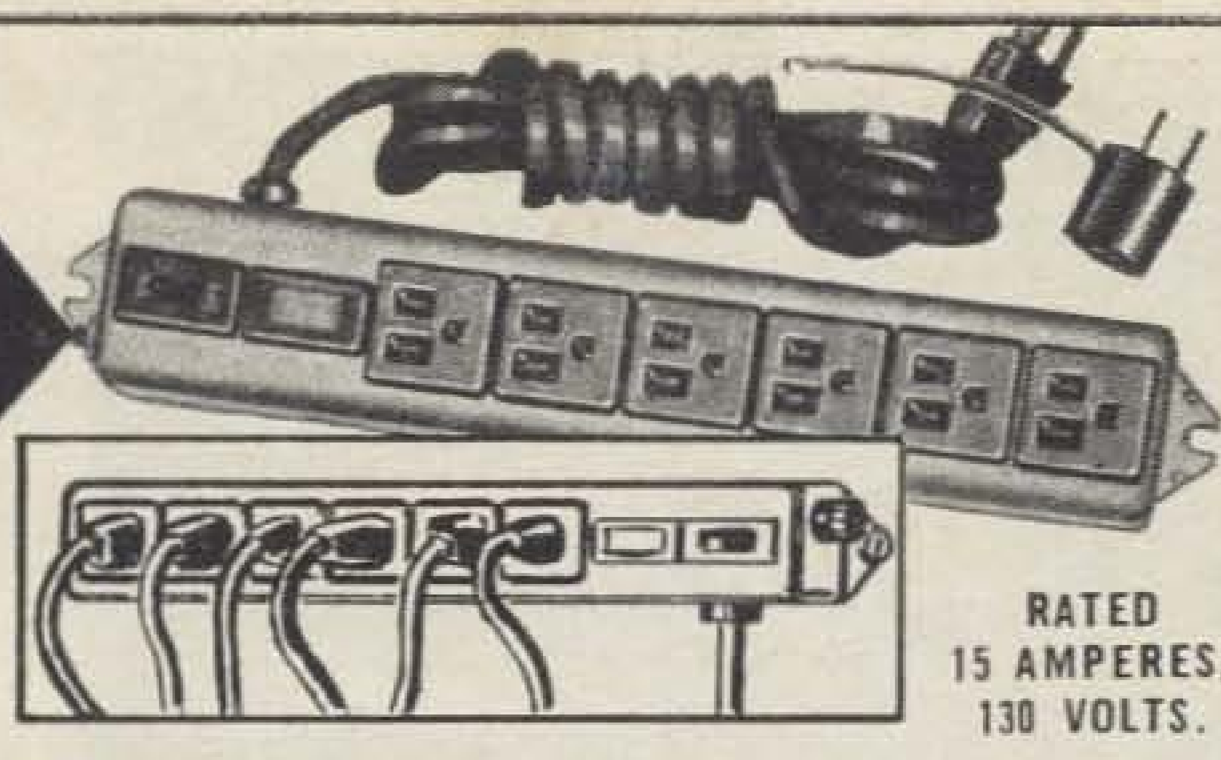

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- Silver Gray Seamless Hammertone Case
- "U" Ground Receptacles
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Model 24CB (Circuit Breaker Type) $10.50

WABER ELECTRONICS, INC.
Hancock & Somerset Sts. Phila. 33, Pa.

the rig had a number of parasitics in the antenna circuit. As a result it was put on the shelf until Dr. Stein's article[2] on using the tunnel diode for isolating thermal conduction appeared.

The improved circuit is shown in Fig. 1 but due to space requirements just the final coil complex is shown. It will be noted that instead of the usual Faraday grounding connection Dr. Stein found it expedient to connect the low side of the screen to the tunnel input and the higher side to the tunnel output. This circular system permits the heat to be properly dissipated in the tunnel.

Despite the Faraday screen the tunnel circuit increased the parasitics in the antenna circuit. Possibly the cause was raising the screen above ground potential. In any event, it was found if the L4 Sartain coil and the 72 Mutch padding condenser were added in place of the simpler Hay wire coil the parasitics could be suppressed. The rig is no longer shelf bound and no reports below a 5 x 9 have been received as yet.

. . . . K7NTE

[1] "Portable KW Transistor XMTR" 73 Magazine, August, 1961; Vol. I, No. 11.

[2] "Kühl Das Berhälter" Frank N. Stein Zeitschrift Fur Narheit Apr. 1961; Vol. II, No. 1.

K7NTE

It should be pointed out that while many letters of accolade were received as a result of the K2PMM article, this is the first to bring carping criticism and we must assume that K7NTE is a troublemaker and probably didn't follow the original instructions. If interest remains at its present fever-pitch we may run a separate article on the newly developed K2PMM transistorized power supply which will completely replace the trailer-drawn unit of the original article. This new supply, while only applicable to twelve cylinder cars in its present stage of development, will enable you to run up to five kw on SSB without noticeable heating of the engine block. . . . . editor.

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Rig is attached to underside of dash with bolts and heavy guage aluminum angle.

Hank Schorle, Jr. W3GSC
3172 Colony Lane
Plymouth Meeting, Pennsylvania

The Hanky Box

WITH the continuing prospect every few years of securing a replacement for the family buggy, and the toil of re-jeeping the car radio for mobile operations facing me, a do or die decision was reached. I decided to do it right just once and then change cars with no hamming difficulties.

This aim was realized by building my mobile transmitting and receiving desires, plus broadcast reception for the XYL and conelrad into one neat package that would fit with ease into any average vehicle. The total size upon completion is 5¾"H x 11"W x 8"D, with a transistor power supply mounted on the rear of the cabinet. This space houses with no great crowding a conventional broadcast receiver circuit with a TNS noise limiter, a 10 meter converterette, a 45 watt VFO or crystal controlled 10 meter transmitter complete with plate modulator, and a meter with switching circuitry to read all pertinent data.

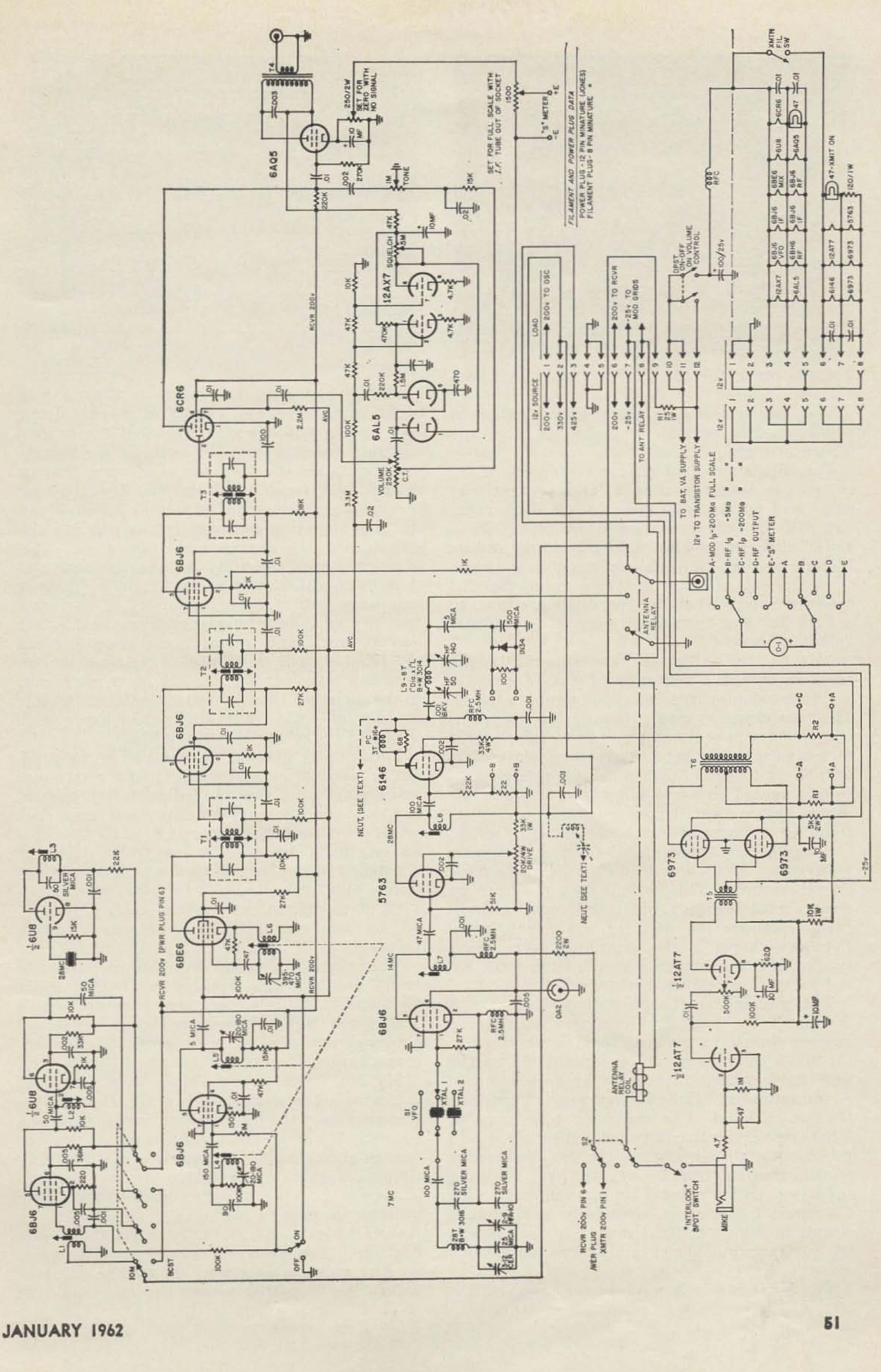
Ten meters was chosen to fit my desires due to local activity, but any band could be chosen, and I've already considered a two bander on 10 & 6. Most mobiliers operate on one band, and that is why I feel a "Hanky Box" type rig is a better buy than a multi-band commercial job.

The cabinet is a California Chassis Co. Low Temperature Cabinet, Model LTC 470. It was procured directly from the manufacturer, as I don't believe they have any distributors east of the Rockies. The circuitry does not constitute anything revolutionary, but its layout must be considered fairly efficient to get it in one chassis 11" x 8" x 2" without layering components.

The heart of any receiver is its tuning mechanism, and part of the secret in space conservation comes from securing from an old auto radio a 3 ganged inductive tuner. My unit only occupies 1½" x 2" of chassis space, and with it's associated trimmer capacitors neatly tunes the broadcast range, and 28.55 to 29.7 mc when placed behind the 10 meter converter. It came out of a 1952 Chevy-Motorola radio, but there are several similar units available in auto radios, or as replacement parts from the distributors. Most run around $5.00 new. Usually a manually tuned unit is to be preferred over a push button type, as they are smaller, less complex, and therefore more trouble free.

Most broadcast circuits use only one *if* stage, but here a second was added primarily to provide better skirt selectivity with the 455 kc *if* and help separate stations when 10M opens up. This brought along with it more signal, and necessitated the 100K audio dropping resistor between the detector and TNS. This need is more apparent on the BC band than 10M, especially since the author lives between 3 local high power AM stations' towers.

The audio & TNS are quite standard, with a tone control and AVC applied to the first audio grid. For better copy of weak stations an AVC off-on switch is used, but it only kills AVC on the converter and rf stage of the BC circuit. Letting the rf end run un-biased gives a better S/N ratio which also helps hearing the weak ones. It was originally intended to kill all AVC, but the *if* strip had too much gain, and the resultant 10 meter hiss and hash


FILAMENT AND POWER PLUG DATA
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FILAMENT PLUG - 8 PIN MINIATURE
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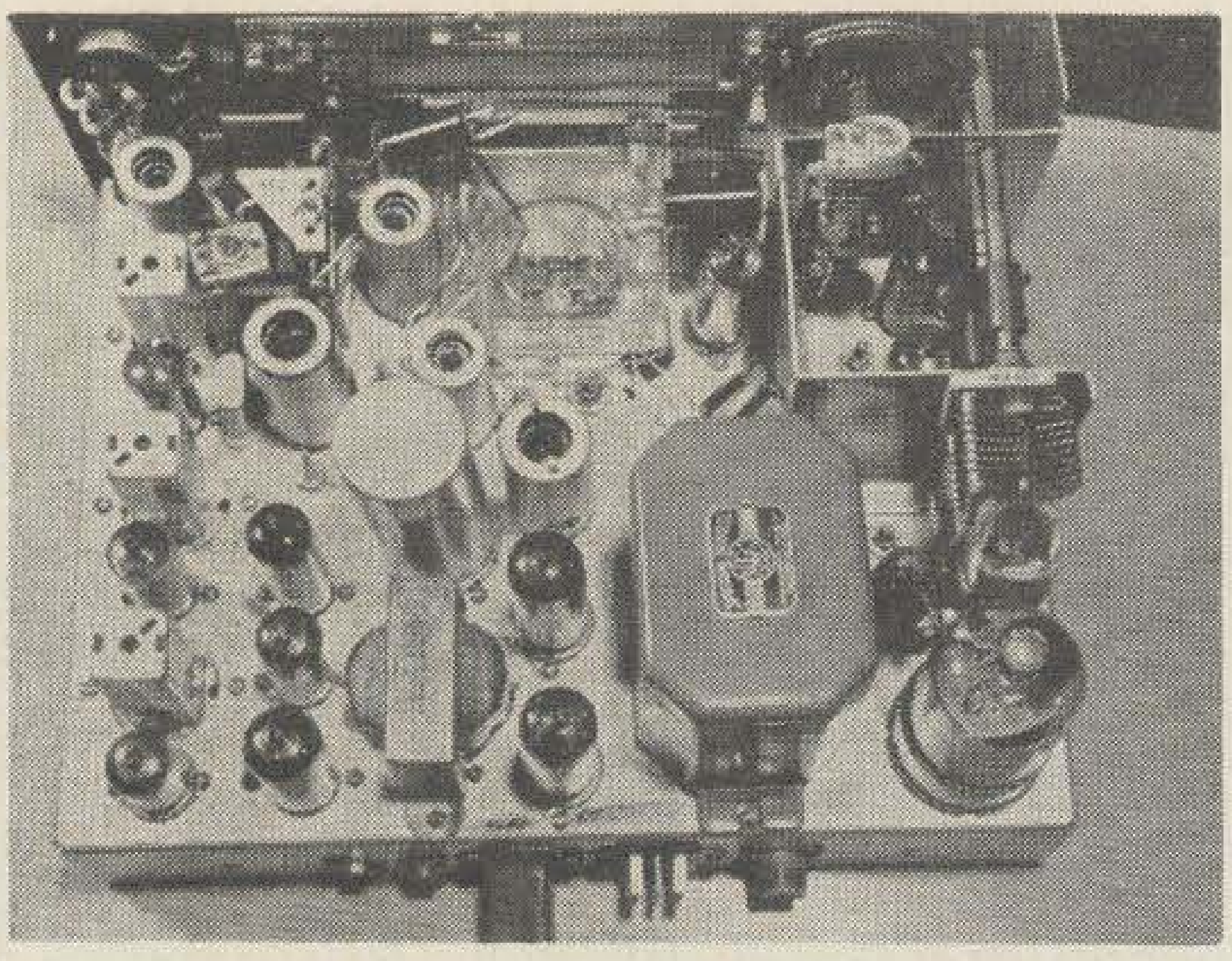
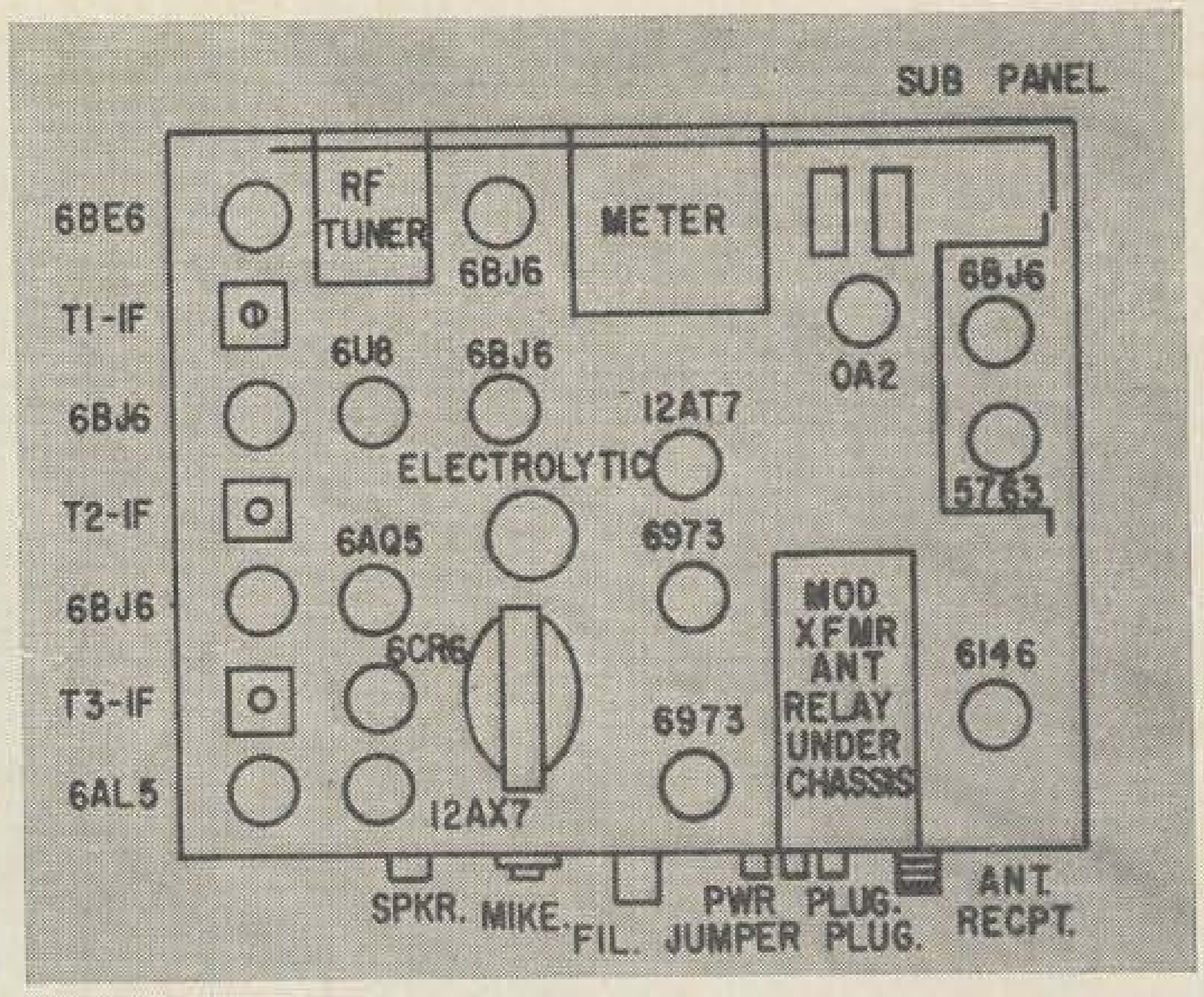
6CR6
6BJ6
6BE6
6U8
12AX7
6AL5
6146
5763
6973
12AT7
ANTENNA RELAY
"S" METER
MIKE
"INTERLOCK" SPOT SWITCH





was too much for the TNS, speaker and eardrums.

The converterette is a popular version in wide use, but crystal controlled to give the ultimate in stability.

The construction of the receiver section occupies one half the chassis, and conventional parts and wiring techniques are used throughout. BC or 10M reception is switched via a 4PDT slide switch, but a 3PDT would suffice. I made use of the construction of my switch to better isolate the antenna from the BC receiver input when in the 10M position, to cut the BC leak-thru to nil even in my vulnerable neighborhood.

No real difficulty was encountered in the receiver except a tendency of the *if* strip to oscillate when there was no signal present. This was cured by re-positioning the disc ceramic by-pass capacitors on each *if* tube socket to act as a shield betwen grid and plate pins, as well as by-pass other pins. All tube sockets were oriented so as to allow shortest possible input and output leads, with no proximity coupling of parts of input and output circuits.

A bridge circuit was used for the "S" meter between an AVC controlled cathode and a fixed biased cathode. This circuit is non-linear on weak signal readings, but it does give an indication without the need of a separate tube. Pots are shown in the print, but to conserve space, once the bridge was adjusted fixed resistors were substituted instead.

The transmitter rf section uses 3 tubes, with the oscillator and doubler-driver plate coils stagger tuned to give uniform grid drive to the 6146. A voltage drive control allows the 6146 grid current to be kept at proper levels. A minimum of 2½ mils was available across the entire band. The oscillator tube may be VFO or crystal controlled, selected by a 2P3Pos switch. On crystal the frequency may be rubbered a few kc via the VFO tuning capacitor, as the crystal is placed in series with the tuned L/C circuit, effectively locking that circuit to one spot; limited only to the amount the VFO can pull the crystal before oscillations cease.

The VFO coil is a mini-ductor type, with a Plexiglas bar cemented inside it. The bar is bolted rigidly to the VFO-Xtal switch using long screws and spacers instead of the originally supplied screws of the switch. This mounting eliminates the transfer of chassis heat to the coil, and mechanical stability then became the only obstacle to a rock-solid VFO. When the coil mounting bar was bolted tight to the switch, and the chassis and front panel combination bolted securely to the cabinet, and that to the underside of the dash, VFO drift and wobbulation were eliminated. I can now spot the VFO on a frequency from a cold start leaving work, and in the 25 minute ride home an HQ-110 will not have to re-tune me in. Just how selective the HQ-110 is, is not meant to be debated, but I felt it offered a fair average of home equipment performance with which to judge my VFO stability.

I originally planned to neutralize the final, but a back order from the parts warehouse and a moment of courage led me to try it without, and to my surprise the final was rock solid! Further checks proved it to be as stable as originally believed so neutralization was omitted. I had planned to use a .5-5mmfd between 6146 plate and a 3 turn addition to the 5763 plate coil, in case anyone desires a method, or any standard form of neutralization homogenous to the circuitry used will do.

The modulator uses little known tubes to hams, but they are popular in Hi-Fi's. Since 25 watts of audio comes from a ceramic mike and three 9-pin miniature tubes, I felt I achieved my aim in performance and space conservation.

My transistor power supply is a "surplus" GE unit, made available thru GE Ham News. I re-packaged the filter section into a mini-box, so with the heat sink it fitted nicely on the rear of the cabinet. The supply contains a multiple contact relay, actuated by my antenna change-over relay via the push-to-talk mike switch, to change voltages from receive to transmit conditions. Actually, I got the supply first, and then designed the rig to best utilize it. Any home brewer may do well to consider before building that either the rig should fit the supply, or the supply made to fit the rig. Which circumstance to follow depends on the availability of one or the other, or how easy parts will be to procure for the needs in question. Any of the commercial supplies on the market could be adapted to, as most have bridge circuits which give two voltages, one for receiving and the other for the transmitter, or any combinations thereof as needed.

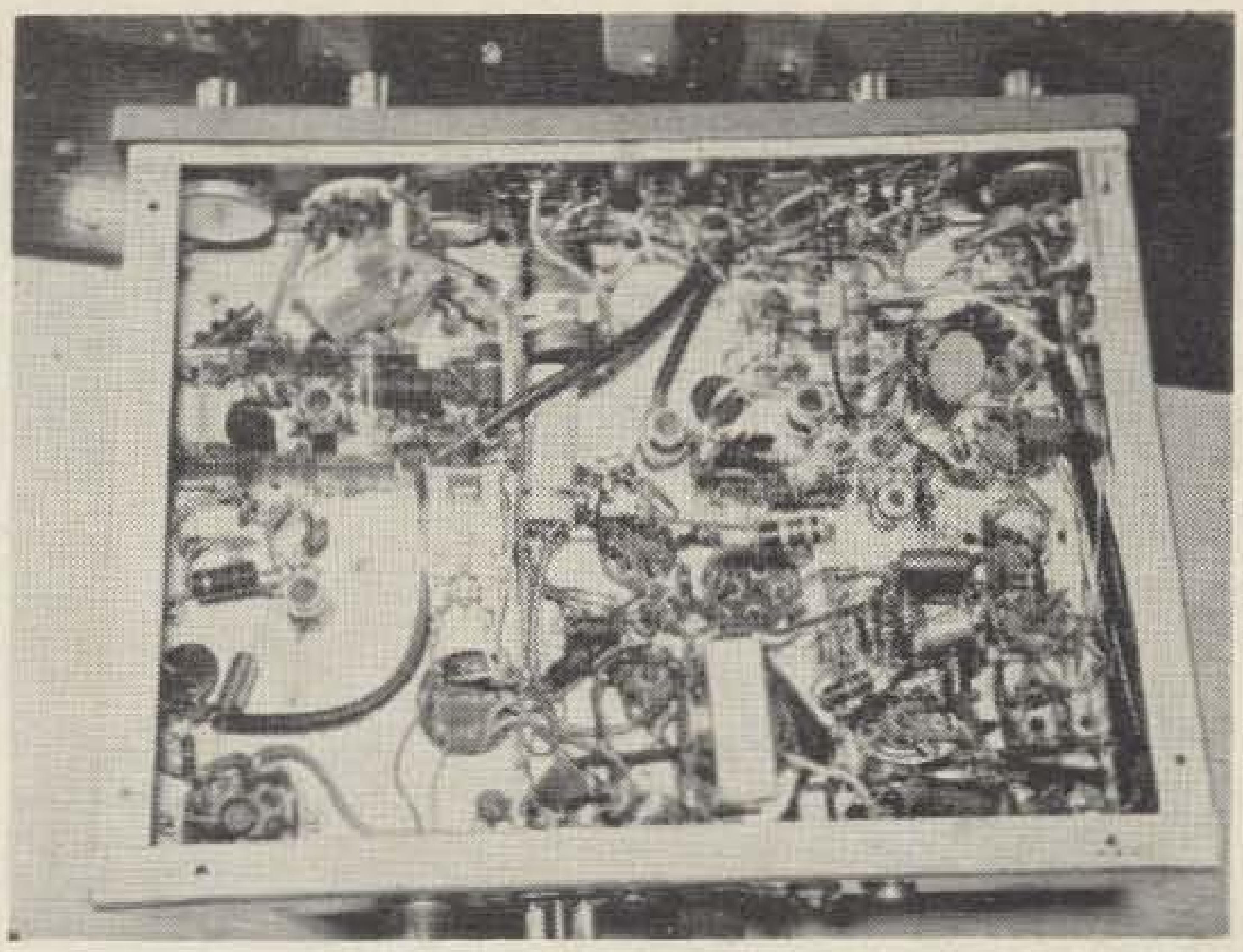
In an effort to further guild the lily, the whole package was wired with provisions to be operated from the 12vdc supply, or an ac supply with 6vac filaments. This was done to facilitate its use at a vacation home or the like without having to hibernate in the car. Not having a use for such features at the present time might make this provision needless work, but this first run model tried to anticipate all needs. Many builders could simplify wiring by eliminating this.

