November 1963
$1.00

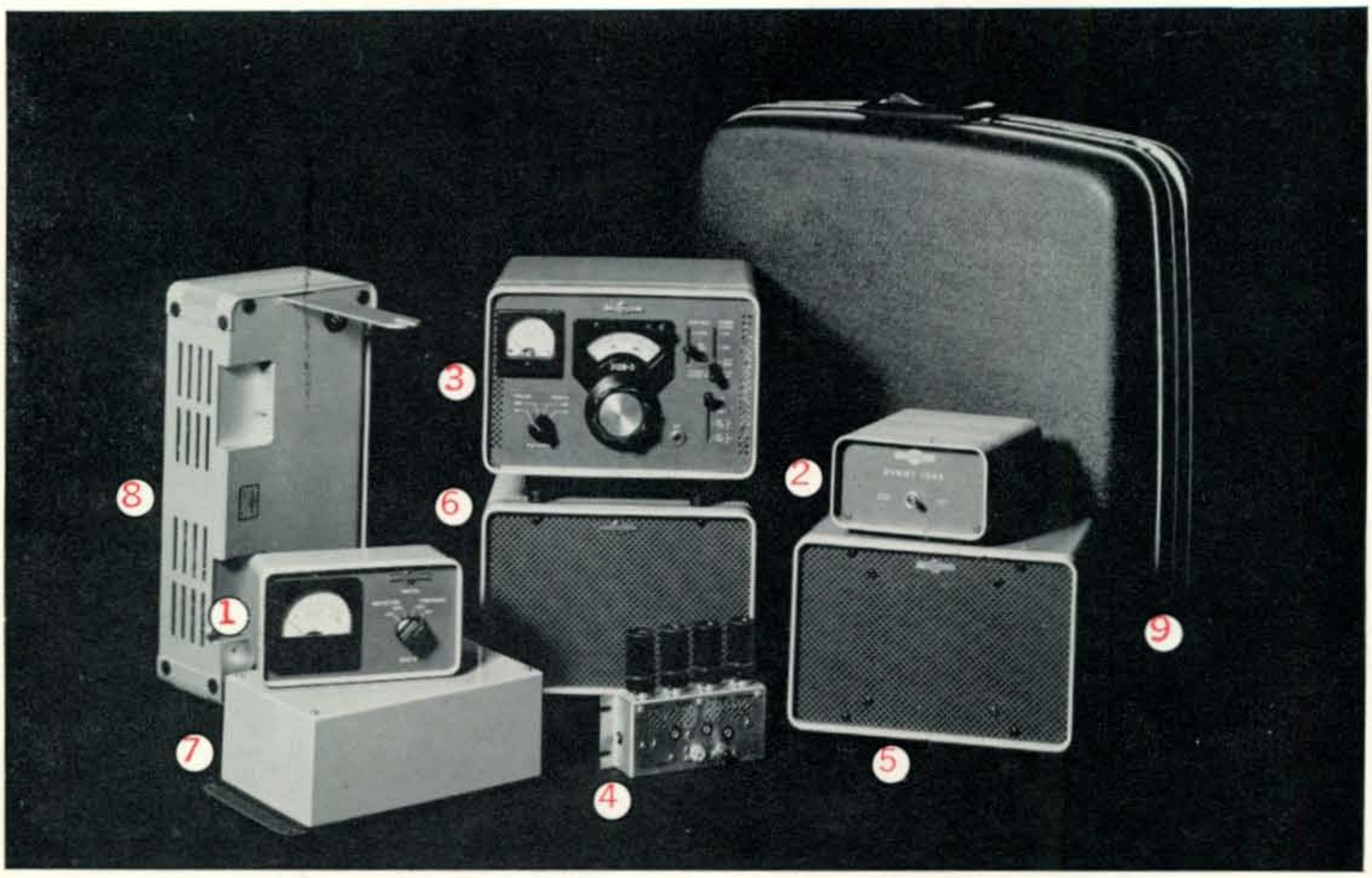
CQ

1963 NOVEMBER ANNUAL

Tools & Workshop

The Radio Amateur's Journal

Improve your rig with these Collins accessories



1. 302C-3 Directional Wattmeter — For fixed or mobile applications. Measures forward and reflected power on 200- and 2000-watt scales accurately (3.4 to 30.0 mc) without calibrating adjustments.

2. DL-1 Dummy Load — A 100-watt resistive load for all HF frequencies. Connects permanently in antenna coax line, with in-out relay switching. Provides easy comparison of antenna SWR and nonband interference tune-up. Type N and RCA antenna connectors are provided.

3. 312B-5 Speaker Console and External PTO — For use with KWM-2 in fixed station operation. Provides limited separation of receive and transmit frequencies, speaker, directional wattmeter, and switching for functional control system.

4. 136B-2 Noise Blanker — For use with KWM-2 in mobile operation. Effectively reduces impulse-type noise in the transceiver. Requires separate antenna resonance at 40 mc.

5. 312B-3 Speaker — Contains a 5″ x 7″ speaker and connecting cable. Styled to match S/Line and KWM-2.

6. 516F-2 AC Power Supply — Operates from 115 v ac, 50-60 cps. Provides all voltage for 32S-3 and KWM-2.

7. MP-1 Mobile Power Supply — Transistorized inverter powered from a 12 v dc automobile, aircraft or boat storage battery to the voltages required for operating the KWM-1, KWM-2 or KWM-2A.

8. PM-2 Portable Power Supply — Compact, lightweight and supplies all voltages needed for KWM-2. Operates from either 115 v ac or 220 v ac at 50-400 cps to give you a completely portable SSB station. An auxiliary speaker is included.

9. CC-2 Carrying Case — Specially designed Samsonite Silhouette case for KWM-2/PM-2 or 30L-1. Molded Royalite interior protects equipment against rough handling. Also available in model CC-3 for accessories.

These are just a few of the Collins accessories which can help you improve your rig. There are many more... mounts, microphones and adapters, to mention a few. Ask your authorized Collins distributor to demonstrate the advantages of Collins accessories. A new Collins book, *Amateur Single Sideband,* will be an invaluable addition to any ham's library.

Do your Christmas shopping early.
See your Collins distributor today.

COLLINS

For further information, check number 79, on page 158

ALL PR CRYSTALS are Continuously Monitored for Frequency During the Lapping Process

AMATEUR TYPES

FUNDAMENTAL, PR TYPE Z-2—Frequency Ranges in Kcs.: 3,500 to 4,000 (80-M); 7,000 to 7,425 (40M); 8,000 to 8,222 (2M); 8,334 to 9,000 (6M) ± 500 Cycles . . . $2.95 Net

(All Z-2 Crystals calibrated with a load capacity of 32 mmfd.)

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Precision at every stage of manufacture is responsible for the outstanding excellence of PR CRYSTALS. Here is a view of the Lapping Room, where blanks for PRs, previously cut and edged, are ground smooth to specified frequency, ready for etching to insure absolute stability during the life of the crystal. During the lapping, the crystals are continuously monitored for frequency with Collins 51J receivers.

PRs are in the rigs of thousands of proud Amateurs. They are famous for accuracy, dependability, high activity and low drift. Every PR CRYSTAL is UNCONDITIONALLY GUARANTEED. Get yours today from your jobber.

PR Crystals

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USE PR AND KNOW WHERE YOU ARE

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For further information, check number 1. on page 158

Are you ready to move up to an HT-32B?

Somewhere along the line, about one of 25 amateurs reaches a "point of no return" in pursuit of this unique and wonderful activity we call ham radio.

Up to this point, his interest, his technical skills and experience have grown and broadened by leaps and bounds. He has studied or experimented with a variety of equipment — enough to know what to expect, and what he personally wants in ultimate performance.

Beyond it, average performance or the absence of needed features no longer are an inconvenience. *They are intolerable.* Beyond it, he will settle for nothing less than an uncompromising leader. The best.

The HT-32B transmitter was designed, frankly and specifically, for the one-in-twenty-five. Like anything exceptionally worthwhile it costs more. But if you are ready to own it, you will know in advance why it is the *least extravagant investment you ever made.*

The incomparable

HT-32B

transmitter

$725.00

amateur net

- **Hallicrafters exclusively** — far superior frequency stability due to Hallicrafters' differential temperature compensation (U.S. Pat. #2718617).
- **Hallicrafters exclusively** — full 500 kc. coverage on VFO dial, with resolution to less than 1 kc.
- **Hallicrafters exclusively** — modes of communication: upper/lower/double sideband; automatic break-in CW; full AM.
- **Hallicrafters exclusively** — complete amateur coverage capability, 80 meters through 10 meters, without changing crystals.
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For complete specifications write today.

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Overseas Sales: Export Dept., Hallicrafters. **Canada:** Gould Sales Co., Montreal, P.Q.

For further information, check number 2, an page 158

CQ

The Radio Amateur's Journal

Vol. 19, No. 11 November 1963

OFFICES

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Departments

In case you figured we had plans for a transmitter that would transceive with the ***SX-117*** . . .

SX-117 SPECIFICATIONS

Exceptionally versatile and compact triple-conversion, superheterodyne communication-type receiver. **Transmitter-type V.F.O.** can be used as crystal locked oscillator; **Selectivity:** Variable in 3 steps, 500-5,000 cycles. Crystal-controlled 1st and 3rd oscillators. Selectable sidebands, constant tuning rate. **Sensitivity:** less than 1 mv. on AM, less than ½ mv. on SSB/CW. **T-notch** for up to 50 db. attenuation to unwanted heterodyne in I. F. pass band. I. F. type noise limiter. Audio inverse feedback. Crystals provided for 3.5—4.0, 7.0—7.5, 14.0—14.5, 21.0—21.5, 28.5—29 mc. Four addt'l. crystal pos. for 500 kc. segments between 85 kc. and 30 mc. Size: 15″ x 17⅛″ x 13″. Net wt. 18 lb. Amateur net price: $379.95.

HA-10 Low freq. tuner adapts SX-117 for 85 kc.—3 mc. $24.95

No other receiver in its class has proven so versatile and reliable as the SX-117. Part of the story is its frequency coverage capability . . . variable selectivity . . . crystal-controlled H.F. oscillators and other high-performance features. Now comes the sequel — Hallicrafters' new SSB/AM/CW HT-44 transmitter. On its own, the HT-44 gives you 200 watts DC input, SSB and CW . . . break-in CW

The unit that stacks up best alongside the ***SX-117*** *is .*

the new ideas in communications
are born at . . . ***hallicrafters***

you were right

HT-44 SPECIFICATIONS

Versatile compact amateur band transmitter for independent operation or slaving with SX-117 receiver for function as transceiver. SSB, AM, or CW on 80 through 10 meters. Features Hallicrafters stabilized phasing system for sideband generation with —40 db of sideband suppression @ 1 kc and carrier suppression of —50 db. Distortion products, —30 db. VOX/CW break-in and PTT operation. Panel-adjusted VOX/CW delay for maximum Phone-CW flexibility. Exclusive AALC gives greater talk power with speech compression up to 12 db. Power input 200 watts DC on CW and SSB, 50 watts AM. Same size and style as SX-117. Furnished with crystals for 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, and 28.5-29.0 mc. Less transceiver cables, $395.00. P-150 AC power supply, $99.50.

operation . . . Hallicrafters' exclusive stabilized phasing system and Amplified Automatic Level Control (AALC) . . . VOX/PTT and a dozen other solid value features. Interconnected, this great new Hallicrafters pair gives you independent or transceive operation at the flip of a switch—and a whole new world of flexibility. Your distributor will give you a convincing demonstration today.

the NEW HT-44 Transmitter by hallicrafters

Fifth & Kostner Aves., Chicago 24, Ill.

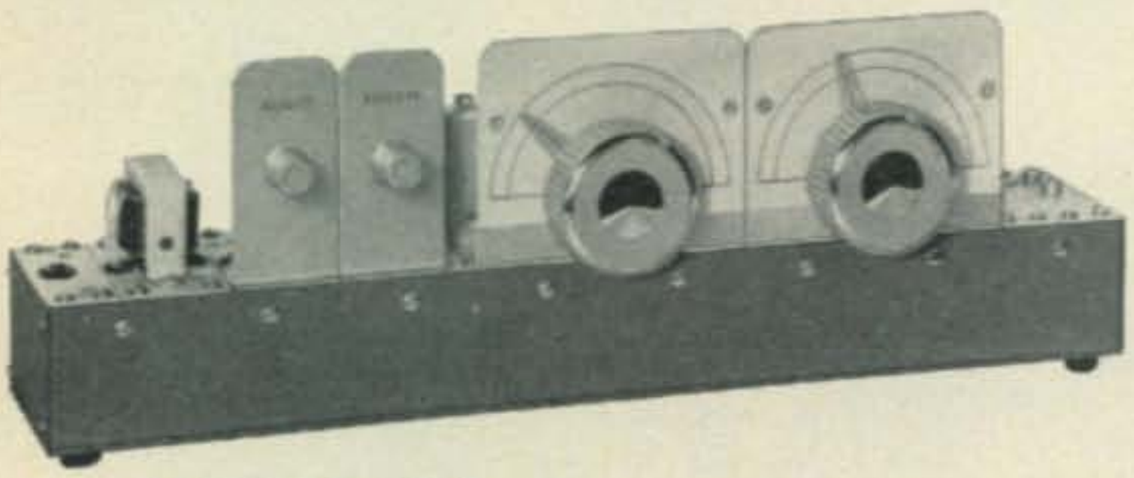
Export: Hallicrafters, International Div. **Canada:** Gould Sales Co., Montreal, P.Q.

For further information, check number 5, on page 158

EXPERIMENTER, SWL or RADIO AMATEUR

Select your receiver, transmitter, or VFO from easy-to-build International A O C kits.

Simple step-by-step instructions show you how to assemble factory prewired units. Designed for top performance at a low cost!



RECEIVER KITS

This new line of International receiver kits cover a wide range of amateur, citizens band and special frequencies. Designed for AM, CW, or SSB reception, this basic receiver using a superheterodyne circuit* with regenerative second detector may be expanded to a more elaborate receiver by the addition of other Add-On-Circuits. Sensitivity usable to below 10 microvolts for voice and 1 microvolt for code. Nuvistor rf amplifier, mixer, oscillator, I.F. transformer, detector/1st audio, and power audio amplifier. Tube lineup: 6DS4 nuvistor, 6BE6, 6U8, 6AQ5. Shipping weight: 15 lbs.

Receiver kit includes 4" speaker and power supply.

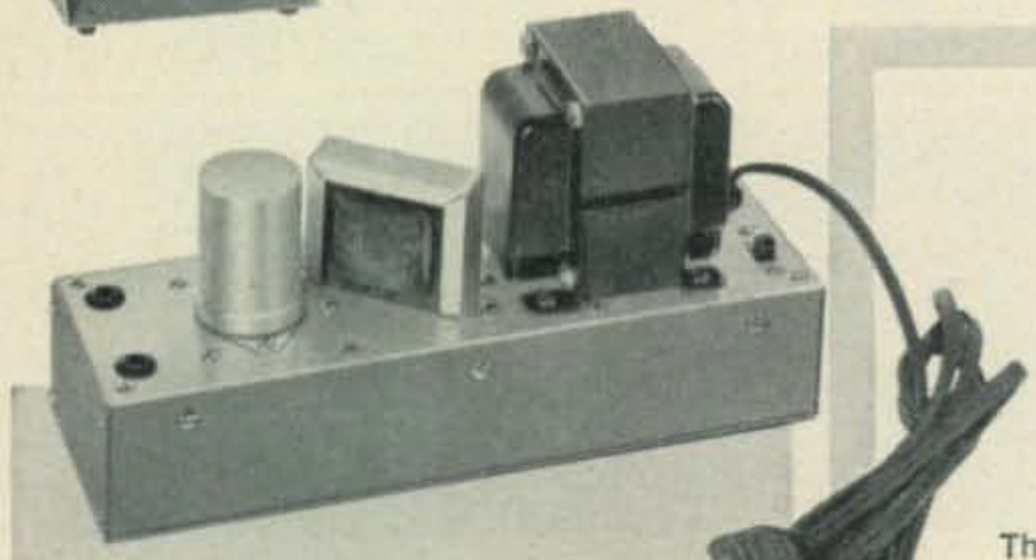
Kit	Frequency	Price
AOR-40	Special	$69.00
AOR-41	150 kc — 450 kc	62.50
AOR-42	2 mc — 6 mc	62.50
AOR-43	6 mc — 18 mc	62.50
AOR-44	80 meter/40 meter	62.50
AOR-45	15 meter/10 meter	62.50
AOR-46	6 meter	66.50
AOR-47	2 meter	66.50
AOR-48	Citizens 27 mc	62.50

*AOR-41 uses a tuned rf circuit with 6BA6

TRANSMITTER KIT

A compact package delivering a plate input of 50 watts for CW operation on 80 or 40 meters. 12BY7 crystal oscillator—6DQ6 power amplifier. Pi-network final. When used with AOR-44 receiver, transmitter operates from receiver power supply. Meter and TR switch.

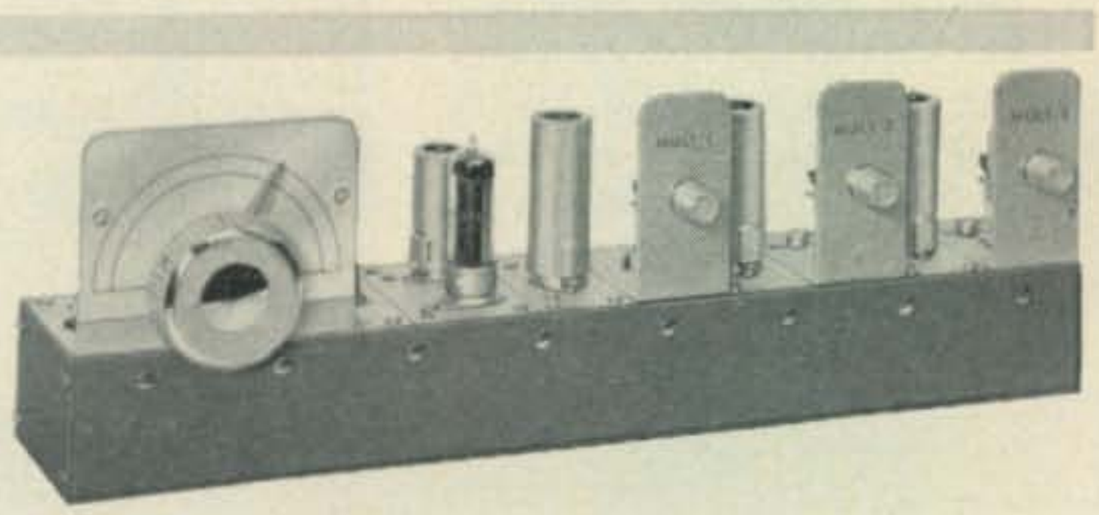
AOT-50 transmitter kit less power supply and key, but with one 40 meter novice band crystal. Shipping weight: 5 lbs. **$35.00**



POWER SUPPLY KITS

AOP-100 350 volts, 150 ma intermittent or 100 ma continuous service, 6.3 volts @ 5 amps. Shipping weight: 8 lbs. **$18.50**

AOP-200 650 volts, 250 ma intermittent or 200 ma continuous service, 6.3 volts @ 10 amps. Shipping weight: 10 lbs. **$32.50**



VFO KITS

The International AOF series of variable frequency oscillator kits is available in three versions. For example, the AOF-91 kit is a complete driver unit to be used with 6 meter and 2 meter transmitters. Approximately .5 watt of power is available on both bands. Tube lineup: 6BH6 oscillator, OB-2 voltage regulator, 12BY7 buffer-amplifier/multiplier. Shipping weight: 5 lbs.

Kit	Frequency	Price
AOF-89	VFO 8 mc — 9 mc and buffer	$22.00
AOF-90	VFO 8 mc — 9 mc plus buffer multiplier and 6 meter output	29.00
AOF-91	VFO 8 mc — 9 mc plus buffer multiplier, 6 meter/2 meter output	36.00

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CRYSTAL MFG. CO., INC.
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For further information, check number 6, on page 158

ZERO BIAS

THIS issue marks the seventh year of Special November editions of *CQ*. If you haven't already guessed it, tools and general workshop practices is the main theme this year. The thirty-three page supplement beginning on page 30 was assembled with the radio amateur in mind.

In these days of commercial equipment popularity, much of the home-brew practices of amateur radio has taken a back seat; and it is with this in mind that "Tool and Workshop Practices" was formulated for presentation this month.

Although it is physically impossible to cover every aspect of tools and workshop habits in one issue we have endeavored to touch upon important points which will be of value to the beginner as well as the advanced amateur.

During its preparation it was concluded that not all readers would receive equal benefits from this section; some having no knowledge at all of the workshop and others more knowledge of tools than ourselves. It is suggested, therefore, that the reader "wade in"; we think you will find at least one small hint that will prove valuable the next time you tackle a home-brew project. To this end we devote our 1963 November issue.

About The Author

Credit for the "Tool" section goes to Wilfred M. (Bill) Scherer, W2AEF, our Technical Director.

W2AEF

To the old timer, the call W2AEF is nothing new to *CQ;* to the newcomer, however, a few brief highlights of his career may be in order.

Bill was licensed in the early '20s and after a stint aboard ship pounding brass with a spark transmitter, he entered the commercial broadcast field.

Behind the controls of many famous CBS radio programs in the thirties and early forties, he worked with such stars as Morton Gould, Harry James, Andre Kostelanetz, Glenn Miller, Lili Pons, Phil Spitalny, Fred Waring, Paul Whiteman, Florenz Ziegfeld and many others.

Bill was later transferred to the CBS affiliated Voice of America shortwave station, WDSI 5 & 6 in Wayne, New Jersey until the station was closed down last spring, at which time he was serving in a supervisory capacity. He was partly responsible, by the way, for successfully de-TVIing all three 50-kilowatt transmitters at the station!

Bill has authorized dozens of articles for *CQ* most of which have become classics in the ham world. His 1947-1949 articles on the construction and application of the Grid Dipper resulted in the g.d.o. becoming one of the most popular and useful pieces of test equipment in the shack. The "Antennascope" also received wide acclaim as well as the "TNS" (Twin Noise Squelch), "W2AEF Converterettes," the "Standard of Comparison Receiver" and many many more.

One of the six charter members of the Single Sideband Amateur Radio Association, Bill saw the advantages of s.s.b. early in its infancy and was one of the first on the air using that mode.

Bill and the XYL Betty (who has no love for ham radio) live in New Jersey and enjoy participating together in year-round outdoor sports.

Notice

W3GD informs us that the FCC release appearing on page 16 of this issue has been revised to take effect December 1, 1963 instead of November 1. He also informs us that the written examination will be mailed only *after* receipt of an application for the examination.

NOW ARRIVING ON TRACK SIX!

Clegg's VENUS 6 TRANSCEIVER

A COMPLETE SSB STATION FOR 6 METERS

Yes, the long awaited VENUS 6 SSB TRANSCEIVER is now being delivered to your distributors. Here's a brand new high quality compact attractively styled SSB RECeiver and TRANSMITTER that puts you on 50 MC single sideband without all the fuss, bother and expense associated with adapting low frequency SSB exciters, relays and linear amplifiers. Its 20 tubes and 4 semiconductors provide performance equivalent to 35 tubes.

ELECTRICAL SPECIFICATIONS

TRANSMIT: Frequency—Any preselected 500 KC segment between 49.7 and 52 MC (50.0 to 50.5 supplied unless otherwise specified). Power Ratings—85 watts P.E.P. input—all modes (AM, SSB, and CW). SSB Performance—(9 MC Crystal lattice filter)—Unwanted sideband down more than 40 db. Carrier suppression greater than 50 db. Distortion products down more than 30 db at full ratings. Frequency Stability—less than 1 KC warmup drift after first five minutes. Less than 100 cycle/hour drift after 30 min. warmup.

RECEIVE: Frequency Range—Same as Transmit. Frequency Stability—same as Transmit. Sensitivity—Less than .25 UV for 10 db s/n. Selectivity—2.8 KC at 6 db, less than 6 KC at 50 db. Overload Characteristics—Less than 2% cross modulation results from any two signals separated by more than 20 KC if stronger signal is less than 5 MV across 50 ohm input. Spurious Responses—images and IF leak through down more than 75 db between 49.8 and 51 MC. AVC Characteristics—less than 6 db change in AF output for input change from 2.5 UV to 1 MV (52 db). Fast attacks, panel selectable release time. AF Power Output—more than 2 watts, 3.2 ohms. Power Requirements—met by the Clegg Model 416A, 115 Volts AC, 60 cps input power supply as well as by many commercially available power supply packages.

PHYSICAL DIMENSIONS: 15" W by 7" H by 10¼" D. Net wgt., approximately 18 lbs.
VENUS 6 TRANSCEIVER—Amateur Net Price **$475.00**
115 V. A.C. 60 CPS Power Supply—Amateur Net Price **$115.00**

See your Distributor or write for information.

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TELEPHONE 627-6800

For further information, check number 8, on page 158

SS-1R

The New Standard of Performance

The SS-1R sets a new standard of performance for amateur band communication receivers. A completely new front end design[1] provides superb freedom from cross modulation and overload, while the low noise balanced mixers deliver superior sensitivity — with *no r.f. stage*. Steep-skirted crystal bandpass filters and newly developed high-Q IF circuits provide optimum selectivity with greater than 80 db ultimate attenuation. Extreme linearity, double loop AGC and front end freedom from cross modulation make this selectivity as effective as though it were *at the antenna terminals*. Frequency precision and stability exceed that of most frequency meters; frequency is read directly on a *digital* display.

There are many new operating conveniences not found in other amateur equipment. The unique SS-1R design, plus fixed tuned WWV positions at 10.0 and 15.0 MC (and an auxiliary 5.0 to 5.5 MC band), permits autocalibration of the amateur bands — *with no cursor lines to twiddle*. The manual tuning rate is slow enough for easy and exact sideband tuning — 10 kc. per knob revolution — while pushbutton motor tuning gives fast traverse. An optional noise silencer accessory with spectacular performance[2] is available, as will be a Video Bandscanner. The SS-1R may be operated in transceiver mode with the SS-1T transmitter.

[1] "A New Approach to Receiver Front-End Design", W. K. Squires, W2PUL, QST, Sept. 1963. [2] "A Pre-I.F. Noise Silencer", *ibid.*, Oct. 1963.

SPECIFICATION PROFILE

- **Frequency Coverage:** 80 through 10 M (eight 500 kc. segments). Fixed tuned WWV at 10.0 and 15.0 MC; 5.0-5.5 MC auxiliary (WWV 5.0 MC). Two general coverage 500 kc segments
- **Selectivity:** 5 kc./2.5 kc./0.35 kc.
- **Stability:** Less than 500 cps warmup drift (typically in less than 5 min.); less than 100 cps thereafter including low to high line variation
- **Sensitivity:** ½ μv, or better, for 10 db S/N on 10 M with 5 kc. bandwidth
- **I.F. and Image Rejection:** Greater than 60 db
- **Cross Modulation:** Example: Receiving a **10** μv signal with 2.5 kc. selectivity, an unwanted **0.1 volt** signal 20 kc. away produces negligible cross modulation
- **Internal Spurious:** None at stated sensitivity
- **AGC:** Attack — 1 ms., **Slow** release — 1.0 sec., **Fast** release — 0.1 sec. Audio rise less than 2 db from 5 μv to 0.3 volt
- **ANL:** I.F. type; operates on AM, SSB, and CW
- **Size:** 7¾" H x 16¼" W x 13" D, 25 lb.

Squires-Sanders, Inc.

475 WATCHUNG AVENUE, WATCHUNG, N.J. • 755-0222

For further information, check number 9, on page 158

A Different Approach to A.M.

Editor, *CQ:*

With the advent of lower power limitations on 160 meters, it seemed that it might be interesting to see what could be done to increase the efficiency of a rig for phone work.

Most single-sideband rigs have some provision for a.m.; however, as they operate as linears the basic efficiency in Class-B operation is about 33% which means that with our new power limitation of 25 watts at night (in Ohio), we'd have a little over 8 watts in the antenna at the best. To this end experimentation took place to increase this efficiency.

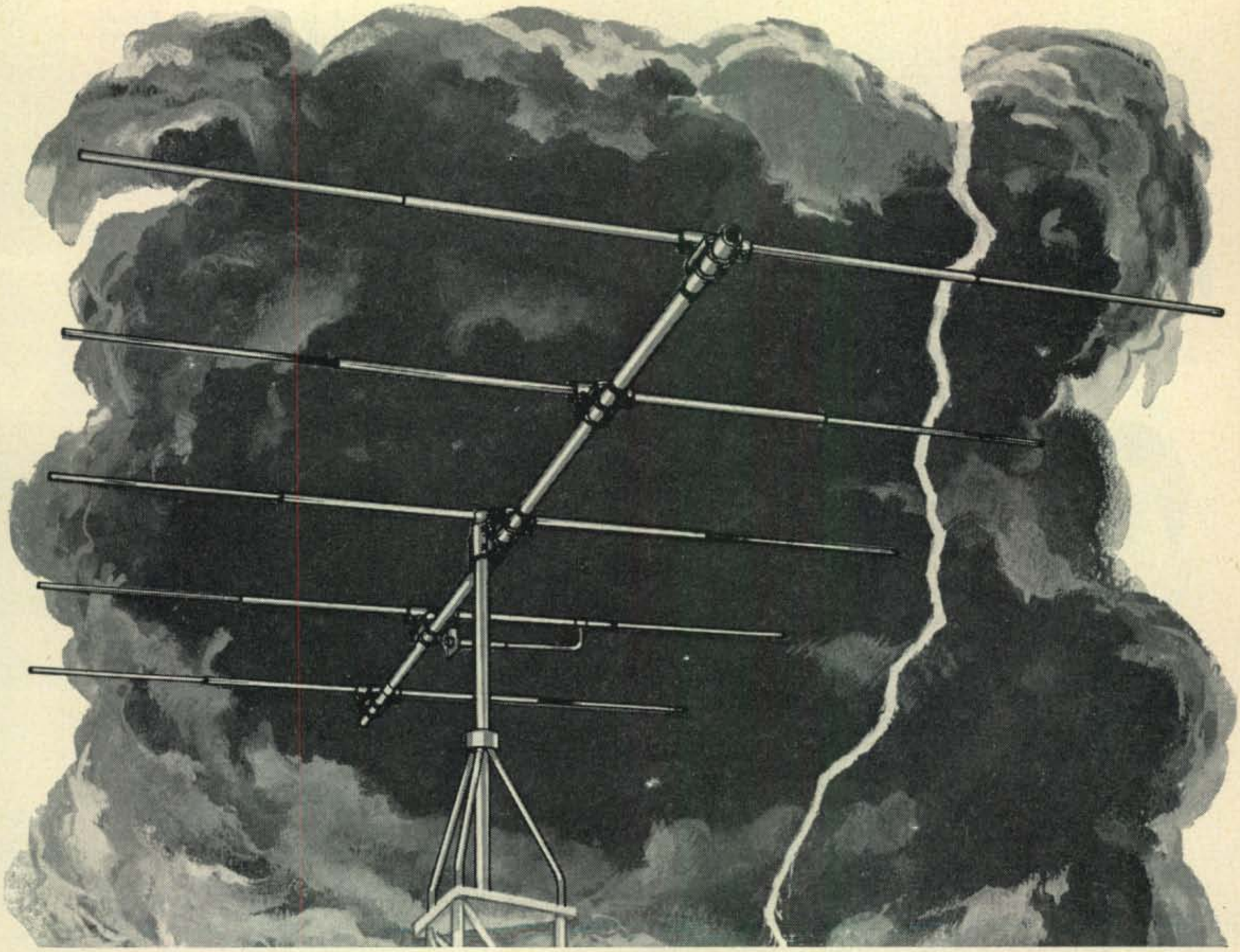
A temporary antenna was put up, and we connected it to our Viking Ranger; the Elenco 77 s.s.b. transmitter being connected to our regular antenna. After setting up controls so that both transmitters could be operated simultaneously, the Ranger was set for a 25 watt c.w. carrier, and the Elenco supplied the audio sideband (just one). It was noted by listeners that the quality of the signal seemed to be equal to that of the double-sideband Ranger, but that the bandwidth was of course only half. By changing the frequency relationship of the two transmitters, the usual low/high "Donald-Duck" type of signal could be produced in the a.m. receiver. It was not difficult to keep the two v.f.o.s locked at this low frequency; the receiver S-meter serving as a check as long as the difference was very low (meter fluttered at the audio difference rate). A higher frequency difference required a monitor to detect. With the carrier transmitter operating Class-C (about 70% efficiency) and the s.s.b. transmitter supplying only the audio, we had more than twice the carrier possible with the s.s.b. transmitter alone, and overmodulation is not possible as there is no physical relationship between the sideband and the carrier.

Our Third Edition of Terman's *Radio Engineer's Handbook* mentions the system under "Polyphase Broadcasting" first suggested by J. F. Byrne, (*Trans. A.I.E.E.* July, 1939) but apparently more than two antennas are involved. No experiments have taken place yet in which a single v.f.o. is operated to drive two final amplifiers (one class-B linear for audio sideband and one class-C carrier) and coupled into a common antenna but it seems that such an arrangement is feasible.

What the power limitations are on such a system is open to conjecture. FCC rules apply to plate power input to tubes "supplying power to the antenna," and in the case of an a.m. rig this is construed as being carrier only. The voltage and current actually doubles on peaks supplied by the modulator, and they are not measured; the average current only being measured. With some other system supplying the sidebands at a radio frequency and at a varying rate power measurement would be quite difficult.

Those amateurs who are interested in experimentation

For further information, check number 10, on page 158



Everything to GAIN... nothing to lose with the NEW M-110

6 meter, 5 element horizontal beam antenna

Forward gain is 10 db. over ½ wave dipole with a 30 db. front-to-back ratio. But it wouldn't be worth a db. if a gust of wind left it lying in your yard.

So we built it to withstand 100 mph winds by using aluminum construction throughout. 1⅜" diameter boom and step-type ⅝" and ¾" diameter elements are of heat-treated aluminum tubing. Specially designed mounting clamps of heat-treated heavy duty aluminum casting, fit 1" pipe or 1⅜" tubing (O.D.). It's a sleek silhouette weighing only 20 lbs.

This is a "one-trip-to-the-roof" antenna. It goes together only one way — the right way — the first time! Every piece is color-coded — every hole drilled to match. Boom length is 16'. Turning radius is a compact 9' — VSWR is less than 1.5:1 — band width under 1.5:1 ± 500 kc — 50 ohms gamma matched. Here's another figure you'll like — Amateur net is only $43.95.

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antenna division

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Exp. Div., 64-14 Woodside Ave. Woodside 77, N.Y

Stripes of Quality ®

Manufacturers of Antenna Specialists brand base and mobile antennas for amateur, professional and CB.

New Zeus PORTABLE ELECTRIC GENERATOR

Virtually eliminates radio interference. Exclusive Permanent Magnet Alternator is the only moving part — no brushes, slip rings, bearings, commutators, etc., to produce irritating generator noise common to ordinary portable units. 1000, 1250 or 3000-watt units, AC.

For further information, check number 11, on page 158

may find 160 meters interesting because the low power limit makes it more inexpensive to try experimentations at the "full legal input."

Willard Waite, W8GDQ
RFD 1, Webster Rd.
Wellington, Ohio

The Swans of Abbotsbury, Again

Editor, *CQ:*

I am delighted that WA2LDC enjoyed my article, (*CQ*, August, 1963) but I feel I must ask you to publish this reply because I was not advocating the incentive licensing system. I do not wish to participate in this particular controversy.

My article opposed the high pressure salesmanship and the tremendous efforts being made, especially in America, to recruit more people into Amateur Radio (I gather that there was recently a high powered sales drive in Jacksonville, Fla.). I am equally opposed to trying to restrict it. My article even said, "We should not, of course, prevent one single person who genuinely *wishes* to become a radio amateur from doing so" and I am certainly not so impressed with examinations as to advocate this method. Many of our great men had most distinguished academic careers.

Must we always be either driving people into amateur radio or keeping them out? Cannot we leave people free to make their own decisions without either trying to sell them the idea or prevent them coming in if they want to? Cannot you find some other outlet for the surplus energy than trying to push people one way or the other? The western nations like to think of themselves as the "free world"—then let it be free, and cut out both the salesmanship and the restrictionism.

E. M. Wagner, G3BID
5, Ferncroft Ave.
London, N.W. 3

Incentive

Editor, *CQ:*

I realize that pure coincidence placed editorials, cast from the same mould, in September's *CQ* and *QST*.

In the various editorials contained in *QST* which deal with "Incentive Licensing," one notices a striking similarity to actions which occurred in George Orwell's *1984*. Statements used as a previous basis for arguments in favor of newer "licensing schemes," are completely eliminated in favor of that which propagandists dearly love; *i.e.*, "The Fear Technique"—loss of radio privileges. Seriously, Mr. Editor, can you honestly state that the delegates to the Conference of the ITU from Ghana, Togo, etc., care 2 milliwatts about the fact that some U.S. radio amateurs have passed a more difficult written examination?

Alvin Liftig, K1IXG
"On the Rocks"
Avon, Conn.

[We hope the delegates from Ghana, Togo, etc. will eventually need electronic technicians of their own rather than the "import" variety now being used. To this end, their own radio amateurs would be a valuable national asset.—*Ed.*]

Editor, *CQ:*

Having read opinions both pro and con for the ARRL proposal, I would like at this time to jump in with both feet and express a few of my own.

At first reading of the idea, I was violently opposed and was going to write an indignant letter cursing the whole thing. Luckily, I cooled down rather quickly and resolved to give the matter some serious thought before going off half-cooked. I have read every article I could get my hands on, and have talked it over with many of my amateur friends.

I suppose I am one of the "mediocre" amateurs. Oh, to be sure, I have learned some new things about the hobby when such knowledge was needed to keep operating, but I haven't tried to go any farther. That is, I haven't until a couple of weeks ago. At that time I took a serious look at myself and the accomplishments of amateur radio and came to a decision. I decided to try to learn something new each day. So far it has worked.

I think that most amateurs are going to have to face the cold hard facts. While some of us may not like it,

and may have different opinions about the way things are being run, I think most of us would rather give up some privileges for a while rather than see amateur radio as a whole deteriorate and eventually disappear altogether.

I'd rather work a little harder, hold my head a little higher, and be able to say with pride, "I am a radio amateur."

R. D. Ellickson WAØASG/6
72163 Sun Valley Drive
Twenty-nine Palms, Calif.

Editor, *CQ:*

Just a note to tell you that I was delighted with your editorial in the September *CQ* which backed ARRL program for a very modest and reasonable tightening up in our requirements.

The League is going to have a very difficult job trying to keep our frequencies for us at the upcoming international convention and it must be able to deal from a position of strength.

Now that commercial pressures for portions of the spectrum are heavy, amateur radio is going to have to justify itself more than ever. And the pressures coming from the many newly formed countries wanting to place radio stations on our frequencies can be successfully combatted only if amateur radio shows itself to be a progressive and meaningful force in the area of technological improvement.

Actually we are being asked only to keep pace with advancing times. This is asking very little and since the future of amateur radio is at stake I welcome the opportunity to support the modest tightening up that the League is proposing. The worst thing that could happen would be for those who wish to abolish our frequencies to get the idea that a large number of hams are opposing reasonable progress within our ranks.

Keep up the good work. Our friends will support us only if we can take a united stand behind the League in supporting reasonable changes that cause others to respect us. Only the League has the know-how and contacts for handling international conference issues.

Ralph H. Turner, W8HXC
198 Shipherd Circle
Oberlin, Ohio

Editor, *CQ:*

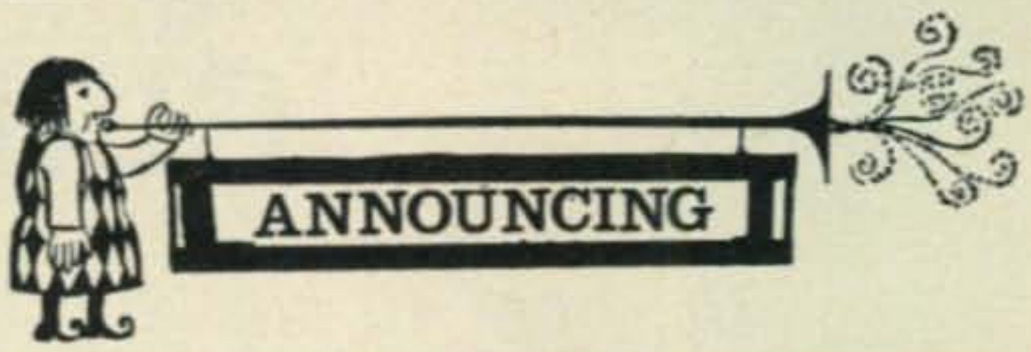
After reading ZERO BIAS in August, 1963 *CQ*, I am more strongly convinced than ever of your "me too" policy and attitude.

You've read as well as I what the League proposes; it's been printed in black and white. So let's get off the fence and take a stand instead of a wichy-washy, namby-pamby jelly-fish editorial and attitude policy.

Let's get on with Ham Radio as a fun hobby while you guys stick to helping the majority of us with articles of general interest and instruction.

The League has grabbed a lion by the tail and now want to get off; they just haven't figured out how. If you really want to help all of us, let's find a way for some self-policing to assist the FCC and clean up some of the stuff you can hear every day by just running your receiver back and forth on any band. That's what we need most!

Ed Robinson, K7VUA
1208 W. 13th
Spokane, Washington



Change In Examination Procedure

A basic change in the administration of Novice, Technician and Conditional class licenses has been made by the Federal Communications Commission. Heretofore, the code requirement was administered by any

amateur holding a General Class license or higher, with the written examination being administered by *any* citizen 21 years or older.

The Commission now stipulates, in the Order below, that the supervisor of an Amateur examination, both code and written, must hold a General ticket or better and have reached the age of 21 years.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of
Amendment of Section 12.44(*c*) of the Commission's Rules governing examination procedures in the Amateur Radio Service

ORDER

At a session of the Federal Communications Commission held at its offices in Washington, D. C. on the 11th day of September, 1963;

The Commission having under consideration the Amendment of Section 12.44(*c*) of its rules which sets forth procedures for the supervision of examinations for the Novice, Technician, and Conditional Class Amateur Radio operator licenses; and

IT APPEARING, That it is desirable that the written portion of an examination be supervised by the same volunteer examiner who administers the code test portion of the examination; and

IT FURTHER APPEARING, That a volunteer examiner should be at least twenty-one years of age; and

IT FURTHER APPEARING, That a volunteer examiner should be the holder of an Extra, Advanced, or General Class Amateur radio operator license, or the holder of a Commercial radiotelegraph operator license issued by the Commission, or should be employed in the service of the United States as the operator of a manually operated radiotelegraph station; and

IT FURTHER APPEARING, That it is necessary that the Rules set forth a procedure whereby a volunteer examiner can obtain, supervise, and submit the written portion of an examination; and

IT FURTHER APPEARING, That the rules adopted herein are procedural in nature and hence are not subject to the prior notice provisions of Section 4(*a*) of the Administrative Procedure Act; and

IT FURTHER APPEARING, That authority for the issuance of the rules herein adopted is contained in Section 4(*i*) and 303 of the Communications Act of 1934, as amended;

IT IS ORDERED, effective November 1, 1963, That Section 12.44(*c*) of the Commission's Rules is amended as set forth in the attached Appendix.

FEDERAL COMMUNICATIONS COMMISSION
BEN F. WAPLE
Secretary

APPENDIX

1. Section 12.44(*c*) is amended to read as follows:

§12.44 Manner of Conducting Examinations.

* * * * * *

(*c*) Unless otherwise prescribed by the Commission, an examination for the Conditional, Technician, or Novice Class license will be conducted and supervised by a volunteer examiner selected by the applicant. A volunteer examiner shall be at least 21 years of age and shall be the holder of an Extra, Advanced, or General Class Amateur Radio operator license, or shall hold a Commercial radiotelegraph operator license, issued by the Commission, or shall be employed in the service of the United States as the operator of a manually operated radiotelegraph station. The written portion of the examination shall be obtained, supervised, and submitted in accordance with the following procedure:

(1) Necessary examination papers shall be obtained from the Commission's office at Gettysburg, Pennsylvania at the written request of the applicant or the volunteer examiner. The request shall include the names and permanent addresses of the applicant and the examiner, a description of the examiner's qualifications

If you, like many of today's amateurs, find yourself with your interest fairly equally divided between working AM/CW and SSB, there's a real feeling of frustration with most available equipment. Why? Because most AM rigs require extensive modification to operate SSB—and no SSB rig offers high level AM and Class "C" CW—and the end result is compromise in one mode or the other!

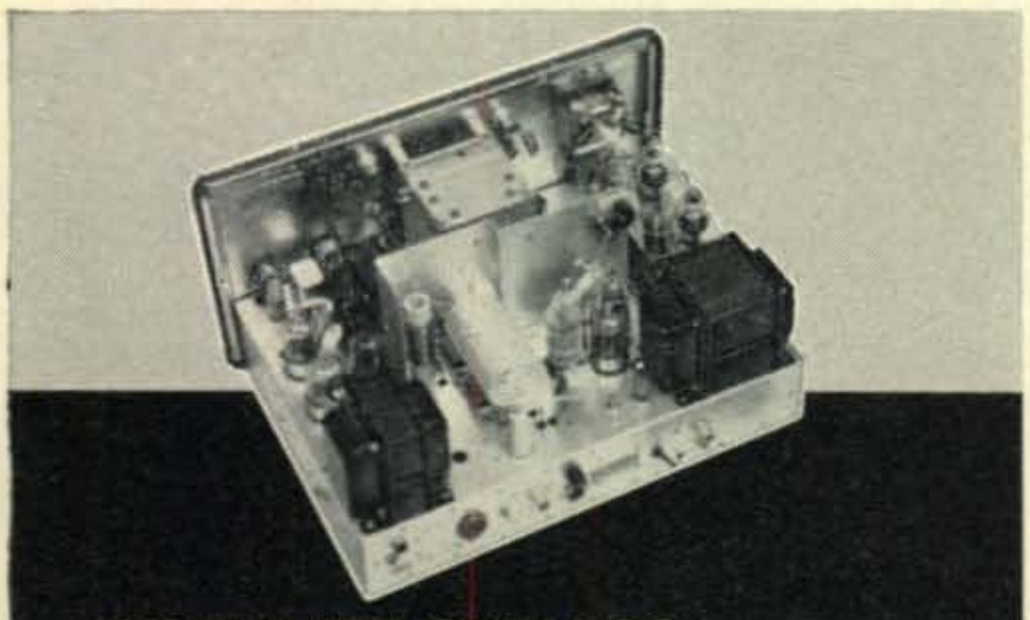
Not so with the Viking SSB Adapter/Valiant II combination, for here's the package that gives you 275 watts CW and SSB plus 200 watts high level AM phone! Now, keep your contacts and work old friends no matter what portion of the band they are operating in, and no matter what mode they are using—and do it with maximum punch!

VALIANT II SSB ADAPTER

SSB ADAPTER

Filter-type SSB generator—bandswitching 80 through 10 meters—more than 50 db sideband suppression—more than 45 db carrier suppression. Features built-in multiplier requiring VFO input only—design and front panel make operating practically foolproof!

Cat. No. 240-305-2... Wired, tested... **Net $369.50**



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Outstanding flexibility and performance in a compact desk-top rig! Bandswitching 160 through 10 meters—275 watts input CW or SSB (with Viking SSB Adapter) and 200 watts AM!

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COMPLETE CATALOG

Drop us a card and we will send you Amateur Catalog 962, which gives the full story on the "Viking SSB Adapter" and the "Valiant II", as well as detailed information on our complete line of amateur transmitters and station accessories.

E. F. JOHNSON COMPANY
WASECA, MINNESOTA, U.S.A.

For further information, check number 17, on page 158

to administer the examination, and, in the case of a request for the Conditional Class license examination, the basis of the applicant's eligibility for such license. Examination papers will be forwarded only to the volunteer examiner.

(2) The volunteer examiner shall be responsible for the proper conduct and necessary supervision of the examination. Administration of the examination shall be in accordance with the instructions included with the examination papers and as prescribed in §§ 12.47 12.50.

(3) The examination papers, either completed or unopened in the event the examination is not taken, shall be returned by the volunteer examiner to the Commission's office at Gettysburg, Pennsylvania within the time prescribed (normally not later than 20 days after the date when the papers are forwarded by the Commission).

Revised Amateur Application Form

The Federal Communications Commission is in the process of revising and combining FCC Forms 610 and 610-A, the application forms used when applying for license for Amateur Operator, Amateur Station, Amateur Club Station, and Amateur Station under Military Auspices. This revised FCC Form 610 is designed for easy handling by electronic data processing procedures and will be used when applying for any of the aforementioned Amateur licenses, including new, modified, and renewed.

This new (August 1963) version of the FCC Form 610 is scheduled to be available for distribution on or about November 1, 1963. Under this time table, applications filed on older versions of the form (May, 1963 and before) will not be accepted after November 30, 1963.

Monetary Forfeitures

We would like to remind you that the FCC continues to levy monetary fines of as much as $100 for the illegal use of the Citizens' Band. Readers are cautioned that these fines can also be made in the amateur service and that careful operating be the guide in situations of this kind.

It is also emphasized that an amateur should respond as soon as possible, if required, to any notice of violation issued by an FCC office.

Correction

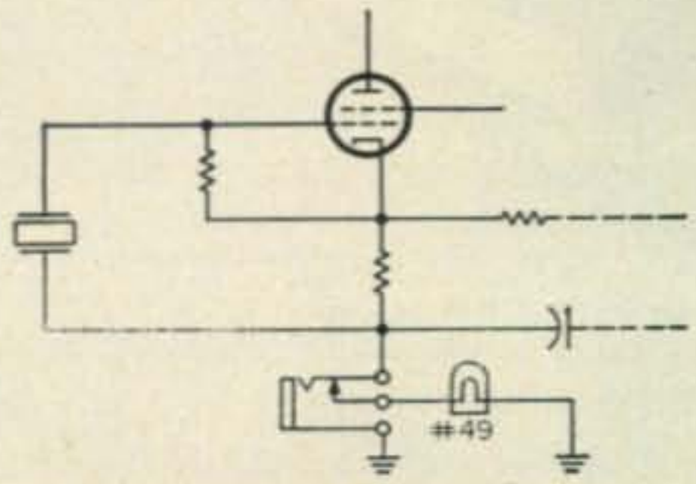
"The Simplest and Cheapest Rig" described in *CQ* for August has brought so much correspondence we feel a few remarks may be in order.

1—Should insufficient coupling be experienced, it is suggested that the link, L_2 be wound directed over the major inductor, L_1, using toothpicks boiled in paraffin as a spacer between the two coils.

2—The application of more than 250 volts usually results in a rapid rise in crystal current and should be limited to that value as a safety factor.

3—The pilot-light, current-indicator lamp may be placed at the key using a normally-closed jack (see illustration below). Tuning for maximum brilliance is then accomplished by removing the key; when the key is inserted, the lamp is disconnected, eliminating any bothersome flicker as the transmitter is keyed.

4—Since most readers missed the correction given in the September issue on page 84, may we remind you that pin 2 was mislabeled; it should be pin 5.

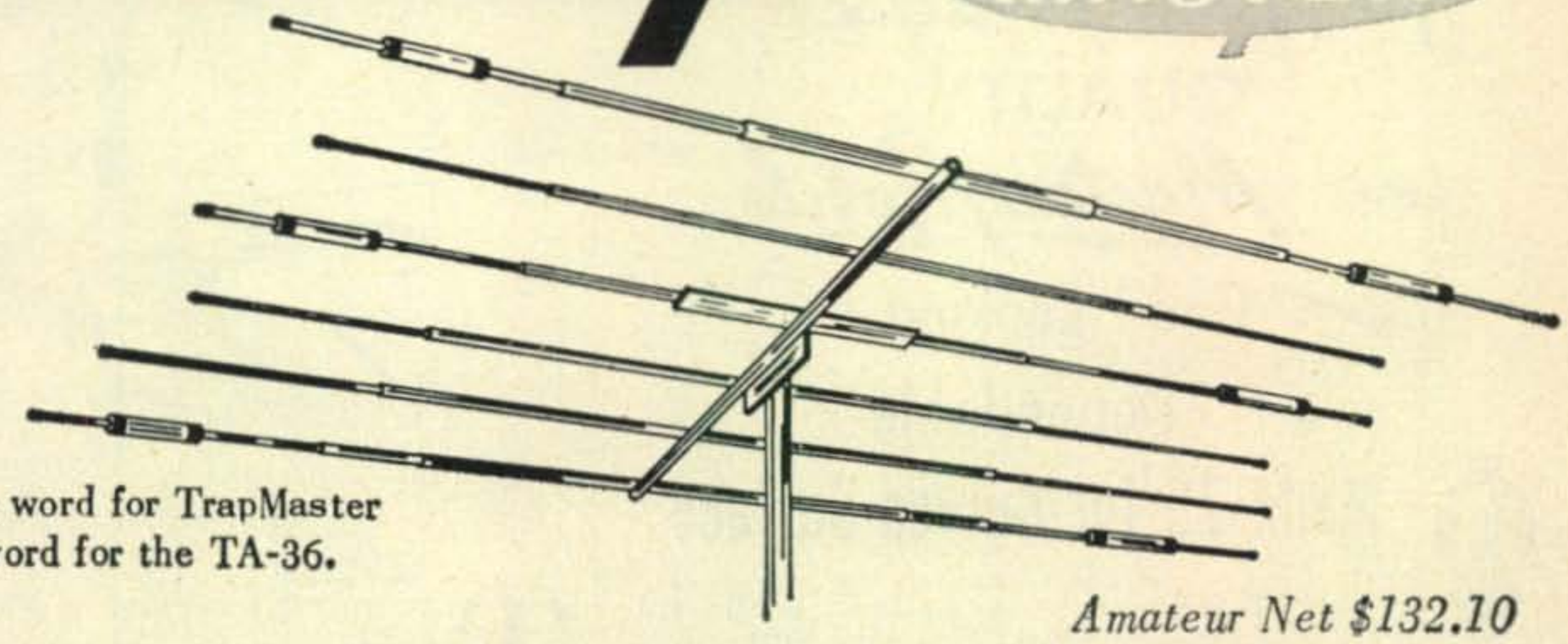


Mosley

TRAP MASTER

MODEL TA-36

for 10-15-20 meters



Incomparable is the word for TrapMaster and terrific is the word for the TA-36.

Amateur Net $132.10

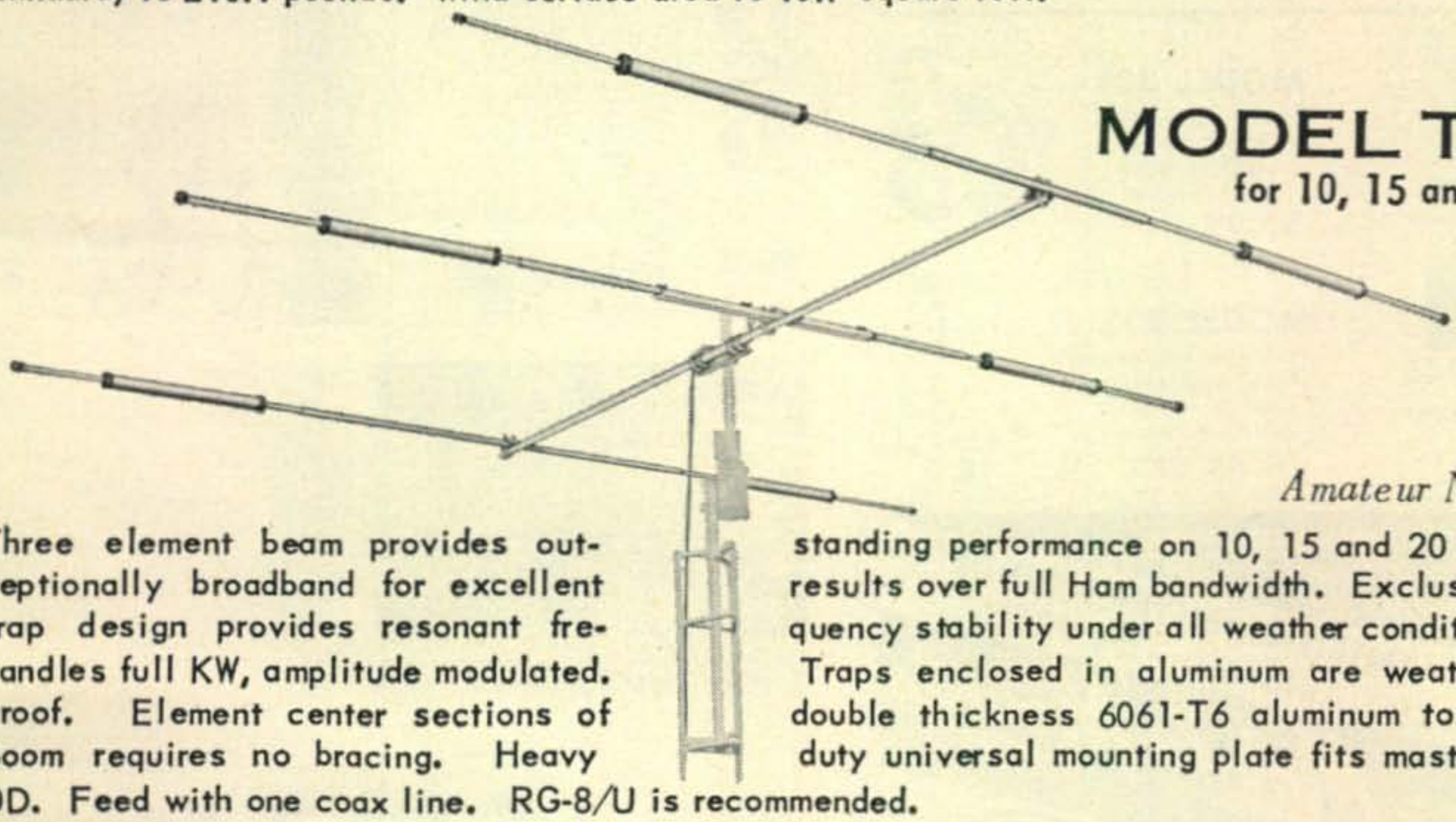
The new clean-line TA-36 . . . the three band beam that will give your signal that DX punch!

This wide spaced, six element configuration employs 4 operating elements on 10 meters, 3 operating elements on 15 meters and 3 operating elements on 20 meters.
Automatic bandswitching is accomplished by means of exclusive design high impedance, parallel resonant "Trap Circuits". Built for operation at maximum legal amateur power.
Traps are weather and dirt proof offering frequency stability under all weather conditions. Just one coaxial feed line is needed. 52 ohm, RG-8/U is recommended.
Antenna comes complete with illustrated instruction booklet and color coded elements for ease of assembly.

SPECIFICATIONS and PERFORMANCE DATA: Forward gain on 10 meters is 9 db., on 15 meters is 8.5 db. and on 20 meters is 8 db. Front-to-back is 20 db. or better on all three bands. SWR is 1.5/1 or better at resonance. Transmission line - 52 ohm coaxial. Maximum element length is 29 feet. Boom length is 24 feet. Turning radius is 19' 3". Assembled weight is 69 pounds. Wind load (EIA Standard) is 210.1 pounds. Wind surface area is 10.7 square feet.

MODEL TA-33

for 10, 15 and 20 meters.



Amateur Net $104.75

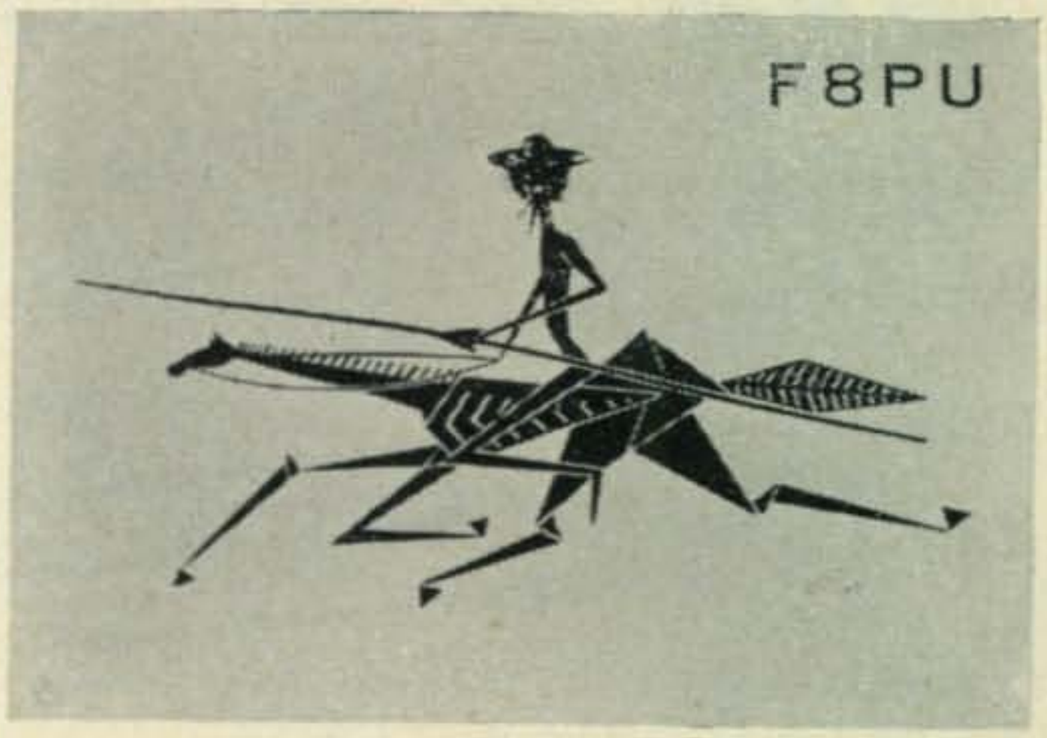
Three element beam provides outstanding performance on 10, 15 and 20 meters. Exceptionally broadband for excellent results over full Ham bandwidth. Exclusive MOSLEY trap design provides resonant frequency stability under all weather conditions. Easily handles full KW, amplitude modulated. Traps enclosed in aluminum are weather and dirt proof. Element center sections of double thickness 6061-T6 aluminum to reduce sag. Boom requires no bracing. Heavy duty universal mounting plate fits masts up to 1½" OD. Feed with one coax line. RG-8/U is recommended.

SPECIFICATIONS and DATA: Fwd. gain up to 8 db. Front-to-back is 25 db. SWR is 1.1/1 or less, at resonant frequencies. Maximum element length is 28 feet. Boom length is 14 feet. Turning radius is 15.5 feet. Assembled weight is 40 pounds. Wind surface area is 5.7 square feet. Wind load is 114 pounds. Shipping weight is 53 pounds.

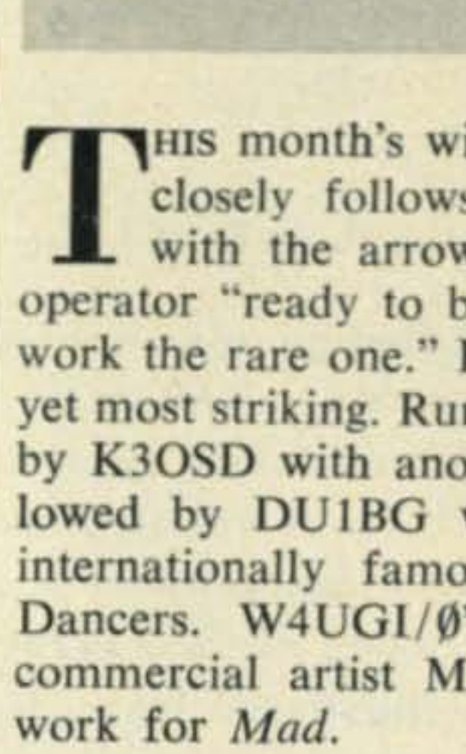
MOSLEY Electronics Inc., 4610 N. Lindbergh Blvd., Bridgeton, Mo., 63044.

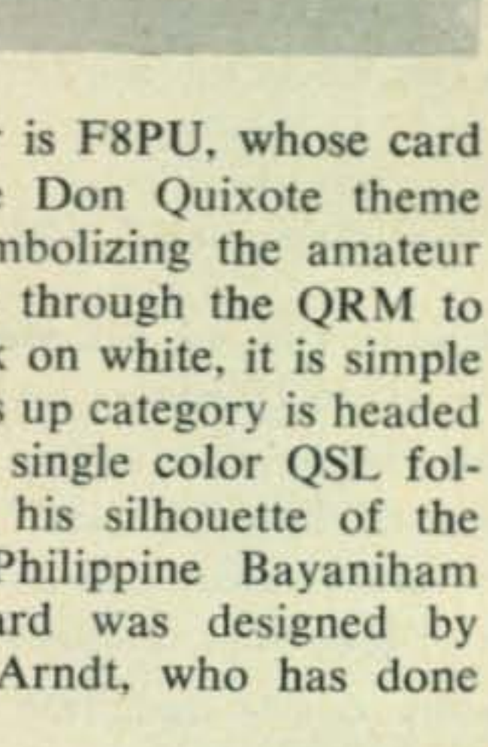
For further information, check number 19, on page 158

QSL contest



THIS month's winner is F8PU, whose card closely follows the Don Quixote theme with the arrow symbolizing the amateur operator "ready to break through the QRM to work the rare one." Black on white, it is simple yet most striking. Runners up category is headed by K3OSD with another single color QSL followed by DU1BG with his silhouette of the internationally famous Philippine Bayaniham Dancers. W4UGI/Ø's card was designed by commercial artist Mike Arndt, who has done work for *Mad*.





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2 great transmitters plus a series of instruments that provide top flight performance, at lowest cost

Eico 720 90-Watt CW Transmitter 'clean' 90W, CW, 65W, AM/ Phone with EXT plate modulation. 80 through 10 meters. Kit **$89.95**; wired **$129.95.**

Eico 723 60-Watt CW Transmitter 'clean' 60W, CW, 50W, AM/ phone with EXT plate modulation. 80 through 10 meters. Kit **$59.95**; wired **$89.95.**

Eico 722 Variable Frequency Oscillator (self powered). Approaches crystal stability. 80 through 10 meters. Kit **$44.95**; wired **$59.95.**

Eico 706 Transistor Code Practice Oscillator Select variable tones, flashing light or both together. Phone jack for private use. Clean, loud signals. Kit **$8.95**; wired **$12.95.**

Eico 730 High-Level Universal Modulator-Driver Delivers undistorted audio for phone operation. Can plate-modulate Xmitters with RF inputs up to 100 W. Unique over-modulation indicator. Kit **$59.95**; wired **$89.95.** E-5 Cover; **$4.50.**

Eico 710 Grid-Dip Meter Continuous coverage 400 kc to 250 mc. 500 μa meter. Includes complete set of coils for full band coverage. Kit **$29.95**; wired **$49.95.**

Eico 430 General Purpose 3" Scope Compact, portable, lightweight. Flat-face CRT; sharp, bright trace. Flat from 2 cps to 500 kc, 25 mv/cm sens. (vert.); 2 cps to 300 kc, .25 v RMS/cm sens. (horiz.). Easy, direct connections to CRT vertical plates. Kit **$65.95**; wired **$99.95.**

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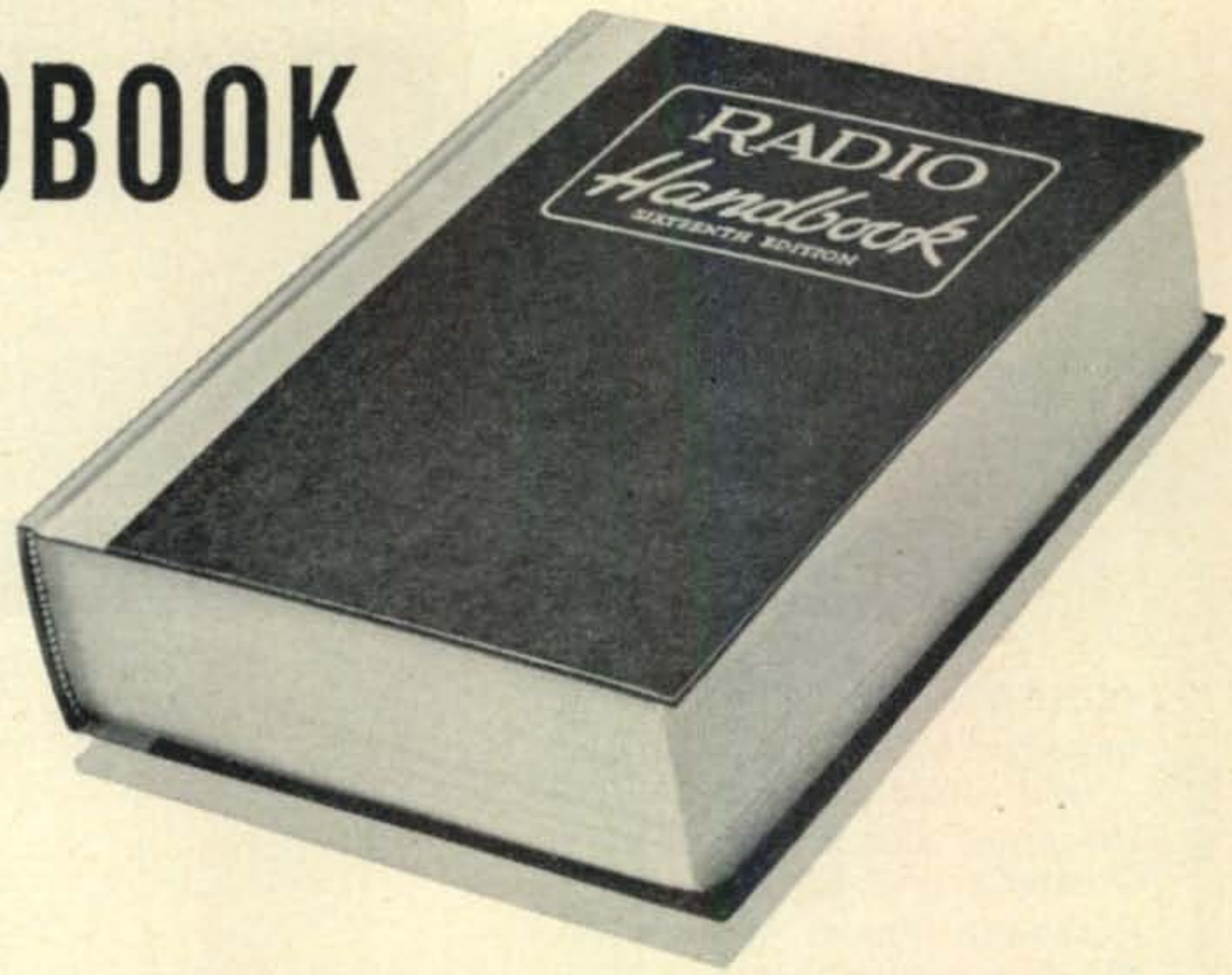
16th EDITION

RADIO HANDBOOK



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All above units are modern in design, and free of TVI producing problems.

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an announcement of significance to all amateur radio operators

The Heath Company takes pleasure in introducing on the following pages, the first of a complete series of fully integrated SSB amateur radio equipment that will set new standards for value, quality, style, and performance. To be designated the Heathkit SB Series, these products represent a major step forward in amateur radio SSB equipment. Now, the best in SSB design features are combined with Heathkit's leadership in electronic kit techniques to bring maximum performance and operating convenience to amateurs at modest prices.

What design features are essential or desirable for the best SSB performance? Some of the more important ones are high mechanical and electrical frequency stability achieved only by employing crystal-controlled heterodyne circuitry with low frequency variable frequency oscillators, optimum receiver selectivity and minimum transmitted signal bandwidth obtainable by means of the excellent shape factors exhibited only by crystal or mechanical filters, linear tuning with 1 kc dial calibration, smooth anti-backlash dial, automatic level control, small size, and light weight. The SB Series has all these plus the several improved and unique features listed below.

To provide even better performance plus maximum ease of assembly, these new Heathkit SSB products also feature linear dials providing 500 kc frequency coverage per bandswitch position while maintaining 1 kc calibration marks spaced approximately ⅛" apart, a high frequency bandpass IF (8.4—8.9 mc) for improved image rejection and suppression of spurious responses, preassembled and prealigned LMO (linear master oscillator), circuit boards and wiring harnesses, plus specially tooled cabinet, knobs, dial mechanism, and LMO components. When the transmitter and receiver are operated in the transceive mode, in addition to the usual practice of employing a common VFO and high frequency oscillator, the receiver BFO is used as the transmitter carrier oscillator to prevent even minute frequency changes between transmit and receive due to crystal tolerances. This attention to detail is typical of the careful, thorough engineering behind the Heath SB Series.

Only Heathkit experience and know-how can provide the engineering and manual skills necessary to bring such quality and performance to kit-form SSB equipment. Despite this background, Heath engineers spent over two years in the design of the equipment, and the developing and specifying of the critical components (such as the LMO, crystal filters, and dial mechanism). Only the most capable manufacturers have been selected to supply the special components and, as always, only the highest quality parts are employed throughout.

Carefully read the features and specifications of the SB-300 SSB Receiver described on the next two pages. The entire SB Series will exhibit all these fine performance characteristics using the same basic critical components in equipment covering all amateur interests.

HEATH COMPANY

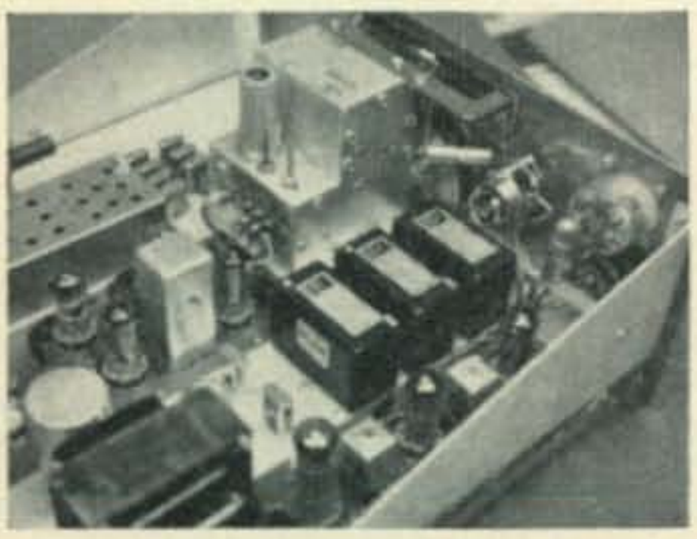
Benton Harbor, Michigan

HEATHKIT® by Daystrom

the deluxe HEATHKIT® SB-300 SSB RECEIVER

$264.95

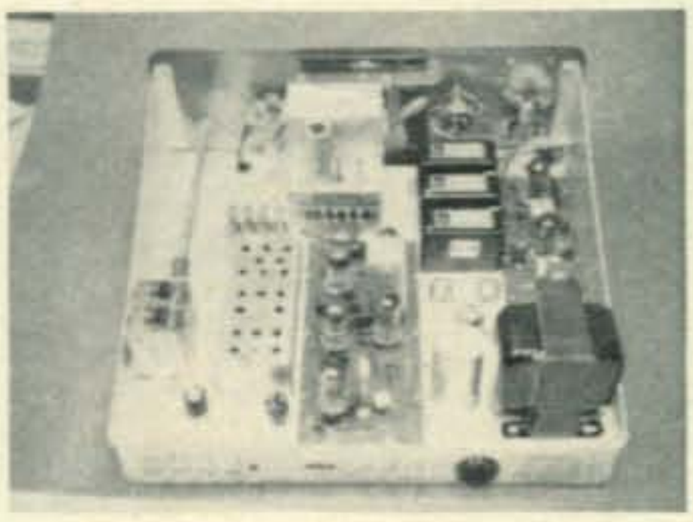
deluxe features for finest performance



Precision-built Linear Master Oscillator (LMO) is completely assembled and calibrated, ready to install; specially designed dial assures accurate readout and smooth frequency control.

Prebuilt, hermetically-sealed 2.1 kc crystal band-pass filter for SSB provides the excellent nominal shape-factor of 2:1 (60/6 db). Optional AM and CW filters shown installed.

Two heavy-duty 3/32" circuit boards and pre-cut, cabled wiring harness maintain a clean, uncluttered layout for fast, easy assembly, years of faithful performance.



All adjustments are conveniently made from the top of the chassis; chassis screening clearly identifies coil and tube locations, etc. Entire top of ventilated cabinet opens for easy access.

SB-300 features

- Complete coverage of 80 through 10 meter amateur bands with all crystals furnished, plus provision for VHF converters
- Crystal-controlled front-end for same tuning rate on all bands
- 1 kc dial calibrations — 100 kc per dial revolution provides band spread equal to 10 feet per megacycle — tuning knob to dial ratio approx. 4:1
- Provision for transceive operation with matching SB-400 Transmitter (available soon)
- Prebuilt linear master oscillator (LMO), wiring harness and two heavy-duty circuit boards for fast, easy assembly
- Professional styling and features throughout for finest HF and VHF amateur band communications

Experienced amateurs will especially appreciate the careful attention to detail behind the design of the SB-300. Its many features include a crystal controlled front-end that provides the same tuning rate on all bands, a prebuilt Linear Master Oscillator (LMO) for linear tuning with 1 kc dial calibrations, built-in crystal calibrator and 2.1 kc crystal-lattice bandpass filter, a smooth, non-backlash vernier dial drive mechanism, and a beautifully styled cabinet and panel. Cabinet top opens completely for easy access to top chassis components. Optional AM and CW filters are low-cost and easily installed, their steep-sided bandpass eliminates, not merely attenuates, adjacent interfering signals for exceptional reception.

Circuit features include a high frequency I.F. for maximum I.F. and image rejection, audio inverse feedback, fast-slow-off AGC control, stability of 100 cps after warmup, and a host of other deluxe features that assure finest communications results. Order your SB-300 now for 60% savings over comparable factory-built receivers! A matching Transmitter, 1 KW Linear Amplifier, and an All-Band SSB Transceiver will be available soon!

Kit SB-300....17 lbs.....no money dn., $25 mo..... **$264.95**
SBA-300-1 CW Crystal Filter (400 cps)....1 lb..... **$ 19.95**
SBA-300-2 AM Crystal Filter (3.75 kc)....1 lb..... **$ 19.95**

Check the superb specifications below and see what a tremendous dollar value the SB-300 represents!

Frequency Range (megacycles): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 8.25, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megacycles. **Frequency stability:** 100 cps after warmup. **Visual dial accuracy:** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps on all bands. **Backlash:** No more than 50 cps. **Sensitivity:** Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation. **Modes of operation:** Switch selected: LSB, USB, CW, AM. **Selectivity:** SSB: 2.1 kc at 6 db down, 5.0 kc at 60 db down (crystal filter supplied). AM: 3.75 kc at 6 db down, 10 kc at 60 db down (crystal filter available as accessory). CW: 400 cps at 6 db down, 2.5 kc at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Audio response:** SSB: 350 to 2450 cps nominal at 6 db. AM: 200 to 3500 cps nominal at 6 db. CW: 800 to 1200 cps nominal at 6 db. **Antenna input impedance:** 50 ohms nominal. **Muting:** Open external ground at Mute socket. **Crystal calibrator:** 100 kc crystal. **Front panel controls:** Main tuning dial; function switch; mode switch; AGC switch; band switch; AF gain control; RF gain control; preselector; phone jack. **Rear apron connections:** Accessory power plug; HF antenna; VHF #1 antenna; VHF #2 antenna; mute; spare; anti-trip; 500 ohm; 8 ohm speaker; line cord socket; heterodyne oscillator output; LMO output; BFO output; VHF converter switch. **Tube complement:** (1) 6BZ6 RF amplifier; (1) 6AU6 First mixer; (1) 6AB4 Heterodyne oscillator; (1) 6AU6 LM osc.; (1) 6AU6 second mixer; (2) 6BA6 IF amplifier; (1) 6AU6 Crystal calibrator; (1) 6HF8 1st audio, audio output; (1) 6AS11 Product detector, BFO, BFO amplifier. **Power supply:** Transformer operated with silicon diode rectifiers. **Power requirements:** 120 volts AC, 50/60 cps, 50 watts. **Dimensions:** 14-7/8" W x 6-5/8" H x 13-3/8" D.