The meter is switched to read modulator plate current, rf grid and plate current, relative rf output, and "S" meter.

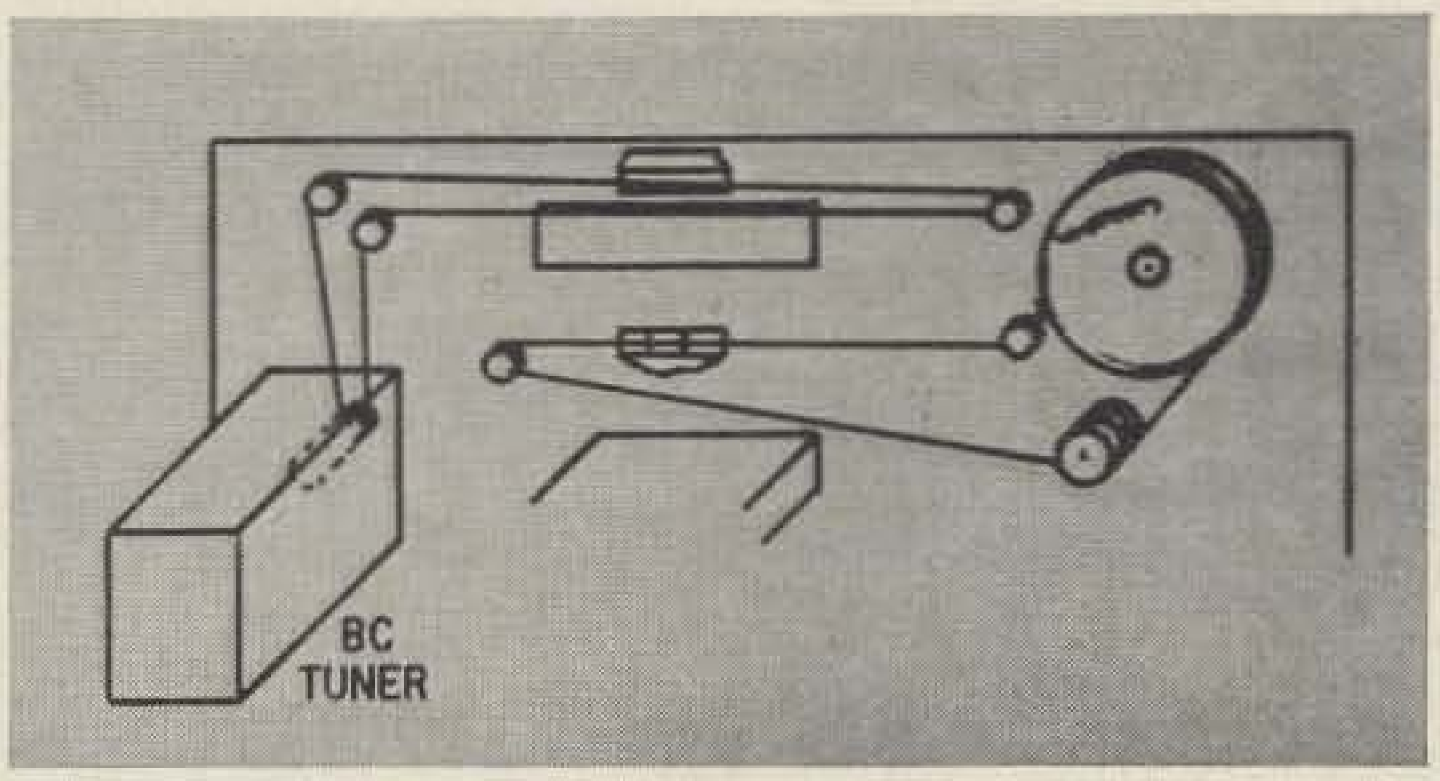
The dual slide rule dial is entirely a home brew effort, and the most ticklish part of the construction in the whole box. The top pointer reads the receiver tuning, with the dial cord patterned after that of the original radio of the tuner. This was secured from a Photo-Fact manual, but with the experience since gained in slide rule dial techniques, I feel it an easy matter to lay out an original.

The lower pointer reads the VFO, and vernier action is achieved by a 2" drum drive turning the VFO tuning capacitor and moving the pointer. The dial assembly is mounted on an aluminum sub-panel behind the front panel. This allows the front panel to be removed without any disturbrance to the mechanism. The dial is made from milk white Plexiglas; India ink marking the lines; and black decal numbers at the appropriate spots. Then the whole affair is sprayed with several coats of clear plastic Krylon to give it a smooth glassy finish. A pilot light assembly is mounted behind the dial, with a second light turned on with the transmitter filament switch positioned so as to illuminate the meter. The meter is a 0-1 ma edgewise reading model, which lends well to the front panel symmetry. The front panel was further dressed up by spray paint, decals and several more coats of clear plastic spray. Aluminum knobs finished the dressing up to the end result of a fairly commercial looking piece of homebrew.

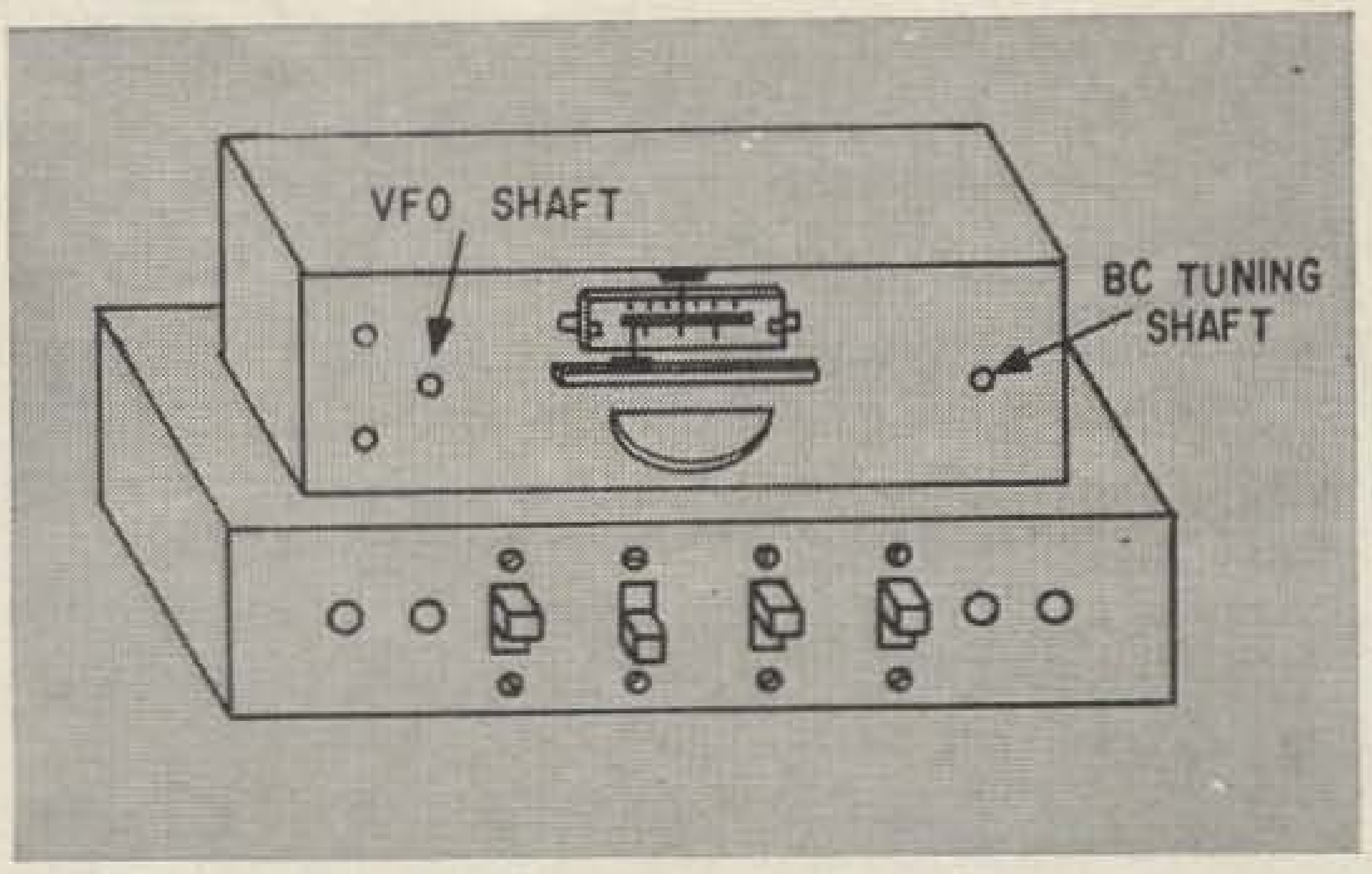
Accompanying diagrams and photos show my layout of chassis and front panel. I believe in a complex effort of this sort very few home brew artists will copy exactly, so detailed wiring and placement instructions might be wasted work. Many will at a glance see little areas of improvement and adaptations of one idea or another to their own desires, and it is hoped this chronology will serve as a stimulus to go and do likewise, and put together



Underside of chassis. Looks like a rats nest, but isn't. Note VFO coil mounting on switch in upper left. Antenna relay space created by modulation transformer above chassis. A copper shield divides the chassis with transmitter rf on one side and receiver and modulator on the other. Shields are used between the oscillator and driver sockets, mounted across each socket.



Dial cord stringing. The dial cord goes around the shaft in the BC tuner four times and then goes through a hole in the shaft and around the shaft again four times in the opposite direction. The knot in the cord is at the pointer clip.



The sub-panel is recessed 1/4" from the front or main panel, which attaches to the chassis via pot and switch nuts of various controls. The screws holding the slide switches are countersunk flat head type so as not to appear on the main panel. Sub-panel has hole cut behind dial for lighting. The top pointer (receiver) rides on the top edge of the sub-panel. The bottom pointer rides in a slot cut in the sub-panel above the meter opening.

what I consider the ultimate in average mobile operations—a one package station that can go from car to car with a minimum of effort, and no need to dig into the car radio, or indeed, no need for that car radio. The effort on my part started four others at WCAU-TV Philadelphia, where I work, on a similar effort, with one on the air and the others still in construction. They are all different in specific layout and design, following only the pattern of a one package mobile station.

Many of the parts were on hand in my junk box, but an effort to figure a price tag on everything needed brought the cost to just under $100.00, including the $21.50 for the GE power supply. Many auto radios set you back as much, so I figure even now I'm way ahead of the game, having BC and ham radio too.

The "Hanky Box," as the fellows at work have tagged it, has been in service since June 1960, and performance and reports have all been favorable. I've also home brewed in the same size package a 2 meter station, consisting of a 20 watt transmitter, triple conversion receiver and ac supply, and will endeavor to chronicle its details as the writers cramp eases off.

I also wish to acknowledge with thanks, the advice and photography equipment of K3ADH, Bob Patterson in getting the pictures of the rig

. . . W3GSC

Parts List

Xmt Fil Sw—SPST slide switch.
RFC—Filament hash choke, supplied with GE transistor supply.
Antenna Relay—6 vdc coil Advance AM/2C/6VD Miniature Antenna type. 6 v coil is used so it is OK for rectified 6.3 vac when used at a fixed location. AC supply then does not need dropping resistor R1, only M500 rectifier and 1000 mfd electrolytic to give dc.
12 pin power plug, filament jumper plug, coax antenna receptical, mike jack and speaker phono plug all mount on rear of chassis.
Transistor supply, consisting of heat sink and mini-box mount on rear of cabinet above opening where chassis connectors come out.
T1-T2—Miller 455 kc *if* input xfmrs 12C1.
T3—**Miller** 455 kc *if* output xfmr **12c6.**
T4—Audio output, 5K to 3.2 ohms.
L1—⅜" LS5 form. 17 turns #24 enam. Link 2 turns hookup wire on cold end.
L2—⅜" LS5 form. 15 turns #24 enam.
L3—¼" LS6 form. 10 turns #26 enam.
L4-L5-L6—See text.
L7—⅜" dia slug tuned. 28 turns #24 enam. Resonate to 14.5 mc.
L8—⅜" dia slug tuned. 12 turns #24 enam. Resonate to 29.3 mc.
S1—Ceramic 2P3Pos VFO-Xtal switch.
S2—DPDT slide switch: VFO spotting, one side wired to break push-to-talk circuit in spotting position.
R1 & R2—Wirewound shunts to permit O-1 ma meter to read 200 ma full scale.
T5—1:3 Audio interstage transformer.
T6—30 watt modulation, UTC S-19. 8K pri to 3700 ohm sec. Modulator current rests at 75 ma, peaks at 115 ma. RF amplifier current loads to 115 ma.
L9—8 turns 1" diameter 1" long (B&W) #3014, Illumitronic 808T).
All capacitors are disc ceramic unless otherwise marked. Where polarity is shown use electrolytic, values are in mfd.
All resistors are ½ watt unless marked.

Rig is attached to underside of dash with bolts and heavy guage aluminum angle.

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Behind beautiful printing lies artwork. However, pretty pictures alone do not constitute artwork. Good artwork satisfies a purpose. The purpose controls the theme. And the theme weaves the art and end-use together.

Artists don't measure costs by mechanical methods. The artist charges according to what the job looks like. Being custom made, art remains high like the services of most professional people. If the finished art looks like twenty-five dollars, twenty-five dollars becomes the price. If, on the other hand, the piece looks like three-hundred dollars, that becomes the charge. Commercial art prices resemble a surgeon's fee—after looking the patient and the situation over, he arrives at the amount.

To get good art cheaply; organize. Many hams belong to radio clubs. Some belong to special clubs featuring one particular facet of amateur radio. All such memberships are "naturals" for low-cost call cards. The type club itself doesnt' matter; just so it represents some ham association. Such clubs afford excellent opportunities to obtain significant, economical designs that establish their members.

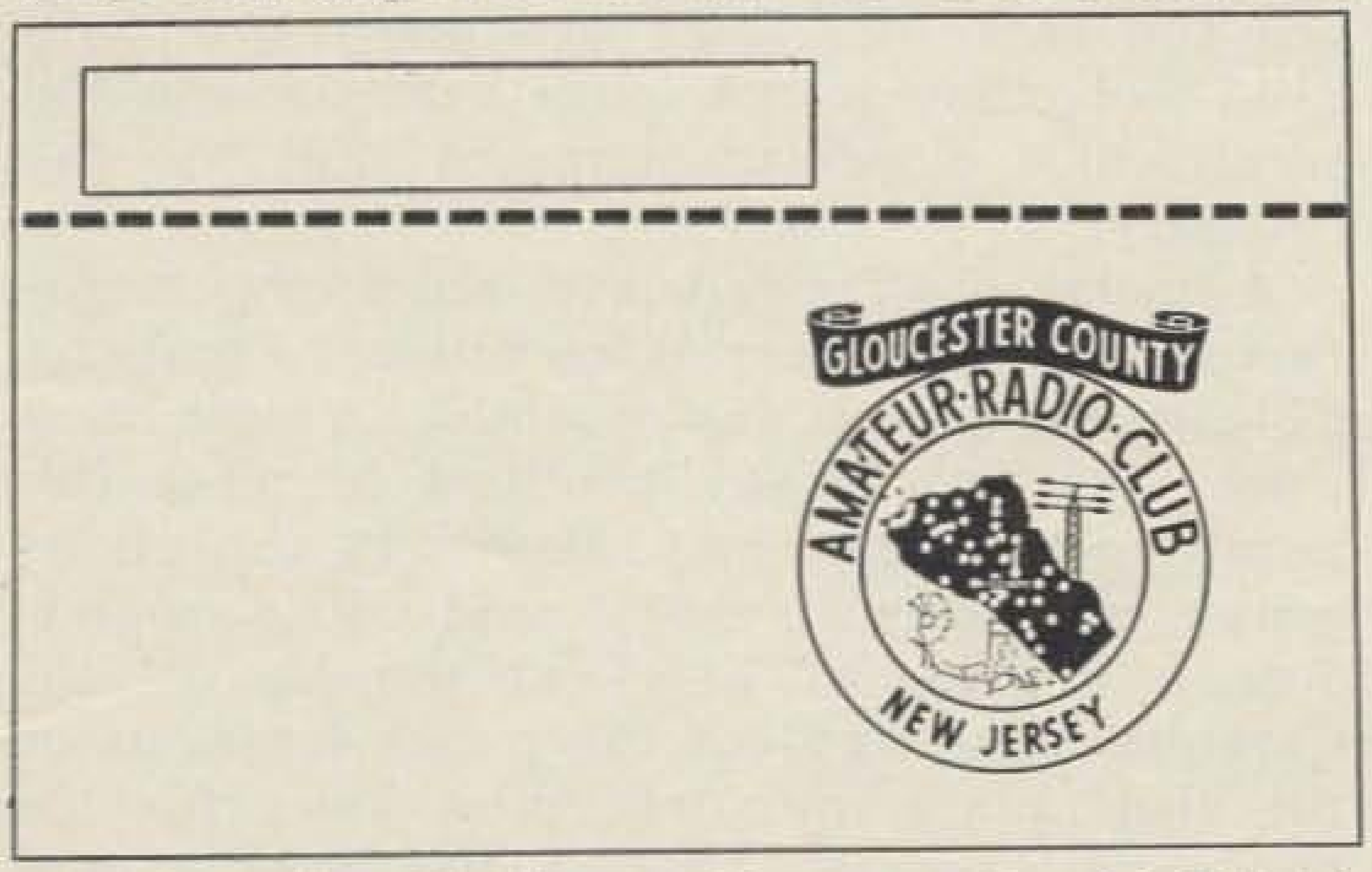
By selecting a club design appropriate for the club yet individual enough for each of the members, the high art cost spreads out over a number of contributors. It's the same principle used by insurance companies—everyone chips in a little to painlessly build up a total that easily takes care of everybody. If fifty hams belong to a radio club and an artist charges fifty dollars for two color separation artwork, the cost to each amateur is only one dollar.

Now one thing immediately becomes evident —every member subscribing will get the same QSL design. Everything remains the same except that each member's cards will contain his own call. However, if your radio club membership totals several hundred, the club does not have to freeze on one design. They could use numerous designs. One might portray the basic overall club; another, the mobile portion; another, a certain band activity; etc.

But perhaps you object to having a call card just like another's. You see plenty of this sameness in type-printed cards sent out by the ham fraternity today. You prefer as much individuality as possible. Let's see how one amateur club handled this problem in their ranks.

WA2NGI, the Gloucester County Amateur Club in southern New Jersey, wanted a snappy call card. While they desired a QSL to strongly represent them, they also wanted it to fit modern scientific times and to show affiliation with the ARRL. On top of all this, they preferred a club card that every member could use by substituting his call for the Club's. Out of this stack of requirements the artist charted a course.

A club card should predominantly represent the club. Therefore, the artist sought something that would highlight this feature. Was there any one thing he could use as a distinct symbol? Call letters wouldn't do because though individual, they are also abstract; they convey no identity to the individual when they stand alone in printing. The logical thing that filled this requirement was the Club's emblem.



Using the Club's emblem as the highlight meant the call letters must be secondary—a design won't support two highlights of equal intensity. The artist met this condition by keeping them small but prominent. To gain this effect, he divided the card into a large and small area by using a bold dashed line. At one of the four main interest points in the large area he placed the Club's emblem. In the left half of the small area where it wouldn't distract from the highlight, he left a small blank space for imprinting the call letters. See Fig. 1.

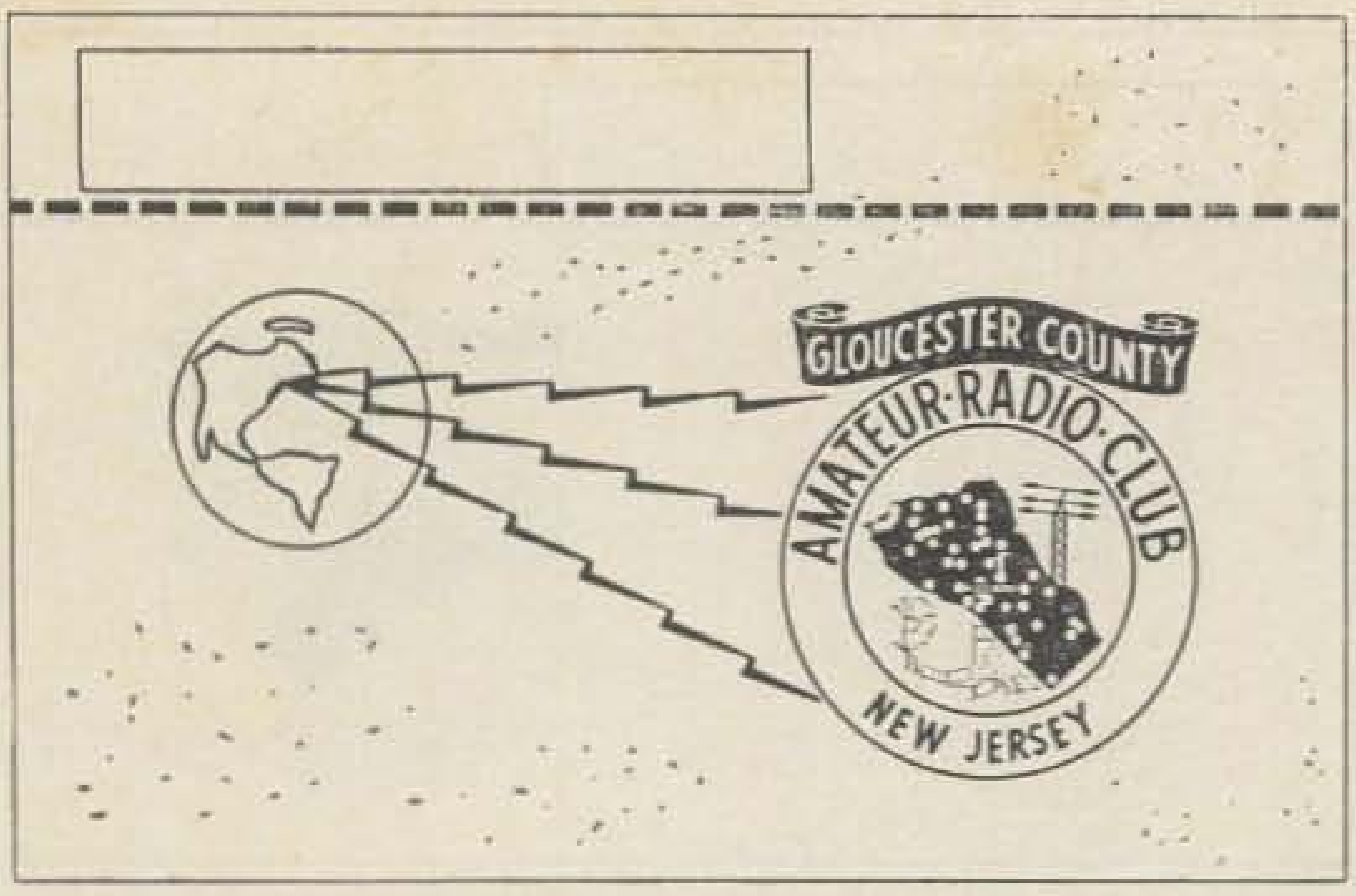
So far the design showed only two planes—horizontal and vertical. Now the artist considered depth. Three choices faced him at this stage in the design: He could place the symbol in isometric third dimension (all lines parallel to their opposites); use artistic perspective to create a large shadow cast by the emblem and fading into the field color of the card; or, leave the emblem in two dimensions but hanging aloft in third dimension space.

The artist selected the third possibility. By choosing this method he also satisfied the requirement of the Radio Club for a modern scientific scene. Proceeding from here he placed a medium-sized Earth at the upper left-hand highlight point. Below the Earth and extending above the emblem into the region above the dashed line, the artist scattered stars. This produced two effects: It gave a feeling of outer space to the Earth and it tied the small area above the dashed line to the basic design. See figure 2.

Now let's sum up what we have. The big Club emblem satisfied the requirement for highlighting the Radio Club. The Earth and stars portrayed the scientific space age of today. But so far no relationship existed between the Radio Club's emblem and the outer space scene. And certainly no excuse existed for showing the two things side by side. In other words, *no theme existed.*

What could the artist do to merge the two separate thoughts expressed at this stage in the design? What excuse existed for the emblem being out in space? If the artist stopped at this point, about the only thing you could say was that the Gloucester County Radio Club was "up in the air"; or, be polite but indefinite and say, "it was out of this world."

To tie them together, the artist drew some lightning flashes from Earth to the emblem. However, signals from anywhere on Earth illustrated no special meaning for the Radio Club. So the artist did a final thing; He arranged the signals connecting Earth to the emblem so they emanated from one place on the map—the approximate location of the



Club. That addition immediately solved the theme problem. *It gave the Club a definite location in space.* See Fig. 3.

Next the artist changed the broken separator line from a dash to a dot. This alteration injected a mildness more pleasant to the eye. At the same time he drew in the ARRL symbol in the lower right-hand corner. By keeping the symbol small, he controlled identification with the League without distracting from the overall design.

The one remaining problem concerned use of the card by the membership. As the design now stood, anyone's call letters could appear in the blank space allotted. However, imprinting various calls on the basic QSL card would make it appear that the Club possessed many calls. The design still lacked firm identification for Club members.

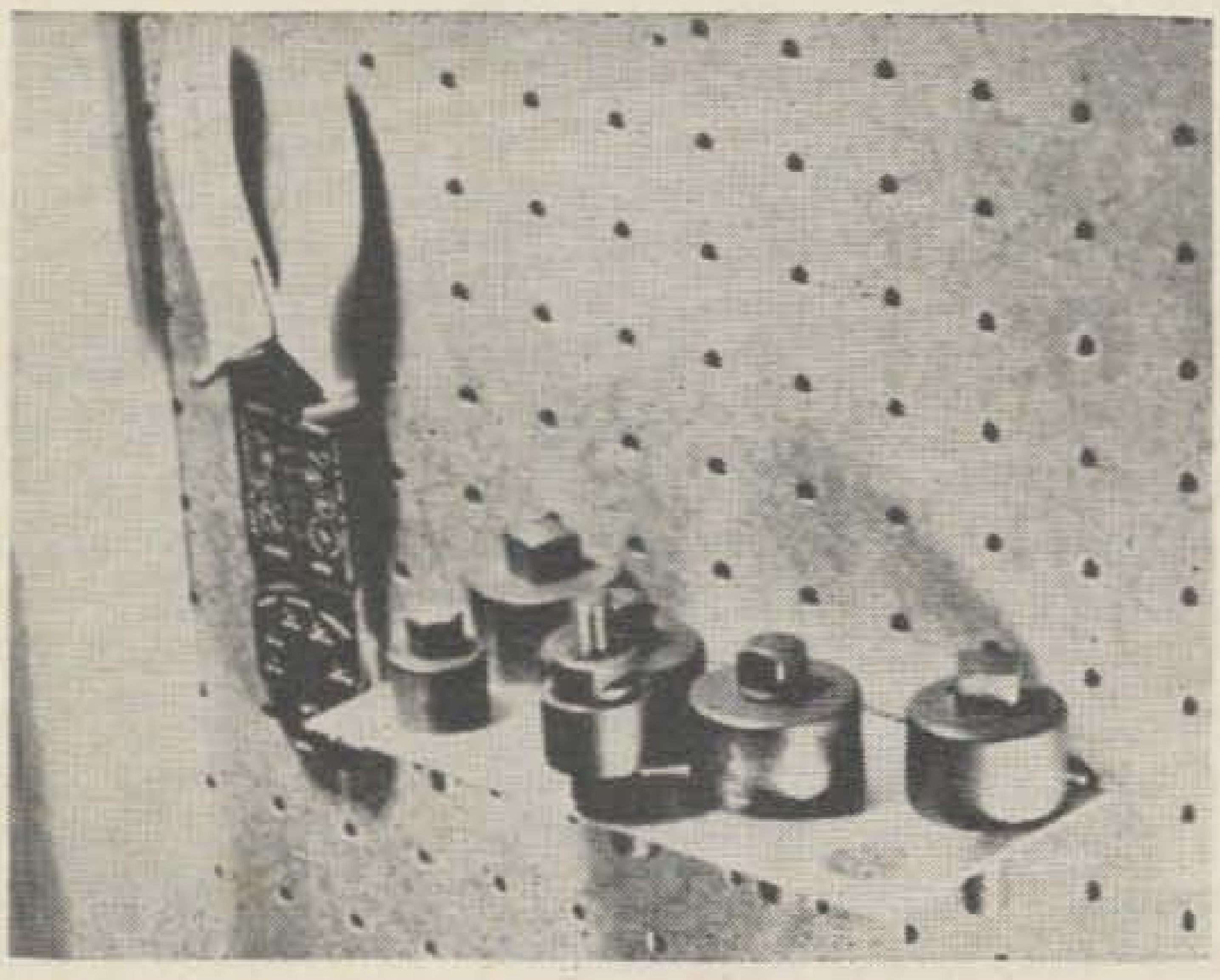
Solution of this final problem proved easy for the artist. And it didn't require any change to the design. He accomplished it by calling for the words "MEMBER OF" to be printed in small letters below a Member's call at the time of imprinting. This simple treatment solved member identification beyond a doubt. See Fig. 4.

The final cards print in blue and yellow. Blue forms the field of the card and some of the lettering in the emblem. The emblem background and the lettering in the ribbon take yellow. The continents get blue with the Earth outlined in blue and yellow. White from the card stock forms the dotted line, lightning flashes and ARRL symbol. And a very light blue produced by the screened portion of the printing plate fills the area left blank for the call letters. The printer first runs a bulk quantity of cards for the Club. The Club sells the cards to its members who arrange with the printer to imprint their calls plus the words "member of" in the blank space on the card.

Membership in a radio club offers numerous advantages. To the amateur it gives stature in the community; to the community, a ready, organized service should disaster strike. For hams who enjoy club membership, club QSLs offer great appeal. And, this opportunity to get a pretty QSL reasonable is just one more service amateur radio clubs extend to their members. To get the best for less, investigate the radio club in your area. . . . W2AAA

Knockout Punch Storage

Adequate storage of tools is always a problem in the home workshop. Use of wall mounted "peg-board" and the variety of special hangers and fixtures now available simplifies the task but there are many commonly used tools that do not lend themselves to this treatment. Knockout punches fall in this category.



A metal shelf peg-board accessory, manufactured by The Kerr Wire Product Company, Chicago 51, Illinois and available in most hardware stores, is easily modified to meet this requirement. The shelf, shown in the photograph, measures 3" x 6½" and will accommodate a number of knockout punches of the Greenlee type. Lay out the punch locations on the shelf plate and drill pilot holes for the punch drive screws. Punch the holes, mount the shelf on the peg-board and install the punches.

The punches are easy to find when needed and storage is neat and secure. Tube socket test adaptors mount just as easily, as do a host of other commonly used tools and test accessories. . . . W4WKM

Investigating 2N169A

Vladimir Gercke K6BIJ

THE G.E. Transistor Manual gives us a page of useful information on 2N169A. Let's see: "DC Characteristics," "Low Frequency characteristics," here we are—"High Frequency Characteristics 455 kc"; gosh,—since when is 455 kc high frequency? But we have nothing else, so we have to use this column.

From it we learn that 2N169A operating on 455 kc has a "cutoff frequency of 9 mc"; also we learn that this interesting event takes place at 25 degrees Centigrade. So, I guess, after carefully reading the whole page of the Manual, we can very definitely assume that our 2N169A is most probably a transistor. Thank you G.E.

Let us try another approach.

The simplest form of a regenerative broadcast receiver using 2N169A will take form of Fig. 1. L1 here is a loopstick and some sort of transistor audio strip will give us a speaker volume.

We start taking turns (a few at a time) off the loopstick, and see what will take place. Two things happen: the floor begins to look as if a french poodle just had a haircut, and receiver frequency goes up. It works on 160 meters—good. It works on 80—fine. It oscillates merrily on 40—excellent; this must be the end, as G.E. said something about 9 mc (not sure what). But it works on 20 with only 3 turns left (we are trimming the tickler too); changing C2 to 25 mmfd and raising the voltage to 9v—it works on 15 meters. L1 is now a ½" plastic coil, iron slug tuned, and has only 2 turns #18 (5 #24 on a tickler), 365 mmfd condenser is all "out," and we are using "gimmick" to couple the antenna. 2N169A quits oscillating shortly after 15 meters, but if you have a handful of them—some will go to 10 meters.

Now we are going to try something rather unorthodox: with 2 turn coil, we will attempt to go as *LOW* in frequency as we can. 2N169A works good thru the range of our 365 mmfd condenser and brings us to about 10mc. We hook up two more 365's in parallel and get to about 8 mc. A 3000 mmfd silver mica is now added to the existing capacity; it cannot possibly oscillate (losses too high, too much "C," not enough "L")—but it works, and right in the 40 meter band.

This is getting ridiculous, but we add another handful of silver micas, totalling about 16,000 mmfd (.016 mfd)— and find ourselves on eighty meters.

In desperation a .1 mfd bathtub paper condenser is soldered across everything we had thus far,—and we hear a commercial from a BC station. Nuts . . . Oh, no . . . my transmitter power supply filter stays where it is now,—*you* try it.

To make the bathtub work—we had to change C2 to 500 mmfd and add a lot of turns to the tickler, but L1 still has 2 turns. (iron slug *must* be all in).

So much for the "pure science" department. Now what good use can we put this contraption to? Let us try it as an 80 meter receiver. The 365 mmfd variable (plus some 16,000 fixed) covers only about 10 kc, it gives perfect bandspread, but to cover the band we must use the slug. Antenna (80 meter transmitting, 70 ohm coax feeder, is inductively coupled using one turn coupling coil.

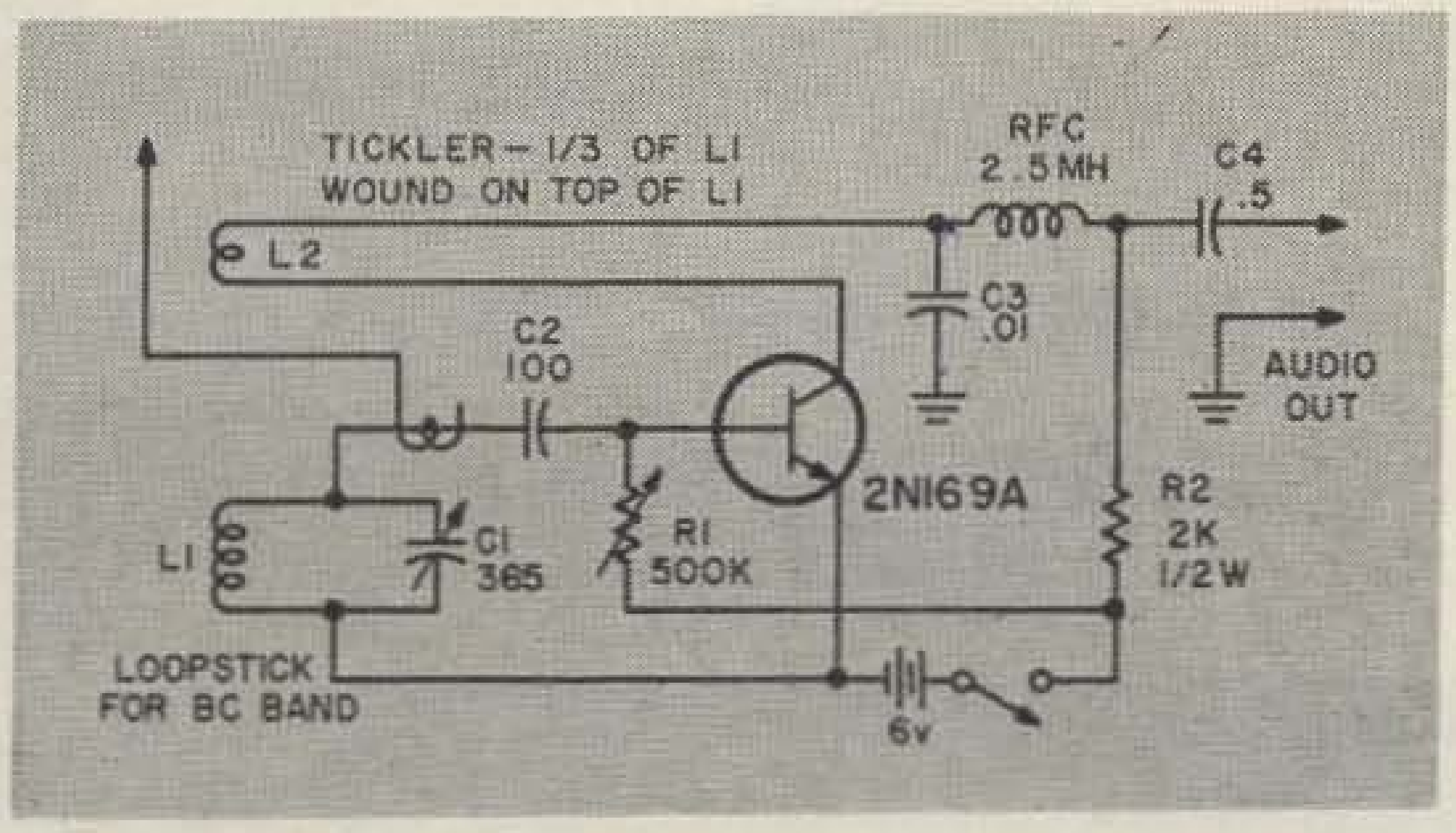
It becomes apparent at once—the receiver has an unusually good SELECTIVITY, better than some communication receivers in the cheaper class. SENSITIVITY, using resonant antenna, is good. STABILITY is perfect. It works on AM, CW, SSB, and does not know what an image is; regeneration is very smooth. Generally it makes a very acceptable communication receiver with two IF's (IF here is "if," not Intermediate Frequency).

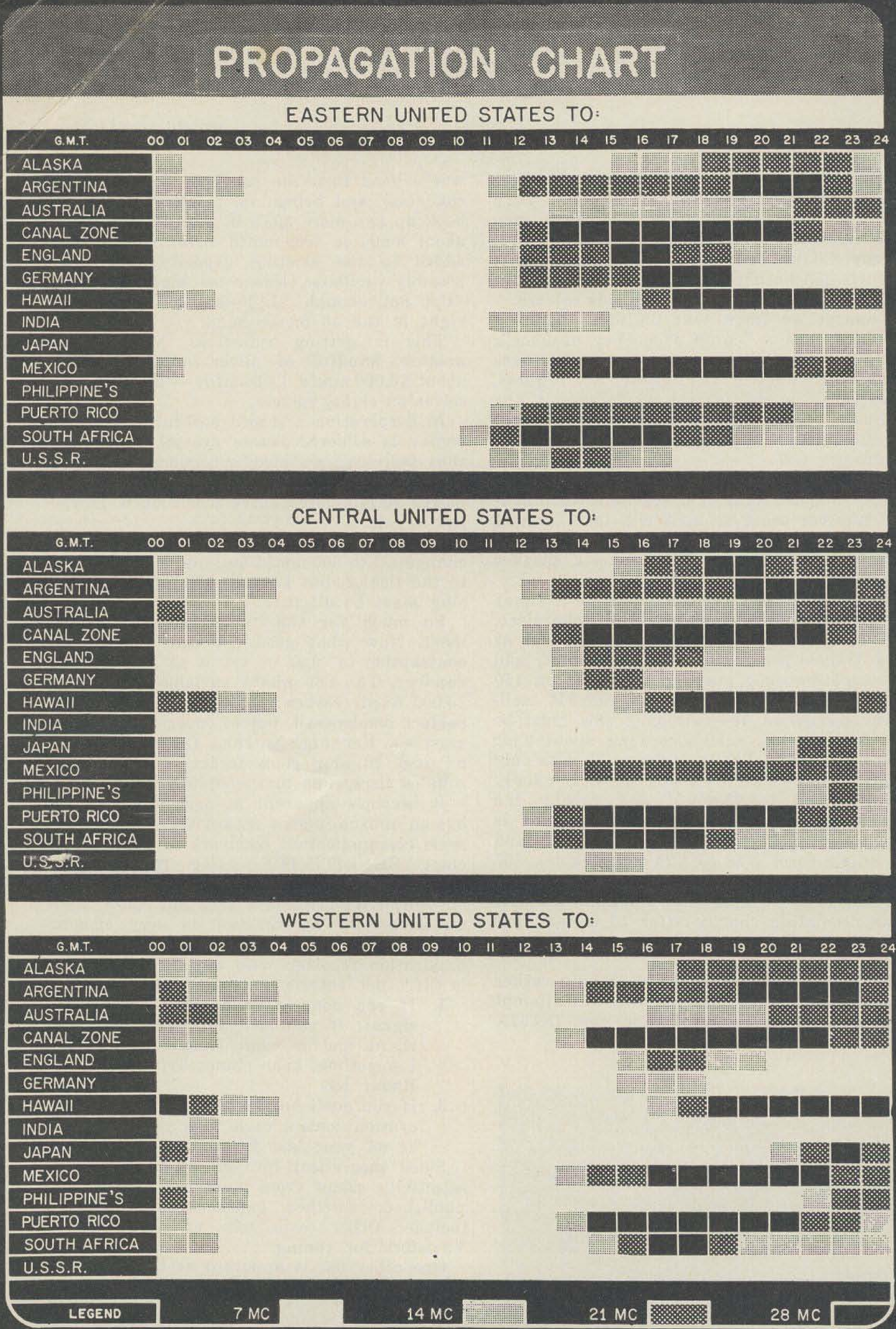
1. If you don't have a very strong local signal; if you have one—you will hear it, no matter what frequency it is on. I sometimes hear planes flying overhead. Radar too.
2. If you don't mind readjusting the regeneration control each time you go a few kc off your last frequency.

Some theoretical info on where the extra selectivity comes from must be obtained and published. Further experimentation should include: Other transistors, rf stage, use of Varistors for tuning.

One other use is apparent at this time—as a "Zerobeatnick."

. . . K6BIJ

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EASTERN UNITED STATES TO:
CENTRAL UNITED STATES TO:
WESTERN UNITED STATES TO:
G.M.T.
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
ALASKA
ARGENTINA
AUSTRALIA
CANAL ZONE
ENGLAND
GERMANY
HAWAII
INDIA
JAPAN
MEXICO
PHILIPPINE'S
PUERTO RICO
SOUTH AFRICA
U.S.S.R.
LEGEND
7 MC
14 MC
21 MC
28 MC

Propagation Charts

David A. Brown K2IGY
30 Lambert Avenue
Farmingdale, N. Y.

For the DX propagation chart, I have listed the HBF which is the best Ham Band Frequency to be used for the time periods given. A higher HBF will not work and a lower HBF sometimes will work, but not nearly as well. The time is in GMT, not local time.

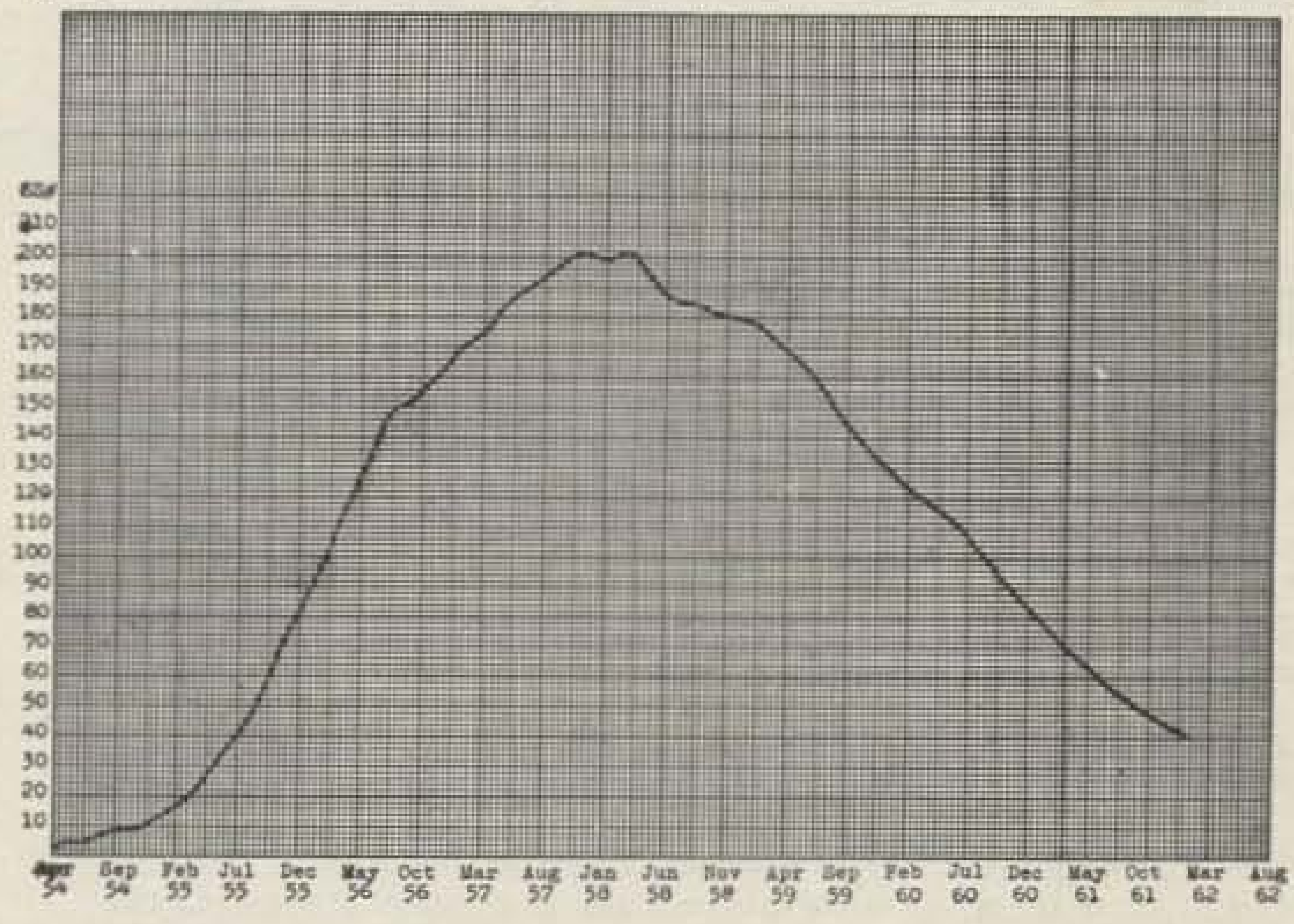
Advance Forecast: January 1962

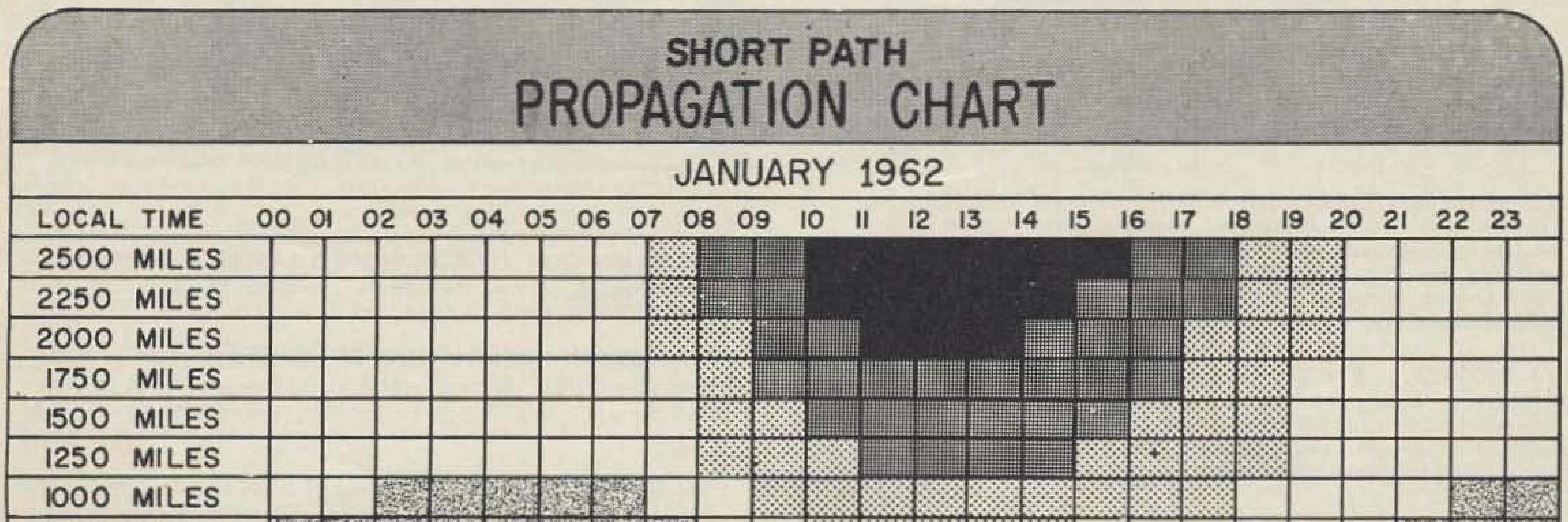
Good: 1-18, 20-21, 27-29

Fair: 19, 22, 26, 30-31

ugh: 23-25

The Short Path propagation chart has been set up to show what HBF to use for coverage between the 48 states. Alaska and Hawaii are covered in the DX chart. The use of this chart is somewhat different than the DX chart. First, the time is the local time centered on the mid-point of the path. Second, the distance given in miles is the Great Circle path distance because of the Earth's curvature. Here are a couple of examples of how to use the chart. A.) To work the path Boston to Miami (1250 miles), the local time centered on the mid-point of the path is the same in Boston as in Miami. Looking up the HBF's next to the 1250 mile listings will give the HBF to use and the time periods given will be the same at each end of the circuit. B.) To work the path New York to San Francisco (2,600 miles), the local time centered on the mid-point of the path will be 1½ hours later than at San Francisco and 1½ hours earlier than in New York (the time difference between New York and San Francisco is 3 hours). Looking up the HBF's next to the 2,500 mile listings will give the HB to use. In San Francisco subtract 1½ hours from the time periods listed for local time and in New York add 1½ hours to the time periods listed for local time.