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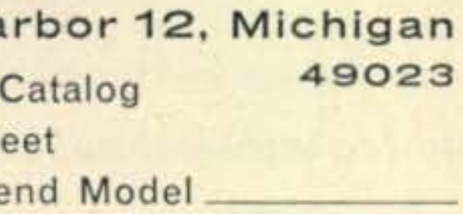

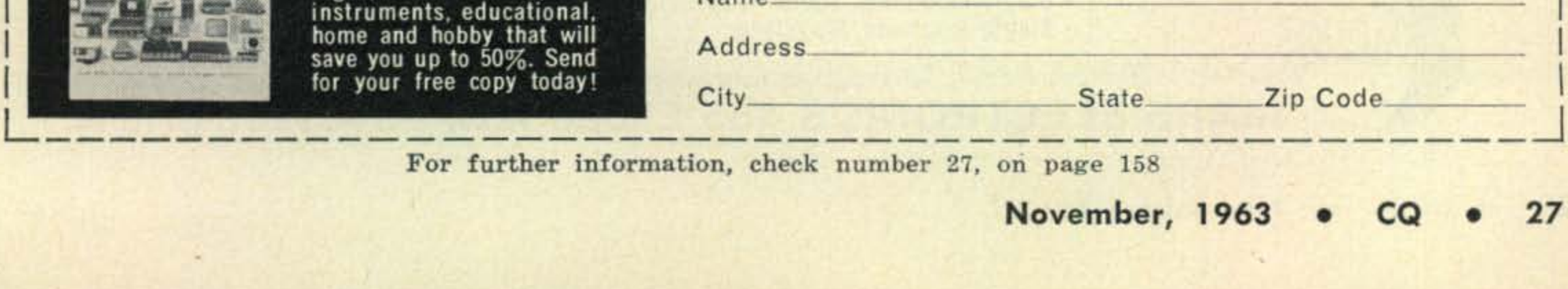

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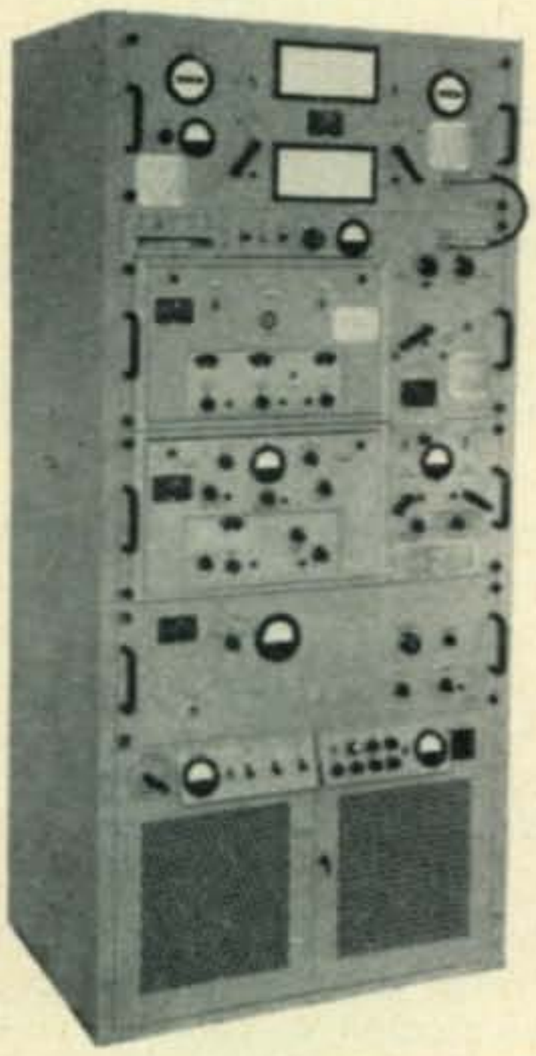

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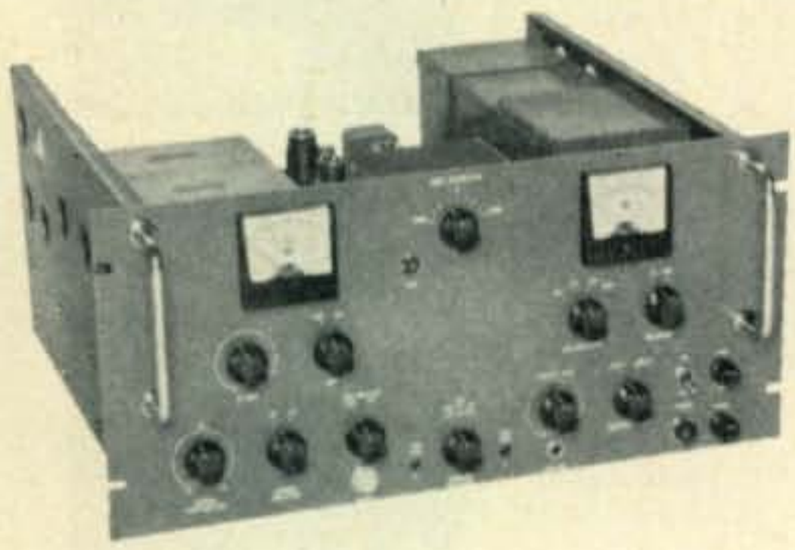

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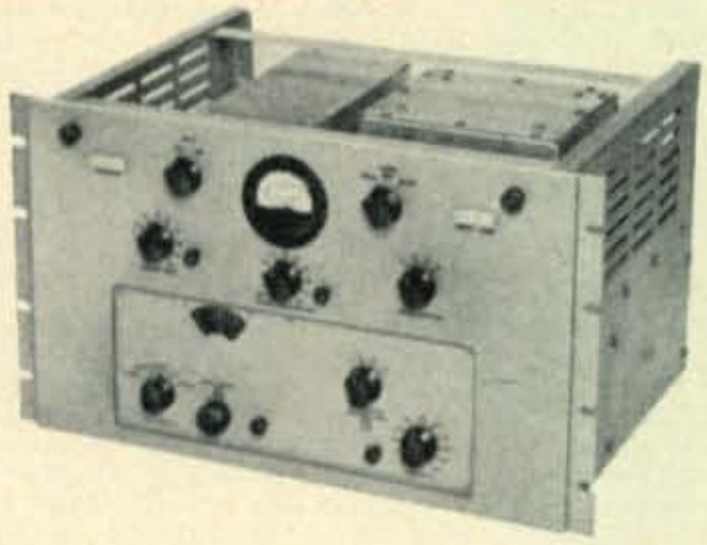

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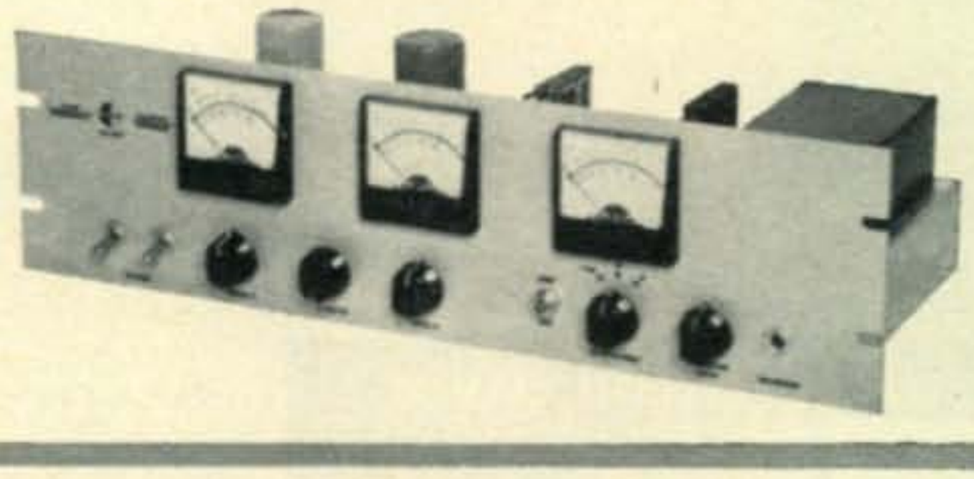

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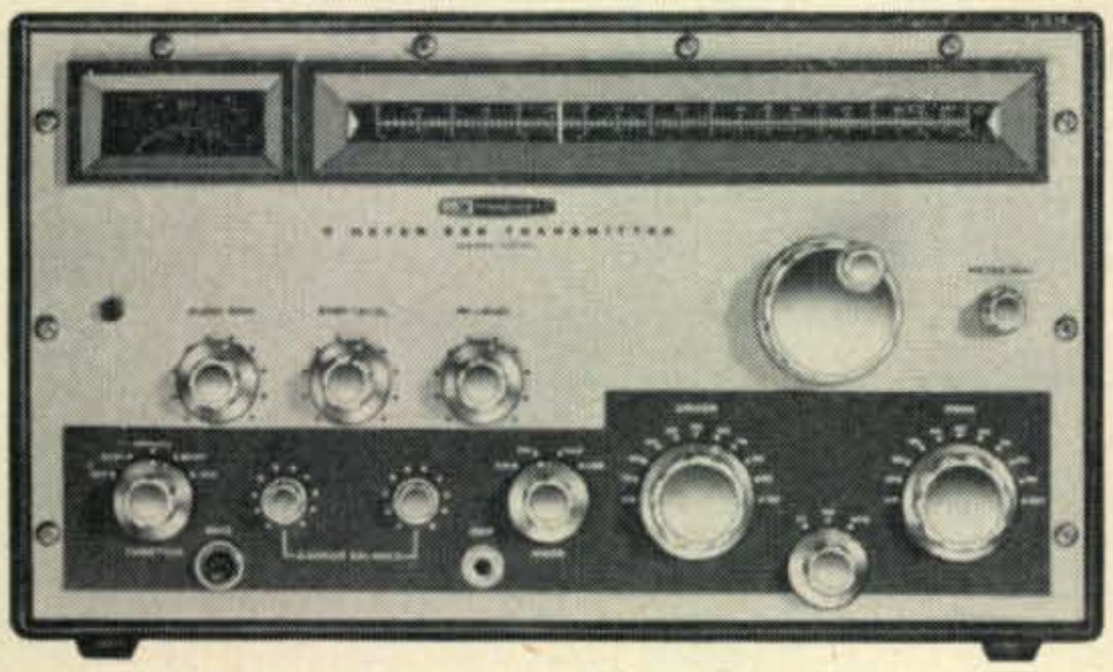

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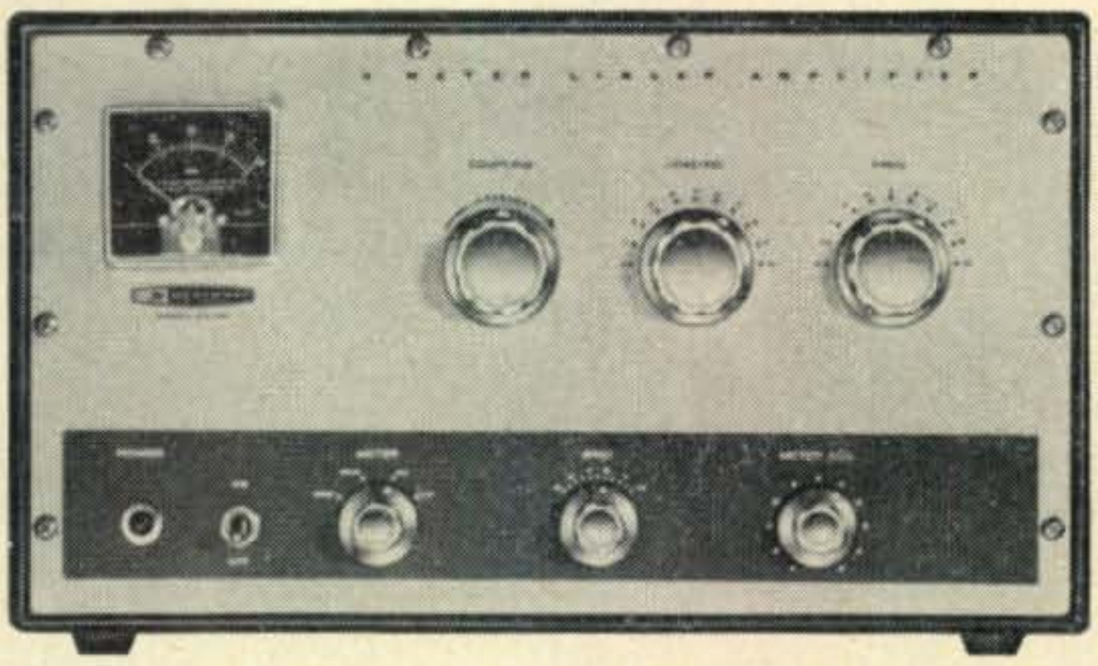

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• *Special Thirty-Three Page Supplement* •

TOOL & WORKSHOP PRACTICES FOR THE RADIO AMATEUR

The Special November issue of CQ *has, in the past few years, featured at least one subject of great interest to amateurs. This year's Special emphasizes tools and workshop practices. We know the material presented will be of great interest and value to all those engaged in this most fascinating of all hobbies.*

If, in scanning the following pages, a single bit of useful information is uncovered, then our efforts will have been justified. We hope, though, that this issue of CQ *will prove so valuable that it will be retained and referred to often in the coming months.*

The credit for "Tools & Workshop" goes to Wilfred M. Scherer, W2AEF, certainly no newcomer to the pages of CQ. *Bill's painstaking research and wonderful eye for detail combine to make the section as complete and accurate as space allows. We wish also to express thanks to the Service Tools Institute, the various tool manufacturers and interested amateurs for their guidance and assistance in the preparation of the following material.*

General Tools for Electronics

A GOOD job cannot be done easily in any type of construction unless the proper tools are used; but having these available is not the entire answer unless one has the ability and knowledge to use them properly. Space will not allow a detailed treatise on the subject, so only a condensed run-down will be given about the use and selection of the major tools needed under several sets of circumstances. Since all the available types of tools cannot be listed, it is suggested that the catalogues of the various tool manufacturers be consulted for the many others which are not covered here.

Working Conditions

Before proceeding further, it should be pointed out that proper working conditions are an important consideration. In this regard, the constructor should have plenty of clear bench space available with a comfortable chair or stool at a height which affords a good reach over the entire work area and which enables one to maintain a comfortable working position.

Good lighting is another important requisite. Electronic construction or repair often involves work in hard-to-see and in hard-to-reach places. A movable or portable clip-on flexible desk or bench lamp of 60 to 100 watts will be helpful in this respect, as it will allow the light to be directed at a particular area.

Categories of Work

There are three general categories of work which will be involved. The first concerns the assembly of equipment such as pre-fabricated kits. A bare number of basic tools is required; however, additional optional tools can help make the work easier. The second group includes the tools needed for general maintenance of electronic equipment or for simple modifications. The last group concerns tools needed for complete fabrication starting from scratch.

Besides selecting the right tools for a particular job, those of high quality should be considered. It will be found well worth the higher price one might have to pay for such a tool, as it will last longer and give better service than will a cheap product of inferior quality. The buyer should beware of the cheap imported tools currently flooding the market. The selection of a tool is best made according to the way it feels to the individual user.

Tools Needed For Assembling Kits

The basic tools required for the assembly of prefabricated equipment, such as kits, are illustrated in fig. 1 and are discussed below.

Soldering Iron: In general, a small-tipped 25 to 60-watt pencil iron or standard type iron, or a lightweight soldering gun of 90 to 100 watts will be satisfactory. The choice will depend on individual preferences, as well as on the type of kit work involved. A more detailed discussion will be found in "Soldering."

Screwdrivers: Screwdrivers with insulated handles should be selected. A ⅛" × 4" size will be

handy for adjusting set screws in knobs or for other small screws. (⅛" is the width of the blade tip; 4" is the blade length.)

A 3/16" × 4" size will be suitable for tightening the most commonly used screws, sizes #3, #4 and #6. It may also be used with #8 screws if care is taken to prevent slipping. However, a ¼" × 6" screwdriver will tighten this size screw more securely and will do so without risk of slipping.

A screwdriver should be chosen which fits completely and snugly into the screw head over the full length of the slot. It should be seated properly at the center of the slot with the blade in line with the screw and be turned using a heavy and steady pressure against the screw. See fig. 2. A worn-out screw driver with a chisel or rounded tip will easily slip and should not be used.

Long-nose Pliers: These pliers are used for bending or forming wires, wrapping leads around terminals or gripping wires for other needs. The 5 or 6-inch long-nose type (also called chain nose or needle nose) are most commonly used.

Long-nose pliers also may be used for holding or starting small nuts, particularly in hard-to-reach places. Their use for *tightening* nuts, especially large ones, is not recommended since the tool may slip easily or the jaws may be sprung.

Diagonal or Side Cutters: This tool is used for cutting wires or component leads to length, or for trimming off wire ends after components have been connected. A 5 or 6 inch size is generally used. When purchasing cutters make sure that the two cutting edges make contact with each other, especially near the tip, so that small size wires may easily be nipped.

The cutters also may be used for stripping plastic insulation from wires. This is done as follows: With the back of the tool facing the end of the wire, lightly clamp it at the point where the insulation is to be cut, but do not exert pressure to cut into the wire. Hold the wire firmly in the other hand and, without exerting any more pressure on the cutter, pull the cutter and the insulation toward the end of the wire.

Some types of long-nose pliers include a side-cutter, near the throat, which is handy for cutting free leads to length, but is awkward to use in close quarters. A more suitable tool is the nose-cutting plier described in "Special Tools."

When heavy wire is to be cut with the diagonal cutters, the cutting should be done near the throat of the tool and should not involve wires larger than about #12. The cutters never should be used for shortening machine screws since this will permanently damage the cutting edges or break the tool. They will not do a clean job of screw cutting anyway.

Slip-joint Pliers: Slip-joint pliers often are called combination pliers. They are used as a general utility tool for holding or tightening nuts, for minor bending operations, for holding heated objects, *etc*. A straight, thin-nose 6-inch size generally is used. Some types also include a side-cutter or a throat-shear. This may be used for cutting screws or large size wire; however, when used on screws, the shearing action will require cleaning up the end of the screw with a file.

These pliers will be found useful for tightening larger size nuts such as found on controls and switches. Such nuts usually are quite thin, so care must be taken to get a good grip with the pliers to reduce the possibility of slipping and damaging components. A better grip can be had by slipping the joint of the pliers to the open position placing the jaws more nearly parallel.

To prevent damage, in the event the pliers should slip or rub against the panel, it will be a good idea to use a thin cardboard or heavy paper washer around the nut and placed between the tool and the panel.

Solder: Solder is supplied with many kits, but

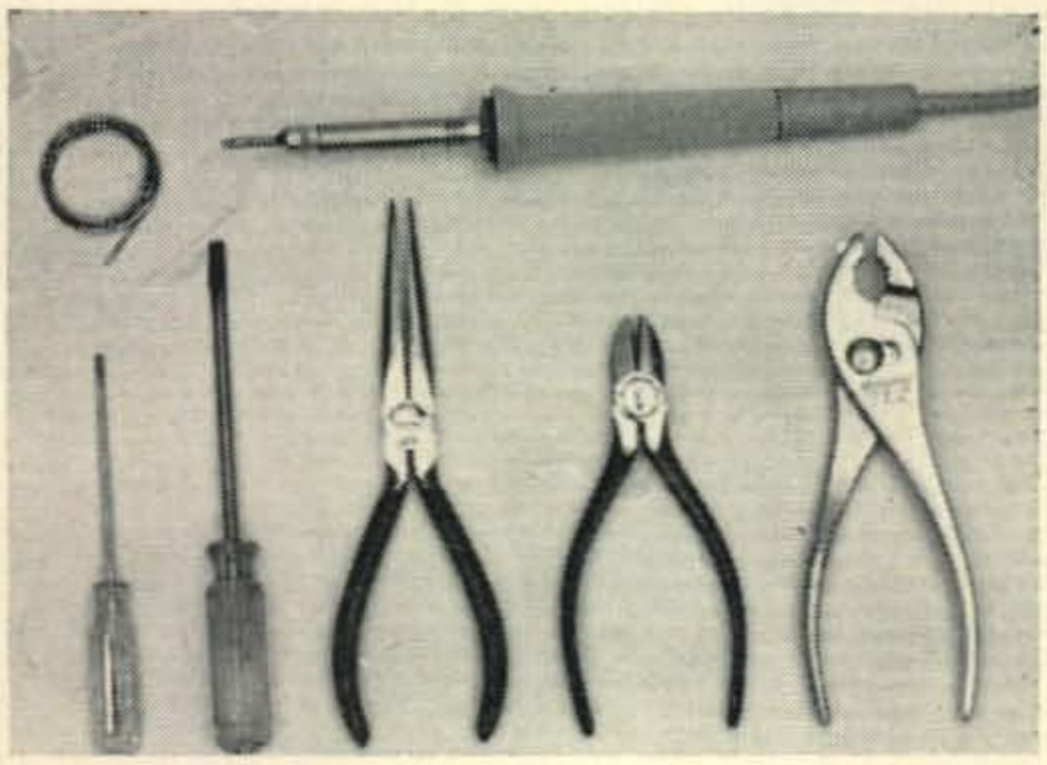


Fig. 1—Pictured in top row, left to right: rosin core solder, light duty pencil-type soldering iron. Bottom row, left to right: ⅛" blade screw driver, 3/16" blade screwdriver, long nose pliers, diagonal cutters and combination wrench.

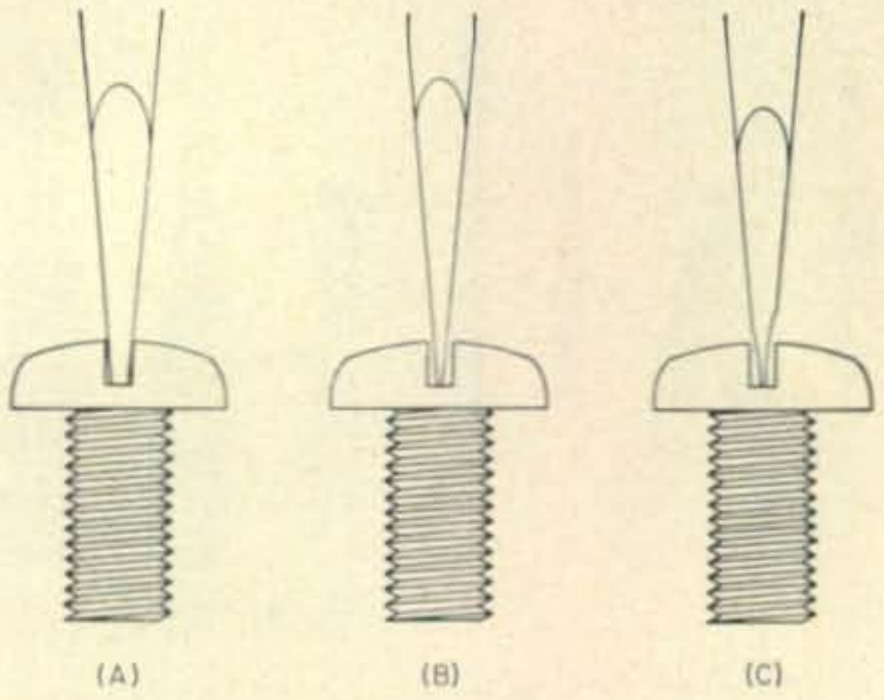


Fig. 2—Properly seated screwdriver is shown at (A). Too small a blade, shown at (B), and a worn out chisel-shaped or pointed blade, shown at (C), will grip poorly and slip easily.

if it is not, a 1/16" diameter *rosin-core* solder, having a tin-to-lead ration of 60/40, 55/45 or 50/50 should be obtained. *Acid core solder never should be used on electronic equipment.* See the discussion in "Soldering."

Optional Tools for Kit Work

The following optional tools, which are illustrated in fig. 3, are additional ones which will make kit work more convenient:

Penknife: A penknife may be used for stripping insulation from wire, but take care not to cut into or knick the wire. The penknife also will be handy for stripping the outer covering from coaxial cable and for scraping enamel from wire. It also can serve as an aid when connections are unsoldered and removed, as described in "Soldering."

Wire Stripper: This tool is used for stripping insulation from wire without danger of breaking or nicking the wire. The strippers usually are an adjustable type which can be used with various size wires. They are particularly handy for use on wires already installed in a chassis, and also may be used for wire cutting. A special type is made for use on shielded cable as shown in "Special Tools."

Nut Starter: This device provides an easy means for starting nuts on screws, especially in hard-to-reach places. It is sometimes supplied with kits in the form of a piece of plastic tubing, one end of which accommodates #6 nuts and the other #4.

Long-nose pliers also can be used, but are not as convenient. Household matchsticks may serve the purpose by inserting the wooden end partly into the nut hole for gripping the nut.

Another type of nut starter is one which fits over the finger as a thimble, the sides of which have depressions for holding various size nuts.

Adjustable Wrench: This type wrench has a parallel set of jaws which may be adjusted for use with different size nuts. A 6-inch model will handle up to ⅞-inch nuts. This tool is especially useful with large nuts and is better to use than slip-joint pliers. A firmer grip can be had on the nut with less danger of slippage. Use of a thin cardboard protective washer around panel-mounted nuts, as described earlier, will reduce the chances of marring the panel.

When an adjustable wrench is used, it should be placed on the nut so that the force, used to turn it, is applied to the stationary side of the wrench as shown in fig. 4. It should be adjusted to fit snugly on the nut to prevent slipping. Never use an adjustable wrench in place of a hammer!

Nut Drivers: Nut Drivers are often called socket wrenches or Spintites. Each one consists of a hexagon-shaped "socket," located at the end of a round shank having a screw-driver type handle. They fit completely and snugly over a nut to obtain a firm grip on it for turning without slippage or damage and are especially handy in hard-to-reach places, as well as for ensuring positive tightening or loosening action.

Nut drivers are made in fixed sizes for nuts of different dimensions. The most commonly used sizes are 3/16" and 1/4". They are also available in sizes ranging from 7/64" up to 5/8". Types with hollow shafts will facilitate use with nuts on long protruding screws. This tool also can serve as a nut starter.

Nut drivers may be obtained separately or in complete sets with a convenient stand or pouch for storage and ease of selection. A quality product is a must. Cheaper varieties either do not seat properly around a nut or wear out quickly.

Tools Needed For General Maintenance

The General Maintenance classification concerns the tools needed for the repair and care of existing equipment. The tools listed in the previous groupings will be required, and the following additions, shown in fig. 5, are suggested:

Soldering Gun: It often happens that a repair job must be made rather quickly, in which case, a soldering gun will be quite handy, since it may

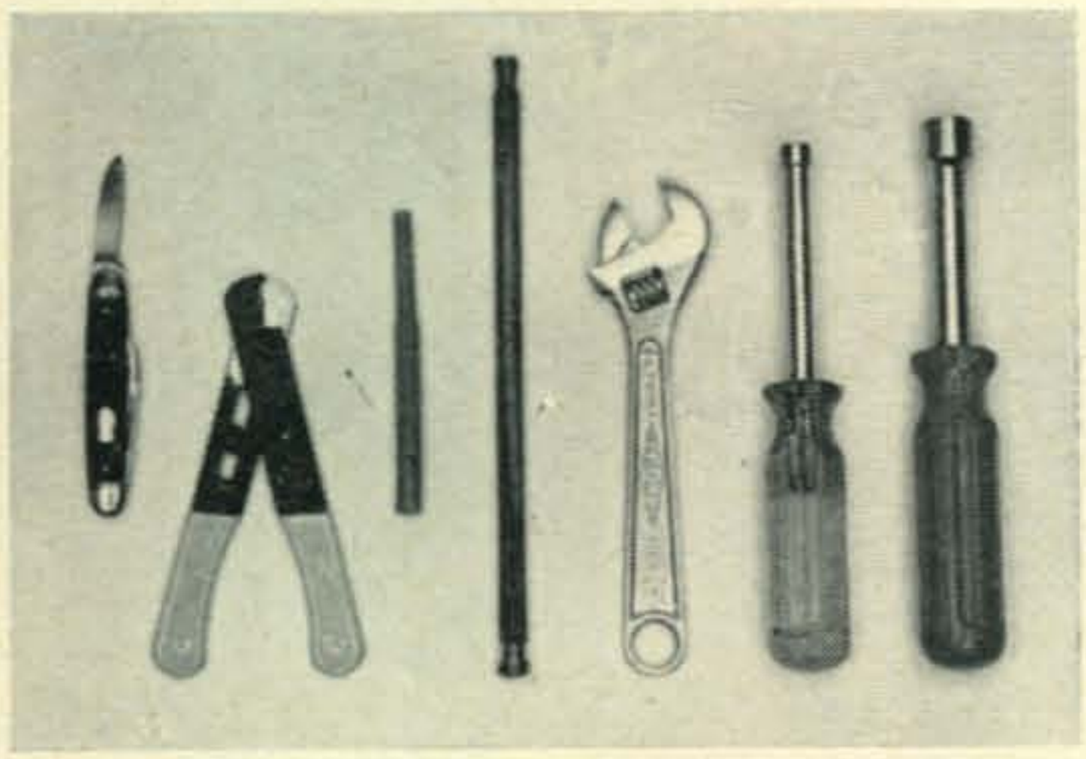


Fig. 3—Pictured left to right: penknife, a simple adjustable wire stripper, plastic type nut starter, nut starter with coil spring at each end to grip ¼" and 5/16" nuts, 6" adjustable wrench and two different size nut drivers.

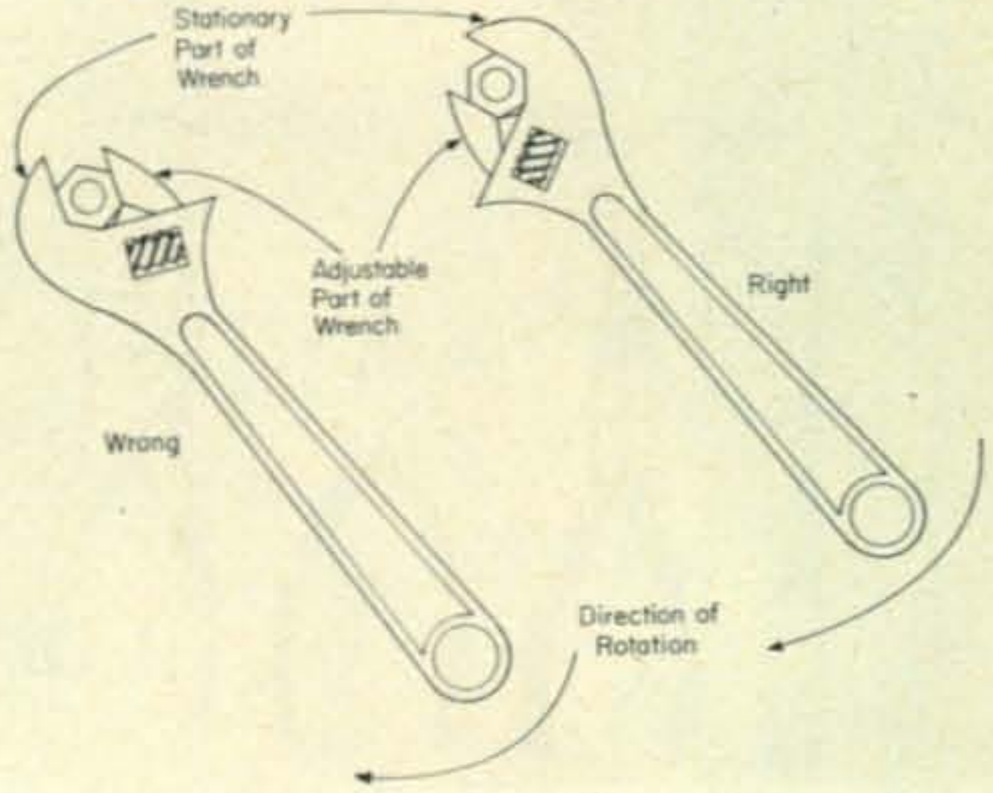


Fig. 4—Proper position for adjustable wrench when used for tightening nut is shown at the right. The force used to turn the nut is applied to the stationary jaw of the wrench. Improper position is shown at the left where the force is applied to the adjustable jaw.

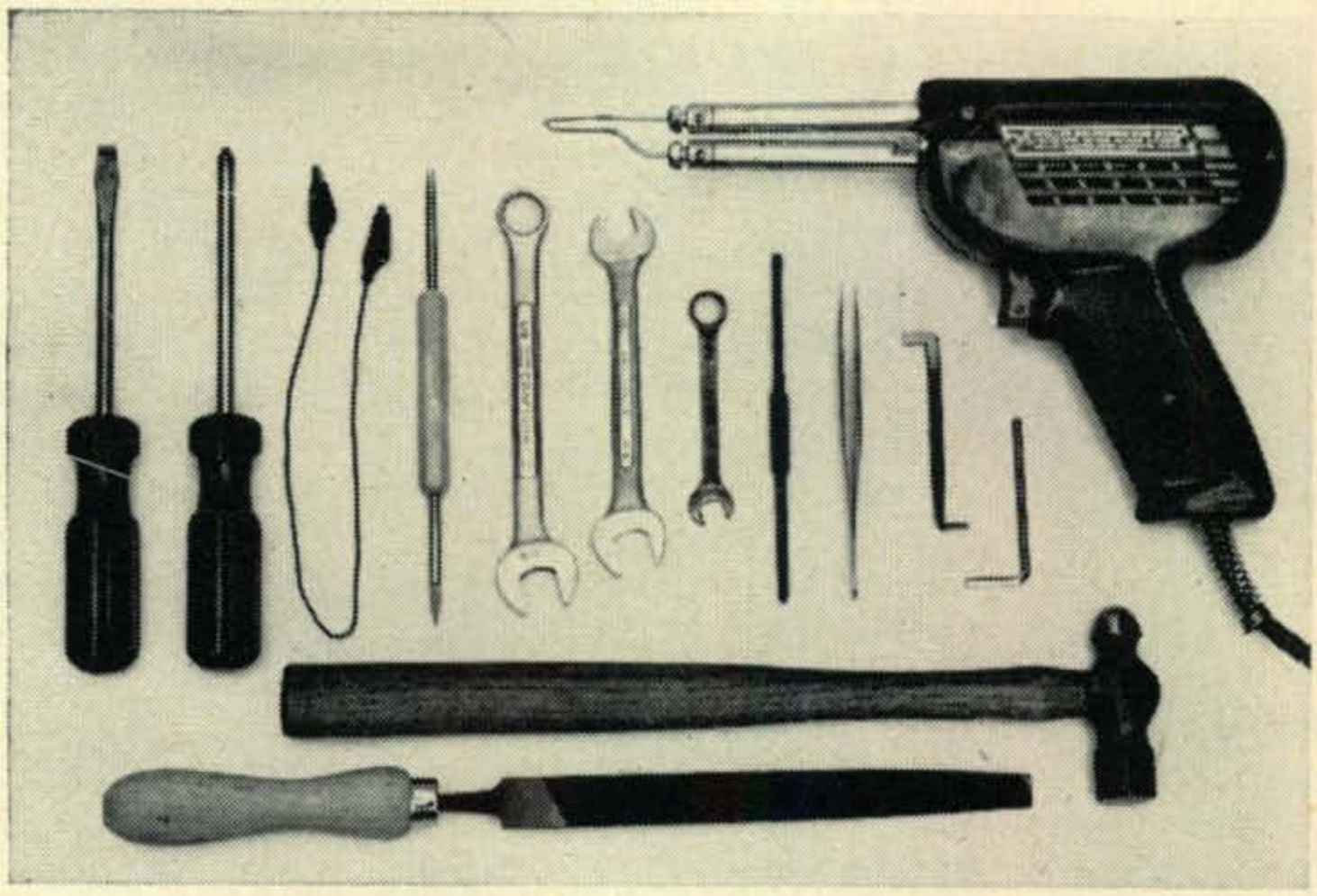


Fig. 5—Pictured left to right: ¼" blade screwdriver, Phillips-head screwdriver, 12" clip lead with miniature clips, soldering aid, combination open end and box wrench, double open end wrench, ignition-type wrench, one type of alignment tool, tweezers, offset screwdriver and hex or Allen head wrench. Top right: soldering gun. Bottom: ball peen hammer and single-cut file.

be heated almost instantaneously, will get into most spots readily and will be heavy enough for most applications. This is covered more fully in "Soldering."

Screwdrivers: A heavy duty screwdriver ¼" × 6" or 5/16" × 8" will be found helpful with large screws. They are also available with square shanks, instead of round ones, to enable the use of a wrench with the screwdriver for added torque.

A 3/32" × 3" size will be a handy addition for very small set screws.

It is desirable to have drivers for Phillips-head type screws, sizes 1, 2 and 3 (size 0 and 4 optional). The correct size screwdriver *must* be used for these screws if slipping and abnormal wear is to be avoided. The Phillips screwdriver should be fully seated and tight in the screw head for proper use.

Off-set Screwdrivers: The ends of off-set screw drivers are bent at a right-angle to permit operation of a screw in small spaces or around corners where a straight-shank type will not fit. They are available for use with either slotted or Phillips-head screws. A more convenient tool for close-quarters work, however, is a ratchet-type offset screwdriver.

Hex Keys: Hex keys are commonly called Allen wrenches, because they are used on Allen head screws which have hex-shaped slots. The keys usually are L-shaped, which in some cases makes them awkward to use, so a straight-shank type Hex driver sometimes will be more convenient to use. See "Special Tools." Hex keys should be obtained for screw sizes 4, 5, 6, and 8. Optional sizes are for #10, ¼" and 5/16" screws.

Tweezers: A pair of tweezers will be handy for retrieving small parts from hard-to-reach spots, for holding small wires during soldering or for use as a heat sink. For use as a heat sink a side-lock or self-closing tweezer will hold onto the lead, leaving one's hand free.

Other uses are for holding cemented parts together, as an aid for stringing dial cordsd or for starting nuts in tight spots.

Open-end Wrenches: Open-end wrenches have fixed jaw sizes ranging from 13/64" to 7/16" and are used for tightening nuts and capped screws. They are more convenient to use in close quarters than an adjustable wrench and they insure a tight fit around the nut, providing better leverage and minimizing the possibility of slipping. The thin type wrenches will be best for use with electronic gear.

Instead of an open jaw at each end, combination type wrenches are available which have a box-head (or hex head) at one end which can provide a more exact and sure fit to a nut, will get into smaller spaces better and which may be operated from several different angles. Certain "ignition-type" wrenches are made this way and are also very thin.

Small Vise: A small clamp-on type bench vise, or a machinist's drill-press or table vise, will be handy for holding wires, cable connectors or other small parts when leads are being soldered to them.

The clamp-on type vise may be readily secured to any point along the edge of the bench where needed. The drill press type may be placed on top of the bench for holding the small parts,

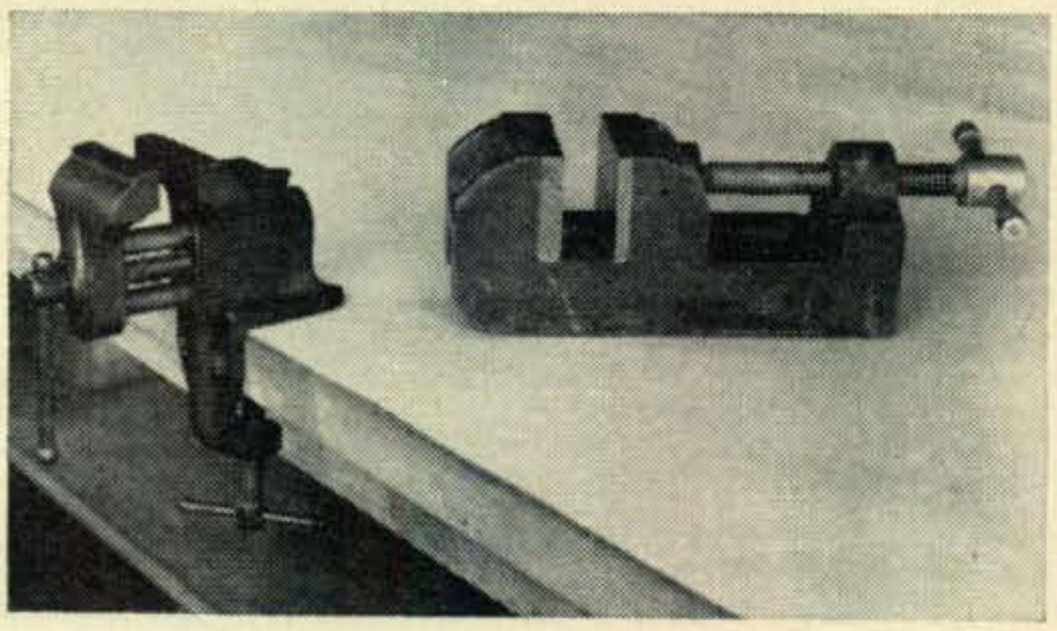


Fig. 6—Portable clamp-on vise is shown at the left with table-top or drill-press vise on the right.

especially round ones during drilling and for use in bending small metal parts as explained in "Bending Metal."

Alignment Tools: Alignment tools will be needed for adjusting r.f. coils, i.f. transformers, *etc.* There are so many types and sizes that a complete listing is impractical here, nevertheless, some of the commonly required ones are: .075" and .125" hex nylon type, blade type duplex aligner with guide cap for slugs having #4 or #6 metal screw studs, and the K-Tran i.f. aligner.

It is important that the correct size and shape aligner be used for powdered-iron cores in which the tool must seat directly; otherwise, the core slot may be damaged, making adjustment impossible.

Many of the hex-type aligners are shaped so that both top and bottom cores of a transformer may be adjusted from the top of the can. The bottom core is reached by passing the tool through the top core until it engages the bottom one.

File: *A* small single-cut file will be handy for smoothing off rough metal edges. Files are discussed in more detail later.

Hammer: A ball-peen type hammer will occasionally be useful. One with about an 8-ounce head will do.

Soldering Aid: A soldering aid is used to facilitate the removal of leads wrapped around terminals as they are being unsoldered. A penknife can be employed, but special tools made for the purpose make work easier. These are described in "Soldering."

Miscellaneous Items

The following items are not tools, but they should be on hand for use in maintenance work:

Volt-ohmmeter: The use for this is obvious in connection with checking potential, current, resistance and continuity.

Clip Leads: Six or more clip leads will be helpful for making temporary test connections or for jumpers. They should be made of stranded and insulated wire with an insulated clip at each end. Alligator clips usually are used, but the smaller pee-wee types will be better in cramped spots. Color-coded leads will be helpful for keeping track of temporary connections.

Hook-up Wire: A small supply of hook-up wire will be needed for general maintenance. Two spools of wire insulated for 1000 volts in wire sizes #18, 20 or 22, one in black, the other red should be adequate.

Shielded Wire: Shielded wire will be required for replacing certain a.f. and, r.f. leads. These usually will be single-conductor type, for which RG-58A/U may be used as an emergency substitute.

Electrical Tape: Plastic electrical tape, ½ or 1 inch width, may be used for insulating spliced joints, repairing frayed insulation, tieing wires together (such as may be needed in a harness), and for other applications where a surface has to be insulated.

Cement: A quick-drying cement can be used for repairing broken non-metallic parts, or for securing wire on coil forms. Household cement will be satisfactory for most applications, but special types are available for use on various plastics and for coating coils.

Assorted Hardware: Assorted hardware will be needed which includes #4, 6, 8 and 10 nuts, screws, lockwashers, flatwashers, soldering lugs, *etc.*

Tools for Complete Fabrication

Besides all the tools listed in the previous categories, the following ones, illustrated in figs. 7 through 10, should be included for use in building electronic equipment from original plans, which will mostly involve the working of metal chassis, brackets, shields, panels, *etc.* Only the more essential items are given.

Combination Square: The combination square consists of a right-angled head which slides on a steel rule. The rule, which is removable, usually has four scales separately calibrated in increments of 1/64", 1/32", 1/16" and 1/8" to accurately measure off distances along a surface. Use of the combination square is shown in "Chassis Layout."

Steel Tape Measure: A 72-inch flexible-steel tape measure will be found useful for measuring off large dimensions. It is made of thin tempered spring steel which allows it to be bent over round surfaces. On the other hand, a six-inch steel rule will be handy for short measurements and it may be conveniently carried in a pocket.

Metal Scriber: A metal scriber is a sharp-pointed pencil-like piece of steel. It is used for marking lines on metal and is far more accurate than a lead pencil.

A metal scriber should never be used as a pry or a punch.

Dividers: Dividers are used for measuring

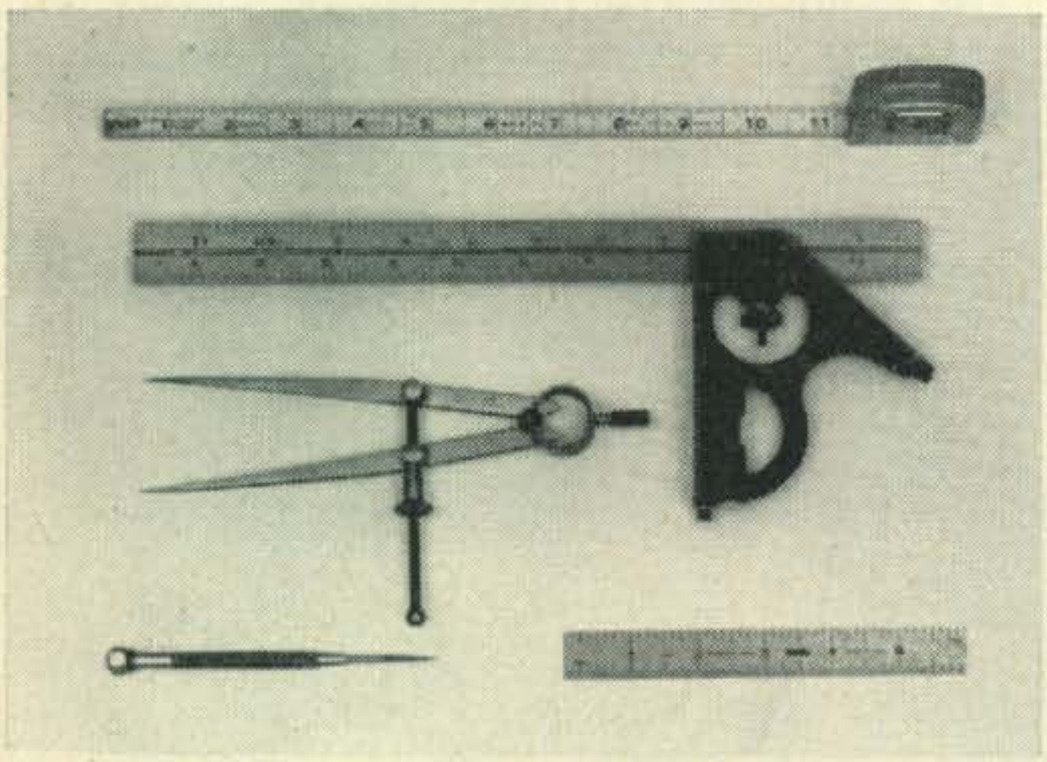


Fig. 7—Pictured from the top: flexible steel tape measure, combination square and dividers. Lower left: metal scriber; lower right: 6-inch steel rule.

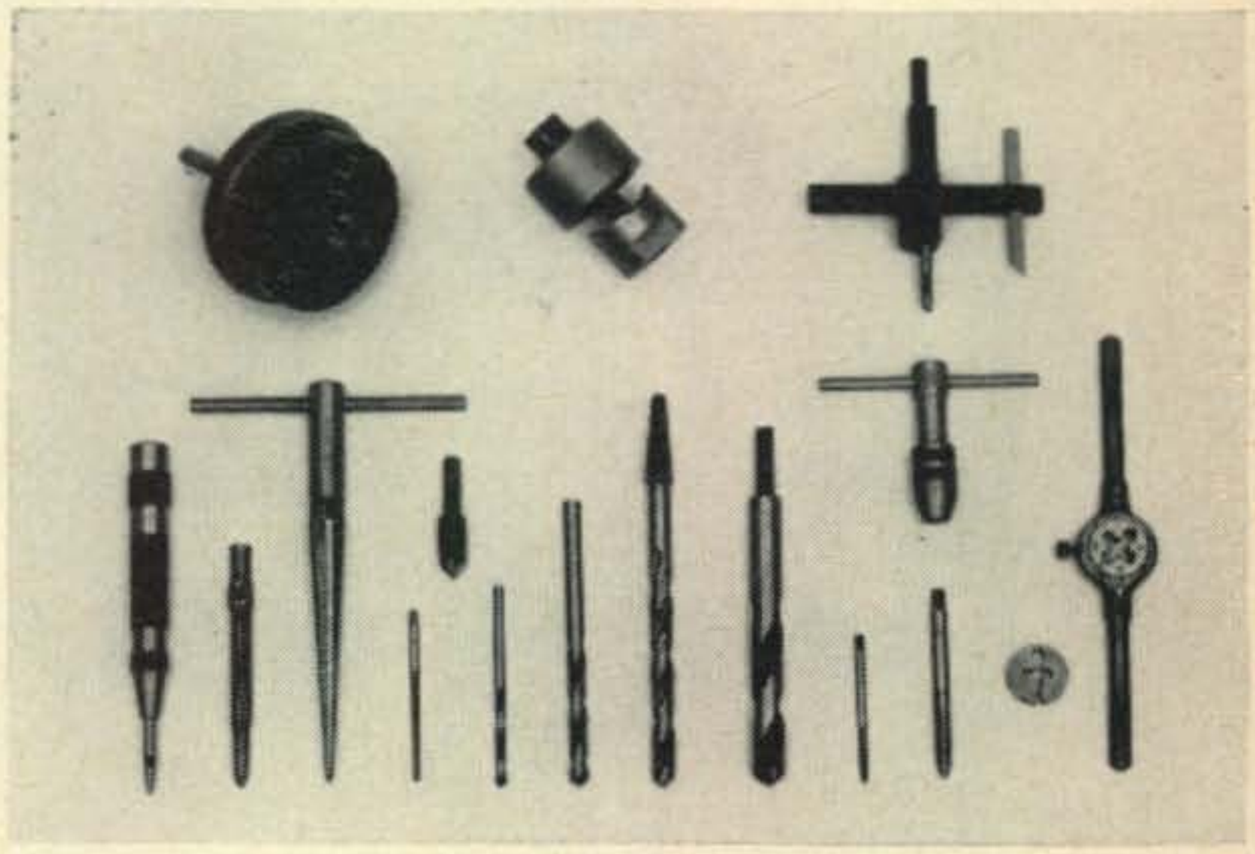


Fig. 8—Top, left to right: hole saw, chassis knockout punch, fly cutter. Bottom row: Automatic spring-loaded center punch, manual center punch, tapered reamer, taper-pin reamer, above and to the right of which is a countersink. Four different twist drills are shown next, the first two having straight shanks, the third having a square shank and the fourth having a shank turned down to ¼". Two different size taps are next with a tap wrench above them. At the right is a die-stock (wrench) and an extra die.

distances between two points, for comparing or transferring measurements directly from a rule, and for marking a radius, circle or arc. They consist of two sharp-pointed steel arms hinged together at one end, which may be locked at any dimension.

Center Punch: A center punch is also a pencil-like tool with a 90-degree point. It is used to make a locating dent in metal for a twist drill in order to prevent the drill from "walking." A sharp hammer-blow on the head of the punch will do the job.

An automatic center punch may also be obtained, which supplies its own striking force through an internal mechanism. It requires only a firm steady pressure by hand until the mechanism strikes.

A prick punch is often mistaken for a center punch which is similar, except that it has a sharper point (30 degrees) intended for marking soft metals. A prick punch should not be used as a center punch because its sharper tip will not provide a good starting hole for a drill.

Twist Drills: Twist drills are used for making holes in metal. They are available in "numbered" sizes, 1 to 60 (.228 to .040" diameter) and in sizes from ¼" to ½". A complete set of both types would be handy, but isn't necessary. For the sake of economy, it might be better to initially purchase two each of the most commonly used sizes as indicated by bold-faced type in the accompanying tap and drill chart.

Twist drills usually have round shanks, equal to the diameter of the drill, but since many drill

Tap and Drill Chart

Most commonly used sizes are shown in italics

Drill Number	*Diameter in Mils*	*Used to Clear Screw Size*	*Used for Tap Size**
1	228.0	—	—
2	221.0	12-24	—
3	213.0	—	14-24
4	209.0	12-20	—
5	205.0	—	—
6	204.0	—	—
7	201.0	—	—
8	199.0	—	—
9	196.0	—	—
10	*193.5*	*10-32*	—
11	191.0	10-24	—
12	189.0	—	—
13	185.0	—	—
14	182.0	—	—
15	180.0	—	—
16	177.0	—	12-24
17	173.0	—	—
18	*169.5*	*8-32*	—
19	166.0	—	12-20
20	161.0	—	—
21	159.0	—	10-32
22	157.0	—	—
23	154.0	—	—
24	152.0	—	—
25	149.5	—	10-24
26	147.0	—	—
27	144.0	—	—
28	*140.0*	*6-32*	—
29	*136.0*	—	*8-32*
30	128.5	—	—
31	120.0	—	—
32	116.0	—	—
33	*113.0*	*4-36, 4-40*	—
34	111.0	—	—
35	*110.0*	—	*6-32*
36	106.5	—	—
37	104.0	—	—
38	101.5	—	—
39	099.5	3-48	—
40	098.0	—	—
41	096.0	—	—
42	*093.5*	—	*4-36, 4-40*
43	089.0	2-56	—
44	086.0	—	—
45	082.0	—	3-48
46	081.0	—	—
47	078.5	—	—
48	076.0	—	—
49	073.0	—	2-56
50	*070.0*	—	—
51	067.0	—	—
52	063.5	—	—
53	059.5	—	—
54	055.0	—	—
55	052.0	—	—
56	046.5	—	—
57	043.0	—	—
58	042.0	—	—
59	041.0	—	—
60	040.0	—	—

*Use one size larger for tapping plastics and soft metal.

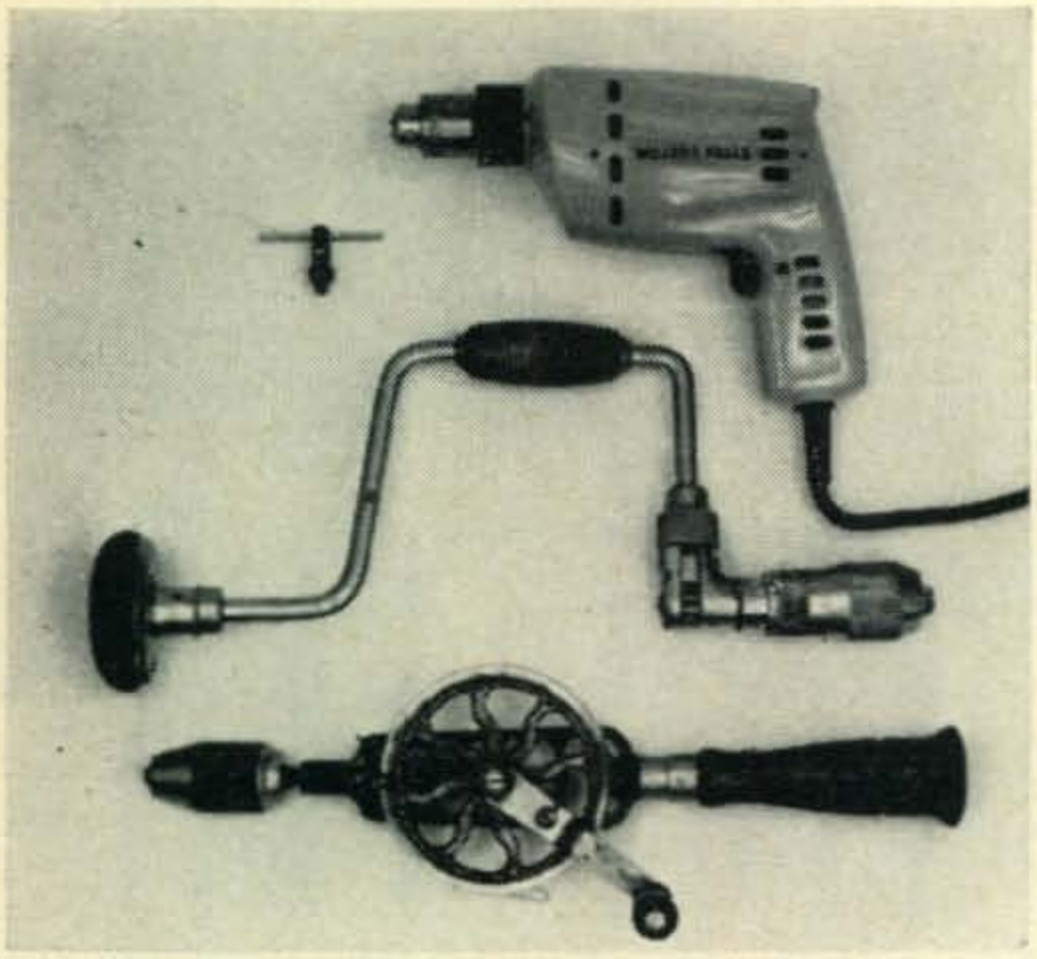


Fig. 9—Pictured from the top: portable electric hand drill, carpenter's brace, hand-operated drill.

chucks will not accommodate sizes larger than ¼ inch diameter, larger size drills often have their shanks cut down to ¼". Large size drills are also available with square shanks for use in a carpenter's brace.

A drill chuck, by the way, is a vise-like arrangement which securely holds a drill bit in a drill-turning tool. Some are tightened by hand, but the better type, known as the Jacobs chuck, is tightened with a specially geared key.

Twist drills are made of carbon steel or of high-speed steel. Carbon steel drills may be used for slow-speed drilling work by hand or for soft metals, but if an electric hand drill or a drill press is used, use the high-speed type, especially for hard metals, because they will hold their cutting edge better. Drills may be purchased with a convenient stand or carrying case. The use of drills is covered in "Drilling and Cutting Metal."

Countersink: A countersink is a short cone-shaped drill which is used to recess the top of a hole to allow a flat-head screw to be installed flush with a surface. Square or round-shank types are available. For machine screws, the cutting angle is 82 degrees.

Hand Drill: A hand drill is used to turn twist drills at a speed faster than could otherwise be done by hand. Single-speed types usually take drill sizes up to only ¼", so other means must be employed when larger holes are required. See "Drilling and Cutting Metal." Other hand drills with ½ inch shanks are provided with two speeds, one of which is geared down to make it easier to drill larger holes.

Electric Drill: An electric hand drill is a motor driven high speed device used with twist drills. It makes drilling a lot faster and easier. The all-around type handles drill sizes up to ¼" at a full-load speed around 1500 r.p.m. Larger drills with ¼ inch shanks could be used with them, but this should not be done as a general practice, because the motor may be overloaded and stall. The tool could easily be wrenched out of your hands should the drill catch. It would be better to use a slower-speed drill designed for heavier work. These are available for drill sizes up to ⅜ or ½ inch.

Carpenter's Brace: A carpenter's brace is a hand-operated tool which will be useful for making holes with twist drills larger than ¼". This tool usually has a square-shank chuck which is better for heavy work than a round-shank chuck, since the square shank prevents drill slippage. Naturally, square-shank drills must be used with a square chuck.

The brace also should be a ratchet type to allow use in close quarters, and is also used with square-shank tapered reamers.

Drill Press: A drill press is an electric drill which is fix-mounted in a vertical position on a stand. The material to be drilled is placed on a fixed table and the drill is lowered down to it by means of a lever on which pressure is exerted during the drilling operation. This is the most accurate means of drilling, because since the drill is locked in position opposite the drilling point, the drill bit cannot walk. Drill presses are made for either floor or bench mounting. They are more expensive than other devices used for drilling and require a greater fixed amount of floor space.

A less expensive arrangement for light duty work is a compromise which allows an electric hand drill to be mounted on a simple drill-press type mechanism.

Chassis Knock-Out Punches: These are hand-operated devices which are used to punch out clean holes larger than can be made with a drill. They save much time and effort, compared with other methods, when making holes for tube sockets, electrolytic capacitors, power plugs, cable connectors, *etc.* Round punches are obtainable in sizes ranging from ½" up to 3" diameters and square punches from ½" up to 1". The most commonly used sizes are listed in "Punches," together with details on their use.

Circle Cutter or Hole-Saw: A circle cutter (often called a fly cutter) is an adjustable device which is used for making any large size hole up to about 6" diameter. It consists of a heavy-bodied shank with an adjustable arm which passes through it at a right angle. A single-blade cutting tool is located vertically at the end of the arm and a center hole pilot drill is at the bottom end of the shank. The circle cutter is best used in a drill press. Square-shank models are available for use in a hand brace, but are not practical for metal cutting, nor are electric hand drills. However, a suitable tool is available for use either in an electric or other hand operated drill, namely a hole saw. This is a circular shaped saw blade which is held vertically in a horizontal disc on the end of a shank and which may be adjusted for various fixed diameters.

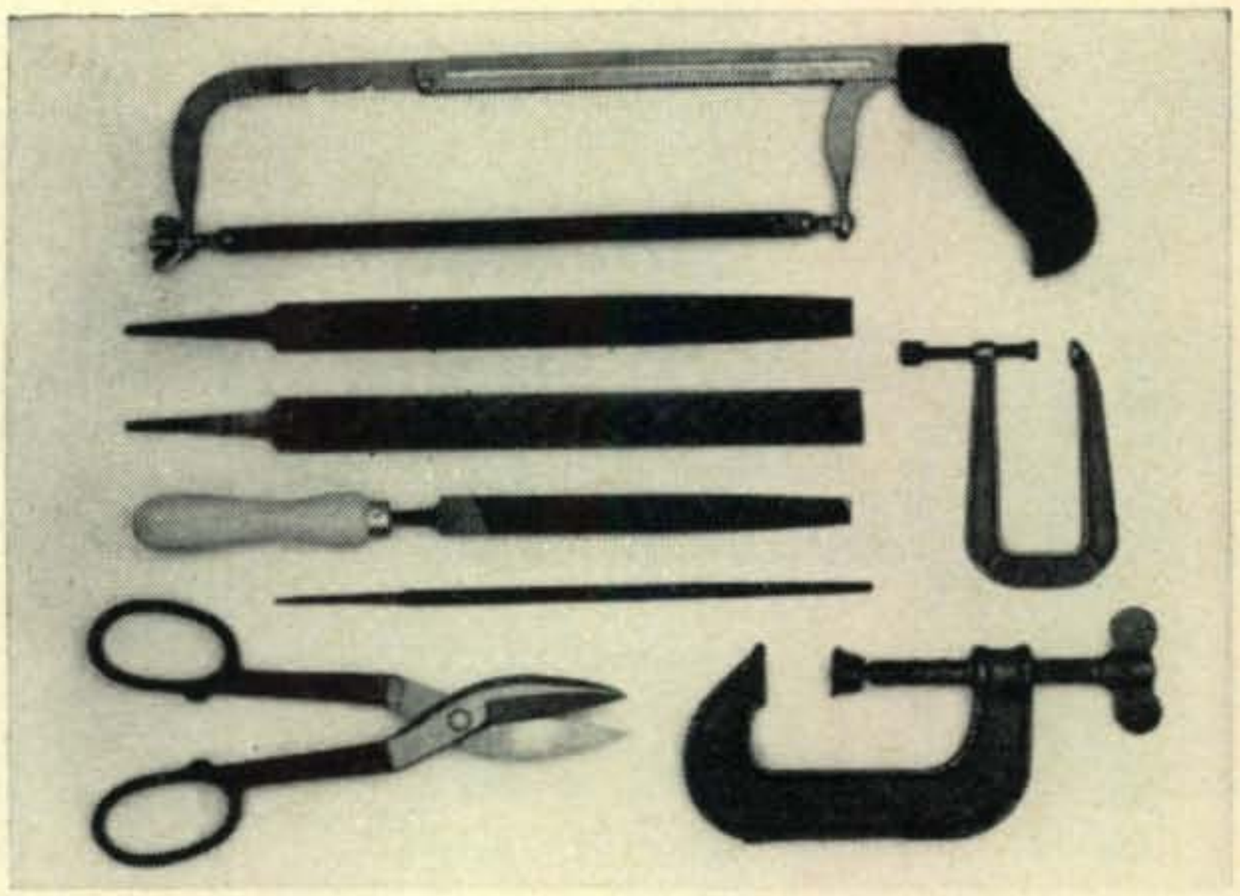


Fig. 10—Pictured from the top: Hacksaw, half-round double-cut file, curved-tooth (or Vixen) file, round or rat-tail file. Bottom left: Metal-cutting shears with two sizes of C-clamps at the right.

Operation will be taken up later.

Tapered Reamer: This is a taper-shaped tool with a number of cutting flutes along its length. It is used to enlarge existing holes to an exact size. The most useful type is a narrow, tapered one with a square shank which may be used in a hand brace for enlarging holes up to ½" diameter. An alternate is the one-half inch size with a T-handle which may be hand operated.

A taper-pin reamer is a small reamer which is useful for enlarging small holes, especially in thin metal as in miniature tube sockets. It may be used in a hand drill or with a hand-operated chuck such as a tap wrench. Size #3/0 is used for miniature sockets.

When a tapered reamer is used, only moderate pressure should be applied, so just a small amount of material is cut at a time. This makes it possible to obtain a more accurately centered and uniform hole with minimum effort. If a thick piece of metal is being reamed, work from opposite sides of the metal alternately to quicken and lessen the work. A reamer should be operated in a clockwise direction only. It should never be turned counterclockwise to back it out of a hole since this will damage its cutting edges. Should it jam, it should be rotated in the forward direction while a steady pull is exerted away from the hole.

Hack Saw: A hack saw has a thin steel blade about ½" wide used for cutting metal. The blade is held in a shallow U-shaped frame with a handle at one end. The distance between the top of the saw blade and the frame runs around 3". This limits the depth of the cut to this amount, however, the frame is arranged so that the blade may be turned 90 degrees to allow deeper cuts.

Hacksaw blades often require replacement, so it will be wise to have spare blades on hand. Blades with course teeth (14 point) are best for soft metals, smaller teeth ones (24 point) are better for hard or ferrous metals. Blades should be installed with the vertical edges of their teeth away from the handle and the sloping edges of their teeth toward the handle. The frame should be adjusted so that the blade is held rigidly and when cutting, a downward pressure on the blade should be used only during the forward stroke. The pressure should be released during the backward stroke.

Lubrication will make the work easier. Oil should be used with ferrous metals, paraffin wax or industrial alcohol with soft metals and plastics.

Files: Files are classified as to the type of cut (single, double or rasp) and as to the degree of coarseness. For rough work, the rough, coarse or bastard (medium coarse) files are used. Those used for finishing are second cut (small teeth), smooth cut (very small teeth) and dead-smooth cut (very fine teeth). Double-cut files usually are best for rough work, while single-cut files are used for finishing work. Files also come in a wide variety of shapes and sizes.

Probably the most useful files to have on hand in the electronic workshop are a large coarse double-cut flat or half-round one, several second or smooth single-cut flat, round, half-round and triangular ones and a ½" rattail file. For work with soft metals like aluminum or lead, a bastard-cut curved-tooth file will be very useful when a considerable amount of filing is needed. Its action is like that of a plane. It rapidly shaves

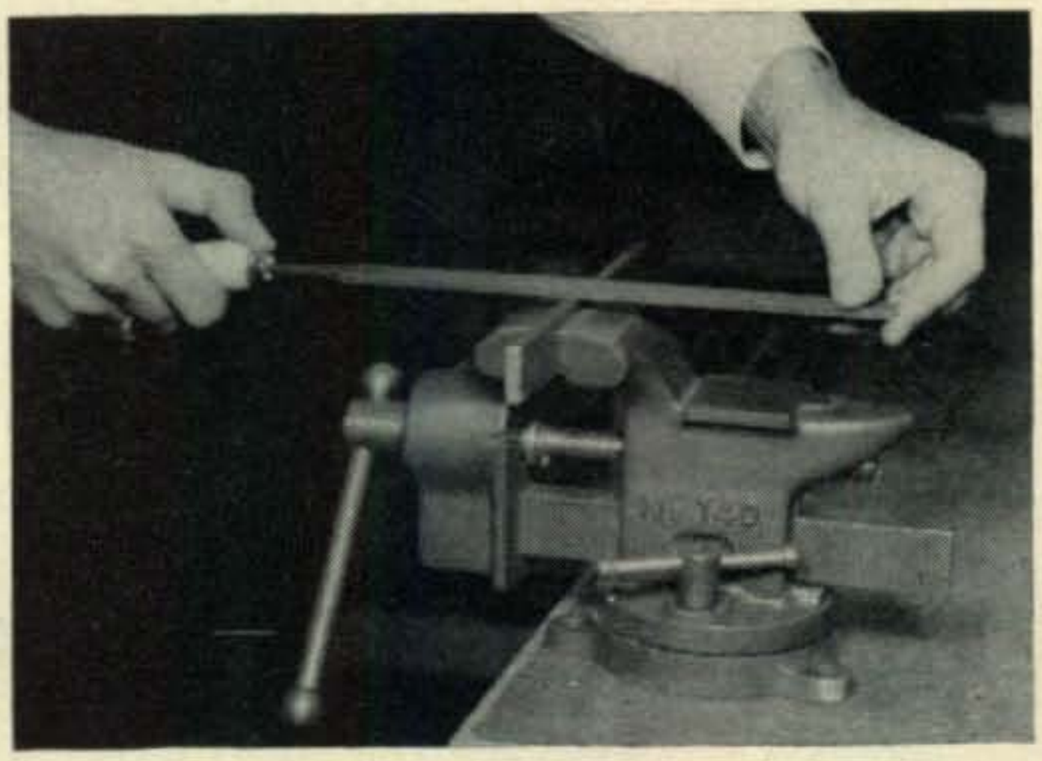


Fig. 11—Normal cross filing operation. See text for procedure.

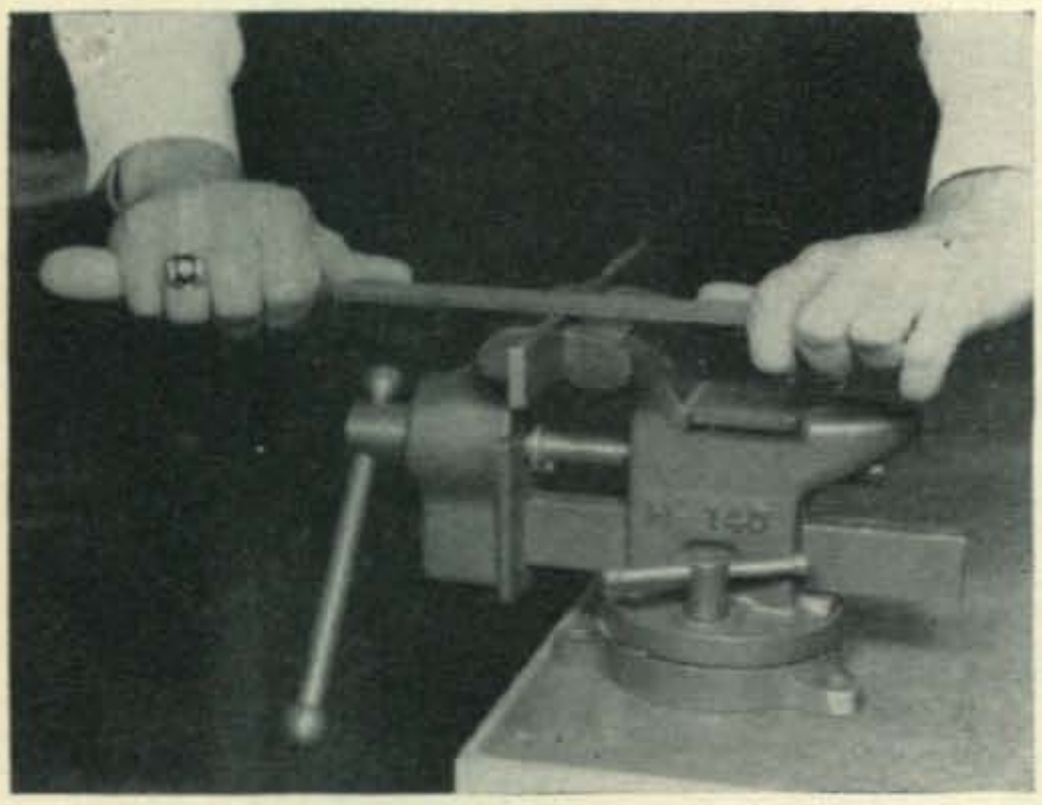


Fig. 12—Draw-filing. See text for explanation.

off pieces of metal nicely and without clogging. A set of Swiss-Pattern files will be useful for work on very small or odd-shaped holes and where sharp corners are needed.

Where possible, the metal to be filed should be held securely in a vise so that it projects slightly above the vise jaws. The file should be held with one hand at the handle and with the fingers of the other hand at the tip. See fig. 11. It should then be moved back and forth across the material and at right angles to it. Pressure should be applied only on the forward stroke. With hard metals, it should be released on the backward stroke to minimize the possibility of dulling it, but when soft metals are worked, pressure on the return stroke will clean out the metal filings, without danger of dulling.

On occasion, when a long edge is to be smoothed and after the major filing has been done, it will be helpful to file lengthwise along the material.

A very smooth and true surface may be obtained by draw filing. This is done by holding the file, with two hands, at right angles to the material and then stroking it back and forth along the length of the metal piece as shown in fig. 12. Pressure may be exerted on both the forward and the backward strokes, but it should not be too great.

Files should be kept clean by using a file brush. This is a flat brush of wood with wire bristles on one side and often with hair bristles on the other side. If the teeth are clogged too tightly, a scorer, usually supplied with a file brush, should be used on the teeth individually. A file should not be banged against a hard surface to knock out filings. This will either break it or dull the teeth. Files should not be lubricated, since they will slide across the work without cutting it. For safety's sake, a file should not be used without a handle on the end of the pointed-tang.

Bench Vise: There are several types and sizes of vises available, but one having a jaw width of 3½ to 5 inches, with a throat depth clearance of 2½ to 3 inches will be suitable for most needs. One type has jaws which are smooth with sharp edges and which meet quite squarely; others have grooves on the jaws to grip the work and keep it from slipping. Work, thus held, may be marred; however, it may be protected by the use of smooth jaw covers made of soft metal. See fig. 13.

A small anvil is located on the back of the rear jaw of some models. A swivel base is also available on some models for rotating the vise to a convenient operating position.

C Clamps: A couple of 2-inch C clamps will do for light duty work, while a pair of 6 or 8 inch ones will be suitable for heavier needs.

A C-clamp should be tightened by hand only and no more so than necessary to hold the work; otherwise, the clamp may be sprung or broken.

Metal-Cutting Shears: These shears, also called tin snips, are used for cutting sheet metal and are made in a variety of shapes and sizes. The most useful ones are the 10 or 12 inch straight-blade type with 3 to 4 inch cutting blades.

Taps and Dies: Taps and Dies are used for cutting screw threads in metal, plastics, hard rubber and bakelite. Taps are used to cut internal threads, as in a hole, while dies are used for cutting external threads, such as on the outside of a rod or screw.

The commonly used taps are the taper tap for starting the tapping operation, especially in hard metals, the plug tap for following through after using the taper tap or when tapping soft metals, and the bottoming tap for threading down to the bottom of a blind hole. The most useful type for the home shop will be the taper tap. Most taps have three flutes with separate thread-cutting edges between them. A lesser known type is the

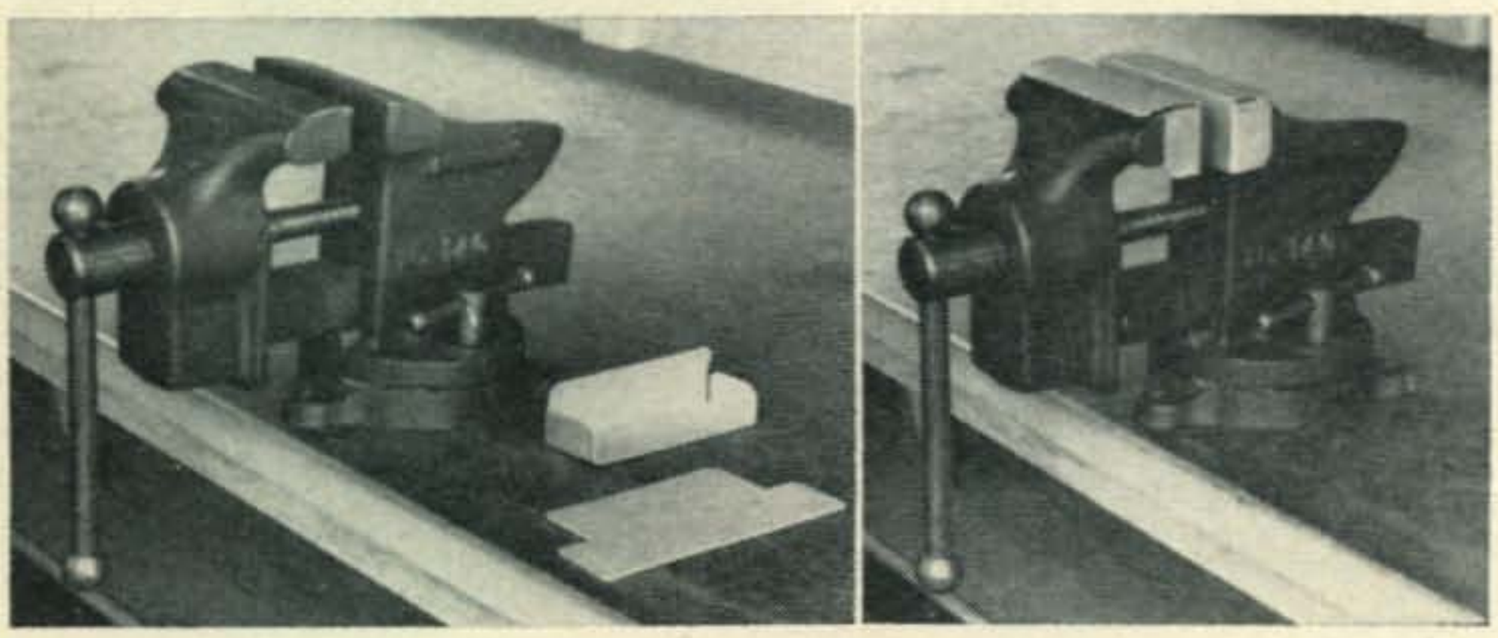


Fig. 13 — Bench vise with 4-inch jaws (left), may be rotated laterally and secured in position by means of a locking screw. Two pieces of soft aluminum, used as protective jaw covers, are shown. The aluminum is cut as shown in the foreground and then bent to fit over the jaws as shown at the right.

two-fluted gun-tap which is especially handy for soft metals.

Dies will be of less use in the electronic workshop; nevertheless they will be found useful, especially for rethreading damaged screws. The commonly needed tap and die sizes are 3-48, 4-36, 4-40, 6-32, 8-32 and 10-32.

When a tap is to be used, it is important that the correct size hole be drilled first. This may be found in the tap and drill chart. For soft metals, the next larger size drill should be used than the one indicated.

The tap should be held in a tap wrench and its threads should be lubricated. For steel use cutting oil (lard oil), however any type will be better than none; for aluminum and plastics, use industrial alcohol or paraffin wax. If nothing else is available and if one is not fussy, a bit of saliva will do if the tap is later wiped clean.

The point of the tap should be placed in the hole and the tap turned clockwise while a slight forward pressure is exerted until the cutting threads obtain a good bite into the material. The tap will then draw itself into the work. The tap should be aligned as straight as possible with the hole.

If the going is a little difficult, the tap should be backed out ¼ turn, then rotated forward ½ turrn, backed out again ¼ turn, forward ½ turn, *etc.*, until the threading of the hole is completed. After the hole has been tapped part way, it will sometimes help if the tap is removed and reinserted after cleaning the chips from the tap.

Taps may be broken quite easily, usually as a result of excessive twisting or bending. The following rules will help to avoid this.

1. Use correct size hole for the tap.
2. Use correct type tap.
3. Use lubrication.
4. Do not force cutting.
5. Do not jerk or twist suddenly. Use a steady motion, no matter which direction the tap is being turned.
6. Back up occasionally as described previously.
7. Keep your eye on the tap to see that it is properly aligned with the hole at *all* times. This also should be done when the tap is backed out. It is just as easy to break a tap as it is backed out as when cutting threads.
8. Use your other hand to steady and maintain the tap alignment with the hole, so that the weight of the tap wrench will not make the tap lean over and break when the working hand must be released from the wrench.—*W2AEF*

Bending and Forming Metal

ALTHOUGH there are many sizes and shaped chassis and boxes on the market, a particular one may not be available when needed, or a special one may be required. In other cases, shield partitions, shelves or brackets may be needed, for which there are no manufactured substitutes. Besides this, the constructor may be one who prefers doing his own sheet-metal work, either for fun, convenience, or financial necessity. It is with this in mind that the forming of chassis and the bending of sheet metal will now be considered.

Type of Metal

Steel or soft aluminum sheet metal, ranging in thickness from 1/32" to 1/16" generally is used for making chassis, and 1/16" to 1/8" stock is used for panels. If aluminum is used for the panels, it should be the half-hard type (24ST). Aluminum is light weight, easy to work, provides good *electro-static* shielding and is a reasonably good r.f. conductor, but soldered connections cannot be easily made to it. On the other hand, steel is heavier and stronger, provides good *electro-magnetic* shielding and may be soldered. It is harder to work, is a poor r.f. conductor and rusts easily. Steel chassis usually are plated with cadmium to prevent rusting. They are also copper plated occasionally to provide high r.f. conduction and electro-static shielding properties as well.

As far as the home builder is concerned, the type of material will depend on that which is most easily procured, but preference should be for aluminum, since it is easier to work.

Procurement of Material

Sheet metal may be obtained from certain metal supply houses in the larger cities, but may be more difficult to find elsewhere. A good source of material is from aluminum acetate-coated electrical-transcription records which can sometimes be obtained from local broadcast stations. The acetate coating may be left on during the work to prevent the aluminum from being marred. The coating may be removed easily later by immersing the piece in boiling water for about five minutes.

Aluminum stock also may be obtained from old surplus gear. Flat aluminum sheets called biscuit or cookie sheets are also a good source of clean unmarred sheet metal.

A glance through the Yellow Pages of the phone directory may be helpful not only for finding a supply house, but also for locating a metal fabricating company which may either provide the material or name a supplier.

Metal Forming Brake

Manufactured chassis are made up using a metal-forming brake, but these are usually too large for the home workshop and are quite high

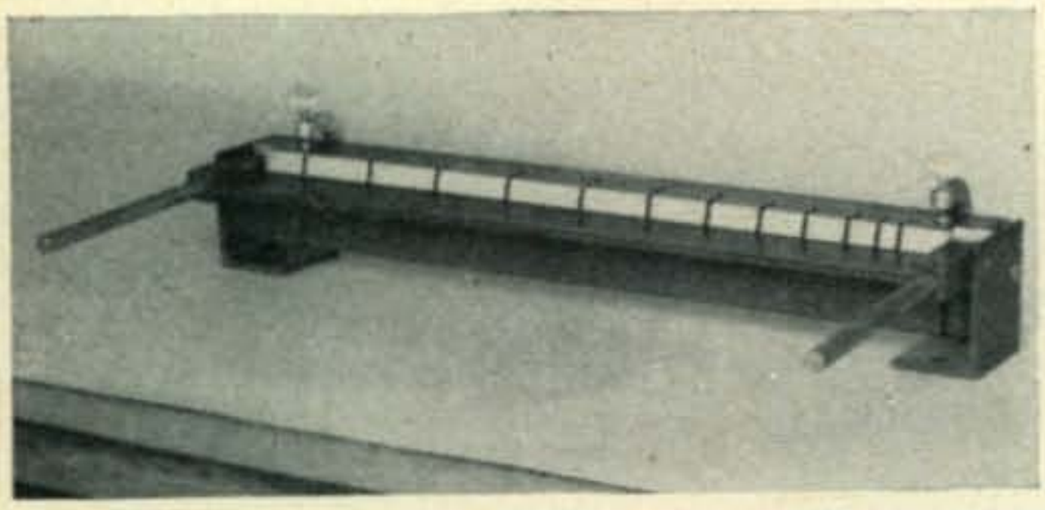


Fig. 1—A manufactured small-size metal-forming brake for limited use with sheet metal up to 1/16" thickness and 18" width. When a piece is bent over on all four sides, the depth of any two opposite sides will be restricted to 1".

in cost. Nevertheless, there is a small metal-forming brake available from some electronic supply houses which is reasonably priced and is handy to use. One of these is shown in fig. 1.

In lieu of such a tool however, there are other methods which can be used for bending metal in the small shop. The obvious one is the use of the ordinary bench vise; and if the proper techniques are used, an admirable job can be done.

Use of Vise

While the use of the bench vise by itself is possible for metal bending, it is not recommended, because many vises have jaws which do not meet squarely or which are serrated to prevent slipping. Moreover, it will not be possible to make neat bends much longer than the width of the vise, which will amount to about three to five inches.

Brake-Angles

A better arrangement is to use a set of brake-angles, or brake-bars, which may be placed in the vise to hold the material accurately aligned, without risking damage by marring. Also, they will provide a clean sharp edge of any desired

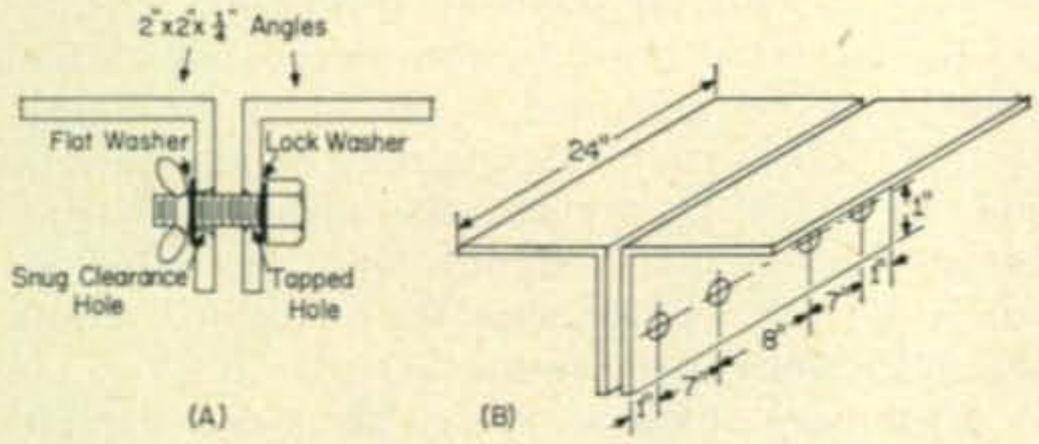


Fig. 2—Fabrication of brake angles. Large capped screws together with hex or wing nuts are used to tightly draw together the angles when they are clamped around the material to be bent. Referring to (B), holes should be drilled through the two pieces of angle while they are aligned and clamped together with C-clamps. The drill size for the desired tap should be used first. The two angles should then be separated and the holes in one piece tapped as needed and the holes in the other piece enlarged to provide a snug clearance for the screw, as shown at (A). This procedure will ensure perfect alignment during bending operations. The edges of the holes on the inner faces of the angles should be slightly countersunk.

Fig. 3—Brake-angle bending operation. The bending point on the sheet metal is aligned with the top edge of the brake-angles in which it is clamped.

length against which the bend may be made.

Brake *angles* should be made from 1/4" × 2" steel (1/8" × 1" for very light work), hard brass or hard-drawn aluminum angle stock having sharp corners along the inside of the angle. Iron stock is not recommended, because its inside corner is usually rounded, making proper clamping and alignment difficult. Also, it's rough finish may mar the material held by it.

Right-angle stock cut to a suitable length can be used without further modification, but a better job can be done if holes are drilled through the angles for take-up screws to firmly clamp and align the brake-angles. This is especially important when long bends are to be made. See fig. 2 for the fabrication of brake-angles.

The best type of bench vise to use has heavy jaws at least 3½" wide and has a throat-depth clearance of about 3" to allow for bend depths up to this amount.

Operation

A mark should be scribed on the sheet metal along a line where the bend is to be made. The material should then be placed between the brake-angles, with the scribed line and the top edge of the front angle aligned as in fig. 3. It should also be placed at a point between the two take-up screw holes nearest to each edge of the material. The take-up screws should now be tightened. Care must be taken to be sure the alignment of the material is properly maintained. If provisions have not been made for using take-up screws, "C" clamps may be used to hold the angles together.

Next, the whole assembly should be securely clamped in the vise, with the material centered and with the angles resting on top of the vise jaws as in fig. 3. A block of wood, placed against the rear of the material and on the top of the rear angle, should now be used to bend the metal forward and over the front brake-angle, resulting in a right-angle bend. Chances are that the bend will not be sharp and it may not be uniform over its entire length. If this is the case, a piece of hard wood should be placed on the

bend so that a hammer may be used to pound the bent edge down as needed, without risking damage to the metal.

Inside Bends

In the case where a chassis is to be made with all four sides bent over, the two longer sides, opposite each other, should be formed first. The position of the bent-over sides will not allow the brake-angles to be used for making the remaining two "inside" bends as previously described.

Set aside the front brake-angle and substitute one which is slightly shorter than the inside bend. The two angles should then be set in the vise with the shorter one in front and the material lined up along the bending line. With the material held in position by hand, the vise should be tightened to securely hold the pieces together. Care must be taken to see that the front and rear angles are aligned evenly on the same plane along the bending edge. The bending operation now continues in the normal manner.

It will be found advantageous to have a number of brake-angle pieces on hand of various short lengths for making different size inside bends.

Use of Drill—Press Vise

In a situation where an inside bend will be about 2½ or 3 inches long with a depth of no more than about one inch, a table-top drill-press vise may be used directly without the aid of other brake parts. This type of vise does not have jaws serrations and the jaws have clean sharp edges which line up evenly. It also will be found handy for bending small brackets or other similar parts.

Brake-Bars

Brake-angles are not well suited for making bends of depths less than about ½", because they usually will not grip firmly enough along the bending edge to prevent the material's slipping out.

For such work it will be better to use a pair of brake-bars instead. These should be made of 1" × 1" steel as shown in fig. 4. Secure clamping may be obtained for small-depth bends and the bars may be used for all other bending as well, except inside bends. The procedure for using brake-bars is the same as that for brake-angles, except that when the assembly is placed in the vise, the top edge of the bars should be set just slightly higher than the top edge of the vise jaws.

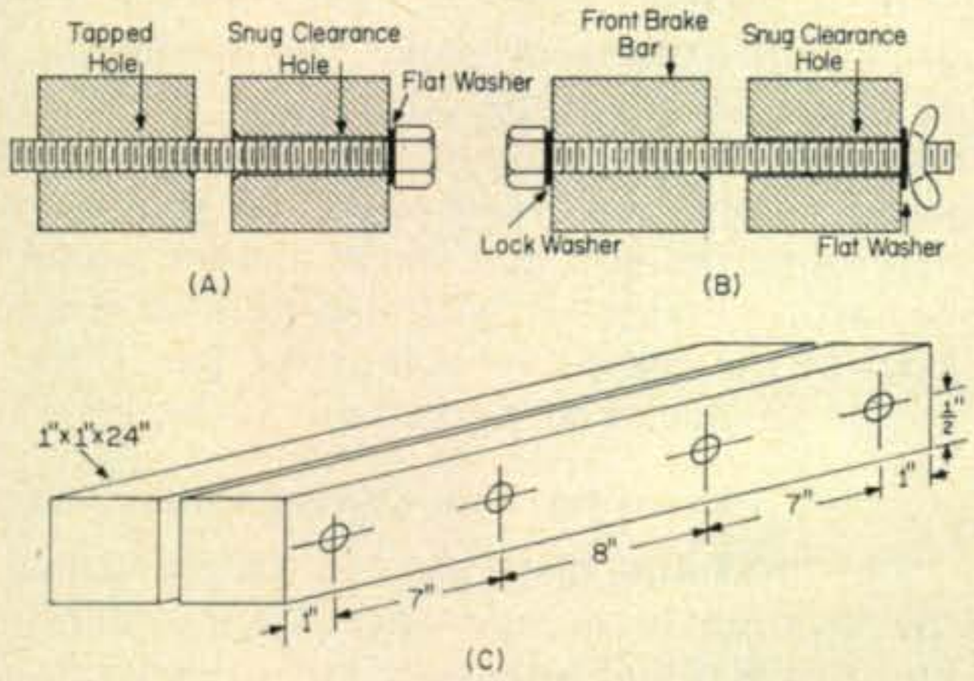


Fig. 4—Fabrication of brake bars. The holes should be drilled in the bars as at (C) using the same procedure as described in fig. 2 for the angles. They may then be held together using either of the arrangements as shown at (A) and (B).

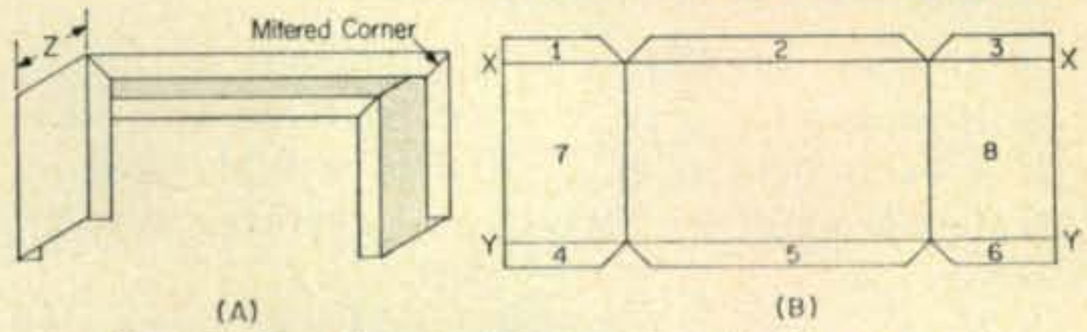


Fig. 5—Bending sequence details. See text.

Bending Sequences

When more than one bending operation is to be performed on a single piece of material, a definite sequence must be followed to enable all the bends to be made without interference from previous bends.

The best sequence can be seen quite easily in cases involving only two or three bends, but where more bends are concerned, careful thought and planning is required. Consideration must also be given to which types of brake tools will be needed. If there is any doubt as to the correct bending procedure, it would be better to use a piece of carboard as a sample to try out the bending order rather than to risk spoiling a good piece of material.

An example is shown in fig. 5. Suppose a piece of material is to be formed as shown at (A). It should be cut and marked as shown at (B). First, sides 1, 2 and 3 should be folded over in one operation along line X-X. Next, sides 4, 5 and 6 should be handled likewise along line Y-Y. This will result in a uniform dimension Z on all sides of the completed piece. Sides 7 and 8 should be folded over last, using the inside-bend technique

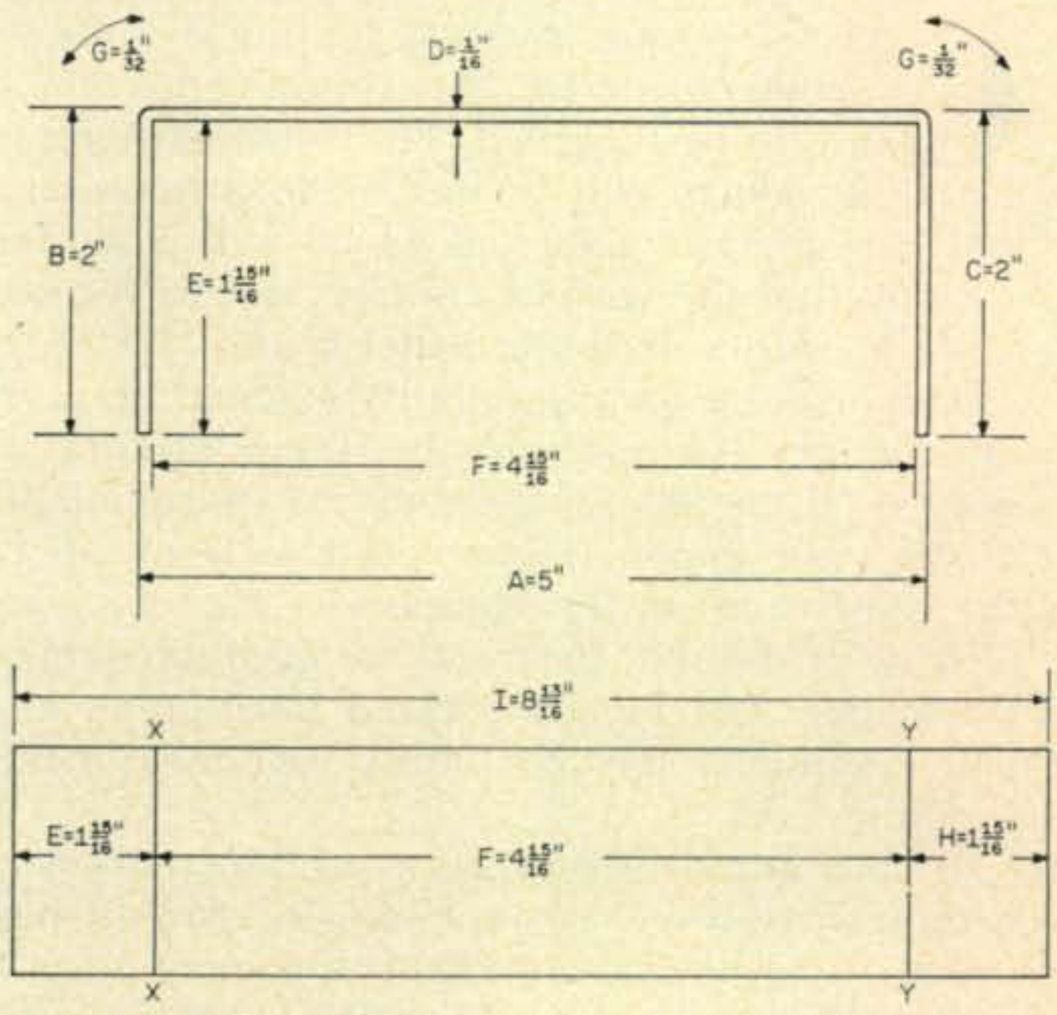


Fig. 6—Bending and cutting dimensions. See text.

with brake-angles, or if dimensions permit, a drill-press vise may be used. If these two sides had been bent over first, they would have interfered with the bending operations for the other sides.

Many more examples could be given, but even these would not cover all possible problems, so other situations will have to be sized up individually.

Bending and Cutting Dimensions

If sheet metal parts must be bent to an *exact* size, special consideration must be given to the bending dimensions. These will depend on the thickness of the material used and on the loss incurred at a bend. This can best be explained with reference to fig. 6.

Suppose the outside dimension, A, is to be 5" and the overall outside dimension of the sides, B and C, is to be 2". The 2" sides will be the ones clamped in the brake because the throat-depth of the vise will not accomodate dimension A. The 5" side is the one which will be folded over the brake-angle. In this respect, the bending loss always occurs on the side which is folded over.

The first bend, X-X, will have to be made at a distance, E, from the edge of the material. E is equal to the outside dimension B, minus the thickness D of the material, or E = B − D = 2" − 1/16" = 1-15/16".

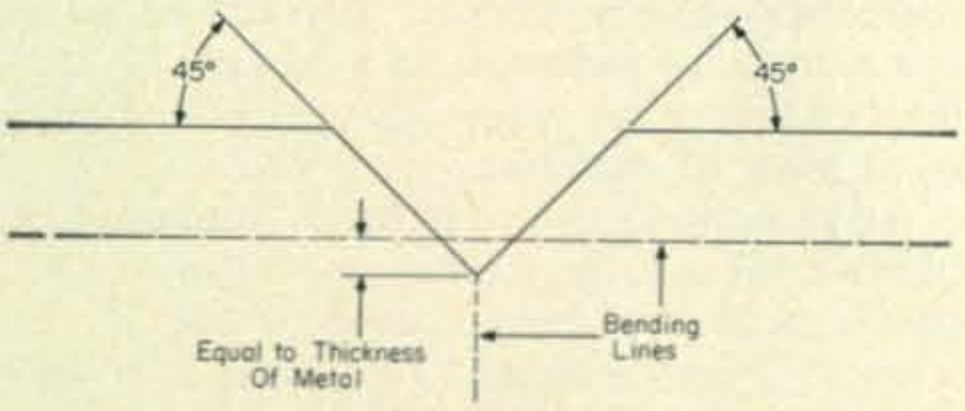


Fig. 7—Cutting details for mitre-cornered sides.

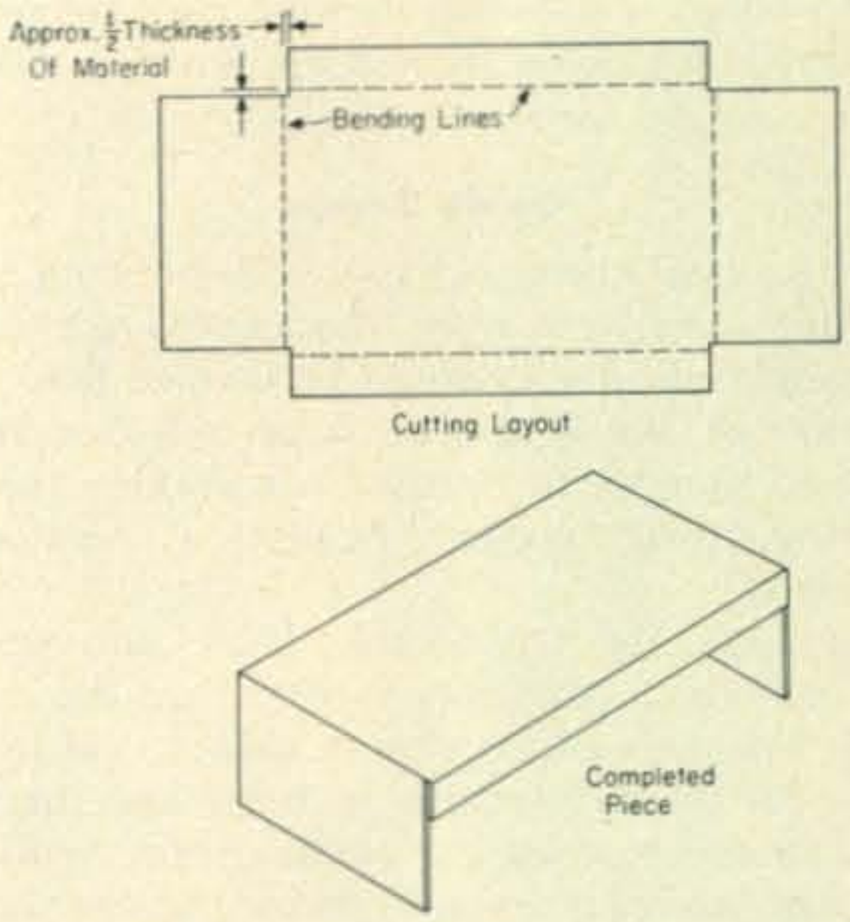


Fig. 8—Cutting details for square-cornered sides.

The next dimension, F, will be equal to dimension A minus the thickness of each of the two sides, plus the bending loss G, incurred at both ends. F = A − 2D + 2G = 5" − 2/16" + 1/16" = 4-15/16".

The bending loss will vary with different metals, their thickness and the sharpness of the bend. In general, it will amount to approximately half the thickness of the material.

Dimension H will be the same as E, and the total length of the piece of material will be E + F + H, or 1-15/16" + 4-15/16" + 1-15/16" = 8-13/16".

When pieces are bent with mitred corners, as shown in fig. 5A, allowance must be made when the piece is initially laid out and should be cut as shown in fig. 7. Square corners should be prepared as shown in fig. 8.—*W2AEF*

Chassis Planning and Layout

CHASSIS layout involves finding a suitable arrangement for the components which are to be mounted. This must be done in a manner which will be best from a functional and wiring standpoint and which will place the parts so that the various controls can be located to tie in with a desirable panel layout.

This may be done simply by placing the parts on the chassis and moving them around as needed. If all the components are not available at the time, paper or cardboard patterns cut to the dimension of the component may be used instead. If desired, they may be used altogether, since they will facilitate rapid positioning and will eliminate the possibility of components toppling over.

If each cutout is marked as to the component it represents, it will be easier to visualize the best order or the ideal grouping arrangement according to the circuit. Where the height of the component may be concerned, it would be a good idea to mark this dimension on the cutout for quick reference also.

If the chassis is not available, it's size may be drawn on a piece of paper, so the layout may be determined. On the other hand, if the chassis size has not yet been determined, the parts or paper cutouts may be grouped on paper area to determine the size and shape chassis which will be most suitable. It will also help to draw the sides of the chassis as well as the panel, the layout of which can be worked out at the same time.

Locating The Components

No hard and fast rule can be prescribed for the location of components. Each situation requires individual attention, but in general, a desireable arrangement will be to place the parts in the order in which they appear in the circuit. This will group like functions together and will help produce the most advantageous wiring procedure, especially when short and direct connec-

tions are needed. Also, it usually will be best to lay out different sections (particularly r.f. stages operating on a common frequency), in a straight line to separate their input and output circuits as much as possible to avoid feedback and instability.

At the same time, consideration must be given to an arrangement which fits in with a suitable panel layout. Usual practice is to make the layout symmetrical for appearance's sake. However, some situations may dictate otherwise, to either accomodate a compact parts layout or for functional reasons. The location of dials and control knobs for variable capacitors, switches, meters, volume controls, *etc.* will be involved. They should be located where the component body can be mounted entirely above or below the chassis deck, so that they will not conflict with the chassis and require special cutouts to be made.

Thought also must be given to the use of shields, particularly in connection with r.f. stages. In this regard, space may be saved, if needed, by the use of spade lugs to support the shields, rather than using those with a right-angle lip at the base. Where a multi-section bandswitch is involved, shields between sections not only will help to isolate stages, but also will serve as a stable support for the switch assembly.

Usually it will be best to mount the larger and heavier components such as power and audio transformers or chokes on top of the chassis and, if possible, near an edge for better support. In the case of an aluminum chasis, this will minimize the possibility of its sagging had the component been centrally placed.

Another thing which should be considered is that, if several heavy components are located along the rear of the chassis, side-brackets may have to be installed between the chassis and panel for additional support. Power transformers also should be mounted away from low-level audio transformers or coils with iron cores to eliminate magnetically inducing hum into them.

Smaller Parts

Small items such as open-frame a.f. transformers may be mounted on the bottom side of

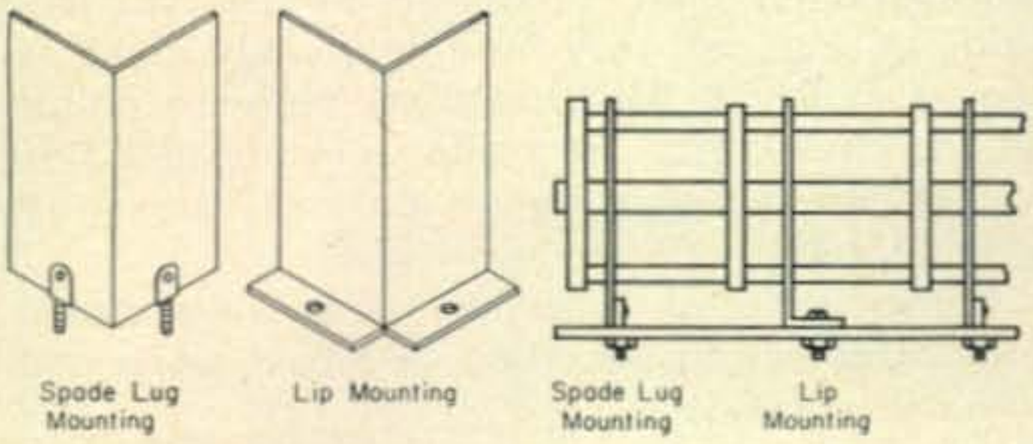


Fig. 1—Spade lug mounting of shield requires less chassis space than a shield with a lip as shown. Spade lug and lip mounted shields are shown between sections of a bandswitch. Note that there is more mounting space for other components in the left hand section than in the right one where the lip of the center shield takes up usable space.

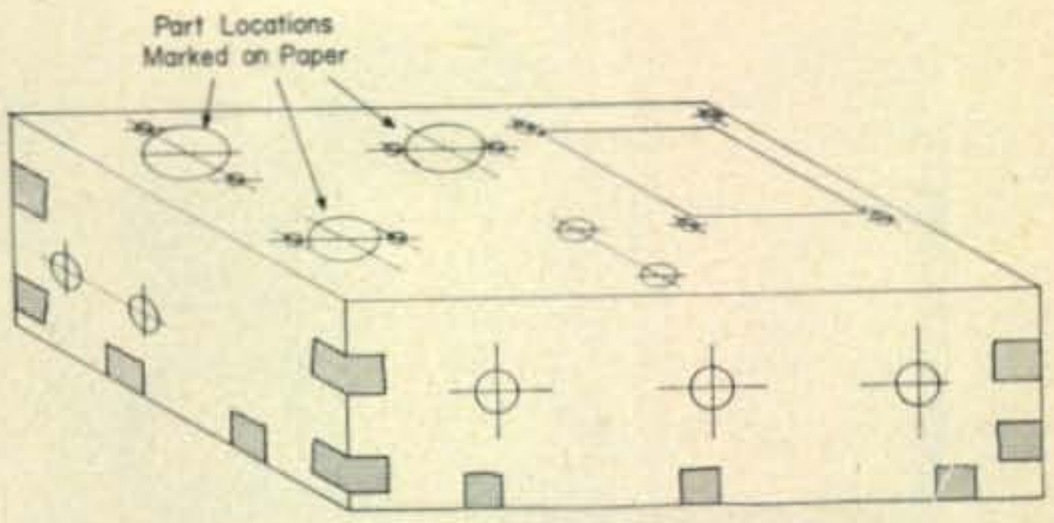


Fig. 2—Paper mask folded over chassis and held tightly with adhesive tape. Location of components may be marked on mask without marring chassis surface.

the chassis deck or on the inner sides. Antenna connectors, power plugs or terminals, fuse holders, *etc.*, most likely will be required on the rear apron of the chassis.

Heat-producing components, like power resistors, are best mounted on top where better cooling and ventilation can be realized, but provisions must be made to prevent their being a shock hazard. If such parts are mounted underneath, they should be placed where their radiated heat will have the least effect on other components, especially heat-sensitive ones, such as those connected with frequency-determining circuits. It would also be well to plan ventilation holes in the chassis deck over major heat producing parts.

Wiring Layout

Another helpful thing to do in the planning stage is to figure out just how the wiring can best be done so that tie-point strips may be properly stage is to figure out just how the wiring can best

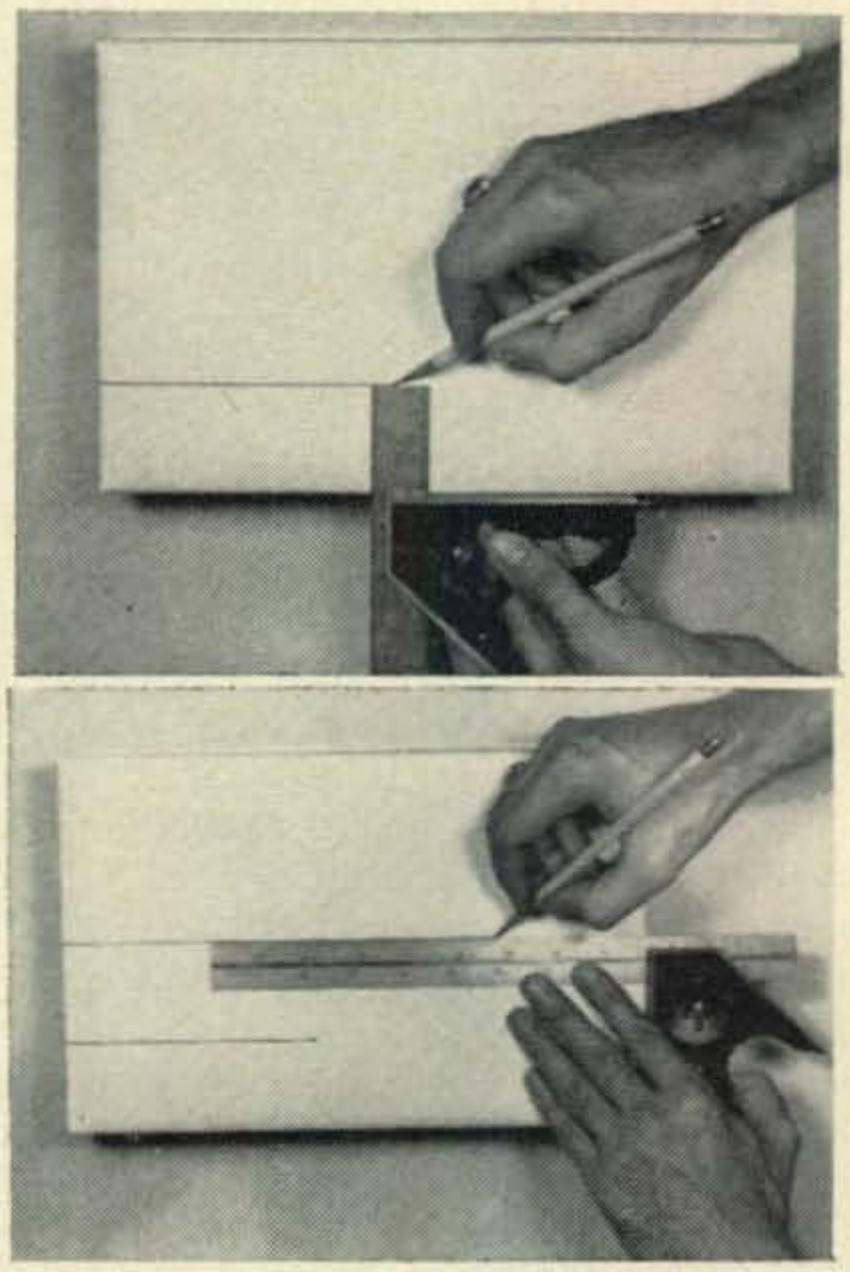


Fig. 3—Two different ways to use combination square for marking off several points having the same dimension from the edge of the surface.

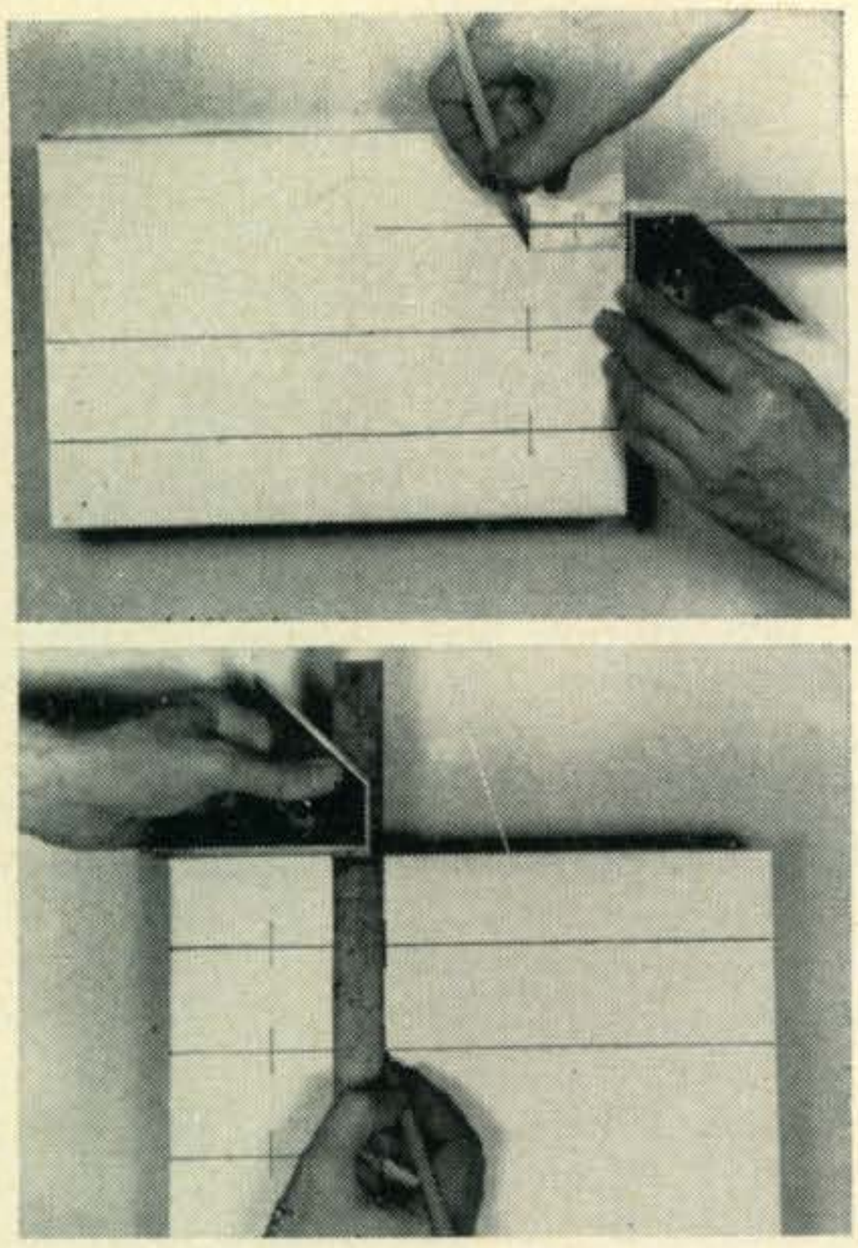


Fig. 4—Combination square used to mark several points having the same dimension from the edge of a surface. At the top, square is moved along the side of the chassis as needed to intersect each of the parallel-drawn lines at the same given distance. Bottom, the square is held at a fixed position while the intersecting lines are marked.

located and sockets be correctly oriented. A good way to do this is to turn the chassis over or use a paper pattern and place the tube sockets upside-down on it to get an idea of what will be involved in the wiring. Paper cutouts with socket terminals drawn on them will also be handy here.

If planning work is done entirely on paper, much of the proposed wiring, together with resistors, capacitors and tie-points can be drawn in, not only to find the best arrangements, but also to serve as an assembly guide during the actual work later on. This will result in a neat and uncluttered job.

Marking the Chassis

After the location of major components has been decided, the next step will be marking out the exact location for their mounting holes. This may be done directly on the chassis or on a paper mask fastened to it. Better accuracy may be obtained by marking directly on the chassis with a metal scriber, but care must be used to make scribed marks as light as possible and no longer than necessary if they are to be inconspicuous on the final product. Pencil markings, which are erasable, may be used instead, but with less accuracy.

The method using a paper mask will not leave markings on the finish. The procedure is to cover the surface with heavy paper folded over the edges, and held onto it by tape. See fig. 2. The markings can then be made with a sharp-pointed pencil, and a center punch used through the paper to indicate the points for drilling. Cross-

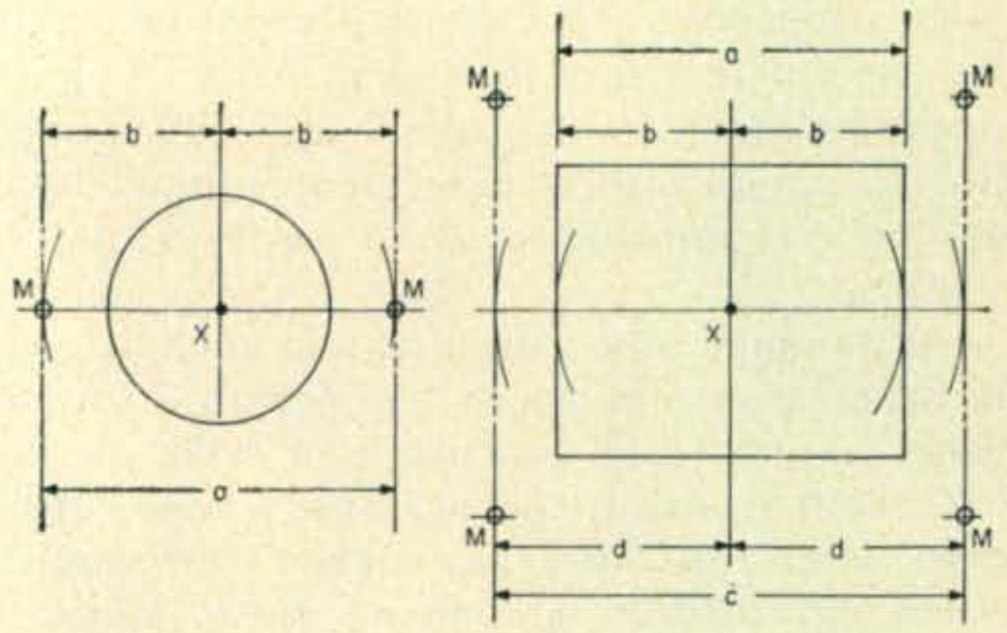


Fig. 5—Dimensions made in reference to a center point X. Dimensions *a* and *c* are obtained with a rule, dividers or compass from the component. They may then be centered about point *X* using dimensions *b* and *d* which are one-half of *a* and *c* respectively. The vertical dimensions may be worked out similarly. The curved lines are marked using compass or dividers; the straight lines are those made using a rule. Component mounting holes are indicated at *M*.

section or graph paper will be helpful for the alignment of parts.

A difficulty, with paper coverings is that if they are not secured tightly enough, they tend to wrinkle or slip around during the work resulting in inaccurate hole locations. On the other hand, besides keeping the chassis from being marked, it also provides the advantage of identifying hole sizes and parts on the paper. Further details will be found in "Drilling."

Spotting the Holes

In many cases, hole locations may be spotted using the component itself as a template. A mark may then be made through its mounting holes, after which the center of the location may be noted by eye and center-punched accordingly.

The combination square will be useful for making alignment lines parallel to the sides of the chassis as shown in fig. 3. The location of the center-point for holes may be determined using a combination square, thin-steel straight rule or a flexible-steel rule. Chassis edges usually are somewhat rounded, making measurements from an edge difficult with a straight rule, but by using a combination square with its right-angle head against an edge, accurate dimensions may be marked and if many points for the same dimension are required, they may be quickly made as shown in fig. 4. Measurements between points on the chassis may be made using the flat rule of the combination square or with a regular straight rule.

Dimensions for holes of some components, such as power transformers, are best taken and

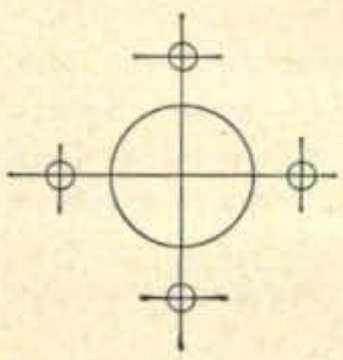


Fig. 6 — Four socket mounting holes, aligned at right angles, will provide optional orientation of socket to facilitate wiring to it later on.

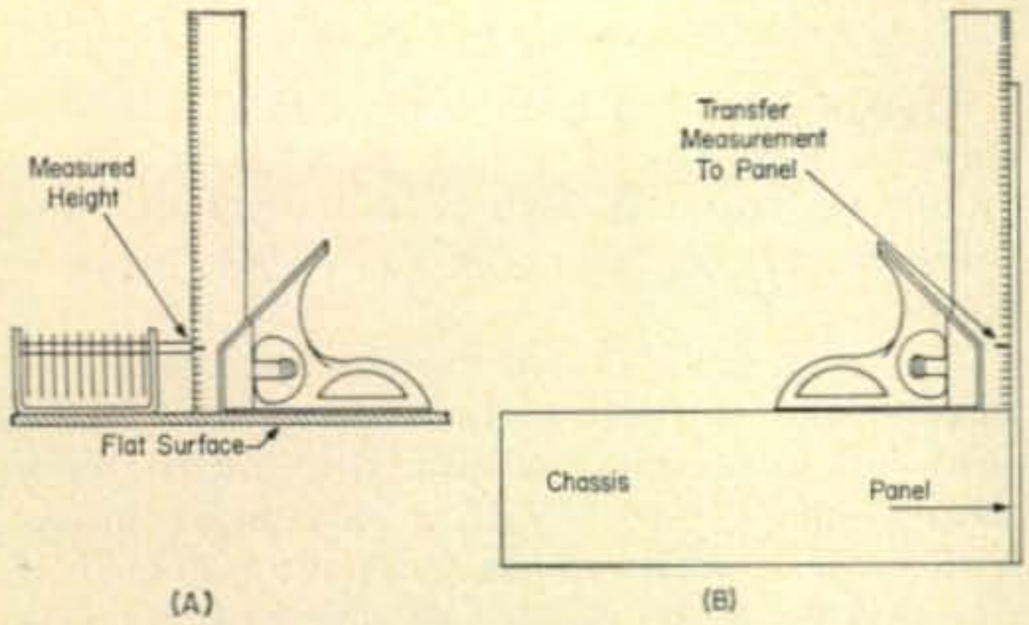


Fig. 7—(A) Combination square used for determining the height dimension for variable capacitor shaft. This dimension may then be transferred to panel as shown at (B).

made from a reference center, using a straight rule, compass or dividers as in fig. 5. Screw holes for fastening tube sockets are more conveniently marked and drilled after the socket hole itself has been made. The socket is first inserted on its hole, and then used as a template for locating its screw holes. In this connection (especially in an experimental piece of gear), it sometimes will be a good idea to make two sets of socket mounting holes at right angles to each other in order that the socket may be rotated 90 degrees if necessary. See fig. 6.

Meter holes may be laid out from a template usually supplied along with the meter, or they may be worked out using a center reference as described above.

When a panel is to be mounted on the front of a chassis, the holes for it and for the controls on the front apron of the chassis should not be laid out or made until the panel is fitted on. Panel holes which are needed above the chassis level for control shafts of chassis-mounted components, like variable capacitors, are also best left for marking until after the panel has been fitted as shown in fig. 7. More on this will be found in "Drilling."

After the various holes have been spotted, it will be helpful to identify them with the size or the number drill ot be used—*W2AEF*.

Drilling and Cutting Holes

With newly constructed or modified equipment, mounting holes and cut-outs for components will have to be made in the metal surfaces on which they will be located. The following describes how this should be done.

The first step to take when a hole is to be drilled is to use a center punch at the center of the desired location. This will make a small conical-shaped indentation in the metal surface to hold the drill accurately in place at the start of the drilling operation. If this is not done, the drill will tend to "walk away" from the spot, until it has bitten sufficiently into the surface.

When the center punch is used, the material should be placed on a hard surface for solid backing. With an automatic punch, a piece of metal at least ¼" thick, held by hand, may be used. In order to allow both hands to be free for use with a manual center punch the back of the surface should be set on a stationary block or on the jaws of a vise. See fig. 1.

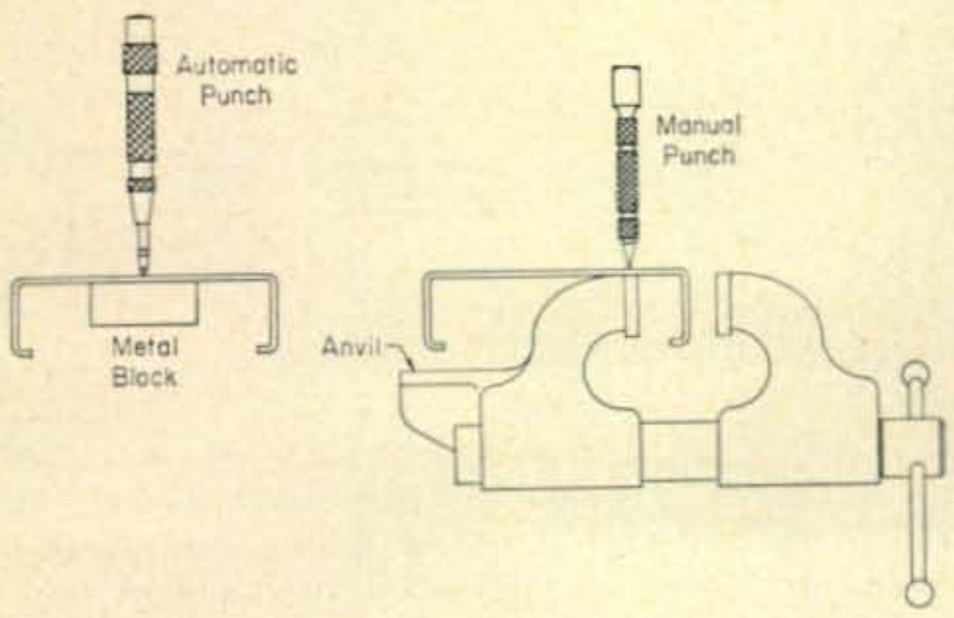


Fig. 1—A heavy metal block, held by hand behind the surface, used as an anvil when an automatic center-punch is used. When a manually operated center-punch is used, the surface must be held against a stationary metal object.

If the drilling is done with a hand drill, only moderate pressure will be needed at the start. If an electric drill is used, considerable pressure may be needed to keep the point of the drill from jumping away from the starting point. If this is experienced often, it may be better to make a larger starting point by enlarging the center-punched one with a small twist drill operated in a hand drill.

The piece to be drilled should be held securely in a bench vise or may be placed on top of the bench. If the work is not clamped in a vise, it would be well to have at least one edge rest against a stationary object to prevent its spinning around, which often happens. See fig. 2. The piece may also be held with a C-clamp.

If a flat piece of metal is to be placed on a bench surface during drilling, a piece of wood should be placed under it to keep the drill from making holes in the bench surface after it breaks through the metal.

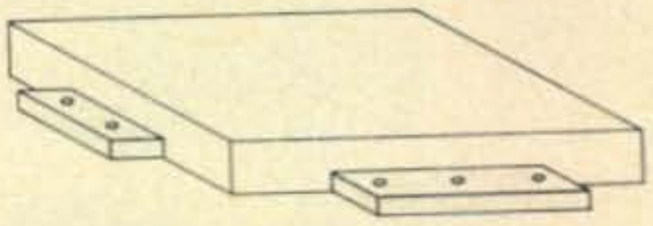


Fig. 2—Part being drilled may be kept from spinning by resting it against blocks anchored to the bench.

Greatest drilling accuracy will be obtained if a small size pilot hole is made first. A drill size of #35 to #40 will be suitable for most commonly needed holes up to ¼ inch. For guiding larger size drills, the small pilot should first be enlarged to about ¼ inch.

Drilling the Hole

The twist drill should be tightened in the jaws of the chuck as much as possible to prevent it's slipping, which could score its shank and produce burrs on it, as well as causing wear on the chuck. If burrs should occur, they should be filed off the shank before the drill is used again.

When a hole is being drilled, be sure the twist drill is positioned at a right angle to the surface, otherwise it will not cut evenly and will tend to creep. Also, no more pressure should be exerted than is needed to make the drill cut, especially if it is a small drill. Too much pressure might cause the drill to bend and break. If an electric drill is being used, it should be held firmly with *both* hands.

A suitable lubricant should be used to minimize wear on the drill and to make cutting easier. Oil should be used when steel is drilled. Industrial alcohol or paraffin wax should be used with aluminum and plastics. The wax will prevent aluminum chips from clogging the cutting edge of the drill. Plastics heat up and soften when holes are drilled in them. This may be minimized by using a slow speed (this rules out the use of and electric drill) and by drilling the hole a few steps at a time, rapidly backing out the drill between each step before the chips have had a chance to re-harden and bind the drill.

When a hole is nearing completion, there is a tendency for the drill-point to catch, after which it will suddenly break through the metal. This catch can sometimes be felt and the pressure should be lightened so the drill chuck will not slam against the surface with a sudden impact. If the hole is being drilled in an assembled piece of gear and if wiring or components are located behind the proposed hole, place a piece of metal or wood behind the surface to prevent damage. The scheme shown in fig. 3 may also be used.

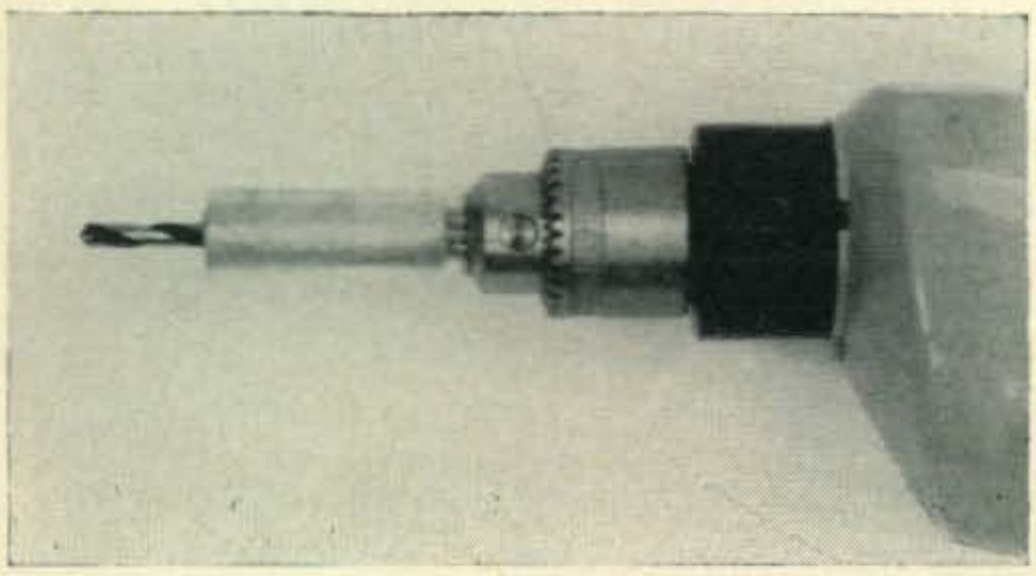


Fig. 3—A piece of stiff plastic tubing, slipped over the twist drill, will limit the depth of the latter through the rear of the material and prevent its damaging internal components.

Finishing the Hole

After a hole has been made, sharp edges or burrs will be found at the back of it. These should be removed with a dull penknife, file, hole scraper or deburring tool (See "Special Tools").

A ½ inch drill rotated by hand makes a convenient tool for de-burring holes, but if many holes are to be smoothed off, it might be more comfortable to use it with a carpenter's brace. A file will often leave unsightly file marks over a large area of the surface. If one must be used to reach a hole which is inaccessible with other tools, it should be a half-round one, the flat side of which curves up slightly near the tip. This part of the file should be used to concentrate the work just at the area of the hole.

If a hole has drifted slightly away from its desired location, it may have to be enlongated or enlarged to fit a certain dimension. The latter may be done with a larger size drill. Elongation may be produced by filing or by using the drill again, this time slightly rocking it back and forth in the desired direction.

If a proper drill is not available for making a large size hole, a quarter-inch one should be made first, and then enlarged with a reamer, as described earlier in "Tools." An alternate method is that of using a round or rat-tail file, but this may be tedious and also may result in a non-uniform hole. As with a drill, a hole which has been reamed or filed may require de-burring.

Holes which are made with large drills are sometimes easier and better done in several steps, starting with ¼" and using a 1/16" or 1/8" inch larger size for each succeeding step.

Use of Drill Press

When a drill press is used, the same general procedure should be used. Small holes may be drilled while the material is held by hand on the drill press table. For large holes and for drilling in very small metal pieces, the material should be clamped to the table, in order to prevent its spinning around. This also prevents the piece from wobbling around which result in

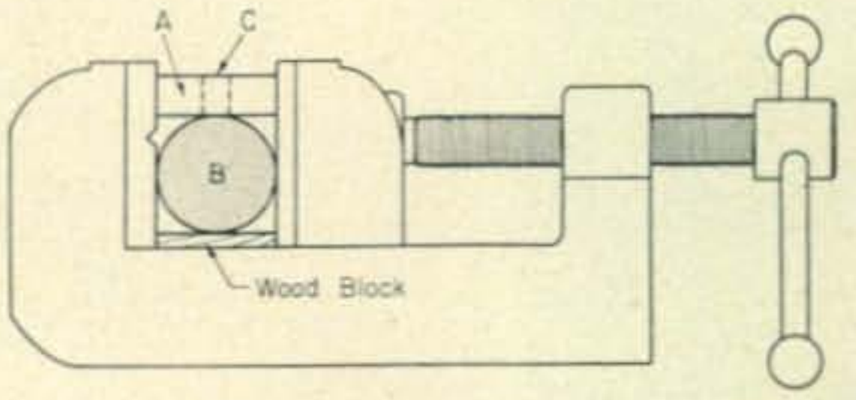


Fig. 4—Use of a guide for accurately drilling hole through the diameter of rod or tubing. The guide, *A*, is made of ¼" to ½" thick piece of round or square metal equal to the diameter of the rod, *B*, which is to be drilled. A hole, C, of the desired size is drilled through the center of *A* and is used to center and guide the drill when the parts are held in the vise as shown. A particular tool (Center-Tru Jigger) designed for this operation is also available. See "Special Tools."

chattering and in a hole which is not entirely round. Instead of clamping a large piece of material when it is drilled, it may be prevented from spinning, by resting one edge of it against the left side of the drill-press column.

Small or round-shaped parts may be held securely and accurately positioned in a table-top or drill-press vise. V-shaped blocks are usually supplied with this type vise to hold round stock.

Accurate alignment of holes drilled through the sides of solid round stock or tubing may be obtained with a drill-press vise using the scheme shown in fig. 4. This will be handy for making set-screws holes in collars and couplings or for wire leads in plastic coil forms. A less accurate method is shown in fig. 5.

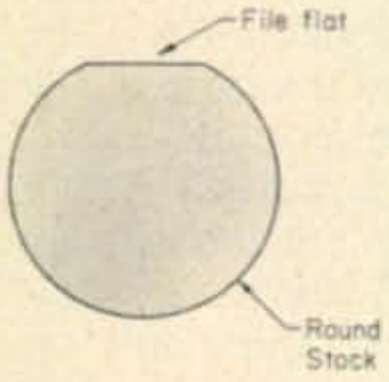


Fig. 5—A less accurate method of drilling through round material. A small flat is filed at the desired location for the hole and a starting hole made with a center punch. Drilling is done with the work lined up by eye.

Holes Larger Than One Inch

Round holes from ½" up to 3" in diameter may be made using chassis knockout punches as described elsewhere. If a correct size punch is not available, the next smaller size can be used and the hole afterwards enlarged using a half-round file. A reamer also may be used for holes up to about one inch.

Holes larger than one inch may be made using a circle cutter. The hole-saw type may be used with a brace, electric hand drill or a drill press. The material to be cut should be placed on a flat piece of wood, so that when the cutter breaks through, it will not mar the bench top. It also should be clamped securely.

A correct size pilot hole must first be made to guide and hold the saw in position. The pilot for most circle cutters is a twist drill at the end of the tool, which makes its own pilot hole. Part of its shanks afterwards is the bearing surface needed for guidance. The tool should be used with its shank perpendicular to the surface to allow all the saw teeth to come in contact with the material at the same time. Plenty of lubricant should be applied during the work. The job will be easier and neater if the hole is cut part way through the material, and the remaining cutting done from the other side.

Fly Cutter

Before a fly-type of circle cutter is used, a circle of the desired size should be scribed on the material at the proper location, with a starting point made by a center punch at the middle of the circle. The fly cutter should be used only in a drill press with the material backed up by a piece of wood and clamped tightly to the drill-press table.

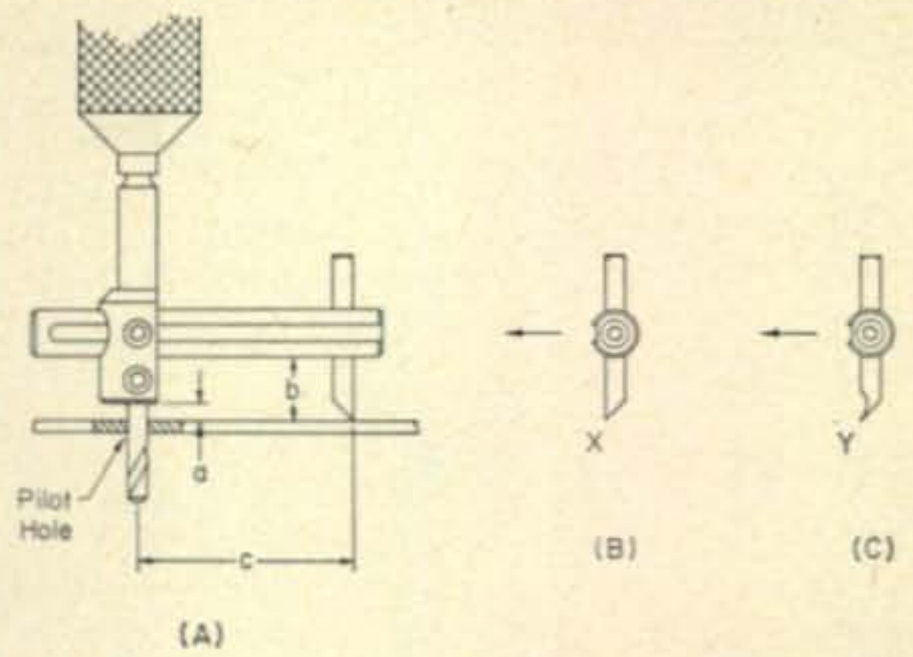


Fig. 6-(A) Setting up the fly cutter. Dimension *b* should be adjusted so that *a* is slightly greater than the thickness of the metal to insure the pilot drill's bearing on the smooth part of the pilot drill shank. Less strain will be placed on the cutting blade also. Dimension *a* should be adjusted according to the radius of the desired hole.

(B) Side view of cutting blade used for steel work. X is the front of the blade which should be flat. Arrow indicates the direction of rotation.

(C) Side view of cutting blade used with aluminum. The front side Y should be ground to provide a slight back angle so that the metal clips will not stick to the blade and hinder the cutting.

A pilot hole will have to be made first. Then, with the fly cutter motionless and set in the pilot hole, its arm should be adjusted for the desired hole dimension, using the scribed circle as a guide. See fig. 6. The drill press should be run at a very low speed and plenty of lubricant should be used. The downward pressure on the drill-press lever should be no more than needed for the cutter to do its job. Cuts may be made from both sides of the material as suggested earlier. Keep hands clear of the fly cutter and use protective eye goggles if possible.

Large holes also may be made by drilling small holes around the inside circumference of the proposed hole, after which the center may be knocked out with a hammer or pried loose with a screwdriver. The edges are then smoothed down with a file. See fig. 7.

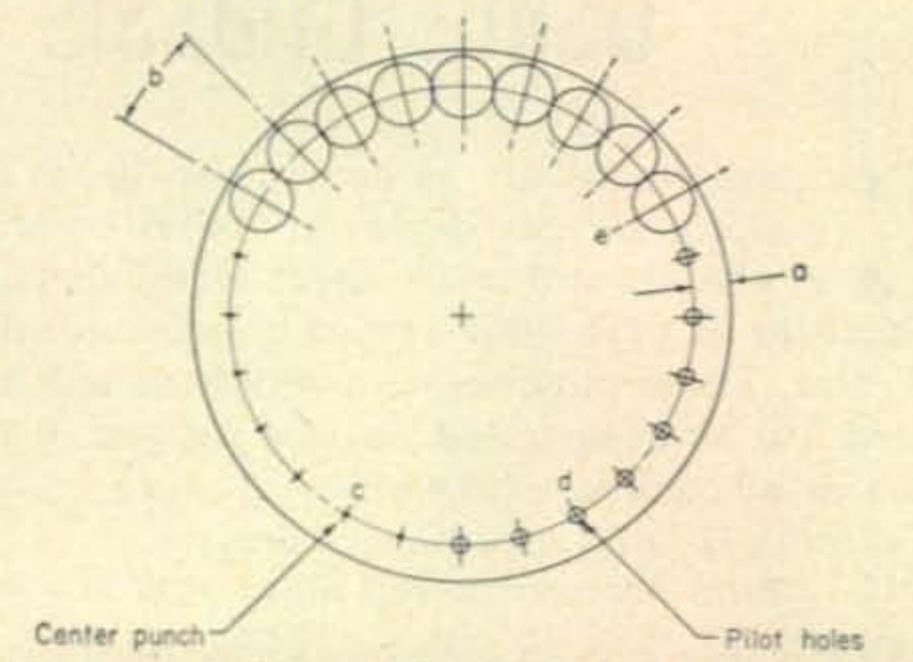


Fig. 7—Large holes may be made by drilling a series of smaller holes around the circumference and then knocking or prying out the center piece. Dimension *a* should be slightly more than the radius of the drill and dimension *b* should equal the diameter of the drill. The locations for the holes should be made with a center punch as at *c*, drilled with a small drill as at *d* and then completed with the larger drill as at *e*.

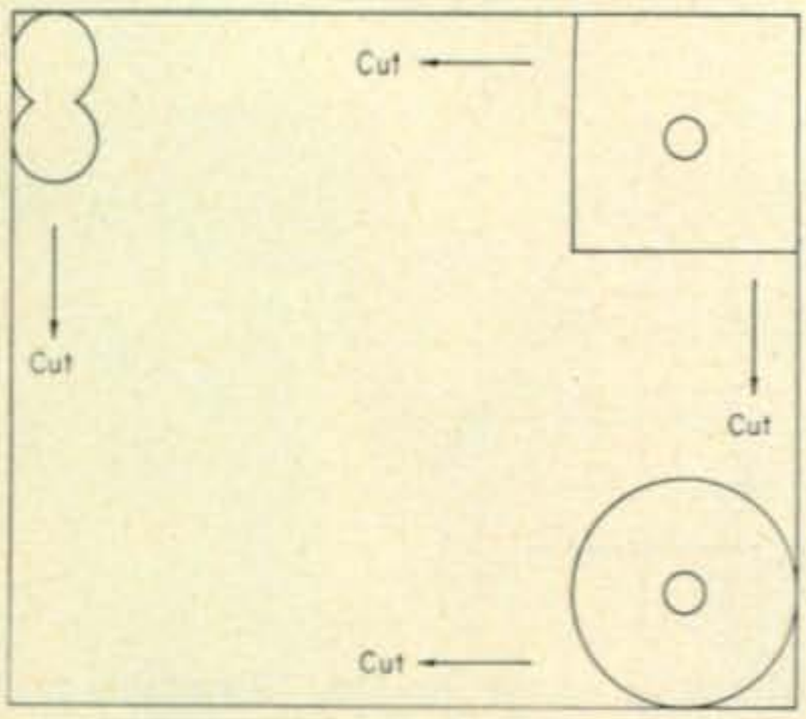


Fig. 8—Making a rectangular cutout. Holes should be made at corners using a square or round chassis knockout punch or several smaller size drilled holes. A hacksaw may then be inserted through the holes and used to cut the remainder of the material in the directions indicated. Corners may be trimmed afterwards if needed.

Rectangular Holes

Rectangular holes may be made using the method just described, but since this is rather tedious, other means would be better.

One method is that of making suitable holes at each corner of the proposed cutout, using a drill or a chassis punch, and then inserting a hacksaw or a keyhole saw through the holes, to cut out the rest of the material as shown in fig. 8. If a large *square* hole is to be made, a circle cutter may be used to cut out the center area; the remainder near the corners can be sawed or filed out.

A convenient method for making the entire cutout is that of using square chassis-knockout punches as described later.

Another simple means of making all sorts of odd-shaped holes is the use of a "nibbling" tool, described in "Special Tools." All it requires is a 7/16" starting hole in which it is inserted. It is then moved along the surface as it bites out about 1/16" × ¼" bits of metal. This sounds like a slow process; however, such is not the case, for the bites may be made rapidly. Four inches of 1/16" soft aluminum may easily be cut in less than one minute.

Panel Holes

When holes are to be drilled which line up with both a panel and the front of a chassis, it is best to first mount the panel on the chassis and then drill the holes in both pieces at once, to ensure perfect alignment. When this is done, the panel may be secured to the chassis with several screws or with a pair of C-clamps.

When two clamped pieces are drilled at the same time (especially for large size holes), the pieces are often sprung apart by the burr at the rear of the first piece. It may be more desirable, then, to make only small pilot holes through both joined pieces, after which the pieces may be separated and the larger holes made individually. If the holes should not quite line up or should make it difficult to install a component through them, a slight touch-up with a taper reamer, after the panel is fastened to the chassis, should correct the difficulty.

Precautions

Besides those already mentioned, the following precautions should be heeded:

1. Never leave the key in a drill chuck, even for a moment. Inadvertent starting of the drill will cause the key to fly off, possibly injuring the operator.
2. Do not wear a necktie during drilling work. It may get caught in the drill.
3. Do not rush the work or overheat the material and drills.
4. Remove hole burrs as soon as possible.

Using Chassis Knockout Punches

CHASSIS knockout punches are used for making various shapes and sizes of holes in chassis and other sheet metal surfaces of steel up to 1/16" thick or of aluminum up to 1/8" size. Those punches with which we are concerned are hand-operated devices for use in the home or electronic workshop.

Commonly used punch sizes are:

1/2" round for ventilation holes and 1/2 inch grommets.

5/8" round for 7-pin miniature tube sockets and type SO-239 coax connectors.

3/4" round for 9-pin miniature tube sockets and screw-on type electrolytic capacitors.

3/4" Square for Jones 300-Series chassis connectors.

1-1/8" round for octal tube sockets.

1-1/4" round for twist-lock type electrolytic capacitors.

The punches may also be used of soft plastics, composition board, bakelite, etc. However, a test cut should be made first to see if the material will crack.

Round punches often are called socket punches because they mainly are used to cut holes for tube sockets. However, they are also useful for making holes to mount electrolytic capacitors, for feed-through bushings, grommets, ventilation, meters, coax connectors, for corner cutouts on rectangular holes, *etc.*

A 1/2"-diameter round punch will make a clean hole without effort when the user's facilities are otherwise limited to making holes no larger than 1/4" diameter with an electric hand

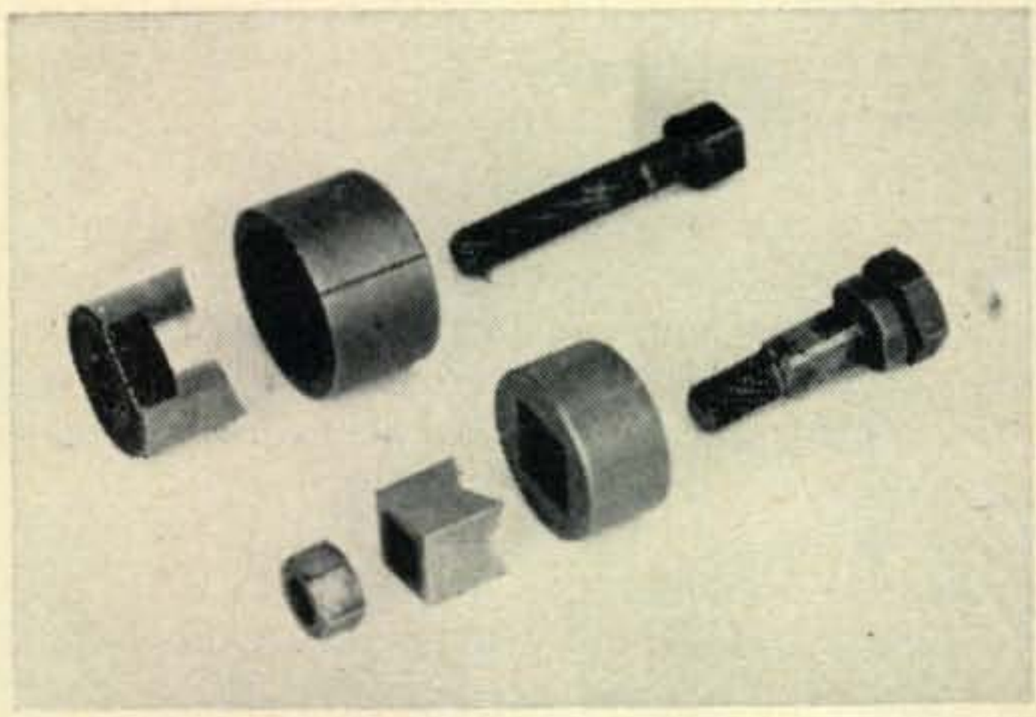


Fig. 1—Disassembled chassis knockout punches. Round model is at the top. The parts are, from left to right: punch, die and take-up screw. The parts for the square punch at the bottom are, from left to right: take-up nut, punch, die and lead screw.

drill. Other round-type punches are made for cutting key- or D-shaped holes to prevent rotation of retainer ring-mounted sockets.

Square-shaped punches, of course, are used for making square holes which may be needed for certain type power plugs, transformer cutouts, miniature relay sockets, *etc*.

Using the Punch

After locating the hole to be punched, mark the center of the hole with a center punch. Next, drill a clearance hole for the take-up screw through the center point. The screws usually are 1/4", 3/8" or 3/4" in diameter, but the hole preferably should be made 1/32" larger. This permits easier removal of the cut slug from the drive screw.

Note: Before the tool is used, the screw and the punch threads, the underside of the screw head, and the working surfaces of the punch should be lightly lubricated.

Place the punch drive screw through the hole of the die. The recessed side of the die must be toward the metal. The drive screw should then be passed through the clearance hole in the chassis and screwed into the punch which is postitioned with its cutting edge toward the metal. See fig. 2. Tighten the drive screw by hand until the cutting projections on the punch bite into the metal surface.

Next, turn the drive screw with a wrench. This draws the two sections of the tool together until the metal is cut through. The wrench should fit snugly on the head of the drive screw to prevent damage to the corners of the head.

The punch is shaped so that only small sections of the material are cut out at a time in a scissors-like manner. Two separate snaps will be felt as the final cuts are made indicating the completion of the job.

The finished hole will have a smooth and slightly rounded edge on the side of the material where the punch part of the tool was used. The side where the die was held usually will have a sharp edge which may be smoothed off with a half-round file or a dull penknife, if necessary. Where circumstances permit accessibility for operating the take-up screw when the hole is being made, the punch part should be placed on the side where the smoother edge is preferred.

Before using the punch again, remove the drive screw from the die and knock out the metal slug. If the slug sticks, it can be easily removed by tapping the take-up screw or screw driver through the center hole of the die.

Enlarging a Hole

A situation may arise where an existing hole must be enlarged, as often happens when a change is to be made from a 7-pin miniature socket to a larger one. The larger opening, of course, may be made with an appropriately larger punch, but the punch must be correctly centered if the new hole is to come out in the same spot. The dies of some of the round chassis punches are marked with guide lines every 90 degrees around the die. These should be lined up with similar reference lines marked across the existing hole in the material, as shown in fig. 3. Where no guide lines are provided on the die, a circular line having a diameter slightly greater than that of the die may be marked around the edge of the old hole. The die is then centered in this circle.

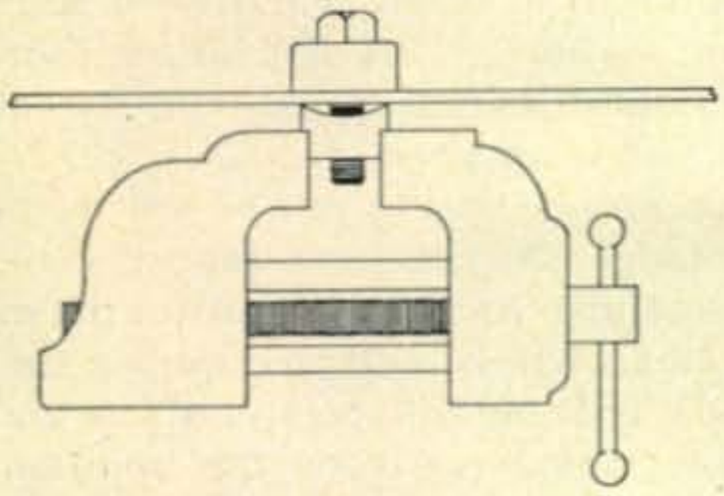


Fig. 2—Punch assembled through pilot hole on piece of metal and held in vise clamped to parallel flat edges on the punch. Where space does not permit use of vise, the work may be held by hand. The punch will not rotate during the operation, because it bites into and locks against the metal.

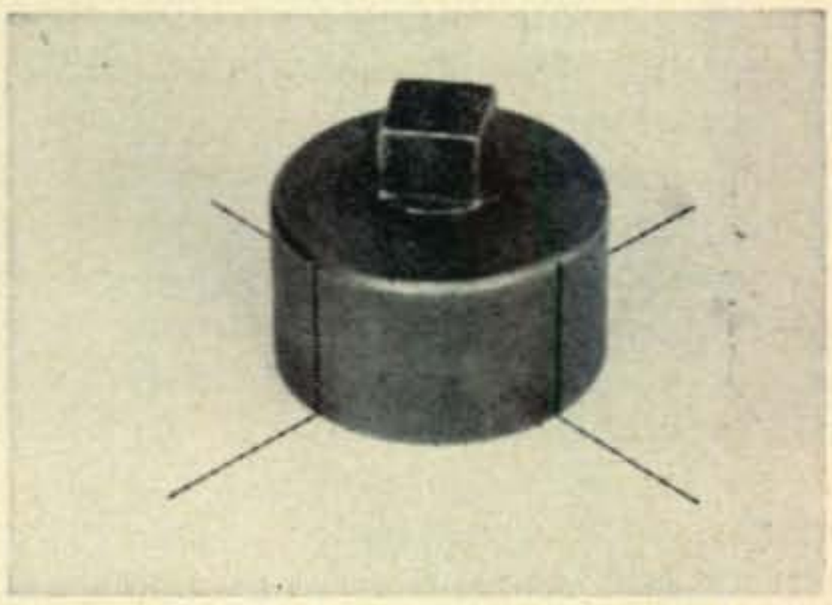


Fig. 3—When an existing hole is to be enlarged, the knockout punch may be properly centered over the hole by means of right-angled guide lines. See text.

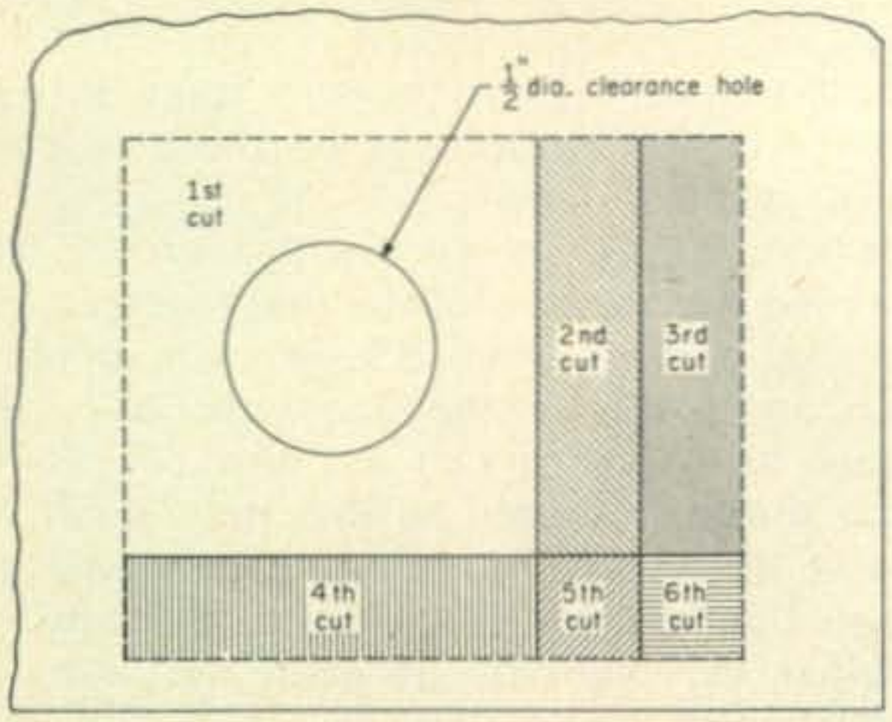


Fig. 4—When a square punch is too small to make a particular size hole, it still may be used by cutting away a bit of the initial hole a step at a time, as indicated by the 2nd, 3rd cuts, etc.

Punching Square Holes

Square holes are made in much the same manner as are round ones, except a take-up nut on a lead screw is used in place of a take-up screw to draw the two parts of the tool together.

Before a square punch is used, mark the outline of the desired hole on the material to be cut. Next, drill the lead screw hole at the exact center of the opening to be cut. The upper part of the lead screw is square shaped and requires a clearance hole of ½" diameter which may be cut out with a round punch if drilling this size hole is not convenient.

When assembling the tool to make the hole, place the punch part on the side of the material with the outline of the square hole marked on it. Hold the punch in the proper position by hand until the drive nut is tightened enough to bite into the metal. Release the die and it will remain in place during the remainder of the punching operation.

If a square punch is not large enough to make a particular size hole, it still may be used for the job simply by cutting away a bit of the initial hole a step at a time. See fig. 4. If the desired hole is large enough, two or more square holes may first be made within its bounds, after which any necessary nibbling can be done.

Storage

Before storing chassis punches, wipe them lightly with oil to prevent rust. To protect the cutting edges of the tool, leave one of the metal slugs in the die and assemble the tool with the drive screw drawn up finger tight. Another way is to place the disassembled parts separately in a wooden rack in which cutouts have been made for the individual parts.—*W2AEF*

Metal Painting and Finishing

METAL may be finished with applications of various types of paint or by a chemical etching process. Aluminum parts such as chassis, boxes, brackets, shields and even panels, often are given a neat looking natural satin-like finish by a chemical process readily done in the small shop. It is especially desirable if the polished surface of the aluminum has been marred.

All that is needed for the job is ordinary household lye dissolved in water and a suitable container to hold the solution with the aluminum part immersed in it.

Procedure

Before the metal component is etched, it will be best to drill any necessary holes in it; otherwise, the new finish may become scratched during layout and drilling work. Bent pieces also should be formed first.

It is important that etching work be done in a well-ventilated area, preferably out of doors, because poisonous gas fumes are given off by the solution as it works. Another precaution is to make certain that the solution does not come in contact with hands, clothing, furniture or painted surfaces.

The lye, which comes under a variety of trade names such as Lycons, may be purchased at any household-goods store or supermarket. It should be mixed with warm water in a pan or bowl made of glass, earthenware, enamel or porcelain of sufficient size to allow the aluminum piece to be completely submerged. A large basin or dishpan will usually do. An aluminum utensil should *not* be used.

About one tablespoon of lye will be needed for each quart of water. A piece of wood should be used to stir the solution until it is thoroughly mixed, after which the aluminum should be immersed in it. Foaming bubbles will appear around the metal as the chemical action takes place. With certain shaped parts, the gas which is generated may tend to lift the piece out of the solution, in which case the part should be re-oriented so this does not happen. After about 30 minutes, the material should partly lifted out of the solution to see if it has been sufficiently etched or "satinized." If not, allow more time in the solution, checking periodically until the desired finish is obtained.

The aluminum should not be left in the solution any longer than needed, since this will result in a considerable loss in thickness of the material and any holes will be enlarged quite a bit.

A black coating will be found on the metal when it is removed from the solution. This should be wiped off immediately with a rag and cold water. Make sure that the coating is cleaned out of corners and from the inside edges of any holes in the part. A solution of vinegar and water will further clean the piece and neutralize any further chemical action.

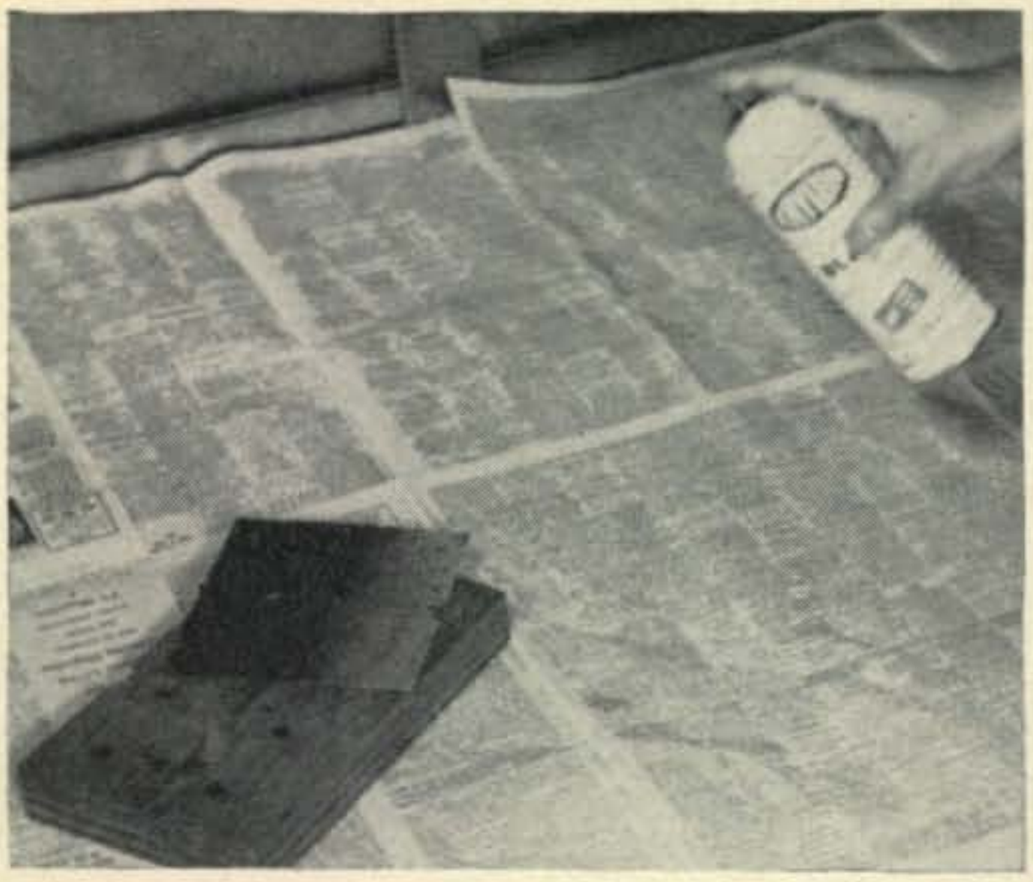


Fig. 1—Newspapers are spread over the working area during spraying. The part being sprayed is placed on top of thumb tacks which are stuck in a block of wood. This raises the material above any surface which otherwise may stick to it along the edges. The sprayer, which in this case is an Aerosol pressurized can of paint, is held at an angle and at a distance from the work which will result in an even coating of paint.

If the metal part is too large to be completely submerged during the work and a larger container is not available, the piece should be rotated from time to time, so that each section will be immersed for equal periods of time in order to obtain an uniform finish. When this is done, any black deposit exposed to the air should be wiped off to prevent staining the metal.

After an aluminum panel has been etched, it is best to protect its surface from dirt and hand smudges by spraying with clear lacquer.

Paints

Whether to use enamel or lacquer must be decided before painting. Lacquer dries fast and results in either a dull or semi-gloss finish, depending on its consistency. It can also be made to produce a "Hammertone" finish which gives a mottled-color effect similar to a stippled finish. This is not only attractive but also tends to cover up scratches or other blemishes on the material. Due to the quick-drying properties of lacquer, difficulties due to settling dust usually are not experienced. When it is to be applied to most surfaces, especially polished aluminum, a primer or undercoating should be used to provide a firm bond.

Enamel produces a glossy finish and when thoroughly dry, it is harder than lacquer and therefore is less subject to scratching. Some enamels are "quick-drying", nevertheless, the time required for drying is longer than that for lacquer, so precautions must be taken to prevent dust from settling and sticking to the fresh paint. Enamels sometimes adheres fairly well to surfaces which have not been given a primer coat provided the surfaces have otherwise been properly prepared. To be safe, the application of a primer is recommended.

Another type of paint produces a crackle or wrinkle finish which often is used on commercial

gear. Although it may be applied in the small shop and be air-dried, a much finer job results when the drying is done by baking. This might not be feasible for the home worker. Also, the rough surface of a crackle finish is harder to keep clean, as dust settles in the crevices of its surface.

Preparation of Surfaces

Metal surfaces must be properly prepared before paint is applied. The surface should be slightly roughened with fine sandpaper to provide a granular base for good adherence of the paint. Etched surfaces already will have this finish. All dirt and dust should be removed and the metal should be washed clean using a surface conditioner or thinner for the type of paint to be used.

Work Area

A work area should be selected which is free from dust. It should be well ventilated because many paints give off toxic fumes which could be harmful if inhaled. In addition, the paints are inflammable and therefore should not be used near an open flame.

Method of Application

Paints may be applied either by brushing or spraying. Most enamel paints may be brushed on, but because of its very fast drying qualities, lacquer is best sprayed on. Application by brush often leaves brush marks and an uneven finish. In either case, the spraying technique generally produces a more satisfactory result and it is an easy and rapid method of application.

Professional spraying is done with a spray gun which operates from compressed air, generally obtained from a separate air compressor. The air is fed through a valve and nozzle mounted on top of a jar which holds the paint. The air, which is controlled by a hand-operated trigger valve, forces the paint through the nozzle to provide the spraying action. The nozzle is adjustable for optimum operation, depending on the type of paint and its consistency.

A low-cost device for the home-user is an electric sprayer which employs a vibrator mechanism instead of externally obtained air pressure. A vacuum cleaner spray attachment also may be used with a reasonable degree of success, but one of its drawbacks is that the air blast is so great that it will tend to blow away the object being painted, unless it is heavy.

The most popular method of paint spraying for the do-it-yourselfer is the use of a paint supplied in an Aerosol pressurized container equipped with a spray nozzle. It may be used by itself for spraying the liquid. The cost for a given amount of paint may run slightly higher than otherwise, but it can be well worth it for the small shop-worker who may do only occasional paint jobs, because of the convenience it affords and because an investment in a spraying outfit is not required.

The Aerosol can is ready to go at any time

with no special preparation required. No paint has to be separately mixed or poured and after the job is completed, cleaning of a sprayer or a container jar is not necessary, thus doing away with messy procedures. Aerosol cans are available either with lacquer or enamel paints in a wide variety of colors and types of finishes. Special primers also are obtainable. Electronic, hardware and auto supply stores will be found a most convenient source of pressurized cans of paint.

Doing the Work

Overlapping pieces of newspaper should be placed on a table, bench or floor in the chosen work area. The part to be sprayed should be placed on the papers, but lifted slightly above them to prevent their sticking when the new paint runs around the bottom edges. Small blocks of wood may be used to raise the object. They should be placed under and away from the bottom edges. A single piece of wood, with several thumbtacks stuck into its top surface, may be handier to use. See fig. 1.

The sprayer and the paint should be prepared and used according to the instructions furnished. In this regard, it should be kept in mind that a primer undercoat will most likely have to be used first. Also, just prior to the actual work, the object should be gently wiped clear of any dust which may have settled upon it.

In general, to get an even coat without bubbles, the spraying will best be done at an angle, from a distance of from 8" to 24", depending on the type sprayer and the consistency of the paint. A sideward back-and-forth motion, going past the sides of the object each time, should be used. Start from the rear or top of the object and gradually work toward the front or bottom. It is also best to have the object lie flat when possible in order that the paint settle out smoothly and avoid runs.

The spray nozzle should not be held too close to the object and the paint should not be sprayed on too thickly; otherwise it will tend to run, smear or form globs on the surface. Also, the sprayer should not be held above the object as globs of paint may drip onto the surface.

If there is any doubt as to the distance from which the sprayer should be operated and if it has an adjustable nozzle, a trial application on a test surface should be helpful. A few squirts on a piece of newspaper may do.

After the part has been painted, sufficient time must be allowed for it to dry before handling, but if any handling is necessary, it should be done along the edges, not on the surfaces. Handling might be required when all sections of an object cannot be reached during one spraying operation, in which case the part may have to be turned around. Of course, if the underside is to be done, it must be quite dry before it is turned over onto one of its fresh-painted surfaces.

Sufficient time for drying also must be allowed before the painted part is otherwise handled and

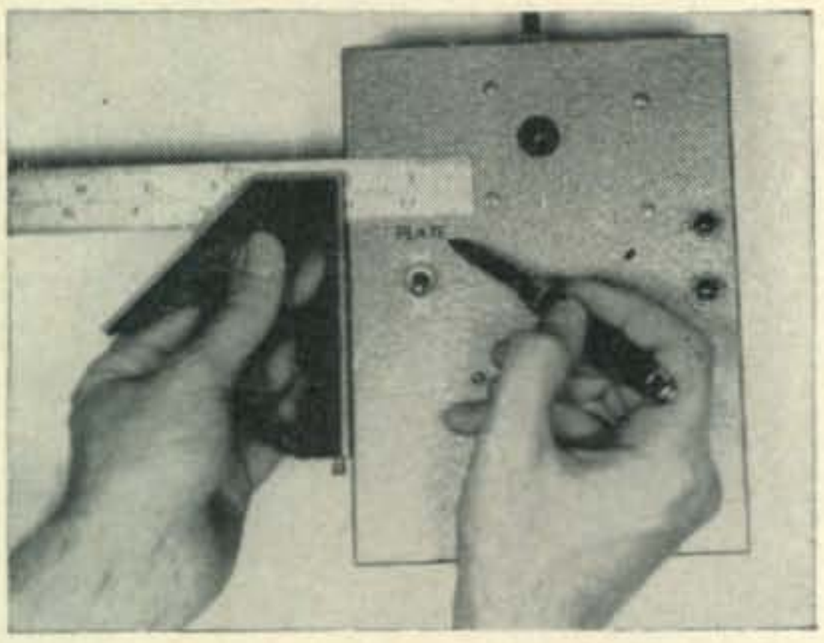


Fig. 2—Application of a decal using the combination square as an alignment guide. The decal has been moistened, slid off its backing and is being positioned with a penknife.

assembled with other components. For lacquer, the time will amount to an hour or so while for enamel, even the quick-drying type, it will be about 24 hours.

After the work has been completed with a spray gun, any paint that is left over should be poured out of the spray jar, after which a bit of paint thinner should be placed in it and sprayed to clean out the nozzle. If an Aerosol can has been used all that is required for keeping it clean for the next job, is to turn the can upside-down and make a few squirts with the nozzle.