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QRN

and the battle to beat it

THIS is being written not as a story to tell you how I whipped my own QRN problems, but as a guide to help you identify and track down the obnoxious nerve-wreckers covering *your* receiver.

In my search for the snaps, buzzes, snorts, and choggles which loused up many a fine DX QSO, I lost a lot of sleep roving the streets while the noise was on. I have been accused of being a nut, roving the streets in pajamas, armed with the tools of the noise hunter. Nonetheless, our record for finding and eliminating QRN stands at 100%. "Our" being myself and my invaluable helper & son, Steve, WA6IVN.

A look at the various noises encountered: There are those which are seasonal such as heating pads, electric blankets, electric heaters, defective thermostats, swimming pool heaters, etc. Heating pads and blankets follow a pattern, starting about 10 pm ending about 8 am, so *time* pretty well pin-points these noisy devils.

But before proceeding, let's look at a few definite needs:

1. A notebook to keep your notes regarding the times involved for your particular QRN, and to keep a record of the area searched, and other noises which are found, but not bothersome at the time. (When you read over your page of notes, the picture becomes much clearer!)
2. A hand-drawn or printed street map of your area to keep track of what you found and where you looked.
3. A single-bit axe or sledge hammer. (Down, boy! This is for research purposes only.)
4. A small transistor radio (indispensable).
5. Car with radio.

Begin by keeping a record of the noise, time of starts and stops. If it is intermittent, a description of it. If you have a beam, an indication of the general direction from which the noise is received. In your hunting, you will probably run across other noises. If they don't match the one you are hunting, simply file them for future reference. Heaters and furnaces generally will be heard in the morning and evening hours with an odd exception or two. Swimming pools in the daytime, the seasons being obvious.

Under nocturnal noises, we have the inevitable heating pads used for illness (*usually* at night). A very hard nut to crack is the 2 KV series street lighting, characterized by their on-at-dusk, off-at-daylight pattern.

After-daylight QRN can be varied. Generally, it is motors in factories, dental laboratories, medical offices, and homes. Don't overlook the do-it-yourself fiend with a complete QRN factory in his garage or basement.

Last, not least, is the steady stuff—really ham-maddening! Power leaks really aren't too hard to find. They sound somewhat like a basso profundo gargling—24 hours a day. This can be worse in coastal areas where insulator salting is a problem. Once the offending line is located, a call to the power company will usually result in the insulators being sprayed from trucks which the power company has for this purpose. Another excellent cure, when answered, is to pray for a monsoon. Other 24 hour QRN includes refrigerator butter warmers and defective bell transformers.

We have yet to mention fluorescent and slimline lighting fixtures. These often betray themselves by their on and off times (I hope the idea of the notebook is beginning to sink in). Still in the 24 hour category are the bad ones, defective grounds and wiring; they are the most difficult to locate.

The time to hunt QRN is when you hear it. If you wait till it's more convenient, it will probably not be there. If a power leak begins at 1 am, if you have a beam, use it to obtain the general direction the noise is coming from. A line on your map indicating this direction will save you time in searching streets not affected. (I've been stopped by the police in my pajamas, an axe in one hand and a transistor radio in the other. I was suspected of chopping down a power pole.)

Heating pad noise also has to be hunted at night, located, and doorbells rung the next day.

Fluorescent lights are best hunted during the evening hours so hunt them relatively early as they usually go off about 10 or 11 pm. (Bedtime?)

The back breaker, defective grounds and wiring can be searched for at any time. However, don't fail to take note of wind conditions indicating exterior wiring or grounds or guy

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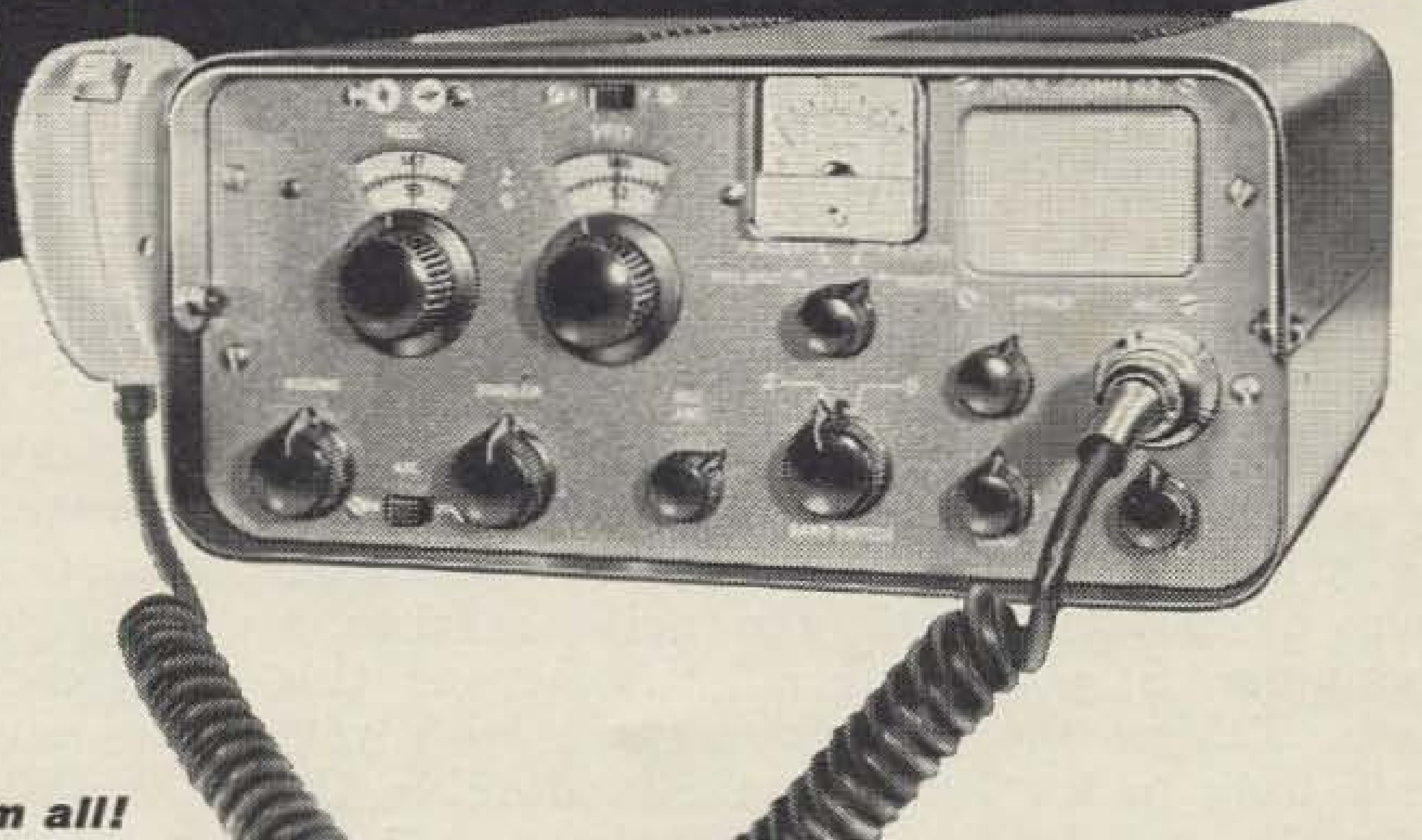

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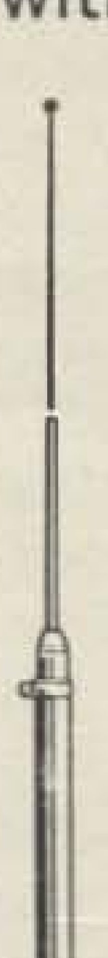

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wires.

Let's make a typical search. Supposing we have deduced from observation that a heating pad is involved. We have established the direction as being north of your QTH. As a rule, S-9 indicates the noise is within 600 feet. A reading of S-3; up to about 1500 feet; will give an idea of the distances to be searched. Now then, using the car radio, gain full on and tuned off of a station, proceed for a distance of at least six blocks, or 1800 feet. Do this as follows:

Be sure to stop at each corner and in the middle of each block or equivalent, with a wait at each stop equal to the off period of the QRN we are looking for. On the map, indicate the route you have covered noting other QRN found, by notes on the map. As you criss-cross your search area, you will suddenly be rewarded by having the car radio pick up the noise. Drive along as close to the power lines as possible until the noise reaches a maximum. Stop the car slightly beyond this point. Taking the transistor radio with you, walk back to the loud point. Standing on the sidewalk and holding the transistor radio at arms length, point it at the opposite side of the street about 100 feet to your left. Slowly sweep through an arc with the radio to a point 100 feet to your right. If there has been no positive indication, cross the street and repeat this process. The transistor radio will point to the house with unerring accuracy indicated by a sharp build up in volume. Note the address and go back to bed.

Now, if no noise was heard on the transistor radio when used as described above, you still are not at the right place. This means you must follow the power line and each power line fed or tapped off it for a radius of about 1500 feet from where you made this initial test. Eventually the transistor radio will hear the noise at one of these nodes, and you have arrived! Remember, even if it is loud on the car radio, if it is not audible, or very weak in the transistor radio, you are *not* in the right place! I had to learn this the hard way.

The following evening after the dinner hour is over, ring the door bell of the house in question. *Do not identify yourself as a ham!* Rather, state you are trying to find some interference which is ruining reception of AM or your Hi Fi radio, and that you have localized it to this immediate area after many frustrating hours of search. Ask if they have a heating pad, an electric blanket, or a thermostat controlled electric heater which is normally used at night. Ask if they have noted static in their radio (usually ac-dc). Try to be concerned about their welfare, pointing out the danger of a pad with arcing thermostats. As a result, usually they will allow you to check everything in the house. Don't forget it takes about fifteen minutes from the time it is turned on for a pad or blanket to act up. Enjoy their hobbies and conversation while you wait. As soon as the noise begins, using the transistor radio to monitor, pull the main switch momentarily. If it stops, it is on the fuse side of the line. Then unscrew one fuse at a time until the proper circuit is located. An investigation of all the lights and plugs on this circuit will disclose the culprit. Thank them kindly for their help and proceed to the nearest appliance shop and purchase a pad with nonradiating thermostats. The following evening, with surprising ease, a trade can be made and the culprit should be taken to a remote place and hacked to bits. In the case of an electric blanket, convince them it shouldn't be used as it is, but should be returned to the dealer for repair or replacement.

Let's go to the power-line leaks. A real bonafide leak goes at it continuously. This is indeed a break when hunting for it. The intermittent variety may be a little more difficult, but the same search manner is to be followed. Remember this, though, if it is a sunset to sunrise noise, it very likely is street lighting and the initial search should be confined to the poles that hold the lamps. In cities this is usually the 2 KV series lighting and is capable of considerable racket. Even if you hear it on every pole with your car radio you will not be at the right one unless you hear it at strong volume on the transistor radio. The search for power noises invloves following the line and its branches at least one-half mile in each direction from your house. Don't fail to observe trees which could cause intermittent windy-night QRN. Walk to the pole nearest the tree, and a healthy whack or two at least four feet up from the ground will cause a sputtering if there is any potential QRN here. It should be noted in the book and spotted on the map. Eventually, as you proceed along power line after power line checking with the transistor radio, you will locate the pole. Now, attack the pole with ten or twelve lustry blows with the back of the axe or sledge. Should a reaction occur, notify the power company as to the pole number and location. If no reaction occurs such as sputtering at the moment of impact, take note of any feed line coming from this pole and check each one with the transistor radio. One such line will be it. Most people think the transistor radio was intended for entertainment. "They're daft, man, daft!" Incidentally, the axe treatment will show up insulator tie wires which are radiating noise. These are very rough ones to find requiring banging each pole along the way with the axe. I reiterate, if you don't hear it on the transistor radio at good volume, regardless of an apparent node in the car radio, YOU HAVE NOT ARRIVED! Don't tap the pole, vent your fury on it! *There is no feeling of joy so profound as to hear a break in the noise as you gleefully bash the pole.* From this point, the power company will take over, usually with quick response.

The salt problem in coastal areas is quite easy to solve. The transistor radio will again quickly point out the offending high voltage transmission line. Again, the cure is to notify the power company. They will soon have trucks out to wash down the insulators. The axe treatment will also take care of poor branch line joints such as loose splice connectors hidden under miles of tape.

We have come to the last item on this list. It is by no means the last known QRN. (Unless 73 wants me as a full time writer for the next five years, I can cover only about 85% of possible noise-sources). These are the defective grounds and poor wiring. First, let us look into defective grounds. These commonly consist of the grounded conductor of the house electrical system and its bond to a cold water pipe. If this bond is not excellent, any appliance, motor or fixture which has a leakage path to ground can cause QRN. The transistor radio again will be of invaluable help and will detect the poor ground when same is shaken with vigor; like—*with a dry glove on the hand doing the shaking*. A severe shock can result if the ground is broken, even momentarily while it is being shaken.

Also, don't overlook the lowly bell transformer which also lights the house numbers. The most frustrating twenty-four hour of QRN I ever contended with was finally located as a defective bell transformer two blocks away. After locating the home, and explaining what was happening to my "Hi Fi," this very cooperative home owner allowed me to spend two hours in his house eliminating item after item, using the transistor radio and unscrewing fuses one at a time until the offending circuit was found. There my headache began. I started by pulling the plugs from all the outlets on this circuit. When this didn't help, I asked permission to take down the fixtures. My startled home owner dazedly allowed me to do this. When this didn't help, I removed each plug from its wall box and inspected it. Still no luck. So giving up in disgust, I put everything back together; and as I was leaving he said, "Did you make sure the door bells are working?" It took me exactly ten seconds to cut one lead to the bell transformer and the noise was over. A new bell transformer cost me $1.80 which I presented to the home owner and installed with joy.

Don't forget guy wires: Your own antenna tower, TV antenna mast, and occasionally power line guys. Whenever a guy wire is not insulated from ground and some sort of a connection exists, a bonding wire must be soldered across the joint. Static build-up will discharge across such places after they have become sufficiently weathered and corroded. TV antennas are terrible offenders when haphazardly guyed to metal flashlights, water pipes, sewer vents, or drain pipes. Due to the

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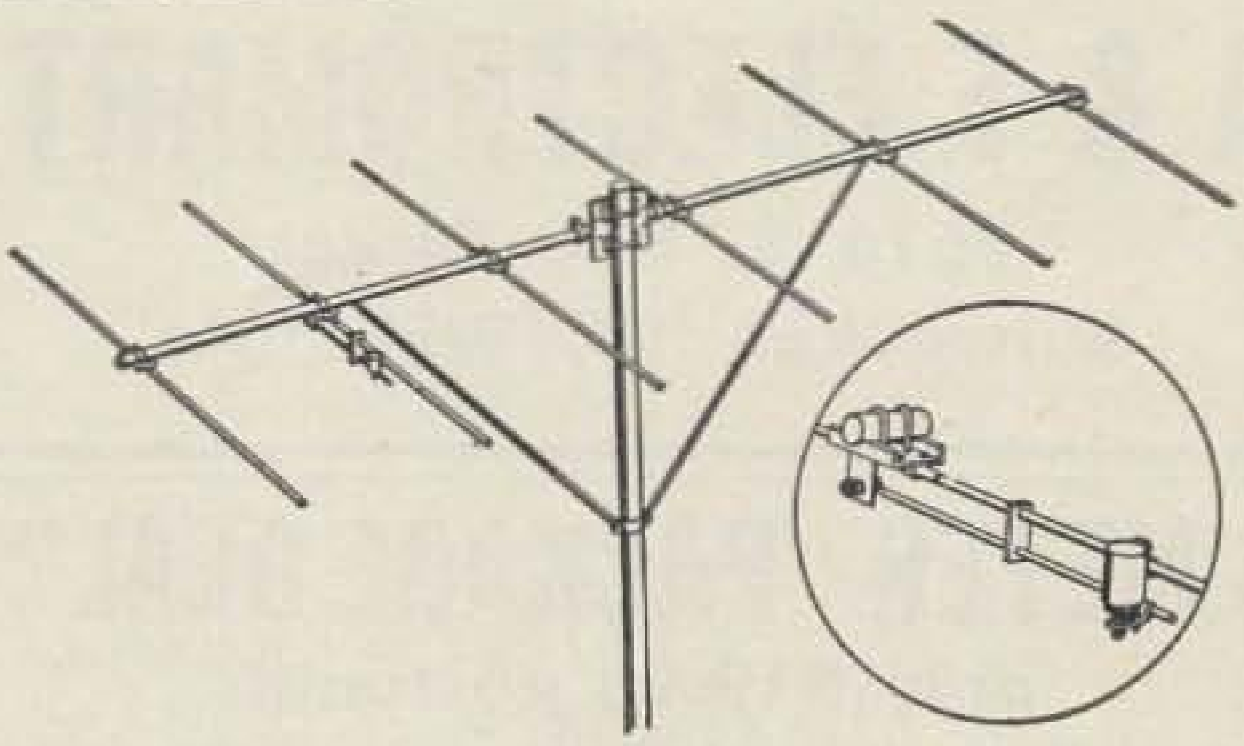

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fact that most TV sets are operated ungrounded, any leakage to ground then goes by way of the TV mast, guy wires, and metal flashings whose joints usually are not electrically serviceable. Static discharge on this item is also the source of some fine noise, but it can be beaten. My experience with this points to the fact that to be objectionable, it must be within 300 feet of your receiving location. There may be remote exceptions to this.

Remember, QRN hunting takes time. It must be done with a plan. It will involve notes on paper and on your map, sleepless nights, and hours of unrewarding search. Nevertheless, the rarest DX you have ever worked won't thrill you half as much as the day you nail your own QRN problem.

To date I have replaced two defective fluorescent fixtures, one bell transformer, fixed four poor grounds (one in my own guying system), bought and traded three heating pads for defective ones, fixed one arcing blanket control, bypassed one fish tank thermostat, taken down two rusted and corroded TV masts and guy wires, and furnished one indoor rabbit ears free to one of the owners.

I have been a ham for two years. The total expenditure to cure various QRN has been about fifty dollars, which adds up to about $2.00 a month. Very cheap indeed, for a hi-fi (translatable as "DX") fan.

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Step two is to make the calibration controls easily available without the bother of removing the case. Drill three holes, each a little more than ¼ inch in diameter, in the back of the case. Carefully align the drilling marks so that the holes will be in line with the calibration pots. Press a wide strip of adhesive plastic tape (white) into place below the three holes. With an instant-drying marker pen, label the access holes according to function.

Step three is to provide a calibration tool, and a place to store it. Purchase a short length of bakelight or plastic rod, ¼ inch in diameter. Such material is shown in all mail order catalogs. Using a file, dress one end of the rod until you have a screwdriver-shaped tool. Mount a regular fuse clip on the back of the instrument case, and slip the tool into place.

Step four is to provide escape from tangled line cords. Remove the instrument case and detach the line cord from the power supply. Drill and file a hole in the metal bracket that originally held the line cord grommet, and install a recessed male TV power connector. Using a portion of the old line cord, wire the TV connector leads to the power supply. Enlarge the power supply cord hole in the instrument case to provide clearance for the TV connector bolts, and reinstall the meter assembly in the case. Plug in a regular TV set cheater cord, and you have a convenient means for removing the power supply cord completely. This is especially handy when moving or storing the VTVM. . . . Bentley

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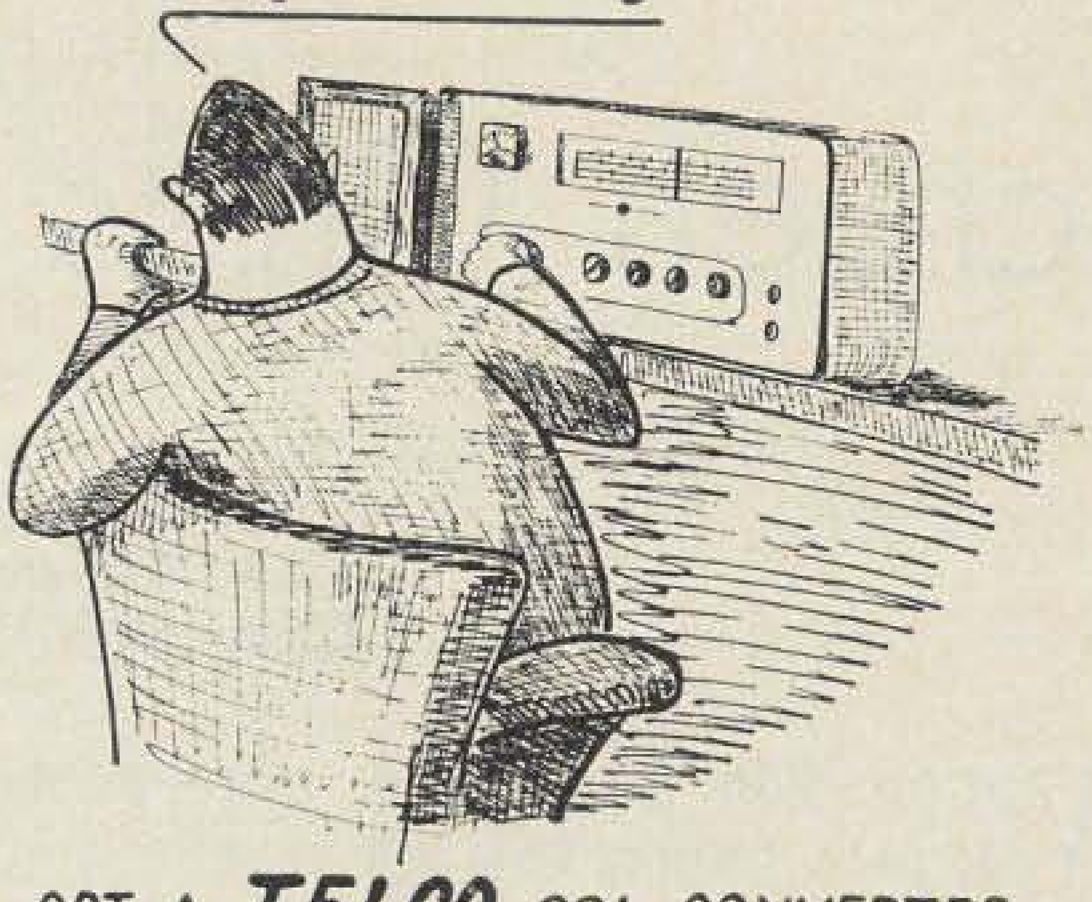

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Look at Fig. 1(a). Here R_s is the resistance of the screen itself (ratio of dc screen voltage to dc screen current), E is the no-load voltage of the screen supply, and R is the internal resistance of the screen supply. Where an ordinary series screen dropping resistor is used, E would be the plate-supply voltage and R the series resistor. Now let us cause the screen resistance R_s to vary (by changing amplifier loading, say) and see what happens to the screen dissipation P_s. The curve in Fig. 1(b) is a plot of screen dissipation versus screen resistance, with supply voltage and supply resistance held constant. It shows that the screen is hottest when the screen resistance is equal to the internal supply resistance. This result, of course, is predicted by the maximum power transfer theorem—we have "matched impedances." Notice that since the current through R and R_s is always the same, the voltage drops across them will be equal in the matched condition.

Suppose we have a single 807 in a class C plate-modulated final. Plate voltage is 600 volts, and the tube manual says to run the screen at 300 volts and 8 ma. A series screen dropping resistor will then have to drop 300 volts at 8 ma. A 37.5-kilohm resistor will do it. The screen is evidently "matched" to its supply (equal voltages on the screen and the series resistor). A change in tuning, drive or loading may change the screen resistance, but it can never increase screen dissipation because P_s is already at the peak of the curve in Fig. 1(b).

Now consider a stage using a single 6146, again class C plate-modulated. Plate supply is 600 volts, and the screen is supposed to draw 7.8 ma at 150 volts. A series resistor from the B— plus would have to drop 450 volts. The internal resistance R of the screen supply would be the dropping resistor, 450 v/7.8 ma = 57.75 K, whereas the screen resistance R_s is only 150 v/7.8 ma = 19.25 K. The screen would then operate well to the left of the peak of dissipation in Fig. 1(b), so any increase in screen resistance would make it heat up. There must be a better way.

We would like the screen supply to have a no-load voltage of twice the screen voltage, or 300 volts, and an internal resistance equal to the normal screen resistance of 19.25 kilohms. Then the screen dissipation will never rise above the operating value.

A properly-designed voltage divider across the 600-volt supply can do just that. To see how, we need another result from network theory—Thevenin's theorem, which states that any linear network, no matter how complicated, is equivalent to a regulated voltage source in series with an impedance. The voltage of this source ("Thevenin generator") is equal to the no-load voltage of the actual network. The series impedance ("Thevenin impedance") is the same as the impedance seen looking into the actual network terminals with all voltage sources short-circuited.

Let us apply Thevenin's theorem to the voltage divider in Fig. 2(a). It is a 2 to 1 divider, so the no-load voltage at the terminals is half of 600 volts. That is, the Thevenin generator is 300 volts. To find the Thevenin impedance, short-circuit the 600-volt supply and measure the impedance looking into the terminals. We see two 38.5 K resistors in parallel, or 19.25 K. The circuit of Fig. 2(a) is thus completely equivalent to the simpler circuit of Fig. 2(b) as far as any measurements at the terminals can tell. This then is the screen supply we

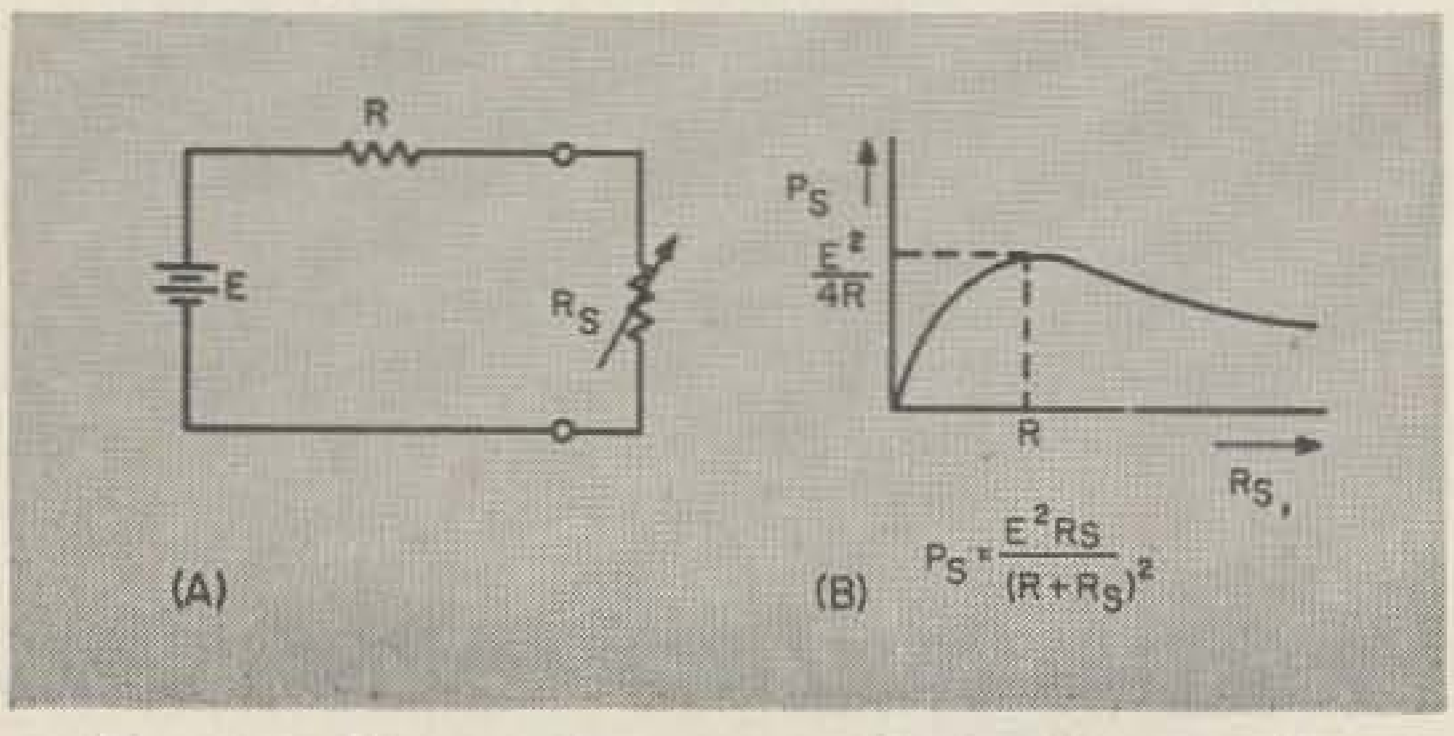

Fig. 1. Change in screen dissipation as the screen resistance varies.

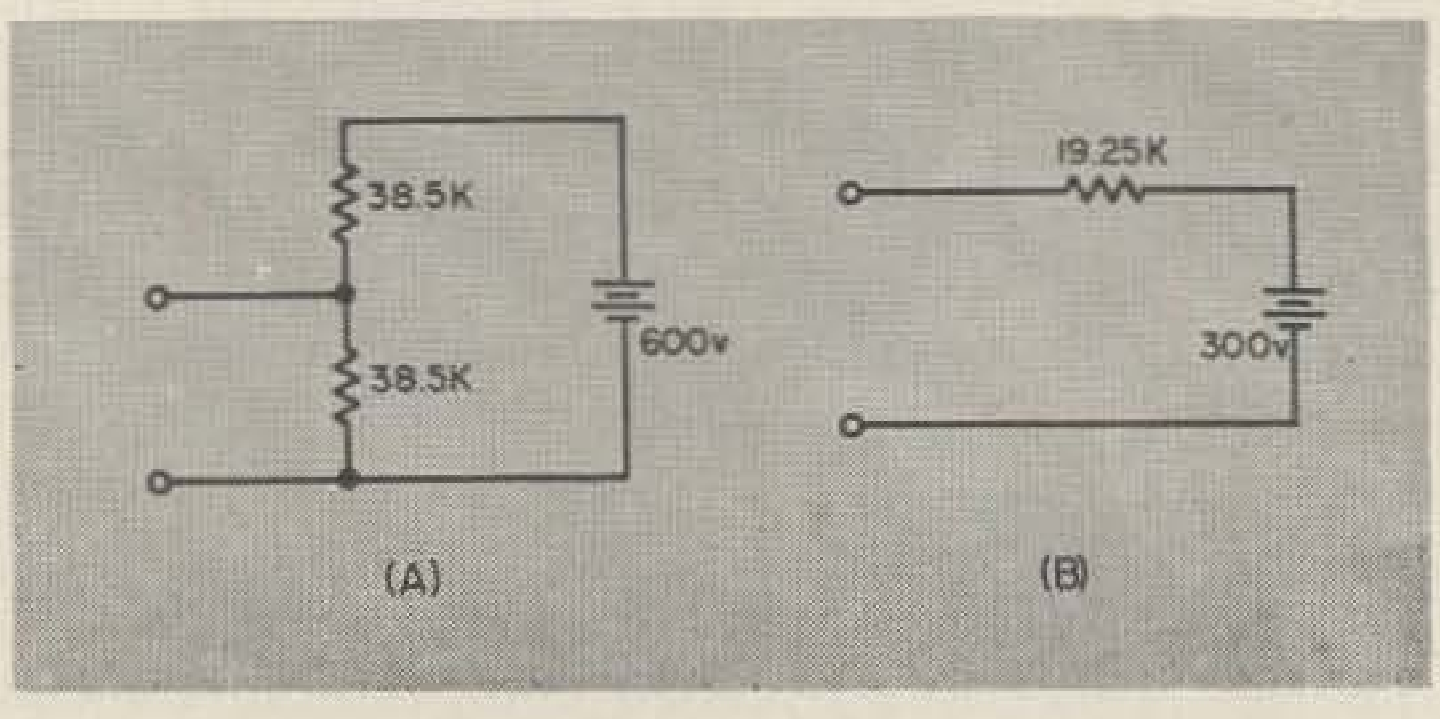

Fig. 2. A voltage divider and its Thevenin equivalent circuit.

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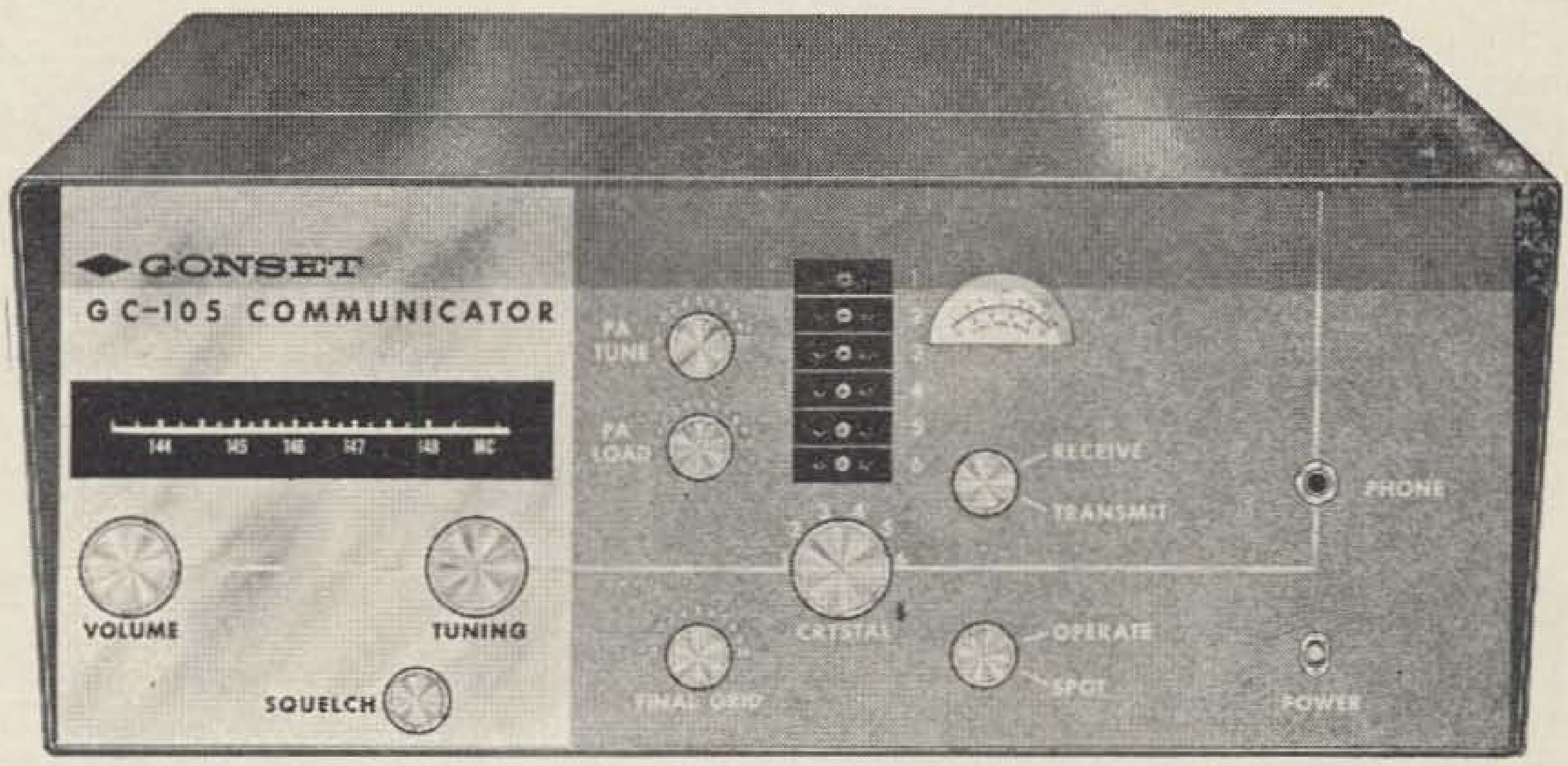

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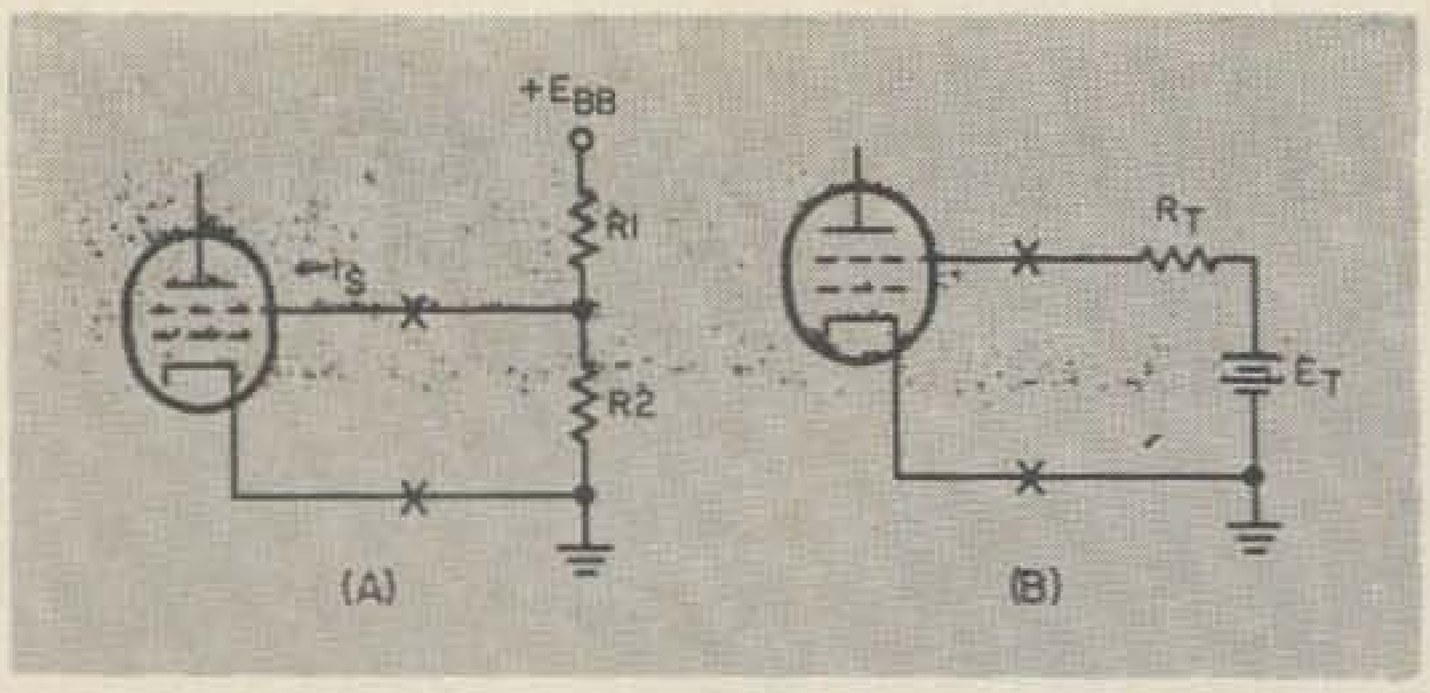

Fig. 3. Screen divider and its Thevenin equivalent, used in deriving equations (1) and (2).

were looking for to protect the 6146 screen.

In any amplifier where the desired screen voltage is less than half the plate voltage, a divider can be designed so the screen dissipation can never be increased by mistuning. We will now derive some simple formulas for the divider resistors. If you don't care to follow the algebra, just skip down to the results, equations (1) and (2) below.

Symbols used are these: E_{bb} is the plate supply voltage, E_s is the desired screen voltage, I_s is the normal screen current, R_1 and R_2 are the divider resistors shown in Fig. 3(a). Looking into the divider at points XX, we want the Thevenin generator to be twice the screen voltage. That is,

$$E_T = E_{bb} \frac{R_2}{R_1 + R_2} = 2\,E_s$$

We want the Thevenin impedance to equal the screen resistance, or

$$R_T = \frac{R_1\,R_2}{R_1 + R_2} = \frac{E_s}{I_s}$$

These two equations can be solved simultaneously for R_1 and R_2, with the result

$$R_1 = \frac{E_{bb}}{2\,I_s} \qquad (1)$$

$$R_2 = R_1 \frac{2\,E_s}{E_{bb} - 2\,E_s} \qquad (2)$$

A divider using these values for R_1 and R_2 makes it impossible for the screen dissipation to increase when the stage is misadjusted.

To show how the formulas are used, we will design the divider for the 6146. Here E_{bb} = 600 volts, E_s = 150 volts, I_s = 7.8 ma. Then

$$R_1 = \frac{600\text{ v}}{2 \times 7.8\text{ ma}} = 38.5\text{ K}$$

$$R_2 = 38.5\text{ K} \frac{300\text{ v}}{600\text{ v} - 300\text{ v}} = 38.5\text{ K}$$

With zero screen current, the divider output is 300 volts. When the screen draws its rated 7.8 ma, the voltage falls to 150, so 450 volts appears across R_1 and 150 volts across R_2. The power dissipated in R_1 is E^2/R, or $(450)^2/38{,}500 = 5.26$ watts. The power in R_2 is $(150)^2/38{,}500 = 0.585$ watts. In practice one would use a 39 K or 40 K 10-watt wirewound for R_1 and a 39 K 1-watt carbon for R_2.

The one disadvantage of using a divider instead of a simple series resistor is that a little more current is drawn from the plate supply. The total drain flows through R_1, and (in the case of the 6146) by Ohm's law this current is I = 450 volts/38.5 K = 11.7 ma, which is 3.9 ma more than the screen current alone. If the stage is plate-modulated, the modulator will have to supply 600 volts x 0.0117 amp = 7 watts to the screen circuit, instead of 600 x 0.0078 = 4.7 watts if a series resistor alone were used.

Adding one resistor is a small price for protecting your screens. Try it. . . . W9IHT

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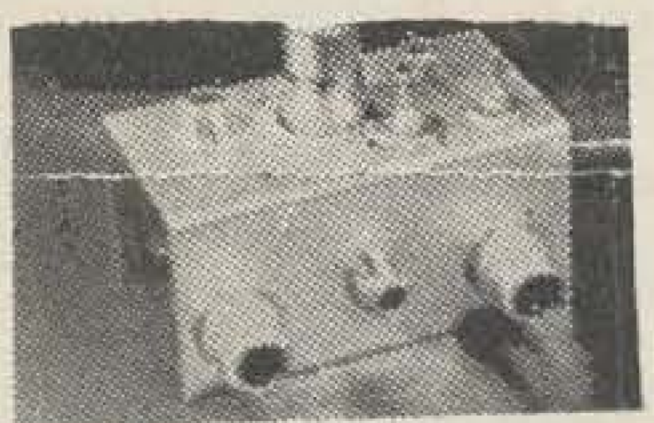

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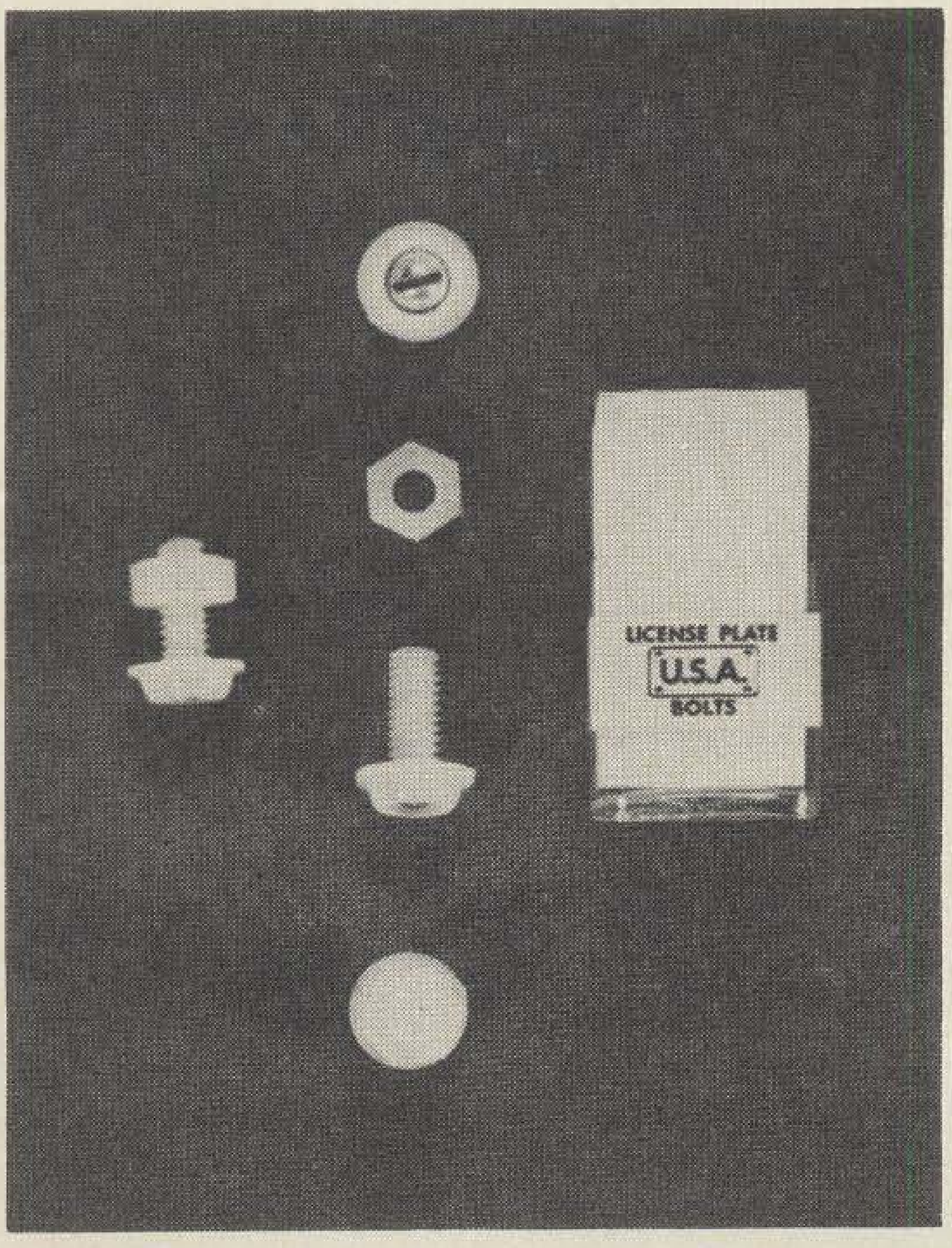
Nylon fasteners of various types have been used for critical electronic and corrosive environment applications for a number of years. However, most radio amateurs have been denied the many advantages of this hardware because of local non-availability. The screws and nuts shown in the photograph are now available through Sears and Roebuck retail stores as "Allstate" auto license plate bolts.

The screws are ⅝", ¼-20 thread, with a slotted head, metal insert. The screw style is similar to the conventional washer head type. The metal insert is molded into the screw body and only the head is exposed. The nut is molded nylon and of the conventional hex type. This low loss hardware is an ideal replacement for the usual extruded fiber washer and machine screw combination in such applications as fabrication of metal plate and film dielectric bypass capacitors and assembly of RF tank components. While the breakdown voltage rating of these fasteners has not been determined, the metal insert is centered in the screw and the low loss insulation appears good for several thousand volts. . . . Pafenberg

Photo: Morgan S. Gassman, Jr.



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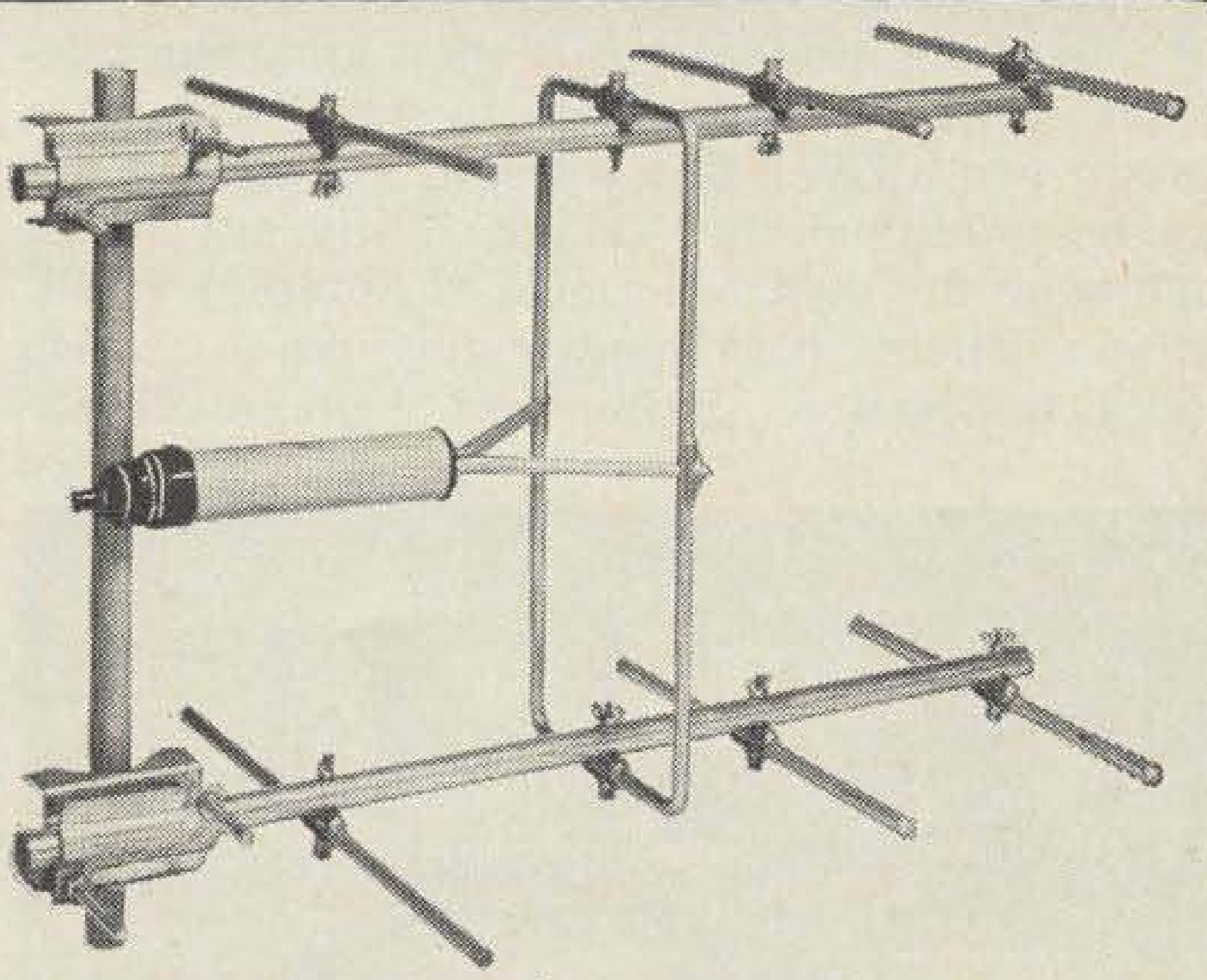

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Very Expensive! Too Complicated! Impractical!