Decals

Manufactured equipment is provided with lettering on it for the identification of its various functions and controls. This is done by engraving, silk screening or with stamped nameplates. These methods are beyond the scope of the home-constructor and the cost of having such work done outside is rather high. Fortunately, this is not necessary because easy-to-apply decals are obtainable. The use of these will give a commercial-like appearance to the home-built equipment.

Decals are available in a wide selection of complete titles for all sorts of equipment categories and functions. Individual letters and numbers also are obtainable. The titles, which have either white or black lettering, are furnished on a sheet of clear thin plastic-like film secured to a paper backing. The desired title is cut and immersed in water or special liquid until the title can be slid off the protective backing and

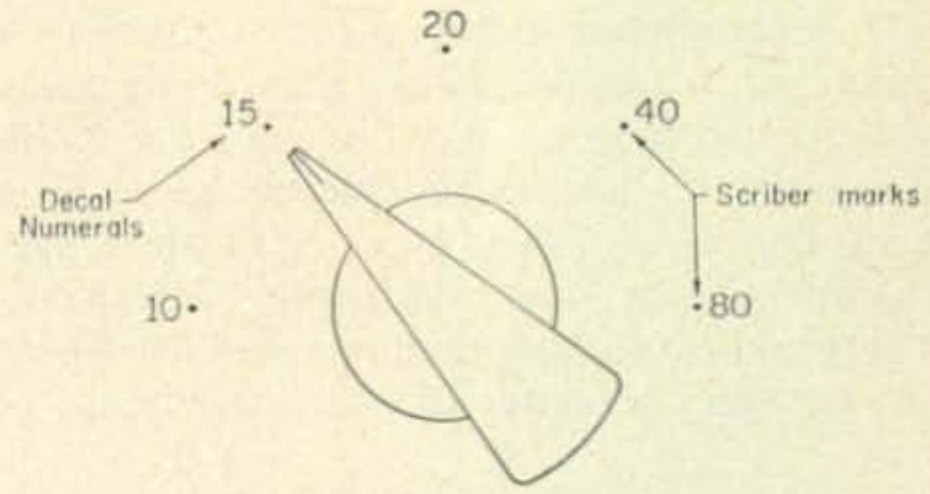


Fig. 3—Guide points for lettering around a selector switch may be obtained by a small indented mark made with the point of a scriber opposite the knob index for each position of the switch.

transferred to the required spot on the equipment.

When this is done, it will be found helpful to first moisten with water the spot where the decal is to be placed. This enables the lettering to be easily positioned without tearing the thin film. Excess water can be absorbed with a blotter later. During the application the decal should be handled with tweezers or on the flat surface of a penknife blade with which it is moved into position. A combination square will serve as a guide for lining up the lettering. See fig. 2. Remember, care must be used to make sure the title is kept moist as it is moved into position otherwise it may tear apart. After the decals have dried overnight, they should be coated with a thin layer of clear Krylon, lacquer or clear finger-nail polish.

Where lettering is to be installed around a selector switch, guide points may be useful. A small indented mark made with the point of a scriber opposite the knob index for each position of the switch will do. See fig. 3.

There is another method of lettering available which is simple, instant and which does not require a liquid. This is the dry-transfer or instant-lettering system called Letraset, made by the Datak Corp. All that is needed is a little pressure to transfer the lettering from a translucent film to the surface of the equipment. Other advantages of this method are that the titles may be positioned more easily, the application of individual letters and numerals can more readily be made and just the lettering alone is applied to the surface, leaving no trace of an adhesive and thereby resulting in a real professional-looking job. Black or white lettering is available.

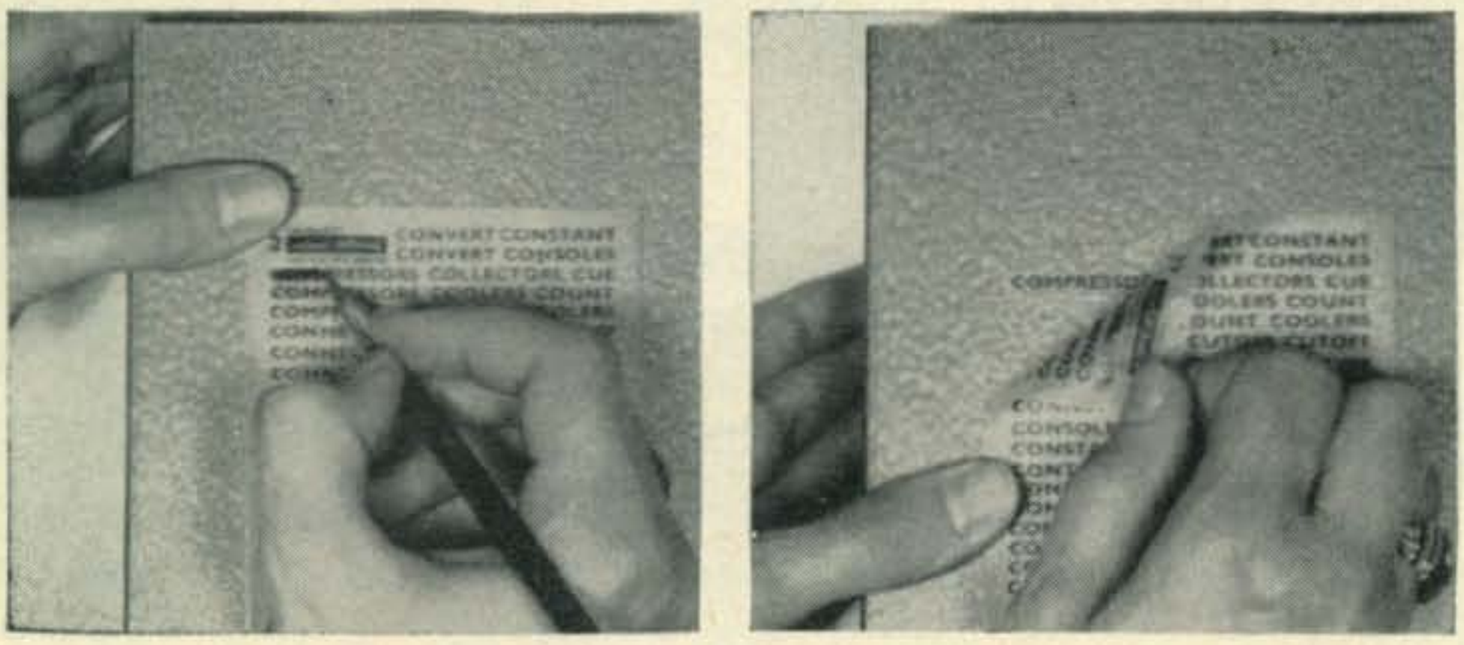


Fig. 4—Application of dry transfer, or instant-lettering, only requires a small amount of pressure applied with an implement such as a ball-point pen as shown at left. Transfer sheet is then lifted away and the lettering adheres to the surface (right).

Soldering Techniques

BEFORE any soldering work is done, a suitable iron should be selected according to the type of work involved, ease of handling, individual preferences and cost.

A small standard iron, having a power rating between 25 and 60 watts, will be suitable for light duty applications such as soldering small wire leads to terminals and for general electronic work. Some of these irons, which are very slender, are called pencil irons. They heat up faster than larger irons, requiring an average of about 1½ minutes, and will be found most handy for use in the intricate confines often encountered in electronic equipment and especially for use on printed-circuit boards.

These irons also are very lightweight (2 to 6 ounces) and thus reduce fatigue when the work is done continuously over long periods of time. Some of them have interchangeable tips of different sizes and shapes for various applications.

Standard soldering irons remain heated continuously during the period of work. The tips are usually made of copper; however, there are specially plated tips which will stand up better under continuous duty, and so are often desirable, especially for small size tips where a high degree of heat is produced in a small mass.

For general use, a ¼-inch size chisel- or pyramid-shaped tip will be suitable. It also may be used for printed-circuit work but a ⅛" tip would be more desirable in this case. Some of the smaller irons have an insulated flange or sleeve near the center of the body which will allow the tool to be placed anywhere on the bench without danger of burning it but a stand would be desirable to prevent accidental contact of the hot tip with other objects.

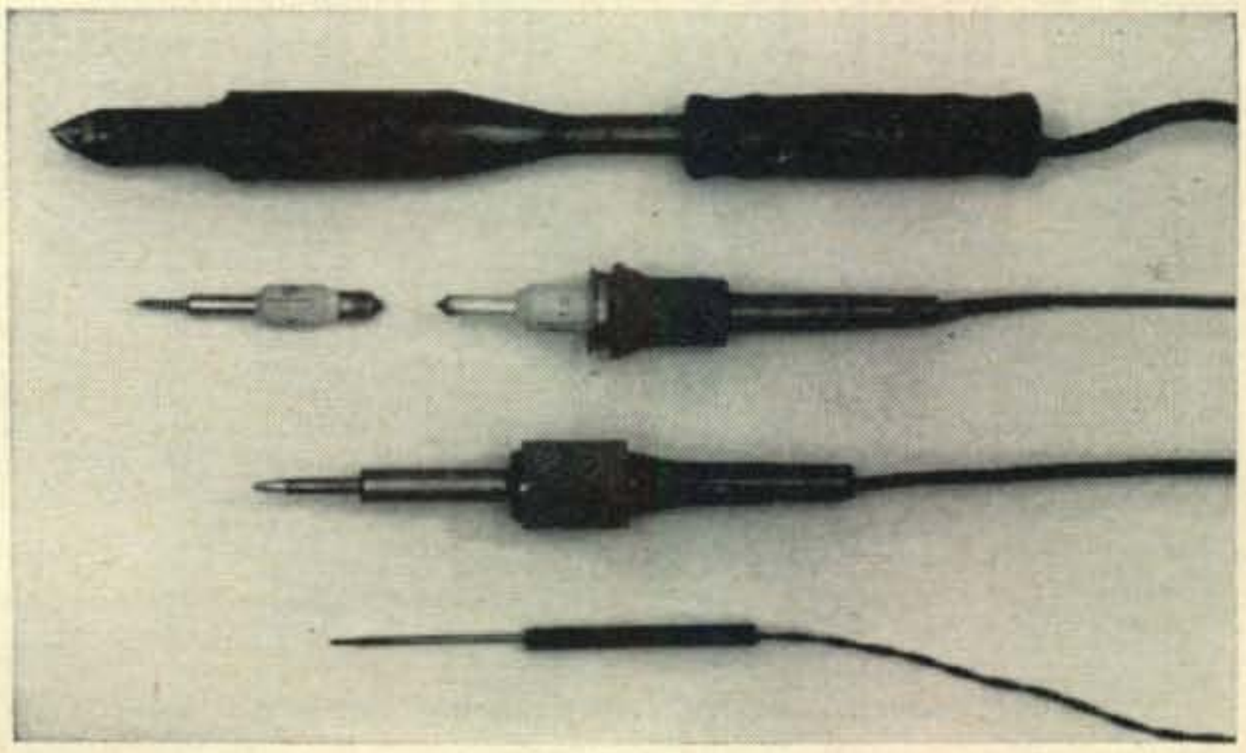
For heavier duty work with sheet metal or with parts having a large mass, a heavier duty standard iron should be used. Sizes from 100 to 700 watts are available, but one around 150 watts will suffice for most needs. Heating time for the larger irons runs upwards of 5 minutes or so.

Soldering Gun. Weller Model 8200, 100-150 watt dual heat. Spare replaceable tip is shown below.

Soldering Guns

The soldering gun is a very popular tool because it is virtually an Instant-heating device (requiring about 5 seconds). It can be turned on and off with a trigger switch as needed, so it offers a convenience not found with other irons, particularly for service work, for occasional soldering or for use during short assembly jobs. It also cools rapidly, so a waiting period is not necessary before it can be stored away safely, and the danger of accidentally burning other objects when it is set on the bench, is minimized. The on-off feature goes a long way toward keeping the electric bill down with work of long duration.

Soldering guns are heavier than smaller irons, weighing from 1 to 3 pounds, and they are somewhat bulky. Most of them are quite well balanced and are handy to use, since the working end is small enough to allow its use in tight areas. The tip also may be bent, if needed, to reach into difficult places. In addition, plated and various shaped tips can be had for particular needs. One or two small lamps are mounted on the main body and are focused to light up the area around the end of the tip to enable one to see the work in dimly lit confines.



Standard Type soldering irons. Pictured from the top: 300 watt iron for sheet metal work, pencil iron with interchangeable screw-in tip and heating element (Ungar Model 776), 40-watt pencil iron with ¼" tip (Hexagon #24S) also available with ⅛" and ⅜" tips. Both of these irons are suitable for most electronic work including printed circuits. At the bottom is the Oryx sub-miniature iron for extra fine work.

Soldering guns are available in various power ratings from 90 to 275 watts. Some are obtainable with a dual-heat feature which provides extra fast heating and two selections of operating temperature. A 100 watt gun or a dual heat 100-150 watt model will be adequate for most electronic soldering in the home workshop.

The soldering gun can be used for printed-circuit work if extreme care is taken. However, its use is not recommended because of the possibility of damaging the boards due to excessive heat from the gun. The use of a small pencil iron is preferable for this type of work.

Instant-Heating Iron

Another type of soldering iron is the on-off instant-heating iron which is similar to a soldering gun, both in operation and appearance. It combines some of the advantages found in both the gun and the small size iron. A soldering "pistol" has recently been introduced which is also similar. Both types are lighter in weight than a gun, the pistol weighing 1 pound and the instant iron 8 ounces. Their working ends and tip are much like that of a pencil iron. A working light is also included. These irons are comfortable to use, are nice for reaching into small areas and are handy for printed-circuit work.

Selection of Solder

A good grade of solder should be selected, which for electronic work, should have a tin-to-lead ratio of between 60/40 and 45/55. A #16 gauge size generally is used, but a #18 gauge is handier for delicate work with printed circuits. Only solder designed for use on electronic equipment should be used since it has a special core of non-corrosive rosin flux. This makes soldering easier and better by removing oxides from the surface to be soldered and keeps it from oxidizing during the work, enabling the solder to properly adhere to it. The rosin may be in a single core or consist of several cores throughout the solder as long as it is properly proportioned with the solder to ensure maximum efficiency.

Under no circumstances should an acid flux or acid-core solder be used on electronic equipment because it will cause corrosion and will eventually ruin the equipment.

Solder made of special alloys may be obtained, with resin cores, for reducing the wear on soldering-iron tips.

Preparing the Iron

Before using a soldering iron, the tip should be "tinned"; that is, it should be lightly coated with solder to provide a good heat transfer between the tip and the work. A brand new iron may not need any particular preparation prior to its initial tinning, except for the possible use of a special paste which may have been supplied by the manufacturer.

The copper tip of a used iron which has worn away or become pitted and scaly will need cleaning or reshaping which should be done with a

file stroked lengthwise toward the end of the tip, not cross wise. The tip should then be tinned immedately. Plated tips should not be scraped or filed.

The procedure for tinning a new or freshly cleaned iron is to hold a piece of solder against the tip while the iron is being heated for the first time, and as soon as the temperature rises to the point where the solder begins to melt, quickly coat all the surfaces of the tip with molten solder, *before* the metal has a chance to oxidize. This could occur if the iron should get too hot before the solder has been applied. A good arrangement is to wrap the tip with a few turns of solder before the iron is heated, so when the melting point is reached, all the surfaces will be coated at once.

Any excess solder should be wiped off lightly. A soft cloth or steel wool is often used for this, but burned strands may leave a carbon deposit which will spoil the tinning or will make retinning difficult. A wet sponge may be used instead. Steel wool will wear away a plated tip. Another method is to make a quick flip of the iron towards the floor to throw off the excess solder. This is a common practice, but care must be taken to see that shaken-off solder does not splatter on a surface where it will do harm. It especially should be kept clear of trouser legs and one's socks!

Preparing the Work

Parts to be soldered must be clean. Any dirt, grease, paint, rust, insulation or oxidization must be removed and a shiny surface obtained, following which it should be immediately tinned, before the air can oxidize it. When large surfaces are involved, as may be the case with sheet metal work, a very thin film of *non-corrosive* soldering paste will prevent oxidization and facilitate tinning. Hook-up wire and the leads and terminals of components usually are pre-tinned and require no further preparation.

Most electronic soldering jobs will concern terminal connections on tie strips, tube sockets and other components. Before soldering these, a good mechanical connection should be made between the wire and the terminal. General practice with commercial gear is to wrap the wire around the terminal several times; however, from a maintenance standpoint, this makes removal of a connection difficult if it should become necessary. A better method is to loop the lead, through the terminal hole and part way around the terminal to form a hook,

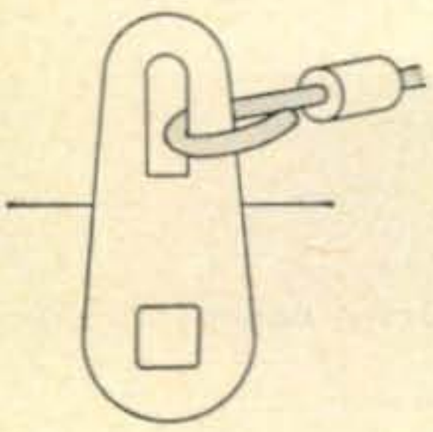


Fig. 1 — Component lead passed through terminal hole and looped back to form a hook, which should be crimped using long-nose pliers.

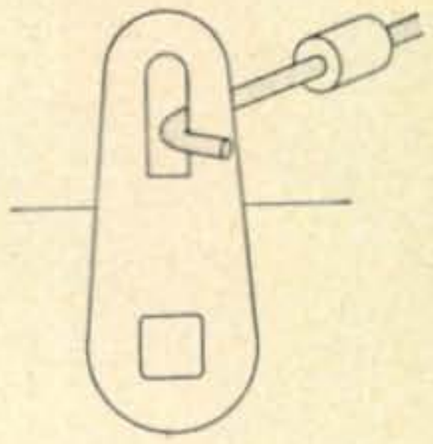


Fig. 2—Temporarily soldered connection. Passing the component lead through the terminal hole, bending it at a right angle and soldering it in place will make later removal of the lead easy if this should become necessary.

crimping it to the terminal with long-nose pliers sufficiently to hold it in place by itself, and then by making sure it is soldered properly. See fig. 1.

An exception to this might be in an experimental piece of equipment where leads are apt to be altered, in which case the lead may be passed straight through the terminal hole and left that way, or bent at a right angle, while the joint is made with the hole completely filled with solder. See fig. 2.

When stranded wire leads are used, it will be helpful to twist the end of the wire strands together and tin them with a bit of solder to solidify them. This makes it easier to insert the lead through terminal holes without spreading out or tangling the wire strands.

Soldering Procedure

The basis of soldering is to get the surfaces to be soldered hot enough to melt the solder and cause it to flow *freely* over the work. The heat should be applied with the full side of the soldering tip placed against the surface, so that maximum heating will be realized as shown in fig. 3. Also, the heat should be applied simultaneously to all the pieces being soldered together at one point. When pieces of different mass are involved, the largest area of the tip should be placed against the bigger piece, while a smaller edge of the tip rests against the lighter piece as in fig. 4. This will ensure a more uniform heat transfer to both pieces.

When a soldering gun is used, it must be heated *before* it is held against the parts. This may be checked by touching a piece of solder to the tip. If it melts, the gun has heated for the work.

A bit of solder should then be melted along the edge of the tip where it touches the parts to be soldered. This will heat the parts quickly, because molten solder transfers heat far more efficiently than does bare metal-to-metal con-

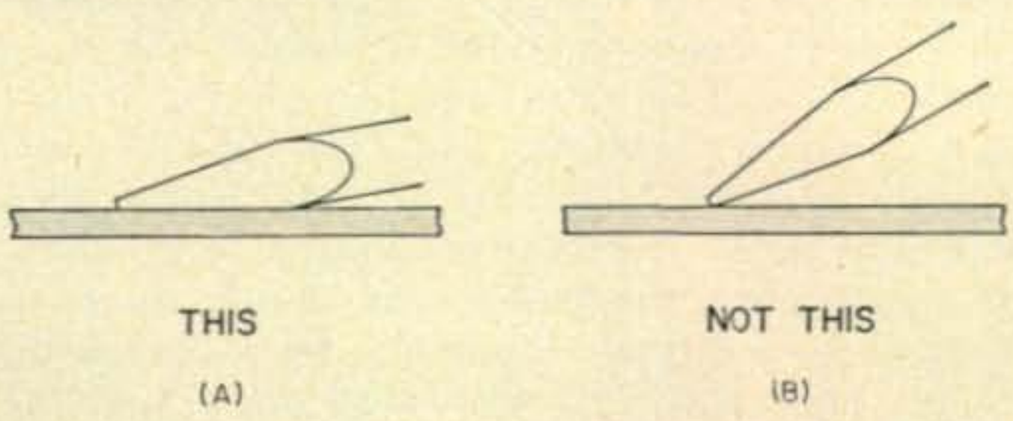


Fig. 3—Application of soldering iron to a surface. The full side of the tip should be placed against the surface as shown at (A), *not* just the point of the tip as shown at (B).

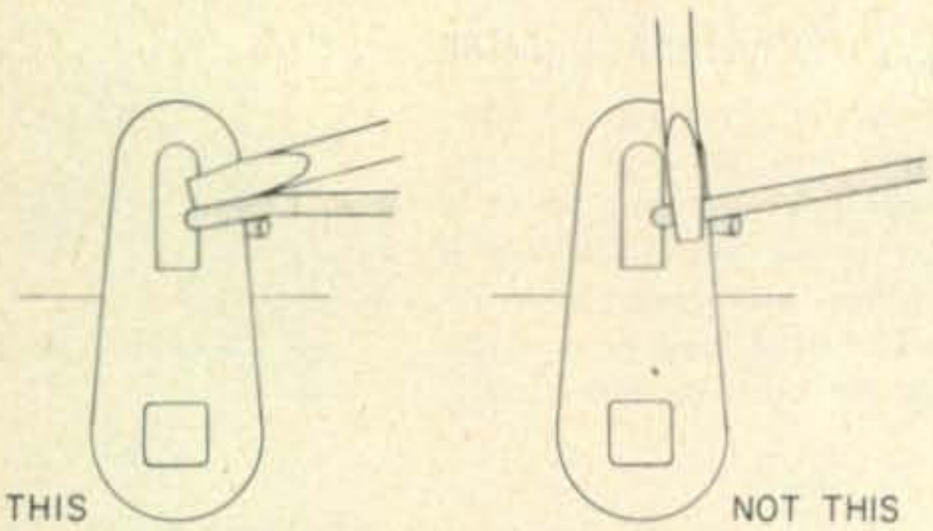


Fig. 4—(A) Application of the soldering iron to several parts. The larger side of the soldering tip rests against the terminal lug which has a larger mass than the component lead against which the smaller edge of the tip rests. (B) Application of the iron to just the smaller component lead is incorrect.

tact. When the rest of the surfaces have been heated sufficiently, solder should be applied to them until it has flown smoothly and freely over and around the joint. No more solder should be used than is needed to just cover the soldered elements. It is not necessary that a large glob of solder cover the joint, but rather that it adheres evenly to all parts of the connection, blending with the metal without any abruptly defined borders. The iron should now be removed and care should be taken not to move the soldered parts until they have cooled off.

A properly soldered joint should have a smooth and somewhat shiny appearance. If it is grayish with a dull, sandy, grainy or pitted finish, sufficient heat was not used, or the parts were moved during cooling. The joint is then considered a cold soldered one which may eventually break apart or which will result in a high-resistance or poor connection.

Rosin Soldered Joint

Another result of insufficient heat is the rosin-soldered connection. Rosin melts at a lower temperature than does solder, so it will flow around a joint before the solder. If the solder has not had a chance to properly flow, only the rosin will hold the joint together. Rosin does not have much tensile strength, so the joint eventually will become loose. Also, due to the fact that rosin is a non-conductor, an electrical contact between the parts may not be made.

If an excessive amount of solder has been applied, it will form an unsightly glob or it may run down the terminal and cause a short circuit to adjacent terminals or other parts. This can also occur if excessive heat has been used. If this occurs, the equipment should be positioned so that the terminal is in a horizontal plane, or at a slightly backward angle, and the soldering iron then used to draw the solder back up the terminal. This procedure can also be used when it is otherwise impossible to fill in a terminal hole with solder if needed.

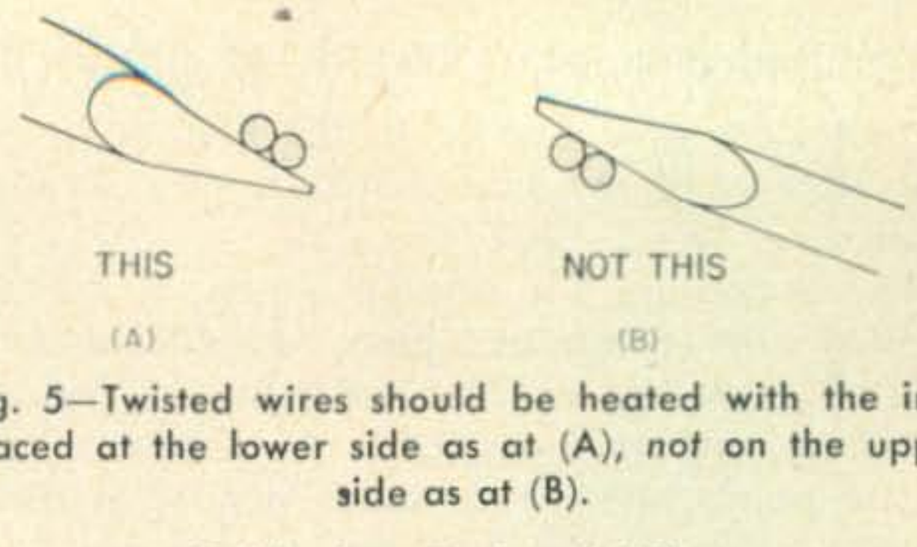


Fig. 5—Twisted wires should be heated with the iron placed at the lower side as at (A), *not* on the upper side as at (B).

Soldering Twisted Wires

It should be kept in mind that heat travels upward and that solder tends to flow towards the point where the heat is applied. Thus, when it is necessary to solder wires which have been twisted together, the tip of the iron should be held against both wires at the underside of the joint. While this part is being heated by direct contact with the iron, the heat will be conducted upwards through the wires to the top side and the entire connection will quickly be heated. See fig. 5. A better heat transfer also will occur if a dash of solder is first melted along the edge of the tip where it makes contact with the wires. When the right temperature is reached, solder applied to the top of the wire will flow down through and around the joint. While this occurs, the iron should be rotated towards the top to draw up any excess solder and prevent a glob from forming underneath.

This routine should be followed when wires are tinned or braided shield is coated. Application of the iron to the top side of the wires will tend to hold the heat at this point, resulting in slow and insufficient heating of the lower areas with poor adherence of the solder.

Printed Circuits

A cause of printed-circuit failures is the result of poor soldering. Only a little heat, applied to just the foil, is needed to cause solder to flow over it and around a projecting component lead, giving the impression that a well soldered connection has been made. However, the solder will not have adhered to the lead due to lack of heat, and a circuit failure is apt to occur. To prevent this possibility, the tip of the iron should be held against the component lead at the same time a smaller part of the tip is held against the

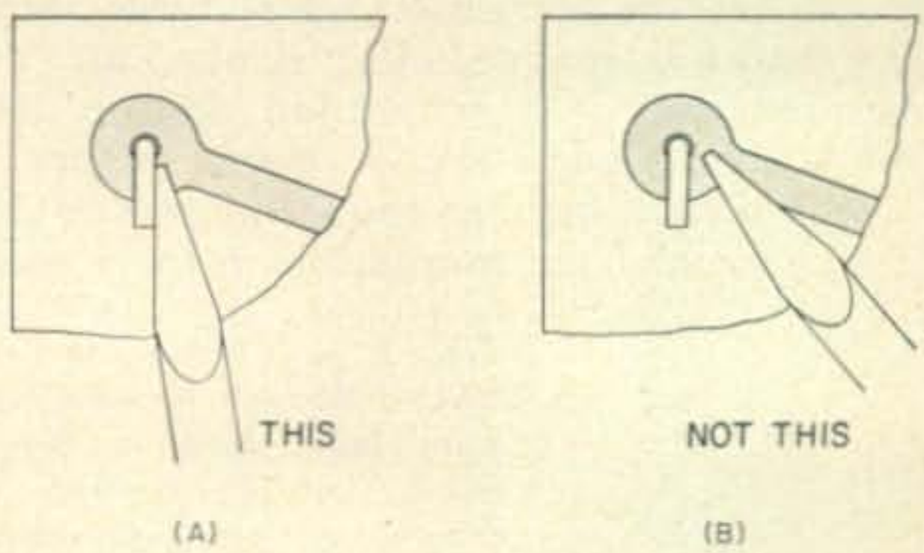


Fig. 6—When printed-circuit connections are soldered, the tip of the iron should be placed against both the component lead and the foil as shown at (A), *not* to just the foil as shown at (B).

foil as shown in fig. 6. The solder should then be applied between the tip and the component lead. It will then melt and flow onto and adhere to both the lead and the foil, making a good connection. Care also must be taken to be sure solder does not flow to and make contact between adjacent foil elements. A good adjunct to have on hand is a magnifying glass to examine printed-circuit boards for shorts and poor connections.

A residue of rosin is sometimes left on printed-circuit boards after the work is done. This may be chipped off with a penknife after the rosin has hardened, or it may be dissolved using denatured alcohol.

Occasionally, equipment failures occur which are of the intermittent or fading variety. This can be due to a poor solder joint and may be extremely difficult to locate. A good way to find or remedy the trouble is to "touch up" the soldered connections on tube sockets or other components in a suspected area. To do this, it is only necessary to apply heat with the iron and use a slight dash of solder at the same time.

Use of Heat Sink

When heat-sensitive components, such as crystal diodes, transistors or plastic-bodied parts are soldered, a heat sink should be used on their leads. The sink is placed between the component and the joint so that heat carried up by the lead will be absorbed by the greater mass of the heat sink instead of travelling up to the component and damaging it. Long-nose pliers, gripped on the lead, are often used for this purpose, but more desirable devices are self-locking tweezers, a pair of "Seizers" or clip-on heat sinks devised for the application. See "Special Tools." Their use will leave a hand free for other uses.

If a heat sink cannot be used during the work, the connection should be soldered as quickly as possible and with as little heat as needed, following which a metal body, such as pliers or the flat side of a screw driver, should immediately be held against the lead to draw any remaining heat away.

When plastic-insulated wire is involved, it often happens that heat, which travels up the wire, softens the insulation and makes it break away from the wire or curl up. When fabric insulation is concerned, it may tend to burn at the ends. Of course, the obvious remedy is the application of as little heat to the joint as needed for soldering; however, a sure-fire method is the use of anti-wicking tweezers of the type shown in "Special Tools." These will be especially handy during soldering on miniature tube sockets and cable connectors.

Soldering Sheet Metal

When sheet metal parts are to be soldered together, they should be cut out to allow one piece to overlap the other by one-half inch or so, where they are to join. The overlapping

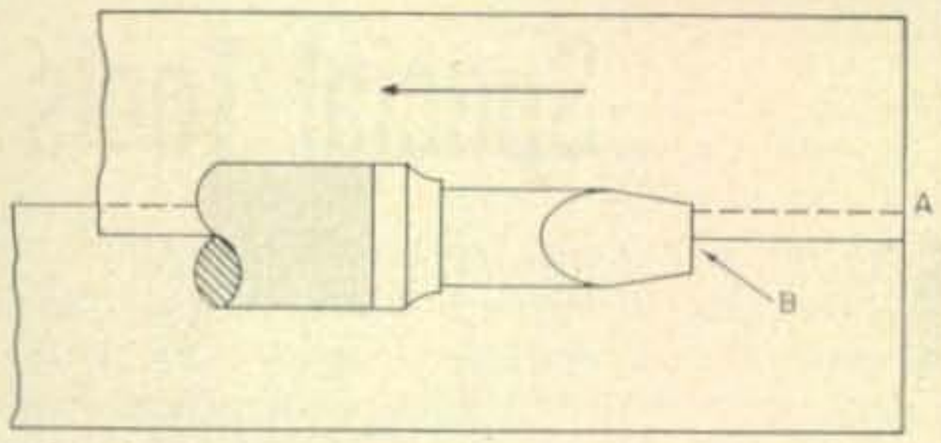


Fig. 7—Soldering sheet metal. Overlap is indicated by line A. The solder should be applied at B while the iron is slowly drawn in the direction shown.

areas should be thoroughly cleaned and tinned individually on both sides of the metal. A thin application of a non-corrosive soldering paste may be required prior to tinning. The two pieces should then be placed on a flat non-metallic surface with one piece overlapping the other. Heat should be applied with a large iron, starting at the far end of the joint. As soon as sufficient heat has been applied, the solder on the tinned areas will start to flow, at which time fresh solder should be fed along the edge of the joint while the iron is moved slowly along the joint toward the operator. See fig. 7. Downward pressure should be used on the iron and a block of wood may have to be slid against the top of the joint to hold it tightly together until the solder cools.

In some cases it may not be necessary to solder along the entire length of the joint. Instead, "spot" soldering just at the ends and at a few intermediate points may be sufficient.

Unsoldering Leads

It is sometimes necessary to unsolder and remove wire leads. A useful tool to help do this is a soldering aid. There are various types, but the one most commonly used has a two-tined fork at one end that can be slipped over a wire lead to untwist it while heat is being applied to soften the solder.

Points to Remember

Here are a few points to keep in mind for soldering: Keep the tip of the iron clean and tinned brightly at all times; If a soldering gun is used, be sure the take-up nuts are tight and the mountings for the tips are clean. With other irons, be sure tip is tight; be sure the work is clean; be sure the iron is of sufficient size for the work and that it is fully heated before use; use only rosin-core solder; be sure surfaces are sufficiently heated to cause solder to flow freely; use just enough solder to make the joint; do not move soldered parts until they have cooled; in between soldering jobs, remove the tip of the iron and clean off scale from its shank and reshape, clean or re-tin the end of the tip; do not scrape or file plated tips, use only a damp sponge to clean.

Other helpful information and catalogues may be obtained by writing to the various manufacturers of soldering irons and solder.—*W2AEF*

TOOLS & WORKSHOP

Special Tools for Electronics

THERE are many special tools which are desirable to have on hand for speeding up and easing workshop operations. Unfortunately, space will not allow a complete listing of such tools, so only a few will be discussed. It is suggested that the reader browse through the catalogues of various tool manufacturers where many interesting and "unknown" tools can be discovered.

Metal-Nibbling Tool: The "nibbling" tool is such a convenient tool, that it really should be a standard workshop adjunct, instead of being classed as a special device. It provides a simple and easy means of making different shaped holes in sheet metal up to 18-gauge steel or 1/16-inch thick aluminum.

All that it requires is a 7/16" starting hole in which to be inserted. It is then hand operated, by squeezing the lever handles, to bite out about 1/16" of material (of ¼" width) at a time, while it is moved along the surface. This sounds like a slow process; however, such is not the case, for the bites may be made in rapid succession. Four inches of 1/16-inch thick aluminum may be easily cut in less than one minute. The edges of the cut are left relatively smooth, so only a slight touch-up with a file is needed.

Screw-holding Driver: This special tool is a screw driver which holds a slotted screw on its tip to provide a means for inserting the screw in a hard-to-reach hole. The screw may be started and then be released from the tool, to be tightened with a regular screw driver. It may also be used for removing screws from holes. Screw-holding drivers are often identified by the manufacturer's trade names such as Klipxon, Magic-Tip, Quick-Wedge, *etc.*

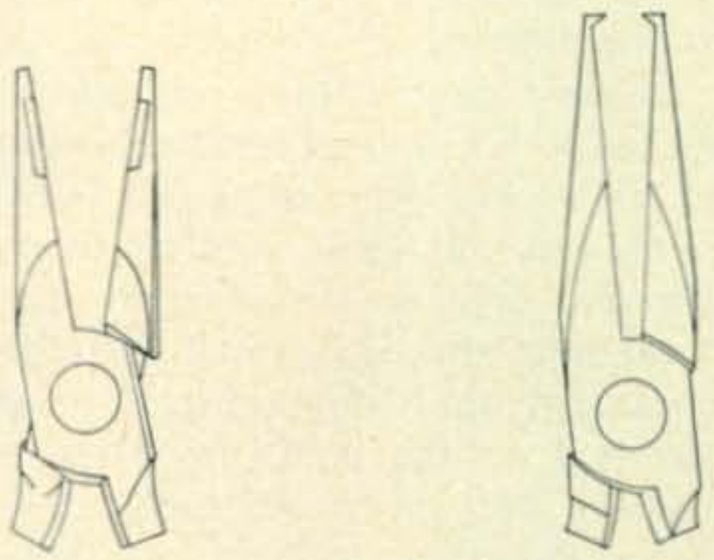
Multi-Grooved-Joint Pliers: These pliers are similar to slip-joint pliers, except it's jaws are adjustable to four or five different positions, in order to keep the offset jaws nearly parallel over a wide range of jaw openings. Great operating leverage is also obtained with this tool, frequently called water pump pliers.

Flexible Screw Driver: This is a screw driver which has a flexible shaft to permit its use in areas which are inaccessible with straight-shank or offset screw drivers.

Flexible Nut Driver: Similar to above, except used for nuts.

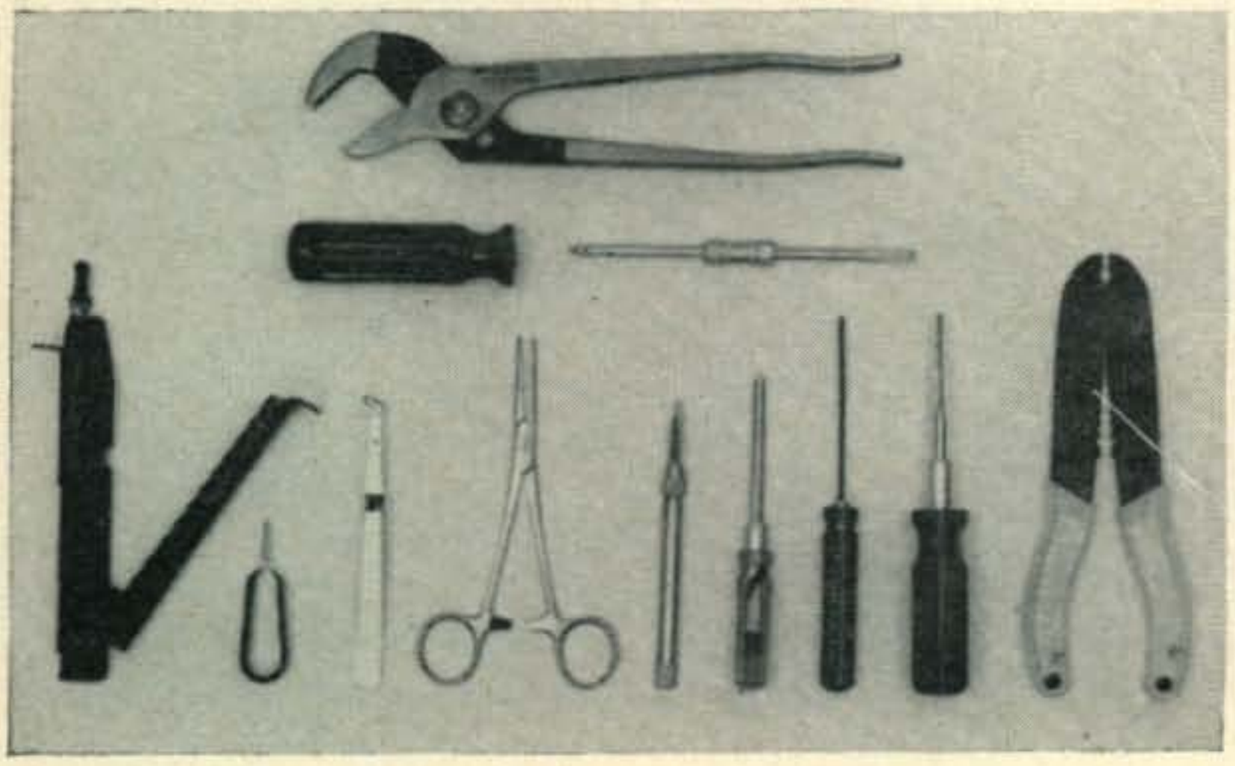
Deburring Tool: Used for removing burrs from the rear of newly drilled holes. The type illustrated has a retractable triangular-shaped double-ended blade which is operated as a scraper similar to the manner in which a penknife may be used.

Anti-Wicking Tweezers: These tweezers are clamped on wire leads during soldering to prevent molten solder from climbing up stranded wires, due to capillary action, and thereby solidifying the strands together. This would make the wire brittle and defeat the purpose of using stranded wire. The type shown also may be clamped around plastic insulation near the end of the wire to prevent its softening and curling.



Nose-cutting pliers (left). A side-cutter is located slightly back from the tip of the nose. End-cutter with transverse cutting blades is shown at the right.

Nose-cutting Pliers: These pliers have a cutter located near the tip of the nose for cutting off wires located in limited access areas or close to terminals such as on miniature tube sockets. One type has a side-cutter located just slightly back from the tip of the nose so the pliers may still be used for handling wire leads. Another type is the end-cutter which has transverse cutting blades at the end of the nose.



Pictured at the top: Multi-grooved-joint pliers, below which is a reversible screw driver (its handle is at the left) with a straight blade at the right end and a Phillips-head blade at the left. Bottom row, left to right: metal-nibbling tool, heat sink, anti-wicking tweezers, holding forceps, deburring tool, screw holding screwdriver, straight hex driver, triple tap and screw cutter with crimping jaw.

Center-Tru Jigger: This tool is used in a drill press for accurately aligning round stock when a hole is to be drilled through the side of the material. It may be used on round material from ⅛" to 1¼" in diameter.

Shaft-X Jigger: This tool is used for accurately drilling and tapping (with 6-32 threads) the ends of ¼" round material as may be required for adding extension shafts on electronic instrument controls. Coupling sleeves may then be eliminated.

Industrial Rush Eraser: This device is used for cleaning wire leads (conductors) or other surfaces before soldering. It does this without damage to the material. Contact points also may be safely cleaned.

Metal-Forming Brake: A small metal-forming brake for limited applications is illustrated in "Bending Metal."

Triple Tap: This tool has three different size taps (6-32, 8-32, 10-32) located successively along its shank which has a screw-driver type handle at one end. It is handy for cleaning or cutting commonly used threads at a moment's notice. Cutter blades are replaceable and they may also be used in a tap wrench.

Hex Driver: Similar to a hex or Allen wrench, except it is made in one straight shank with a screw-driver type handle at one end. It thus provides screw-driver action which speeds up work and often is more convenient to use in close quarters than is the L-shaped type of hex wrench. All the popular sizes are available.

Screw Cutter: A plier-like device used for shortening screws. It does this with a clean shearing action which eliminates the need for further trimming of the cut end. It is designed for screw sizes 4-40, 6-32, 8-32, 10-32 and 10-24. Most models also are designed for crimping work at the tip and some include wire-stripping blades in the throat of the tool. If the purchase of just a crimping tool is contemplated, be sure it is one which includes the screw-cutting feature. It will be found most useful.

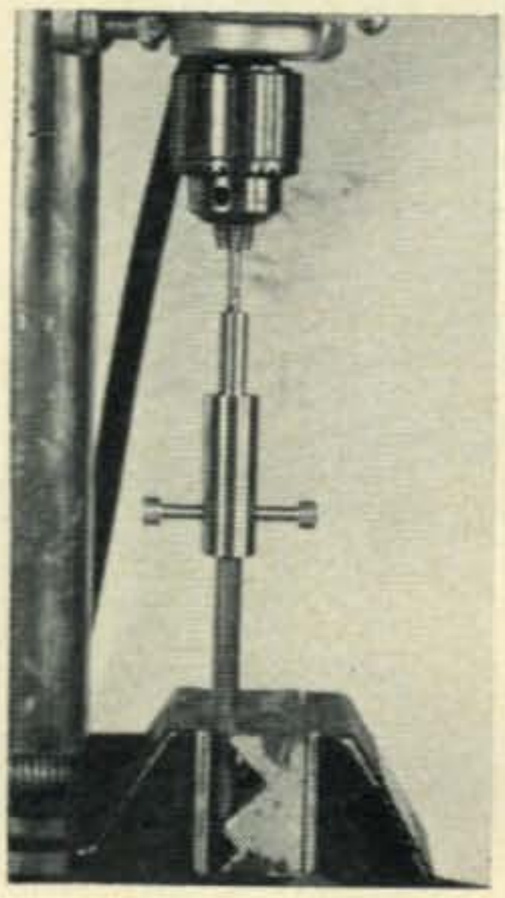
Work Holder: A vise-like device on a flexible mounting which may be used in many positions. It is convenient for securely holding work during such operations as soldering to connectors.

A work holder on a universal mounting to enable it to be adjusted to a convenient position during the work.

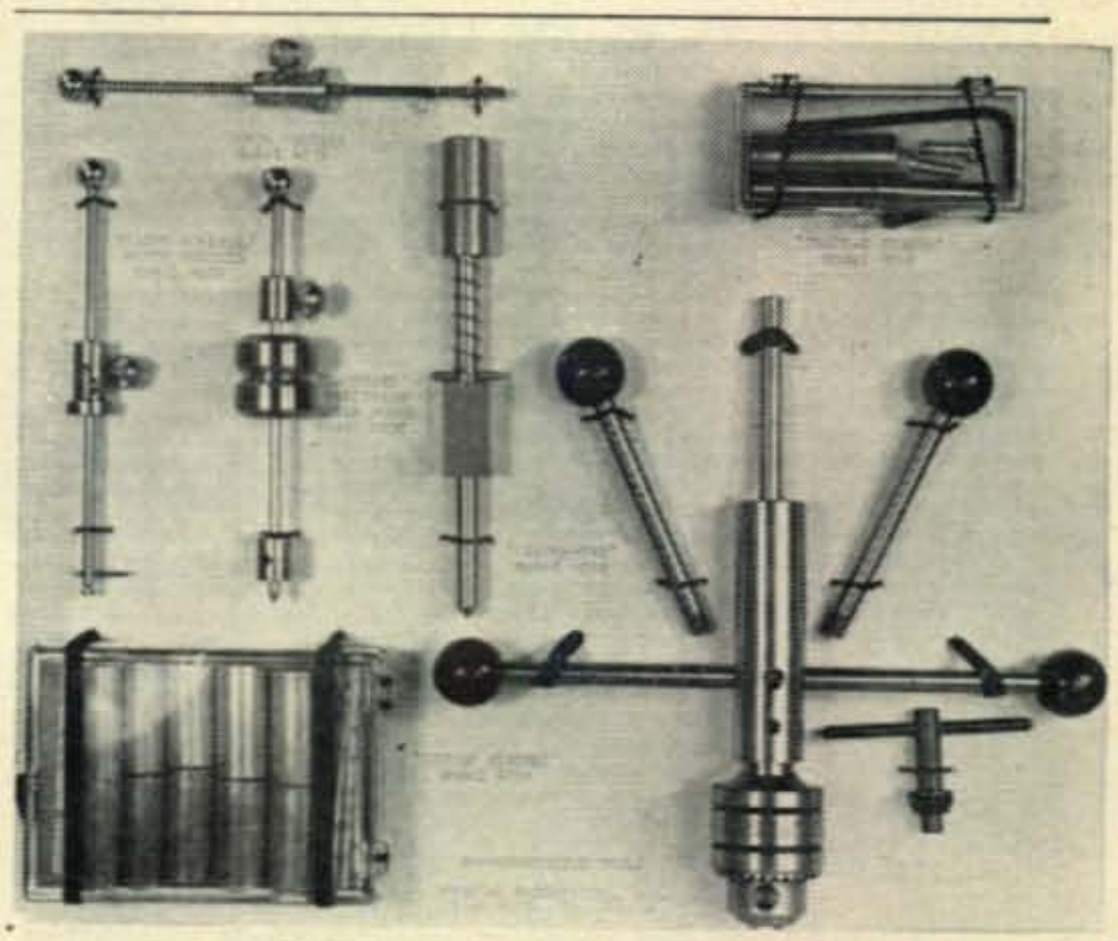
Heat Sink: This device is clipped on the leads of heat-sensitive components during soldering to draw heat away from the component end of the lead and prevent its travelling to and damaging the component. See "Soldering" for application.

Holding-Forceps: This is also called a Hemostat, Seizer or Scissor-Clamp. It may be clamped and locked on leads for use as a third hand or as a heat sink.

Reversible Screw Driver: A screw driver with a removable blade which may be reversed in the handle to provide a different type working end. This tool usually is supplied with a blade having a regular tip for slotted screw heads and a tip for Phillips-head screws. A combination is also available with a different size Phillips-head driver at each end.



Shaft-X Jigger used for drilling and tapping the ends of ¼" round material.

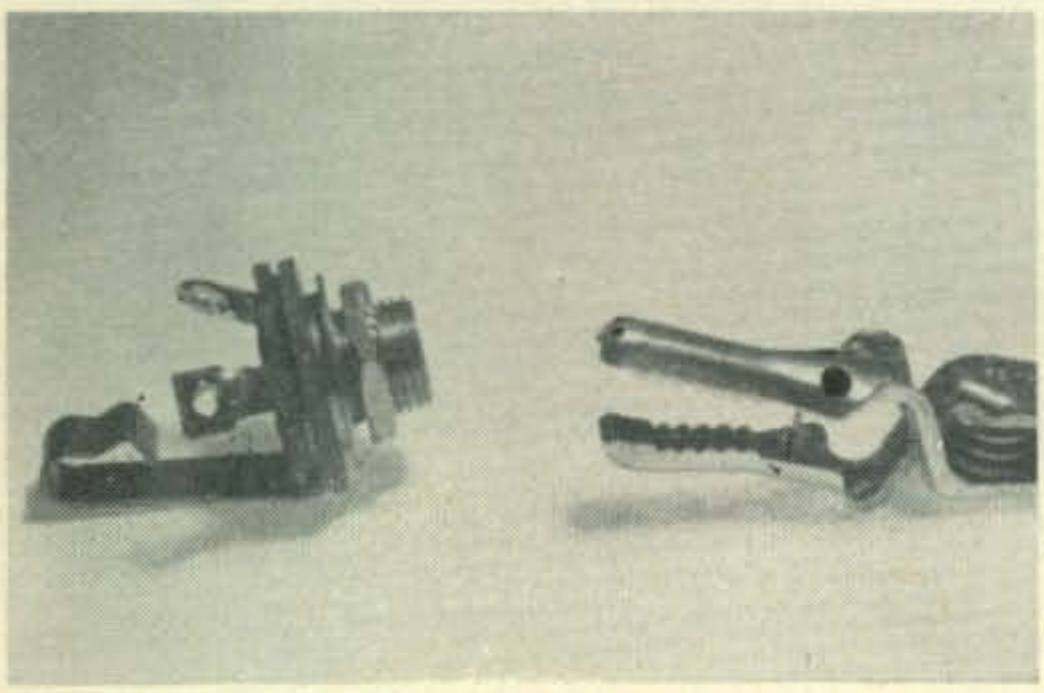


Care of Tools

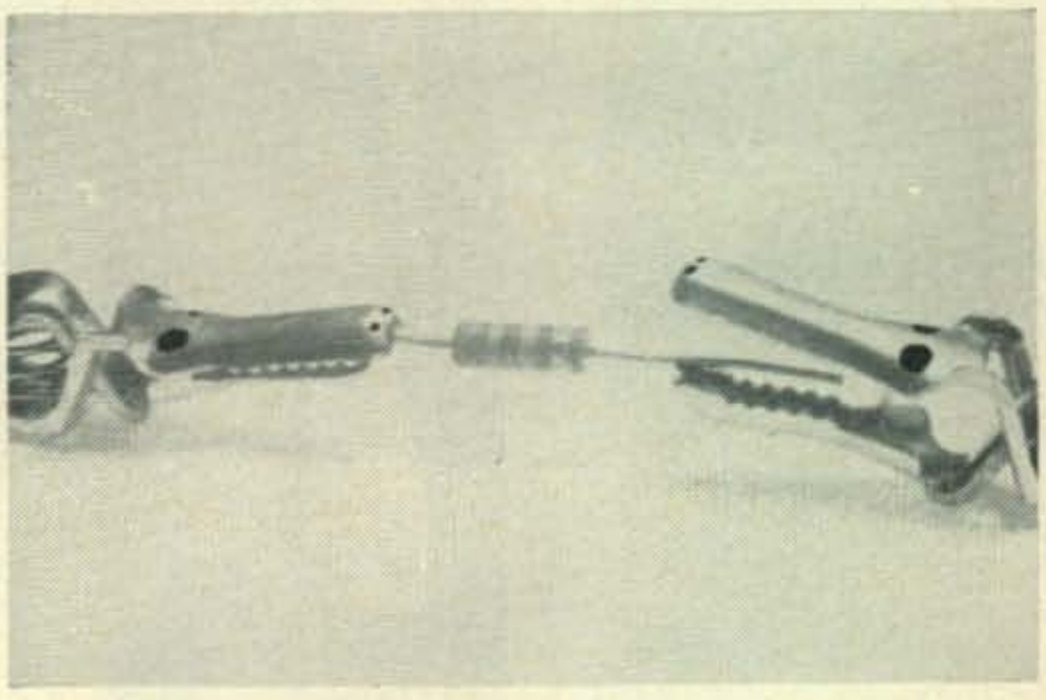
TOOLS should be properly cared for if they are to do efficient work and last a long time. The following suggestions should be helpful in this respect:

1. Always use the proper and the right size tool for the job at hand.
2. Never use a tool for a purpose other than that for which it is intended.
3. Operate tools properly.
4. Use a suitable lubricant when cutting tools are used. This will preserve the cutting edges and make the work easier. An exception to this rule is the file, which should always be used dry.
5. Keep tools in working order. Cutting edges should be kept sharp. A small oilstone will be handy for touching up cutting edges from time to time. Badly dulled tools will need regrinding.
6. Keep tools clean.
7. Maintain a very light film of oil on tools to minimize the possibility of their rusting, especially when located in damp areas, or during storage.
8. Store tools where they may be easily found and selected when needed. A good way to do this is to hang them with hooks or clips mounted at the rear of the workbench or on a wall. If this is not possible, they may be kept in a drawer or tool box, but when this is done, the tools should not be thrown carelessly against others, especially those with cutting edges. Cutting edges may be protected by wrapping them in paper, particularly files. Place a cork on the ends of sharp pointed tools. This will not only protect the point, but also will prevent personal injury.
9. Separate the different types of assorted hardware items and store them in individual small size glass jars for ease of selection when needed.

"Photo-Toons"



"Hi, Jack!"



"Clara, why must you resist my advances?"

Antenna Impedance Matching

PART I

BY PAUL C. AMIS*, W7RGL

This two part article on impedance matching has been written in a clear and concise manner geared primarily at the amateur and his age-old antenna problems. The discussion is not on a do-it-yourself level since the objective is to acquaint the reader with the techniques of measurement and to develop a practical understanding and appreciation of Smith charts. Part one deals with initial calculations of antenna impedance networks using a signal generator, an r.f. impedance bridge and a receiver with an S-meter. After this groundwork has been laid, we will transfer our figures to a Smith chart and in part two will take more meaningful steps toward the optimum in proper matching through expanded use of these unique charts.

THE subject of antenna impedance matching has been a topic clouded with considerable mystery to most hams. Too many of the amateur gentry are convinced that a long-whiskered professor with at least seventeen degrees from noted colleges is required to design an antenna matching network. Really, it isn't quite that hairy.

There are several procedures for the computation of impedance matching networks currently in use, and probably the most common is the one utilizing a r.f. impedance bridge, a signal generator, a receiver with an S meter, a bundle of Smith Charts, and lots of luck!

In an effort to shed a smidge of light on this august subject, the bridge method of determining matching units for a given antenna will be discussed, not as a "do-it-yourself" project, since most hams cannot readily lay hands on a r.f. impedance bridge and the necessary gak which goes with it, but just as a general discussion of how it is done.

To begin with, let's refresh ourselves a bit about just what the term "impedance" entails. Actually, the big stumbling block with this term is that impedance signifies a vector, not a "you-can-see-the-value-there-on-the-meter" thing. On an X and Y plot, the resistive component of the impedance vector defines the X axis magnitude, while the reactive component is found, either plus or minus, on the Y axis. We hams talk cheerfully about impedance as a single value, where actually we are discussing the *magnitude* of the vector and disregarding the phase angle (the angle between the X axis and the vector, either plus or minus). Generally speaking, this notation proves satisfactory for general discussion, but when it comes to actual impedance matching this phase angle is most important.

From the above, then, it will be noted that the actual impedance is composed of two terms; the resistive component and the reactive component, with the sign of the reactive component indicating whether the impedance vector is "capacitive" or "inductive." This can be shown, simplified, as

$$Z = R + jX$$

The j term is an operator which takes care of the sign of the reactive component and, mathematically speaking, is equal to $\sqrt{-1}$.

Now that we have a way of indicating the impedance of an antenna, we can proceed to the business of measuring it. Let us assume we have a long wire of fixed length which we want to use on 40 meters, and feed with a 50 ohm coaxial cable. Obviously, unless we have more luck than most, we will have to whip up an impedance matching section to match this cable to our wire antenna. The first thing to do will be to determine the antenna's impedance over the entire 40 meter band.

To begin with, we'll simplify this problem by stating that the end of the wire antenna comes directly into the shack and can be relocated so that it can be coupled handily into our r.f. bridge. The test equipment we will use is shown in fig. 1. The signal generator can be a regular

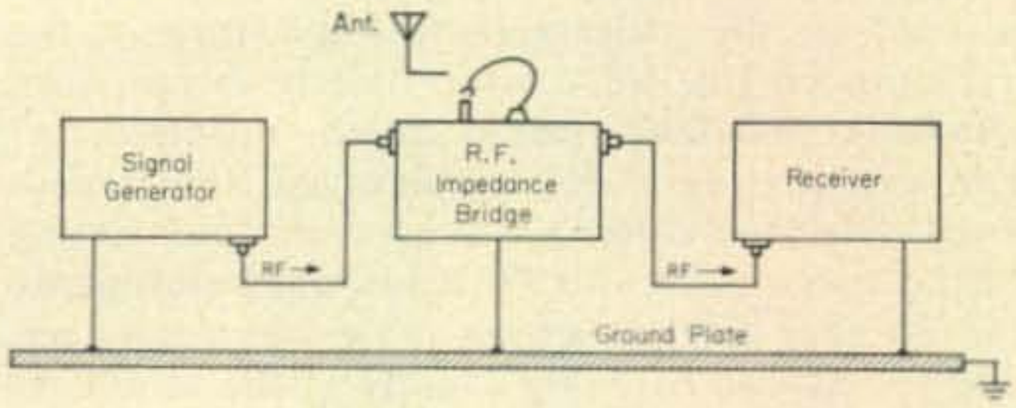


Fig. 1—Test equipment set-up used to measure the impedances of an antenna over its operating frequency range. The receiver used must have an S meter.

*Route 1, Box 438, Poulsbo, Washington.

DATA SHEET

Antenna_____ Date____

Sheet____

Freq.	XI	XR	(XI-XR) XF	$\frac{XF}{F}$ X	R	$\frac{R}{Z_0}$	$\frac{R}{Z_0}$	Dial

Fig. 2—A typical chart for recording the data taken during a series of measurements. The significance of the column headings is described in the text.

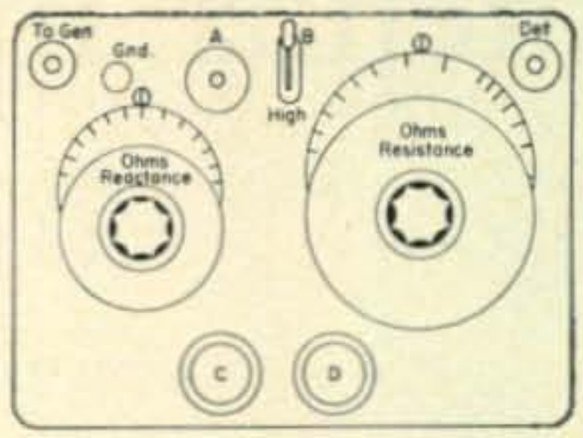


Fig. 3— View of the controls found on a typical r.f. impedance bridge. Connector A is the input for the antenna; B is the INITIAL-BALANCE RANGE switch; C is the RESISTANCE INITIAL-BALANCE control and D is the REACTANCE INITIAL-BALANCE control.

garden variety type, but with the signal output fed through coaxial line to minimize r.f. pickup by the other units. The receiver can be any good communications receiver with a sensitive S meter, as long as the receiver has a coaxial input. With such a setup, total grounding is very important. Normally a grounded plate is used to set the test equipment upon, with heavy ground straps secured directly to each unit. The grounded plate can be constructed from a piece of stout plywood, covered with sheet copper, and, in turn, grounded by a short heavy strap to a good earth ground.

We will try and take measurements every 50 kc throughout the 40 meter band. I say "try", since it may be that these frequency points will be too close, and the impedance points thus plotted may fall almost on top of one another. In this case, we can separate our measurement points, as needed. To record our initial data, we will prepare several sheets of paper, divided into columns as indicated in fig. 2. Don't get wrought up over the mysterious column indicators—they aren't that complicated. The left column labeled FREQUENCY lists all the frequencies we want to check—in this case, from 7.0 mc to 7.3 mc in 50 kc steps. The column marked *XI* is the bridge's "initial" reactive balance—we'll cover this notation later. The *XR* is the final *reactive* reading of the bridge. *XF* is the difference between the *XI* setting and the *XR* reading—with proper observation of sign. In the column marked *X*, we divide the previously obtained *XF* by the frequency of that reading as noted in the FREQUENCY column. The column headed by *R* is the *resistance* reading as obtained from the bridge, and the next two columns are self-explanatory; the resistance reading from the *R* column and the *X* quotient from the *X* column divided by the characteristic impedance of the transmission line we want to match; in our case, 50 ohms. This latter step is called "normalizing" and gives readings independent of line impedance. The final column is the vernier dial setting of the signal generator (if it has one) so that we can go back to that setting if we want, later on, and be assured of being exactly at the same frequency. This tabular sheet will be filled out for all the chosen frequencies. Note that the "*R* divided by 50" and the "*X* divided by 50" represent the actual coordinates of the antenna impedance at each of our chosen frequencies.

Bridge Operation

The operation of the bridge is accomplished as follows: Most antenna impedance bridges have four dials (see fig. 3). The two lower "set" dials are used to null the bridge, and the upper left dial reads REACTANCE and runs from 0 to 5000 ohms. The upper right dial reads RESISTANCE and runs from 0 to 1000 ohms. The bridge is nulled by attaching the short test lead supplied with the bridge to the ground post, setting the REACTANCE dial to the chosen reading and the RESISTANCE dial to 0, adjusting the signal generator to the frequency desired, finding that signal on the receiver and adjusting the receiver gain to get a suitable reading on the S meter, and finally adjusting both of the SET dials, one at a time, until the input signal nulls completely, or nearly so. This maneuver will take a calm hand and a bit of patience if a good null is to be obtained. Once the bridge is nulled, the antenna is secured to the short test clip and the upper two dials, REACTANCE and RESISTANCE, are rotated until the bridge nulls again. The final reading is then taken from the two dials, and entered in the *XR* and *R* columns of our data sheet. If we could be sure that each impedance reading would be positive (increasing) in the inductive direction, we could start each bridge setting with the REACTANCE dial at 0; however we may have a capacitive reading, and would then have to re-balance the bridge at a higher point so that the readings could go counter-clockwise. To save a bit of trouble, commonly the REACTANCE dial is balanced at 500, thus allowing the reading to go below this value if the load should prove capacitive. This original REACTANCE dial setting we have "guessed" at is called the "initial" setting, or *XI* on our chart. If our final REACTANCE dial reading is larger than the initial setting, all further columns headed by an *X* are positive (inductive), while if the final reading is less, these columns are negative (capacitive).

After we have obtained the values of *XI*, *XR*, and *R*, we can compute the other values and finish filling in our sheet. Now we can begin to draw pictures of the antenna under question on a prepared graph called a Smith Chart.

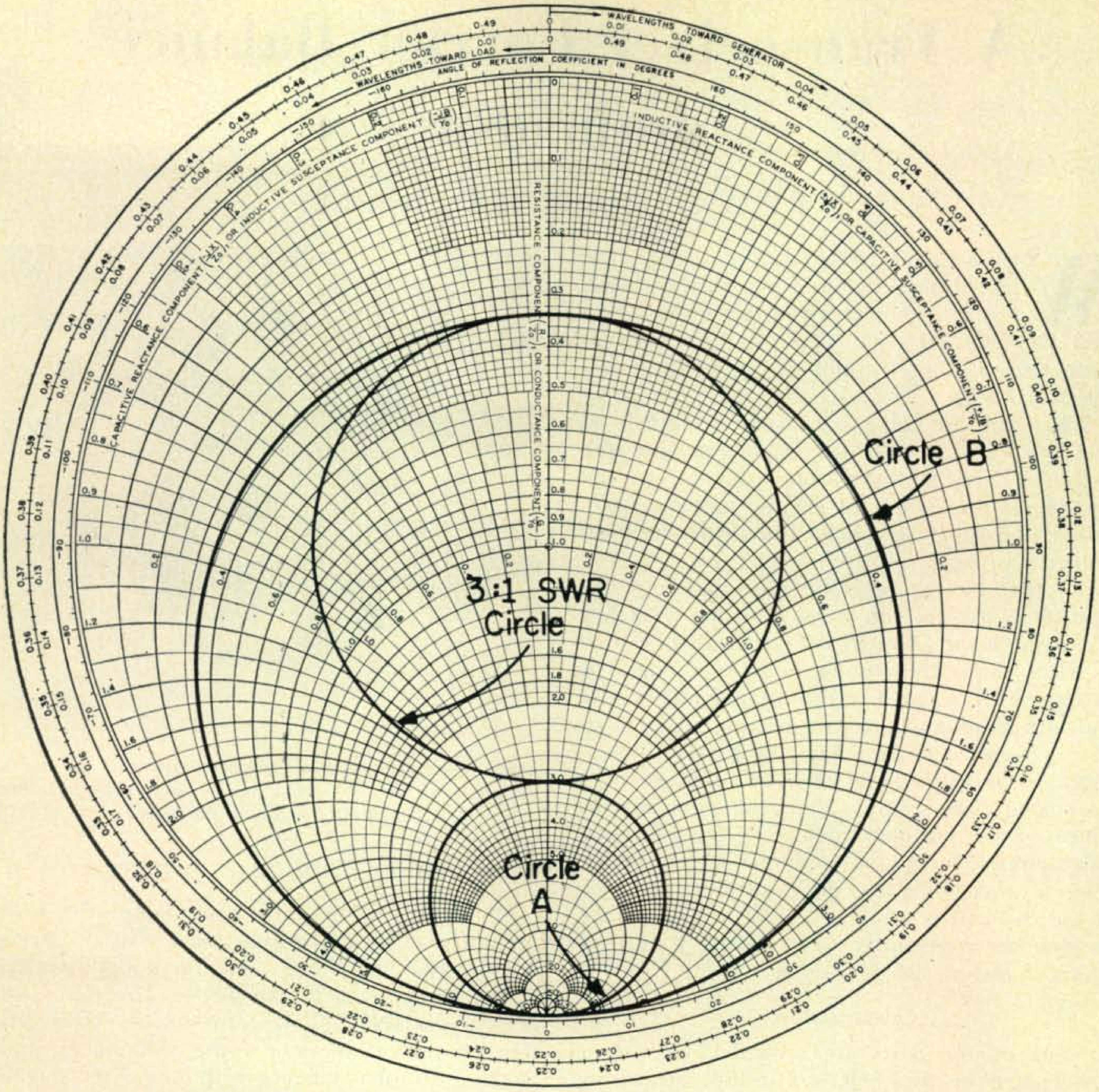


Fig. 4—A Smith Chart with the chosen s.w.r. limit (3:1) circle. The other circles, as explained in the text, represent the limits within which the plot must fall in order to be transformed with reactive components to fall into the 3:1 circle.

Smith Charts

The Smith Chart was originally described by Mr. P. H. Smith as a transmission line calculator. It was derived from a rectangular coordinate system and is used, not only as a means of graphically plotting antenna impedance, but to evaluate impedance, current, and voltage at any point along an r.f. transmission line. Figure 4 shows a Smith Chart with the chosen s.w.r. limit, definition circles, and series boundaries drawn in. In this example, an allowable 3:1 s.w.r. has been chosen. This s.w.r. circle is constructed by using 1.0 on the resistance component scale (the vertical scale through the center of the Smith Chart) as a center, and a radius of whatever s.w.r. we will accept as plotted on the lower half of the vertical resistance component scale; in the case of the example, 3. Circle *A* is constructed by locating its center on the resistance component scale, and is tangent to the s.w.r. circle at 3.0 (or whatever maximum allowable s.w.r. was chosen), passing through the point of infinity at the bottom of the chart. Circle *B* is constructed by locating its center on the vertical resistance component scale and is tangent to the s.w.r. circle at the minimum value of *R* and passes through the point of infinity at the bottom of the chart. The area between the circumferences of these two circles represents the series boundaries, that is, the area within which the plotted antenna impedance curve can be transformed with a series reactive component, possibly to fall within the allowable s.w.r. circle. Various points of the impedance curve that may lie outside of these areas may possibly be transformed to become within the s.w.r. circle through the use of parallel reactive components.

Next month we will delve into laying out the imaginary plot of an imaginary antenna using the example of an actual wire antenna originally designed to cover frequencies from 6 to 18 mc with a desired maximum s.w.r. of 3:1. After obtaining the figures for this antenna from our data sheet (fig. 2), we'll plot them on the Smith Chart.

[*To be continued*]

A Transceiver Carrier Balance Indicator

BY E. H. MARRINER*, W6BLZ

WHY a tuned carrier null indicator? Too often, on a vacation trip with my s.s.b. transceiver, I received the report, "Say, your carrier's showing." This bothered me as there was nothing I could do about it until I got back home.

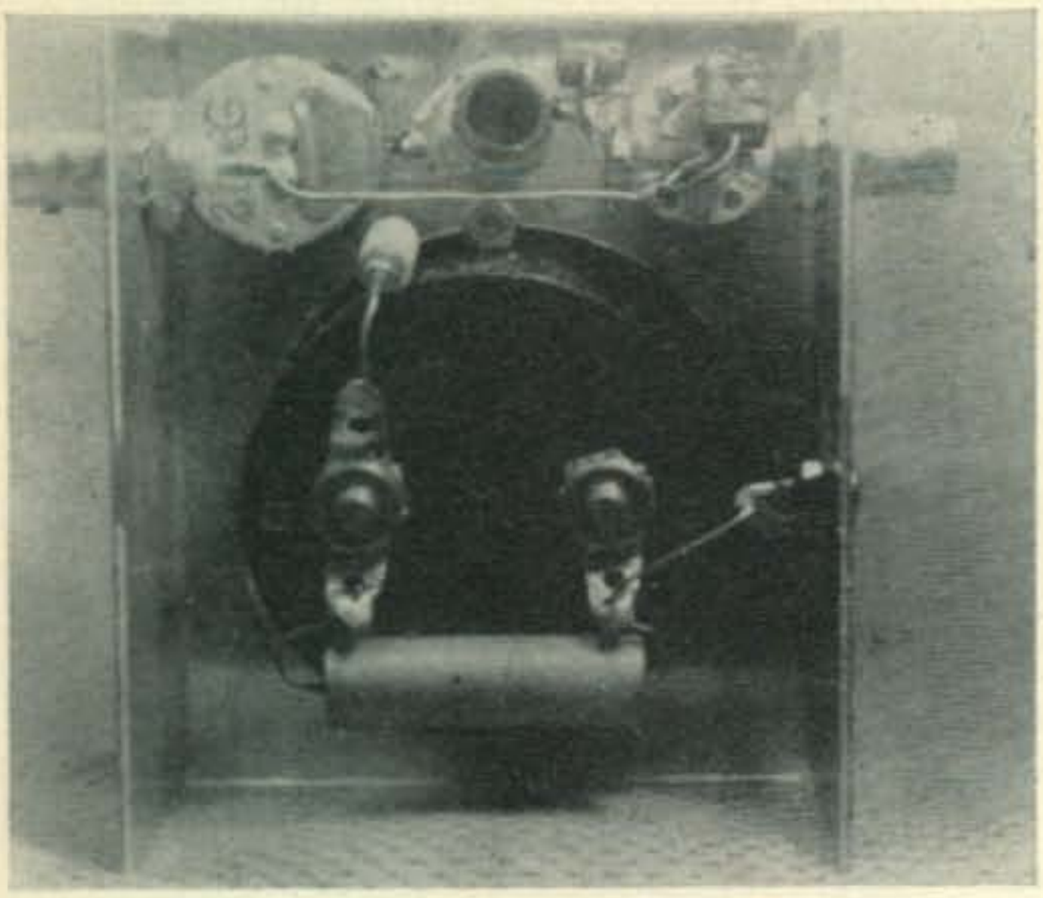
When you are using a transceiver there is no way you can listen to the receiver portion and check the carrier. Most portable transceivers just don't have provisions for a good null indicator. That's the story of how this little monitor gadget was born.

All that has to be done after building this monitor is to slip it in series with the coax line and balance out the carrier. It can also be used to check the output tuning and frequency. The advantage of a tuned indicator is to make sure that the residual signal from any spurious or mixing frequency does not give a false indication. An unwanted signal, even though it is attenuated considerably, can still show on the meter of an untuned indicator. By adding a tuned circuit, the gadget acting as a wave meter helps to make sure that the transmitter is inside of the band. It is very easy, with some exciters, to tune the transmitter to a mixing frequency which is outside of the amateur band.

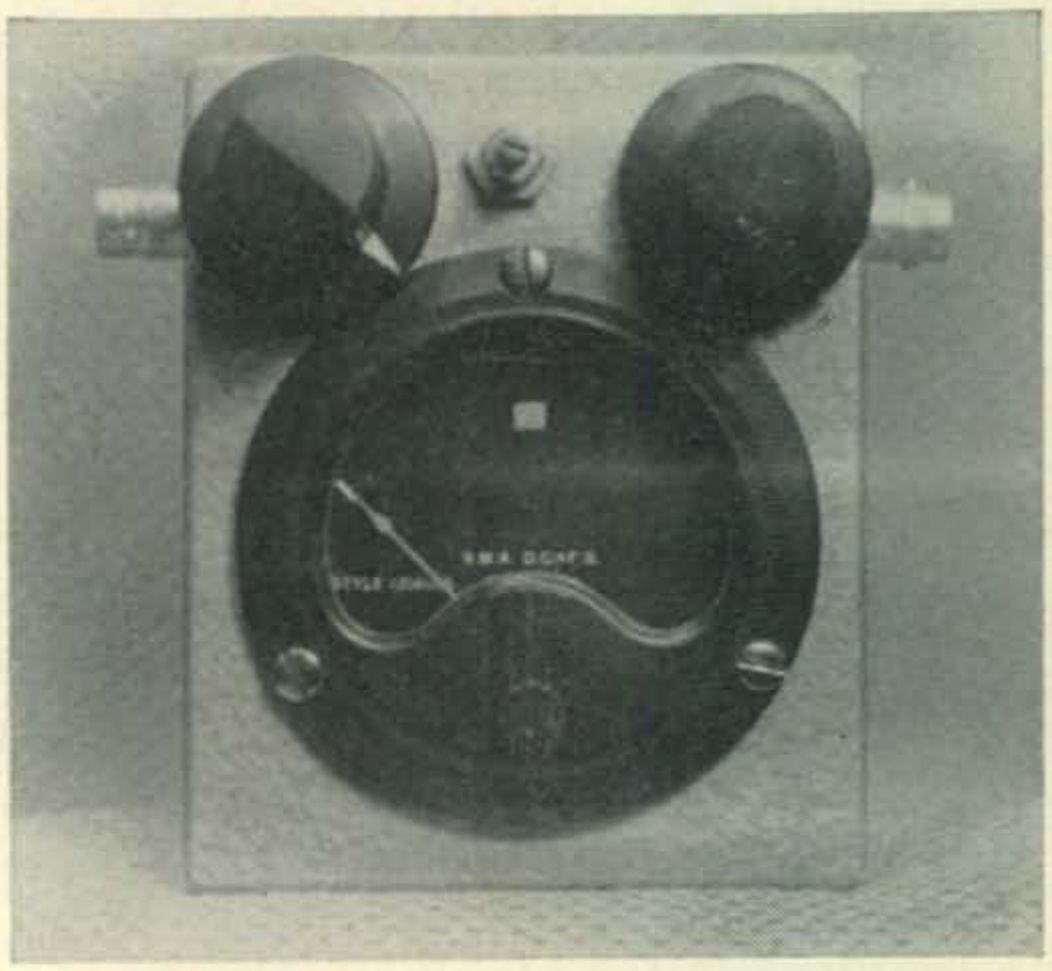
Construction

None of the parts are critical. The unit is constructed in an LMB box #135, measuring 3" × 3½" × 2 inches. For exciters or low power s.s.b. transceivers up to 175 watts, the breakdown voltage of the 68 mmf capacitor should be 600 volts. The meter is not critical, it can be a 0-1 ma or a 0-5 ma.

*528 Colima Street, La Jolla, California.



Interior view of the carrier balance indicator shows the extreme simplicity of the device.



Front view of the carrier balance indicator. The sensitivity control is to the right and tuning to the left. The slug for L_1 is above the meter.

Testing

When the unit is finished, put it in series with the antenna coax line and insert a little carrier while advancing the 2 megohm potentiometer. If the meter goes in the wrong direction, just reverse the 1N34 diode connections. After getting an indication, adjust the slug of L_1 and peaking C_2 for resonance with your 7 mc signal. (This can be used on any amateur band by redesigning the L_1 and C_2 circuit.) After the monitor is tuned, balance out the carrier and advance the potentiometer for more sensitivity to get a good null indication.

That is all there is to it! Next time you take a trip, don't be caught without this handy gadget. It's well worth the effort to build it. ■

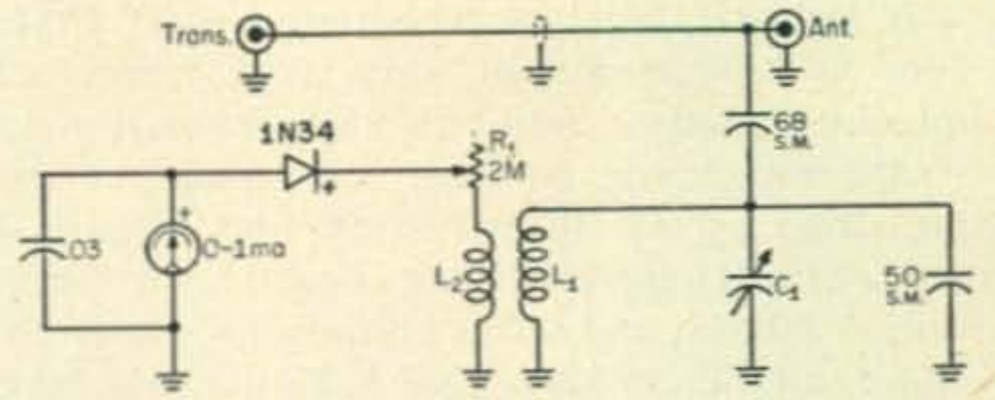


Fig. 1—Circuit of the tuned carrier balance indicator for the 7 mc band. All capacitors are in mmf unless otherwise noted.

C_1—11 mmf variable. Johnson #160-107-11.
L_1—20t #26 on ⅜" slug tuned form or Miller #21A686RBI.
L_2—3t hookup wire on cold end of L_1 (wound in same direction).

Project Interference

Part II

BY JOHN H. GRADY*, K4TUA

Part II of this three part series on interference in the amateur bands, covers the quality of a.m. and s.s.b. signals and the effect of quality upon the signal bandwidth. A set of standards is proposed by which all phone signals may be judged. Part III presents a comprehensive program designed to reduce QRM.

During the bandwidth study, the results of which were presented in Part I, an analysis was made of the bandwidths commonly occurring on the amateur bands on both a.m. and s.s.b. The results of the analysis were startling, showing that 96.4% of the a.m. signals measured had a bandwidth of more than 6 kc, and 97.6% of the s.s.b. signals measured were wider than 3 kc!

The entire interference story is not told only in terms of bandwidth; several other factors also play a role. Among these are audio distortion, inadequate carrier suppression on s.s.b., frequency drift, hum on carrier and splatter. These defects were also noted during the bandwidth study and tabulations of them are shown in Tables IV and V for both a.m. and c.w. The defects were lumped together and are shown as a percentage of total observations.

From Tables IV and V it becomes evident that excessive bandwidth is the major contributor to the inetrference situation on 40, 20 and 15 meters.

Usable Channels

To get an idea of how excess bandwidths limit the usable space on the ham bands, Table VI was drawn up. For the purposes of the study, an ideal channel is defined as 6 kc for a.m. and 3 kc for s.s.b. Thus, looking at the 20 meter band we see 150 kc allotted to all types of phone operation with a nominal division between a.m. and s.s.b being about 70 kc for a.m. and 80 kc for s.s.b.

Nearly 12 a.m. signals 6 kc wide can then be accommodated in the a.m. segment and nearly 27 s.s.b. signals of 3 kc width can be accommodated in the s.s.b. segment.

If, however, we are dealing with a.m. signals 10 kc wide and s.s.b. signals 5 kc wide, only 7 a.m. and 16 s.s.b. signals can occupy the same 150 kc of spectrum space without co-channel interference. The effect of the wider signals is to reduce by about 42% the number of amateurs that may use a band at one time without interference! This is quite a formidable reduction particularly in the light of the rapidly increasing amateur population.

*404 North Briarcliff Road, Warner Robins, Georgia.

Table VI—Usable Phone Channels

Band	Phone Portion (kc)	A.M. (kc)	A.M. Channels 10 kc	6 kc	S.S.B. (kc)	S.S.B. Channels 5 kc	3 kc
80	200	100	10	17	100	20	33
40	100	75	8	13	25	5	8
20	150	70	7	12	80	16	26
15	200	100	10	17	100	20	33
10	1200	900	90	150	300	60	100
Total	1850	1245	125	209	605	121	209

Some simple arithmetic will show that in the 80 through 10 meter bands a total of 1850 kc is available to phone operation. Of this approximately 1245 kc is normally used for a.m. work with the remaining 605 kc used for s.s.b. Ideally, this would represent over 207 a.m. channels and 202 s.s.b. channels. But, with the bandwidth findings in our study, it is obvious that considerably fewer channels are available, and with propagation conditions failing on 10 and 15 meters, the usable channels are reduced still more. Little wonder that the bands are bursting at the seams with interference.

Speech Characteristics

Most intelligibility in speech occurs in the 300-3000 c.p.s. range. The high intensity peaks of speech sounds are due primarily to vowel sounds adding little to the intelligibility of a voice. The major intelligibility is produced by the consonant sounds. The average voice, however, contains frequencies far outside the 300-

[*Continued on page 132*]

Table IV—A.M. Distortion

Band	*Total Observations*	*Total Defects*	*% Defects*
40	300	52	17.3
20	600	147	24.5
15	100	17	17.0
Total	1000	216	2.16

Table V—S.S.B. Distortion

Band	*Total Observations*	*Total Defects*	*% Defects*
40	300	49	16.3
20	600	135	22.5
15	100	15	15.0
Total	1000	199	19.9

UP-Grading Inexpensive Receivers

BY JOHN R. LAUDERMILCH*, W3FYG/2

The inexpensive receiver can be upgraded so that it is suitable for serious amateur work. Outlined here are the addition of an r.f. stage, b.f.o., Q-multiplier, crystal calibrator, i.f. gain control, noise limiter and various mechanical improvements.

For the person that has the fortitude to tear into his receiver, and dislikes numerous accessories necessary to get on the air, here are a few worth while modifications that can be incorporated into some inexpensive receivers, such as the S-38 or AR-1. The author used an S-38, and first converted it to a.c. operation by installing a power transformer. Ample chassis space allowed this, and the following additions. The most significant and simplest addition was a gain control in the cathode of the i.f. amplifier, a change not necessary in the AR-1, and most other receivers.