ABSOLUTELY RIDICULOUS ! ! The time has long since passed when amateur television could be defined with statements like those given above! But why the change? What has been happening? After all, if one scans back over the past ten years of amateur publications, there is virtually no trend which would indicate a simple and economical approach to Ham TV. In fact, a few years ago if someone would have told you that you could construct a complete station for less than $50, you would have probably exclaimed, "Impossible!". The contrary is true today however, for this is not only possible, but quite practical!

Scenes like this are common in practically every appliance store throughout the country. These sets often can be obtained for practically nothing just to make room for more. This picture was snapped at Gibson Appliance, Sioux City, Iowa.

What then actually took place? Well first of all, circuits have been drastically simplified . . . they are no longer being confined to the complex and expensive techniques used by broadcasters. And secondly, but equally as important, has been the tremendous surplus of used TV receivers. These sets are presently flooding the backrooms of practically every service shop and appliance store throughout the country. So much so, in fact, that give-away prices of $5 or less are not at all uncommon. The availability of these receivers is just what ham TV enthusiasts have been waiting for; since these sets contain approximately 90% of all the parts required to construct a complete station!

Getting Started

However, this did not appear to be the complete answer, (even though it was a tremendous boost) for TV was still not progressing in proportion to the ever mounting interests

CALL.......... NAME.......................... ADDRESS....................................

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ADDITIONAL REMARKS: ....

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AMATEUR TV SURVEY QUESTIONNAIRE. Cut out and send to: 73 Magazine, 1379 East 15th St., Brooklyn 30, New York.

Typical "less than $50" TV station.

shown among thousands of amateurs.

Why the continuing lag? Apparently it had to be blamed on one remaining factor . . . lack of down-to-earth literature fully covering simple and straightforward circuits and at the same time providing sufficient background theory necessary to put the entire subject of Ham Television in its proper perspective.

After some serious thought, Wayne and I came up with the following answer. We decided that in order for Ham TV to finally get off the ground once and for all, what we really needed at the present time was a complete manual fully covering the basic principles of Ham TV along with easy-to-understand circuits which could be constructed almost entirely from parts salvaged from old TV sets . . . thereby keeping the cost of the entire project below $50. Such a station is shown in the photo.

Consequently, Wayne agreed that if I wrote the book, he would publish it. So for the next ten months all available time was spent either working over the typewriter or else in the darkroom tediously processing photos and illustrations. Well, it's a little over a year later now and the project has finally been completed. Wayne informs me that the manuals have recently come back from the printers and are ready to go. Incidentally, (ahem . . . short commercial!) for those of you who are interested in obtaining this book, further details along with a handy order blank can be easily located on page 72.

The TV Station

Lets once again refer back to the photo for a closer look at the typical "less than $50"

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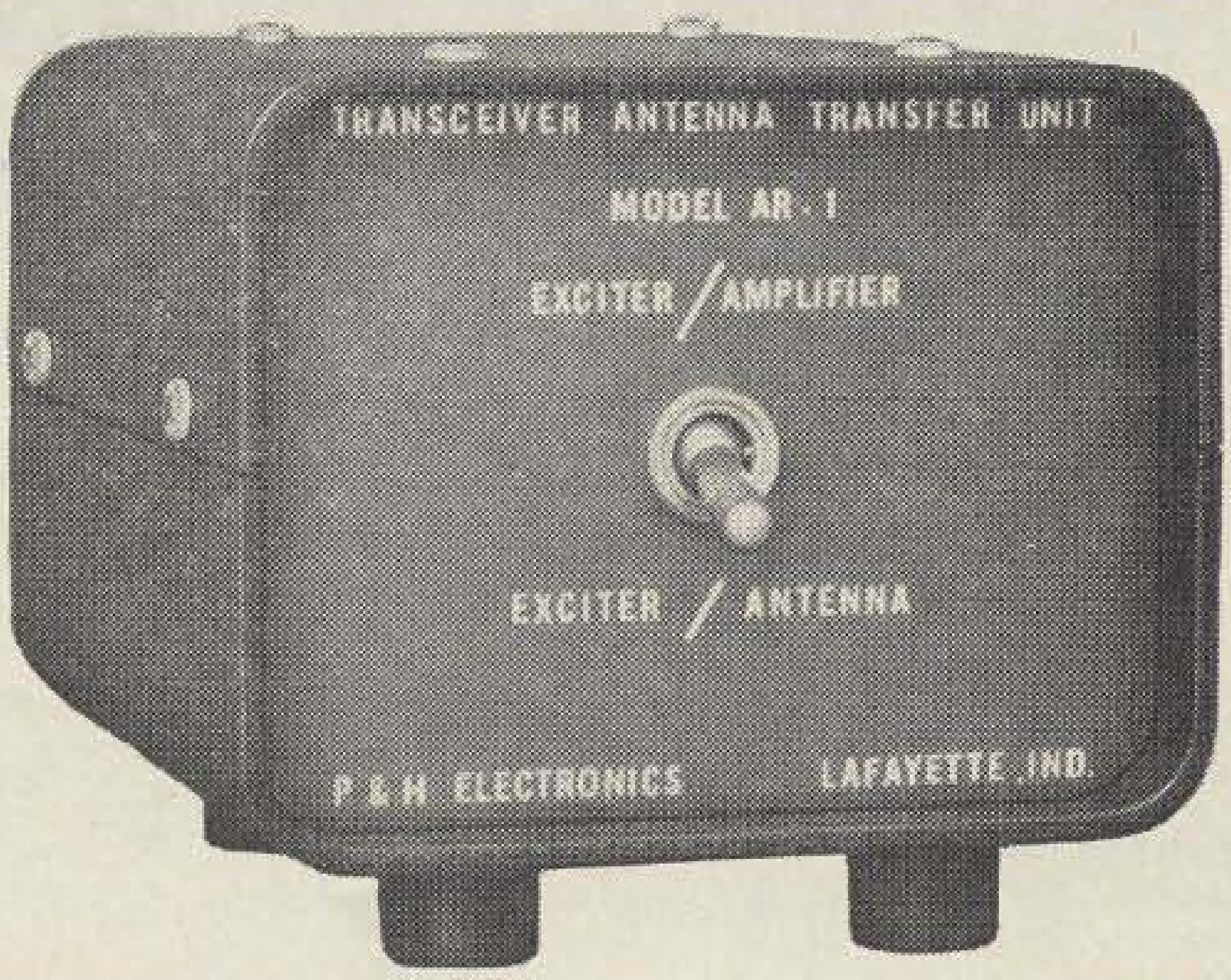

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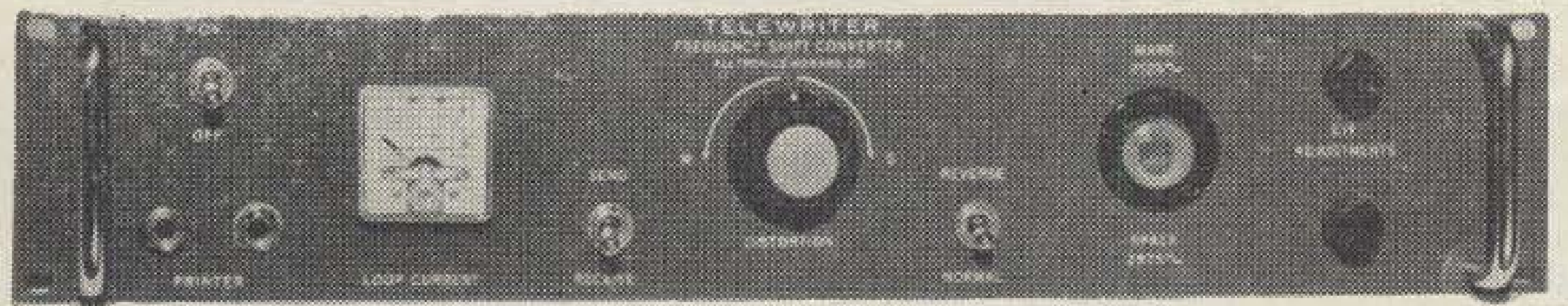

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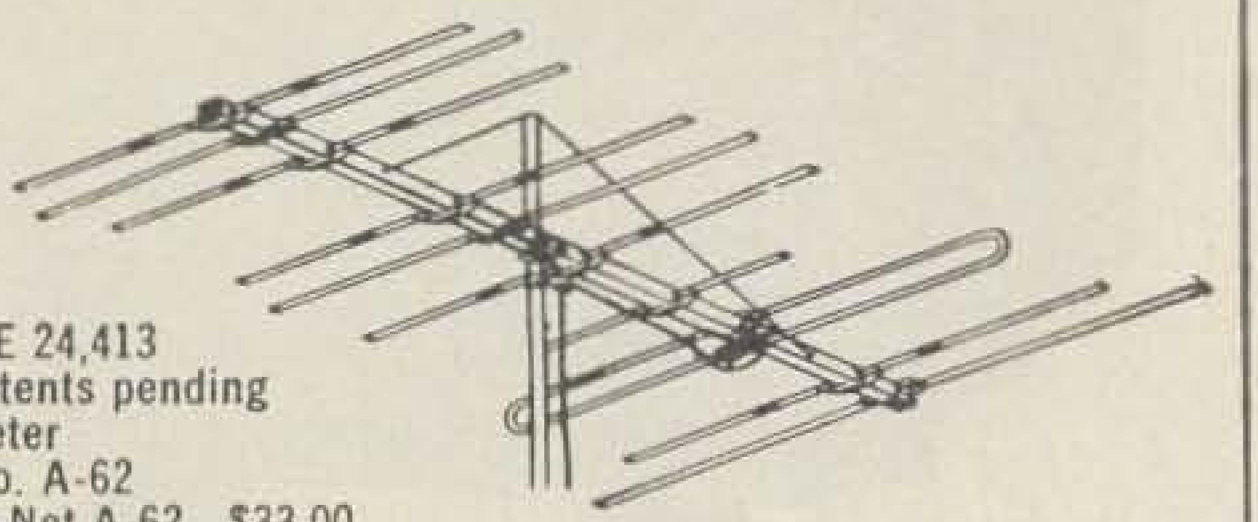

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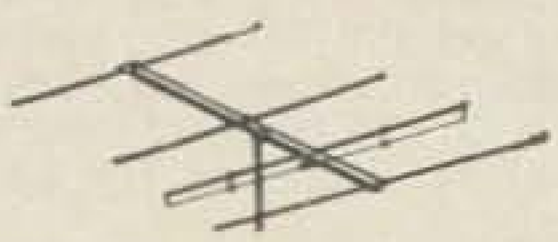

A6-4 6 Meter 4 Element
Amateur Net $17.16
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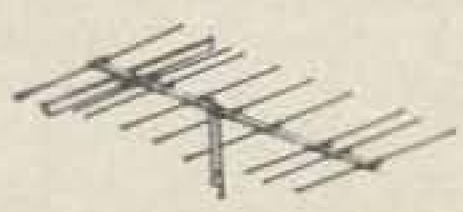

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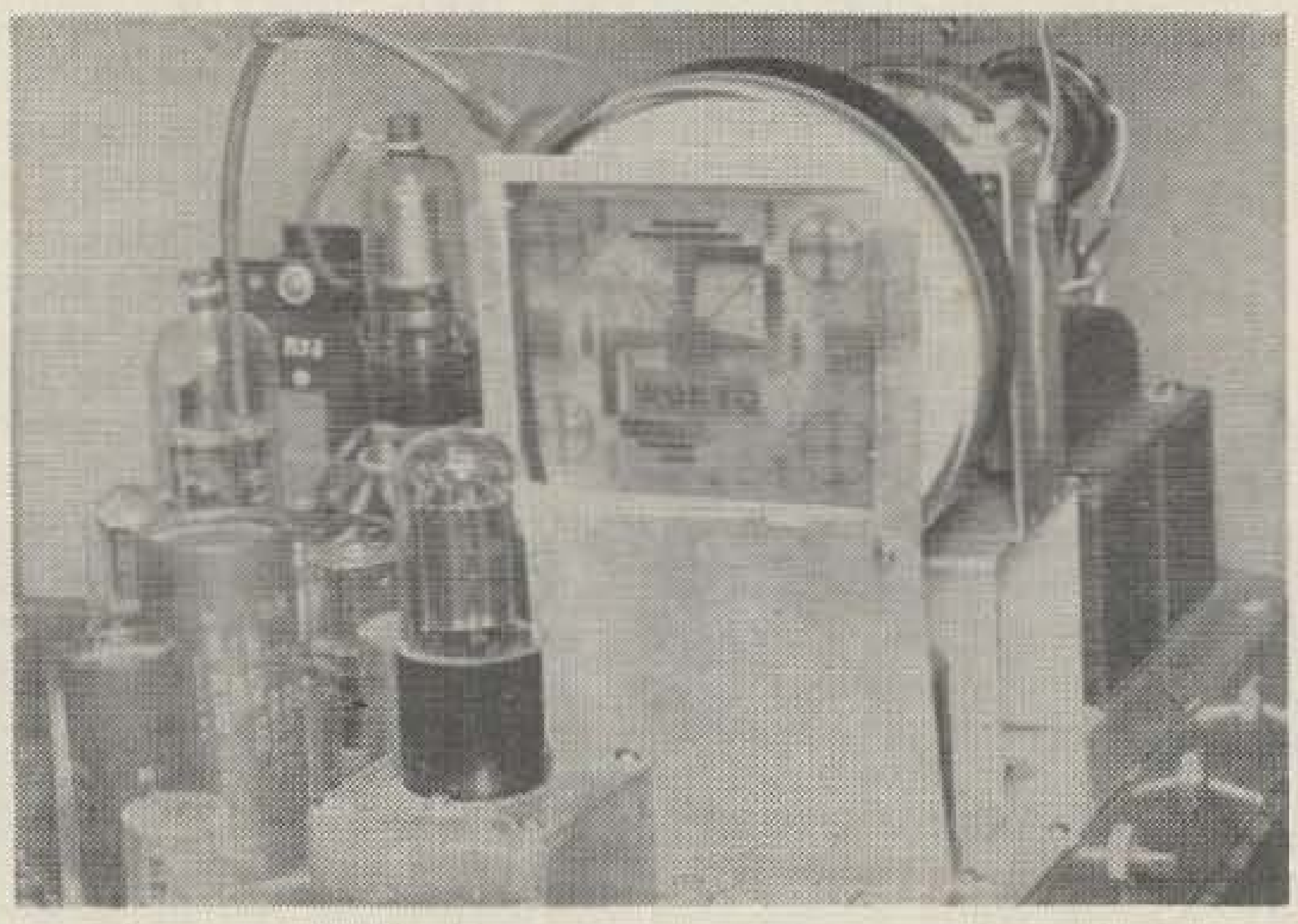
station mentioned above. It can be divided into basically three units: (1) a receiver fed by a 420 mc converter, (2) a camera and (3) a modulator-transmitter unit. The converter is shown setting on top of a conventional TV set. Its purpose being simply to convert the 420-450 mc signal down to an unused TV channel. The camera is shown in the center and is of the flying spot scanner variety. Its output is fed directly into the modulator-transmitter unit shown at the extreme right.

The flying spot camera, for the benefit of those of you who may not be familiar with it, is essentially a slide type camera being used mainly for transmitting negatives, transparencies and line drawings. It is undoubtedly the most economical and practical approach to Ham TV.

The scanner functions in the following manner: The scanning beam of a small cathode ray picture tube is made to scan out an unmodulated raster, very similar to the raster produced on an ordinary TV set when tuned to an unused channel. Next, a slide is placed against the face of this tube so that the scanning light beam must first pass through it before being detected by a sensitive photomultiplier tube located several inches away. In this manner, the intensity of the light beam, at any one instant, will be in direct proportion to the density of the slide at that point. Consequently, we have successfully separated the picture into light variations which can be converted by the photomultiplier tube into a conventional video signal. The only thing remaining is to further process this signal, mix it with the syncblanking pulses and feed it into the modulator-transmitter unit. This method completely does away with expensive and hard-to-obtain image converter tubes, such as the vidicon and iconoscope.

The usefulness of this camera is limited only by one's ingenuity. For instance, some amateurs are mainly interested in transmitting drawings of diagrams and other sketches. In these cases, they will often choose to use a relatively large cathode ray tube (10-12



Closeup of the image converting portion of the flying spot camera.

inch) for the scanning light source and in this manner are able to very conveniently apply the drawings directly to the surface of the tube with the aid of a grease pencil. Still others like to place the light source tube in the vertical position so that games, same as checkers and chess, can be played simply by placing a transparent playing board (made of plastic) directly on the surface of the tube. These are but two of many examples in which this versatile type camera can offer unlimited possibilities in addition to simply televising "slide-type" material.

Need for Organization

Once new hope can be put back into a project, it demands continual recharging so that there will be no tendency for it to once again go stale. One very important way in which this can be done is through periodic articles (written by a variety of TV amateurs) which will keep us informed of new and different circuit ideas.

In addition to this, we need to organize (at least partially) so that we can keep in better contact with fellows who are working on projects similar to our own.

And finally, we need to determine the approximate number of 73 readers who are interested in seeing more articles on Ham TV . . . this would be a great aid in determining the demand for such articles.

As a preliminary answer to these problems, a questionnaire has been prepared and can be located at the end of this article. If everyone will take a few minutes to fill this out and paste it on a postcard we will be able to draw more concrete conclusions as to the present status (as well as the future status) of Ham TV. If a sufficient number of questionnaires are returned to indicate definite trends, the results will appear in a later issue of 73 magazine. Even if you are not interested yourself, please direct the questionnaire to the attention of your TV friends. In this manner a more complete survey can be obtained.

Additional TV Allocations

The average amplitude modulated video signal is usually considered to contain sidebands extending as far out as 4-5 mc each side of carrier; this is tremendous when contrasted to the ±3 kc sidebands of an amplitude modulated audio signal.

As a result of this large bandpass, the FCC has confined Ham TV operation to the bands of 420-450 mc and above. This is unfortunate, for before the development of satisfactory UHF receiving techniques (such as very low noise rf amplifiers) the range over which satisfactory pictures could be transmitted was quite restricted; and as a matter of fact, even

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Television picture after passing through an amplifier system whose bandpass was limited to 1 mc.

today the range is limited to essentially local and medium range work.

But do we really need this much band width in order to transmit pictures of a quality sufficient for amateur purposes? This is a common question raised by many and was also present in a recent long distance phone conversation with Wayne . . . so in order to further substantiate our feelings, extensive tests were conducted. Initially, this simply consisted of feeding a conventional video signal through an amplifier whose band-pass was limited to approximately 1 mc. This, however, immediately proved completely impractical, since the upper frequency requirements are determined almost entirely by the horizontal scanning frequency, (presently 15,750 cps, or in other words, resulting in 262.5 horizontal scanning lines) this being far too high to yield anything but a poor picture.

Previous experiments conducted by a variety of amateurs indicated that the number of horizontal lines required for our purposes could often be as low as 100 lines. Therefore, the next step consisted of lowering both the camera and the receiver horizontal scanning frequencies to a point which gave us approximately 150 scanning lines. This was a very simple modification in both the camera and receiver, requiring only the addition of a resistor in the horizontal frequency circuit of the camera and nothing more than a minor adjustment on the receiver. The results of this test immediately showed promise. The quality of such a picture is shown in the photo.

For those of you who may be interested, the required bandpass of a TV signal can be easily determined by the following formula:

$$\text{BANDPASS} = \frac{H1^2V\ (1.33)}{2}$$

Where H_1 is the number of horizontal scanning lines, V is the vertical scanning frequency (standard is 60 cps) and the 1.33 is the aspect ratio . . . also being standard at 4:3.

For example lets assume that we desire 100 horizontal scanning lines and the vertical frequency is to remain at 60 cps. Then the required bandpass would be:

$$\text{BANDPASS} = \frac{(100)^2\ (60)\ (1.33)}{2}$$

$= 399{,}000$ cps or approximately .4 mc

But exactly where does all this lead to? It would appear that these tests indicate that television signals limited to a total bandpass of 1 mc are entirely practical for amateur communication purposes. Consequently, we would like to know if there is sufficient interest among TV enthusiasts to merit petitioning the FCC for 1 mc television transmission in the upper portions of 6 and 2 meters. If operation were allowed on these frequencies, it would probably be considered the biggest single boost since the beginning of Ham TV. Long distance transmissions would finally become a reality instead of simply a dream!

One limitation to 1 mc TV transmission, however, is that normal TV receiver audio systems would no longer function since they require audio carrier to be separated from the video carrier by 4.5 mc. This however, is not usually considered serious since the larger portion of amateurs prefer to use their regu-

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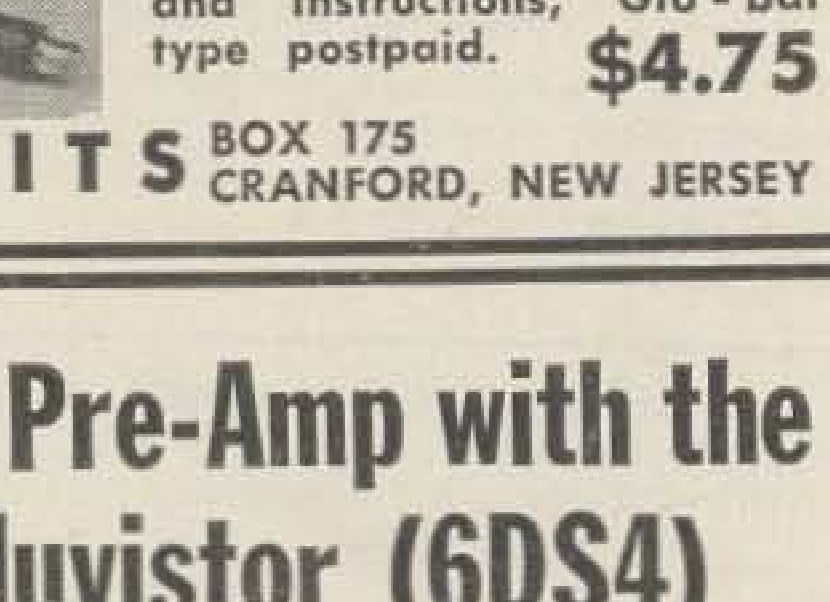

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lar radio telephone stations to handle the audio portion of the signal.

At this point, undoubtedly some of you may be wondering if this system wouldn't be in opposition to the ARRL petition for "slow-scan" TV in the 10 and 15 meter phone bands requiring a bandwidth no greater than a conventional audio signal. (Presently before the FCC.) On the contrary, our system can no more be compared to "slow-scan" TV than you could compare it to facsimile . . . for this is basically all "slow-scan" TV really amounts to; the only difference being is that it is an all electronic system in which the picture is displayed directly on a special long persistence type CR tube. This system not only requires a special picture tube, but, due to the very low scanning, also requires special deflection circuits; thereby eliminating the possibility of using conventional TV receivers.

"Slow-scan" TV also differs in another way . . . that is, it is absolutely confined to still type pictures . . . each picture requiring approximately 5-10 seconds to be transmitted. So as can be seen, the two systems are completely two different modes of communication.

This proposal would in no way be in opposition to either the "slow-scan" picture system or the present "wideband" TV system. Instead it will be a third system for transmitting pictures, using a conservative bandpass of 1 mc on bands that will make possible nationwide TV QSO's.

As in the past, the amateur bands have been designed to serve amateurs in the best possible manner. Therefore, in order to determine if there is sufficient merit to petition for this type of television transmission which would utilize the upper portions of the 6 and 2 meter bands, it is very important that the questionnaire be properly filled out and returned. This should be considered as a vote "for" or "against" the advancement of Ham Television. Please express your wishes!!