R.F. Stage

Next, an untuned grounded grid r.f. stage was added with unusual results. Normally, it is considered that such a circuit will not improve the front end selectivity, hence the image to signal ratio. Little gain was realized, but it was enough to hop up the high bands the desired amount, and offer low impedence input for use with coaxial line. As it turned out the image rejection was improved a surprising amount, about 6 db at 29 mc. This is because the primaries of the antenna coils were disconnected, thereby eliminating the effect of lowering the *Q* of the secondary coils. The compromise coefficient of coupling between the antenna, and mixer coils, in the original design, and the radiation resistance of the antenna, lowers the Q of the mixer input, broadening the front end selectivity. A grounded grid stage offers excellent isolation; however it is necessary for the location of this addition to be close to the mixer stage.

*N. Grand Ave. at Brenners, Poughkeepsie, N.Y.

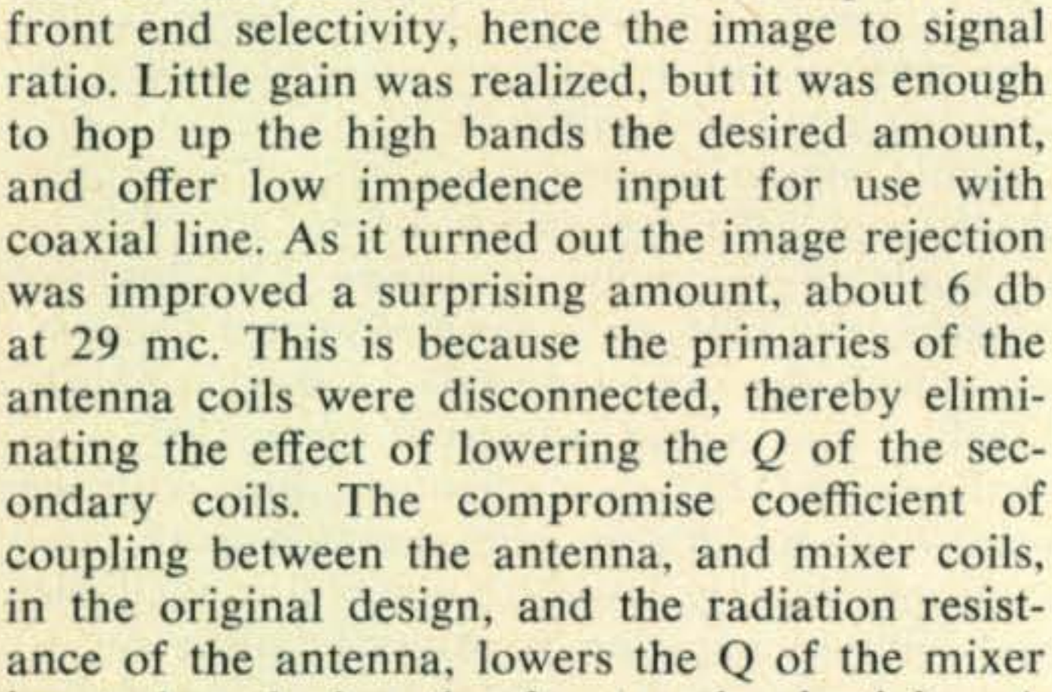


Fig. 1—This unconventional antenna changeover circuit utilizes the tank of the transmitter final to give the companion receiver improved front end selectivity.

Front view of the S-38 shows the added controls are on the front panel. The new gain control is located lower right where the RCV-STANDBY switch was. The Q Multiplier ON-OFF switch and PEAKING control are on the lower left. The upper toggle switches are, from l to r, A.V.C., B.F.O., ANL and CRYSTAL CALIBRATOR. The C.W. PITCH control is to the right of the BANDSWITCH.

By using the pi-network of a companion transmitter in the unconventional antenna change over circuit shown in fig. 1, a further improvement can be obtained in front end selectivity. This in effect uses the transmitter final tank to tune the input of the grounded grid stage, making it necessary to tune up the rig for good receiver performance on any particular band.

Figure 2 shows the circuit of the grounded grid stage as added. The other half of the 12AT7 was used as a crystal calibrator in a conventional circuit shown in several handbooks.

An extremely important adjustment necessary to get optimum performance after adding the r.f. stage, is to carefully realign the front end of the receiver, especially the high bands.

Q Multiplier

The crowded conditions on the bands pretty well demand some sort of variable selectivity as provided by a crystal filter or Q Multiplier. Here is a rather simple approach to the selectivity problem. This Q Multiplier circuit requires no

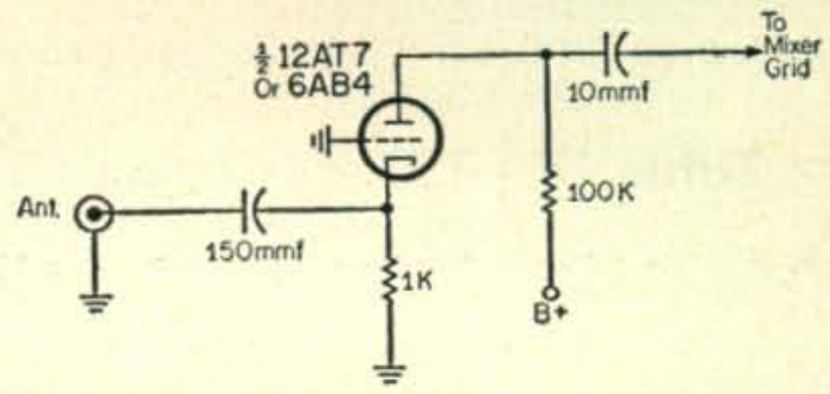


Fig. 2—This grounded grid r.f. stage provides enough gain to soup up a lazy receiver especially on the high bands.

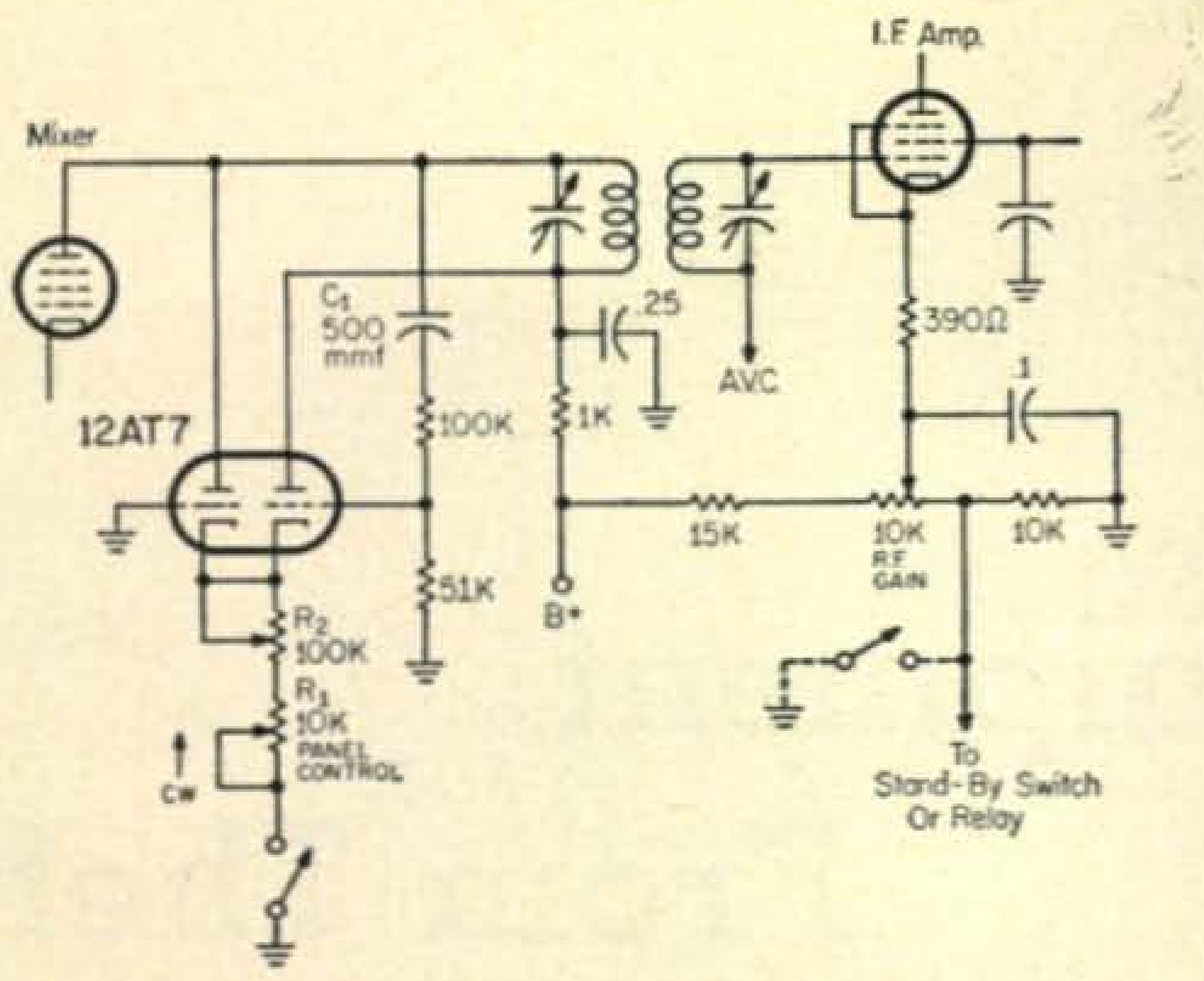
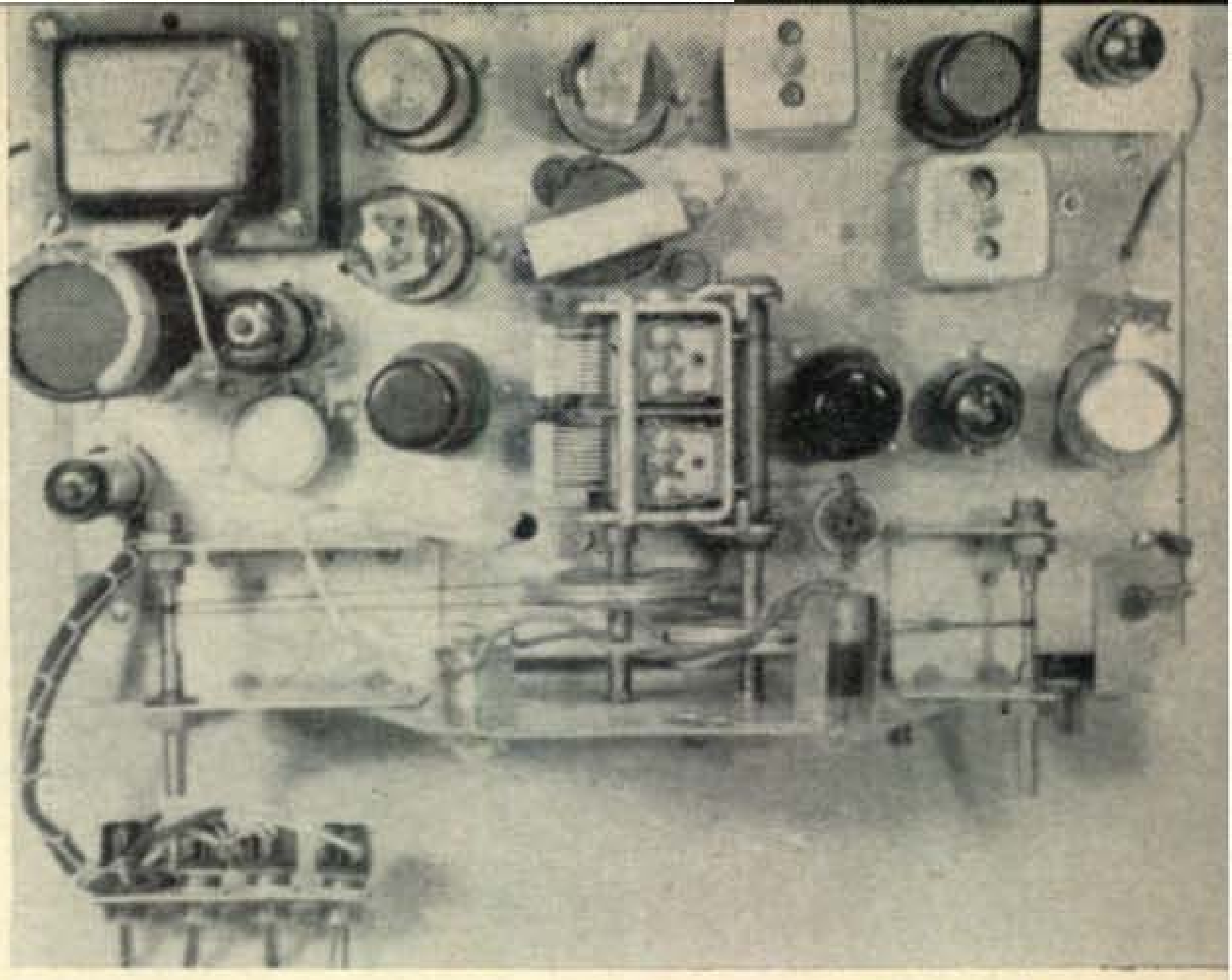


Fig. 3—Here is a Q-Multiplier that requires no coils, a special advantage for receivers with an odd-ball i.f. It can only peak, however. The i.f. gain control and standby switch is shown in the i.f. cathode.



The top view of the S-38 shows the new drive shafts smaller diameter. The crystal oscillator-r.f. amplifier is between the 6SA7 converter and surplus 100 kc crystal on the right. The 6AK5 harmonic generator is in the upper right. The 12AT7 Q Multiplier and R_2 may be seen near the power transformer.

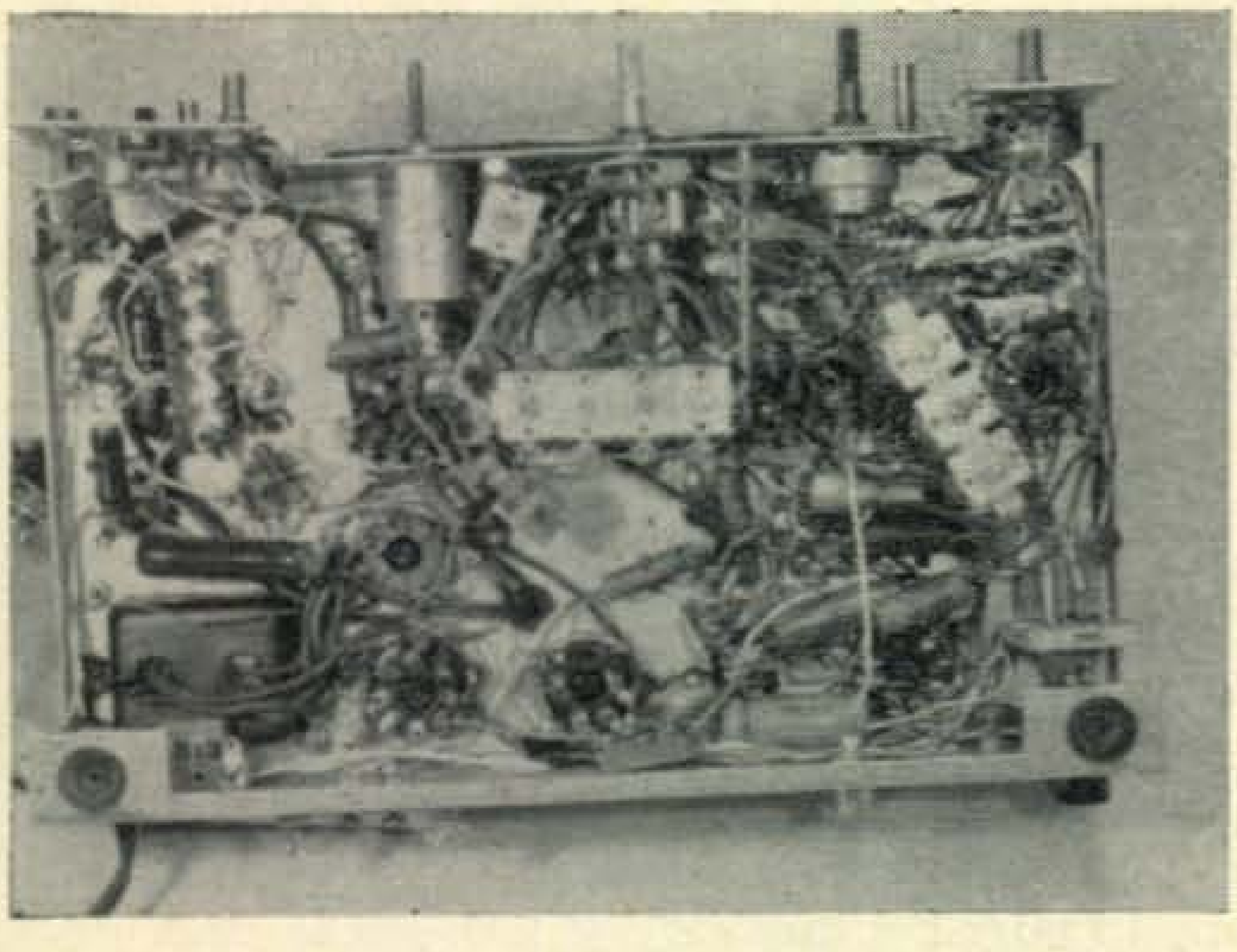
additional or special coils as shown in fig. 3. This advantage is especially significant on some surplus gear with an odd-ball i.f. frequency such as the BC-348. As with other Q Multipliers, not only is the selectivity greatly improved, but the i.f. gain is increased about 10 db when fully peaked. Since a peaking action is the most necessary, and panel space was limited, this circuit was used and found extremely helpful on both phone and c.w. The circuit somewhat resembles a cathode coupled multivibrator. It's a cathode follower driving a grounded grid amplifier. In describing its operation one can assume a pulse of noise coming out of the mixer and fed through C_1 to the grid of the cathode follower. The follower output drives the grounded grid stage which supplies the voltage gain necessary for regeneration. Since neither of the stages affords any significant phase shift, the original pulse will be reinforced. This has the effect of causing the i.f. primary to ring or produce a damped oscillation controlled by the magnitude of the regeneration and the Q of the transformer. The end result is an artificial raising of the primary Q as characterized by a hollow barrel sound.

Upon completion of the installation, it is best to run R_1 full clockwise (minimum resistance) and adjust R_2 until the circuit just goes into oscillation. Then back off on R_1, the peaking control, for the hollow sound previously mentioned. Retune the i.f. transformer primary to the center of the i.f. bandpass, usually 455 kc. While doing this keep the peaking control just below the threshold of oscillation.

One headache encountered was the problem of regeneration in the i.f. amplifier of the receiver itself. Symptoms of this problem are recognized by the fact that the frequency of the peaked bandpass shifts when changing the amount of regeneration with the peaking control. The problem was remedied by removing the cathode bypass capacitor of the i.f. stage. Some loss of gain resulted, but the improvement afforded by the Q Multiplier more than offsets this loss. Some of this regeneration can be reduced by lowering the b.f.o. coupling.

As with other Q Multipliers, a bit of practice

[*Continued on page 118*]



Bottom view of the S-38 after all the modifications. Gone is that uncluttered appearance. The b.f.o. transformer may be seen to the left of the bandswitch. An added heavy steel wire support from the front panel to the oscillator coil bracket was added which improved frequency stability greatly.

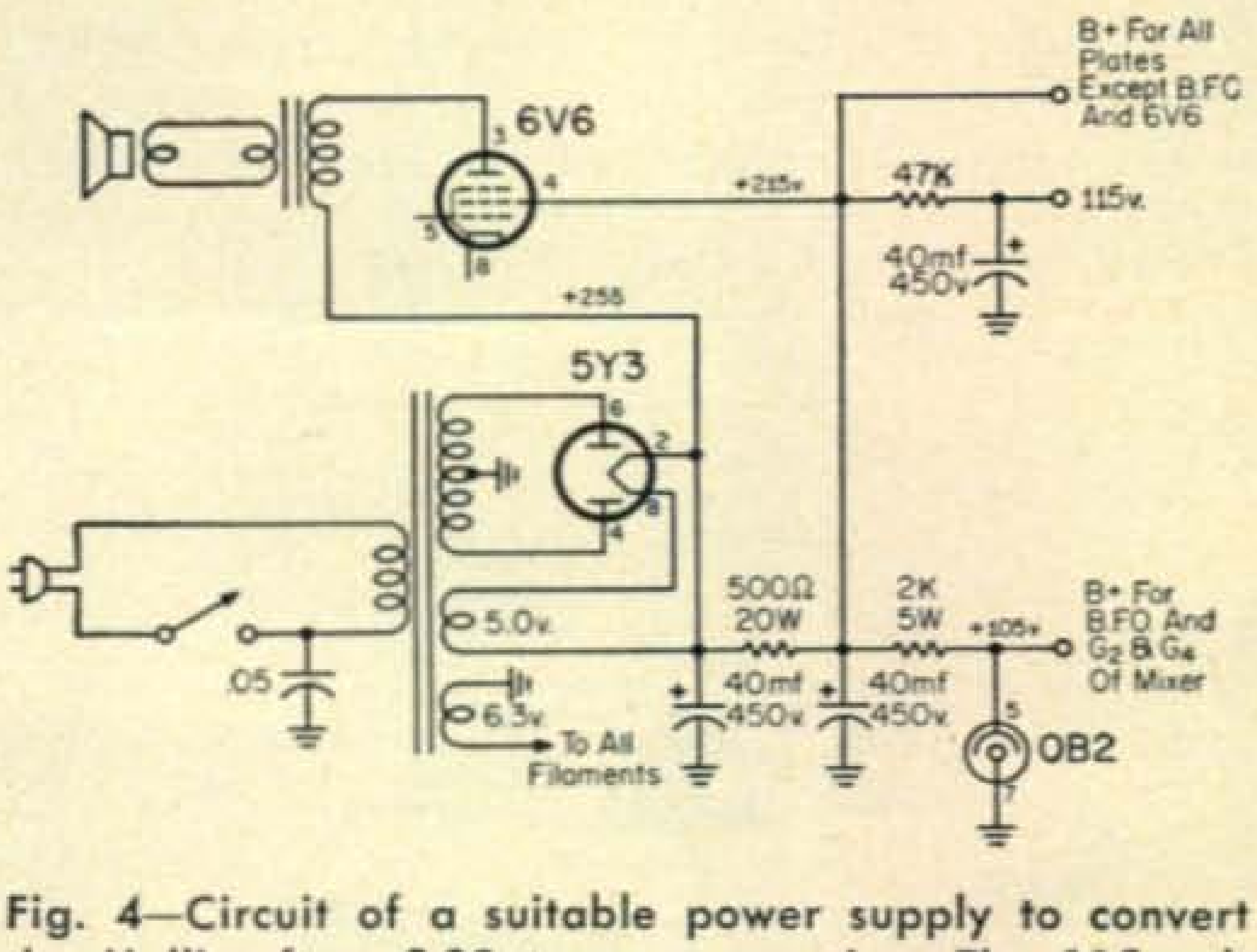


Fig. 4—Circuit of a suitable power supply to convert the Hallicrafters S-38 to a.c. operation. The 115 volt line is for the screen grid of the i.f. amplifier and the regulated 105 volt line is for the b.f.o. and the mixer screen grid. The power transformer is a Merit P-3051 or equivalent.

Based on personal interviews with more than thirty convicted burglars now serving time in Michigan's maximum security prison at Jackson, this article is an authoritative guide on how to . . .

Protect Your Equipment From Theft

BY ROBERT DALE and WILLIAM R. MOREY*

ACCORDING to FBI figures, burglaries occur in the United States at the rate of one a minute, twenty-four hours a day — or more than half a million every year. These figures also indicate that burglary is the most common and fastest growing crime on the books. And according to the burglars who make those statistics it is also the safest and most profitable crime. Most people seem to think they are immune from burglars simply because they have no expensive furs and not much cash or jewelry around the house. Burglars, however, are like other smart businessmen and they keep a sharp eye on public demand. A growing awareness of the world of electronics and the steadily increasing popularity of electronic equipment used by radio amateurs in recent years has drawn a great deal of larcenous attention where such equipment is available. Many burglars have begun to specialize in this field. And where a thief's loot may once have been a sack of jewels, it is now more apt to be a transmitter, scope, or a receiver.

If you are an average ham, your home contains more valuable merchandise than a thief could hope to obtain by robbing a dozen other homes. As an extra bonus, he doesn't have to worry about burglar alarms, regular police patrols, barred windows, heavy-duty locks and 500-pound safes.

What this means to you in terms of dollars and cents is this: if a rank amateur blunders into your shack he can walk out with enough loot under his arm to keep you off the air for several weeks. If he's a professional burglar and takes enough time to load the trunk of his car he can strip your shack right down to your call letters.

And if you think losing a car full of costly equipment can be expensive you should see what can happen to a shack when a crew of really determined thieves goes to work on it. One of the most recent and most popular burglary techniques is a large scale operation known among professionals as the "truck hustle." Steve Catel, now serving a 5-to-15-year sentence in Southern Michigan Prison, was an expert at this. On a typical job he and his two partners would locate a home displaying a short-wave antenna. As soon as they determined that the house was empty, they would drive up with a large rented van and start loading all the ham's radio equipment into the van. When conditions were right they would take everything in the house that would bring a dollar.

This is a dangerous form of burglary because it's all out in the open and there's no telling when a suspicious neighbor will call the police. But the men who practice this racket turn the openness to their own advantage. One oldtimer even made a specialty of talking the neighbors into helping him load the truck.

Don't Risk Trouble

There is a popular and dangerous misconception that burglars don't carry guns. According to burglars themselves, though, at least 70% of them *do*—and the rest admit that they would be prepared to use a knife, a crowbar or some other makeshift weapon from their burglar tools if they felt they were cornered in a residence. As one second story artist put it, "What else can

*4000 Cooper Street, Jackson, Michigan.

. . ."Larcenous attention". . .

. . ."Right down to your call letters". . .

ya do when some big ape in pajamas comes after you with blood in his eye and a poker in his hand?"

All burglars prefer to work in an empty house and they usually take great pains to determine that no one is inside before entering. This natural preference is reinforced by laws in many states which specify that burglars can receive many more years in prison for robbing a house that is occupied than for one that is empty.

But even the most careful thieves can make mistakes, and they make them often enough that the wise ham should know how to behave during a burglary — or what to do until the prowler leaves. If he *is* a wise ham, he does exactly nothing. He doesn't jump out of bed and turn on the lights, and he especially doesn't go barging out to do battle with the intruder. While you are half asleep, confused and filled with righteous indignation, the burglar is wide awake, alert to your coming and determined not to be caught at any price.

There are only two sensible courses of action: remain perfectly still until you are sure he has left, or make some small noise—cough or rattle a bedside table. Burglars are constantly on the alert for such waking sounds, and if you're not standing between them and the window they'll be only too happy to vacate your premises without causing any uproar.

Take Adequate Precautions

There is no practical way to make an illegal entry into your home impossible. Even the strongest door locks will yield eventually to the brute force of a wrecking bar or heavy hammer. And if a burglar wants to be a little more quiet about it he can always apply tape to one of your windows and knock it in onto the rug. But your concern is not so much keeping burglars out as it is discouraging them from wanting to get in. By taking adequate precautions to protect your home and equipment you can put the odds against theft very much in your favor.

—The most obvious precaution is a good set of locks with dead bolt mechanisms that can't be opened by the first burglar who happens by with a strip of celluloid in his pocket. A common mistake is to put a solid lock on the front door and a cheap spring lock on the back door. This is just dandy with burglars—they always prefer to break in at the rear where there is less chance of being seen. So be sure to use good locks on *all* outside doors. And don't neglect the windows.

—If you hide a spare key outside the house *don't* put it in any of the traditional places—under the mat, over the door or in the mail box. Many burglars check these places as a matter of routine. Hide your key at least ten feet from the door. No prowler will waste his time searching the entire front of a house.

—Leaving your house empty with all the lights out, or with only the porch light burning, is a sure way to attract burglars. At least one light inside the house will discourage most burglars —and the best place for it is in the bathroom. A single light there, no matter how late, will appear quite natural. But if you allow it to burn on into the daytime you might as well put on a recording and broadcast your absence. There are a number of inexpensive devices on the market that can handle this for you—the photo-electric type that automatically turns your lights out at dawn[1], and the automatic timer type that can be set to turn any lights on or off at any time. Both are very effective, especially if you are going to be gone for any length of time.

—When you plan that next vacation, be sure to stop all deliveries and make arrangements for your mail to be picked up and your lawn cared for. Burglars watch for cluttered porches and shabby front yards.

—Burglars also keep an eye on the newspapers, so don't allow any notices to be printed that you are off for two glorious weeks at Lake Liebpfabe. If your absence becomes general knowledge in any way, you're in for trouble.

—Dogs are excellent burglar insurance, but if you take yours with you when you leave home make certain his empty kennel isn't too conspicuous. Added to other small signs, this can tell an experienced burglar all he needs to know.

—Notify the police when you leave on vacation and let them know the approximate date of your return. By letting them know which home to watch for signs of suspicious activity you'll be making their job easier and protecting yourself much more thoroughly.

—And, just in case, keep a good description of all your equipment. If necessary, this can aid recovery and expedite insurance claims.

You should also try looking at your place from the burglar's point of view. No thief with half his wits about him is going to run a criminal obstacle course when there are plenty of ham shacks in homes that have cheap locks, open windows and obviously absent owners.

See to it that you are not one of those who invite theft . . . and you won't have to worry about burglars. ■

[1]Allied Radio in Chicago lists one which sells for about $8.00. Catalogue #77P364.—*Ed.*

A Different Approach to RTTY Design

BY EUGENE AUSTIN*, WØLZL

Here is a converter unit that uses two thyratrons in a flip-flop circuit. It eliminates the need for three conventional tubes and the polar relay.

SOME years ago, the author got into a heated argument about the characteristics of the lowly thyratron. The upshot was the design and building of a radioteletype converter, using thyratrons as the switching element, rather than "hard" tubes.

The initial success was so encouraging that, after many mistakes, modifications, and mangled fingers, the end result was two lonely thyratrons sitting where there used to be three "hard" tubes and a mass of resistor-capacitor networks and polar relays.

Circuit Operation

The basic circuit of a thyratron keyer is shown in fig. 1. When a mark signal is received, an audio (a.c.) voltage builds up in the output of the "mark" filter. When the first positive half-cycle builds up to a critical value, it causes V_1 to suddenly ionize and conduct. For all practical purposes, this tube then becomes a dead short between all elements. The two grids have lost all control, and conduction will continue until plate voltage is removed long enough to permit deionization.

Note at this point that C_1 will now assume a charge, with the conducting plate of V_1 causing that end to be negative and the other end positive, since there is no drop across R_4.

When, some time later, a "space" signal is received, the voltage disappears from the "mark" filter, and a new signal appears at the output of the "space" filter. The first positive half cycle of this new voltage causes V_2 to fire.

When V_2 fires it has the same effect as if the plate were suddenly grounded. The charge on C_1 is effectively applied as positive at ground (plate of V_2), and negative on the plate of V_1. Since thyratrons are essentially rectifiers, and do not conduct when the plate is negative, this charge has to be dissipated through R_5, the selector magnet, and R_4. Having discharged, C_1 will then recharge, but with opposite polarity, since the plate of V_2 is now effectively at ground and the plate of V_1 is now at plus 250 volts.

During the first half of this discharge-recharge cycle, the negative plate of V_1 will not conduct, permitting the tube to deionize . . . providing C_1 is large enough to allow sufficient time. Since there is now no signal on the grid of V_1, the tube will remain in the "ready" condition until a "mark" signal is again received.

We now have the switching circuit. The considerations entering into setting up such a circuit are somewhat unusual.

Time Constants

Tube manuals state that the usual thyratron deionizes in about 75 μ-sec. That is about right for new tubes. But an old, or abused tube requires much more time. I found here that at least 250 μ-sec was necessary for long-term stability. Since only half of the time constant is used for deionization purposes, you have to allow at least 500 μ-sec. Even this is a bare minimum. One millisecond is a good all-round figure, allowing for old tubes, line capacity, and other effects.

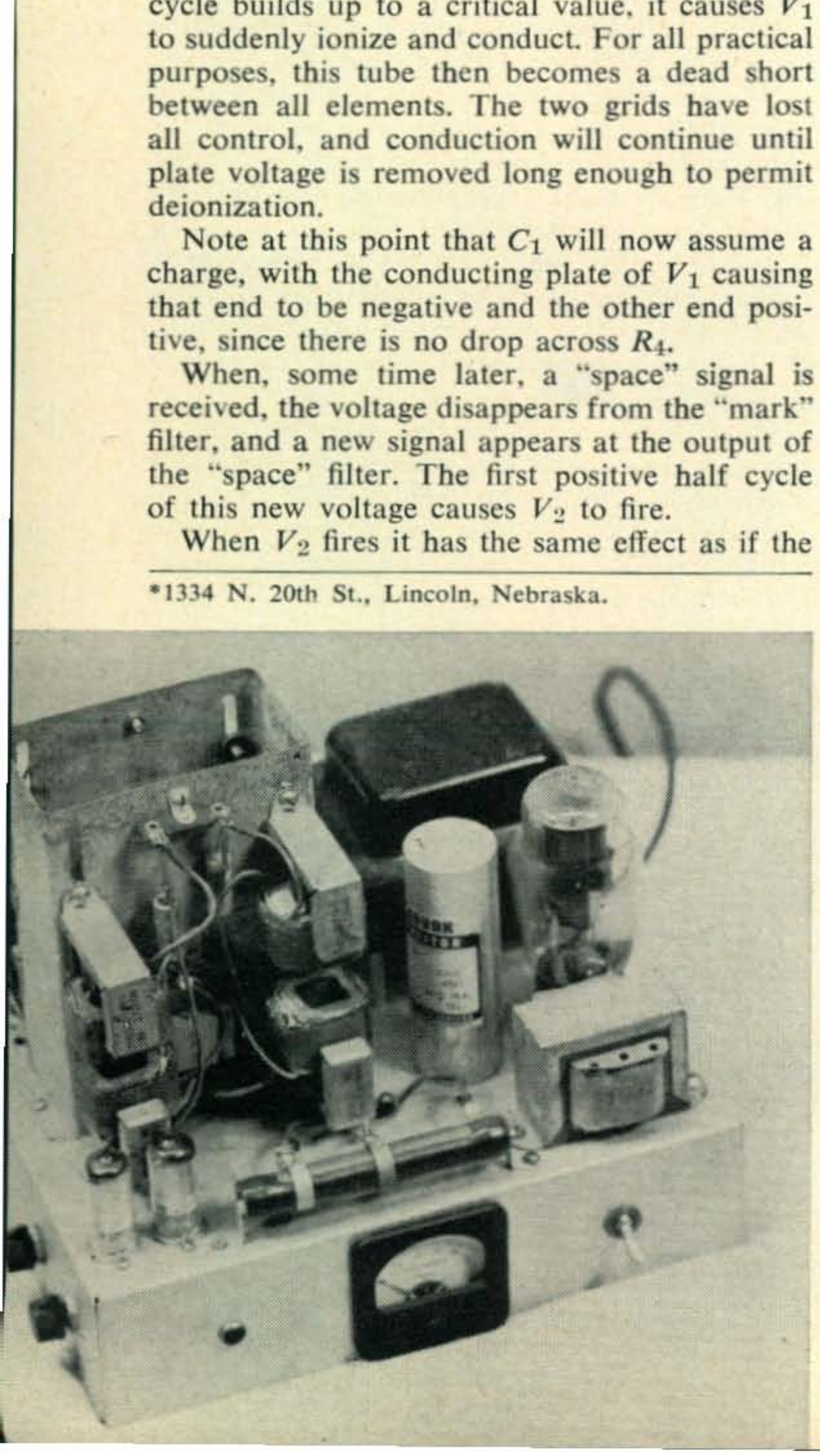
Noise Suppression

Since thyratrons are an excellent "white noise" generator, certain precautions are necessary to prevent this noise from getting out of the chassis. By using inductive wire-wound resistors for R_4 and R_5, the r.f. choke characteristics can be used in combination with the resistance to provide effective noise filtering. The 0.01 disc ceramic C_5 is the capacitive element in the filtering. For this same reason, it is important that the two resistors be used with the shortest possible leads to the plate contacts on the sockets.

Power Supply

Some sort of d.c. power supply is necessary to key the reactance modulator in the transmitter. By "floating" this supply, and connecting it to a

*1334 N. 20th St., Lincoln, Nebraska.



Top view of the converter chassis. The bandpass filters are constructed on the sub-chassis and the two 2D21's may be seen in the front left. The two bias controls for the thyratrons are on the left chassis flange.

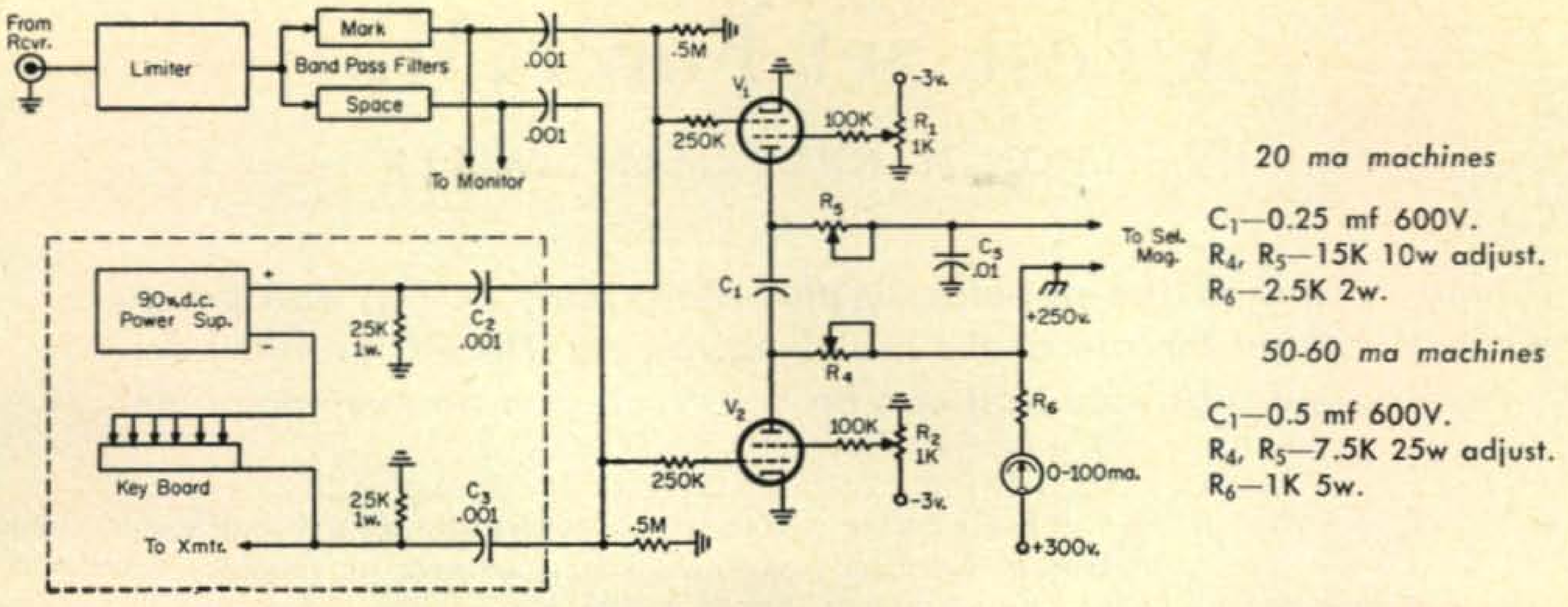


Fig. 1—Circuit of the RTTY converter unit employing two thyratrons, V_1 and V_2. These may be either 2050's or 2D21's. The entire B-minus circuit is floated above chassis and one side of the selector magnet circuit is grounded to the chassis as shown. All capacitor values are in mf and all resistors are ½ watt unless otherwise noted.

center-tapped resistor setup, it can be used to operate this same unit for a local loop power supply. You can use a small bias supply with very simple rectifying and filtering to key both.

In operation, the use of the two resistors has a polarity reversal effect on the pulses generated by C_2 and C_3, when the keyboard contacts open and close. Closing the keyboard contact gives a positive pulse from C_2, at the same time a negative pulse from C_3. The negative pulse has no effect on V_2, but the corresponding positive pulse will fire V_1. When the keyboard is opened, another pair of pulses are generated, this time opposite polarity. This puts the positive pulse on V_2, and switches the system to space.

Figure 2 was necessary in the original model because of a low impedance path to ground through the bandpass filter. In later models, the circuit shown in dotted lines in fig. 1 proved to be better suited.

Figure 3A is the circuit of the bias supply for the thyratron control elements. You will note that a center-tapped filament winding is used, with the bias drawn from one half of the winding. If you find it necessary to use a transformer with no center tap, the circuit in fig. 3B will give the same results. I do not recommend using more than 3 volts bias. The adjustment of R_1 and R_2 gets entirely too critical!

Adjustments

Make the adjustments on the taps of R_4 and R_5 as follows:

1. Set up converter with the desired selector magnets, relays, if used, etc., in the circuit.
2. Set R_1, MARK BIAS control, for minimum voltage, and R_2, SPACE BIAS control for maximum voltage.
3. Adjust R_5 for the proper current value for your equipment.
4. Reset R_1, MARK BIAS control, for maximum voltage and R_2, SPACE BIAS control, for minimum voltage.
5. Adjust R_4 for the same current you previously adjusted R_5.

Adjustment of the bias controls R_1 and R_2 is somewhat more difficult. A means of controlling the output amplitude of the limiter is necessary for an accurate adjustment. However, this is made difficult by the fact that a good limiter reaches full output with a very small input signal.

In the usual converter, the monitoring scope is connected with the horizontal to the "space" output, and the vertical to the "mark" output. Under proper signal conditions, therefore, a vertical line shows for "mark" input, and a horizontal for "space." The ordinary audio converter will have the "mark" coils tuned to 2975 cycles, and the "space" coils tuned to 2125 cycles.

If you connect a variable audio oscillator to the converter input and slowly sweep the frequency from 1000 cycles to 4000 cycles, you will note that the horizontal line will start from a spot, expand to a full line, shrink to a spot,

[*Continued on page 119*]

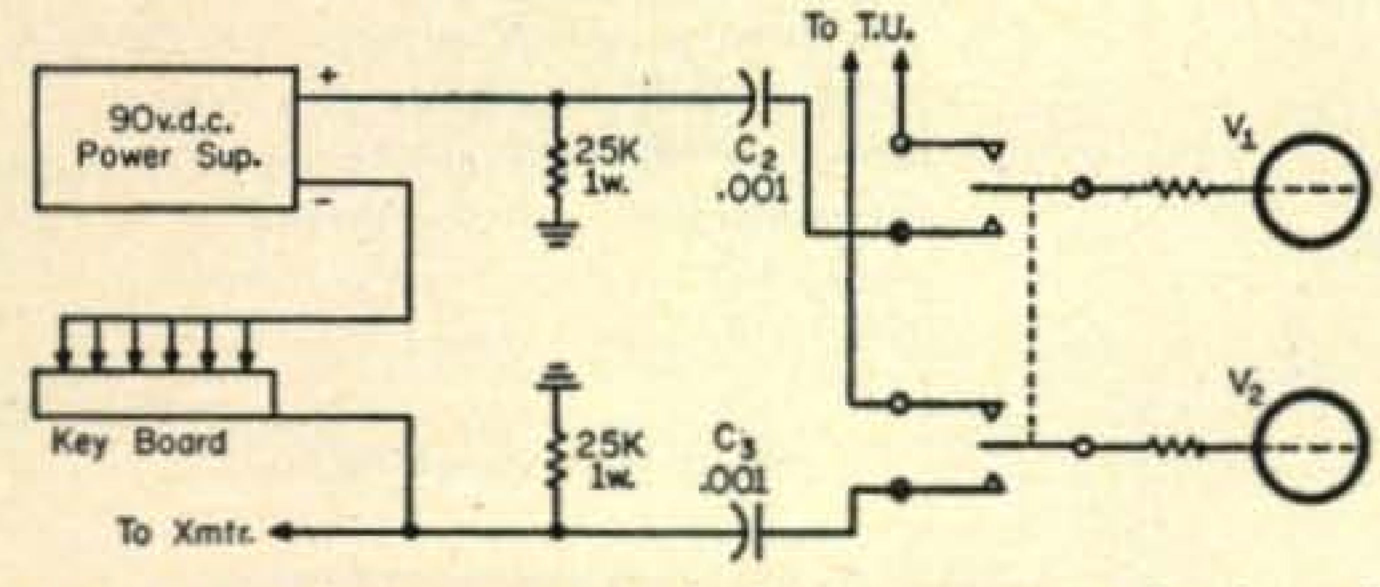


Fig. 2—An alternate method of connecting the keyboard and transmitter to the RTTY converter in the event the Mark-Space filters have a low impedance. The relay contacts are part of the transmit-receive relay.

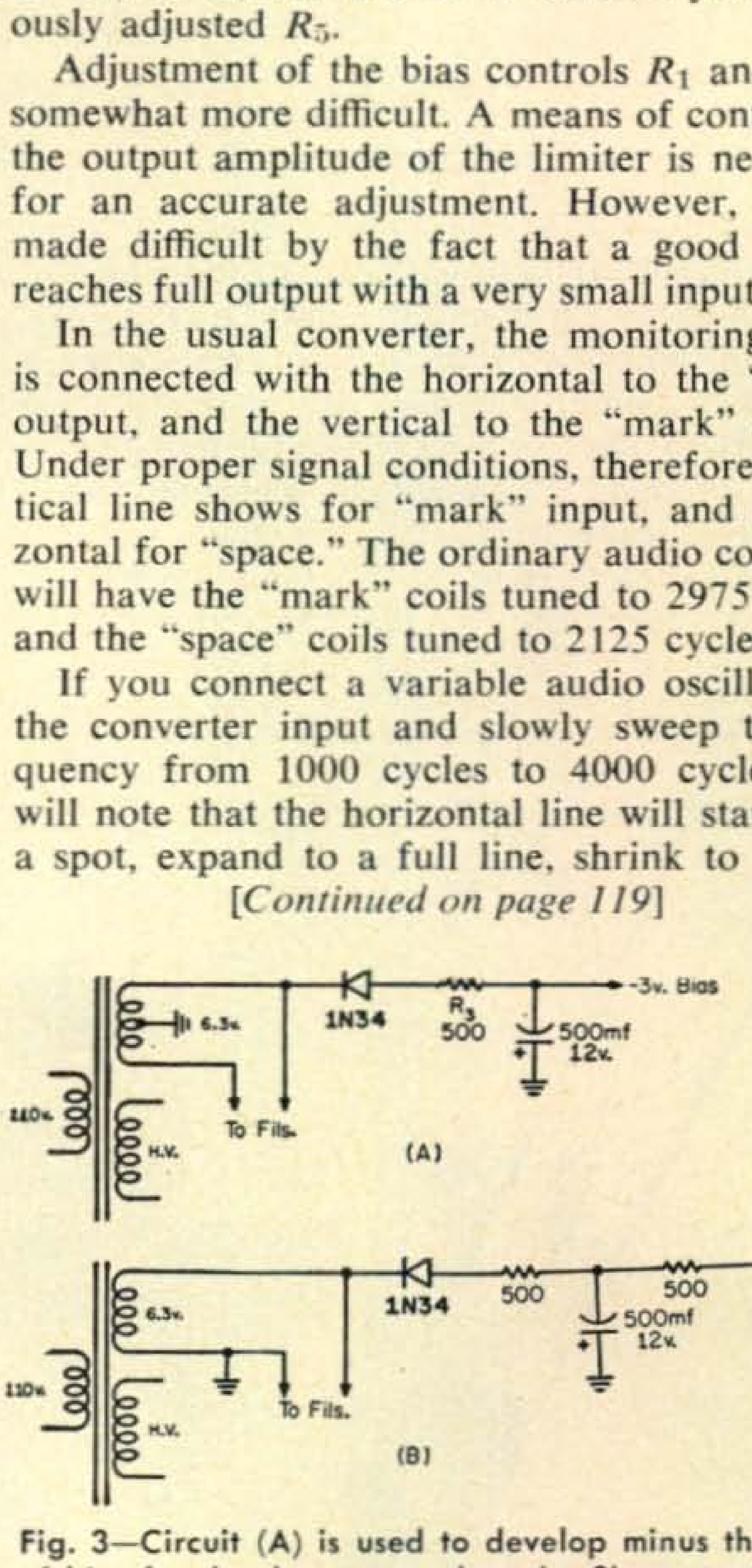


Fig. 3—Circuit (A) is used to develop minus three volts of bias for the thyratrons when the filament winding is center-tapped. Circuit 3(B) is used when the filament winding is grounded on one side.

A Test Set For F.M.

BY BYRON H. KRETZMAN*, W2JTP

Tuning-up one of the popular surplus Motorola f.m. rigs can be quite a chore without the aid of the matching test set. Here is an inexpensive home-brew substitute that can be constructed in an evenings time.

THOSE of you who operate v.h.f. are aware of the ever-increasing activity of f.m. stations on the high ends of the 6 and 2 meter bands. These stations are using retired, and slightly modified, police car and taxicab "two-way radio" sets. Modification of this commercial surplus equipment is relatively simple, consisting mainly of the construction of an a.c. power supply as compared to the modification of war surplus. Sometimes a turn or two must be taken off a coil to reach the 6 meter band with a "low band" set or a capacitor or two added to reach the 2 meter band with a "high band" set. These compact sets usually have transmitters that give 30 to 60 watts output, while the crystal controlled receivers have a fantastic sensitivity, compared to the SCR-522.

Using The Metering Socket

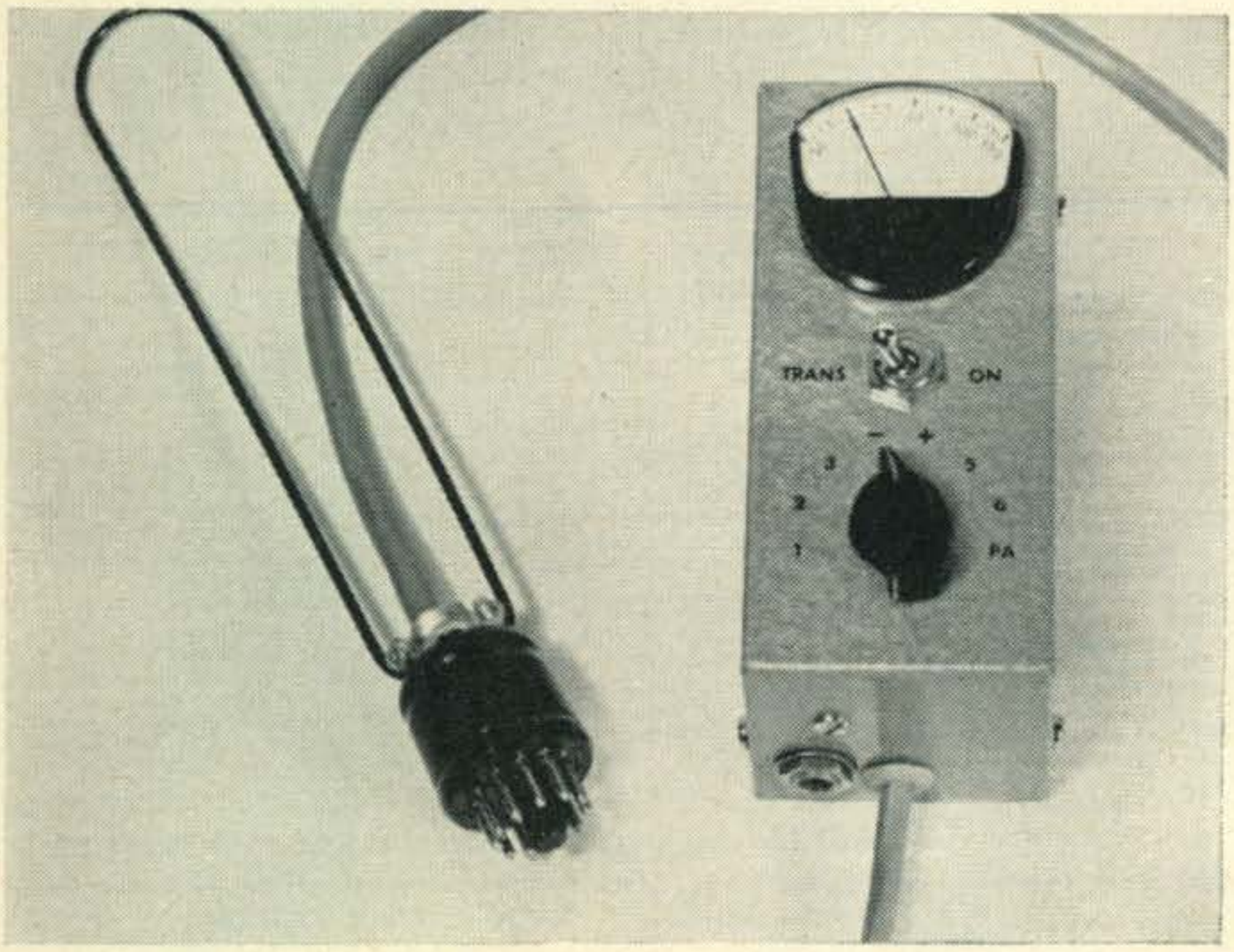
Most of the f.m. equipment which has been made available to hams has been made by Motorola, such as the -80-D and the -140-D. Of course, since the majority of these sets were designed for mobile operation, there are no meters for tuning. Built into each receiver and transmitter, though, there is an eleven-pin metering socket which gives access to all metering points required to do a complete tune-up. To facilitate tuning, Motorola developed a Test Set, the Model P-8501, to be plugged into these test sockets. Basically, this test set uses a 4-inch square meter with a 50 microampere movement. A series resistor makes it a 20,000 ohms-per-volt volt. A rotary switch then permits selecting the desired circuit in either the transmitter or the receiver. Other features were a monitor loudspeaker, a crystal oscillator, and a toggle switch to allow keying-on the transmitter. Naturally, not very many of these test sets have hit the surplus market.

The v.h.f. (f.m.) operator, like the RTTYer, doesn't hesitate building a little 'ole piece of test gear. The problem is finding the meter. Big 50 microampere meters don't come cheap, even if you can find one in surplus, which is rare. Ah, but we *did* find a source of beautiful small, modern, 50 microampere meters (down on Radio Row in New York City) for only $4.95. These are Minneapolis-Honeywell meters, and they have the zero off-set. That is, the scale reads minus 50 to the left of zero and plus 150 right of zero. This is ideal for looking at the discriminator of an f.m. receiver. The meter movement is 50 microamperes full scale and its resistance is 2,000 ohms. The scale is linear to the left of zero, and to the right of zero up to 100. The 100 to 150 portion is not linear, but that is not important as we shall explain.

A Simple F.M. Test Set

We simplified the construction of our test set, thereby reducing its size accordingly. The speaker

*431 Woodbury Road, Huntington, N.Y. 11743



Simple test set for v.h.f. f.m. equipment, ideal for the converted Motorola —80-D and —140-D units popularly in service on the 2 and 6 meter amateur bands. The rotary switch selects the desired circuit in either the transmitter or the receiver to make its measurements. Also included is a jack for loudspeaker monitoring and a remote TRANS ON switch. The handle shown was made from a wire coat hanger.

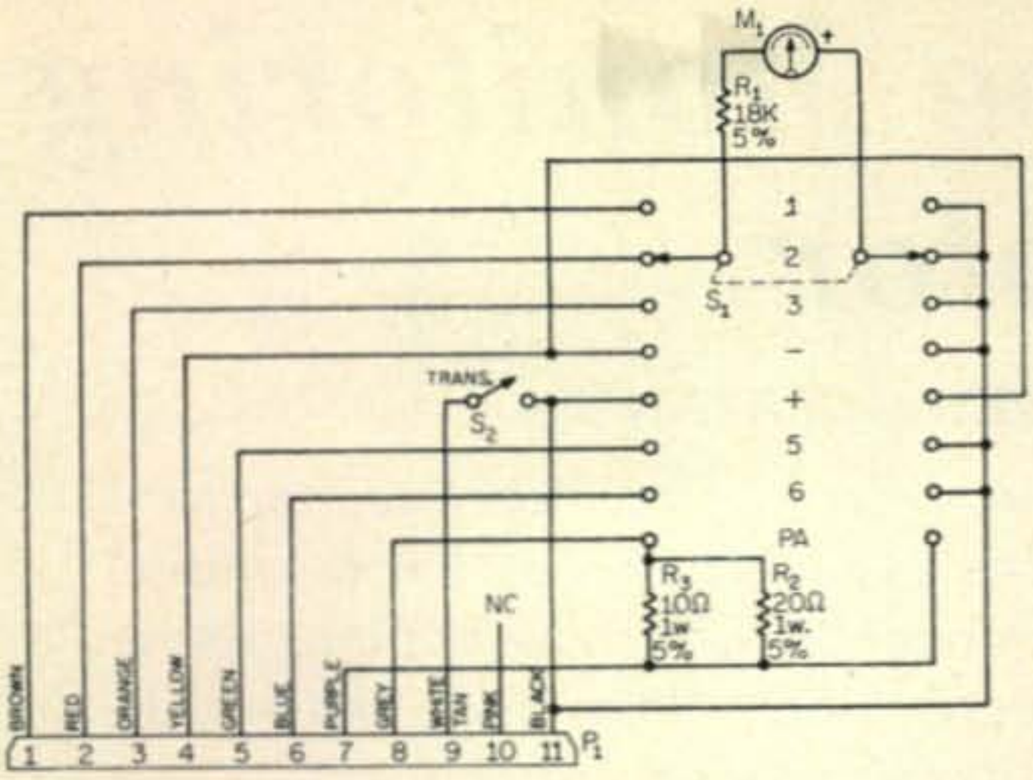


Fig. 1—Test set diagram for the Motorola f.m. sets.

M_1—Miniature 50 μa meter. Minneapolis-Honeywell surplus. Edlie Electronics, Inc., 154 Greenwich St., N.Y., N.Y. 10006. Catalogue #CA1060, priced at $4.95.

P_1—11 pin cable connector. Amphenol 86PM11.

S_1—2 pole 11 position rotary switch, non-shorting. Centralab 1413.

S_2—S.p.s.t. toggle switch.

was omitted, but a jack is provided to permit plugging in either headphones or an external speaker. Also omitted was the crystal controlled test oscillator. The TRANS ON switch was retained and has been found to be quite useful; actually essential.

As you can see from the diagram, fig. 1, the circuit is very simple, consisting mainly of wiring from the eleven-pin plug, *P* to the two-pole eight-position rotary selector switch, *S*. Switch positions are marked the way they are in the P-8501 Test Set, except the position to read relay voltage was eliminated. Positions 4 and 5 are marked — and + respectively, to check the discriminator of the receiver. The last position is marked PA and is used to measure the voltage drop across one of the two series resistors, one for each tube (section), in the plate circuit of the final. Note that we have added two parallel resistors, R_2 and R_3. These were added so that the meter, in the PA position, would read the plate current (of one tube at a time) directly in milliamperes for the —80-D set. When plugged into the —140-D transmitter test socket it reads one-half the actual plate current to either half of the final tube. Switching between final tubes is done on the transmitter by means of a switch marked BALANCING on the —80-D.

Construction

Our f.m. test set is built into a 2¼ × 2¼ × 5 inch mini-box, a Bud CU-1004. The plug is an Amphenol 86-PM11 (79-CC4) with a handy coat-hanger-wire added for a handle (quite useful when removing the plug from a test socket). The cable is a four-foot length of 12-wire (stranded) cable. The rotary selector was found in surplus, however, there is an equivalent made by Centralab. Be sure that the receiver audio output jack is insulated from the chassis. (This

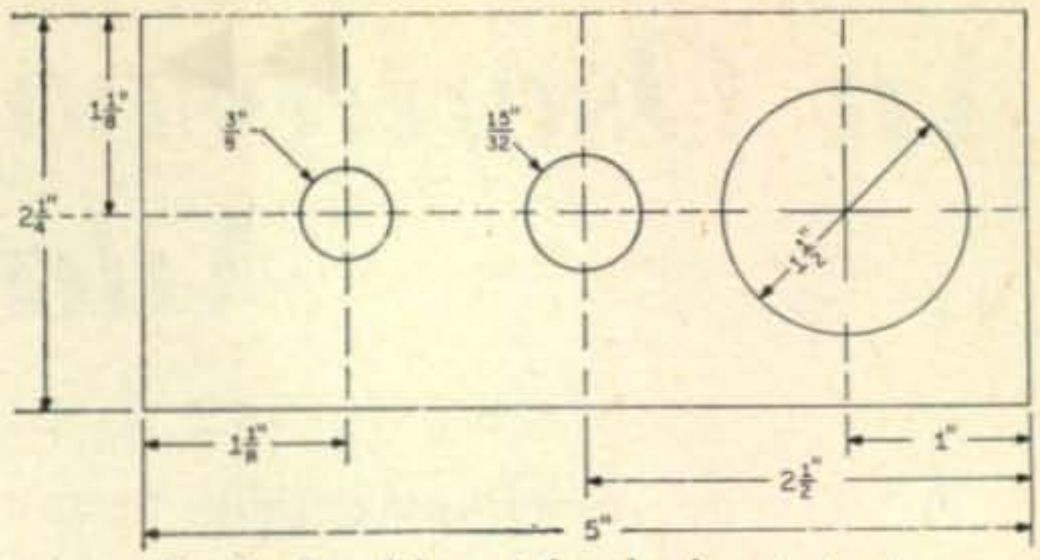
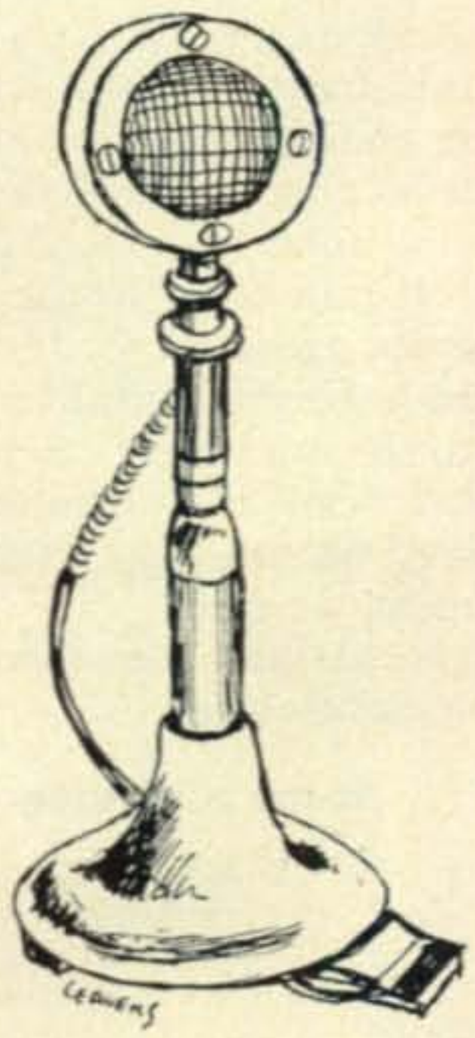


Fig. 2—Panel layout for the f.m. test set.

prevents accidental keying of the transmitter by grounding the case.)

After wiring is completed, except for temporarily leaving one wire off the meter, use an ohmmeter to check your wiring to make sure you haven't made an error. Note that the transmitter plate voltage appears on plug pins 7 and 8. Any foul-up here and Pouff!, up goes that nice 50 microampere meter. When you are sure everything has been wired correctly, connect the meter, then cross your fingers and plug it in. You can very easily check the adjusted calibration of the test set in the PA position by first measuring the plate current, between pins 7 and 8 on the transmitter test socket, with a milliameter; then plug in the test set. If the meter reads a little too high, add some resistance in parallel with R_2 and R_3. If a little too low, increase the value of R_3, say to 27 ohms. A reading of more than 100 means that you are drawing too much plate current, so quickly switch the transmitter final to LO. The scale above 100 doesn't read correctly, but who cares? You shouldn't be up there, in the PA position, anyway. For the other circuits the actual reading is not important as you tune the circuits for a peak reading, or in the case of the receiver discriminator, for a zero reading.

Anyway, for a couple of hours work you will have built yourself an extremely useful device, and wonder how you ever got along without it. (Loan it to somebody for a while and you will find out!). ■



An Oscilloscope Monitoring Adaptor

BY DAVID T. GEISER*, WA2ANU

While many excellent articles have been written on oscilloscope monitoring methods, very few have described ways to mate scope kits to simple transmitters without complicated attachments. This article outlines some generally useful procedures for most scopes and transmitters. The necessary parts are simply two resistors and two capacitors.

C.w., phone, and sideband operators can all profitably use oscilloscope monitoring. The author, for instance, does not know any phone or sideband operator who has abandoned the use of scope monitoring once he has tried it.

The two most common ways of displaying a signal on a scope are Sweep and Lissajous. Sweep methods use the internal sweeping circuits of the scope to move the trace across the screen, usually as a linear function of time. This is most useful for observing keying, and on phone gives the conventional "modulation envelope." It is also useful for sideband "two-tone" tests, n.b.f.m., and d.s.b. single-tone test. "Lissajous" is the general name for patterns such as the a.m. "trapezoidal" and s.s.b. and d.s.b. "bow-tie" patterns. These patterns are obtained by feeding some audio into the horizontal channel of the scope, while r.f. is fed into the vertical channel.

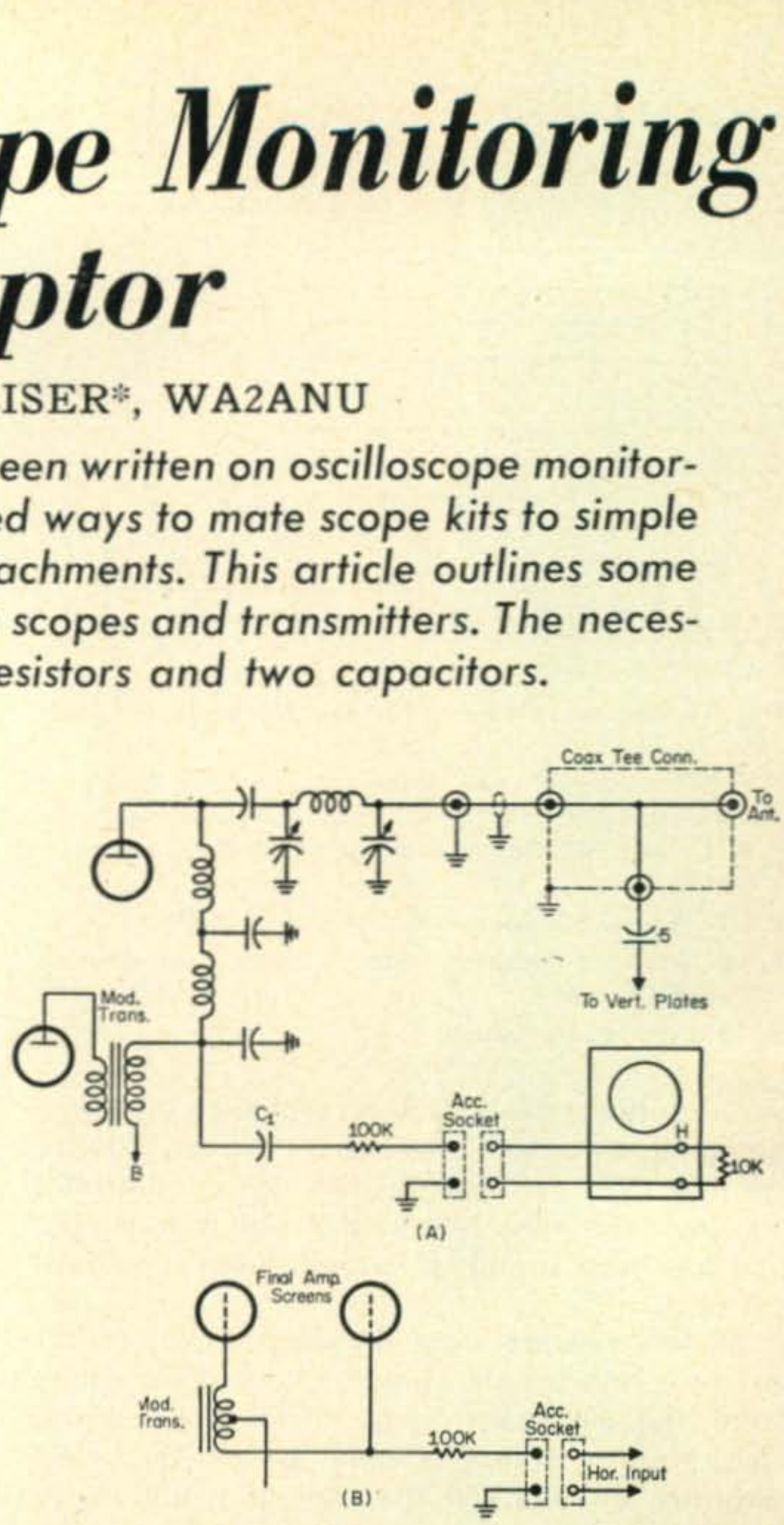


Fig. 1—How to pick up the a.f. and r.f. in an a.m. transmitter is shown above in (A). Pick up of audio in d.s.b. transmitter (DSB-100) is shown in (B).

Theory

Vertical amplifiers of inexpensive oscilloscopes do not usually amplify amateur radio frequencies well, but an oscilloscope cathode ray tube usually gives faithful deflection to thirty megacycles or higher. The r.f. sampled is used to feed the vertical plates directly, without sending the signal through the amplifier.

At frequencies under 30 mc, the vertical plates of a scope-tube look almost like a pure capacitor, but above this frequency the leads running to the deflection plates display inductance that may cause less deflection, in the style of a low-pass fllter. Since the tube looks capacitive below 30 mc, the correct attenuator to use on these bands is a small series capacitor.

As both the horizontal amplifiers and the usual connection to the horizontal plates look resistive at audio frequencies, the modulating audio or a part of it may be fed into either input. If an attenuator must be made, two or more series-connected composition resistors make an acceptable voltage divider.

Scope Changes

Practically all scopes require no wiring changes to feed the deflection plates directly. The inexpensive service types use terminal strips with jumpers for direct connection. These strips are located on the rear of the scope, frequently under access plates. The coax may be connected directly to the strip or the installation may be prettied up by mounting a Mini-box with a coaxial receptacle and a T in place of or near the access door.

Fifty watts on a matched fifty ohm line gives approximately a one inch deflection with a 5 mmf attenuator capacitor. Two capacitors appear in the detail photo, as the author *did* have two 10 mmf units, and no fives. For a bigger picture or for transmitters with less power than the DSB-100, more capacity may be desirable; for higher powers or a smaller picture, use a smaller capacitor. Not much capacitance variation is required, for while 50 watts output is 50 volts in a fifty ohm line, 1600 watts output is only 283 volts. (The 1600 watts is both legal and realistic in amateur practice. For instance, this is the peak power of a 400 watt carrier 100% modulated. The scope shows voltage at *every* point of a modulation cycle.)

*Light Military Electronics Dept., General Electric Co., Utica, New York.

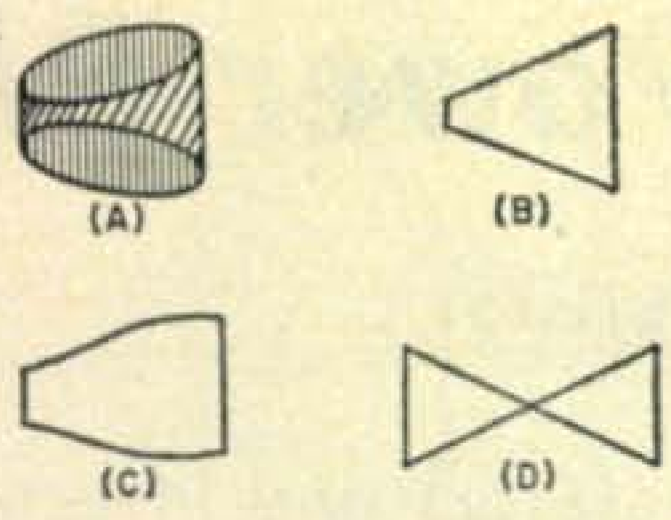


Fig. 2—Some of the patterns found when monitoring various phone transmitters. Pattern A is a trapezoid showing less than 100% modulation plus phase shift in the scope. Pattern B shows the phase shift eliminated as explained in the text. Pattern C is caused by improper drive or final tank tuning. Pattern D shows a correctly adjusted d.s.b. output. Other patterns are described in the available handbooks.

Transmitter Modification

Modification of the transmitter to take out the audio signal to the scope for trapezoid observation is very easy. Since the audio level is very high at the take-off point a ten to one divider consisting of a 100K and 10K resistor is used as shown in fig. 1. The 100K resistor is kept as close as possible to the accessory socket (or other connection point) so that it will act as an r.f. choke and help prevent TVI. The 10K resistor is located at the scope input terminals. Most scopes have a d.c. blocking capacitor in series with the input connection so a separate capacitor may be unnecessary.

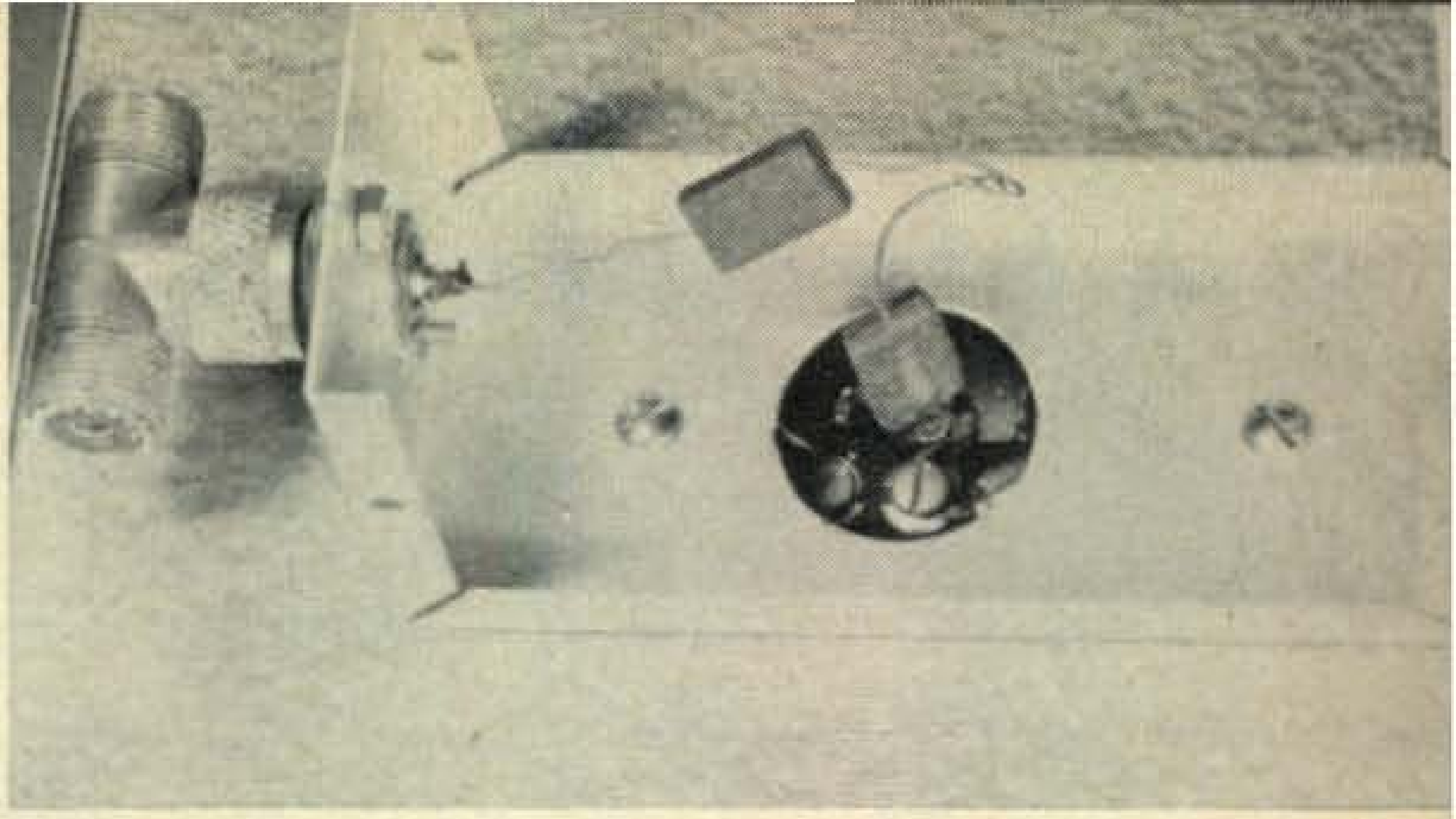
Should the final d.c. plate voltage be more than a few hundred volts, d.c. current in the audio attenuator might be disturbing, if the scope does not have a blocking capacitor. Then, an external capacitor should be used. Its capacitive reactance should be very low (compared to the divider resistance) at the lowest audio modulating frequency of interest. One percent reactance (or less) is a good ball-park figure; for instance, 0.5 mf is about 1% of the 110K total audio divider resistance at 300 c.p.s. The voltage rating of the capacitor should be the sum of the d.c. *and* modulating a.c. peak voltage.

Typical Patterns on Phone

Occasionally a pattern such as shown in fig. 2A will be seen. This is typical of phase shift between the modulator and the oscilloscope horizontal plates. With the installation shown, all that was necessary to obtain the proper pattern (fig. 2B) was to adjust the horizontal gain control of the scope. (Gain control settings may vary phase shift also.) If this procedure is not satisfactory, try placing a few mmf of capacitance across first one, then the other of the audio voltage divider resistors. The chances are that the most effective capacitor position is across the resistor connecting the modulator and the scope.

When the oscilloscope has no horizontal amplifier, the audio voltage divider (which, of course, can have *any* ratio) may be unnecessary. The modulating voltage may couple capacitively directly to the horizontal plates.

It is not important what size cathode ray tube



View of the Mini-box attached to the rear of an Eico 425 scope. The 83-1T connector ties to the scope through two series connected 10 mmf capacitors.

is used; the same information appears on both one and five inch tubes. At v.h.f., however, the longer internal lead length to the deflection plates may cause large sensitivity changes in some of the bigger tubes as explained in the Theory section.

Figure 2 also shows some patterns obtained with misadjustments as well as under proper operating conditions. Quality is excellent with proper adjustment, and poor to bad under the improper conditions.

Scope Monitoring C.W. Signals

On c.w., the set-up on another rig had been guilty of vicious key-clicks. Sweep observation of the keying waveform pinpointed the reason—the sharp-pointed waveform of fig. 3. Scope observation of the power supply showed poor regulation. The cure is another story.

Other Applications

The c.w. man will find his biggest use for the monitoring device in checking keying waveforms, but he, like all other amateurs, will find the scope useful for checking parasitics and for antenna loading. In these days of pi-networks that will "match anything," it is easy to so lower the Q of the final amplifier that the maximum output point does not coincide with the plate current dip. The scope, being an excellent r.f. voltmeter, will advise the careful amateur that he is getting more output "off resonance" and had better start looking for harmonics.

The phone man with screen grid or other efficiency-type modulation (yes, clamp-tube and exalted types qualify usually) must have some

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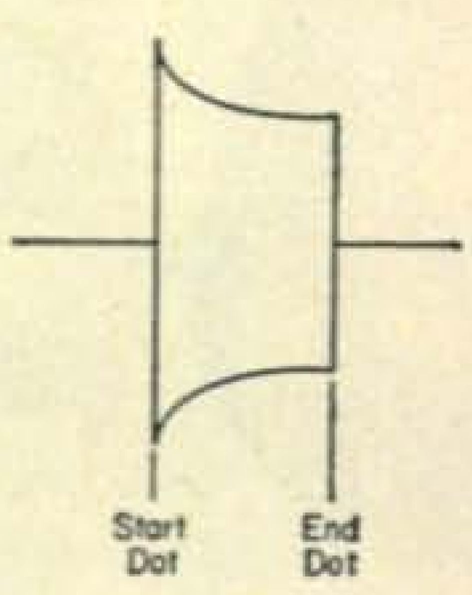


Fig. 3—Keying waveform shown by using the internal sweep of the scope for horizontal deflection. The sharp droop after the start of the dot is caused by poor regulation in the external power supply.

A Flexible Portable Power Plant

BY VIRGIL C. WEST*, W5JBR

Here is a new way to put those old surplus generators and inverters to work. This power plant provides both 28 v.d.c. and 115 v.a.c. and doubles as a back up for emergency operation and a field day power source.

No doubt many hams have thought of owning a portable power unit for an emergency or field day excursion. But generally commercial units are expensive and even on the surplus market are hard to obtain. This article describes a versatile power plant which can be made almost entirely from surplus units. It is particularly adaptable to the "junk boxes" of neighborhood surplus collectors. The unit is essentially a gasoline motor driven generator capable of delivering either 28 volts for operation of unconverted surplus equipment or for feeding to a 28 v.d.c. to 115 v.a.c. inverter for operation of a fixed or portable station. It is of rugged construction, can be used almost anywhere, and installed quickly.

Materials

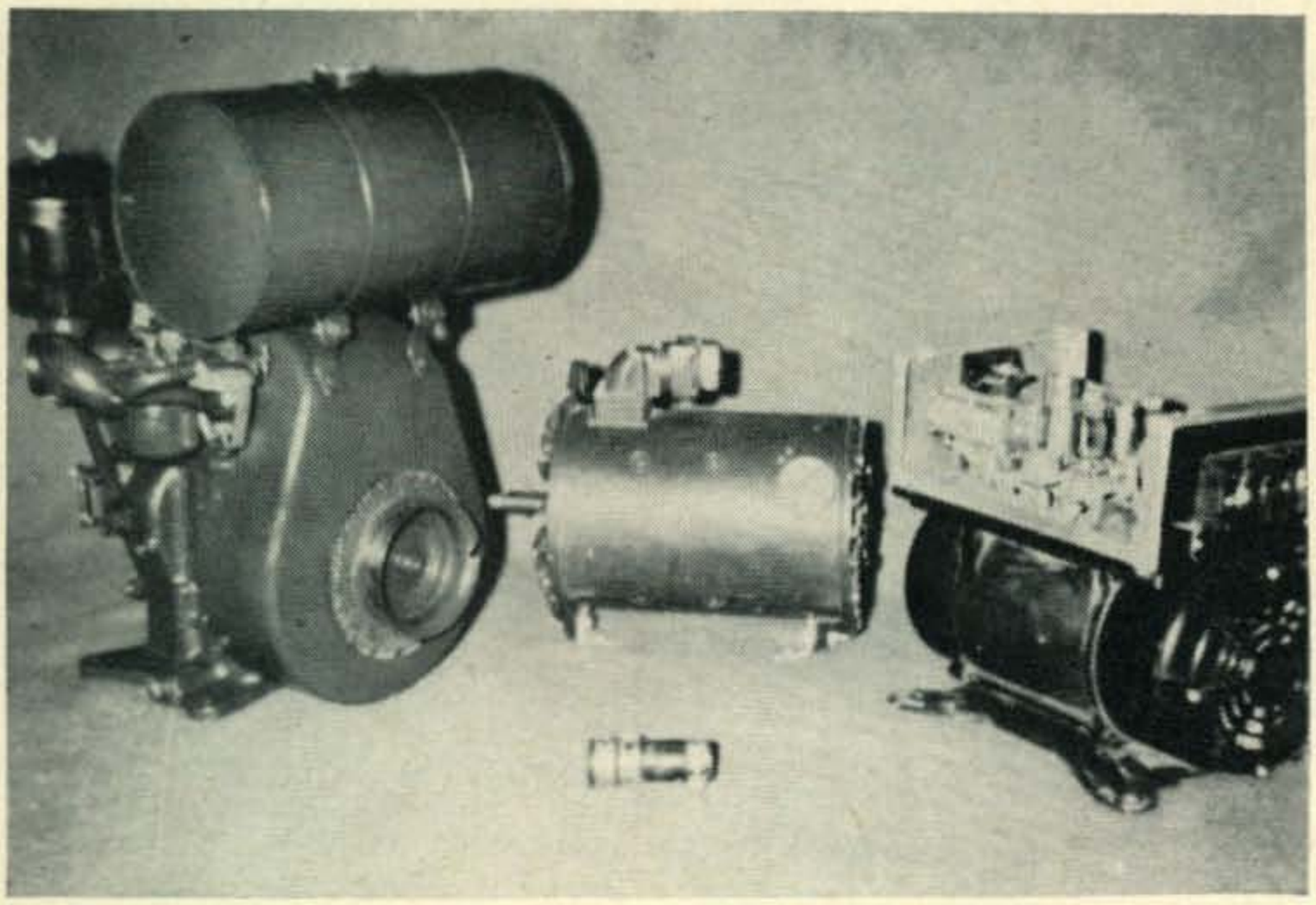
The unit consists of three principal components: a four-cycle, single-cylinder gasoline engine, a 28-volt d.c. generator, and a 28 v.d.c. to 115 volt a.c. inverter. The engine should be rated at two or more horsepower and capable of at least 2000 r.p.m. to operate the generator. An engine from an old reel mower or other forced-air cooled engine types will work quite satisfactorily.