. . . WøKYQ

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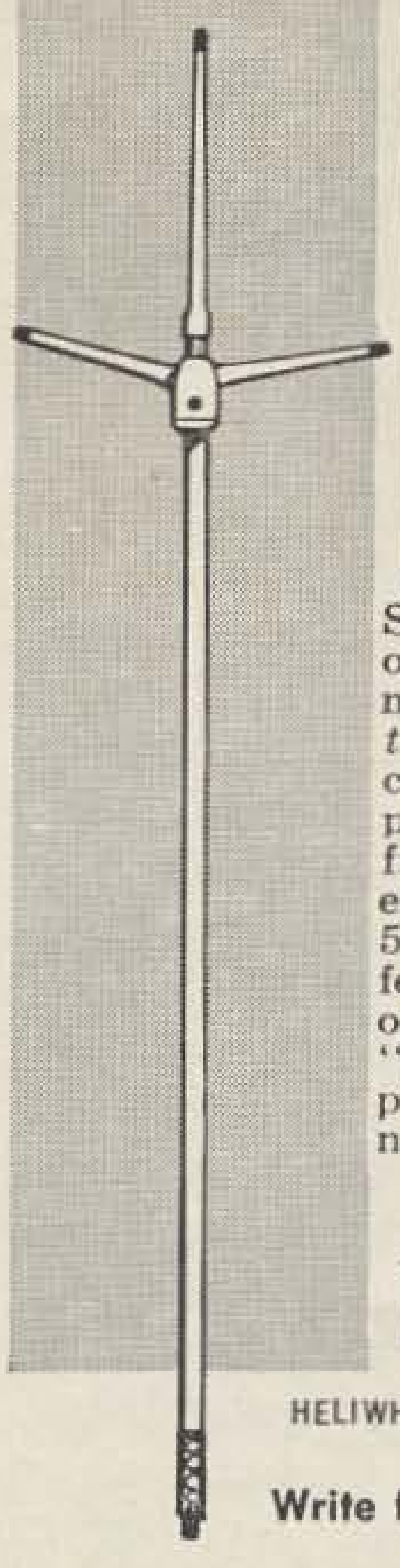

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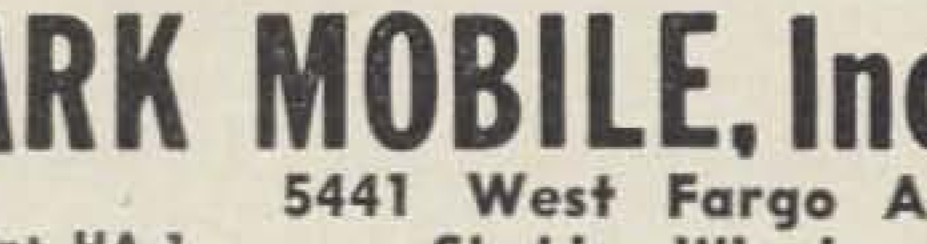

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At present many amateurs have an opportunity that may not repeat itself. I refer to the many army and navy surplus frequency meters now available, through MARS and surplus sales. Many of these meters have the original calibration chart missing, and are considered virtually useless. This is demonstrated graphically by prices, the frequency meters with charts costing $100, the meters without charts selling for one-third this amount. Meters without charts are worth more than this would seem to indicate. It is no great job to calibrate one of these meters, but it is time consuming. A little care is required, but you do not need to be a super technician or electronic engineer to do the job. Neither is elaborate equipment required.

Essential to the calibration are several items not commonly available around the shack, but easy to build. Figure 1 illustrates the first requirement. This is a 10 kc multivibrator, which will operate from a 100 kc xtal calibrator, and give 10 kc markers up to 20 mc. I am assuming here that you have or can beg, borrow, or steal a 100 kc calibrator, this being a common item. In fact, some receivers have them built in. Using this 10 kc marker source, the high band of the frequency meter can be calibrated. Interpolation to 1 kc points is then possible, and if care is used an accuracy of better than 0.005% will result.

Fig. 2 shows a simple beat detector that can be used with earphones to get an exact zero beat. It took about ten minutes to wire up a

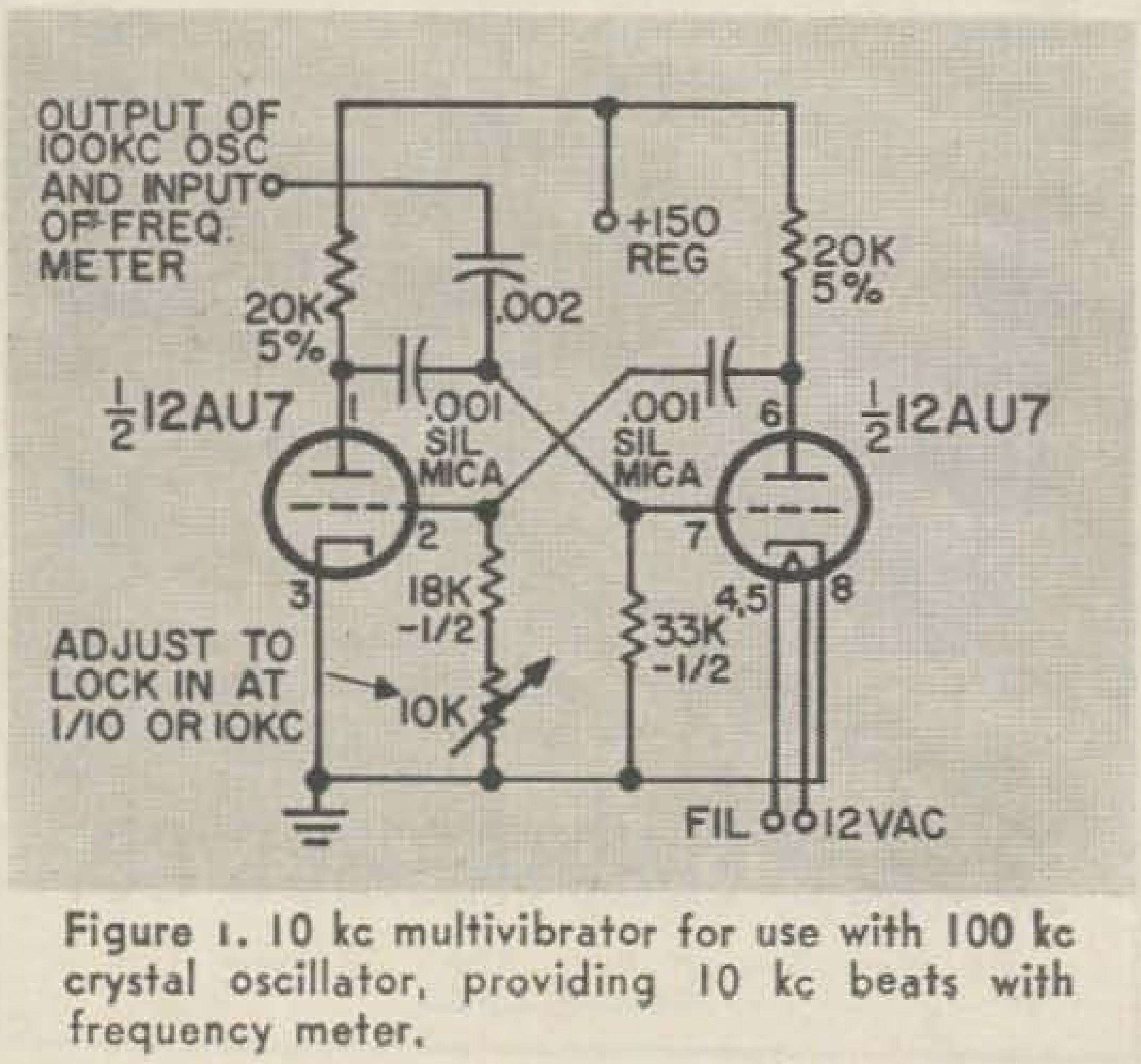

Figure 1. 10 kc multivibrator for use with 100 kc crystal oscillator, providing 10 kc beats with frequency meter.

1629 (army surplus magic eye tube) temporarily for this purpose, and it is certainly worth while in the interest of increased accuracy.

With your equipment assembled, connect the frequency meter to its power supply. Allow at least one hour for proper warm-up so that all equipment will stabilize, including the 100 kc calibrator and 10 kc multivibrator. Set the CALIBRATE control on the frequency meter to center, and be especially careful not to move it until the calibration is complete. After the warm-up period the 100 kc calibrator should be zeroed against WWV, at as high a frequency as possible. The 10 kc multivibrator

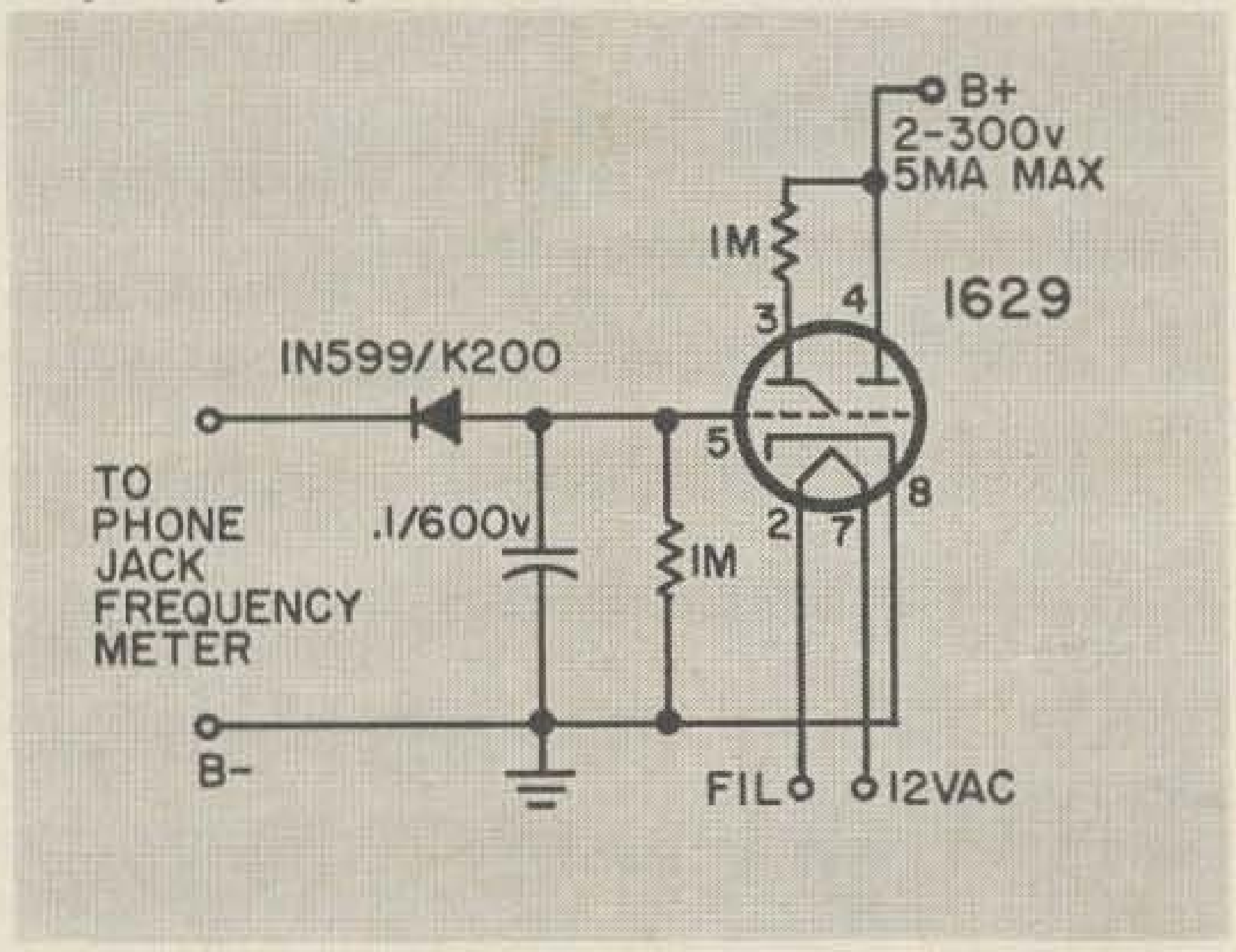

Figure 2. A simple zero-beat indicator for use in conjunction with headphones.

must be checked to see that it gives nine beats between each 100 kc beat. This can be done with your communications receiver, and it will be easiest to do it on as low a frequency as possible, say 600 to 700 kc. Now type several sheets of paper, listing the high range of your frequency meter by 10 kc points. If you are in doubt as to the range, check it with your receiver. To do this set the dial to the low end of its range, turn on the internal xtal, and zero in on the strongest beat at or near the low end. Turn off the internal xtal oscillator and find the signal from the frequency meter with your receiver. Note the frequency. Tune your receiver until you reach another harmonic from the frequency meter. The difference between the first and second readings is the frequency of the meter at the low end of its dial. Now do the same thing at the high end, and you have the primary coverage

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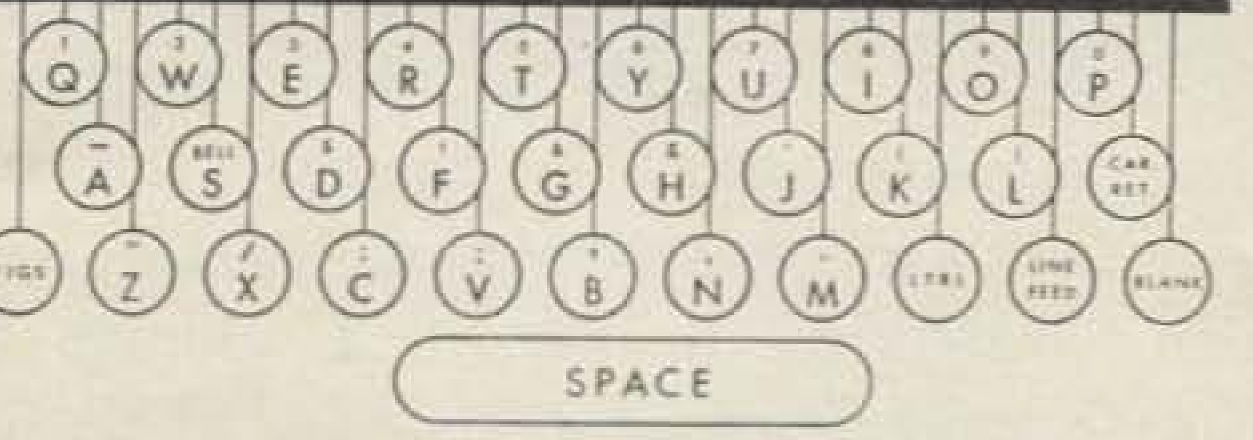

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of your frequency meter. Most have a range of 125 to 250 kc on the low band and 2 to 4 mc on the high band.

When you write up the frequency range by 10 kc points, leave a space between notations, since you will be adding information here later. Now, using the 100 kc xtal, check the high band of the frequency meter at 100 kc points, listing the dial readings. Now go back and check the dial at 10 kc points, listing all the dial readings. The checks should agree with the 100 kc checks at every tenth point. This is a handy method of cross checking yourself. You might note that on equipment of this type, always approach the final reading from below. If you pass the zero beat point, don't jockey the dial back and forth for zero beat. Go back below the beat by 5 kc or so and approach again from below. This procedure will help to eliminate error from dial backlash.

After your 10 kc points are all listed, interpolate to 1 kc points. This is the hardest part of the job, and is very time consuming. A big pot of coffee and a patient and loving XYL will be a big help here. The patient XYL can be replaced with an adding machine if you have one available, but you'll still need the coffee.

The difference between each 10 kc point must be listed. Note this in the space you left on your sheets. Each 1 kc will be 10% of this, so add 10% to the 10 kc listing for 11 kc, 10% more for 12 kc, 10% more for 13 kc, and so on. When you reach the next listed 10 kc point, the calculated listing and the measured listing must agree, another cross-check. This will take 2000 individual additions.

After the high band is finished, you may wish to calibrate the low band in the same fashion. Referring to Figure 1, change the grid-plate capacitors to 0.01 mfd. This will put the multivibrator at approximately 1 kc intervals. If you have trouble syncing the multivibrator, you may have to build another to operate at 10 kc, and sync the 1 kc from this. No trouble should be had with a strong output xtal calibrator, however. Calibrate the multivibrator as before, except with 1 kc intervals instead of 10 kc.

A calibration book can be prepared when you finish. It is a good idea to file all your original calculations and papers, should the book ever be destroyed. The frequency meter is now as good as any with original calibration book, at a good saving of money.

Sensible Attitude

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So you want to be a ham, or perhaps you already are one. It's a great hobby; really fun. But like any other interest that can take all you can give, and perhaps more, it must be approached with caution and appreciated in sensible doses. Don't get me wrong. I'm not hinting that ham radio has its faults. However, overindulgence and misdirected enthusiasm can cause enough trouble to make any avid fan lose interest. What do I mean? Well, listen to this unhappy story.

Bill Jones (I've changed the name to protect the innocent), after a year of what he thought was struggling along with only a 100 watt rig and an old receiver, decided that he wasn't going to be pushed into the QRM by those California kilowatts any longer. Since he couldn't beat them, he decided to join them. He talked his XYL into letting him put a cool 2500 bucks into what he convinced himself, and her, would be the best Ham station around. Out went the compact 100 watt rig and in went a shiny new "Voice of America" blaster. However, instead of taking up a small amount of space in his den, this new station filled the place up. The almost invisible antenna on the outside of his house was replaced by a too noticeable tower stuck in the middle of his backyard. Things were going great for Bill, but not so with his wife and the neighbors.

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with the 100 watter, now became a serious problem. Because the tower was so obvious, Bill was blamed for TVI even when he was off the air. To keep peace in the neighborhood, Bill restricted his activity to late evening. This didn't work out either because he had a job that required him to get up early in the morning. Soon, he found himself operating on weekends only. Within six months, Bill began to question the wisdom of his actions. And when his wife began to complain that she had sacrificed a new refrigerator, washing machine, and clothes dryer for that Ham gear that he hardly ever used, he was ready to throw the towel in. It didn't take long. Within a year after he had bought his new station, Bill was out of the ham business. He sold everything for the best price he could get; and that was that. Why did this happen? Maybe Bill should have stuck with the 100 watter.

Harry Smith, another unfortunate ham, had a different problem. He was continually redesigning his gear. As a result, his station was hardly ever in operation. He was either tinkering with the *if* stages of his receiver or "improving" the keying circuit in his transmitter. Theoretically, his approach to do-it-yourself hamming was admirable; however, he forgot that the prime purpose for being a ham is to be on the air.*

Harry Smith hasn't stopped being a ham; but the long periods of inactivity have caused him to forget the Morse Code. And when he goes on the air with voice, his contacts are always poor. Why? Well, he never settled on a decent modulator design, and his antenna coupling network is just a bit too haywire to put a sufficient amount of power into his antenna. In other words, Harry has never really had a workable station in operation; perhaps he never will.

What is it with some of us hams? What makes some of us turn away from the hobby that we worked so hard to become a part of? What causes a ham to write the kind of advertisement in the classified ham swap columns which reads, "Getting out of ham radio, will sell all my gear for $500.00, or will swap for camera equipment, or what have you?" I am not going to pretend to know the answers. I'm sure that each ham who is getting out of the "business" has his own good reasons. However, I have been able to analyze the reasons why some hams are losing interest. Most of the difficulties are caused by: lack of room in a new residence; too much money invested in seldom used ham gear; and, believe it or not, the inability to keep a workable sta-

*The author and the Editor are in disagreement here. Hon. Editor believes that the experimenter is doing far more to earn his keep than the rag chewer and that the continued availability of frequencies for hamming will in the final analysis be dependent upon the technical advances that hams develop.

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tion on the air.

Instead of discussing the above points in detail, for the sake of brevity, I would rather outline what I think is a sensible approach to the whole situation. First, get a small inexpensive CW or phone station on the air as soon as you can. After this is done don't make any extensive modifications to it. Any increase in power or mode of transmission should be done by building or buying additional gear. By doing this you will have a rig available which will work at any time. Second, don't go wild with extra gear purchases unless you're sure you can afford it. Third, put yourself on an operating schedule that will not conflict with your family's interests.

I've hinted at this small inexpensive workable station throughout this article. I can't overemphasize this point. For those hams who live in relatively cramped city quarters who like phone, get yourself a 2 meter rig. This set-up is inexpensive and activity is plentiful on a local basis. I prefer 40 meters for CW. I have a folded dipole antenna snaked about my attic that my neighbors can't see. My DX-35 and an old Hallicrafters Sky Buddy receiver with a Heath Q-multiplier complete my ever working station that never gets modified. TVI suppression is easy when you can concentrate on one band with relatively low power. I admit that I get very few super DX QSO's with this set-up, but I can get on the air in minutes confident that I'll make some fine contacts. I never have that guilty feeling that perhaps I've got too much dough tied up I can really relax and enjoy my hobby.

Getting on the air regularly is important if one is to maintain interest in ham radio. However, overindulgence, as in other things, can get you in trouble. What wife wants to be a ham widow? The important thing is to get on the air at least twice a week; and make at least one of these contacts on CW. I know some phone enthusiasts who have completely lost their "fists." I have heard some of them say, "I used to send and receive at 25 wpm, but I've spent so much time gabbing away that I can't copy code anymore."

Don't let this happen to you. Most of us have worked too hard to reach the required 13 wpm for our General license. It's a shame to let it all go down the drain.

For most of us ham radio is a hobby. And by definition a hobby is supposed to be a happy, enjoyable pursuit. And when our hobby ceases to be a pleasurable source of relaxation, we lose interest. You can prevent this loss of interest by always having a workable rig on hand; by not going too deeply in "hock" when you expand your station; and by following a reasonable operating schedule that doesn't foul up your home life. What I'm trying to say is, adopt a sensible attitude toward ham radio. . . . K2ENU

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(W2NSD from page 4)

Which Brings

Me to where I left off last month on page 75. . .the International Porsche-Treffen at Locarno Switzerland. Shortly after whipping over the San Bernardino Pass I found myself in Locarno. A little hunting uncovered my hotel where reservations had been made by the Porsche Club of America. Locarno is a small resort town overlooking Lake Maggiore and about ten miles from the Italian border. The one hundred cars of the PCA assembled the next morning in Lugano, a couple of miles away, and drove with banners flying in a convoy to the Treffen meeting.

There were reported to be over 1000 Porsches at the meeting! We counted over 800 on the huge field where we parked for the free lunch put on by Knorr (soup manufacturers). There were large contingents from the various Porsche clubs throughout Europe. I know of nothing else like this in the world. The license plates were from Norway, Sweden, Finland, England, Ireland, Belgium, Netherlands, Luxembourg, France, Germany, Austria, Italy, Spain, Switzerland, Monaco, Portugal, Denmark, and the U.S.A.

The events went on for two days, including a hill climb and a gymkhana. The Porsche factory rented three large sightseeing boats, loaded them with food, wine and bands, and we were all off for a cruise of the lake down into Italy and back. The final event was an ox-roast with about six oxen being roasted and several truckloads of wine to help wash it down. It was a wonderful affair.

One of the lads managed to spin his Porsche off the road and roll it over a few times. He wasn't hurt, but the car was a mess. I went right down to the garage and took a couple Polaroid shots to send back to K2QWO, just to worry him a bit about his car. I noted on the photos: "Ooops!!"

Locarno was so close to Varese Italy that it was only natural to buzz on down and stop in to see I1LOV. Somehow I managed to get talked into staying overnight there and operating his rig. Rig? No, rigs is closer. He had one each of everything made. His shack looked more like one of those setups at a worlds fair where they have room for ten people to operate simultaneously. I could describe Augusto's house, but you wouldn't believe it. Palatial.

The next day I drove back up into Switzerland and landed in Geneva by nightfall. George Jacobs W3ASK had made reservations at a nice inexpensive hotel right in the heart of things for me. George filled me in on what had happened so far. I signed in the next morning and got my credentials as an official member of the U.S. Delegation, which included a stack of papers about two feet high. This pile sorted down to a small handful that were concerned with the amateur allocations.

The decision by the Russians, at the opening of the Conference, to back up the U.S. position of making no changes in the short wave frequency allocations at this particular conference and holding all problems of allocations for a future conference a few years hence, had reduced the matters pertinent to ham radio to a few very minor points to be clarified. The Conference dragged on for over three months, but much of it was more vacation than work.

When the time came about three weeks later for me to return to Stuttgart for the return flight of the P.C.A., it was obvious that there really was nothing to be gained by staying around in Geneva. On the return I stopped at Mt. Blanc and made the trip up the tramway. It is awe inspiring to be dangling over several thousand feet of nothing like that. Don't miss this trip if you can help it. They don't believe in safety precautions like we do and there were only rough boards thrown over some scaffolding to walk around the top of the mountain, with lots of room to fall. No one fell though.

Once back in Stuttgart we turned our cars over to the Porsche factory with instructions for any modifications, accessories or repairs, boarded a bus and were soon on our way back to the U.S.

The trip made such an impression on me that I have been dreaming of making it again. Now that I'm married I'd like to show Virginia what Europe is like and what all the hams over there are like. We've signed up for the 1962 Porsche Treffen which will fly to Stuttgart on April 1 and come back on the 28th. The money for all this folly was donated by my Grandmother as a wedding gift. It had to come from somewhere outside for 73 still can't pay me a salary. Instead of buying one of those nice new 1962 Porsches we will ship my 1958 model over and have it waiting for us with a repaint job and some upholstering by the factory.

I'd like to meet club groups in as many cities as possible. Maybe you can put me in touch with fellows to contact along the way. The itinerary runs about as follows: Stuttgart (DJ1BZ), Heidelberg, Darmstadt, Weisbaden. Frankfort, Berlin, Hanover, Rotterdam, Amsterdam, Brussles, Paris, Geneva, Berne, Luzern, Zurich, Liechtenstein, Locarno, Varese, Milano, Genova, Fierenze, Venice, Trieste, Zagreb, Wein, Linz, Munchen, Stuttgart. Ambitious for four weeks, but that is all the time we have and we want to visit as many places as we can.