The generator should be rated for an output of 24 volts at 50 amperes or better. The need will naturally depend on the input rating of the inverter used as well as on the current required by any 28 volt equipment. To illustrate, if the inverter is rated to pull a maximum of 45 amperes d.c., and 28 volts at 5 amperes will be needed simultaneously, say for a relay network, a 50 ampere generator should be used. To simplify circuitry, the shunt-wound, self-excited type of generator is employed. If available, a voltage regulator may be used with the generator, but since the engine will maintain a relatively constant speed under varying load, this is not essential.

The other major component, the inverter, should have a rated input voltage equal or nearly equal to the output of the generator, that is, from 24 to 28 volts, have a power rating of 500-750 volt amperes, and deliver an output of 115 v.a.c. at 60 cycles. Together, the generator and inverter can be purchased for about $35.00.

Oddly enough, I found that a 400 cycle inverter worked quite well. The Leland Electric model 3514-1 inverter, which I am using, is one of several makes which have 400 cycle output. I found that I could compensate for the increased impedance of a 60 cycle power transformer by placing the voltage adjust pot on the inverter to a nearly maximum clockwise position. The Leland inverter described above will operate my entire station from receiver to soldering gun. The only difference is that in place of any 60

*4523 40th St., Lubbock, Texas.



Components before the final assembly. The Clinton Model D-1100 gas engine shown on the left more than filled the bill. The generator in the center is a Delco and the inverter is made by Leland Electric. The shaft coupler described in the text is shown in the foreground.

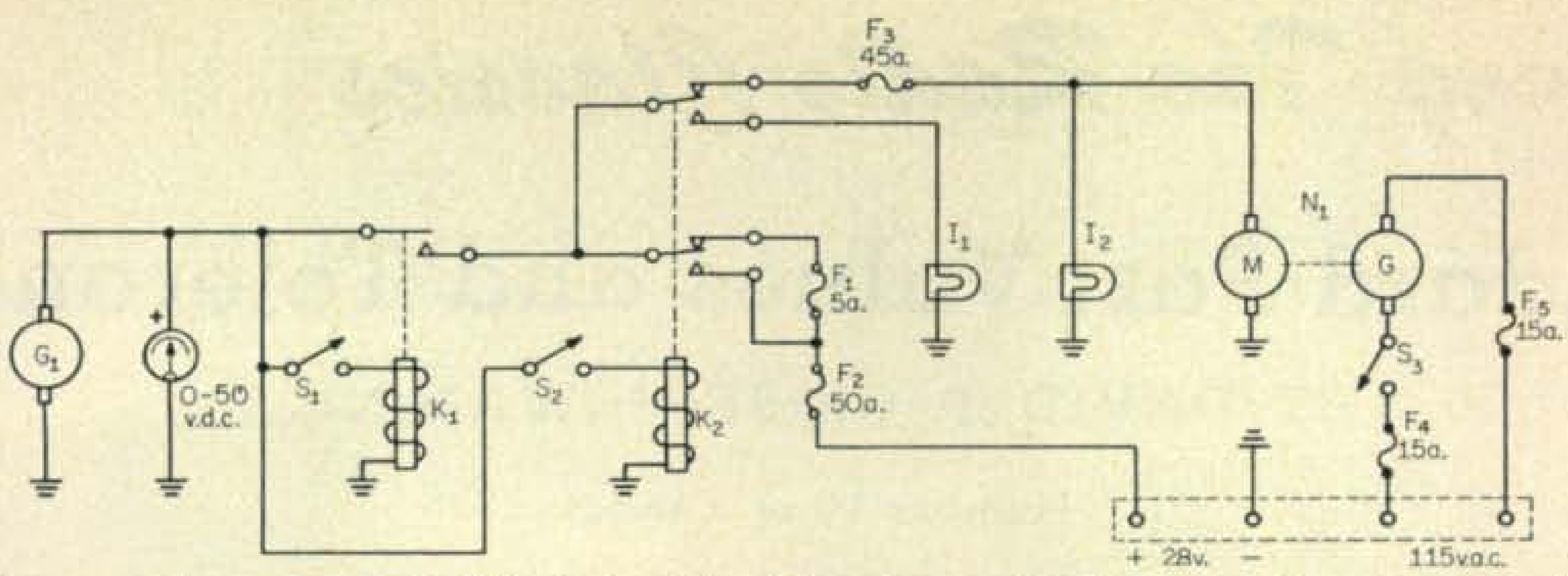


Fig. 1—Circuit diagram of a power plant that provides 28 v.d.c. and 115 v.a.c. Generator G_1 is driven by an air cooled gas engine.

G_1—D.c. generator, 24-28 v.d.c. at 50 amps. Shunt wound, self excited.

I_1, I_2—24 v. lamps, AN-3157-6 (G.E.).

K_1—28 v.d.c. coil, contacts s.p.s.t., 28 v.d.c. at 50-75 amps.

K_2—28 v.d.c. coil, contacts d.p.d.t., 28 v.d.c. at 50-75 amps.

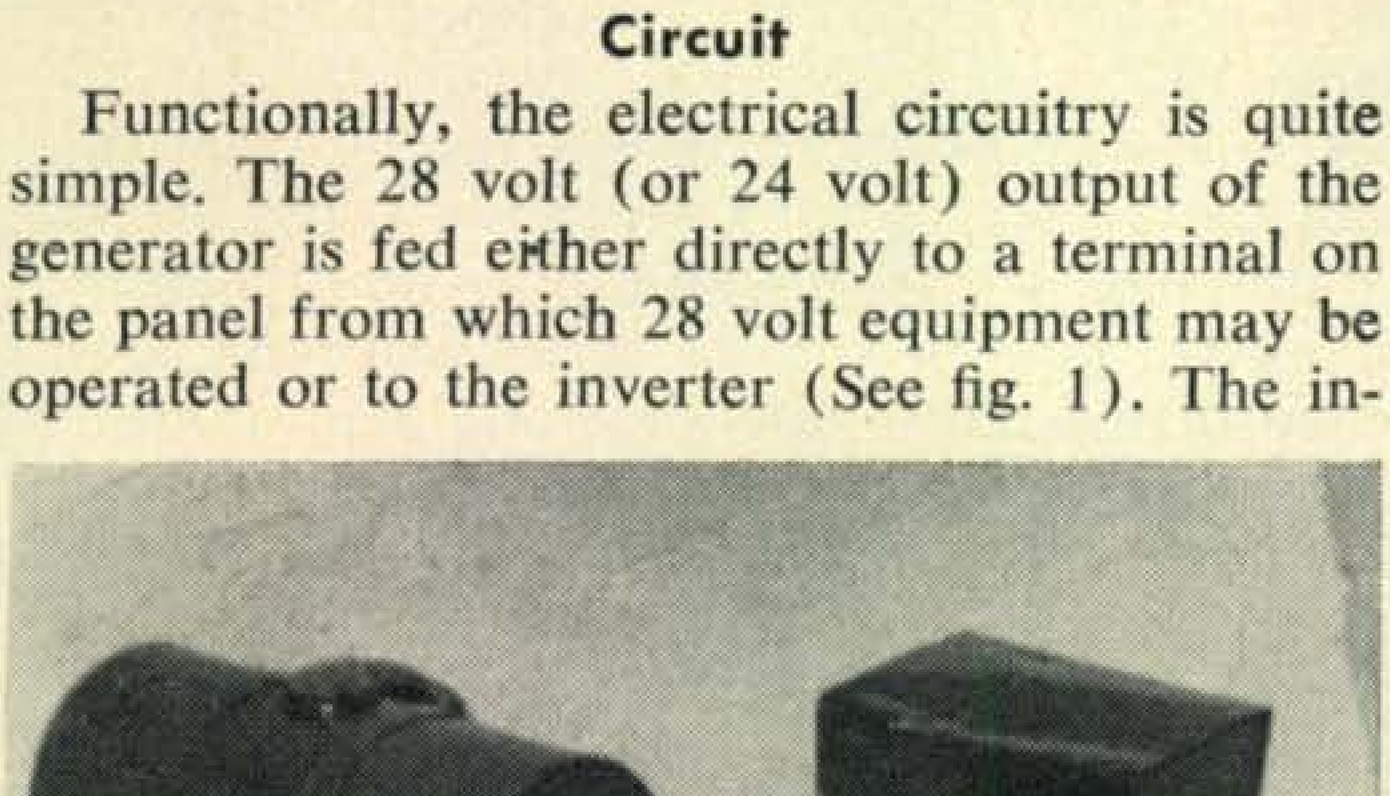
N_1—Inverter, 24-28 v.d.c. input, 115 v.a.c. 60 cycles output. (Alternate—400 cycle output. See text.)

or 120 cycle hum in the equipment, a 400 or 800 cycle pitch is heard. This hum, however, is not objectionable and may not even be apparent. Likewise, I found the 400 cycles to have no effect on transmitter, receiver, or oscilloscope operation. So, if you have an old 400 cycle inverter lying around, don't hesitate to try it. Otherwise, one can be purchased for less than the 60 cycle models.

All the major components—engine, generator, inverter—are mounted on a rugged aluminum chassis made from roughly 7 square feet of ⅛" soft aluminum and can be enclosed in a sturdy aluminum cover. The cover would require about 25 square feet of 1/16" aluminum. A recessed panel is used both as a protection for the controls and as a safety feature to guard against accidental contact with the power terminals during operation.

Circuit

Functionally, the electrical circuitry is quite simple. The 28 volt (or 24 volt) output of the generator is fed either directly to a terminal on the panel from which 28 volt equipment may be operated or to the inverter (See fig. 1). The inverter's function is to convert the low voltage into the higher potential, 115 volts a.c., which is, in turn, fed to the terminal board. A red and a green panel lamp indicate which system, the inverter or the generator only, is on. Three circuits fuse the outputs according to the mode of operation. If 115 volt operation is desired, power switch S_1 on the front panel, when closed, energizes K_1 completing the circuit to the inverter.



View of completed power plant painted, mounted and ready for action.

For simultaneous operation of both the 28 volt and 115 volt systems, the d.c. current available at the terminals will, as pointed out earlier, depend on the specifications of the generator. In the previous example, a net difference of 5 amperes would be available at the terminals. In this case, a 5 ampere fuse would be used for F_1. For 28 volt operation only, S_2 is closed *prior* to S_1; relay K_2, energized by closing S_2, puts the generator current through a straight 50 ampere line to the terminal. (Incidentally, this high current source is ideal for operation of the ART-13 transmitter from the dynamotor, DY-17). In addition to the fusing and switching circuits a 0-50 v.d.c. voltmeter is included in the equipment to permit monitoring of the generator output.

Construction

The chassis is cut from ⅛" aluminum sheet and is provided with openings for the recessed panel, voltmeter, and power leads. The recessed panel, made in the form of an open box, houses the switches, fuse holders, terminal board, and panel lamps. The subchassis is wired with heavy

[*Continued on page 119*]

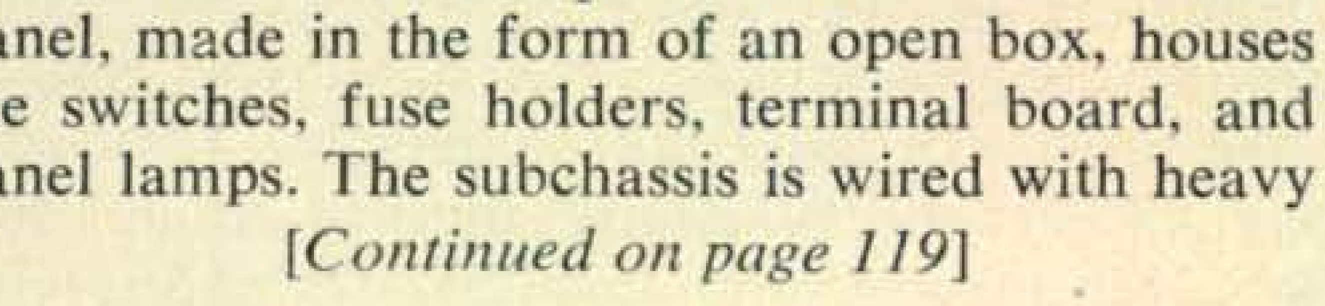


Fig. 2—Details for constructing a "lazy M" mount to hold the generator. Dimension *t* is explained in the text.

Reviewing The Radio Classics

Standard Part Values and Tolerances

BY DAVID T. GEISER*, WA2ANU

Number 10 of a series

THE electronics beginner sometimes wonders why the ordinary resistor or capacitor has such peculiar nominal values as 820 ohms or 0.033 microfarads. The old-timer sometimes sighs for the days when no "odd" values cluttered Ohm's Law, and regrets the change; actually, both groups profit. This short review describes why and tells something of the reasoning behind the "standard" values that came to wide use in the late thirties and early forties.

Tolerance

There are two reasons for the need of tolerance. Very few designs need an exact value of part in a circuit to work properly. Almost all circuits will work well with parts as much as 20% different from the specified value. A small number of circuits need values within 10% of the listed values, and a few circuits need parts within 5% of the specified value.

The part manufacturer who strives to make a component a specified number of ohms or microfarads usually comes pretty close—but the odds are that he won't hit it exactly. Most of his parts will be near the desired value, but some will be further away. If we arbitrarily say that all parts within 5% are good, there will be some 10% and 20% parts that will have to be rejected. Yet most constructors can use 10% or 20% parts. The manufacturer usually sells these parts at a reduced price.

Naturally, an experimenter wants to be able to choose a range of resistance and capacitance values. Whether he wants a 20% or a 5% resistor, he also would like to have other values close to it, a higher and a lower step.

There was a time, many years ago, when all values were in steps like 1, 2, 3, 4, and 5. This permitted easy arithmetic, but there were holes in the resistance range. Let us imagine 10% resistances, and the "standard" steps of 20 and 30 ohms. Ten percent more than 20 is 22 ohms; ten percent less than 30 is 27 ohms. There was nothing in between. A value of 24 or 25 ohms was needed to fill the hole. There were a number of these holes and they didn't match very well with "good-looking" (ending in 5 or 0) numbers.

Plain economics dictated that the best practice for manufacturers, distributors, *and* users was to develop a new set of "standard" steps.

Numbers

A good way to set up a standard group of numbers is to start with either the lowest or the highest value you'll ever want to use and multiply it by a fixed fraction every step. Imagine that the lowest value you want is one ohm, and you decide that the fractional multiplier will be 3/2. The first step will be at 1½ ohms, the second at 2¼. (This step is the true value for a 20% tolerance.) When you have multiplied 1 by 3/2 a number of times, you find that you *jump* 10 ohms. You can either start over at 10, or try to find another way of selecting the numbers if you want to use the same basic numbers between 10 and 100 as between 1 and 10. (Numbers like 1.5, 15, and 150 would all be the same basic number. Only the decimal point would be different). A quick survey with ordinary arithmetic can be made and will show that exact five and ten percent tolerances will also not "repeat" themselves.

As it becomes very inconvenient to have a number system that does not repeat itself with numbers ten times bigger (like our dollars and cents do), we must find a step which, multiplied by itself a whole number of times, comes out exactly 10. This step would be called a *root* of 10. The second (or "square") root of ten is about 3.163; the third (or cube) root of 10 is 2.154. Three "2.154s" multiplied together equals 10.

A tolerance of about 18.9% results from the sixth root of ten (1.467) which we would use as a multiplier. Six of this multiplier multiplied by each other give 10 and the series will both have better than a 20% tolerance and repeat itself. The individual values obtained between 1 and 10 would be approximated (rounded off) after the multiplication to keep the nominal value from looking too complicated. (Table I)

Steps of 10% use the 12th root of ten (1.211)

[*Continued on page 142*]

Table I—Standard Values

20%	10%	5%	20%	10%	5%
10	10	10			36
		11		39	39
	12	12			43
		13	47	47	47
15	15	15			51
		16		56	56
	18	18			62
		20	68	68	68
22	22	22			75
		24		82	82
	27	27			91
		30	100	100	100
33	33	33			

*Snowden Hill Road, New Hartford, N. Y. 13413.

CQ Awards Honor Roll

Worked All Zones. **The following is a list of the call-letters of top DXers throughout the world who have qualified for the Worked All Zones Award as of August 5, 1963. Calls are listed in alphabetical order by call area and country.**

RADIOTELEGRAPH

W1AB
W1ACB
W1AJG
W1AZY
W1BFT
W1BGA
W1BGW
W1BIH
W1BIL
W1BLO
W1CKA
W1CKU
W1CTW
W1CV
W1DGT
W1DHO
W1DMG
W1DQH
W1EIO
W1EOB
W1EQ
W1FFO
W1FH
W1FQA
W1FZ
W1GKK
W1GVZ
W1GYE
W1HGT
W1HX
W1HZ
W1ICP
W1IJB
K1JDN
W1JYH
W1KQF
W1KXU
W1LHZ
W1LQ
W1LZE
K1MLI
W1MV
W1NHJ
W1NLM
W1ODW
W1OJR
W1OOA
W1OOS
W1ORV
W1OTX
W1PFA
W1QJR
W1QNC
W1RAN
W1TSL
W1TYQ
W1WDD
W1WLW
W1WY
W1ZD
W1ZW
W1ZZK

W2AEB
W2AGW
W2AQW
W2AYJ
W2AYU
W2AZS
W2BAC
W2BBS
W2BHM
W2BHU
W2BOK
W2BRR
W2BRV
K2BU
W2BVN
W2BXA
W2BYP
K2CD
W2CNT
K2CPR
W2CWK
W2CZO
K2DCA
W2DEC
W2DEO
W2DGW
W2DOD
W2DS
W2DSU
K2DSW
W2EHN
W2EQS
W2ESO
W2FBS
K2FC
W2FCQ
W2FSN
W2FXA
W2FXN
W2FZY
W2GDX
K2GFQ
K2GMO
W2GNQ
W2GT
W2GVZ
W2HMJ
W2HO
W2HSZ
W2HTI
W2HQL
K2HXL
W2HZY
W2ICO
W2IOP
W2IRV
W2IWC
W2JAE
K2JGG
W2JT
W2JVU
W2KCE
W2KED
W2KJZ
W2KUW
W2LAX
W2LNB
W2LPE
W2LSX
W2LV
K2LWR
W2MES
W2MUM
W2NOY
W2NUT
W2OBX
W2OCL
K2OEA
W2OGE
W2OKM
K2OLS
W2OTC
W2PCJ
W2PDB
W2PEO
K2PFC
K2PIC
K2PKT
W2PTD
W2PTI
W2PZI
W2QHH
K2QHL
W2QJM
K2QXG
W2RA
W2RDD
W2REF
W2SAW
WA2SFP
W2SHC
W2SHZ
W2SSC
W2SUC
W2TP
W2TQC
W2TQR
W2TVR
W2TWC
W2TXB
W2UFT
K2UKQ
K2UPD
W2UTH
W2UVE
W2UZF
W2VCZ
W2VND
K2VUI
W2VYX
W2WS
W2YTH
W2YXY
W2ZGB
W2ZVS
W2ZXL
W2ZY

W3AEL
W3ALB
W3AOH
W3ARK
W3AS
W3AXT
W3AYD
W3AYS
W3BCY
W3BES
W3BHV
W3BQA
W3CA
W3CGS
W3CPV
W3DBX
W3DRD
W3DWY
W3DXN
W3ECR
W3EFZ
W3EOB
W3EPR
W3EPV
W3EVW
W3FYS
W3GAU
W3GEN
W3GHD
W3GJY
W3GRS
W3HHK
W3IMV
W3IPO
W3IXN
W3IYE
W3JKO
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W3JTC
W3JTK
W3JW
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W3KVQ
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W3LE
W3LMA
W3LMM
W3LMO
W3LOE
W3LUD
W3MFJ
W3MFW
W3MJF
W3MSR
W3MVQ
W3MWC
W3NCF
W3NKM
W3OCU
W3OP
W3PGB
W3PN
W3RBF
W3RBW
W3RPG
W3RSR
W3RUT
W3RZL
W3SOH
W3SWV
W3TMZ
W3UXX
W3VKD
W3WGH
W3WU
W3WV
W3ZAO

W4AAU
W4AH
W4AIS
W4AIT
W4AIX
K4AW
W4AZK
W4BFR
W4BJ
W4BPD
W4BQY
K4BVQ
W4BYU
W4BZ
W4CKB
K4CLT
W4COC
K4CTU
W4CXA
W4CYR
W4CYU
W4CYY
W4DHZ
W4DKP
W4DQH
W4DQS
W4EEE
W4EO
W4EPA
W4FFV
W4FZO
W4GD
W4GRP
K4GSS
K4GSU
W4GXB
W4HA
K4HFS
K4ICK
W4IFN
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W4IMI
W4IUO
W4JAT
K4JEY
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W4KWC
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W5PSB
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W5RS
W5TIZ
W5TPC
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W5UX
K5UYF
W5VIR
W5WZQ

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WA6AMZ
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W6DIX
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W6DQH
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W6ZZ

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K7ADL
W7ADS
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W7AHX
W7AJS
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W7AQB
W7ASG
W7AUS
W7BD
W7BE
W7BGH
W7BPS
W7BTH
W7CAB
K7CHT
W7CKY/
KL7
W7CMO
W7CNM
W7CSW
W7CWE
W7DAA
W7DET
W7DIS
W7DJY
W7DL
W7DXZ
W7DZ
W7EJD
W7ENW
W7ETK
W7FB
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K7GIE
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W7GUV
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W7IYA
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W7MGT
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W7PB
W7PHO
W7PQE
W7QGF
W7QNI
W7QON
W7QY
W7RT
W7SGN
W7STC
W7UVR
W7VY
W7WVE
W7YGN
W7ZAS
W7ZOH
W8AE
W8AJW
W8BHW
W8BOJ
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W8CLR
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K8CVQ
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W8DAW
W8DEN
W8DFQ
W8DHC
W8DLZ
W8DMD
W8DSZ
W8DX
K8DYX
W8ELL
W8EWS
W8EYE
W8FRW
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W8GLK
W8HGW
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W8HUD
W8IBX
K8IKB
W8ILG
K8IQQ
W8IQS
W8IRN
W8JBI
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W8KZT
K8LSG
W8LY
W8MCC
W8MPW
W8MTQ
W8NBK
W8NJC
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WØAZT
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WØBFB
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WØBSK
WØBTD
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KØDMY
KØDQI
WØDU
WØDVZ
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WØFFV
WØFLK
WØFNN
WØFUH
WØGUV
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KØKKU
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WØLVA
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WØNCS
WØNLY
WØNTA
WØNUC
WØOQK
WØOUH
KØPEF
WØPGI
WØPNQ
WØQDF
WØQGI
WØQVZ
WØQYE
KØRAL
WØRBA
WØSMV
WØSNL
WØSQO
WØSYK
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WØUOX
WØUQV
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WØVBQ
WØVKB
KØWQI
WØYTL
WØYTQ
WØYXO
WØZYB

CE3AG
CE3AX
CE3DZ
CE3HL

CN8BP
CN8DJ
CN8GU
CN8IF
CN8JX

CO2SW

CR6BX

CR7IZ
CR7LU

CR9AH

CX1BZ

CX1FY
CX2CO

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DJ1JW
DJ1KR
DJ1VP
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DJ2HI
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DU7SV

EA4CR

EI3R
EI4Q
EI9U

EI9Y

F2BS
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F3CB
F3DM
F3FA
F3YP

F3YR
F3ZU
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F8TM
F8VQ
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F9MS
F9RS
F9TX

FA8RJ

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G5VU
G5YV
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GI3NPP
GI3OQR
GI4RY
GI6TK
GM3ASM
GM3CIX
GM3DHD
GM3EST
GM3LYS
GM5RH
GM6MD
GW3BNQ

HA5AM
HA5BI
HA5BU
HA5KAG
HA5KBP
HA5KFR

HB9DB
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HB9X

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IT1ZGY

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JAØAC

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KG6AL
KG6GD

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KH6MG
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KH6PY
KH6QH
KH6VP

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KL7PI
KL7PIV
KL7PJ
KL7UM
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KP4YT

KP6AA

KR6LJ

KV4AA

KW6DF
KW6DG

LA1K
LA2B
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LA4DD
LA5HE
LA6U
LA7Y
LA7Z
LA8LF

LU5AQ
LU6DJX
LU7AS
LU8BAJ
LU8EN

OD5LX

OE1BH
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OE1FF
OE1RZ
OE3NH
OE3RE
OE3WB
OE5JK
OE8SH

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OH1PI
OH1TM
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OH3RS
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OH3TH
OH3TY
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OH5NK
OH5OP
OH5OU
OH5PE
OH5RH
OH5TK
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OH6OA
OH6RC
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OH8QA
OH9NC
OH9PF
OH9RD

OK1AEH
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OK1CG
OK1CX
OK1FF
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OK1GL
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OK1MG
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OK1PD
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ON4MN
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ON4SB
ON4TA
ON4TX

OY7ML

OZ3GW
OZ4H
OZ4RT
OZ5JT
OZ7BG
OZ7KV
OZ7SN
OZ8SS
OZ9N

PAØFAB
PAØFX
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PAØLY
PAØOI
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PAØVO
PAØWOR

PK4DA
PK6HA

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PY1BG
PY1DH
PY1GJ
PY1HQ
PY1HX
PY2CK
PY3QX
PY4AO

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SM7TQ
SM7YO

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SP3DG
SP4JF
SP5AA
SP6AAT
SP6FZ
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SP7HX
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SP9KJ
SP9TA

ST2AR

SVØWP
SVØWZ

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UAØOM
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UB5CI
UB5FJ
UB5KAB
UB5MZ
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UC2AD
UC2AR
UC2CB
UD6AM
UF6FB
UQ2AN
UR2AR
UR2BU

VE1EP
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VE7ZM
VE8AW
VE8PB

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VK2DI
VK2HZ
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VK2PV
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VK3RJ
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VK3XB

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VK7CH
VK7LZ

VO1DX

VQ2GW

VR2BZ

VS1FZ
VS1JF

VS4RS

VS6AE

VU2MD

XE1CV
XE1PJ

XZ2TH

YO2BU

YU1AG
YU3OV

YV5FK

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ZC4IP

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ZE6JY
ZE8JJ

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ZS2CR
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ZS4MG
ZS6A
ZS6AJQ
ZS6ATA
ZS6CT
ZS6DW
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ZS6IF
ZS6IW

3V8AB
4X4CJ
4X4FQ
4X4KK
4X4RE

5A5TE
5A5TH
5A5TO

9S4AX

RADIOTELEPHONE

W1BAN W1BHP W1BIH K1IXG W1ORV W1UOP
W2APF W2BOK W2BXA K2DCA W2DEC W2FXN W2HTI WA2IZS W2JT W2OKM WA2SFP W2UTH W2UZF W2VCZ W2ZX W3AYD
W3GHD W3LE W3LMA W3NKM W3WGH
W4AZD W4DQH W4EEE W4JGO W4PDL W4TDW
W5AFX K5JEA W5KBU W5KGX W5PQA W5PSB
W6AM W6BAF W6EKZ W6GT
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W7PHO W7ZAS
W8BF K8CFU W8EWS W8KIA W8KML W8MPW W8PQQ W8ZET
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WØQVZ WØTJ
CN8MM
CX2AX CX2CO
DJ2AA DJ2YI DL1FK DL1IN DL3DW DL3EA DL3LL DL3RK DL6EN DL7AA DL7AB DL7AD DL7BA
F3DJ F8DC
FA8RJ
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HK3LX
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JA1ACB JA1BK JA6CY
KG6AJB
KH6DLF KH6OR
LA5HE LA5LG
LU1DAB LU6AJ
MP4BBW MP4BCC
OE1FF OE2YL
OK1MB OK2AG
ON4DM ON4RC
OZ7FG
PAØFX PAØHBO PAØWWP
PY2CK PY2JU PY4CB
PZ1AX
SM3AZI SM3BIZ SM3EP
SM5CO SM5LL SM5RY SM5TR
SP7HX
UC2AA UQ2AN UR2BU
VE1WL VE5RU VE6BY VE6TF VE6TP VE6VK VE7CE VE7GI VE7IT VE7MD VE7ZM
VK4FJ VK4RQ VK6RU
VQ4ERR
XE1CV
XZ2SY
ZL1ACI ZL1AIX ZL1HY ZL1KG ZL2GX ZL4BO
ZS6Q
4X4DX
9K2AZ

ALL SINGLE SIDEBAND

W1BAN W1BHP W1BIH W1DCE W1ICV K1IXG W1LLF W1OOS W1ORV W1UOP W1YDO W2BXA K2DCA W2DGW W2FXN WA2IZS W2JXH W2LV WA2SFP W2UTH W2UZF W2VCZ W2ZX W3GHD W3JTC W3KT W3LMA W3MAC W3NKM W3WGH K4AJ W4INL W4LZT W4OPM K4PUS W4QCW K4TJL W4VCB/KL7 W4WDI W5AFX K5JEA W5KGX W5MMD W5PQA W5PSB W6BAF W6EKZ WA6EYP W6GT WA6HOH W6HYG K6LGF K6MLS W6RKP K6RWO W6VUW K6VVA W6WWQ W6YMV W6ZJY W6ZXW W7AQB W7BPS W7CMO W7DLR K7GCM W7PHO W7UPF W7ZAS W8BF K8CFU W8EAP W8EWS K8GLH W8MPW K8NZD W8PQQ K8RTW W8TMA K9EAB W9EXY W9JJF WØBMQ WØCTL WØCVU WØKFA WØMLY WØNFA WØQVZ KØRAL KØRDP WØTJ WØUUV DJ3CP DL1AU DL1FK DL1IN DL1JV DL1UX DL3DW DL3IR DL6EN EI4Q EP2AG F8DC G2BVN G3AIZ G3AWZ G3DO G3FKM G3KZI G3NUG G6LX G8KS GI3IVJ GI6TK GM3CIX GM3JDR HB9TL HB9ZY I1UA JA1DM JA2JW KG6AJB KH6DLF KR6HL LA5HE LA5LG MP4BBW OD5CT OE1ME OE1RZ OH2HN OH2NB ON4DM ON4QX OY7ML OZ7FG PZ1AX SM3BIZ SM5CO SM5DW SM5LL SM5MC SM6SA TI2HP UA3CG UA3CR UA3DR UA3FG UB5KAB UR2AR VE6BY VE6TF VE6VK VE7CE VE7GI VE7IT VE7MD VE7ZM VK3AHO VK4FJ VQ2AT VQ4ERR XE1CV XW8AS YO3GK ZL2GX ZL3AB ZL3IA ZS5DW ZS5JM 4X4DK

WPX The following list indicates the amateurs who have qualified for the Worked Prefix award as of September 5, 1963 and their relative standing. A prefix is defined as the first one-or two-letters of the call sign and its accompanying numeral; *i.e.*, W1, K1, WA1, WV1, KN1; G2, G3; etc. Amateurs are encouraged to work as many different prefixes as possible and apply for the award directly to the WPX Certificate Committee, 300 West 43rd Street, New York 36, N.Y. Application forms may be obtained from the above address or from the DX Editor, W2DEC. See the DX section in this issue for more information.

CW WPX

W2HMJ	685	W9SFR	501	W3AYD	443	W4YWX	404	ZE3JO	371
W8KPL	632	W2EMW	500	W6UNP	442	GI3OQR	404	SP7HX	370
W5KC	629	W2FXA	500	OE1FF	442	KP4AOO	404	UA3AN	368
W2AIW	617	K2ZKU	500	W3BQA	437	VK5RX	404	W1DGT	366
W2EQS	605	K9EAB	497	LA5HE	437	ZS4MG	404	DL6MK	366
W6KG	596	W2MUM	495	ON4FU	433	K2ZRO	403	VU2MD	366
W2NUT	571	W3GJY	495	VE3ES	433	W9DYG	403	W3GRS	365
W4OPM	571	W1WLW	494	W8UMR	429	W9IHN	403	W4AZK	365
W9UXO	566	LA3DB	491	WØAUB	429	VE6VK	403	W6DLY	364
K6CQM	565	OK3DG	488	SP6FZ	429	W2FLD	402	MP4BBE	364
W5OLG	564	SM5CCE	488	W2RA	428	G8PL	402	VE5JV	362
DL1QT	552	W4BYU	487	K5LIA	428	WA2CBB	401	W9QGR	361
W1IJB	546	W8PQQ	481	OK1MB	428	K9BVR	401	W9ZB	360
K2UKQ	546	W4HYW	478	W3CGS	426	WØVBQ	401	WØMLY	360
W9YSX	544	W5BUK	473	W1EIO	425	IT1TAI	401	K2UYG	359
W9GFF	538	WØMCX	472	KL7MF	424	VE3JZ	401	WØCDP	359
SM7MS	534	W3OCU	466	SM5WI	424	K4HPR	400	SM5AJU	359
ON4QX	533	K6SXA	464	WØPGI	420	OE3WB	400	W2GNQ	358
W1EQ	528	W2KIR	463	W7ABO	419	SP4JF	400	UA9DT	358
W2HO	526	PY4OD	462	HB9TT	419	VE1AE	400	DJ4HR	357
G2GM	526	JA2JW	461	G3HIW	418	VE4OX	400	G8KS	357
K9AGB	515	W9WIO	460	KH6BLX	418	VK3KB	400	UC2AA	357
IT1AGA	515	W9WCE	458	W8IBX	416	ZL2GS	385	VE3DIF	357
KP4CC	515	W3BCY	457	K2PFC	415	W4HVQ	384	W3TXQ	356
W6WO	511	W7HDL	457	VK3XB	415	SM3AGD	384	UA4PA	356
DJ2KS	511	OK3EA	456	W5AWT	412	IS1FIC	383	W2GVZ	355
W2GT	510	UC2AR	456	W5DA	412	SP2AP	383	W9IRH	355
W8LY	506	DL3RK	454	WA2DIG	411	F9MS	382	DL6OS	355
W9DWQ	506	K4TEA	451	W2PTD	411	W4CKD	380	OH2VZ	355
G3EYN	503	PAØLOU	451	K5LZO	411	W4BFR	379	W6ISQ	354
YU1AG	503	W3PGB	450	W4DKP	410	W8KSR	378	G2FFO	354
W5LGG	502	DL1YA	450	W1CKU	408	W4BJ	377	HA5AM	354
W6YY	502	DL9KP	450	K4IEX	408	WØQYE	377	K4GSS	353
DL7CS	502	W8JIN	449	K4JVE	407	CE3AG	375	W3AYS	352
K2CPR	501	W9UZS	447	W5AFX	407	G8KU	374	G3LPS	352
		W8RQ	445	SM5AJR	406	HA5BI	373	W6ID	351

F3DM	351	W1BGA	325	PAØVB	315				
K1SHN	350	W2OWX	325	PAØVO	315				
K2PKT	350	VK3CX	325	DL3ZA	315				
W4BHG	350	W6RLN	324	W1NHJ	314				
W4RVW	350	DJ3HW	324	K9GVE	314				
W6UDR	350	W2HUG	323	DJ5IM	314				
K6VVA	350	HA5BU	323	SM8TV	314				
W9MQZ	350	PAØVER	323	W1IUU	313				
PAØZL	350	F9IL	322	W1RCQ	313				
PY4AYO	350	W9KA	320	W3NCF	313				
W3GAU	349	SL5AB	320	W6YC	313				
I1IZ	348	UA1AI	320	UA6UI	313				
W9OVF	346	UA3FT	320	VK7SM	313				
VK2APK	346	UA9DR	320	G3FPK	312				
W9IU	344	W4HUE	319	G3GSZ	312				
PAØWOR	340	G8DI	319	SM5WI	312				
OH9NC	339	EA4CR	318	W3RZL	311				
SM7ID	339	F2MA	318	W5BRR	311				
DL1IA	337	LA6CF	318	W5EJT	311				
W6BZ	336	OK3UI	318	W5EJV	311				
UR2BU	335	SM7EH	318	EA5BD	311				
W3AHX	334	ZB2I	318	SM5AHK	311				
WØRJV	334	DJ4OP	317	UA9VB	311				
W3HA	333	EA2CR	317	UC2CS	311				
W2BOK	332	HA5KDQ	317	W3GHD	310				
LU5ABL	332	LA3UF	317	W4HOS	310				
OH9PF	332	VK5NQ	317	W4OMW	310				
OK3EE	331	K4SXR	316	W7DIS	310				
WØVFE	330	WØQGI	316	W7STC	310				
IT1AGA	330	DJ1VS	316	K8LSG	310				
K2QXG	327	DJ5VQ	316	K8ONV	310				
WØSNL	327	OK1ZL	316	W9BPW	310				
SM7CNA	327	UT5CC	316	K9GTK	310				
VK5NO	327	VK6WT	316	W9UX	310				
LU8EN	326	W2BYP	315	WØEWH	310				
UA9CL	326	W2HQL	315	OH3TH	310				

PAØLY 310	PZ1AH 304	ZL4CK 301	G3JUL 300	CX2CN 354		EP2AG 229	K9AGB 510
SM7TQ 310	UB5FY 304	W1BGW 300	G3KMQ 300	PY2CK 354	**SSB WPX**	G3WW 227	W5LGG 509
SVØWZ 310	YO2BU 304	W1BPW 300	GI3JEX 300	5A5TO 353	MP4BBW 462	W6DLY 223	K2ZKU 508
UA3BN 310	ZL2PM 304	W1CV 300	KH6DKA 300	W1ORV 351	HB9TL 452	W8JXY 222	W9DWQ 508
VE2IL 310	W1FPS 303	W1HWH 300	OK1MP 300	LA5HE 351	W4OPM 451	W1WDD 221	W4BQY 505
VK3RJ 310	W2ECU 303	W1IJO 300	PY4AO 300	ZS6IW 350	G3AWZ 428	HB9TL 221	W3KPD 501
G2BUL 309	WA2HXC 303	K1KPS 300	PY5ASN 300	W8PQQ 347	G3DO 424	W8WT 219	W8UMR 500
UA2KAA 309	K2OUS 303	K1NOL 300	SM2BCS 300	W5PQA 344	W3MAC 403	W3CGS 217	LA5HE 500
ZS1ACD 309	K2UPD 303	W1QQV 300	SM5BPJ 300	LU9DM 343	W3NKM 402	W1DGJ 216	DL3RK 493
DJ3BB 308	K2YMO 303	W1YPH 300	SM7BHF 300	UR2BU 333	K9EAB 401	OY7ML 216	JA2JW 480
F9BB 308	K2ZCD 303	W2CUE 300	ST2AR 300	WØMLY 332	G8KS 400	W1AOL 215	W3CGS 475
HB9EO 308	W6BYB 303	W2DEC 300	VE3CIO 300	DL9OH 330	G3NUG 394	W6YY 213	W9FVU 474
SM5AHJ 308	K6HOR 303	W2DEO 300	VE7SB 300	KP4WD 328	W2HXG 359	VE6VK 213	G3FKM 463
SM5BCE 308	W7CNL 303	K2HIY 300	VK3AXK 300	F8HA 327	TI2HP 356	K2CJN 212	DL1YA 456
VQ2W 308	K81KB 303	W2LJX 300	VK4TY 300	ZE1JE 326	I1AMU 346	W9YHE 211	WØVBQ 452
W9YNB 307	K8MFO 303	W2PDB 300	VO2NA 300	HB9MX 325	PZ1AX 345	W9SFR 210	PAØLOU 452
DU7SV 307	W8WT 303	W2QHH 300	YO3FD 300	VE1ADE 325	K1IXG 344	DL4AS 208	GI6TK 450
SM5BBK 307	W9VIN 303	K2QHL 300	ZS1RM 300	TG9AZ 319	W6YMV 340	GI3CDF 208	HK3LX 450
SP6AAT 307	WØLBB 303	W3DKT 300		W3CGS 317	VE3BQP 334	SM3BIZ 208	W2GNQ 442
SP9RF 307	DJ3WP 303	K3ERC 300	**Phone WPX**	F9MD 315	W4RLS 322	K2JXY 206	VE5JV 439
UA3HK 307	DL1ES 303	W3HNI 300	W9WHM 605	G2AFQ 312	W2VCZ 320	W5DA 204	GI3OQR 434
W2SAW 306	DL1TA 303	W3LMA 300	CT1PK 600	G3BID 312	W1UOP 318	W3BVL 203	OK3EA 433
W8NAN 306	DL3TW 303	K3RRA 300	W8WT 589	GI3CDF 312	W2YBO 318	K4HYL 203	W1EIO 432
W8RSW 306	OY7ML 303	W3SOH 300	G3DO 583	I1CBZ 312	W8PQQ 315	W5RHW 203	KP4AOO 432
DJ2EO 306	SM4BZH 303	W4GXB 300	W9YSQ 471	XE1CV 311	W1ORV 307	W9WIO 203	G3NUG 430
F9RS 306	SP2HL 303	K4KOY 300	CT1HF 466	YU1AG 311	K4PUS 305	LA5LG 203	G3HDA 427
G5GH 306	VE3HB 303	K4TKM 300	W9UZC 462	W9SFR 310	DJ3CP 304	UA2AO 203	GI3CDF 427
PY5FO 306	W1HGT 302	W4YMG 300	MP4BBW 454	GM3BCL 308	WA2SFP 300	K1GHT 202	SM5BPJ 425
UA3HI 306	WA2KSD 302	W5ARJ 300	PAØHBO 453	I1PDN 307	K2TDI 300	W5DVV 202	W9YT 422
UA9DN 306	W3DBX 302	K5ESW 300	W6YY 448	VE3PV 307	W3VSU 300	ZE1JE 202	ZS6IW 419
VK4SS 306	W5LEF 302	W5VA 300	G8KS 430	K3COW 306	W4NJF 300	W9EXY 201	W5PQA 417
W2TP 305	K8KTZ 302	W6BIL 300	G3NUG 429	ZP5CF 306	KØRDP 300	DL4NQ 201	DL9OH 414
K4HXF 305	W8YAH 302	W6DIX 300	VK6RU 421	W9EXY 305	WØCVU 291	UW9CC 201	G6VQ 413
W4LRN 305	K9CLO 302	K6EIV 300	W3AYD 420	IT1SMO 305	GI6TK 278	K2KGS 200	W3BVL 411
W4SHX 305	W9MZP 302	W6FLT 300	F8PI 418	ZE2JE 305	WA2EOQ 275	K2ZKU 200	K4RID 410
W5AZB 305	WØDMA 302	W6JNX 300	PZ1AX 413	W3HUG 304	VE3ES 274	W5DNL 200	W1ORV 409
W5WZQ 305	G3NRZ 302	W6MDK 300	K9EAB 412	W4RLS 304	K2JFV 266	KP4AQQ 200	VE7CE 409
W8ONA 305	OH2FS 302	W6NUQ 300	K2CJN 409	DL3RK 304	K2MGE 263	UA3FG 200	K8ONV 407
WØGUV 305	OK1KKJ 302	WA6SBO 300	DL3TJ 404	SM3BIZ 304	W3AYD 262	VE3PV 200	W9IRH 405
KP4BEA 305	PY4AP 302	K6TQR 300	W1UOP 402	W5JCY 303	W4EEU 262	VQ2AT 200	W9KA 405
UA6LF 305	SM3BEI 302	W6WWQ 300	W6USG 400	OE1PC 303	VE3BKL 259		G2FFO 405
VE3BWY 305	SM5CXF 302	W7LZF 300	VE3BQP 386	VE2AFC 303	DL1PM 257	**Mixed WPX**	W8TTN 404
YO8CF 305	SP9ADU 302	W7TPE 300	OE1FF 382	VE6TF 303	XE1CV 256	W4OPM 629	WØLBB 404
ZL1AV 305	SP9TA 302	W7VIU 300	SP7HX 381	VK6KW 303	G3FKM 255	G3DO 624	K3COW 403
W1BFT 304	VE3IR 302	W8BQV 300	TG3AD 381	EI3R 302	UR2AR 255	W9YSX 622	W4BFR 403
W1FZ 304	W1WHQ 301	W8GMK 300	DL6VM 376	PY1NC 302	K5OGP 254	W8WT 621	K2ZRO 402
W3GOQ 304	W2DGW 301	K8ITH 300	DJ3CP 375	K8CFU 301	K1SHN 253	W8JIN 605	K4BAI 402
K4BVD 304	W2ZXL 301	W8JAQ 300	W3DJZ 374	W9PQA 301	W6USG 252	W3OCU 588	W4NNH 401
K4DRO 304	W4IMI 301	K9KDI 300	PAØSNG 369	W1FAB 300	TG9AD 252	K9EAB 578	W6WX 401
K5JZY 304	K4OMR 301	K9LIO 300	G3FKM 366	W1ZSU 300	K2POA 250	W6YY 570	W9EXY 401
W6NWI 304	W4PLL 301	K9OKD 300	W8UMR 363	K5MDX 300	CN8AW 250	W4BYU 557	W1UOP 400
W6RLP 304	K8CVQ 301	WØDVZ 300	SM3AZI 362	DJ2UU 300	DL2AB 247	W3AYD 552	W4BHG 400
K6RTK 304	W8TTN 301	WØFLK 300	DL2UZ 361	DJ3OJ 300	W1GR 246	YU1AG 552	W6USG 400
K8GHG 304	K9WTS 301	WØOVQ 300	SM3EP 361	EA2EL 300	W2HMJ 240	HB9EU 551	W8JXY 400
DJ2SR 304	JA3FT 301	CR7IZ 300	W1DGJ 358	EA2FE 300	DL9OH 235	WØMCX 529	DJ5VQ 400
OK1AEH 304	LU5AQ 301	DL1PM 300	W5ERY 358	GB2SM 300	W6EKZ 233	W2GT 528	SM5AJR 400
OK2QR 304	OK1CX 301	DL9PF 300	W8JIN 356	XE1AE 300	DL4FX 233	DJ2KS 524	VE3PV 400
		G2MI 300	G3GHE 356	ZS1AB 300	W1EQ 232	G8KS 520	ZS4MG 400
					K8PUU 230		

USA-CA

The United States of America Counties Certificate is awarded in six levels for working different numbers of United States counties beginning at the 500 county level. The following list, in alphabetical order, indicates those who have received the USA-CA Certificate and additional endorsements. Complete rules for the Program will be found elsewhere in this issue.

1500

K4BAI
K9EAB

1000

W1GF
W1GKJ
K4BAI
W5NXF
K5UYF
K6BX
W6KG
K6SXA
W6YC
K6YMZ
K7NHG
W8NAN
K9EAB
KØHUU
WØMCX
VE3BKL

500

K1BUR
K1CXP
W1DMD
W1EIO
W1EQ
W1FPS

W1GF W1GKJ W1HGT W1HOY K1INO K1KPS K1MBM K1NLE K1PMY K1QZV W1RWP W1SXX W1UOP W1UOT W1YPH K2BFU K2CJN K2CPR W2EMW K2ETC W2ETS W2EWZ W2FLD K2PFC WA2PWI W2SNI K2UKQ K2UPD WA2WKU K2ZKU

W3AYS W3BNU K3BTT W3BVL W3DKT W3EFY W3IMN K3HNP K3IYZ W3KDP K3LXN K3QVV W3TKQ K4ADU K4BVD W4BWR K4CDZ W4EEE WN4EBE W4EJP W4EJQ K4GLA W4HOS K4IEX K4JIG W4JUJ K4KZF K4MPE W4NOK K4PXY

K4RNS W4UF K4VQP K4VRI K4WVX K4ZNK K5ABE W5AKR W5AWT K5BQS W5BUK W5CME K5DGI W5DJB W5DQK W5EHY K5FTH W5AKR K5IKL K5IML/Ø W5JD W5KKL K5LWL K5MID K4MPE K5MWV W5NXF K5OCX K5OPT W5PQA

W5PSB W5RIT K5SBN K5SHQ K5UYF W5WZQ WA6AJF WA6ATY W6BIL K6BX K6CJF WA6CRN W6DIX WA6DWH W6FGJ WA6GWM K6HOR W6JNX WA6KNE WA6MWG W6NUQ W6QIW W6PCA K6PQY W6QIL K6SXA K6UHI W6UBP W6YC

K6YMZ K6YVV K7AGJ K7CPC K7CRL W7DZB W7GBL K7GTK K7KHA K7KPM K7MPQ K7NHG W7NNH W7NPV W7OEB W7RZY W7VJI W8AL W8APN W8BHG W8CIR W8CSK W8CXS W8EUX W8GKF W8HWX W8IEX W8IEC W8IQB

K8JIC K8KPL K8KPM W8NAN W8NXN W8OQV W8RQ W8RSW K8TBR K8TNE W8UMR W8UPH K8VSL W8WT W8WUT K8YBU K8ZCG K8ZNI W9ACU WA9AJF K9AMD K9AZX W9CLH W9CMC W9DGA K9EAB K9GDF

W9GFF W9GML K9GOE W9HUF W9IRH W9JQE W9LXW W9OIJ K9QBV W9QGR K9QGR W9QWM W9SZR K9UTI K9YND W9YT K9ZXG WAØAAD WØARO WØBBS WØCUC KØDEQ WØEXD/5 KØFIK KØGIC WØHSC KØHUU KØIDV WØIJN

WØIUB WØJPL WØMCX WØMLY WØPLN KØOJG KØQJG KØRGU WØTFQ KØTKQ KØWEM KH6BLX KH6DKA KL7MF KP4CC KZ5JW CO8JK CR6CA CR7IZ DL1IB DL1QT DL9PF F9BB G2FFO G3DO G8PL GB2SM GI6TK HK1QQ

HK3LX HK3RQ HK7ZT HV1CN I1ER IT1AGA LU1DAB OK3EA PJ2AF PZ1AX SM5CCE SM5WI SM7ID TG9AD VE1AE VE3BKL VE3LZ VE3RN VE6ABP VE7HJ VE6UP VE7CE VE7HJ VK3XB XE1AE XE2DS YV5ACP ZL1TB ZL4CK

DX DX DX DX DX DX

URBAN LE JEUNE, JR.*, W2DEC

The following certificates were issued during the period from August 6th to and including September 5th, 1963.

CW-PHONE WAZ

1833	YO2CD	Mircea Negrutzi
1834	W2RGV	Jack Lee
1835	VK3AX	Harold D. Boast

ALL-PHONE WAZ

199	K3COW	Raymond E. Murphy
200	W2GNQ	Joseph A. Anderton

TWO-WAY SSB WAZ

173	K6EXO	Harvey Shore
174	W1AOL	William A. Dickson
175	ZL1AIX	W. J. Robinson
176	K3COW	Raymond E. Murphy
177	W2GNQ	Joseph A. Anderton
178	DJ3DR	Jurgen Rottger
179	VK6RU	J. E. Rumble
180	JA3UI	Ken Kishimoto

CW WPX

471	LA3DB	Thorleif Soloy
472	G2MI	Arthur Milne
473	VK5RX	G. W. Luxon
474	UB5FY	Anatoly Revcov
475	DL6OS	Karl Dunkelmann
476	K8MFO	Donald Karvonen
477	K6TQR	W. J. Thompson
478	K1NOL	James E. Power, Jr.
479	K3RRA	Raymond H. Black
480	W3GJY	John F. Wojtkiewicz
481	KH6BLX	Clyde E. Stickle

PHONE WPX

95	W4RLS	J. Foy Guin, Jr.

SSB WPX

142	OQ5IE	Jane Hiernaux
143	I1AMU	Alfonso Porretta
144	DL9OH	Karl Muller
145	K2KGS	Fred A. Duran, Jr.

MIXED WPX

72	DJ2KS	Hans-Ulrich Widdel
73	G3HDA	M. E. Bazley
74	DL9OH	Karl Muller

WPX ENDORSEMENTS

	Mode	*Continent*	*Band*
W3AHX	CW	E	
W3GJY	CW	E	
W3GOQ	CW	E	14
W4BHG	CW	E	
K4HPR	CW	E	
W7ABO	CW	E	
DJ2KS	CW	F	
DL1TA	CW	E	
G3GHE	CW	E	
G3NUG	Phone	E-F	
	Mixed	E-F	
I1AMU	SSB		14
LA3DB	CW	E	
PAØLOU	CW	E-F	14-3.5
SP6FZ	CW		14
VE5JV	CW	E	
VK5RX	CW		14
VK7SM	CW		14
VK9XK	CW		14

A-Asia; *E*-Europe; *F*-Africa; *N*-North America; *O*-Oceania; *S*-South America.

Gus, in his inimitable fashion and in the manner of the Prime Minister of DXing that he is, has added to his growing list of "Impossible" accomplishments by inducing the King of Bhutan to permit the division of that State into Radio Districts making the area around Pouchling AC7 and securing for himself the call of AC7A, while also opening up third-party traffic and fone-patch traffic by special order of the King. There is little doubt that Gus has been and will continue to be the greatest ambassador of good will, and the United States Amateur Radio Fraternity may well take great pride in the knowledge that this great amateur-ambassador is sustained, in part, by the voluntary contributions of those whose interests lie in foreign communications with the outposts of civilization, for the sheer love of it.

*Box 35, Hazlet, New Jersey 07730

W1BB in pajamas checks 160 meter DX opening during "Wee Small Hours." Stew had only a receiver for this portable operation. See text for information on what looks like a red hot season on 160 meters.

The above words are those of Frank, W5IGJ, editor of the West Gulf DX Club *Bulletin*. I think Frank has summed up how we all feel about the grand old man of DX. Your help to keep this wonderful show on the road would be greatly appreciated. Why don't you send a Quid or two to W4ECI as a token of your appreciation.

Contest

Don't forget contest time is upon us. Phone weekend is October 26th and 27th. C.w. follows on November 23rd and 24th. See September, *CQ*, page 46 for full details. Logs are still available for a self-addressed stamped envelope.

VR6AC

I am very sorry to report that Floyd McCoy, VR6AC, has become a silent key. Floyd succumbed to cancer on the 16th of September.

W2-DXfest

The North Jeresy DX Association is pleased to announce the first annual W2-DX banquet to be held on Saturday evening March 21st, 1964 at Schraffts' County Restaurant in Scarsdale, New York. Cocktails and general conversation to start at 4:00 P.M.; Dinner to be served at 7:30 P.M.

A full program of DX topics is currently in the planning stage and will be announced shortly. Tickets are $7.50 per person and includes a prime ribs of beef dinner with all the trimmings. Write: W2VCZ, Bob Stankus, Dinner Chairman, 30 Pitcairn Ave., Ho-Ho-Kus, New Jersey. This is the Saturday *preceding* the IEEE show so start talking your boss out of one extra day.

Here And There

AC5 Bhutan: Chawna, AC5PN, will be active weekends using SR-150 and two-element beam which was installed by Gus.

CEØ Easter Island: WA2BWH and possibly WA2WUV are going to Easter Island in mid or late January for a seven-to-ten day stay. All bands and modes to be used. Additional information next month.

CEØX San Felix: W4QVJ and W8FGX, while on their Juan Fernandez trip, will attempt to firm up transportation arrangements for San Felix. They are going to try and charter a PBY. If so, about ten operators will make a trip to this new country some time in early 1964.(*Tnx Florida* DX Report)

CEØZ Juan Fernandez: W4QVJ and W8FGX will DXpedition to this spot for one week of operation starting the 23rd or 24th of October. Frequencies to be used are 3515, 7015, 14015, 21015 on c.w. as well as 7095, 14125, 14347, 21447 on s.s.b. The rig used will be a SR-115, SX-117 with a Hy Gain beam. QSL via W4QVJ. (*Tnx Florida DX* Report)

CR8 Portuguese Timor: CR8AG now joins CR8AC in dispensing Timor QSOs. 1000 to 1100 GMT with 14022 preferred. *(Tnx WGDXC)*

EAØ Annobon: U.R.E. confirms that the recent EA1FL/Ø and EAØFL operation was a phony.

EAØ Spanish Guinea: EAØAB is again active around 14100 kc with a badly drifting T5 note. Shows up on different frequency after each transmission. *(Tnx NEDXC)*

EA9/EAØ Rio de Oro/Ifni/Spanish Guinea: A DXpedition to these spots is planned by EA2CA and EA4CR. Early 1964 is the target date. (*Tnx NEDXC)*

EP Iran: Mostafa, EP2AS, occasionally around 14001 kc at 2100 GMT. *(Tnx WGDXC)*

FB8WW Crozet Island: Every year in January, a French ship leaves Reunion Island to call on FB8ZZ, FB8XX and Crozet. This year a ham will be one of the party who will land at Crozet. It is not known who he is or whether he will make a concentrated effort to dispense FB8WW QSOs. *(Tnx VERON)*

FB8ZZ Amsterdam Island: FB8ZZ is getting active again. Heard many times recently on 14030 between 1130 and 1200 GMT. *(Tnx Florida DX* Report*)*

FG7 Guadeloupe Island: FG7XJ, Henry, most weekends on 14025 kc starting at 1300 GMT. *(Tnx WGDXC)*

FK8 New Caledonia: FK8AU on 14132 s.s.b. most weekends between 0300 and 0500 GMT. He listens around 14250 kc. *(Tnx WGDXC)*

FY7 French Guiana: FY7YK is now QSV on the low end of 7 mc most days at 1100 GMT. *(Tnx WGDXC)*

HL9 Korea: Augie, K2UVU, President of the North Eastern DX Association, and part time editor of their excellent bulletin, has been assigned to "Frozen Chosen" and should be signing HL9 after January. Aug promises a little roving à la HL9KH. Good luck Aug.

JT1 Mongolia: JT1CA continues active from Mongolia supplementing s.s.b. activity with c.w. QSOs around 14045 starting 1500 GMT almost daily. *(Tnx NCDXC)*

JY Jordan: Angus, HZ1AMS, of 5N2AMS fame, hopes to be active from Jordan in the not too distant future. He has also been issued the following calls: Bahrein, MP4BEF; Quatar, MP4QBP; Muscat, MP4MAP; Trucial Oman MP4TAX. *(Tnx Florida DX* Report*)*

LX Luxembourg: LX1DE occasionally around 14107 kc 2130 to 2200 GMT. *(Tnx WGDXC)*

MP4T Trucial Oman: MP4TAD has been active on 14 mc s.s.b. 14300 preferred. He is located in Abudhabi which counts as Trucial Oman. *(Tnx VERON)*

PY Fernando de Noronha: PY7AKW is active from this spot on c.w. and a.m. on all bands. *(Tnx WGDXC)*

SD1 Swaziland: The prefix for Swaziland will shortly be changed from ZS7 to SD1. There is a possibility that the current hams will keep ZS7 and the newcomers will receive SD1 calls. *(Tnx Florida DX* Report)

ST2 Sudan: ST2AR has returned from his leave in the United Kingdom. He brought an s.s.b. rig back with him and is now active on that mode. (*Tnx Florida DX* Report)

We are indebted to 9M2JJ (W8SWN) now serving in the Peace Corps. in Malaya for this fine 9M2 profile. From top to bottom 9M2JJ; 9M2FK; 9M2FZ; 9M2GH (visited by 9M2FZ); 9M2GD and 9M2BS. All are active an can be found on 40, 20, and 15.

TA Turkey: TA2NK (DJ7BO) is active almost daily between 14040 and 14060 kc. Usually starts about 2100 GMT. *(Tnx WGDXC)*

TU2 Ivory Coast: Smitty, TU2AL, may be found daily on 14050 c.w. or 14345 and/or 14110 s.s.b. 2000 to 2100 GMT preferred. Smitty never listens on his own frequency but announces listening frequencies regularly. QSLs should be sent direct, c/o American Embassy. *(Tnx WGDXC)*

VK2 Lord Howe: W5LAK plans Lord Howe activity in mid November with S-line. *(Tnx NEDXC)*

VK4 Willis Island: VK4JQ has been intermittently active from Willis. Several different frequencies, both phone and c.w. have been used. He is indeed a tough nut to crack but maybe activity will increase as time goes on.

VK9 Cocos Island: True to his word Lionel, VK9LA, has been very active as his departure date approaches. He has been active around 14066 c.w. and 14300 s.s.b. 1300 to 1600 GMT preferred. *(Tnx WGDXC)*

VK9 New Guinea: VK4HG, of recent Willis Island fame, has been reassigned to New Guinea. *(Tnx WGDXC)*

VKØ Heard Island: VKØVK leaves Antarctica the end of October and may stop at Heard Island for a few days of operation in early November.

VP1 British Honduras: Someone has been pirating VP1TA's call of late. Lee operates only phone so all c.w. contacts are N. G. He has been active on 21 mc a.m. phone, usually between 21200 to 21300 around 2130 to 2300 GMT.

VP4 Trinidad: Trinidad lost one of its more active hams recently when VP4NC returned to Canada. The South Trinidad Amateur Radio Society gave Lawrie a wonderful sendoff with a dinner and West Indian coffee table. Anyone who did not receive his VP4NC QSL can obtain same by sending another card to VE3FPF. (See QTH section).

VQ4 Kenya: Word comes to us that VQ4I ("I" for Independence) will be operational between the 9th and 14th of December in celebration of their Kenya's Independence Day, December 12th. A new prefix will be assigned shortly thereafter, probably 5Z4 or 5Y4.

VS5 Brunei: VS5CW occasionally on 14 mc c.w. between 1200 and 1300 GMT. *(Tnx NEDXC)*

VS9 Maldive Islands: VS9MB has been active around 14040 kc s.s.b. activity also continues. 1100 to 1300 GMT preferred. *(Tnx WGDXC)*

VS9 Kuria Muria Island: A DXpedition by the Aden RAF gang to this Island, which qualifies as a new country, is set for the last week of October or the first week of November. There is a possibility that the time may be delayed for a


Don, DJØIR, recently put San Marino on the air using the call 9A1IR. The 9A-block is assigned to San Marino while the M-block is not. Don's operation was the first as 9A1.

month. All band, 24-hour daily operation will be provided during the seven to ten day stay. *(Tnx VERON)*

XW8 Laos: XW8AL and XW8AU operate on s.s.b. occasionally as their work and conditions permit. *(Tnx WGDXC)*

YA Afghanistan: K4UTE has left for a two-year assignment in Africa. He has taken a KWM-2 with him and hopes to operate from this rare spot. *(Tnx Florida DX Report)*

YI Iraq: YI12WS sporadically on 14 mc c.w. and s.s.b. around 1700 GMT *(Tnx NEDXC)*

YVØ Aves Island: The Radio Club of Venezolano is making a DXpedition to Aves Island and the call will probably be YVØAA. Operations during the *CQ* W. W. Phone Contest, a.m. and s.s.b. C.w. out of contest. There will be ten operators, all members of R. C. V. *(Tnx YV5BBU)*

ZD3 Gambia: ZD3A active on occasion on 14090 at 2030 GMT. *(Tnx NEDXC)*

ZD8 Ascension Island: Ascension Island now boasts several active hams. ZD8HB is the most recent addition and he has been very active on the low end of 20 c.w. around 2200 GMT. *(Tnx WGDXC)*

ZK2 Niue Island: ZK2AE is active on a.m. fone. He is ex-ZL2TK.

ZL1 Kermadec Island: ZL1ABZ still cranking out QSOs on 14 mc c.w. and s.s.b. between 0300 and 0400 GMT. Look around 14115 s.s.b. and 14050 c.w. Two operators now man the station. *(Tnx NEDXC)*

WAZ and WPX

The WAZ and WPX certificates are awarded by the *CQ* DX department. WAZ is issued for proof of contact with the 40 Zones of the world as shown on the official WAZ Zone Map. WAZ is issued in three classes, *i.e.* Any mode, all phone and all s.s.b. For complete rules, see the January, 1962 *CQ*, page 50.

WPX is issued in four classes, *i.e.*, all c.w., all phone, all s.s.b. and Mixed. The number of prefixes required are: C.w.-300; Phone-300; s.s.b.-200; Mixed-400. For complete rules, see January, 1962 *CQ*, page 52. WAZ applications, Zone Maps and WPX applications may be obtained from the DX Editor at the address shown at the head of this column. Please send a self-addressed, stamped envelope or a self-addressed envelope and an IRC. All applications should be sent directly to the DX Editor.

ZS2MI Marion Island: ZS1OU has persuaded ZS2MI to spend more time on the ham bands. Times of activity are very difficult to forecast due to unpredictable commercial schedules. The following schedule is adhered to when possible: *Weekdays* 1030 to 1130 GMT 14060; 0500 to 0630 GMT 7005 kc. *Weekends* 1000 to 1145 GMT 14060. *(Tnx Florida DX Report)*

5X5 Uganda: Bob, 5X5IU, is active around 14345 kc almost daily starting at 2130 GMT. *(Tnx WGDXC)*

6O1 Somali Republic: Woody, 6O1WF, is occasionally active on s.s.b. Norm, 6O1ND, is very active on both s.s.b. and c.w. *(Tnx WGDXC)*

5T5 Mauritania: Alban, 5T5AD, is now active on s.s.b. mostly weekends. 14213 kc usually used. Best time for states is 1700 to 1800 GMT.

9L1 Sierra Leone: John, 9L1JC, is a newly licensed ham who is on 14008 every Sunday starting at 1730 GMT. QSL via WA4CXR.

9M2 Malaya: "I am one of the 150 or so Peace Corps volunteers in Malaya at the invitation of the Malayan Government. Many of us are teachers in the Malayan school system; some are nurses in the hospitals or rural health centers and some are working in the Public Works or Drainage and Irrigation Depts. I have been here since last October, (1962) and am assigned to teach at the Secondary Trade School of Ipoh. The students here are between the ages of 16 and 20, studying for three years and learning the basics of a trade. Offered at our school are courses in bricklaying and carpentry, automotive mechanics, machine shop and welding, electrical installation and repair and radio and electronics servicing. My teaching is connected with the latter, and will keep me here until sometime about December, 1964.

"I was licensed in Michigan as W8SWN back in 1954 and now being out here in Malaya, I made an application for a Malayan amateur radio license. I was issued 9M2JJ in January of this year and was on the air the same day that the ticket arrived after some frantic running about. 9M2GD helped me by loaning me his HRO-M and making the arrangements with 9M2FR (via 40 meter QSO) to borrow his spare tx stored in Ipoh. I've been on the air since on 40-20-15 both c.w. a.m. We don't use 80 here because the QRN is usually quite high. I am able to work mostly anywhere, depending on conditions. At present, the antennas up are a set of dipoles, an inverted V for 40, and an all-band dipole known as the G5RV. Things seem to work quite well on these, although a Quad is in the planning. We have an active evening group going here on 40 nightly at about 7050 kc between 1030 and 1130 GMT as well as Sunday mornings between 0130 and about 0330 GMT. 40 meters, by the way, is 7000-7100 kc here. We are limited to a 150 watt d.c. input power regulation here on all bands. Present on these sessions are a number of 9M2s as well as some of the VS1 gang from Singapore. On 20 and 15 we work DX and I think that there is a Malayan Amateur on at least five nights of the week; yet, it is still fun to have someone come back and tell you that you are the first for them. There are about twenty active 9M2s and about that many VS1s as well, so if you haven't worked any of us give a listen on s.s.b.-a.m.-c.w., whichever mode you favor

"In reference to equipment, a lot is modified surplus. Some is that of those who were once stationed here and left it behind. That is, some of the Commonwealth personnel or business people. Some of the fellows now have American equipment but it is very expensive due to the duty and shipping charges that are added.

"There is another Peace Corps volunteer here who also has a license but he has been unable to get on the air so far. He has managed to get a CR-150 and recently a TCS tx but has not yet been heard locally. His name is John Thayer, 9M2JT and although he is a former resident of Kalamazoo, holds a K3-call.

[*Continued on page 136*]

PROPAGATION

GEORGE JACOBS*, W3ASK

LAST MINUTE FORECAST

The following is a forecast of day-to-day propagation conditions expected during November, 1963. This forecast attempts to predict *specific* days upon which openings shown in the Propagation Charts in this column are most likely to occur, and the expected quality of the openings. For example, the following forecast shows that circuits rated (2) in the Propagation Charts are most likely to open with "good-to-fair" quality (B-C) when conditions are above normal (November 3, 8 and 30), and with "fair-to-poor" quality (C-D) when conditions are expected to be normal. Circuits rated (2) are not expected to open on those days forecast to be disturbed, etc.

PREDICTED PROPAGATION CONDITIONS AND CIRCUIT QUALITY

Prop. Chart Forecast Rating	*Above Normal Days (WWV rating higher than 6)* 1, 4, 26	*Normal Days (WWV rating 5-6)* 2-3, 5-7, 14, 19-21, 23-25, 27-30	*Below Normal Days (WWV rating 4)* 8, 11, 13, 15, 17-18, 22	*Disturbed Days (WWV rating less than 4)* 9-10, 12 16
(1)	C	D-E	E	E
(2)	B-C	C-D	D	E
(3)	A-B	B-C	C-D	D-E
(4)	A	A-B	C	D

Where:

A—is an excellent opening with strong steady signals.

B—is a good opening, moderately strong signals, with little fading and noise.

C—is a fair opening, signals fluctuating between moderately strong and weak, with moderate fading and noise.

D—is a poor opening, signals generally weak, with considerable fading and high noise level.

E—is a very poor opening, or none at all.

It looks like Normal propagation conditions for the Contest Period Nov. 23-24.

The c.w. section of the 1963 *CQ* World-Wide DX Contest will be held November 23-24. Special DX Propagation Charts for use during the Contest appeared in last month's column. Be sure to check these Charts for a prediction of band openings and for other propagation data which should be useful during the c.w. section of the Contest. For a day-to-day forecast of general propagation conditions expected during the month of November, including the Contest dates of November 23-24, see the "Last Minute Forecast" appearing at the beginning of this column. This month's column contains a Short-Skip Propagation Chart for use in the continental United States for distances between approximately 50 and 2,300 miles. Special propagation charts centered on Hawaii and Alaska are also included.

*11307 Clara Street Silver Spring, Md. 20902

Sunspot Cycle

The Swiss Federal Solar Observatory at Zurich reports a monthly mean sunspot number of 33 for August, 1963. This results in a smoothed sunspot number of 29 centered on February, 1963. Smoothed sunspot activity from December, 1962 through February, 1963 has remained practically constant. A smoothed sunspot number of 17 is forecast for November, 1963.

The Swiss Observatory announces that it has observed the first sunspots of the next sunspot cycle in mid-latitude on the face of the sun. This is a good indication that the end of the present sunspot cycle is approximately one year away.

VHF Openings

Some auroral activity is expected during the month when ionospheric conditions are predicted to be below normal or disturbed (check the "Last Minute Forecast"). It is generally possible to maintain skywave communication on the v.h.f. bands during auroral activity as a result of the unusual ionization that often accompanies such conditions.

Some v.h.f. meteor openings are likely to occur during the *Leonids* meteor shower which is expected to take place between November 14 and 18.

73, George, W3ASK

CQ SHORT-SKIP PROPAGATION CHART

November-December, 1963

Band Openings Given in Local Standard Time
AT PATH MID-POINT (24-HOUR TIME SYSTEM)

Band (Meters)	*50-250 Miles*	*250-750 Miles*	*750-1300 Miles*	*1300-2300 Miles*
10	*Nil*	*Nil*	10-16 (0-1)	10-16(1)
15	*Nil*	*Nil*	09-11(0-1) 11-14(1-2) 14-16(0-1)	08-09(0-1) 09-11(1-3) 11-14(2-4) 14-15(1-3) 15-16(1-2) 16-18(0-1)
20	*Nil*	09-11(0-1) 11-16(0-2) 16-18(0-1)	07-09(0-1) 09-11(1-4) 11-16(2-4) 16-18(1-2) 18-20(0-1)	06-07(0-1) 07-09(1-3) 09-16(4) 16-18(2) 18-20(1)

[*Continued on page 148*]

CONTEST CALENDAR

FRANK ANZALONE*, W1WY

CALENDAR OF EVENTS

October	26-27	*CQ* WW DX Phone
November	2-3	RSGB 7 Mc C.W.
November	6-7	YL/AP Phone
November	9-11	ARRL SS
November	16-18	ARRL SS
November	16-17	RSGB 21/28 Phone
November	23-24	*CQ* WW DX C.W.
December	7-8	OK DX C.W.
December	14-16	Virginia Party

RSGB 7 Mc C.W.

Starts: 0001 GMT Saturday November 2
Ends: 2359 GMT Sunday, November 3

It's too late for the Phone section, but the more popular c.w. week-end is now coming up for you 40 meter fans.

Complete rules were given in last month's CALENDAR.

Your logs go to: R.S.G.B. Contest Committee, New Ruskin House, Little Russell Street, London, W.C.1, England.

YLRL Phone Party

Starts: 1700 GMT Wednesday, November 6
Ends: 2300 GMT Thursday, November 7

The c.w. section has already been run off as you read this, but check Louisa Sando's column in last month's issue for details on the phone section. It's a YL *only* party, you know.

ARRL SS

Starts: 2300 GMT Saturday and
Ends: 0801 GMT Monday, *on both week-ends.*

Everybody gets into the act in the Sweepstakes. With two weekends going for them, some fantastic contact totals are run up by the leaders.

There were over 2,200 entries in the last one, so that just about makes it the most active of all contests. Its been going on for 30 years now, so you should know what its all about by this time.

In case you don't, I suggest you check the current *QST;* it's their shindig you know. And don't forget their new address, 225 Main Street, Newington, Conn. 06111.

RSGB 21/28

Starts: 0700 GMT Saturday, November 16
Ends: 1900 GMT Sunday, November 17

*14 Sherwood Road, Stamford, Conn. 06905

1963 CQ World Wide DX Contest

Phone

Starts: 0000 GMT Saturday, October 26.
7:00 P.M. EST Friday, October 25.
4:00 P.M. PST Friday, October 25.

Ends: 2400 GMT Sunday, October 27.
7:00 P.M. EST Sunday, October 27.
4:00 P.M. PST Sunday, October 27.

C.W.

Starts: 0000 GMT Saturday, November 23.
7:00 P.M EST Friday, November 22.
4:00 P.M. PST Friday, November 22.

Ends: 2400 GMT Sunday, November 24.
7:00 P.M. EST Sunday, November 24.
4:00 P.M. PST Sunday, November 24.

It's going to be slim pickings in this phone only contest this year, but maybe they will be lucky and come up with some good openings. It's the world working the British Isles (G, GB, GC, GD, GI, GM and GW).

1—The usual five-figure serial number, RS report plus a progressive 3-digit number starting with 001.

2—For overseas stations, each contact will count 5 points. Only one contact per band is permitted with the same station and cross-band operation is not allowed.

3—An additional bonus of 50 points may be claimed for the first contact with each British Isle country/prefix on each band. G2, G3, GB2, GC3, GM6 and etc.; a possible 37 on each band.

4—An additional bonus of 50 points can be claimed for every ten stations worked in each of the 37 country/numeral prefixes, irrespective of the band.

5—Your final score therefore will be the sum of QSO points and bonus points; no multiplier is involved.

6—Log sheets should be columned and show in this order: Date/time in GMT, Station worked, serial number sent and received, band, bonus points and QSO points.

7—Each entry should also include a summary sheet with name and address in BLOCK LETTERS, and other pertinent information. And don't forget

[*Continued on Page 150*]

SPACE COMMUNICATIONS

GEORGE JACOBS*, W3ASK

THIS month's column will be devoted to bits and pieces of news concerning exploits in space communications by radio amateurs. More detailed coverage of the items discussed will appear during the next few months.

Project OSCAR News

According to information received at press time from Project OSCAR's Chairman, Chuck Towns, K6LFH, the 90-day countdown for the OSCAR III satellite has begun. If all goes according to plan, and if there are no holds, amateur radio's first repeater satellite should be in orbit by late winter. More details on this next month.

Dave Veazey, W4ABY, reports that a Project OSCAR East is being formed, with headquarters in the Washington, D.C. area. Drawing from the large number of radio amateurs professionally engaged in the aero-space field on the eastern seaboard, Project OSCAR East plans to have an amateur satellite built and ready for launch by the end of 1964. This project is in its initial stage, and east coast readers of this column who would like to participate should write directly to W4ABY for more details.

From 4U1ITU, Geneva, Switzerland, comes word that Project OSCAR Europe is under way. With the International Amateur Radio Club of the I.T.U. acting as focal point, radio amateurs from several European countries are combining their talents to build Europe's first amateur radio satellite. Arrangements are now underway to utilize a Swiss technical institute as headquarters and workshop for OSCAR Europe, and it is hoped that the European-built radio amateur satellite will be ready for launch sometime during 1964. This project is also in its initial stage, and European readers of this column who wish to participate should write for more information directly to Mr. John Gayer, President, International Amateur Radio Club, Geneva 20, Switzerland.

*11307 Clara Street, Silver Spring, Md. 20902

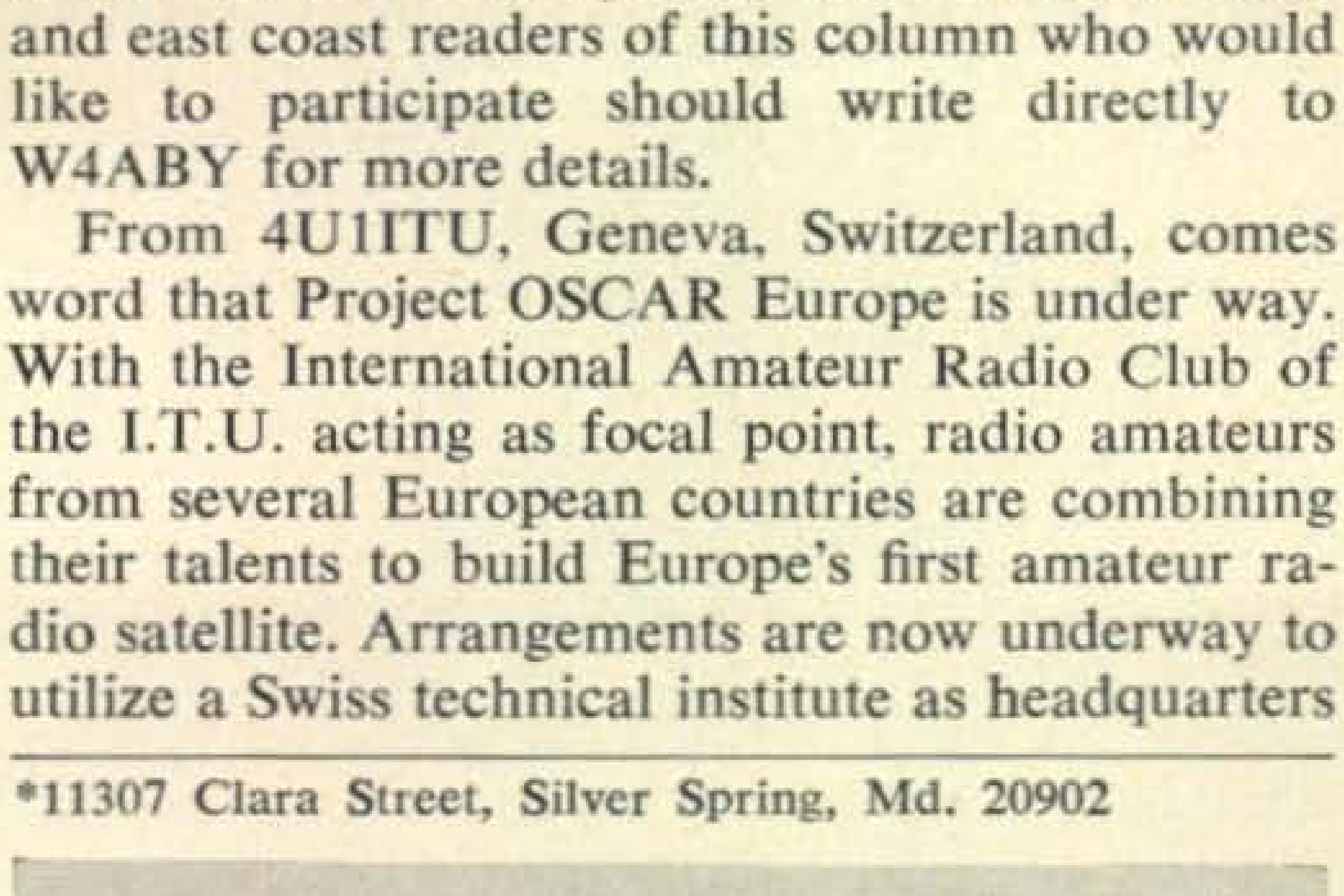
East-West support for OSCAR. Leading Soviet radio amateur Ernst Krenkl, RAEM, is shown holding OSCAR with Herbert Hoover, Jr., W6ZH, President of ARRL, and Britt-Marie Stenvall, SM7BAC. Photo was taken by Frank Stenvall, SM7ACB, at OSCAR exhibit held during recent European meeting of the International Amateur Radio Union at Malmo, Sweden

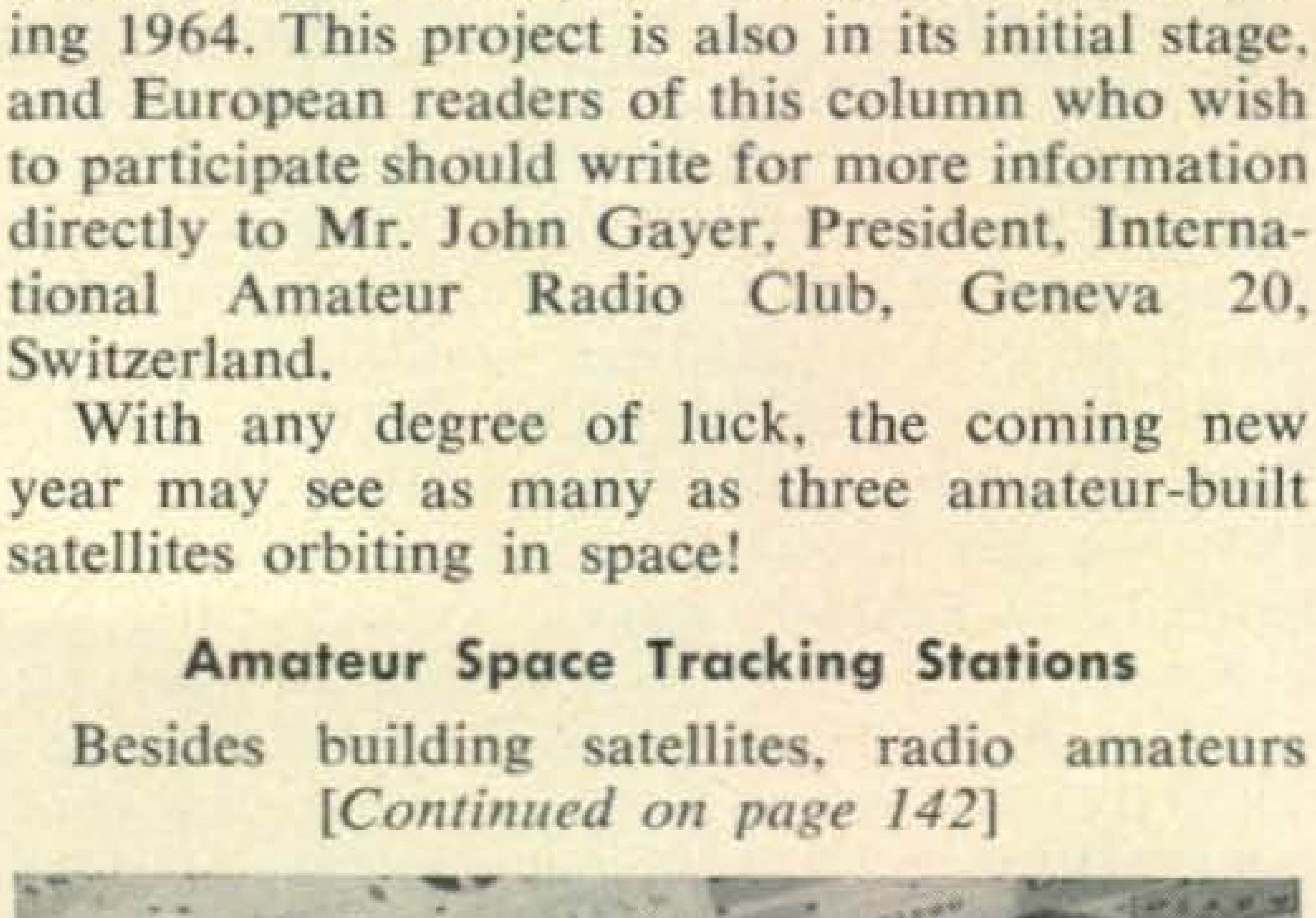
With any degree of luck, the coming new year may see as many as three amateur-built satellites orbiting in space!

Amateur Space Tracking Stations

Besides building satellites, radio amateurs

[*Continued on page 142*]





The spiral antenna at the left with parabolic reflector has been used by Dieter Oslender for tracking almost every satellite launched since SPUTNIK I. Dieter's QTH is Wurzerstr. 9, Bad Godesberg 532, West Germany. At the right Dieter at his amateur satellite tracking station located in Bonn, Germany. This is one of many stations which are now forming a world-wide network of amateur tracking stations.

sideband sideband sideband

SIDEBAND

IRV & DOROTHY STRAUBER*, K2HEA/K2MGE

SSB DX HONOR ROLL

TI2HP	283	G3FKM	261	W1AOL	238
PY4TK	279	W5IYU	260	PJ2AA	232
W8EAP	278	DL1IN	258	WØCVU	229
W2ZX	276	K2MGE	257	OZ7FG	228
K8RTW	276	MP4BBW	256	K4AJ	226
VQ4ERR	275	W2TP	255	G2PL	225
W2FXN	272	W6RKP	254	K6LGF	224
K4TJL	269	G3NUG	253	WA6EYP	222
HB9TL	269	W6BAF	252	WØPGI	221
WØQVZ	268	WØUUV	251	WA6HOH	219
W6UOU	266	K1IXG	250	W3VSU	217
W4OPM	265	G2BVN	249	W7DLR	208
K9EAB	263	W6PXH	247	DJ3CP	207
W2VCZ	262	W8YBZ	246	W1ICV	205
W3LMA	261	K6ZXW	243	OH2NB	204
PZ1AX	261	W6WNE	241	W9SFR	203
G8KS	261	WA2IZS	240		

SSB DX ENDORSEMENTS

K8RTW	275	UA3DR	150	W5ILR	75
G3FKM	250	G3WW	150	K7RJK	75
OZ7FG	225	G6UT	150	DJ1BV	75
W1ICV	200	VS6EK	100	W1ETF	50
DJ3CP	200	G3KXT	75	W3AYS	50
G3NUY	175	K8KOM	75		

Is Ron, ZS1NE, throwing up his hands in anticipation of the pile-ups when the band again opens to Capetown? Ted, ZS1RA, (left) seems to be gazing into the future wondering how his signal will compare with that of George, ZS1JD, who always manages to cut through the QRM.

JUST four short years ago, there was great rejoicing in the SIDEBAND column when Ami, 4X4DK, became the ninetieth operator to earn the "Worked 100" Certificate. Since then, sideband operation has gained such impetus that a careful count of all countries from which there is or has been sideband operation reveals the outstanding total of 305 countries! This, of course, includes countries no longer in existence and also those which are now on the banned list. Further research indicates that the following are the only countries which have not yet had any sideband activity: AC3, Sikkim; AC4, Tibet; (although by the time you read this, W4BPD probably has changed these statistics!); BY, China; C9, Manchuria; CEØA, Easter Island; CR4, Cape Verde Islands; EA9, Rio de Oro; FB8, Amsterdam and St. Paul Islands; FB8, Kerguelen Islands; VKØ, Heard Island; VP8, South Georgia; VP8, South Sandwich; VP8, South Shetland; VQ8, Rodriguez; YK, Syria; and ZS2MI, Marion Island.

As a matter of general information, we feel that the above statistics present a very interesting picture of sideband activity around the world and will, no doubt, surprise a number of present-day sidebanders who may be unaware of just how deeply sideband has penetrated to the most remote corners of the earth.

*12 Elm Street, Lynbrook, New York.

Slide Exhibit Available Soon

The Long Island DX Association is preparing a "DXerama" slide exhibit—a collection of color slides of the world's leading ham radio operators and DXpeditions. This unusual presentation will be available, free of charge, as program material for any interested organized groups throughout the world. If your group would like to reserve a showing, send your request to: DXerama, Box 296, Massapequa, L.I., N.Y. As soon as the "DXerama" exhibit is completed (about December, 1963), you will be notified by the Long Island DX Association as to when your group may schedule a viewing. This project is being planned by the LIDXA as a public service to other ham organizations throughout the world.

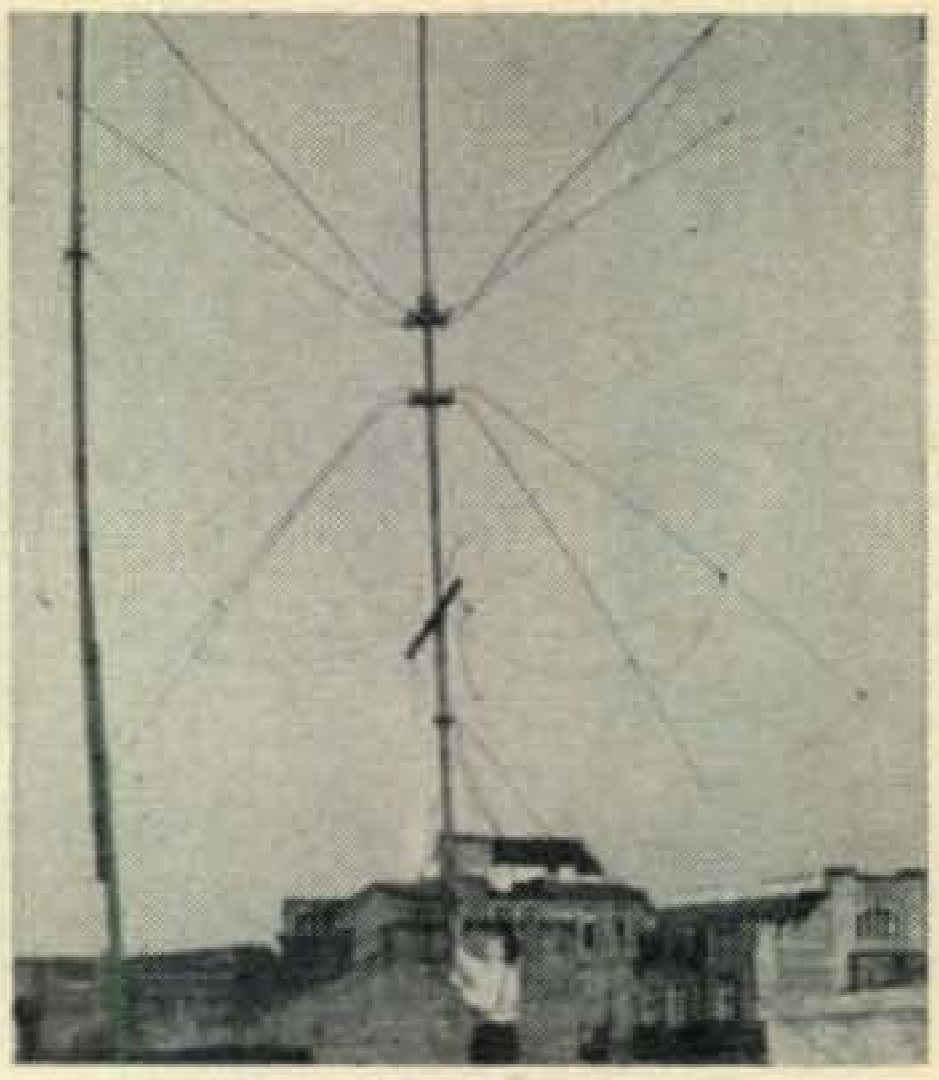
From Our Mailbag

"Dear Irv and Dorothy,

"Back in April, 1962, your column carried a special announcement. Special recognition was to be given for s.s.b. DX on 40, 75, and 160, due to the 'increased activity on these bands' and because a number of the gang had requested it. The wording of the announcement gave the impression that this was going to be quite a thing with good competition expected.

"Before long, GI3CDF, K2GXI, and W8JIN [*Ed. note: also GI6TK*] received the first of these special endorsements. Since then, however, months have gone by with no more mention whatsoever of this competition. Has it proved





This is Serge, UB5UN, his station and his antenna at his home in Kiev. His exciter uses an 829B output stage and drives four 811A's in a new final. The receiver is a well-modified AR-88 with some original UB5UN ideas incorporated. His cubical quad is made of fiberglass with aluminum wire elements. *(Photos courtesy W4INL).*

to be a flop? Is no one else interested? It must be 4 months ago that I sent in my 75 confirmations for 7 mc s.s.b., and even that hasn't been mentioned . . . "73, Bob Sommerfelt, K2GXI"

Just an oversight and lack of space, Bob! We're very proud of your efforts on 40. How about it, fellers? Let's keep the ball rolling on these bands —40, 75, and 160—by increasing the efficiency of your rigs and antennas and seeing how much international sideband activity you can encourage. The more, the merrier, and with the ebb in the sunspot cycle here's a unique oportunity to test the performance of sideband under adverse conditions.

RSGB Certificates

A note from R. F. Stevens, G2BVN, DX editor of the *RSGB Bulletin,* requests that we inform you to send *all* claims for RSGB certificates directly to RSGB headquarters, 28 Little Russell Street, London, W. C. 1, England. Steve notes further that cards dated after May 30, 1961 from South African stations (ZS1, 2, 4, 5, and 6) are not valid for Commonwealth Awards such as WBE, BERTA, EDXC, *etc.*

CQ W.W. DX Contest Reminder

Our good friend, Frank Anzalone, W1WY, is looking forward to a bumper crop of participants in this year's World Wide DX Contests, the phone section taking place on Oct. 26-27 and the c.w. section on Nov. 23-24. Please check Frank's "Contest Calendar" in Sept *CQ* for full details.

Domenico Petti, I1CNS, operator of Vatican's amateur radio station HV1CN, with Trav Marshall, K9EBE, left, and Bill Halligan, W9AC, of the Hallicrafter Company.

W1ICV, Earns "Worked 200"

Congratulations to Jane Anderson, W1ICV, XYL of Vern, W1OOS, who became the fifth XYL in the world to earn *CQ*'s "Worked 200" Award for having 200 s.s.b. countries confirmed. With the thousands of lovely ladies now active as radio operators, Jane's achievement is outstanding. We are looking forward to having many more XYL's follow in Jane's footsteps.

Domenico

Along with numerous DX'ers, we treasure in our collection a QSL card from HV1CN, the amateur radio station of Vatican City. Imagine our surprise when one afternoon a familiar voice on the phone asked; "How'd you like to have dinner with Domenico Petti, I1CNS?" If you don't already know, Domenico is the

[*Continued on page 134*]

ATTENTION SIDEBAND READERS

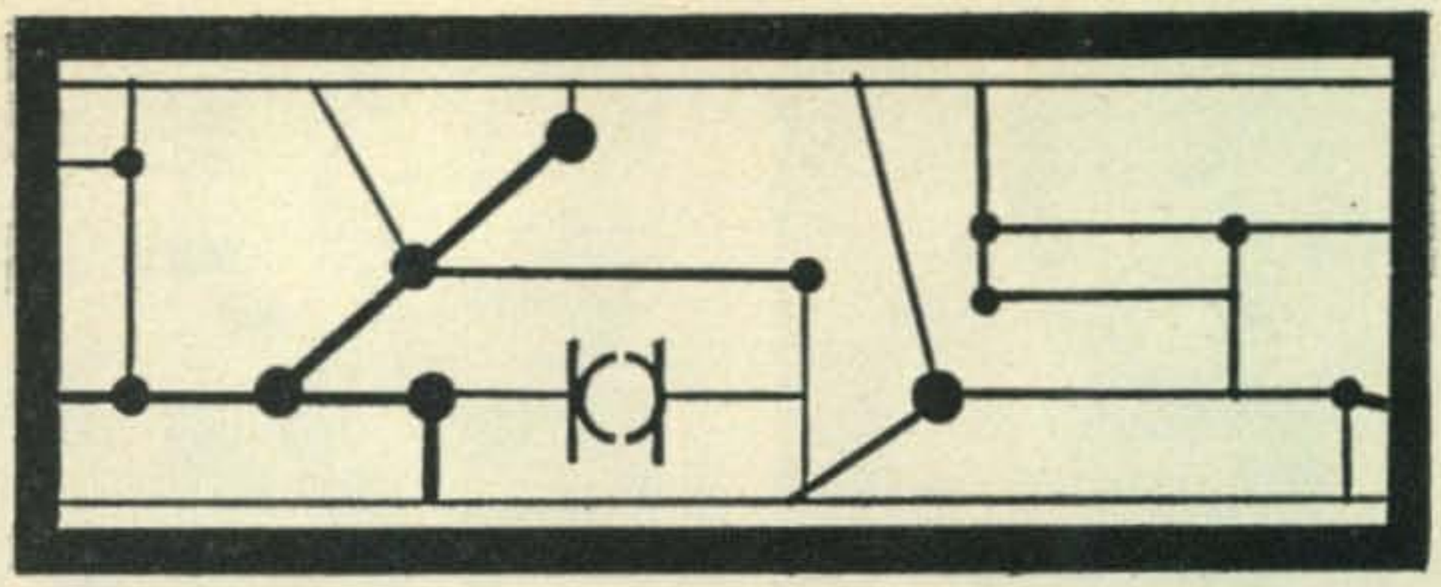
We are sorry to report that this will be the last Sideband column presented in *CQ*. After considerable thought, and owing to the fact that sideband has certainly "come of age," it is felt that a separate and distinct section devoted exclusively to sideband is no longer urgent.

We are indeed proud of our Sideband column and would like to think that it played an important part in popularizing the mode.

The *CQ* Sideband Honor Roll, Certificates and endorsements will continue! Separate listings will appear in the DX section and cards will be handled by the DX column editor.

No doubt a delay will occur in the transition from one columnist to another and we hope that those who have material pending will be patient.

NOVICE



WALTER G. BURDINE*, W8ZCV

As this issue of *CQ* is devoted to tools and construction of equipment, I have decided to present some of the ideas in use at W8ZCV's shack which have helped me to get the most from my low powered equipment. This is important when you run less than ten watts as I have done for the last four years.

First, get a good receiver or build the best converter that you can afford and hook it to your present receiver. You can't work them if you can't hear them. Almost any receiver will perform well if it has a good converter that is properly adjusted and installed and coupled to the best antenna that you can build. With this combination, almost any kind of receiver has adequate sensitivity and selectivity for all but the most exacting ham; additional features can be added later if necessary. Learn how to listen with your receiver, learn to adjust it correctly and keep it in operating condition at all times.

I had an SX-25 that never had the filaments turned off for four years until the lightning came in on the telephone lines and jumped to the receiver, blowing the switch into many small particles. The receiver was adequately grounded, however. I always fasten a small neon bulb (NE-22) across the antenna terminals to protect the antenna coil from transmitter overload or from static discharge voltages. And, of course we employ the usual lightning arrester. *Always ground station equipment to a good ground system.* This protects both the equipment and the operator.

Keep the inside of the receiver clean at all times—a film of grease-bearing scum can cause leakage paths that will impair receiver operation, causing lowered sensitivity. It really isn't much trouble to keep a receiver in good condition.

For me, there is no pleasure in ham radio like that of building a piece of radio equipment that looks neat and works well. The pride of accomplishment is well worth the effort expended in doing a job well. Getting the job done well takes a good deal of planning and preparation. I must admit that the manufactured equipment looks beautiful and works very well. It usually has good resale value and can often be bought and put in operation while the solder is still warm. But if trouble develops, it must go back to the factory or wait until a local jobber gets the parts from the factory. I have known this to take up to four months.

Home built equipment, on the other hand, can usually be repaired with parts on hand or easily obtainable at the local parts store. One is not afraid to use a substitute part for a repair, since it won't hurt the resale value. Even if parts are readily available the average ham won't attempt the repair of commercial equipment because he isn't as intimately acquainted with the equipment as he would be if he built it himself. Then, too, many hams do not have the necessary knowledge and patience to build their own equipment.

When starting to build a new item for my station I usually get all the parts together, put the small parts in one of those small, multi-compartment trays obtainable at the "five & ten" for holding silverware. The larger parts are assembled on one corner of the workbench and the diagrams and assorted papers put on a card table. If the diagram is large enough to work from, I place a glass cover over it to protect it from soiling and tearing. If the diagram is small and complicated, I re-draw it on a larger paper, put glass or heavy plastic over it, and as my project progresses, I trace the diagram for each item on the plastic covering. This way I can tell what parts have been wired and can keep tabs on the progress of the project. The plastic covering can be used for many projects; a damp cloth will remove the old schematic (I use a china marking grease pencil or just ordinary crayons).

Diagrams, ideas, modifications and parts lists along with the manufacturers part numbers of major components should be kept in a looseleaf notebook for future reference. Most of us think that we will always remember all about our equipment, but when need to repair the equipment occurs, we need all of this information. Large diagrams can be made on two or more sheets of notebook paper. Use only one side for diagrams so that the entire item can be used at once. Pertinent references to magazine articles on equipment should also be jotted down for future reference.

If an item is modified or rebuilt, be sure that a note is attached to the item for reference and keep a diagram in the note book for the future.

*R.F.D. 3, Waynesville, Ohio 45068

Again, as you are reading your magazines, you might note any article or item pertaining to your equipment; it is nice to be able to reach for the notebook and have the information at- hand when needed.

This idea has saved me much time and effort when building radio equipment both for myself and for the Air Force.

Chassis Layout

Preparation of the chassis for the new project is an important item. Much can be done at this point to make the wiring and assembly an easy task. Proper placement of parts will aid neatness and compact construction. Good tools, correct wire, solder lugs and tie points also are aids for neatness. Check over the solder lug assortments next time you are in the parts store and select some for your project. Those two-way L shaped lugs can be mounted on a single 6-32 bolt to effect a four way ground tie-point which can possibly be used for two stages. Be sure and use lock washers under the nuts holding the solder lugs. These lugs often have the lockwasher built in the lug. Multiple connection tie points are available in many sizes; the small ones are nice for soldering in the chassis if copper clad printed circuit board is used for the chassis.

Make templates for all large transformers and chokes. I make the template ⅛" larger on all sides than the transformer to allow for any in-accuracies in layout. Old tubes from which the pins have been removed or ground off can be used in layout to good effect. Place all large items on the chassis to visualize the entire unit as it will appear after construction.

After placement of parts has been decided, the drilling, socket punching, and cutting for the transformer mounting can be started. Leave the protective paper wrapping on the chassis while doing this work as it protects the new chassis from damage and fingerprints. After the drilling is complete remove the paper from the chassis, spray with acrylic spray and let the chassis dry. This thin coat of acrylic spray will provide a tough protective covering for the chassis that can be cleaned easily, and protects the chassis from fingerprints while handling and assembling the unit.

Tools for Chassis Cutting

The clamp type socket punches most needed for mounting the tube sockets are the 1-5/32" for octal sockets, ⅝" for 7 pin sockets and ¾" for 9 pin sockets. A 1" square socket punch is useful for making transformer cutouts, however a small hand tool known as a "nibbler" is available for this purpose and is invaluable for cutting large, odd shaped holes in chassis. A good center punch and a supply of files is needed. A set of drills and a small electric or hand drill is needed.

A round and a half-round file makes finishing large transformer cutout easier. Do not leave any rough edges around any of the holes as these can cause short circuits and detract from the appearance of the finished unit.

Soldering is covered elsewhere in this issue and therefore I will not say much about this very important subject except to say I always have at least two soldering irons for my soldering. The best motto is: *Keep it Clean.*

Some Random Construction Notes

The cheapest way to come by heavy wire for very high current filament circuits is to watch the sales of the large mail order houses for plastic covered Romex house wiring. You can often pick up a hundred feet of #14 wire for about $2.50. Split the protective covering and you have two nice heavy duty plastic covered wires for filament circuits and any other heavy duty wiring job at a very reasonable cost.

If you need shielded wire and can't find any that is large enough to carry the current, you can take the #14 wire and cover it with some shield sleeving by pushing it over the wire, and then pulling it back to tighten the shield.

Copper clad laminated printed circuit board material can be used for building up small circuits. A hole can then be cut in the main for the small circuit. I use this method of construction when experimenting with new circuits; you don't need to rebuild the entire unit. I mount the small circuit board with either 4-40 or 3-48 bolts.

When a coaxial feed-thru was needed to bring the lead-in through the wall of my shack and I could not get one long enough for the job, I made one by taking an SO-239 chassis connector, grinding the mounting ears off and fastening the two connectors together with a length of ½" copper tubing. They just match, and the two center connectors are connected by a length of #14 copper wire. Solder one connector before assembly and drill a hole in the copper pipe above the other connection so that you can solder it after the two SO-239 connectors are soldered on the ½" tubing. Use a large soldering iron and wrap Scotch insulating tape around the pipe after soldering all connections to keep out dirt and moisture. This works fine and the impedance match is good if carefully constructed.

Keeping Notes

A "magic slate," obtainable at the "five & ten," is a useful adjunct to my operating desk. If a question is asked, write it down, and after you've answered it, lift the top cover and you are ready for the next entry. They are very helpful on field day for keeping notes.

Well, its about time to close down the column this month. I hope that some of these ideas will help you to build a better station and operate it better. I hope that you can add to the enjoyment of your time on the air by using some of these ideas. If you need help and you write me the full particulars, I will put your name in the column. It *usually* gets results. Just write: Walter G. Burdine, R.F.D. #3, Waynesville, Ohio, 45068. I need some letters and pictures from you for our column; thank you for those in the past. Good luck and good DX.

73, Walt, W8ZCV

What Better Way?

EACH one of us is indebted, in one way or another, to one or more amateurs for kindness done and favors given over the past year. Maybe it was the fellow who ran a phone patch for you, possibly the fellow with whom you keep a sked, or maybe it's the op down the street who helped you put up the antenna.

WHAT better way to say "thanks" and wish your friends a Happy Holiday Season than by giving them a gift for each and every month of the coming year?

YES, a gift subscription to CQ *costs but $5 and will be a reminder of your thoughtfulness for each of the next 12 months.*

AN active ham, be he Novice, VHF'er, DX hound, traffic handler (in fact, if he is interested in any of the 1001 phases of Ham radio) will find CQ, *or one of our books, to be an invaluable aid in keeping abreast of our dynamic hobby.*

CHECK the Subscription envelope and rates on the opposite page. A handsome gift card, signed with your name and call will be sent with each gift book or subscription.

HAM CLINIC

CHARLES J. SCHAUERS*, W4VZO

THIS month we are devoting most of the column to questions received from readers. The questions chosen for publication are those which we believe will be of greatest interest to the majority who look forward to reading HAM CLINIC every month.

Again, we repeat (for the new HAM CLINIC reader), time does not permit us to do specific circuit design to order, nor will we loan instruction books, diagrams, etc. on commercial equipment—too many have been loaned and not returned. We ask that you confine your letter to one question. For a speedy answer (while I am in Europe), airmail your letter to me at my Switzerland QTH[1] and enclose two International Reply Coupons obtainable at any Post Office. If you can wait for a reply, then send your letters to me at *CQ*.

Answering readers' questions often entails a great deal of research and lots of time. As we have said before, being human we do make mistakes and do not claim technical infallibility.

The service we render through HAM CLINIC is free and your communications are treated confidentially. If you enjoy the column and want to see it continued, drop a card to the editor. Now for the questions and other information.

Questions

SB-10 for 6 Meters—"Tell me, what methods would you suggest to use the Health SB-10 s.s.b. adapter on 6 meters? Please, no major set 'butchering'."

A number of hams have used the 10 meter position in the SB-10 for 6 meter operation by trimming coils and r.f. phase-shift network adjustment (using smaller capacitance values). They then fed the SB-10 a 50 mc signal directly from a stable source.

Changing the r.f. phase-shift network *is* a job for 50 mc operation! As a starter, try substituting 55 mmf for the 110 mmf capacitors now used in the 10 meter position. If you still have trouble, then give some attention to the r.f. chokes used. A switch to v.h.f. chokes in the 10 meter position will help.

Another way would be to use the heterodyne converter described in the June 1963 issue of *CQ* by W9BUB. If you already have a good stable 64 mc signal source, you need use only the last stage of W9BUB's circuit, the 6JH8. However, remember that the SB-10 *was not* designed to hit 14.5 mc, the top injection frequency needed with the converter. You'll have to do a little coil pruning of the 20 meter coils in the SB-10 to reach 14.5 mc. W9BUB's scheme will work FB with the SB-10.

Those of you who have converted the SB-10 for 6 meter operation are requested to let us have the information so that we can pass it on via the column.

KWM-2 Relays—"I realize that even the most expensive relays can develop contact trouble through pitting and burning. I have been having some trouble with the pitting of relay contacts 12 and 13 on relay K_2 and contacts 15, 16 and 17 on relay K_4 in my KWM-2. My set is second hand and I do not receive service notes. Can you help me?"

Sure. To minimize the burning or pitting of the relay contacts mentioned, first disconnect the white, black, red and green colored wire and C_{170}, the 0.1 mf capacitor located at K_2, terminal 12. Next, disconnect and discard this wire from K_4, terminal 1. Then install a 100 ohm, ½ watt resistor in place of the wire just removed. Reconnect C_{170} to relay K_4, terminal 1. *Please note:* in later units, capacitor C_{170} will not be visible between K_2 and K_4; it will be located in the PA shield and attached to K_2, terminal 2. Capacitor C_{211}, will be deleted. Electrically, this will be the same as the above change. (Thank you Collins for your assistance on this one!)

SSB Monitor—"Having just swapped my a.m. gear for s.s.b., I am very anxious to make certain that I am putting out a good clean signal. Can you show me how to connect my scope for use with either a two-tone oscillator or voice modulation (constant monitor) so that I can tell when my final is overloaded and to check overall linearity?"

Yes. The best circuit I have used for the purposes you mention is shown in fig. 1. This circuit enables constant monitoring of a voice signal as well as short two-tones tests. The envelope detectors required can be constructed in a metal box if you remember to isolate each one.

*c/o *CQ*, 300 West 43rd St., New York, N.Y. 10036.
[1] Lutzelmatt Strasse, Luzern, Switzerland.

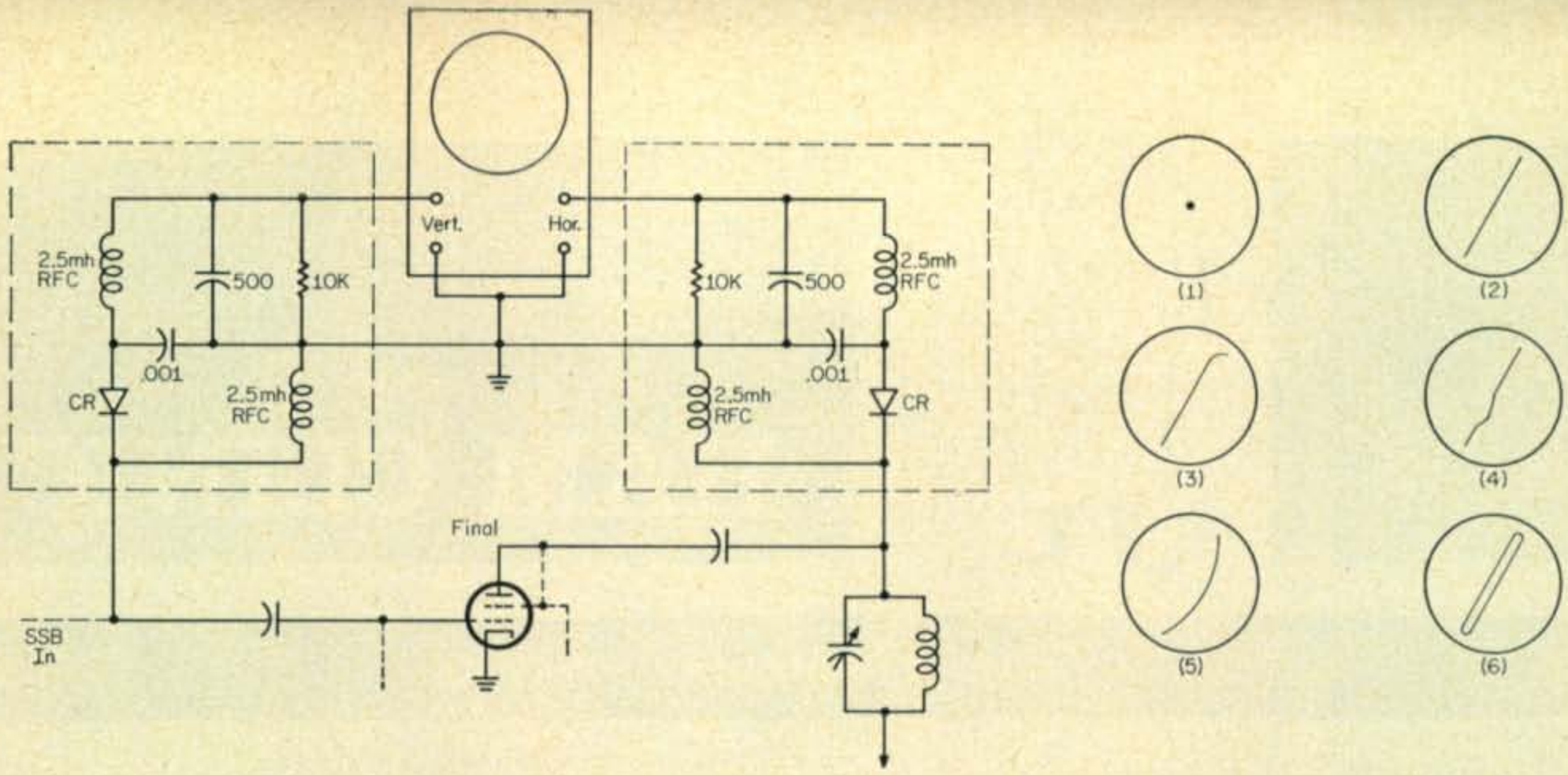


Fig. 1—S.s.b. monitoring by use of two envelope detectors shielded from each other. Diodes (CR) are matched RCA IN445Bs.

With the two-tone test your patterns, of course, will be more clearly defined, but with voice modulation you can still tell when your amplifier is flat-topping and perhaps putting out a distorted signal. Input to the horizontal section of the scope may be taken from any linear stage preceeding the final amplifier.

HX-50—"I have an HX-50 and love the little giant, but lately when I modulate it, I can hear a sputtering noise come from within the set. I have been getting on-the-air reports that something is wrong. Any hints?"

First check for r.f. arcing in the final—do this in the dark, looking for arcing within the final tube, the tank, *etc*. Also look for arcing in high voltage circuits due to close connections (sometimes due to vibration during transportation). If you can see nothing, then take a solid wooden stick (a short broom handle will do) and place it against the power transformer (the other end to your ear) and while modulating the set, check for an arcing noise within the transformer. Do this also with the filter capacitors. I found a bad filter capacitor this way in the TX-1 I once owned. Your address indicates to me that you live in a very high humidity area. If I were you, I would also check for possible corrosion of various parts which could cause arcing. I like the HX-50; it is a fine set.

KWM-2 R.F. Transient—"While checking out my KWM-2 I noted that sometimes an r.f. transient occurs in the output when the vox relay drops out. How can this be eliminated?"

My friend WØYZD suggests that this can be eliminated by installing a 100K ¼ watt resistor from K_2, terminal 5 (receive) to —70v. transmit-ground line.

HT-41 Driving—"I have a CE-20A exciter and want to drive my HT-41 to full output, but I am having trouble. Any help you can offer?"

Yes. Write Hallicrafters for form Nr. 094-903119. This errata sheet for the Model HT-41 gives the changes necessary to assure compatability with most available transmitter-exciter units. I have used the HT-41 with a number of drivers, including the old 10A and it performed beautifully.

NC-303 Changes—"Would you suggest replacing the tube rectifier in the NC-303 with selenium diodes? Further, how can I increase the intensity of the calibration signal from the crystal calibrator?"

To your first question, no, not unless you live in a real hot climate and have heat problems. To your second, all you need do to increase the calibration signal is to increase the value of C_2 in the crystal oscillator to 15 mmf. (See the next question).

Crystal Calibrator XCU-303 to 5 Mc—"I have an NC-303 (and wouldn't be without it), but I have a heck of a time picking up WWV on 10 mc at my location when the skip is on. Anything I can do to use the XCU-303 crystal calibrator on 5 mc?"

To modify the XCU-303 to allow it to bring in WWV at 5 mc, insert a 100 mmf ceramic capacitor across both the h.f.o. coil and the mixer coil of the XCU-303. Trim the mixer slug to 5 mc with the dial of the NC-303 set at the red WWV mark on the 40 meter range. Trim the HFO slug to 2070 kc. WWV on 5 mc should now be heard with good sensitivity. If you own an NC-300 and use the same calibrator, trim the mixer slug to 5 mc with the dial of the NC-300 set at 7070 kc. (Thanks National).

Valiant and S.S.B. Adaptor with One Mike—"How can I use one microphone with the Viking s.s.b. adaptor and the Valiant, so that I can merely switch the mike from one to the other from s.s.b. or a.m. operation?"

See fig. 2. Construct the switch in a small metal box containing a terminal strip and

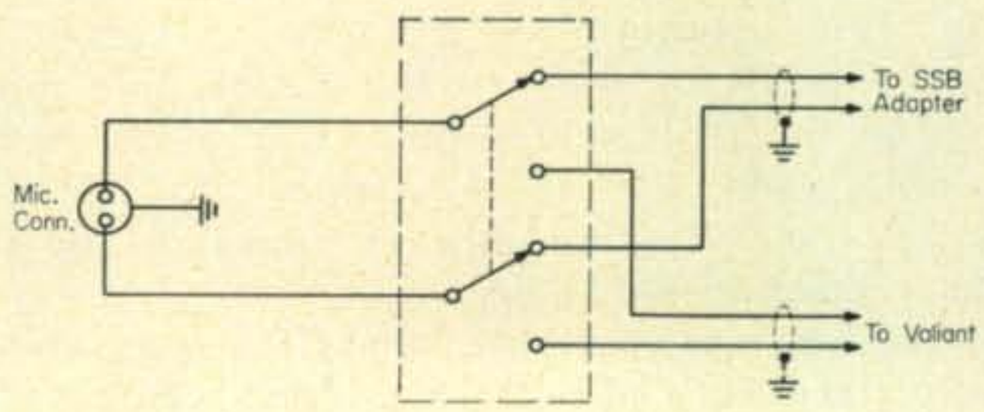


Fig. 2—Diagram showing switching necessary to use one mike with both the Valiant and Viking s.s.b. adapter.

another mike socket. The d.p.d.t. switch enables you to switch between the adaptor and the Valiant. (Thanks Johnson).

An Appeal for Hams-to-be—HAM CLINIC continues to receive requests from hams and hams-to-be from all over the world for *material* as well as technical assistance. From U.S. hams-to-be alone, who are not in a financial position to acquire radio parts, tools, books, etc., we have many letters requesting help. Some of the writers say that they do not have money for postage even if they were lucky enough to be offered help. Some of these hams-to-be are physically incapacitated and all they can offer in return for help rendered is a heartfelt "thank you."

So if there are any of you out there in "hamland" who have tools, miscellaneous small radio parts, books, ham publications, code practice oscillators, *etc.*, let us know and we'll send you the name of a needy U.S. ham-to-be. Upon receiving the name if you do not wish to or cannot pay postage, query the aspiring ham first.

When the U.S. list is exhausted, we'll then send the names of needy foreign hams or hams-to-be.

Thanks a billion!

Gonset G-66—"If I use headphones I can use my G-66, but the speaker will not operate. What could be the trouble?"

First, check to make sure that your speaker is connected to pins 3 and 7 of the socket SOC_1. If so and it still does not operate, then remove the connections of the speaker and check with an ohmmeter across pins 3 and 7. If there is no reading, the output transformer secondary is open. If there is a reading, then check the primary of the same transformer (T_7). Check to make sure that C_{27} is not shorted.

Swan 240—"How about changing the 6DQ5 final in the Swan 240 to a pair of 6146s? Wouldn't overall efficiency be improved?"

No. Furthermore, where would you install the additional tubes? Leave well enough alone. This set is getting fine reports.

Log Periodic Limit—"In a log periodic antenna (such as is made by Collins), when is the high frequency limit reached?"

When the shortest transverse element is approximately ⅜ wavelength long.

Zero Bias Triode—"I am thinking about building a linear final and want to use a good zero bias triode tube to get away from screen voltage, bias, *etc.* Would you recommend one to me that will give me about 500 watts input?"

Why not try the UE752A? Two of these tubes will give you a kw input. Although it can be used to replace the 811A, it has twice the power handling capability. Write United Electronics Co. and ask for their bulletin on this tube. Their address: 42 Spring St., Newark 4, N. J. (Tell 'em *CQ*'s HAM CLINIC sent you!)

TBY to 6 Meters—"Please give me a reference to converting the TBY surplus receiver-transmitter to 6 meters?"

Obtain a copy of the September 1957 issue of *CQ*. ($1.00 from *CQ*).

SCR-522 to 2 Meters S.S.B.—"In what issue of *CQ* did modification of the SCR-522 to 2 meter s.s.b. appear?"

It didn't. It was in *QST* for November 1956.

BC-375 for a Linear—"I have a lot of BC-375 and command set parts around and I have heard that an article appeared in *CQ* describing the construction of a bandswitching linear using them. What issue?"

May 1961. This is a 400 watt linear and a good one.

RCA 7580 for V.H.F. Linear—"Please recommend a good tube for use on 220 mc which will handle at least 700 watts p.e.p. output and has a plate dissipation of around 250 watts. It must have a 6 volt filament and I do not mind cooling it."

Certainly. I recommend the RCA 7580. It is of ceramic-metal construction, a beam power tube and provides good power output at lower plate voltages. If your dealer does not have one, try Allied Radio, Chicago. The tube can be obtained from them for $45.05.

Drake 2B—"What's a fair price for the Drake 2B receiver (used)?"

$200. It is a fine set.

Lafayette Converter—"What do you consider a 'bargain' two meter converter today? I'll spend up to $35.00."

The best one for the price range you're hitting for is Lafayette Radio's HE-71 for $32.95. It contains its own power supply, has an antenna input Z of 52 ohms, very high sensitivity, a 7-11 mc output and is crystal controlled. A recommended buy.

Book Review—If you are a Collins fan (and many hams are), you'll want to obtain a copy of their new s.s.b. book titled "Amateur Single Sideband." This 143 page book with seven chapters covers everything from the history of s.s.b. to station considerations. Edited by Stuart E. Bonney with effort contributed by five other hams, the book is bound in a hard cover and sells for $4.00 at Collins Distributors. It is recommended reading for those who want to "get their feet wet" on s.s.b. as well as the oldtimer. The chapter that *I* liked best was chapter IV devoted to r.f. linear amplifiers. The Collins "boys" covered the subject in a very fine manner. Well done!

Thirty

We here in Europe will also celebrate Thanksgiving—that is, the Americans will. This is the time of the year when we would rather be home, but there are thousands of us who must be here. We who are overseas wish you back in our land of the free and the brave, a very happy and bountiful Thanksgiving!

73 and 75, Chuck

The United States Of America Counties Award

RULES and PROGRAM

The United States of America Counties Award sponsored by **CQ**, is issued for confirmed contacts with specified numbers of U.S. counties under Rules and conditions hereafter stated.

A. Awards Classes

The USA-CA is issued in seven (7) different classes, each a separate achievement as endorsed on the basic certificate by use of special seals for higher class. Also, special endorsements will be made for all one band or mode operations subject to the rules.

Class	Counties Required	States Required
USA-500	500	any
USA-1000	1000	25
USA-1500	1500	45
USA-2000	2000	50
USA-2500	2500	50
USA-3000	3000	50

USA-3079-CA for ALL counties and Special Honors Plaque

B. Conditions:

1—USA-CA is available to all licensed amateurs everywhere in the world and is issued to them as individuals for all county contacts made, regardless of calls held, opertaing QTHs or dates whatever.

Special USA-CA's also available to s.w.l.'s on a heard basis.

2—All contacts must be confirmed by QSL and such QSLs must be in one's possession for identification by certification officials.

3—Any QSL card found to be altered in any way disqualifies applicant.

C. County Identity:

1—The Directory of Post Offices (P.O.D. Publication #26) will be the official guide in determining identity of counties of contact as ascertained by name of nearest municipality. It is suggested a copy of P.O.D. Publication #26 be obtained to facilitate operating reference and precheck cards for application purpose. Publication #26 is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Price $2.50)

2—Unless otherwise indicated on QSL cards, the QTH printed on cards will determine county identity.

3—For mobile and portable operations the postmark shall identify the county unless information stated on QSL cards make other positive identity. When in doubt of location, mobile stations should name the nearest municipality as identified by road sign or road map.

4—In the case of Cities, Parks or Reservations not within counties proper, applicants may claim any one of adjoining counties for credit.

D. Administration of USA-CA Program:

1—The USA-CA program will be administered by a **CQ** staff member acting as USA-CA Custodian, and all applications and related correspondence should be sent direct to him at his QTH.

2—Decisions of the Custodian in administering these Rules and their interpretation including future amendments are final.

E. Record Book and Bookkeeping:

1—The scope of USA-CA makes it mandatory that special Record Books be used for application. For this purpose, **CQ** has provided a 108 page, 8½ × 11" Record Book which contains application, and certification forms, a USA county map, maps of each of the 50 U.S. States showing county outline, and which provides record-log space meeting the conditions of any Class award and/or endorsement requested.

2—A completed USA-CA Record Book constitutes medium of basic application and becomes the property of **CQ** for record purposes. On subsequent applications for either higher classes or for special endorsements, applicant may use additional Record Books to list required data or may make up own alphabetical lists conforming to requirements. In this connection, through a printer's bust, the Record books left out the column for naming Cities/Towns, mandatory to validate County identity, so it is suggested that the time/date column be renamed and used for this purpose.

3—Record Books are to be obtained directly from **CQ**, 300 West 43rd Street, New York 36, N.Y. for $1.25 each. Recommend two be obtained, one for application use and one for personal file copy.

F. Application:

1—Make Record Book entries necessary for county identity and enter other log data necessary to satisfy any special endorsements (band-mode) requested. It is mandatory that Cities and Towns or other specific location be named.

2—Complete application forms provided in Record Book, or, if preparing own lists for later applications, use special application forms available from the Custodian for s.a.s.e. or 1 IRC.

3—Have the certification form provided signed by two licensed amateurs (General Class or higher) or an official of a national-level radio organization or affiliated club, verifying that QSL cards for all contacts as listed have been seen. The USA-CA Custodian reserves the right to request any specific cards to satisfy any doubt whatever. In such cases applicant should send sufficient postage for return of cards by registered mail.

4—Send original completed Record Book and certification forms and handling fee of $1.00 U.S. or 10 IRC's to USA-CA Custodian, Clif Evans, K6BX, Box 385, Bonita, California 92002. For later applications for higher class seals, send either Record Book or self prepared list per the rules and 25¢ or 3 IRC's handling charge. For application for later special endorsements (Band/Mode) where certificates must be returned for endorsement, send certificate and 50¢ or 5 IRC's for handling charges. Note: At the time any USA-CA award certificate is being processed there are no charges other than the basic fee regardless of number of endorsements or seals; likewise, the Directory's "Top Class Rule" prevails and one may skip lower classes of USA-CA and get higher classes without losing any lower awards credits or paying any fee for them.

the USA-CA PROGRAM

CLIF EVANS*, K6BX

Fifteen USA-CA-500 Awards were mailed in August along with special endorsement to two others. Endorsements on the following included nine for mixed operations; one all 7 mc; one, all 7mc c.w.; one, all 14 mc; one all 14 mc c.w.; and three all phone. The complete USA-CA Honor Roll given this issue includes the winners, 258 through 272.

In order to bring you the USA-CA Honor Roll and complete USA-CA Rules in November, we will cut other column copy short in this issue.

USA-CA HONOR ROLL

K4PXY	258	K9UTI	263	VE7HJ	268
WA6KNE	259	KØTKQ	264	KØFIK	269
K3QVV	260	K8PFX	265	K7KHA	270
K5IML/Ø	262	K4IEX	266	W5AKR	271
YV5ACP	262	K4MPE	267	G8PL	272

QRP Club Tops 1000 Members

The QRP Amateur Radio Club (international) in two short years has over 1,000 members who advocate and restrict own use to low power operations. The QRP A.R.C. does not, however, advocate reductions of power limits established by any country. The QRP A.R.C. is simply devoted to the challenge and enjoyment of amateur radio through more efficient, courteous and proper operation on low power. Members who exceed 100 watts input power on c.w. and a.m. or 200 watts p.e.p., are automatically dropped from QRP rolls.

The QRP Club currently sponsors five awards for operating achievements; holds informal QSO parties monthly; and an annual world-wide QSO Party. In this way the QRP gang hopes to encourage more enjoyment of the hobby through *voluntary* power limitations. The QRP A.R.C.'s awards program is as follows:

QRP-25 For working 25 members. Endorsements for 50, 100, 200, etc. No limitations. No endorsements otherwise. Members must have been running "QRP" (100 watts or less c.w./a.m. or 200 watts p.e.p., s.s.b.) at time of QSO. Send log data and either power input or QRP member number with $1 or 7 IRCs to Bill H. Thompson, P.O. Box 425, Scooba, Miss. Endorsements free for s.a.s.e.

DXCC/QRP For confirmed contacts with 100 QRP stations as defined above in 100 different countries. Power or QRP rig must be shown on QSLs and application. Apply as above but with certified (GCR) list, $1 or 7 IRC. Endorsement for two-way QRP being used.

WAC/QRP For two-way QRP confirmed contacts with each of the six continents. Apply as above with GCR list and statement of your power used for all contacts.

Here is the WAS-QRP award sponsored by the QRP Amateur Radio Club now with over 1000 members. See text for information on this and four other awards sponsored by the club.

*United States of America Counties Award Custodian, Box 385, Bonita, California 92002

Pictured here is Military Air Transport Service VC-137 in which Senator Barry Goldwater, possibly set a few aeronautical mobile records. Actually the picture is one side of the special QSL cards Barry used for the operation. On August 22nd, while flying in Air Force 86970 from Andrews Air Force Base to Marietta, Georgia, and return, Barry made 69 contacts which included all call areas but two, 26 states, and stations in Costa Rica, Labrador and Newfoundland. Barry also worked a half dozen mobiles and three maritime mobiles ranging from Caribbean to off Nova Scotia. He says the most surprising QSO was a roundtable with himself aeromobile between a land mobile and a ship mobile.


UNITED STATES OF AMERICA
COUNTY AWARD
BY CQ
THE RADIO AMATEUR'S JOURNAL
Be it known to all those present, that on this day _____
has provided satisfactory evidence in communicating with five-hundred or more different counties of the United States of America, with special Band/Mode endorsements affixed hereto.
Endorsements
Certificate no. _____
Date _____
USA-CA Custodian
2500 COUNTIES
2000 COUNTIES
1000 COUNTIES
1500 COUNTIES
3000 COUNTIES

In February, we gave you details of the Worked Indiana Counties Award sponsored by the Indiana CHC Chapter 11 along with two other awards . . . here is the County Award. For details on these and other world-wide awards, send s.a.s.e. to K6BX for information.

WAS/QRP For two-way QRP confirmed contacts with each of the 50 U.S. states. Apply as above with GCR list, $1 or 7 IRC and statement of your power used for all contacts. NOTE: Only QRP-25 requires that members be worked; any low power station acceptable for others.

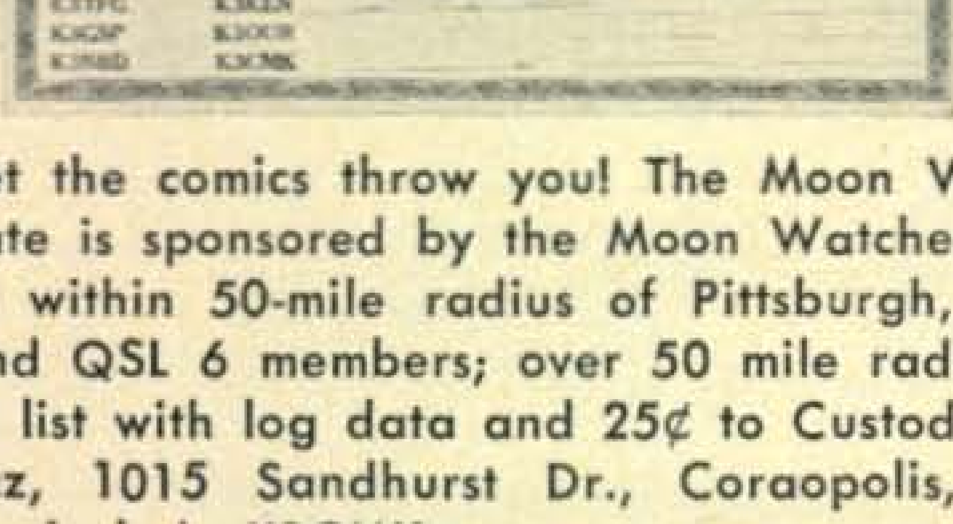
QRP-10 VHF For working 10 members, five of which were worked on skip or further than 200 miles from QTH. Send list, 25¢ or 2 IRC with full log data as above.

For information about QRP membership or an up-to-date members list, send s.a.s.e. to Jim Perry, K4WVX, 2691 56th St., No., St. Petersburg, Fla. 33710.

See picture of WAS—QRP Award.

Low Power vs High Power and The Public Interest

In recent months much attention has been focused upon FCC Section 12.0 which sets forth five basic purposes through which amateur radio serves the public interest. As might be expected special-interest groups and even our League have placed their own emphasis upon certain specific stated purposes and somewhat ignored the merits of others.



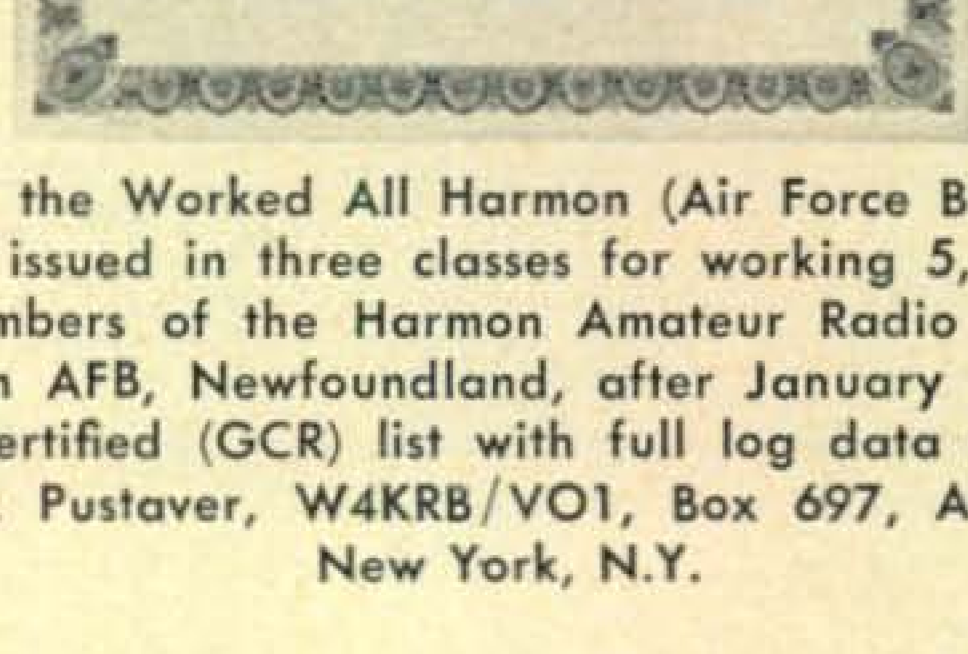
Don't let the comics throw you! The Moon Watcher's Certificate is sponsored by the Moon Watcher's Club. Stations within 50-mile radius of Pittsburgh, Penna., work and QSL 6 members; over 50 mile radius work 4. Send list with log data and 25¢ to Custodian, Bob Silwanicz, 1015 Sandhurst Dr., Coraopolis, Penna. Members include K3CMK, GSP, KEN, NBD, OIE, OUR, PJH, QQQ, SBP, TFG, TJO; W3GBE, GQJ, LBH, UFR; WA8BBF, BBG.

This is the colorful Colorado Counties Award sponsored by the Colorado YLs Club for working Colorado Counties in five classes: (1st figure is for U.S., Canada & Mexico; 2nd figure is for all others) Class A, 63/63 Counties; Class B, 55/40; Class C, 45/30; Class D, 30/20; and Class E, 15/10 different counties, all after WWII. Send certified (GCR) list, log data and 50¢ (DX stations send 2 IRC) to Custodian, Marte Wessel, KØEPE, 1635 Tamarac St., Denver, Colorado. For seals B, C, D and endorsements, send s.a.s.e. only.

Every so often some special interest group grasps upon the idea that a possible cure to crowded bands might be found in forcing all to restrict power below 100 or 200 watts input. Present FCC Regulations stipulate 1 kw (2000 watts p.e.p. s.s.b.) input power limits with provision that minimum power below 1 kw should be used commensurate with successful communications. Whatever the merits of the advocates of low power may be, such merits are hinged solely upon opinions and desires in the area that amateur radio exists only to satisfy personal needs and wholly ignore the public interest aspects envolved. Let's explore a few public interest factors.

If one understands and accepts the premise that amateur radio exists primarily because it provides a vast man-power training institution; contributes in a major way to the art and science of communications and design engineering, and goodwill communications . . . all leading to major contribution to the public interest through industrial and economic healthy growth, then one will immediately have to label any movement to restrict maximum power below the present

[Continued on page 152]



Here is the Worked All Harmon (Air Force Base) certificate issued in three classes for working 5, 10 and 15 members of the Harmon Amateur Radio Club at Harmon AFB, Newfoundland, after January 1, 1963. Send certified (GCR) list with full log data and 25¢ to Rick Pustaver, W4KRB/VO1, Box 697, APO 864, New York, N.Y.

RTTY

BYRON H. KRETZMAN*, W2JTP

RTTY Operating Frequencies

Nets centered on frequencies given; operation usually ± 10 kc on h.f.

80 meters	3620 kc
40 meters	7040 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.60 mc
2 meters	146.70 mc

FREQUENCY shifting a commercially built "amateur" transmitter for radioteletype seems to be a continual problem, if the contents of our mailbag are any indication. Our recommendation that you write to the manufacturer apparently is a little less than satisfactory. Either the hapless owner of one of those shiny, chrome-plated, s.s.b. transmitters gets no answer at all; gets told that it is "not practical" to f.s.k. the device, or gets sent a circuit that requires some real digging-in (might ruin the resale value) and/or which is clumsy to use.

We won't go into the reasons why these manufacturers don't build-in RTTY in the first place. (Notable exception: Hammarlund). We can't understand them anyway, as the additional parts required wouldn't cost them even one dollar.

*431 Woodbury Road, Huntington, N.Y. 11743.

The "Mainline" FSK-E System

Irv Hoff, K8DKC, of Ann Arbor, Michigan, has come up with a type of f.s.k. that is so simple that it can easily be installed in nearly any kind of transmitter using a Clapp oscillator and which no doubt could be slightly modified to install in most other kinds as well. The heart of Irv's system is a little keyer consisting of only three parts: a ceramic variable capacitor, an r.f. choke and a diode. Such a keyer can be built in ten minutes and installed in ten seconds. No "modification" is required of any transmitter—the worst you might have to do is drill a 5/32" hole; however, most transmitters have screws handy in the area of the v.f.o. which can be used to mount one or two of the keyers.

Figure 1 shows the schematic diagram of K8DKC's f.s.k. system. It was designed to work primarily with the type of terminal unit (TU) or converter that has a high current pentode tube, like a 6W6GT, 6Y6GT, *etc.*, with the Teletype machine receiving selector magnets and the keyboard all in series with the 120 volt "loop" supply. (*RTTY*, Jan. '63, page 3). It can also be used with a TU that has polar relay output. Instead of the circuit going from the machine to the tube V_1, it would go through the polar relay contacts to ground. For the usual loop supply of 120 volts, R_1 would be 6000 ohms,

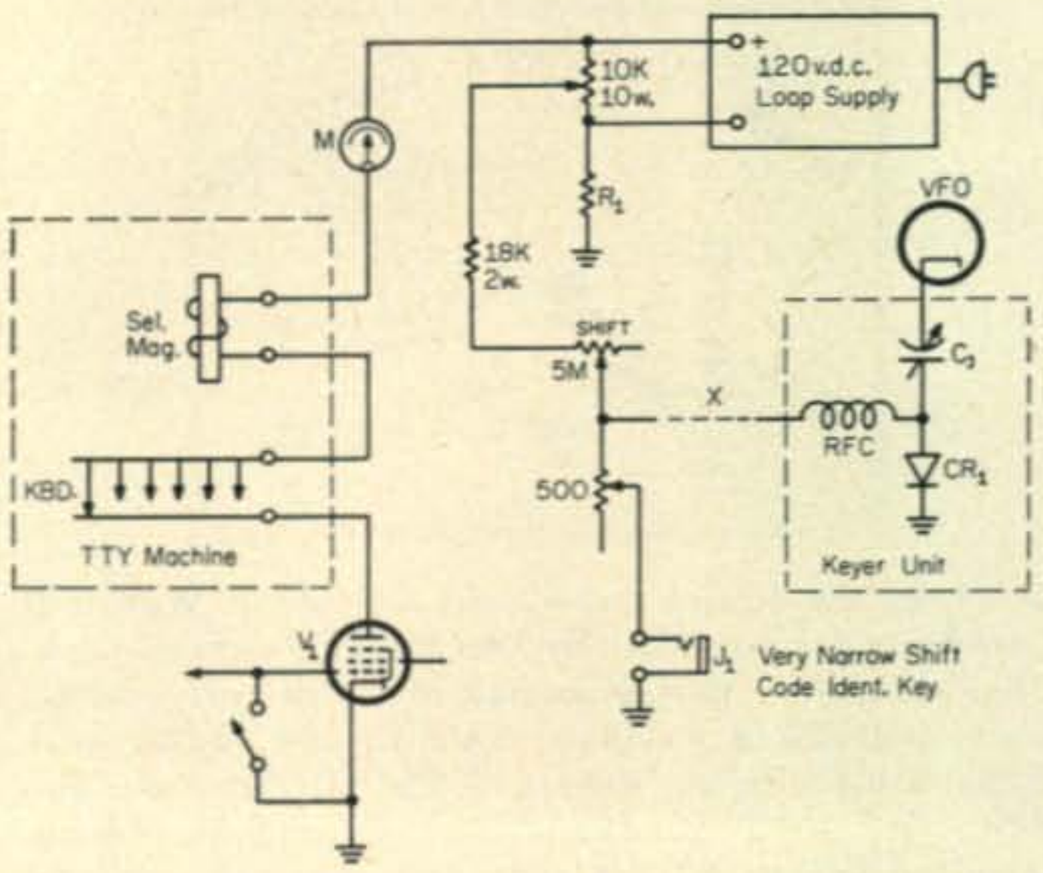


Fig. 1—FSK-E shift system of K8DKC, schematic diagram.

RTTY The Hard Way...No. 26

"John is burned up because he just spent $500 for a low-drift receiver and now he has to spend all his time retuning because everyone else is off frequency."

10 watts, for a 20 ma loop, and 2000 ohms, 20 watts, for a 60 ma loop.

Irv installed two keyers in his HT-32A. One is used at the top end of the v.f.o. to get 850 cycle shift on 20 and 15 meters and has the diode CR_1 connected to conduct on *space*, as shown in the diagram. The other is used at the bottom end of the v.f.o. to get 850 cycle shift on 80 and 40 meters and has the diode reversed to conduct on *mark*. Since these keyers take up so little space, others have been installed to provide 170 and 85 cycle shift. Switching is done simply at the point "X" in the diagram. For the Collins S-Line, the diode is installed in the reverse position, and only one keyer is needed to get 850 cycle shift on any band. Note, too, that very narrow shift is built in especially for the purpose of dual identification by International Morse Code, as still required by the FCC.

Construction

Each keyer is built on a 4-terminal tie point strip such as the Cinch-Jones #53F. The 1.5 to 7 mmf variable capacitor C_1 is an Erie #557-10R. The 2.5 mh r.f. choke is miniature, such as the National R-50. The diode can be most any type, such as the 1N297, 1N100, 1N34A, *etc.* The strip should be installed so that a reasonably short wire connection can be made from the capacitor C_1 to the cathode pin of the v.f.o. Actual connection could be made by using a socket adapter, or simply by wrapping a wire around the tube pin. Shielded wiring to the TU is not required, by the way.

Adjustment

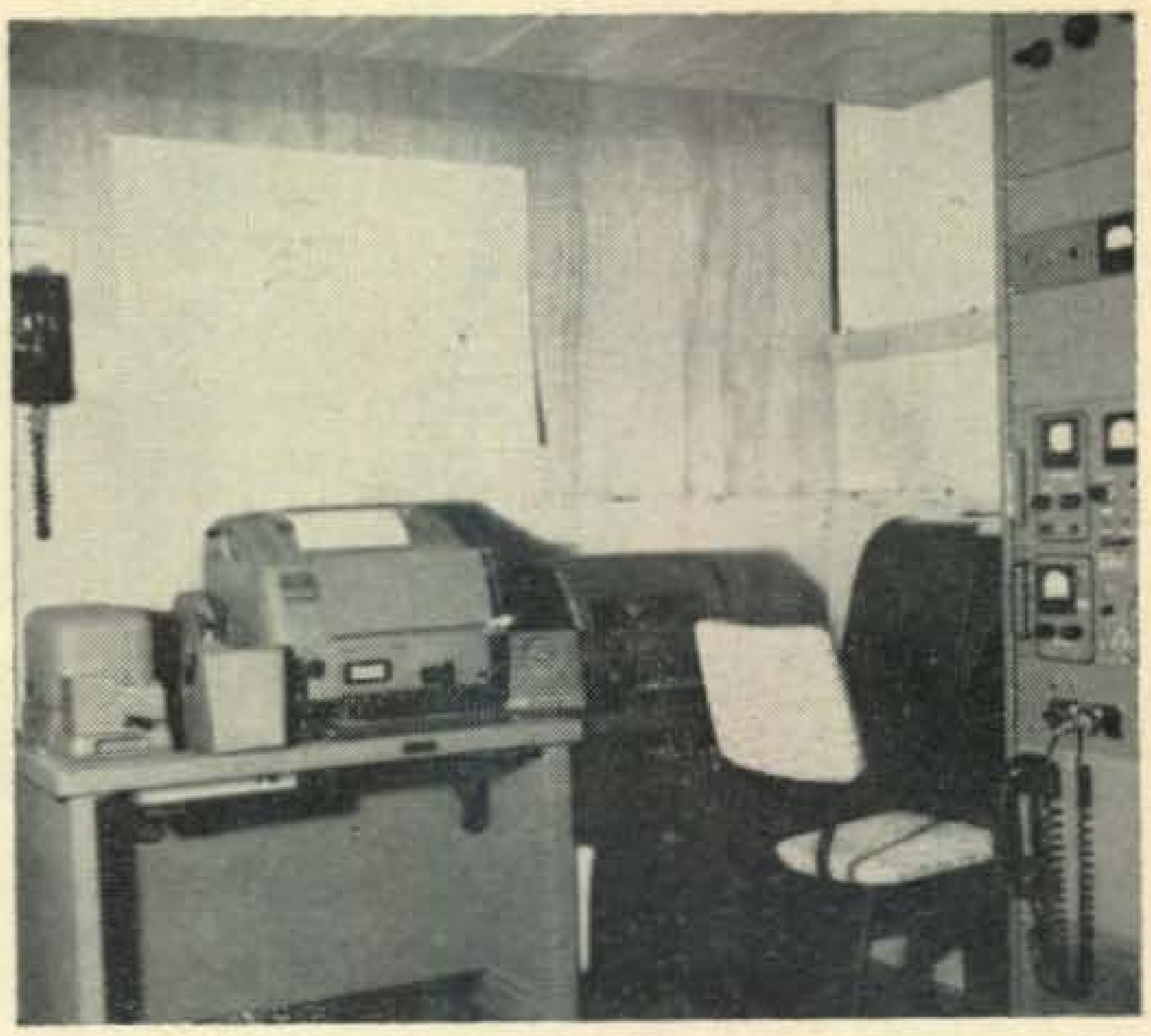
All initial adjustments are made with the SHIFT pot at minimum resistance, and by adjusting C_1 to get the desired shift for that particular keyer. The SHIFT pot is then used for other bands where other v.f.o. multiplication factors might be used; and, for experiments with other odd values of narrow shift. The tap on the 10K ohm 10 watt resistor across the output of the loop supply is set so that the current through the diode is in the order of 3 to 10 ma. It will be a pleasant surprise to find that the v.f.o. stands still on *mark*, and that it is the *space* that is varied by the pot.

A telegraph key plugged into the jack permits dual identification by means of very narrow shift. The actual amount of shift for this purpose is unimportant and is usually set to about 25 to 50 cycles with the 500 ohm pot and the key closed. (Note that this key circuit is normally open.)

For further comments from Irv on shifting Collins and Hallicrafter transmitters, refer to *RTTY* April, May, and June 1963. (*RTTY* is the monthly bulletin of the RTTY Society of So. Calif.; $3 per year via W6AEE).

On the Bauds

K3RLR/1 at Caswell, Maine, is on with a Model 19, a CV-182, a 51J-3, and a Viking II.



W8DTY at Ann Arbor, Michigan, station of Ed Bruning. Note W2JAV TU *(RTTY Handbook,* page 98) and similarly styled patching and control unit. Operation is largely on 146.94 mc f.m. phone and 145.350 mc a.f.s.k./phone on f.m. A Marauder and GPR-90 are coming up on h.f.

Tom reports KØARN/1 at Presque Isle on with Models 15, 19, and 28, KWS and 75A-4; KØKPU/1 at Bucks Harbor operating K1FDG with a Kleinschmidt and looking for an i.f. TU for 455 kc; K1FCF at Loring Air Force Base going RTTY with a Model 15, a CV-31 TU, and an SP-600 receiver. WA2HWJ of Huntington, N.Y., is on 80 as is WA2ZSA of Woodcliff Lake, N.J., both running low power, 60-75 watts. K2YGL of New Hyde Park, N.Y., fills in as acting NCS on the East Coast F-1 Net which meets on 3620 kc Wednesday evenings at 8 P.M. K3LLI of North Wales, Pa., is on 20.

W4ISM of Vienna, Va., sent us copy of their efficient State net operation. W4AIS of Taylors, S.C., heard on 20 in a 3-way with W1MQT/VO1 and DL3IR. K4QVD of Melbourne, Fla., is working up a new shack. W5JWP of Hearne, Texas, is looking for a technical manual on the CV-57/URR. *(Try Propagation Products, Box 242, Jacksonville, Fla., and the Technical Manuals Co., 515 LaFayette St., Utica 4, N.Y.)* WA5DXP of New Orleans, La., is on 20 meters.

On August 16th, Maribel, XYL of Buck W6VPC (RTTY Column, July '63), passed away. NCARTS and all deeply feel a sense of loss. WA6SZV of Daly City, Calif., is looking for a Model 12 for budgetary reasons. *(A Model 12 is too noisy for h.f., Tom; we suggest a Model 26.)* K7VTY (WØWHE) of Phoenix uses a CV-57 converter with an SX-100 by means of a home-brew mixer, 50 kc in and 455 kc out.

W8DTY of Ann Arbor, Mich., has developed a simple automatic carriage return and line feed system for the Model 15. (*Watch for an article on it in CQ*). K8WTE of Alliance, Ohio, is looking for a manual on the Model 15. W9ILN of Milledgeville, Ill., has acquired a Model 14 strip printer and is building the W2JAV TU (*RTTY Handbook*, page 97).

[*Continued on page 138*]

YL

LOUISA B. SANDO*, W5RZJ

CONGRATULATIONS to the newly elected officers of the Young Ladies Radio League who will take up their duties on January 1, 1964. President Blanche Randles, K1IZT, is already well known to YLs as V.P. of YLRL during 1963 and secretary in '61 and '62. Licensed in '54, she is certificate custodian for WRONE, and meets all the YL nets time allows. Her OM, Wes, is K1HTK and they have one daughter, Diane. Blanche is Mother Advisor for Rainbow Girls and Assoc. Conductress in her Eastern Star chapter. (See photo Nov. '62 *CQ*, p. 87).

Vice President Martha Edwards, W6QYL, served YLRL as advertising chairman for three years and has been 6th D/C during 1963. Licensed in '53, she and OM Noel, W6RQD, met over the air. While they were in Lebanon in '58, Martha operated as OD5CH. She enjoys the YL nets and skeds on 75 s.s.b. During this past year Martha has held elective offices in five different women's groups, including corres. secretary of L.A. YLRC and publishing that club's monthly bulletin. All this will soon change for Martha and Noel who are now the proud parents of Paul Charles Edwards, born Aug. 6, and introduced at the tender age of 5 days to the L.A. YLs at the club's annual picnic.

Secretary Fran Bailey, K7RMX, was re-elected to that post, having served as secretary in '63.

*4417 Eleventh St. N.W., Albuquerque, New Mexico 87107.

Sue Pierce, K5SBN, displays her HYLH certificate No. 1, awarded by YL CHC Chap. No. 4.

YLRL's vice president for 1964, Martha Edwards, W6QYL, holds 22-day old son Paul, adopted by Martha and OM Noel, W6RQD, at age of 3 days.

Licensed in '60, she is a member of Portland Roses and active in the YL nets. Her OM, Doc, is K7LDK and they have two jr. ops.

Treasurer Shirley Rex, K8MZT, also was re-elected to her post. Licensed in 1960, she is very active and is a member of Chix-on-Six and Buckeye Belles and is chairman for YLRL's 25th Anniversary Convention to be held in Columbus, Ohio, in June '64. Shirley's OM, Chuck, is K8MZS, and they have a son and two granddaughters.

District Chairman for YLRL during 1964 will be: K1OLM, Joyce Garlick; WA2GPT, Bea Dietz; W3GTC, Carolyn Currens; W4TVT, Claire Bardon; W5ZPD, Cindy Dougharty; W6BDE, Esther Given; KH6DUM, Hattie Bloomer; K7RAM, Bobbie Wilson; K8LHF, Marion Allen; K9ILK, Fran Yelch; KØWZN, Annabelle Meck. DC's for KL7 and VE to be appointed.

K5SBN

With new certificates constantly becoming available, there's always a chance for someone to be "number one." Sue Pierce, K5SBN, of Cut Off, La., holds Hunt the YL Hunters certificate No. 1, which she earned for being the first to

Alice Nelson, K8MQB, proudly displays the proclamation signed by Gov. W. W. Barron and awarded to her as 1963's Most Outstanding Amateur in West Virginia. She was approved for the award by a committee of the State Radio Council for her untiring efforts on behalf of other ham operators in W. Va. Alice has been YLRL 8th D/C during '63 and a member of the nominating committee, and has served as secretary of the Kanawha R.C. She holds CHC and is a member of YL Chap. 4 CHC and International SSB'ers. Photo by K8HGM.

work 25 members of YL CHC Chap. No. 4. Sue says it was "pure luck," but she is very active on the air, having earned over 60 certificates. She also loves contests and in the last *CQ* WW DX Contest was runner-up for the U.S. on 10 meters.

Sue got her General in 1959, having been a Novice for 6 months prior to that. Her interest in radio was whetted by winning a "Disc Jockey for a Day" contest as a teenager in New Orleans. She applied for a job at a station in a nearby town and was given a show on Sunday afternoons, to do with as she liked. Sue says she chose to play classical music from the huge record library and claims her audience was a very loyal one—consisting of her mother, father and grandmother!

Then Sue met two hams who taught her code and theory. Broadcast radio seemed "pale" after the excitement of having someone "talk back," so she gave up the show and settled down to teaching piano and hamming. Ragchewing is Sue's first love, especially with DX in Latin America and the K5SBN beam stays pointed toward S.A. most of the time. She says they are most patient with her Spanish, and she finds it good practice. Her favorite bands are 10 and 15 meters.

Contests

Just a reminder—phone section of YLRL's 24th Anniversary Party to be held Nov. 6-7; rules in Oct. *CQ*.

Also, the c.w. section of the *CQ* WW DX Contest will be held Nov. 23-24; details in Sept. *CQ*.

Colorado YLs

Taking office in July for the Colorado YLs were: Pres. KØRGU, Tillie; V.P., KØRXK, Lola; treas., KØBTV, Kay; secy, KØEPE, Marte.

Gifts, Anyone?

Once again it's getting toward the time of year for that perennial question: *What* shall I get the OM (or YF)? Still a good answer, we think, is a copy of the one and only book about the YLs—*CQ YL*. It contains 18 chapters, over 500 photographs, and covers all phases of YL participation in ham radio. Order from this column editor, QTH above, $3, postage paid. *CQ YL* also makes a fine gift for DX friend or "adoptee."

33, W5RZJ

YL NETS

Day	*Time (EST)*	*Freq. (mc)*	*Name*	*NCS or Mgr.*
Mon.	0830	3.900	Buckeye Belles Phone	K8MZT
	0900	3.920	U. P. Mich YL	Rotates
	1100	7.235	Loaded Clothes Line	K7WVT
	1300	50.4	IMPS	K9YIC
	1430	3.737	Buckeye Belle c.w.	K8TFG
	1800	3.890	Oregon YL's	W7HHH
3rd Mon.	2130	146.502	Jersey Tomaters	Rotates
Tues.	0830	3.900	Blue Ridge	K4CZP
	0830	3.940	Jayhawker	KØHEU
	0900	51.3	Buckeye Belle	Rotates
	0900	145.260	Buckeye Belle	K8WDZ
	0900	3.933	Floridora YL SSB	Rotates
	1000	50.33	Floridora YL Southern	W4VSG
	1300	7.179	Buckeye Belle c.w.	WN8DZL
	1300	50.4	IMPS	K9YIC
	1300	14.331	YL Int. SSBers	K4RHL
	2130	50.5	Colorado YL	WAØBBR, Alt. KØWZN
	2130	3.825	Gaylark	Rotates
Wed.	0830	3.900	Yankee Lassie, WRONE	K1LCI
	0930	50.25	Hawk Roost	K9MZV
	0900	3.900	YL Welcome Net	K8LHF, Alt. W8ATB
	1100	7.100	LCL CW Net	Rotates
	1300	50.4	IMPS	K9YIC
	1300	14.331	CHC SSB	K4ICA
	1400	50.65	WRONE	K1LCI
	1400	14.288	20 Mtr. YL SSB	K6KCI & WA4FJF
	2100	50.7	Chix on Six Akron	Rotates
	2100	50.3	Suncoast YL	K4EAC
	2100	50.7	Chix on Six Cleveland	Rotates
	2200	146.1	LAYLRC	K6BUS
Thurs.	0900	7.270	Friendly Forty	W3UUG
	0900	3.860	Georgia Peach	K4MXL, Alt. K4ZNK
	0900	3.880	Tylrun	K5IOJ Pres.
	1130	7.235	Tylrun	K5IOJ Pres.
	1300	14.240	Tangle Net	KØEPE
	1300	50.4	IMPS	K9YIC
	1300	14.231	YL Int. SSBers	K4ICA
	1900	50.64	Buckeye Belles Columbus	W8LGY-K8CEN
	2300	28.8	10 Meter Chirps—W6	Rotates
Fri.	1200	3.830	Northwest YL Net	K7RAM
	1230	7.250	40 Mtr. Round-table—W6	Rotates
	1300	50.4	IMPS	K9YIC
Sat.	0930	3.910	Hawks Roost	K9ILK
	1300	3.845	Baylarc Mermaid Net	WA6LIZ
Sun.	1700	3.940	Jayhawker	W9JUV

New from Gonset

A HIGH QUALITY TRANSISTORIZED SSB TRANSCEIVER

that is

ULTRA-COMPACT • LIGHT WEIGHT • low in cost

Gonset has scored a breakthrough with the new "Sidewinder"—a 2 meter SSB, AM and CW transceiver that combines technical excellence with contemporary design and compact, sturdy construction.

The Gonset "Sidewinder" provides coverage of the entire 2 meter band in four segments 1 Mc wide. It has built-in VFO and the receiver is *completely* transistorized. There are a total of 21 transistors, 6 diodes and three tubes in the "Sidewinder," which operates on either SSB, AM or CW.

The power supply is designed for snap-on back or remote installation.

CHECK THESE DELUXE FEATURES AT YOUR LOCAL DISTRIBUTOR!

• Receiver and transmitter utilize dual conversion. • Designed for mobile and fixed station operation. • Illuminated dial and "S" meter. • High voltage power supply is used only in transmit mode. • Highly Stabilized VFO. • Crystal lattice filter for both receiver and transmitter. • 20 watts PEP input SSB, 6 watts input AM, 20 watts input CW.

Transceiver: 8¾" wide, 4¾" high, 7" deep. Weight: 7 lbs.-10 oz. Amateur net price **$349.95**

Power supply: 8¾" wide, 4¾" high, 5½" deep. Weight: 11 lbs.-2 oz. **$49.95**

The new Gonset "Sidewinder" SSB Transceiver will be on display at your local distributor's soon.

GONSET INC.
A SUBSIDIARY OF ALTEC LANSING CORPORATION
1515 SOUTH MANCHESTER AVENUE, ANAHEIM, CALIFORNIA

For further information, check number 30, on page 158

Vol. 5, No. 11—Nov., 1963

VHF AMATEUR

BOB BROWN, K2ZSQ

SEVERAL changes are being made in *The VHF Amateur,* most of which will be evident with this issue. First off, rather than beginning with a photograph on this page every month, there will be an editorial. We hope to cover topics timely and important to v.h.f. men as well as general discussions on the state of our bands with occasional prodding here and there when we feel it is due. Secondly, there will be a concerted effort toward compiling an entirely new column, VHF REPORT, which we hope will bring to *CQ* more information about the very high frequencies than possible before. Other innovations are in the works, such as a regular Counties worked listing, a more inclusive reporting program as well as expanded u.h.f. coverage under the able leadership of K2UYH.

Another Look at VHF

A famous philosopher once remarked that the real test of any man is his ambition. The adage goes on to say that once he becomes satisfied with his accomplishments, his ambition dies . . . and so does the man. I think we'll all agree that this can well be applied to the v.h.f. enthusiast and what he gets out of his hobby. It has long been my contention that there is something notably intriguing offered on the v.h.f. bands that simply cannot be found anywhere else in amateur radio. Perhaps it is the philosopher's "ambition" we find here. Perhaps this is why so much in the field of technical advancement has been accomplished on the bands above 50 mc by amateurs. What are a v.h.f. man's "ambitions"? Read back over the achievements in the past years and compare these to what was being done twenty-five years ago. I think you'll find that both records stand as one continual line of progress in the same direction: getting the most out of the frequencies we have. And this doesn't mean just working a new one on six meters.

I've recently spent some time in a personal re-examination of the six and two meter bands in my locale, the frequencies most populated by today's Technician. It appears that we've been overlooking much of what is offered to the serious enthusiast! I found myself listening more and more to such area v.h.f.ers as K2DZM, K2ISA, K2TKN, K2UYH, W2AZL, W2CXY, W2LOY, W2UUN, and in many cases paying visits to their shacks. These well-known individuals appear to be constantly at work accepting new challenges, and doing things dubbed heretofore impossible. Although each has his own particular specialized interest and project, all strive at accomplishing something that will add to the enjoyment of the v.h.f. bands for others to follow. Yes, these men are definitely leaders. And the goals they set for themselves are high, but never altogether out of reach. They know it and work toward those heights, contributing more and more as the years progress. This means a lot of inventive interest in the latest technical advances, a lot of "on paper" circuitry and ideas, but most important, a great deal of trial and error experiments in the attempt to get these ideas from paper into action. Most often the amateurs who contribute the most to the v.h.f. world are the ones who are heard the least on the air. When we do run across them on the low end of six or two meters, they're generally testing out that new final or antenna system. While everyone else seems to be content chasing DX or ragchewing with the locals, the true dyed-in-the-wool v.h.f. man is busy working on his new kilowatt for 432, his parametric amplifier, that synchronous detection system, *etc.* He won't be satisfied until he has the very best. New advances are taking place all around us, but it seems the only time we're aware of them is when the "Acme VHF Company" incorporates them into their all-new Universe Spanner with a price tag of $499.99. Then we gripe because it costs too much . . .

The New Breed

There is no doubt that we are facing a crisis in amateur radio today. Commercialism has all but taken over on the lower frequencies and is rapidly making inroads into v.h.f. With it has come an entirely new breed of hams. But the fact remains that there are still the thousands of us who are not content to watch the "experimental frequencies" turn into a high-class Citizens Band. And continued contributions by active amateurs is the only way I know to preserve what we have. To quote the FCC, ". . . the Technician Class license was created for those interested in experimentation and construction of equipment for the very high frequencies."

CQ and *The VHF Amateur* are striving to meet this challenge.

BOB BROWN, K2ZSQ

An Inexpensive 220 Mc Preamplifier

BY LEROY MAY*, W5AJG

The tuning section of the ARR-1 and ARR-2 can be used as a stable three stage preamplifier at 220 mc. They employ three 6AK5s or acorn tubes.

RECENTLY we had occasion to provide a capability of receiving signals (non-amateur) in the range of 215 mc to 230 mc. The particular requirement did not seem too severe, and since we had on hand a surplus APR-4 radar receiver, we planned to make use of that device. As it turned out, the APR-4 did receive the transmissions, but due to the low power transmitter involved and the moderate distance (about 40 miles), coupled with the rather poor performance of the APR-4, results were a little on the weak side. It was thought that a bit of pre-amplification would help the situation.

Since this was a public service zero budget deal, we consulted the *old* junk box, the one stored *way* under the house—not the current modern junk box—and lo and behold, some real relics were unearthed, some long forgotten.

Among these, the old ARR-1, ARR-2 units reared their heads once again. At one time, somewhere in the past, it was remembered that these gadgets worked very well on 220 mc. This was way before the days of the 416B's and 8058's. Specifically, this was the era of acorns and 6AK5's.

Reviewing a bit, the ARR-1 was one of the early pieces of surplus equipment modified and put to work on the ham 220 mc band. The ARR-2 was a later version but very similar in circuitry. In this later unit however, 6AK5 tubes were used in place of the acorn 956 types. Many of these units flooded the surplus market and

View of an unmodified ARR-2X. The tuning section is located at the lower left and is cut away from the main unit.

no doubt many conversions were accomplished to do one thing or another.

Since the antique ARR-1 unit was now lacking the acorn tubes and whereas the spare stock of these early bottles have been long since obsoleted and depleted, the later ARR-2 chassis was cleaned of dust and grime and prepared to act like a preamplifier for the APR-4 receiver. It was quickly hay-wired up as such and given a fast trial and the results were rather astonishing —how could such an obsolete old dog breathe such vigorous life into the old APR-4 receiver?

At any rate, the results were very good and out of curiosity, brought forth further diddling with the old ARR-2 as a preselector in front of the regular 220 mc station converter. It is diffi-

*9428 Hobart Street, Dallas 18, Texas.

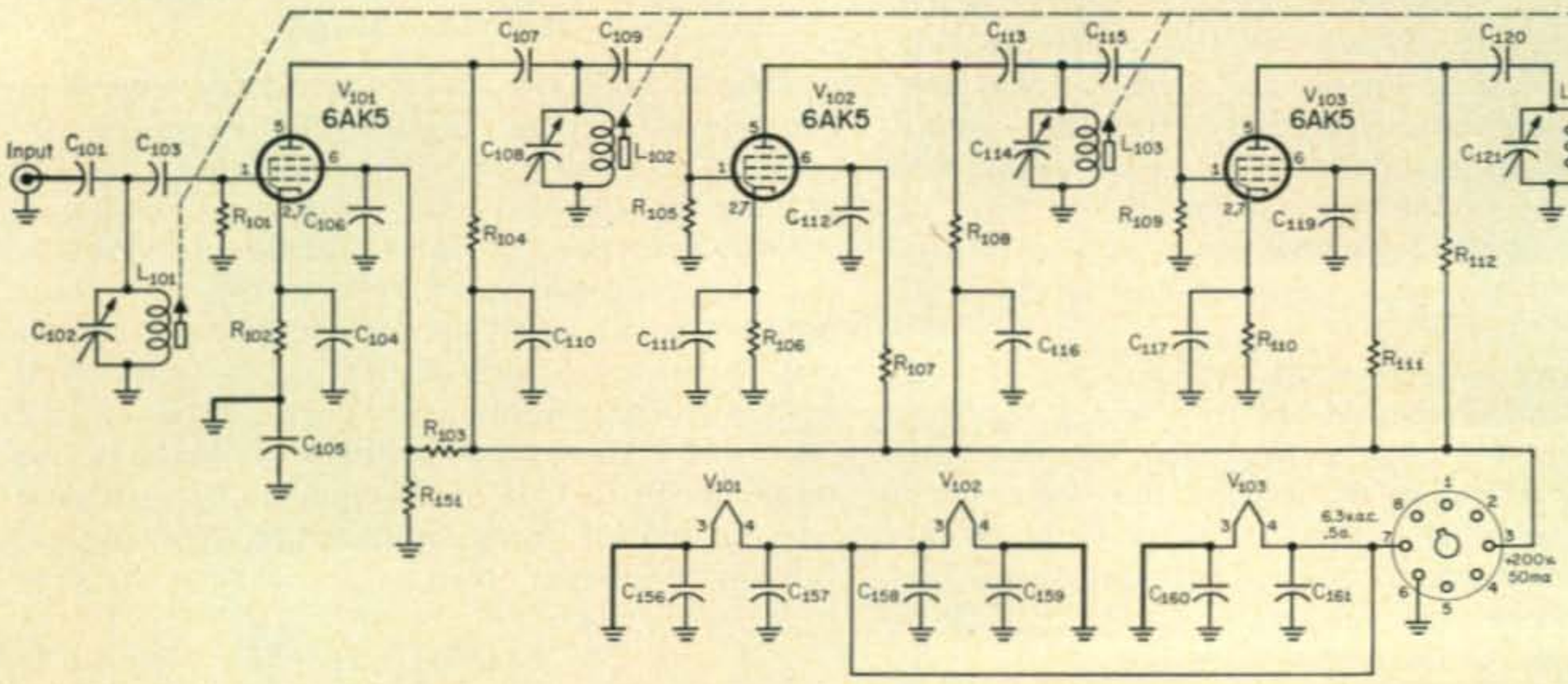


Fig. 1—Circuit of the ARR-2 modified for 220 mc amplifier operation. The output is taken from the cold end of L_{104} through a two turn link.