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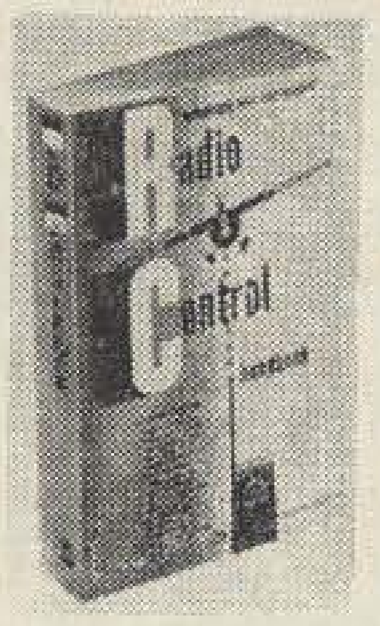

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Pole Pig Picking

W. S. Baker K2LZF
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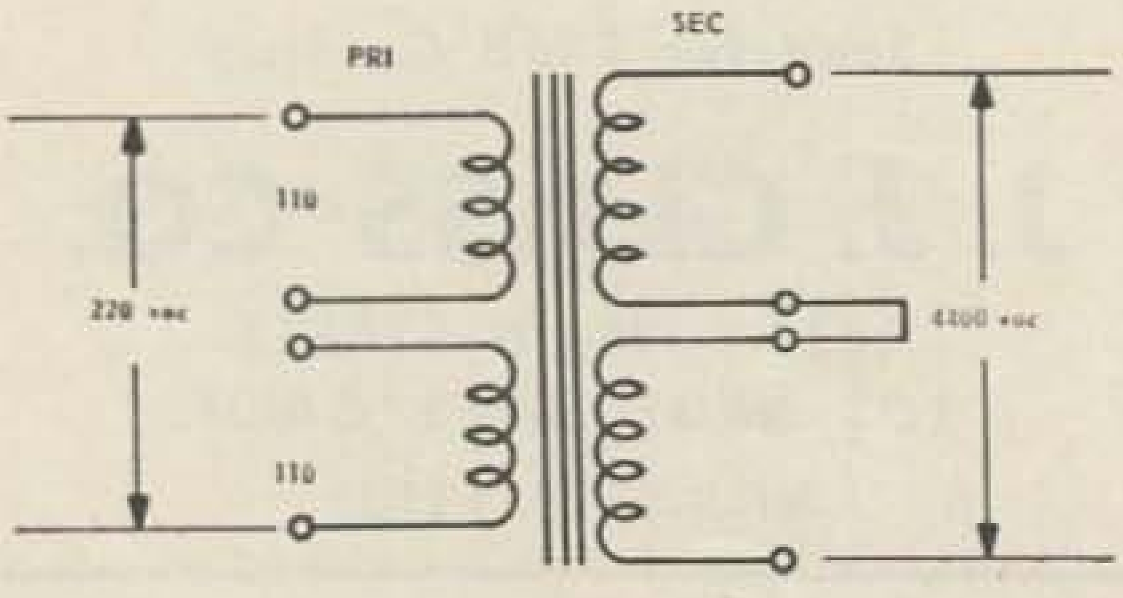
THE beast we are to consider here has a squat bulky appearance, stubby high voltage snouts, and weighs in like a razorback. Case, oil, and all it runs around one hundred pounds. Contact with this animal when it is excited is not recommended. This is the venerable pole pig transformer used by power companies.

Knowledgable amateurs have been using pole transformers for years in high voltage supplies, but there has been a lack of information which dealt with these cheap sources of B plus thoroughly. In this day of hypersil cores, improved steels, and general miniaturization of transformers, there are those who would assert that the pole pig is obsolete. Maybe so, but it still provides an economical way to high power.

There are two ways to obtain these transformers. Since few power companies are installing new pole transformers with less than a ten k.v.a. rating, the 1½, 3, and 5 k.v.a. models are obsolescent and are gradually being replaced. Method one is to have a friend in the power company who can watch for one of these transformers when they are being replaced. If you can't scrounge one this way, the second method is to meet them at the junk yard. The pigs are seldom shuttled off for use elsewhere, more often they are sold to junkies who burn them to free the laminations from the valuable copper. The latter method has been the most fruitful one used in these woods. Consider that there are several hundred old transformers at the local junk emporium —most of them bad. How to tell a good pig from a bad one?



You are presented with a morass of transformers, some good, some burned out, and of several different ratings. The ratings are marked on the cases: 1½, 3, 5, 10, etc. k.v.a. The 1½ k.v.a. models are rarely found with high voltage center taps, ordinarily they put out 2200 v.a.c. from leg to leg. Even if you used one of these models by bridge rectifying, the regulation would be poor. If you can find only 1½ k.v.a. models, get two, and run the secondaries in series for 2200-0-2200 v.a.c. The 3 or 5 k.a.v. sizes are the ones to look for. They provide a neat, one package, way to go. Pigs larger than 5 k.v.a. have high exciting currents and are difficult to turn on. Besides, they are unnecessarily bulky. Disregard any "bad" markings on the cases, they are frequently misleading. It is a good idea to add your own marking so that when you come back to get another pig, you will not duplicate earlier efforts.

To select a good pig you are going to call into use all your senses. Open the top cover and look in. In a good unit the oil should be reasonably clear. There should not be evidence that the oil has boiled away leaving a charred residue. There will be a rancid, burned out smell and the core will be blackened in a bad pig. The visual definition of good or bad is usually quite clear.

Assuming that you have found a transformer which merits further investigation, look to the electrical characteristics. The high voltage side is supported in ceramic and the low voltage side has leads running directly to feedthrough terminals from the core. Also, the low voltage leads appear to have high current carrying ability. If there are four terminals on the high voltage side, you have a pig that is 4400 volts center-tapped, or 2200-0-2200 vac. The center tap is made by joining the two center terminals. If there is no center tap, only two terminals on the secondary, you would have to bridge rectify the transformer to use it. If the unit is one you can use, begin checking with your trusty VOM which you have brought. There should be no shorts from primary to case, secondary to case, or between windings. The primary should be continuous and show very low resistance. The secondary resistance reading should show the effect of Lenz's Law for inductance, the VOM reading will ooze on due to the high inductance present. The reading should finally rest at 50 to 70 ohms. There is enough inductive energy storage here to see a good sized spark upon discharge. If the pig passes these tests, you are ready to pay for it and take it home. Leave the case and oil behind if you don't want to carry them, they are unnecessary. Contrary to the belief held by some, the oil plays no part in the insulation of the transformer, it is coolant only. At the ratings you will be running the pig, you will not miss the oil. In several years of supplying a kw with associated bleeders and modulator, I have never even taken the chill off the iron in the beast. With its low secondary impedance, this transformer makes an excellent high voltage source. You will probably pay $2 to $3 per K.V.A., and since the junkies are interested in the copper only, they usually allow the return of any transformers which turn out bad at home. In several years of pig picking, the author has had a hand in locating approximately a dozen transformers. Only one was found to be bad after it was taken from the yard, and this was when one of the aforementioned rules was ignored.

Both primary and secondary are split into two separate windings. The low voltage side, or "primary" as we use it here, should be paralleled for 110 vac operation or seriesed for 220 vac operation. Both connections can give the full secondary voltage, but the 110 volt connection is not advised for high power work. The doubled line current in 110 operation as against 220 operation does not help the regulation of the supply. Proper high power practice dictates the use of 220 volt input. Needless to say, you cannot put 220 volts on the 110 connection for twice the secondary voltage. This would over-excite the primary, and certainly burn up the transformer. Also, the phasing of the input leads must be proper. If the phasing is out, there will be zero voltage developed in the secondary. A safe way to check phasing is to excite the primary with a low value of ac such as could be gotten from a filament transformer. Then check to see if there is voltage in the secondary; if not, reverse the primary leads, and the voltage should appear. Remember this connection for when you install the full line voltage. Remember always that the device you are working with is lethal! You do not have a second chance.

With 220 volt input, a full wave rectifier, and a normal, low resistance filter, the output voltage should be just under 2100 vdc from a supply using a pole pig. A variac running on the 15% over setting will increase the output to almost 2400 vdc. These transformers can be used in many ways. Put 110 vac on the 220 vac connection and use the 1000 volts so derived for the exciter supply. Research here shows that the secondary could even be used as a swinging choke, the value ranging from 9 hy to 3 hy over the current range from .1 amp to 1 amp. One user has gone so far as to employ two pigs back to back to form a kw modulation transformer. The purists may scream, but only one person in ten could tell that the audio system had been changed from a standard modulation transformer, and his comment was that the low frequency response appeared to be better than it had been!

. . . K2LZF

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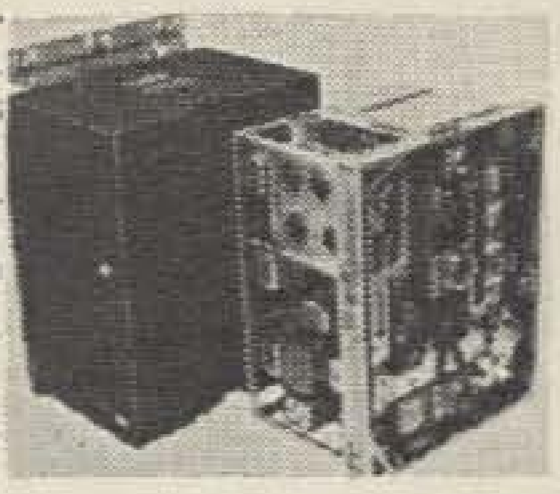

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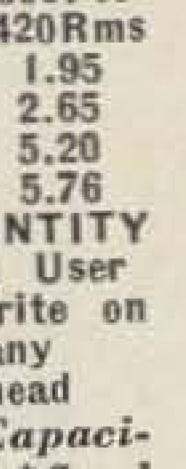

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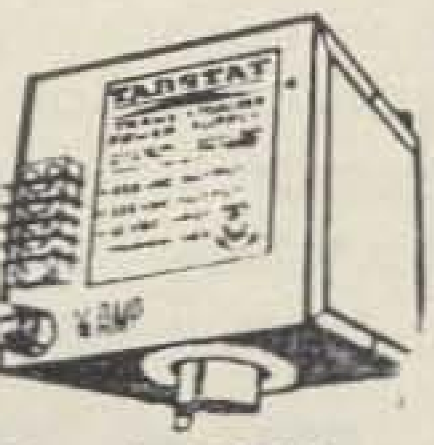

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Operation Up to 125°C Case Temp.

D.C. Amps	300Piv 35Rms	400Piv 70Rms	500Piv 105Rms	600Piv 140Rms
2	.25	.35	.45	.55
3	.60	.85	1.00	1.25
6	.70	1.00	1.25	1.50
12	.85	1.20	1.50	1.70
35	1.80	2.15	2.50	2.90
70	3.75	4.50	4.95	5.60
240	4.80	5.70	6.90	8.40

D.C. Amps	350Piv 210Rms	400Piv 280Rms	500Piv 350Rms	600Piv 420Rms
2	.80	1.00	1.50	1.95
3	1.50	1.80	2.10	2.65
6	1.75	2.00	3.70	5.20
12	2.00	2.20	3.90	5.76
35	4.95	6.10	FOR QUANTITY	
70	10.80	15.30	Export & User	
240	19.60	29.75	Prices. Write on Company Letterhead	

**Derate 20% for Battery or Capacitive Load or D.C. Blocking! *Stud mounted on Heat-sink.*

NEW BATTERY CHARGER BC612X

For 6 or 12 Volt Batteries Trickle & Full Charge up to 10 amps Charges 6 & 12 volt batteries.
Built ready to use
BC612X @ $14.00
BC612B up to 2 amps.$7.45

TWO 866A's and FILAMENT XFMR 10 Kv Insltd SPECIAL **$6**

"VARIAC®" Type Variable Transformer "SUPERIOR" Powerstat Type 10. 165 Watt 0 to 132V Special $6 each: 2 for $10

General Purpose — PNP — Computer Grade
Use as Amplifier—Oscillator—HiFi, RF, IF
Logic—Servoamp—Power Supply
Pulse Amplifier or High Current Sw
Vcb, Vce, Veb Approx. 40V
CP 3C rated 300 Mw. 50 ea.; 10 for $4
CP 10C rate one watt. 75 ea.; 10 for $6

B&W
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- 5100 B Transmitter.......... 269.00
- 51SB-B SSB Generator...... 99.00

Central Electronics
- Model "B" Slicer............ 49.00
- GC-1 Gated Compression Amp........ 39.00

Collins
- 75S-1 Receiver.............. 425.00
- 75A-2 Receiver.............. 299.00
- 32V-2 Transmitter........... 249.00
- 312B-4 Console............. 140.00
- 312B-3 Speaker............. 25.00

Drake
- 2-A Receiver................ 229.00

Eico
- 720 Transmitter............. 79.00
- 730 Modulator............... 42.50
- 730 Mod. with cover......... 49.00

Elmac
- AF-68 Transciter............ 154.50
- PMR-7 Receiver............. 109.00

Geloso
- G212TR Transmitter (built-in VFO)............. 149.00

Globe
- DSB-100 Transmitter........ 89.00
- King (old model w/V70D's. 149.00
- King 500A.................. 315.00
- Champ 300 Transmitter...... 219.00

Gonset
- G-43 Receiver............... 99.00
- Communicator IV 2 Meter 299.00
- G-76 All Band Transceiver w/AC Supply 425.00
- G-76 Transceiver only........ $325.00
- G-28 10 Meter Transceiver... 169.00
- GSB-101 Linear Amplifier.... 225.00

Hallicrafters
- HT-18 VFO (w/NBFM Mod.). 29.00
- HT-31 Linear Amplifier...... 149.00
- HT-32 SSB Exciter.......... 399.00
- HT-32A SSB Exciter......... 449.00
- HT-33 Linear Amplifier...... 299.00
- HT-40 Transmitter.......... 75.00
- S-40B Receiver.............. 59.00
- SX-62A Receiver............ 199.00
- SX-71 Receiver............. 139.00
- S-85 Receiver............... 79.00
- SX-99 Receiver.............. 114.00
- S-107 Receiver.............. 74.50
- SX-101A Receiver........... 299.00
- S-108 Receiver.............. 108.00

Hammarlund
- HQ-100 Receiver............ 129.00
- HQ-110C Receiver.......... 189.00
- HQ-140X Receiver.......... 159.00
- HQ-150 Receiver............ 199.00

Harvey-Wells
- APS-90 AC Supply.......... 39.00

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- Apache Transmitter......... 229.00
- VF-1 VFO.................. 15.00
- DX-35 Transmitter.......... 35.00
- DX-40 Transmitter.......... 48.00
- DX-100 Transmitter......... 159.00
- SB-10 SSB Adapter......... 79.00

Johnson
- Navigator Transmitter....... 149.00
- Valiant Transmitter......... 299.00
- Viking II Transmitter........ 159.00
- Viking "500" Transmitter.... $449.00
- KW Matchbox.............. 99.00

Knight
- T-50 Transmitter............ 29.00
- R-55 Receiver................ 67.00
- V-44 VFO................... 19.95
- C-11 CB Transceiver........ 25.00

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- Phasemaster IIA SSB Exciter Brand new; closeout price. 229.50
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Lincoln
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- MBR-5 Receiver............. 75.00
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- NC-109 Receiver............ 119.00
- NC-183D Receiver.......... 195.00
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- NC-66 3-Way Portable Receiver.................. 49.00
- HRO-50T Receiver.......... 229.00

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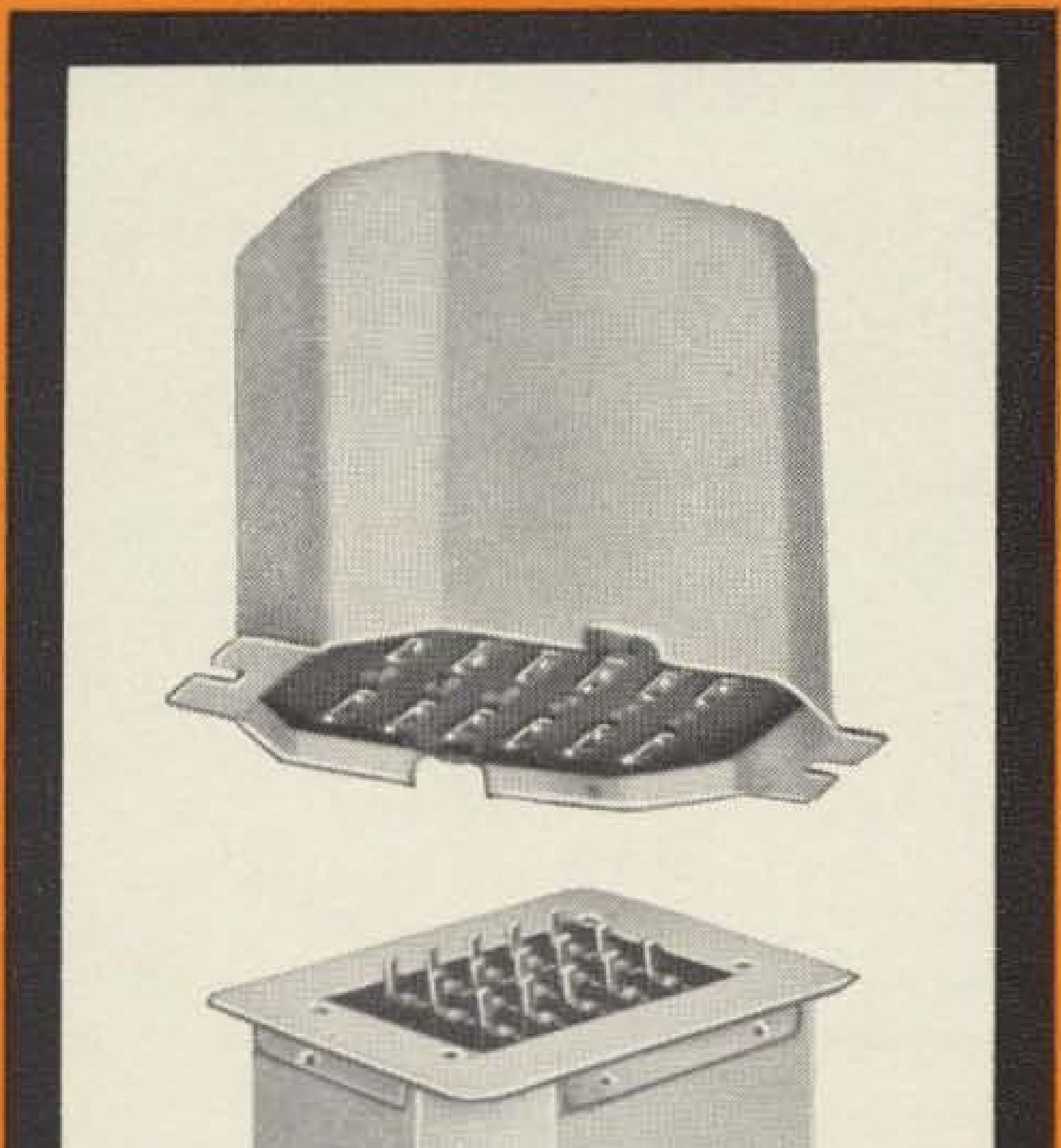

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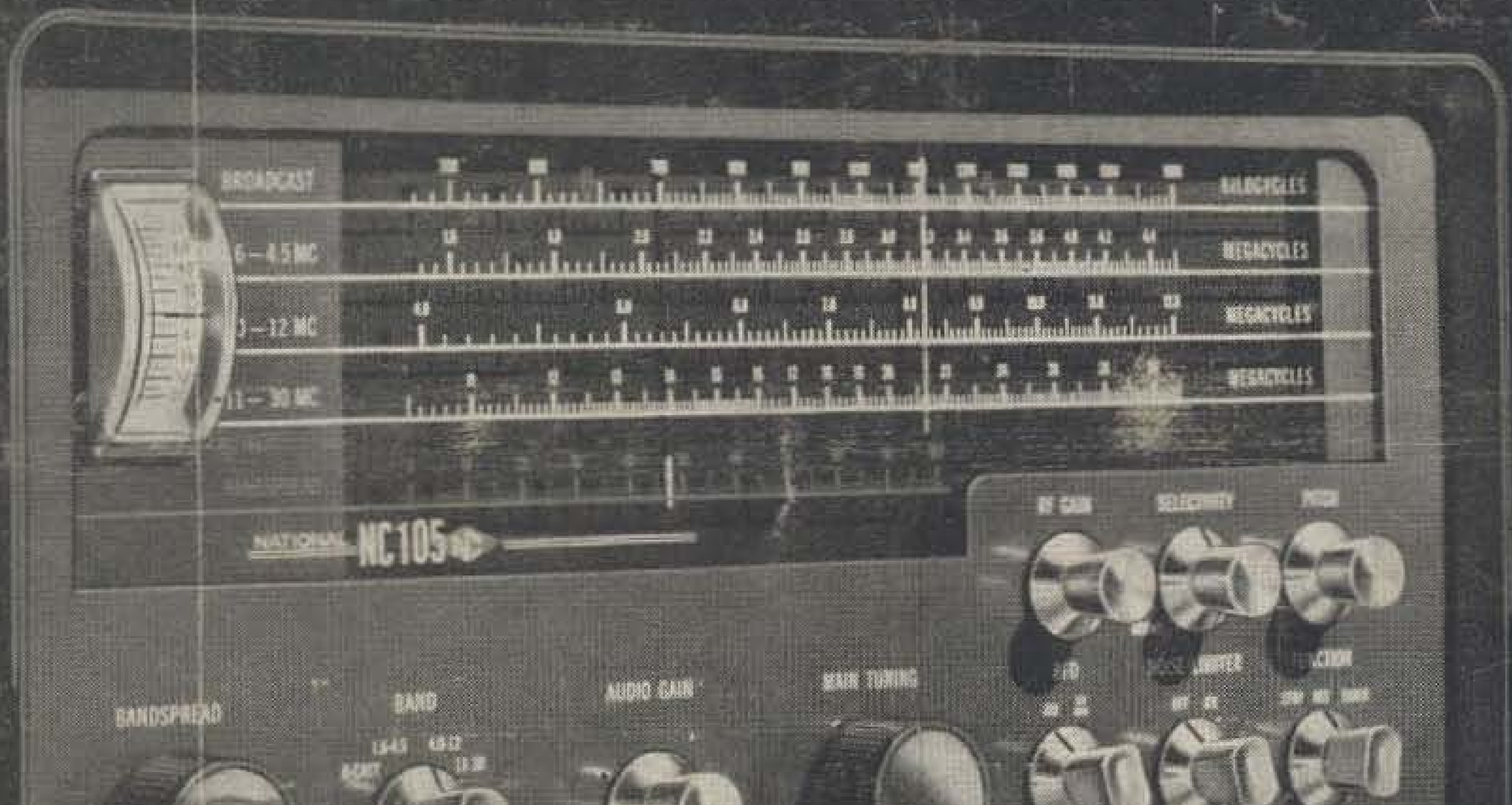

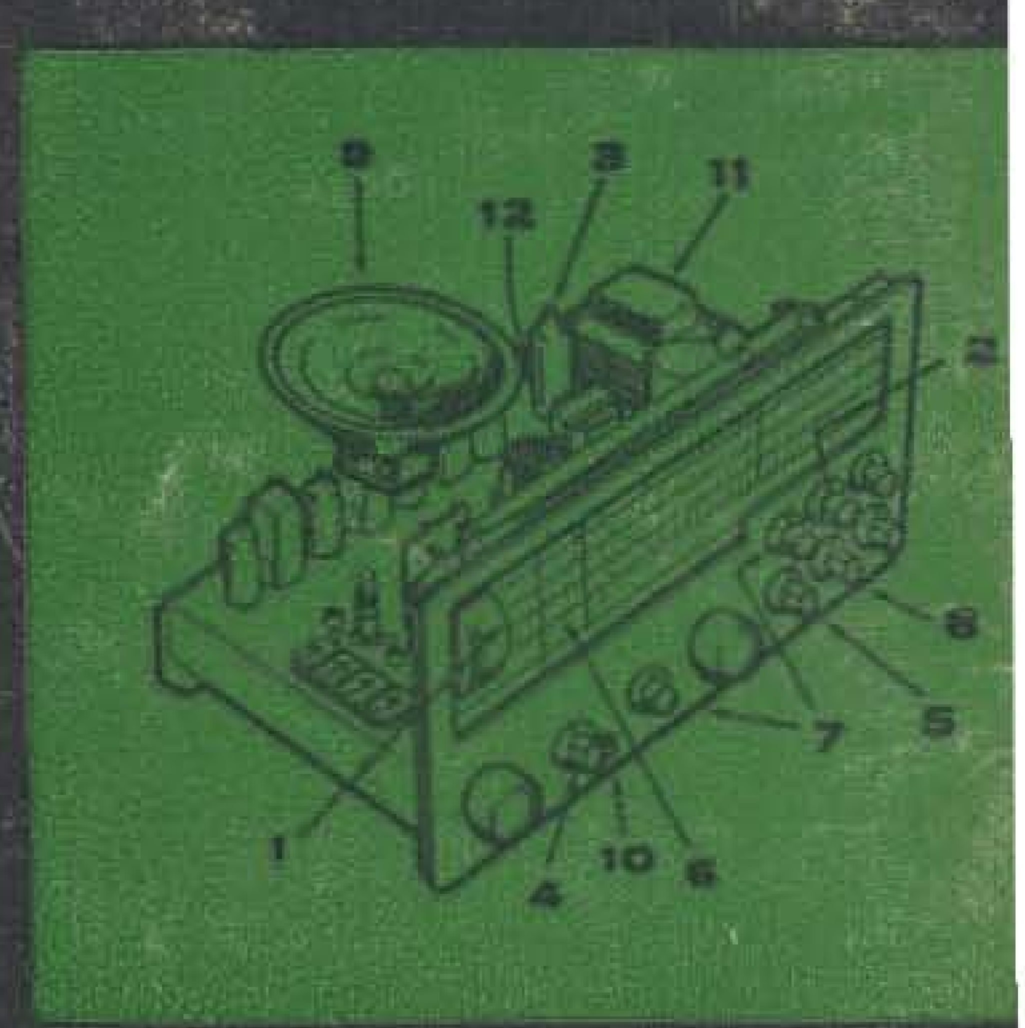

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2 Exclusive National peaking Q multiplier works on CW as well as AM
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