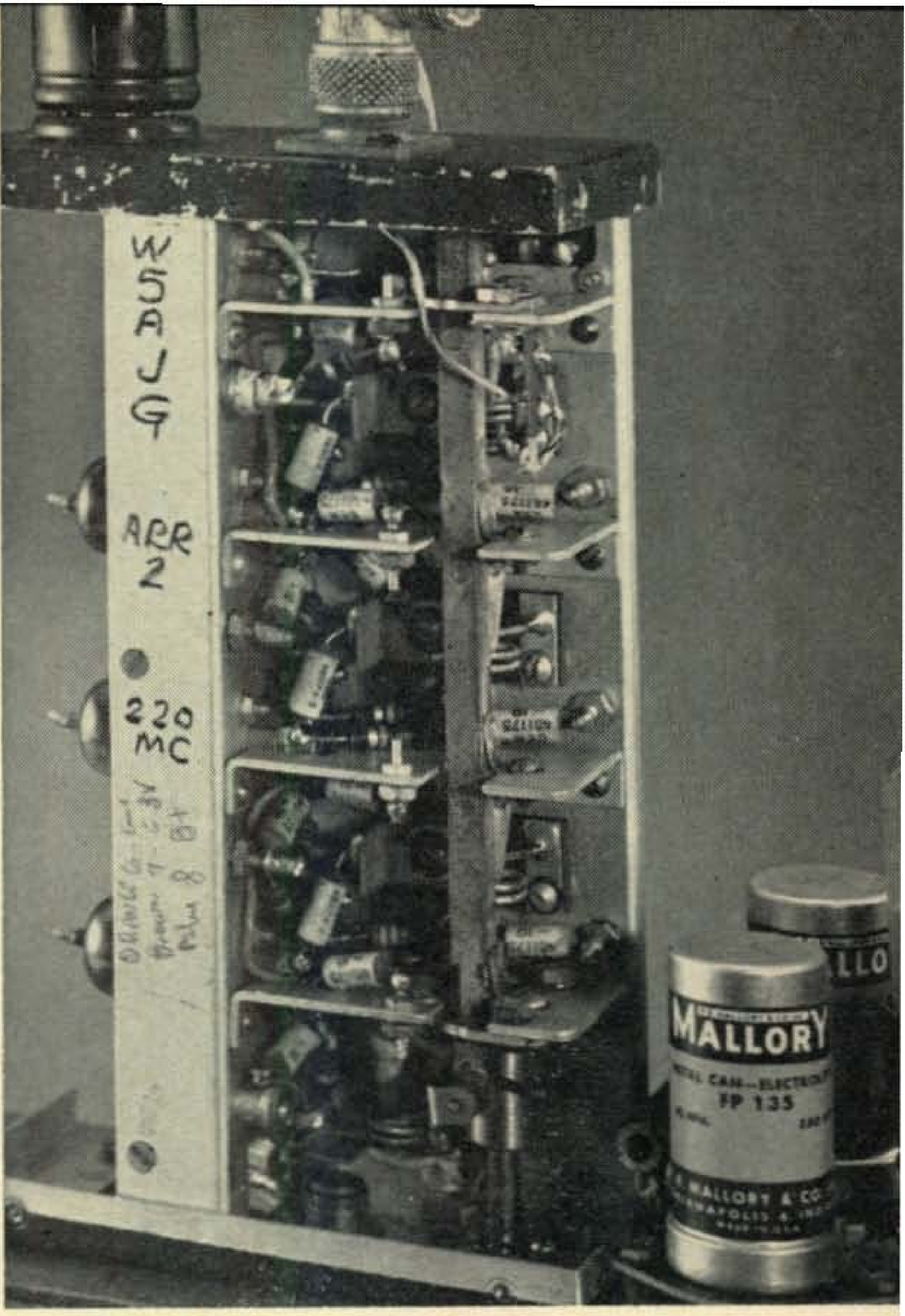
cult to see why such "noisy" tubes as the 6AK5's used as a three stage cascode 220 mc preamplifier works as well as it does. In fact the operation is so smooth, it was thought worth while to dress it up a bit, mount it on a standard rack panel and have it available for general use. It has since been loaned out to other 220 mc hams for trial and in all cases seems to work surprisingly well. These ARR-2 units are dirt cheap, selling for $1.50 to $3.95 today and literally hundreds of them have been seen lying around on the ground in junk-yards over the years selling at two-bits per pound.

Modifications

Originally they were used as complete 220 mc converters and as such used self-excited variable oscillators. Then came the days of the crystal-controlled broad band converters and the old tuned r.f. jobs were retired. Still, there is a lot to be said for the tuned r.f. portion of the old-timers. In this case of our ARR-2 unit, only the three stages of r.f. amplification (V_{101}, V_{102}, and V_{103}) are used and the remainder of the unit is sawed away and discarded. The 1st detector (V_{104}) is not used at all. All this will mount on a standard 3.5 inch rack panel with a small power supply and will make a complete instrument. The original frequency range of 234 mc to 258 mc can be shifted downwards by a slight compression of the r.f. coils. In this case it was no trick at all to tune over the desired range of 215 mc to 230 mc. Merely check each coil with the g.d.o. with the tapered slug all the way out. This will correspond to the lowest frequency desired. The highest frequency will be reached with the slug all the way in. Trimmers C_{102}, C_{108}, C_{114} and C_{121} may be peaked for maximum response after the coils have been properly squeezed.

The heaters are normally wired for 24 v. operation. They may be rewired easily for 6.3 v.a.c. Voltage at the plates of the 6AK5's should be 150 volts d.c. and the screens should run about 115 volts d.c. This is with a power supply delivering 200 volts at about 50 ma. The heaters will require 6.3 v.a.c. at ½ ampere. The cathode resistor, R_{102}, of the first stage, V_{101}, is normally provided with a lead to connect with the control box and i.f. stage, for external control. Ground the bottom of this resistor as per the converted schematic. Tube V_{104} is pulled from its socket and not used in the preamplifier.

A two turn link is made up and coupled tightly to L_{104} for the output of the unit. A coax receptacle is mounted on the chassis as shown in the rear view photo. The antenna input is connected by a short lead from C_{101} to a input coax receptacle. The antenna trimmer C_{102} protrudes through the rack front panel and may be adjusted from this point.

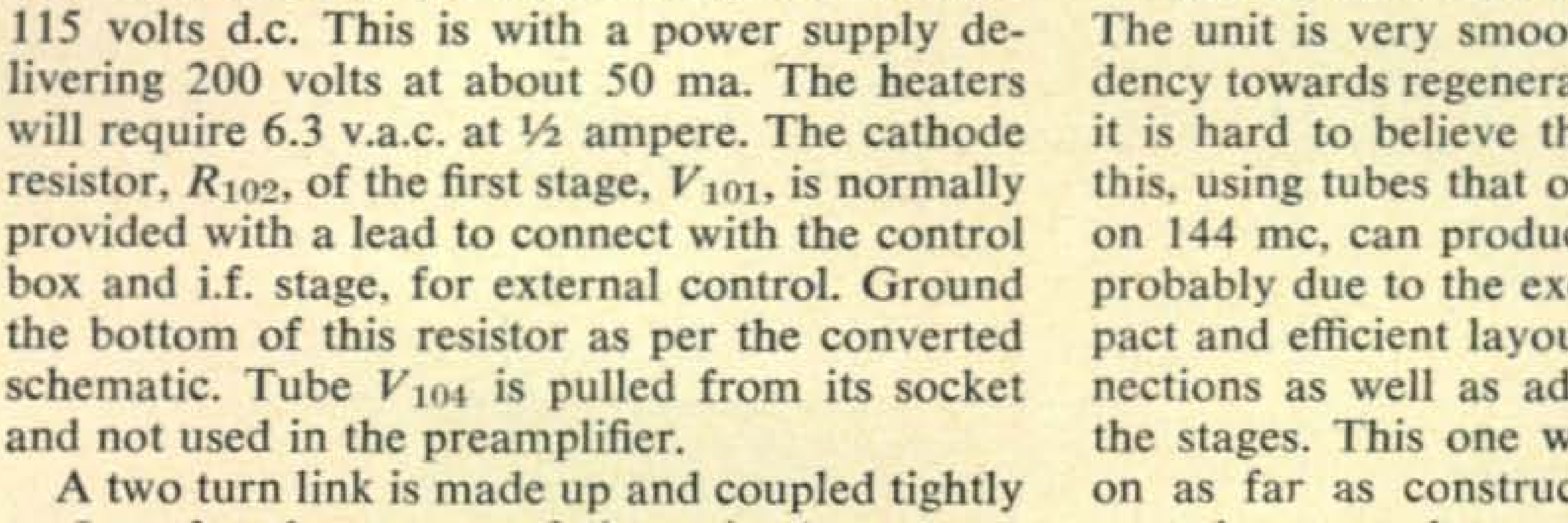


Rear panel view of the modified ARR-2 used as a preamplifier for 220 mc. Output coax is on the top along with the power plug. (Photos by Jim Dungan, Dallas)

Operation

Peak all trimmers on a weak 220 mc signal. The unit is very smooth in tuning with no tendency towards regeneration or oscillation. Again, it is hard to believe that an old design such as this, using tubes that often act suspiciously even on 144 mc, can produce such good results. It is probably due to the excellent construction, compact and efficient layout and the very short connections as well as adequate shielding between the stages. This one would be hard to improve on as far as constructional technique is concerned, even today.

[*Continued on page 134*]



Front panel view of the ARR-2 tuning section mounted on a 3½" rack panel. The antenna tuning capacitor, C_{102}, is to the right of the main tuning dial. The antenna input connector may be seen projecting over the panel near C_{108}.

VHF REPORT

an exclusive feature of The VHF Amateur

BY BOB BROWN*, K2ZSQ

A PLEASANT AFTERNOON WAS SPENT recently when Jay Gooch, W9YRV, from the University of Illinois stopped by to eye the 128 element antenna at K9EID. Jay was explaining the new two meter s.s.b. transmitter he built and it sounds like a real jewel. He is using a unique balanced modulator: three 7587 tetrode nuvistors are used in a three-phase balanced affair which are driven in the control grid by a low impedance "length"; the first tube is driven directly while the second tube grid driving voltage is delayed one-third cycle (or 120°) by a length of RG-58/U cable. The third tube grid voltage is delayed two-thirds cycle (or 240°) by a longer length of coax. Under conditions of no audio input, these three grid signals are amplified and summed in the form of three 120° phase r.f. plate currents in the tank circuit. If the amplitudes of these three currents are fairly equal, the sum is zero and true suppression results. This system is really quite simple when we compare it to the low frequency mixer-type methods that are commonly used today, but *is* something new to v.h.f. Perhaps Jay can be persuaded to write it up?

Here's a glimpse at K2LTW's QSL collection—all 50 states on 50 mc. The first card he received toward the total was from K4*EYE* (Va.) and the card that gave him 50 confirmed was W*ØEYE* (Colo.). Point of interest: K2LTW is an EYE doctor, otherwise known as an optometrist.

New Hampshire and KV4CQ

KV4CQ (WA2DEW) recently returned from an interesting trip through New England full of news about v.h.f. doings up there. Randy operates 50 mc mobile but initially found contacts "nil" through the area. After a few visits to prominent area v.h.f. stations, however, he soon learned that most 50 mc activity in the New Hampshire area is between 50.3 and 50.55 mc. (Tropo enthusiasts bear this in mind if you need N.H. on 6!) A trip to the local ham emporium rectified the situation for Randy (new crystal). The annual outing of the Central New England Phone Net and the Contoocook Valley Radio Club on September 7 and 8 proved of considerable merit to the W1-area v.h.f. men. Randy reports that the parking lot was just blooming with halos and wheels! Among those in attendance were: K1s DER, DNK, EGC, HRE, ITS, NLA, NOS, ITS, OLE, PCY, PPP, RMF, RMG, RMH, UKF, UYA, VHF, YAM, YMY; W1s ALE, CRP, IC, JXZ, MKA, MOI and NHO. The group, in a discussion concerning v.h.f., agreed that despite the mountainous terrain, there seems to be consistently good distances covered locally on 6 and 2 meters. So who says there's no activity in New Hampshire?

**The VHF Amateur*, 300 W. 43rd St., N.Y., N.Y. 100[illegible]6.

In the near future we plan to initiate in this column a Counties Box for the DX-conscious among us who are striving for the ultimate in v.h.f. competition. The box will list separately 50, 144, 220 and 432 mc and will include call. call areas confirmed and total counties confirmed. Present plans call for running this box every month in these pages. All those interested are urged to write today for application forms and details, s.a.s.e. please. In the meantime obtain a copy of P.O. Directory #26 (available from the P.O. Department, Washington, D.C. 20260, for $2.50) and start adding up your counties! The USA-CA Record Book will help too.

Miscellaneous Tech

Simple 2 Meter Transmitter: The circuit shown in fig. 1 originally appeared in the *VHFER,* edited by Doug DeMaw, W8HHS, and will drive an 829B, 5894, pair of 6146s, 4X150 or similar tube to full output on 144 mc. Used by itself as a transmitter, it will deliver comparable power to the somewhat ancient SCR-522 or similar surplus transmitter. Four 5763s are employed thus permitting filament hookup for 12 volt mobile use. The tubes are low priced and readily available. The output stage is connected in push-push, eliminating neutralizing problems and permitting comparable efficiency to a conventional straight-through amplifier. Any modulator capable of delivering 12-18 watts of audio will fully modulate this rig. (Push-pull 6AQ5s will do the job). The modulator will "look into" 2,800 ohms load impedance.

There was an omission in fig. 1. Note: there should be a .001 disc ceramic bypass at the junction of the p.p. doubler final RFC and screen resistor. Likewise at the same junction of the driver stage.

The usual TVI precautions should be observed with this rig as is the case in usual v.h.f. practice. All capacitors should be disc ceramic; short, direct leads should be employed. Adjust all tuned circuits for maximum output. If used as an exciter, L_4 can be varied for proper grid current to the final stage. This push-push doubler rig should make possible many DX contacts or drive that high-powered final with excitation to spare.

New VHF Tube: Amperex has just announced their new DX245 indirectly heated beam power tetrode which can be used as an r.f. amplifier, frequency multiplier, or oscillator up to 250 mc. This tube will deliver close to 50 watts *output* when used as a final amplifier at 144 mc with only 1½ watts of drive from the exciter. The

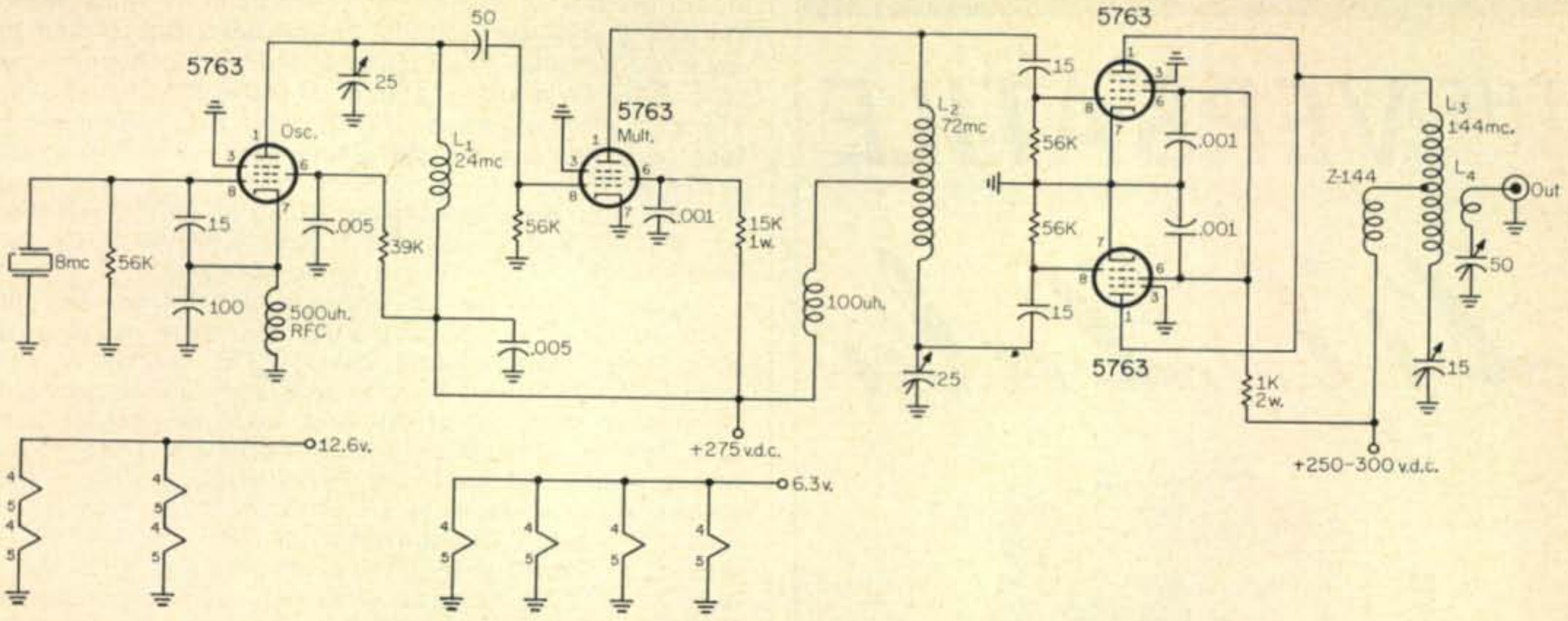


Fig. 1—W8HHS's 2 meter transmitter using four 5763s. Power supply requirements: 250-300 v.d.c. at 150 ma.; 6.3 v. at 3 amps. or 12 v. at 1.5 amps. All capacitors are in mmf unless otherwise stated and all resistors are ½ watt.

L_1—15t. #20 e., ⅜" dia.
L_2—12t. #18 e., c.t. ½" dia.
L_3—4t. #16 e., c.t. ¾" dia.
L_4—2t. link inserted in center of L_3, made from #18 e. wire.

manufacturer claims that the DX245 is the first reasonably priced v.h.f. power tube available using professional transmitting tube materials and manufacturing techniques. At this writing we are told that the tube will retail for around $15.00, but considering this tube's capabilities, it appears well worth looking into for future transmitter designs and existing final amplifier replacement, if for no other reason than for its size! Write Amperex for their data sheet on the DX245.

144 Mc Reports

Portland, Maine, is represented by K1MTJ who's now DXing with a 5/5 and new receiver preamplifier. K1RTS finally snagged New Hampshire for his sixth state on 2 meters during the August 24 *CQ* V.H.F. Contest with K1FYP in Cheshire County. KN1FYS was also a lucky one here. K1VLU/1 and W1STR were worked and K1UGQ/1 in Maine was heard S2 at 144.1 by K1RTS in late August. Walt wants skeds to Maine, Maryland and Delaware on 144.02 c.w. K1BTF wants us to know that he's building a new 4-125A final and will soon be on two from Framingham, Mass.

WB2AOG is making plans for an 80 foot tower that'll hold his 44 elements. [Also hear tell that a new final is in the works in New Jersey.] WA2HNI spent his time in early September snagging W3DBU, K1FYP, K1VPD and W1SFX on 2 meters. Bill employs an 11 element Yagi up 30 feet. Ten states in one night at WB2GTR! On August 17 he worked 'em from Maine to Virginia. "Seems like every 10 to 20 kc of the band was occupied from 2000 to 2400 hours." Dick reports an interesting QSO with K1JSG at Block Island. He was using a pair of his "skewed wheels" (bent-up "big wheels"). A choice of 10 element Yagis at WB2GTR indicated equal effectiveness in either axis of polarization. He was able to minimize the effect of QSB by switching from horizontal to vertical polarization when the signals deteriorated and vice-versa. Poor man's diversity?

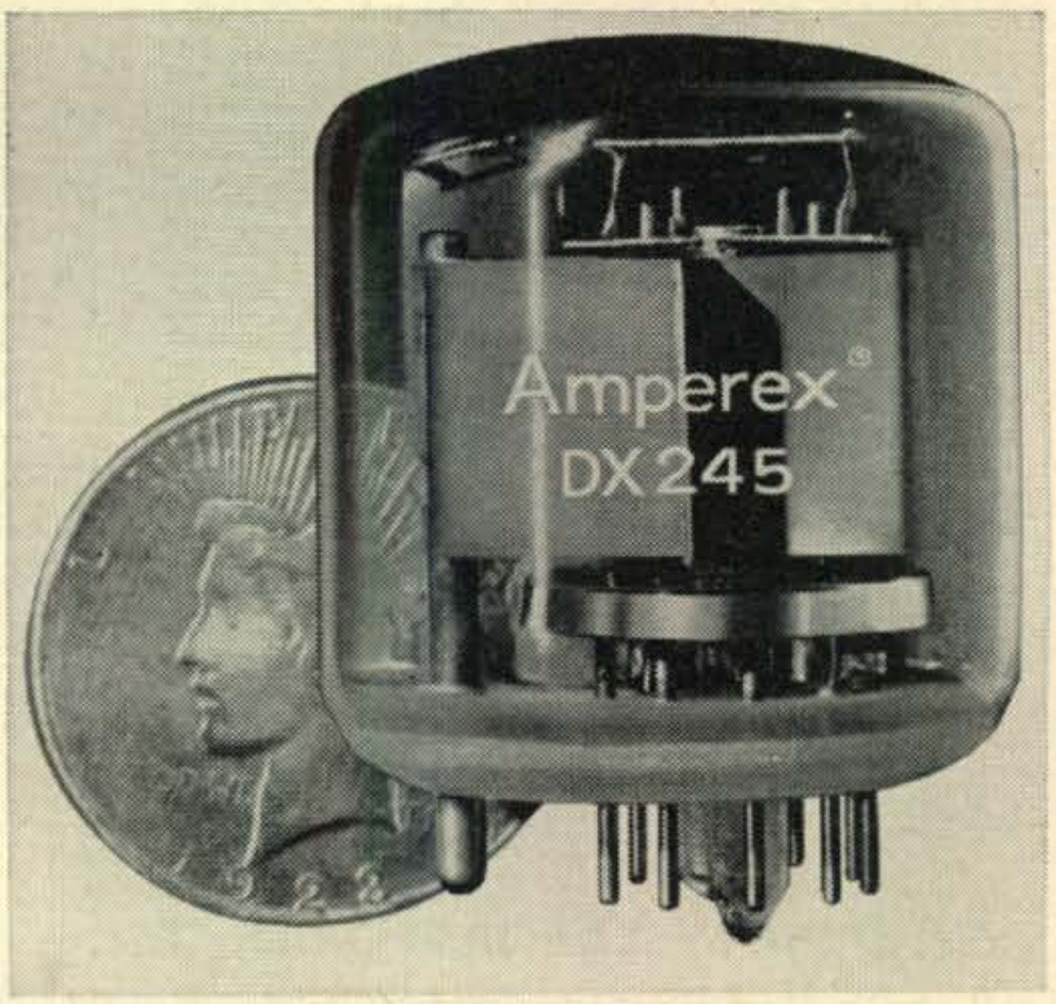
"Big news on 2 meters," sez WA4FIJ. Dick's been maintaining regular skeds with group near Orlando, K4NTD, W4MNT, and W4AWS. Distance is 280 miles. K4IXC in Melbourne is worked often, 325 miles. "Have been working K4SJF in Atlanta also—270 mile path. Sigs good both ways." K4QIF in North Carolina is now active with an 829B and 11 element Yagi and is looking for skeds. W4ZCM in Kentucky is building his 2 meter s.s.b. mixer to use with an 8 over 8 "J" and Parks converter.

W5JWL in Arkansas and W5FYZ Louisiana, worked WØDQY in Missouri in late August and early September on 144 mc s.s.b. Congratulations!

W6NLO is working hundreds of miles from his portable 6 QTH at Dance Point, California. Merit operates through a "J" slot antenna mounted on his Ford Camper. More repeater news from the vicinity: WA6YCZ on Mt. Umunham transmits on 147.71 mc and receives on 146.85 mc. The Mt. Vaca relay, W6AEX, has both input and output on frequencies in the General licensee part of the band. No frequencies available at this writing. [Thanks WB6AAE for this info.]

Oregon is ready for skeds through K7SJQ who now runs a surplus (Navy) TDQ, 100 watts to a 10 element Yagi. Ron comments that "activity's good toward the Portland area from here." Two 4-125As driven by an 829B into two stacked 10 element beams all help to make K7BBO in Tacoma, Washington, one of the more outstanding sigs on the air in the West. Dave snagged VE7BBA British Columbia, not long ago with 5-9 sigs. Congrats! A 14 ft. dish is ready to be used for 144 mc moon bounce work. Skeds needed here.

Ohio, Wisconsin, Pennsylvania, New York, Illinois, Indiana and Canada are being heard by WA8DZF, but few contacts. Look for Dennis from Saginaw, Michigan. He's just converted an Army surplus BC-625 and has stacked fives up. A ninety-foot tower is the big secret at K8ZES in Crawford County, Ohio. Sid's got a 17 element Yagi on a 32 foot boom and is rotating the affair with a prop pitch motor. K8PBA's running a rebrewed FMTRU-50BYC with a pair of 4CX150As at 250 watts with a pair of 6146s modulating it. Homebrew 417A neutralized triode cascode converter into a 75A-3



Sneak preview of the new DX245 v.h.f. beam power tetrode by Amperex.

and a homebrew 32 element collinear at 76′ plus homebrew 5″ panadapter (± 200 kc) all help. Bob picked up some 60 counties on 2 meters during the August contest. K8HNW's using a pair of 4CX250Bs into a 40 element "J" slot antenna up 130 *feet!* Receiving complement is a homebrew 7788 preamplifier to nuvistor converter to 75A-4 and panadapter. W8CLH, Birmingham, Michigan, is using a 6146 at 40 watts into 8 elements up 35 feet and managed to work K8ZES, K1CRQ/1 and K2LOK/2 (New York) on August 24-25.

At this writing the 128 element "J" slot antenna has been performing like a champ for three months at K9EID (see last month's cover). The success of this installation has been proved time and time again with astounding long-haul tropo work on 2 meters. Be sure and look for K9EID on 145.20 u.s.b. WA9DMF has a new converter for his Drake 2B. K9HQG has his HT-32 on two meters with a nice homebrew heterodyne mixer and uses a new Parks converter for receiving. K9PMK is setting his Phasemaster II on 145.20 u.s.b. with the 8 over 8 "J" slot antenna. Another tropo enthusiast is K9OYD who now has his 829B feeding into an 11 over 11 from Gary, Indiana. A 400 mile QSO was made between K8EUK in West Virginia and K9WZB, Indiana, in July possibly setting a new record here for tropospheric work on 144 mc. K9WZB also worked WØRWL (Iowa) and WØDQY (Missouri) on the morning of August 4. Skeds to Minnesota and Tennessee on 145.006 mc would be appreciated. A 610-mile contact with WØEMS in Omaha was made on August 7, added K9WZB! W9OKM operates from his mobile trailer with 15 elements and 20 watts between Oswego and Joliet, Illinois. Many new counties available here.

WØRSP in Marvin, South Dakota, worked K9EBA, O'Fallon, Illinois; K9SGD, Sparta, Illinois; W9WDD, E. Alton, Illinois; and WØLFE, Bowling Green, Missouri, in the early September tropo's. KØRIR fired up his SB-62 to give K8RZB a Missouri contact. Don was in QSO with K9EID when K8RZB broke in to let 'em know he was listening. W9GWI, W9MWK, W9TZB and K9RZN were all heard working two meter sidebanders on the night of August 23.

50 Mc News

WA2GWM/1 has been providing many with Bershire County, Mass., from atop Mt. Greylock, elev. 2,200 feet. W1IBY and K2MTB have been logged from Frank's N.J. QTH also. Up 2,500 ft. on Pack Monadknock you'll catch K1PDA/1, who spends a good deal of time passing out N.H. QSLs to tropo workers. Low power, but what a sig!

W2UUN's been busy on both a.m. and s.s.b. with his kilowatt and 11 el. Spiralray snagging K1s GHY, DKX, PYX, RRR, SLL, UVP, ZFE, ZHR, W1s QXX and WHL; K2ISA; and K3s ACR and IPM.

K1PHM, K1YHM, W1QHF, W3JZY and K4VNG were worked by W3MFY on August 24-25 using his 4-400A at one kilowatt to his 5 el. up 60 ft. K1SLL, W1RRY and K8ZSY/4 were snagged by K3LOM in Ambler, Pa., same period.

Consistent 200 mile work by W4GUP is providing many ground wave followers with Houston County, Ala. W4DGH is hearing Texas from Valley Head, Ala., on tropo, but no luck yet. K4GEQ at Reed, Ky., has a new HX-30 and Interceptor receiver driving his 10 el. Yagi. Watch for him on 6 meter s.s.b.

K8REG/5 in Carlsbad, N.M., managed 15 skippers in one day while vacationing in August. "I'm the first to operate 50 mc from this location," comments Vince. Mississippi is well represented now by K3QKP/5 at Keesler Air Force Base where he's catching all kinds of DX with a minimum in the way of equipment.

KØZZM/Ø and KØFLE were worked by K6ORH during the August 24 contest skip. Eight days and eight states reports W6IEY in La Mesa, California. W6NIT also sent a long list of Sporadic-*E* DX snagged during the summer.

K7OCG reports several good skip months for him during the summer months from his Arizona QTH.

W8HJR is another long-haul boy that's available for skeds. Ed uses a Clegg 62T10 to an 11 element Spiralray. WA8CDF worked WA2GHN/2 via tropo on August 25. George runs a 6C21 at 900 watts to seven

[*Continued on page 153*]

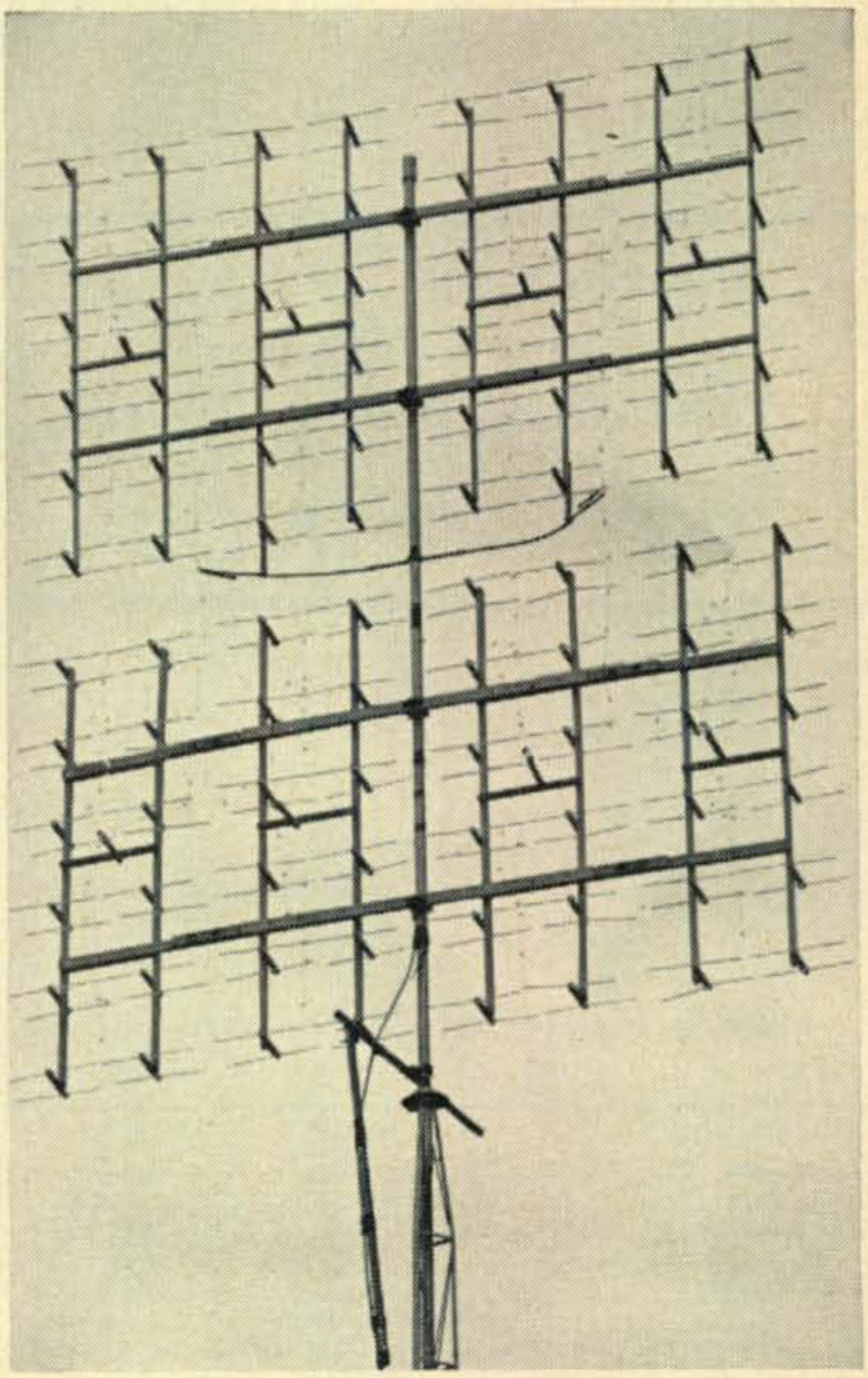
UHF ROUNDUP

an exclusive feature of The VHF Amateur

BY ALLEN KATZ*, K2UYH

THE BIG NEWS THIS MONTH is the recent 220 mc DXpedition by K2TMB and K2CBA. George and Jud travelled 1500 miles in three days, providing three new states for the 220 mc gang. Gear used was a pair of 4CX250B's (600 watts a.m., 800 watts c.w.), a Drake 2B with 6CW4 nuvistor converter and a 13 element beam up 15 feet. All operation was from inside the car, with the rack-mounted power supply and modulator in the trunk, the control deck in the back seat. All they needed was an a.c. outlet. Saturday night, September 7, they operated as K2TMB/3 from Magnolia, Delaware, with power supplied by K3KEO. Stations worked were K2DZM, K2CBA, K2ISA, W3UJG, W3OTC, K2AWT, K2ZRJ, W2SEU and W1BU, providing them all with a new state. Sunday night the team was in Kitty Hawk, North Carolina, parked at a motel 20 feet from the ocean where they obtained their a.c. power, and were off again. This time K2TMB/4 worked W3UJG, K2AWT, K2ZRJ, K2DZM, W3CGV, W2SEU, W2EIF, K2SWI, W3QQV, K2CBA and W1BU. Monday evening, September 9, the boys found themselves in West Virginia atop a mountain in Berkeley Springs. They plugged into the line at a service station, set up the antenna, and there was K2TMB/8 at it again. Stations snagged were K2DZM, K2CBA, W2SEU, W3UJG and W2AOC. So who says there's no DX on 220 mc?

Actually, the purpose of this trip was to help Jud get 16 states on 1¼ meters, thereby putting on the top of the "states worked" list. K2CBA (North Greenbush, New York) was operated by K2ISA (Paul) during this period.



W8JLQ had this 192 element 432 mc array up for a couple of months, but now employs just half of it (same height but half as wide). This antenna is used extensively in ham-TV work. For more information and pictures see this column for March and July of this year.

Weak Signal Detection

More than once the subject of very weak signal detection has reached the pages of this column, a topic which we feel will be of great importance to the future of v.h.f.-u.h.f. DX work. Last month we printed a letter by K2TKN describing his system of synchronous detection. This month we have a letter from VE3BZS; no newcomer to v.h.f., his opinion is respected by many for his fine work in the field of 6 meter moon bounce. This letter presents a different view of synchronous detection:

"I was interested to read your comments on the synchronous detection system in the June issue of *CQ*, as I made one similar (I believe) to the system described a few years ago. I frequency modulated the h.f. oscillator of my converter at about 1 kc and detected any resultant signal by the slope detection method. The resultant 1 kc signal was passed into a phase sensitive detector.

"Unfortunately this type of system will not give the weak-signal performance that one expects from a synchronous receiver. The trouble occurs because the spectral density of the noise occurring at the output of the receiver's second detector depends upon the previous i.f. bandwidth and the modulation frequency. In other words all you are essentially doing is receiving an f.m. signal and passing it through a filter which happens to be a phase-sensitive detector. The effective bandwidth of the seceiver is definitely not just that of the phase sensitive detector alone. Also in any system where you switch the signal on and off cyclicly you will lose 3 db in signal-to-noise power ratio.

"I pass along the previous comments to point out that you can't get something for nothing. Frequency stability, narrow bandwidths and hence long integration times are necessary for reception of weak signals."

A bit bewildered, eh? Well before you give up hope of working that new state and settling down to cold winter nights of just monitoring the bands

*48 Cumberland Avenue, Verona, New Jersey.

with the smell of molten solder in the background, let us try to unravel at least part of the mystery.

To begin with synchronous detection is not the only form of so-called "under the noise" or "very weak signal" detection. Unfortunately the two have become synonymous in some people's minds. Back in April we introduced the subject by briefly describing a method of integration detection. Integration detection does *not* give something for nothing—it sacrifices time. This means that you may have to send at a rate of one word every 5 minutes to work Europe. Just the exchange alone may take over an hour. But who cares, it is still a valid QSO. Consider how long the average meteor-scatter contact takes.

The only connection between this method and that of synchronous detection is the possiblitiy that the two systems can be advantageously combined. At this moment we do not have enough facts to make a decision on the relative merits of synchronous detection. However, the more we learn about the system, the more we feel that the eventual use of synchronous detection will be that of a *gain stabilizer* for sophisticated systems of integration detections.

The question of balanced feedline versus unbalanced (coax) on the u.h.f. bands has been around for many years. One side of the coin is represented by W9OVL who suggests using balanced 300 ohm foam-filled solid copped u.h.f. TV line for power levels up to 100 watts. For higher power, however, 300 ohm kw line should be employed with plastic-ended standoffs. Tune with a 3½" tinfoil strip wrapped around the 300 ohm line several feet from the transmitter. Slide this strip back and forth for the best s.w.r. As for me, I haven't quite made up my mind yet just which system is best; we're still using both. How about your comments on the subject?

Looking for a really broadband antenna for u.h.f.? K7VQI (ex-W4LSA) comments that the AT-49/APR-4 discone antenna with a bandwidth of 300-3000 mc is certainly worth looking into. For some interesting comments on the discone, by the way, check WA2ANU's "Reviewing the Radio Classics" on page 45 in last month's *CQ*. This particular antenna is a small omni-directional job with 50 ohm impedance and weighs but a few pounds. If you want one, Al suggests you write Hy-Way, 1147 Venice Boulevard, Los Angeles 15, California, who has them for sale for $5.50 postpaid. K7VQI mounted his atop his ham-TV installation by use of a small bracket. "Works FB!"

Those Florida u.h.f.ers never stop trying to

TERRY
W9DIA

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ADDRESS _____

CITY _____ STATE_____

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Power Plant [*from page 79*]

panel, made in the form of an open box, houses the switches, fuse holders, terminal board, and panel lamps. The subchassis is wired with heavy 10 to 12 gauge, well insulated wire. All in all, the "musts" of good wiring mechanics apply. A good treatment of the subchassis with glyptal varnish will guard against rust and corrosion.

Above the subchassis are mounted the engine, generator, and inverter. If the generator is not provided with a flat base mount, one can be made easily from ⅛" aluminum by shaping it to form the "lazy m" shown in fig. 2. The distance *t* will depend on the height to which the generator must be raised to meet the engine shaft. Before securing, however, the engine and generator shafts must be coupled. For this purpose, two 3 to 4 inch sections of sturdy rubber hose, one made to fit snugly inside the other, are fixed together with hose clamps, onto the shafts, leaving the keys in the shafts to afford a stronger grip. The inverter, more often than not, will be equipped with a flat base so its installation should present no problem. The voltmeter should be shock mounted on the assembly to protect it from the vibration.

The power plant may be installed either at a fixed station or used portable simply by disconnecting the power cable at the terminal board. To test the generator, first be sure that S_3 is open to disconnect the inverter output. Next, connect the 115 v.a.c. power leads from the inverter directly to the equipment to be operated. Start the engine of the power unit, close S_1, and adjust the speed of the engine to give a 24-28 volt meter reading. Close S_2. Adjust the inverter voltage output control to minimum. Start with a small 115 volt load such as a light bulb or soldering gun; then apply greater loads. Adjust the voltage control to a setting which will permit optimum operation of station equipment. Determine the most practical control setting and generator speed—one which will leave both transmitter and receiver calibrations unchanged.

General care and maintenance is essential. Make periodic checks on operation every two to three weeks. Wash off with solvent all accumulations of grease and dirt, and check the oil level and generator bushings periodically. It is also a good idea to place a blanket or tarp over the unit when not in use. ■

Receiver Modifications [*from page 69*]

and experience is necessary to realize the benefits as well as the limitations of the circuit. As previously mentioned, about 10 db gain is realized when fully peaked, so it is sometimes necessary to reduce the i.f. gain for proper performance. The selectivity can, when peaked, be as narrow as a few hundred cycles, affording good single signal selectivity. Phone signals on 15 meters, too weak to be heard normally, could be sucked out of the noise with good readibility.

Improved Tuning Ratio

An improved tuning ratio can be obtained by machining new tuning shafts with a ⅛" diameter in the area in which the dial cord rides. Old volume control shaft bearings were used to support the new drive shafts. A number of other methods may be employed and these are limited only by the ingenuity of the individual, but an improved tuning ratio is extremely desirable for s.s.b. reception.

Power-Supply

The addition of the full wave power supply is an ambitious undertaking but produces some very excellent results. The circuit shown in fig. 4 includes a regulator for stabilizing the local oscillator and b.f.o.

All the tubes are changed to their six volt equivalents. The power transformer is located over the old 35Z5 socket and the additional components are placed in the vicinity. Diodes may be used instead of the 5Y3 to conserve space.

The bypass capacitors that are not rated at 400 volts, at least, must be replaced and the screen grid wiring of the i.f. moved to the 115 v. line. The b.f.o. and mixer screen must be connected to 105 v. regulated.

B.F.O. And ANL

The original b.f.o. circuit in the S-38 is satisfactory as is. However, those who have the S-38A require a b.f.o. as the feedback system used is not reliable for s.s.b. reception. Any b.f.o. circuit[1] is suitable if it is at the correct i.f. frequency and may be coupled into the diode plates through a 3 twist wire gimmick.

Again, the S-38 had a simple ANL circuit which the S-38A does not have. It may be added by shunting a IN34 from the control grid of the audio output stage through a s.p.s.t. toggle switch to ground, with the plate of the diode at the grid end. ■

[1]Kerwin, K. Carr, W, "A Transistorized Add-On B.F.O.," *CQ*, December 1961, Page 38.
Schauers, C. J., "Ham Clinic, Combo-B.F.O.-Q-Multiplier," *CQ*, June 1962, page 28.

Scope Adapter [*from page 77*]

means of checking if he is to obtain linear modulation. Few users of such transmitters seem to realize that the plate load and grid drive may cause "the modulation capabilities of the transmitter to be exceeded," to loosely quote the FCC rules.

N.b.f.m. on sweep position should show an unchanging rectangle. On Lissajous, the pattern should jump out in rectangular shape with the speech, not showing any ripple along the edges. (Incidentally, here the speech signal should be picked off after the pre-emphasis network, and the scope horizontal amplifier may be necessary.)

All in all, modulation linearity is only a measure that the r.f. section is faithfully reproducing in r.f. power what is presented to it. The check will not eliminate the possibility of a bad microphone or hum in an amplifier. It will not detect incidental f.m. in an a.m. signal. Lastly, a scope picture that looks good gives no positive protection against violation notices, particularly when the owner of the transmitter is running more power than is necessary for the contact. ■

New Approach to RTTY [*from page 73*]

expand to a full vertical line, and shrink again to a spot. You will find that this method is convenient for controlling the amplitude of the limiter output, both for initial setup and for spot checking with the receiver after it is put into operation.

Using this method, adjust the amplitude of the limiter output to half its full value. That is, the line on the monitor should be half length. Adjust the bias control for that tube so that it just fires at half of full output. You will have to swing the input frequency from one side to the other several times, each time adjusting the "ready" tube until each fires at half output. The machine itself is a satisfactory indicator for this purpose when the motor is running.

General

The circuit is forgiving of variations in component values. Tolerances run in the order of plus 20% and minus 50%. It is not, however, forgiving of stray r.f. If you radiate part of your output via the house wiring and the water pipes, shielding is in order.

Power supply stability requirements are very loose. Current drain is constant, and line voltage variations cancel out. A rise in plate voltage tends to lower the firing point, while the corresponding rise in bias voltage brings it back to where it was.

The advanced beeper will note the absence of a "mark hold" feature.

No real effort was made to develop a "mark hold" circuit. In practice, reducing the r.f. gain provides much the same effect in the normal QSO when dealing with a normal signal. Since this is a flip-flop circuit, it stays where it is put, and does not degenerate into a half-current or similar condition in the absence of signal unless noise is present.

If you are dealing with reasonably good signals, reduce your r.f. gain control until the noise pattern on the monitor scope is no more than 20% of full amplitude. Under this condition, the signal will come through with more than enough strength to operate the converter. If the other station goes off, or if he keys "mark" for identification purposes, it has no effect on the converter.

This does not apply when everything is wide open. The presence of noise will make the machine chatter like a sick magpie. So, if you're trying to pull up a weak one out of the mud, leave the motor off until you have the guy tuned in!

What I like best about this unit is its staying power. It has been moved three times in five years, and none too gently, at that! So far, it still works like it did the day I set it up. ■

Geographical Listing Of Distributors

Who? What? Where?

CALIFORNIA

HENRY RADIO

931 No. Euclid Avenue, Anaheim

1, 2, 4, 5, 6, 7, 8, 10, 11, 13, 15, 18, 19, 20, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 37, 39, 40, 42, 46, 47, 48, 50, 51, 59, 60, 61, 62, 65, 66, 67, 68, 69, 70, 71, 72, 74, 75, 77, 78, 79, 80, 81, 82, 84, 85, 87, 90, 92, 98, 99, 100, 101, 103, 104, 105, 106, 107, 109, 110, 111, 112

HENRY RADIO

11240 W. Olympic Blvd., Los Angeles

1, 2, 4, 5, 6, 7, 8, 10, 11, 13, 15, 18, 19, 20, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 37, 39, 40, 42, 46, 47, 48, 50, 51, 59, 60, 61, 62, 65, 66, 67, 68, 69, 70, 71, 72, 74, 75, 77, 78, 79, 80, 81, 82, 84, 85, 87, 9-, 92, 98, 99, 100, 101, 103, 104, 105, 106, 107, 109, 110, 111, 112, 114

RADIO PRODUCTS SALES

1501 So. Hill Street, Los Angeles 15

1, 2, 4, 6, 7, 8, 9, 10, 11, 13, 15, 16, 18, 19, 20, 21, 23, 26, 27, 28, 29, 30, 32, 36, 37, 40, 42, 46, 47, 49, 50, 59, 61, 62, 65, 68, 69, 72, 75, 77, 79, 80, 81, 83, 84, 85, 88, 92, 98, 99, 101, 103, 104, 105, 106, 107, 108, 109, 111, 114

CONNECTICUT

ARROW ELECTRONICS, INC.

225 Main Street, Norwalk

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 62, 63, 65, 67, 68, 69, 70, 72, 74, 75, 77, 79, 80, 81, 82, 83, 84, 88, 90, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 114

FLORIDA

AMATEUR ELECTRONIC SUPPLY

23 Azalea Park Shopping Center, Orlando

1, 4, 5, 6, 7, 8, 9, 13, 14, 15, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 32, 35, 36, 40, 42, 44, 46, 47, 50, 51, 59, 61, 65, 67, 68, 69, 70, 72, 77, 78, 79, 80, 81, 83, 84, 85, 88, 90, 92, 96, 97, 98, 99, 100, 103, 104, 108, 109, 110, 111

ILLINOIS

ALLIED RADIO CORPORATION

100 N. Western Avenue, Chicago 80

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 20, 21, 23, 25, 27, 30, 31, 36, 37, 39, 40, 42, 46, 50, 51, 52, 53, 59, 61, 62, 65, 67, 68, 69, 70, 72, 75, 77, 80, 83, 84, 88, 90, 93, 97, 98, 102, 104, 106, 107, 109

AMATEUR ELECTRONIC SUPPLY

6450 Michigan Avenue, Chicago

1, 4, 5, 6, 7, 8, 9, 13, 14, 15, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 32, 35, 36, 40, 42, 44, 46, 47, 50, 51, 59, 61, 65, 67, 68, 69, 70, 72, 77, 78, 79, 80, 81, 83, 84, 85, 88, 90, 92, 96, 97, 98, 99, 100, 103, 104, 108, 109, 110, 111

GROVE ELECTRONIC SUPPLY CO.

4115 W. Belmont, Chicago 41

6, 7, 11, 18, 19, 30, 36, 46, 53, 65, 69, 80, 83, 87, 88, 104

INDIANA

GRAHAM ELECTRONICS SUPPLY, INC.

122 South Senate Avenue, Indianapolis

1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 33, 34, 36, 37, 38, 39, 40, 42, 44, 46, 47, 48, 50, 51, 53, 56, 59, 61, 62, 65, 67, 68, 69, 70, 72, 73, 74, 75, 77, 79, 80, 81, 83, 84, 85, 87, 88, 90, 91, 92, 93, 96, 97, 98, 99, 100, 101, 102, 104, 107, 108, 109, 110, 111, 115

IOWA

WORLD RADIO LABORATORIES

3415-27 W. Broadway, Council Bluffs

1, 4, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 18, 19, 20, 21, 23, 25, 26, 27, 28, 29, 30, 31, 33, 36, 37, 38, 39, 40, 42, 44, 46, 47, 48, 50, 51, 55, 59, 60, 61, 62, 65, 67, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 83, 84, 85, 87, 88, 90, 92, 95, 97, 98, 99, 101, 103, 104, 106, 107, 109, 110, 111, 113

MAINE

DOWN-EAST HAM SHACK

57 Main Street, Lewiston

4, 8, 20, 21, 23, 25, 26, 34, 40, 41, 42, 46, 50, 59, 65, 68, 69, 70, 72, 74, 75, 79, 81, 103, 107, 109, 110, 111

MASSACHUSETTS

LAFAYETTE RADIO ELECTRONICS CORP.

110 Federal Street, Boston

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114, 115

ALCO ELECTRONICS INC.

3 Wolcott Avenue, Lawrence

1, 2, 4, 5, 6, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 33, 34, 35, 36, 37, 39, 40, 42, 44, 46, 47, 53, 55, 59, 61, 62, 63, 65, 67, 68, 69, 75, 79, 80, 81, 83, 87, 95, 96, 98, 99, 100, 102, 103, 104, 106, 107, 109, 111

LAFAYETTE RADIO ELECTRONICS CORP.

1400 Worcester Street, Rte. 9, Natick

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114, 115

GRAHAM RADIO, INC.

505 Main Street, Reading

4, 6, 7, 8, 10, 13, 15, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 36, 37, 38, 40, 42, 43, 44, 46, 49, 50, 51, 53, 55, 59, 61, 64, 65, 67, 68, 69, 70, 72, 74, 75, 79, 81, 83, 84, 85, 88, 92, 95, 99, 101, 103, 104, 109, 110, 111, 113

MICHIGAN

RSE HAM SHACK
DIV. OF RADIO SUPPLY & ENG.

90 Selden, Detroit 1

1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 18, 19, 20, 21, 23, 25, 26, 27, 29, 30, 31, 32, 35, 36, 37, 40, 41, 42, 43, 46, 47, 50, 51, 59, 60, 61, 62, 63, 65, 67, 68, 69, 70, 72, 74, 75, 77, 78, 79, 81, 84, 85, 86, 87, 88, 89, 90, 92, 95, 97, 98, 99, 100, 101, 103, 107, 109, 110, 111

RENO RADIO CO.

1314 Broadway, Detroit 26

4, 5, 6, 7, 8, 10, 11, 18, 19, 20, 21, 23, 25, 26, 30, 35, 37, 39, 40, 42, 46, 50, 59, 62, 65, 67, 68, 69, 72, 74, 78, 79, 80, 81, 87, 90, 92, 98, 99, 104, 109

MISSOURI

HENRY RADIO

Butler

1, 2, 4, 5, 6, 7, 8, 10, 11, 13, 15, 18, 19, 20, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 37, 39, 40, 42, 46, 47, 48, 50, 51, 59, 60, 61, 62, 65, 66, 67, 68, 69, 70, 71, 72, 74, 75, 77, 78, 79, 80, 81, 82, 84, 85, 87, 90, 92, 98, 99, 100, 101, 103, 104, 105, 106, 109, 111, 112

REED AMATEUR SUPPLY

Boonville at Brower, Springfield

4, 5, 6, 7, 8, 9, 11, 18, 19, 21, 29, 31, 36, 37, 39, 40, 42, 46, 49, 50, 61, 62, 65, 68, 74, 77, 84, 90, 104, 107, 109, 111, 114

NEW HAMPSHIRE

EVANS RADIO INC.

Rte 3A, Bow Jct., P.O. Box 321, Concord

4, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 18, 19, 20, 21, 23, 26, 27, 29, 30, 34, 36, 37, 39, 40, 42, 44, 46, 47, 50, 51, 55, 61, 62, 65, 66, 67, 68, 69, 70, 72, 73, 74, 75, 76, 78, 79, 80, 81, 83, 84, 85, 87, 88, 90, 91, 92, 95, 96, 97, 98, 99, 101, 102, 107, 109, 110, 112

NEW JERSEY

ATKINSON & SMITH, INC.

20 Broad Street, Eatontown

2, 4, 6, 8, 10, 18, 19, 20, 21, 23, 29, 31, 32, 38, 42, 44, 46, 47, 50, 59, 63, 65, 68, 69, 72, 81, 97, 100

LAFAYETTE RADIO ELECTRONICS CORP.

42 Central Avenue, Newark 2

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 54, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

LAFAYETTE RADIO ELECTRONICS CORP.

182 Rte. 17, Paramus

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 54, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

LAFAYETTE RADIO ELECTRONICS CORP.

139 West 2nd Street, Plainfield

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 54, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 98, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

NEW YORK

FEDERAL ELECTRONICS

Vestal Parkway East, Binghamton

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 27, 29, 30, 34, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 61, 62, 65, 67, 68, 69, 70, 72, 74, 75, 76, 77, 78, 80, 82, 84, 87, 88, 90, 97, 98, 99, 102, 103, 104, 106, 109

LAFAYETTE RADIO ELECTRONICS CORP.

542 East Fordham Road, Bronx 58

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

ARROW ELECTRONICS, INC.

900 Broadhollow Road, Farmingdale

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 62, 63, 65, 67, 68, 69, 70, 72, 74, 75, 77, 79, 80, 81, 82, 83, 84, 88, 90, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 114

HARRISON RADIO CORP.

144-24 Hillside Ave., Jamaica

4, 6, 7, 8, 10, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 30, 32, 36, 37, 39, 41, 42, 44, 46, 47, 48, 50, 51, 55, 59, 60, 61, 62, 65, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 85, 88, 90, 92, 94, 95, 97, 98, 99, 101, 103, 104, 106, 107, 109, 110, 111, 113

LAFAYETTE RADIO ELECTRONICS CORP.

165-08 Liberty Avenue, Jamaica 33

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

ARROW ELECTRONICS, INC.

525 Jericho Turnpike, Mineola

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 62, 63, 65, 67, 68, 69, 70, 72, 74, 75, 77, 79, 80, 81, 82, 83, 84, 90, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 114

ARROW ELECTRONICS, INC.

65 Cortlandt Street, New York 7

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 62, 63, 65, 67, 68, 69, 70, 72, 74, 75, 77, 79, 80, 81, 82, 83, 84, 88, 90, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 114

BARRY ELECTRONICS CORP.

512 Broadway, New York

8, 10, 13, 18, 19, 20, 23, 27, 29, 35, 42, 44, 50, 65, 68, 69, 73, 87, 96, 98, 103, 106, 109

HARRISON "HAM HEADQUARTERS, USA"

225 Greenwich St., New York

4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 30, 32, 36, 37, 39, 41, 42, 44, 46, 47, 48, 50, 51, 55, 59, 60, 61, 62, 65, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 85, 88, 90, 92, 94, 95, 97, 98, 99, 101, 103, 104, 106, 107, 109, 110, 111, 113

HARVEY RADIO CO., INNC.

103 West 43rd Street, New York 36

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 27, 29, 30, 34, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 61, 62, 65, 67, 68, 69, 70, 72, 74, 75, 76, 77, 78, 80, 82, 84, 87, 88, 90, 97, 98, 99, 102, 103, 104, 106, 109, 114

LAFAYETTE RADIO ELECTRONICS CORP.

100 Sixth Avenue, New York 13

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 45, 46, 47, 49, 50, 53, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

TWO WAY RADIO COMMUNICATIONS

232-6 Hylan Blvd., Rosebank, Staten Island

4, 8, 10, 11, 13, 16, 17, 18, 20, 21, 29, 30, 31, 34, 37, 39, 44, 46, 47, 54, 59, 63, 65, 68, 69, 70, 72, 74, 75, 83, 84, 88, 89, 90, 97, 103, 104

LAFAYETTE RADIO ELECTRONICS CORP.

691 Central Park Avenue, Scarsdale

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 54, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

LAFAYETTE RADIO ELECTRONICS CORP.

111 Jericho Turnpike, Syosset

4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 29, 30, 31, 35, 37, 38, 39, 40, 42, 44, 46, 47, 49, 50, 53, 57, 59, 61, 62, 65, 66, 68, 69, 70, 74, 75, 77, 79, 80, 81, 82, 83, 84, 87, 88, 90, 91, 92, 93, 94, 97, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 114

HARVEY SYRACUSE

Pickard Drive, Box 185, Syracuse

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 27, 29, 30, 34, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 61, 62, 65, 67, 68, 69, 70, 72, 74, 75, 76, 77, 78, 80, 82, 84, 87, 88, 90, 97, 98, 99, 102, 103, 104, 106, 109, 114

NORTH DAKOTA

JOHN IVERSON CO.

216 Second Street, S.W., Minot

4, 6, 7, 8, 9, 10, 12, 13, 20, 21, 23, 26, 27, 29, 30, 31, 35, 36, 37, 39, 40, 41, 43, 46, 50, 59, 60, 65, 68, 69, 70, 72, 75, 79, 80, 81, 82, 83, 84, 88, 90, 92, 96, 98, 99, 100, 101, 102, 104, 107, 109, 111, 114

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709 Arch Street, Philadelphia

4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 18, 19, 20, 21, 23, 25, 26, 27, 29, 30, 36, 37, 39, 40, 42, 44, 46, 50, 54, 59, 61, 62, 65, 68, 69, 72, 74, 75, 76, 77, 79, 80, 82, 84, 85, 87, 97, 99, 100, 101, 104, 107, 108, 109, 110, 111

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TEXAS

AMATEUR ELECTRONICS, INC.

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1, 4, 5, 6, 7, 8, 9, 11, 13, 15, 16, 18, 19, 21, 23, 25, 26, 27, 28, 29, 30, 33, 37, 39, 40, 42, 46, 47, 50, 59, 61, 62, 65, 67, 68, 69, 71, 72, 73, 74, 79, 80, 81, 90, 92, 93, 98, 103, 104, 109, 110, 111

ELECTRONIC EQUIPMENT & ENG. CO.

1823 Walker Street, Houston

1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 15, 16, 17, 19, 20, 21, 23, 25, 27, 29, 30, 36, 37, 39, 40, 42, 44, 46, 50, 51, 55, 59, 60, 62, 65, 67, 68, 69, 72, 74, 75, 78, 80, 81, 83, 84, 85, 90, 92, 93, 96, 98, 99, 100, 101, 104, 106, 107, 109, 110, 111, 114

THE HARGIS CO., INC.

1205 Washington, Waco

1, 4, 5, 6, 8, 9, 11, 18, 19, 20, 21, 23, 26, 29, 30, 31, 39, 40, 42, 46, 47, 50, 59, 62, 65, 67, 68, 72, 73, 75, 77, 80, 81, 84, 87, 90, 98, 99, 100, 103, 104, 107, 109, 110

VIRGINIA

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1, 4, 5, 6, 7, 9, 13, 17, 18, 19, 20, 21, 23, 25, 26, 27, 29, 30, 31, 36, 37, 39, 40, 42, 46, 47, 50, 51, 55, 59, 61, 62, 63, 64, 65, 67, 68, 69, 70, 72, 73, 75, 76, 77, 78, 79, 80, 81, 83, 85, 87, 88, 90, 95, 96, 97, 98, 99, 100, 103, 104, 106, 107, 109, 110, 111, 113

WISCONSIN

AMATEUR ELECTRONIC SUPPLY

3832 West Lisbon Ave., Milwaukee 8

1, 4, 5, 6, 7, 8, 9, 13, 14, 15, 18, 19, 20, 21, 23, 25, 26, 29, 30, 31, 32, 35, 36, 40, 42, 44, 46, 47, 50, 51, 59, 61, 65, 67, 68, 69, 70, 72, 74, 75, 77, 78, 79, 80, 81, 83, 84, 85, 88, 90, 92, 96, 97, 98, 99, 100, 103, 104, 108, 109, 110, 111

ALLIED RADIO OF WISCONSIN

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PAYETTE RADIO LIMITED

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4, 6, 7, 8, 9, 10, 11, 12, 18, 20, 21, 23, 27, 29, 30, 36, 37, 39, 40, 42, 46, 50, 51, 59, 61, 62, 65, 67, 77, 80, 84, 87, 88, 93, 98, 102, 104, 107, 109

For further information, check number 36, on page 158

Alphabetical listing of Manufacturers

1 Adcom Linear Systems Inc.
605 University Avenue
Los Gatos, California
Power Supplies
Linear Amplifiers

2 Alco Electronics Mfg. Co.
Alco Electronics Parts
3 Wolcott Avenue
Lawrence, Mass.
Grid-dip meters—dollar specials (diodes, rectifiers, transistors, etc.)

3 American Crystal Co.
P.O. Box 2366
Kansas City, Missouri
Crystals

4 American Electronics Co. (Ameco)
178 Herricks Road
Mineola, L.I., N.Y.
Converters, Preamplifiers, Code Courses, Books

5 Amperex Electronic Corporation
230 Duffy Avenue
Hicksville, L.I., N.Y.
Transmitting Tubes

6 Antenna Specialists Co.
12437 Euclid Avenue
Cleveland 6, Ohio
Mobile Communications Antennas

7 Astatic Corp
Conneaut, Ohio
Microphones

8 Barker & Williamson, Inc.
Canal Street & Beaver Dam Road
Bristol, Penna.
S.S.B. Transmitters, Amplifiers, TR Switches, Inductors, Baluns & Components

9 Belden Mfg. Co.
415 S. Kilpatrick Avenue
Chicago 44, Illinois
Electronic Wire & Cables

10 Burgess Battery Co.
Foot of Exchange Street
Freeport, Illinois
Batteries

11 Centralab
954K E. Keefe Avenue
Milwaukee 1, Wisconsin
Switches, Components

12 Clarostat Mfg. Co., Inc.
Dover, New Hampshire
Resistors variable & fixed

13 Clegg Laboratories
Rt. #53
Tabor, N.J.
VHF Transmitters and Receivers

14 Clemens Mfg. Co.
630 South Berry Rd.
St. Louis 22, Mo.
Signal Generators, Laboratory Test Equipment

15 Collins Radio Co.
855 35th Street N.E.
Cedar Rapids, Iowa
Receivers, Transmitters, accessories

16 Columbia Products Co.
Rte. 3
Columbia, So. Carolina
Mobile Antennas

17 Communications Products, Co.
Marlboro, N.J.
Antennas

18 Cornell-Dubulier Electronics
50 Paris Street
Newark 1, N.J.
Capacitors, Antenna Rotors

19 Cowan Publishing Corp.
300 W. 43rd Street
New York 36, N.Y.
CQ, S9, Semiconductor Products & Solid State Technology, and technical library

20 Cush-Craft
621 Howard St.
Manchester, N.H.
Antennas

21 Dow-Key Company, Inc.
Warren, Minnesota
Coaxial Relays, TR Switches and Connectors

22 DPZ Corp.
30 Broad Street
New York 4, N.Y.
Portable Antennas

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20	14.0-14.5 mc	USB and CW

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23 R. L. Drake Co.
Miamisburg, Ohio
Receivers, Transceivers, Interference Filters

24 e.c.i. Electronic Communications Inc.
325 No. McQueston Pkway
Mt. Vernon, N.Y.
r.f. amplifiers, test equipment

25 E-Z Way Towers, Inc.
5901 East Broadway
Tampa 5, Florida
Towers and accessories

26 Editors & Engineers, Ltd.
Summerland, California
Books

27 Eitel-McCullough, Inc.
798 San Mateo Avenue
San Bruno, California
Transmitting Tubes

28 Electrophysics Corp.
2502 West Coast Highway
Newport Beach
California
Electronic Keys

29 Electro-Voice Inc.
Buchanan, Michigan
Microphones, Speakers

30 Electronic Instrument Co., Inc. (EICO)
30-00 Northern Blvd.
Long Island City, N.Y.
Transmitters, Test Equipment, accessories

31 The Finney Company
34 Interstate Street
Bedford, Ohio
Antennas

32 Gavin Instruments, Inc.
Depot Square & Division St.
Somerville, N.J.
TV Interference filters, Power Meters

33 Gain, Inc.
1209 W. 74th Street
Chicago 36, Illinois
Beam Antennas

34 G.A.M. Electronics
138 Lincoln Street
Manchester, N.H.
Antennas

35 Glas-Line
Div. of Grady-Travers Co., Inc.
111 8th Avenue
New York, N.Y.
Insulated Guy Line

36 Globe Electronics Company
Division of GC-Textron Electronics Inc.
400 So. Wayman St.
Rockford, Illinois
Transmitters, Amplifiers, Test Equipment and accessories

37 Gonset
Subsidiary of Altec Lansing
801 So. Main Street
Burbank, California
Receivers, Transmitters, Amplifiers, and accessories

38 Gotham
1805 Purdy Avenue
Miami Beach 39, Florida
Antennas

39 Greenlee Tool Company
2371 Columbia Avenue
Rockford, Illinois
Socket & Hole-Punching Tools

40 Hallicrafters Company
4401 W. 5th Avenue
Chicago 24, Ill.
Receivers, Transmitters, Amplifiers and accessories

41 Ham Kits
308 Edgar Ave.
Cranford, N.J.
Dummy Loads

42 Hammarlund Mfg. Co., Inc.
a Giannini Scientific Company
53 West 23rd Street
New York 10, N.Y.
Receivers, Transmitters, r.f. amplifiers and component parts

43 Heath Company
Benton Harbor, Michigan
Transmitters, Receivers & Accessories

44 Hi-Par Manufacturing Company
347 Lunenburg Street
Fitchburg, Mass.
Antennas

45 Hornet Antenna Products
P.O. Box 808
Duncan, Oklahoma
Antennas

46 Hi-Gain Antenna Products
8045 N. E. Highway 6
Lincoln, Nebraska
Antennas

47 Hunter Mfg. Co.
30525 Aurora Rd.
Cleveland 39, Ohio
Linear Amplifiers

48 Instructograph Co., Inc.
4711 Sheridan Road
Chicago 40, Ill.
Code Practice Equipment

49 International Crystal Mfg., Co., Inc.
18 North Lee Street
Oklahoma City 2, Oklahoma
Transmitters, Crystals and Accessories, Printed Circuit Amplifiers

50 Johnson E.F. Co.
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Transmitters, Amplifiers, Antennas, Rotators and Components

51 M.C. Jones Co.
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For further information, check number 42, on page 158

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53 Knights, James Co.
Sandwich, Ill.
Crystals

54 Kolin Engineering Co.
Box 357
Bronxville, N.Y.
Transistorized noise limiters

55 Herb Kreckman Co.
Cresco, Penna.
Vertical Antennas

56 L.W. Electronic Labs.
Route 2
Jackson, Michigan
VHF Transmitters, Converters

57 Lafayette Radio
111 Jericho Turnpike
Syosset, L.I., N Y.
Receivers, Transmitters, Accessories, Test Equipment, Components

58 Lampkin Laboratories, Inc.
Bradenton, Florida
Frequency Meters

59 Master Mobile Mounts, Inc.
1306 Bond Street
Los Angeles 15, California
Mobile Antennas, Mounts, Coils, Field Strength Meters

60 McCoy Electronics Co.
Mt Holly Springs
Pennsylvania
Crystals and crystal filters

61 Millen Mfg Co., Inc., James
150 Exchange Street
Malden 48, Mass.
Transmitters, Amplifiers, Power Supplies, Component Parts, Laboratory Test Equipment

62 J W. Miller Co.
5917 South Main Street
Los Angeles 3, California
R.F Coils and I.F. Transformers

63 Mini-Products, Inc.
1001 W 18th Street
Erie, Penna.
Antennas

64 Mor-Gain
P.O. Box 6006
Alexandria, Virginia
Antennas

65 Mosley Electronics, Inc.
8622 St. Charles Rock Road
St. Louis 14, Missouri
Antennas, Receivers and Accessories

66 Mobiliers
Box 128 722 Main
Coshocton, Ohio
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67 Multi-Elmac Co.
214 70 Coolidge Hwy.
Oak Park 37, Mich.
Mobile Transmitters and receivers

68 National Radio Company, Inc.
61 Sherman Street
Malden, Mass.
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69 New-Tronics Corp.
Div. of Automatic Radio
3544 Vega Avenue
Cleveland 13, Ohio
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70 P & H Electronics, Inc.
424 Columbia
Lafayette, Indiana
Transverters, Amplifiers, Test Equipment

71 Pacific Plantronics, Inc.
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Santa Cruz, Cal.
Lightweight Headphones Sets

72 Pennwood-Numechron Company
7249 Frankstown Ave.
Pittsburgh 8. Penna.
Clocks, Timers

73 Penta Laboratories, Inc.
314 North Nopal Street
Santa Barbara, Calif.
Transmitting Tubes

74 Petersen Radio Company, Inc.
2800 West Broadway
Council Bluffs, Iowa
Crystals

75 Polytronics Labs., Inc.
88 Clinton Rd.
West Caldwell, N.J.
Transceivers

76 Premax Products
Div. of Chisholm-Ryder Co., Inc.
6225 Highlands Avenue
Niagara Falls, N.Y.
Antennas-Antenna Equipment

77 RCA Electronic Components & Devices
Harrison, N.J.
Electron Tubes

78 Radio Industries, Inc.
1307 Central Avenue
Kansas City, Kansas
Amplifiers, Antenna Rotators

79 Radio Publications, Inc.
Wilton, Conn.
Books

80 Rider Publishing, Inc., John F.
116 West 14th Street
New York 11, N.Y.
Books

81 Rohn Manufacturing Co.
116 Limestone, Bellevue
Peoria 5, Illinois
Towers and Accessories

82 Rotron Manufacturing Company, Inc.
Hasbrouck Lane
Woodstock, N.Y.
Cooling Devices

For further information, check number 44, on page 158

83 Seco Electronics, Inc.
5015 Penn Avenue So.
Minneapolis, Minn.
Test Equipment and Accessories

84 Shure Brothers, Inc.
222 Hartrey Avenue
Evanston, Illinois
Microphones & Headsets

85 Sideband Engineers Inc.
Rancho Santa Fe, California
ssb tranceivers

86 Skylane Products
406 Bon Air
Tampa 10, Florida
Quad Antennas

87 Sonotone Corp.
Electronic Applications Div.
Elmsford, N.Y.
Microphones

88 Sonar Radio Corporation
73 Wortman Avenue
Brooklyn 7, N.Y.
Transceivers

89 Space Raider Antennas
1076 East Walnut
Pasadena, Calif.
Antennas

90 Sprague Electric Co.
235 Marshall Street
North Adams, Mass.
Resistors, Capacitors, Transistors, Ignition Noise Suppression Kits

91 Supreme Electronics Inc.
Front & Main Sts.
Upland, Pa.
Towers, ssb transmitter

92 Swan Engineering Co.
Oceanside, California
Transceivers

93 Sylvania
730 Third Avenue
New York 17, N.Y.
Electronic Tubes

94 Tapecode
Langhorne, Pa.
Code Instruction Courses

95 Tapetone, Inc.
10 Ardlock Place
Webster, Mass.
VHF Transmitters and Converters

96 Technical Material Corporation
Mamaroneck, N.Y.
Receivers, Transmitters, and accessories

97 Tecraft Sales Corp.
Teterboro, N.J.
VHF Converters & Transmitters

98 Telex, Inc.
1633 Eustis Street
St. Paul 1, Minnesota
Head Sets

99 Telrex, Inc.
Asbury Park 2, N.J.
Antennas, Rotators and Accessories

100 Texas Crystals
1000 Crystal Drive
Ft. Myers, Florida
Crystals

101 Topaz Transformer Products, Inc.
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Power Supplies

102 Triad Transformer Corp.
4055 Redwood Ave.
Venice, California
Transformers and Chokes

103 Tri-Ex Tower Corp.
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Tulare, Calif.
Towers and Accessories

104 Turner Microphone Co.
925 17th Street, N.E.
Cedar Rapids, Iowa
Microphones

105 U.S. Crystals, Inc.
142 S. LaBrea Avenue
Los Angeles 19, Calif.
Crystals

106 United Transformer Corp.
150 Varick Street
N.Y. 13, N.Y.
Transformers and Chokes

107 University Loudspeakers, Inc.
80 South Kensico Ave.
White Plains, N.Y.
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108 Utica Communications Corp.
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Chicago 25, Ill.
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109 Vibroplex Company, Inc., The
833 Broadway
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Keys

110 Waters Manufacturing, Inc.
Wayland, Mass
Station Controls, Dummy loads, and accessories

111 Webster Manufacturing
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San Francisco, Calif.
Mobile Antennas

112 Whippany Laboratories, Inc.
1275 Bloomfield Ave.
West Caldwell, N.J.
VHF transmitters

113 World Radio Laboratories
3415 West Broadway
Council Bluffs, Iowa
Transmitters and Accessories

114 The Datak Corporation
63 71st Street
Guttenburg, N.J.
Electronics lettering kits

115 Euphonics
173 West Madison Street
Chicago 2, Illinois
Microphones

For further information, check number 47, on page 158

For further information, check number 48, on page 158

Project Interference [*from page 67*]

3000 range. If frequencies carrying the most useful communications are accentuated in a transmitter without exceeding 100% modulation, the effectiveness of the transmitted signal is correspondingly increased.

An important factor controlling the bandwidth of the modulating signal is the microphone. The high-frequency limit of a microphone usually is determined by its application. A "hi-fi" mike may have a high-frequency limit of 15,000 c.p.s. or more. This, however, is not at all desirable for communications work where the 3000 to 15,000 c.p.s. output is contributing nothing to the intelligibility and is helping to broaden the transmitted signals bandwidth.

Microphones intended for communications work are designed to inherently limit frequency response to the 300-3000 c.p.s. range while attenuating signals beyond this range. Such microphones are strongly recommended for all amateur phone work, both a.m. and s.s.b.

Thus, we can summarize by saying that in order to achieve the standard signal bandwidths of 6 kc for a.m. and 3 kc for s.s.b., one or more of the following methods must be used: Install an audio bandpass filter with 300-3000 c.p.s. bandwidth, use a limited response microphone, or use a speech amplifier which has been tailored to give best response in the communications range.

Signal Quality Standards

Much difficulty has been encountered in criticizing and correcting poor phone signals, mainly because a firm set of standards is not available on which to base comparisons.

As a result of much on-the-air discussion as well as research in various technical publications, the following broad standards were established. They represent the bare minimum of signal quality. Most items seem routine enough, but unfortunately they are overlooked often enough to cause trouble.

A.M. Signal Quality Standards: Not over 100% modulation; not over 6 kc bandwidth; no audible hum or carrier; no f.m. of carrier; minimum of drift; minimum of entraneous background noise.

S.S.B. Signal Quality Standards: Not over 3 kc bandwidth; minimum of drift; 50 db or more carrier suppression; 40 db or more unwanted sideband suppression; odd-order distortion products 35 db down at output of exciter; 30 db down at output of final amplifier; spurious signals 50 db or more down from peak output.

These signal quality standards were found to be acceptable when discussed with many amateurs, and, based on past performance, the average amateur transmitter is quite capable of achieving this performance.

Part III of "Project Interference" will discuss a program aimed at utilizing the information gathered in Parts I and II to effect a "reform" on the amateur bands.

[*To Be Continued*]

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HT-33B Linear Amplifier	995.00
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HT-40K Kit form of above	89.95
HT-41 Linear Amplifier	395.00
SX-100 General Coverage Receiver	325.00
SX-101A Ham Band Receiver	445.00
SX-110 General Coverage Receiver	169.95
SX-111 Ham Band Receiver	279.50
SX-115 Ham Band Receiver	599.95
SX 140 Ham Band Receiver (80-6)	124.95
SX-140K Kit form of above	104.95
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Sideband [*from page 93*]

chief operator at HV1CN and we accepted with alacrity the opportunity to meet one of the most famous DX station operators in the world.

So one evening shortly afterwards, we were seated across from Domenico in the company of Bil Harrison, W2AVA; Trav Marshall, K9EBE of the Hallicrafter Company; Arne Trossman, W2DTJ, Editor of *CQ;* Ben Snyder, W2SOH; Urb Le Jeune, W2DEC, DX Editor of *CQ*; Neal Latorraca, K1JMN, Domenico's interpreter; Bob Finlay and Bob Finlay Jr., WB2HSF.

Domenico, tall, sandy haired, with a ready smile, made a hit with every ham he met in his week long tour of New York, Chicago, Detroit and Hartford. Imagine the surprise among the DX'ers attending the Hamfesters' Picnic in Chicago when they suddenly became aware that HV1CN was among those present! Surrounded by hundreds anxious to talk with him, Domenico revealed that he was born in the same house that Marconi had lived in! Numerous hot dogs later, he spent the evening at the home of W9TO, Jim Hicks, the designer of the "TO" Keyer and the following day toured the extensive Hallicrafter laboratories and manufacturing facilities.

Looking back, we find that we have completed 44 columns totalling uncounted thousands of words since we first began writing this column in April of 1960. We have seen Sideband grow from the days of "homebrew" to pages upon pages of advertisements featuring nothing but sideband gear. We have watched the development of the transceiver—that fabulous instrument which replaces the cumbersome equipment that graced the basement or the attic—making possible the "ham shack" in the den or in any part of the house.

However, this is to be our last column for *CQ*. We have enjoyed writing it for you; we have made many new friends during its tenure; we look forward to talking with them on the air and at Hamventions and we shall continue to work for the advancement of Sideband and Ham Radio in any way we can.

73, Irv and Dorothy, K2HEA/K2MGE

220 Mc Preamp. [*from page 111*]

As mentioned above, out of curiosity, this ARR-2 unit was tried in front of the regular 220 mc station converter in place of the normal two stage 416B preamplifier as used on this band. It is not as good as far as signal to noise ratio is concerned, compared to the 416B's, but the difference is not nearly as much as was anticipated. The selectivity is excellent and should clear up any spurious stuff from TV or f.m. stations nearby in case trouble is experienced along this line.

Now back to that old ARR-1 job—you know, taking a second look at that thing again, it just may be possible to substitute 8058's for those acorns. It just might be. ■

DX [*from page 88*]

"Have just received my Heath Twins, as they are affectionally known, the HX-20 and the HR-20 so am now helping to put Malaya on the s.s.b. map as well. There are a number of 9M2s on this mode, among the more active 9M2CR, DQ, CM, GV as well as VS1JH, MB, AU, BC and several others. Look for us on c w - a.m.-s.s.b. on the 40, 20, and 15 meter bands in particular and we would be most happy to give anyone a contact or chat." Thanks to John, 9M2JJ, for the above letter.

QTHs and QSL Managers

AC3PT via W4ECI.
AC5A/AC4 via W4ECI.
AC5A via W4ECI.
AC7A via W4ECI.
AP2AR via W8QWI.
AP5GB via W4ECI.
CP5EZ via W2CTN.
F9RY/FC via HB9TL.
F9UC/FC via DL9PF.
FP8AS via W2EQS.
HS1L via W7YB.
HS1P via W4CKB.
HS1X via WA2WCB.
HL9TD Sgt. R. L. Loar, Detachment B, 304th Sig. Bn (A), APO 970, San Francisco, Calif.
HM1AP via K6QPG.
HR2FG via W2CTN.
HZ1AMS P. O. Box 7388. General Post Office, N. Y. 1, N. Y.
JZ0HW via W6DLN.
KC6BO via W4YHD.
KG6SA U. S. Coast Guard Station, Saipan, Marianas Islands.
ex-PJ2AF via K4OGT.
PX1KK via K2JFV.
PX1MO via K2JFV.
PY1MCC via WA6UZA.
PY7AKW Box 1034, Recife, P. E., Brazil.
PZ1CE via W1NTH.
TA2NK via DJ2NY.
TU2AU Frank Smith, U. S. Embassy, Abidjan, Ivory Coast.
VK4JQ via W6HYG.
VK4WV/VK4HG via VK2AGH.
VP2AB James A. N. Brown, Box 340, Antigua, B.W.I.
VP2MM via K8ONV.
ex-VP4NC via VE3FPF, Rev. Lawrence A. Purdy, 1407 Locklin Trail, Port Credit, Ont.
VP7BC via W4CNS.
VP9FK Box 509, Hamilton, Bermuda.
VS5CW via VS1CW.
W4VGL/KG6 Cdr. Far East Section, Marcus Is. APO 94, San Francisco, Calif.
XW8AL via K4KTR.
YA1AN via DL3AR.
YI2WS via SM5CCE.
YS1TA Box 517, San Salvador, El Salvador
ZB1BX via W2CTN.
ZD7BW via G3PEU.
ZD8HB GMRD, Box 4187, Patrick AFB, Fla.
ZD8WF via W3PN.
ZM7AD via K6ERV.
3V8CA via W4YWX.
5X5IU Box 355, Kampala, Uganda.
6O1ND Norman Duxbury, Box 397, Mogadiscio, Somalia, Africa.
6O1WF Box 6, Mogadiscio, Somali Republic.
9A1TAI via W4VPD.
9L1JC ia WA4CXR, 11 Chestnut St., Lexington, N. C.
9Q5TH Box 2214, Leopoldville, Rep. of Congo.
9U5BH Box 81, Astride, Ruanda.

Two QSL managers report throwing in the towel because of non-cooperation on the part of the DX station. They are K6EC, who has sent VR4CV all QSLs. His QTH is Alan Viegas, Two Fifty Lodge, 250 Victory Parade, East Melbourne, Vic., Australia. W5VSQ has also closed the books on 4X4DH. Bruno has sent no logs.

160 Meters

160 meter season 1963/64 starts with a bang . . . opening wide in September. In an unusually early surprise opening, 5N2JKO made a first. Nigeria/USA contact with W1BB, for W1BB's No. 72 country on 160. Other QSOs with W1BB were DL1FF for his first season's crossing; G3PQA, G3RAU, G3IGN, G3MYI, also came thru. W2IU worked DL1FF, G3MYI, RBP, OUV, IGW. W2IU was heard by 5N2JKO/449 —the band was alive and signals very good. VE1ZZ/Jack and VE2UQ/Gordon made the first crossings of the season when they both QSOd G3UOV July 24th and 25th.

Many transatlantic G-QSOs were made. G3GRL/VE1ZZ tested antennas, GRL peaking

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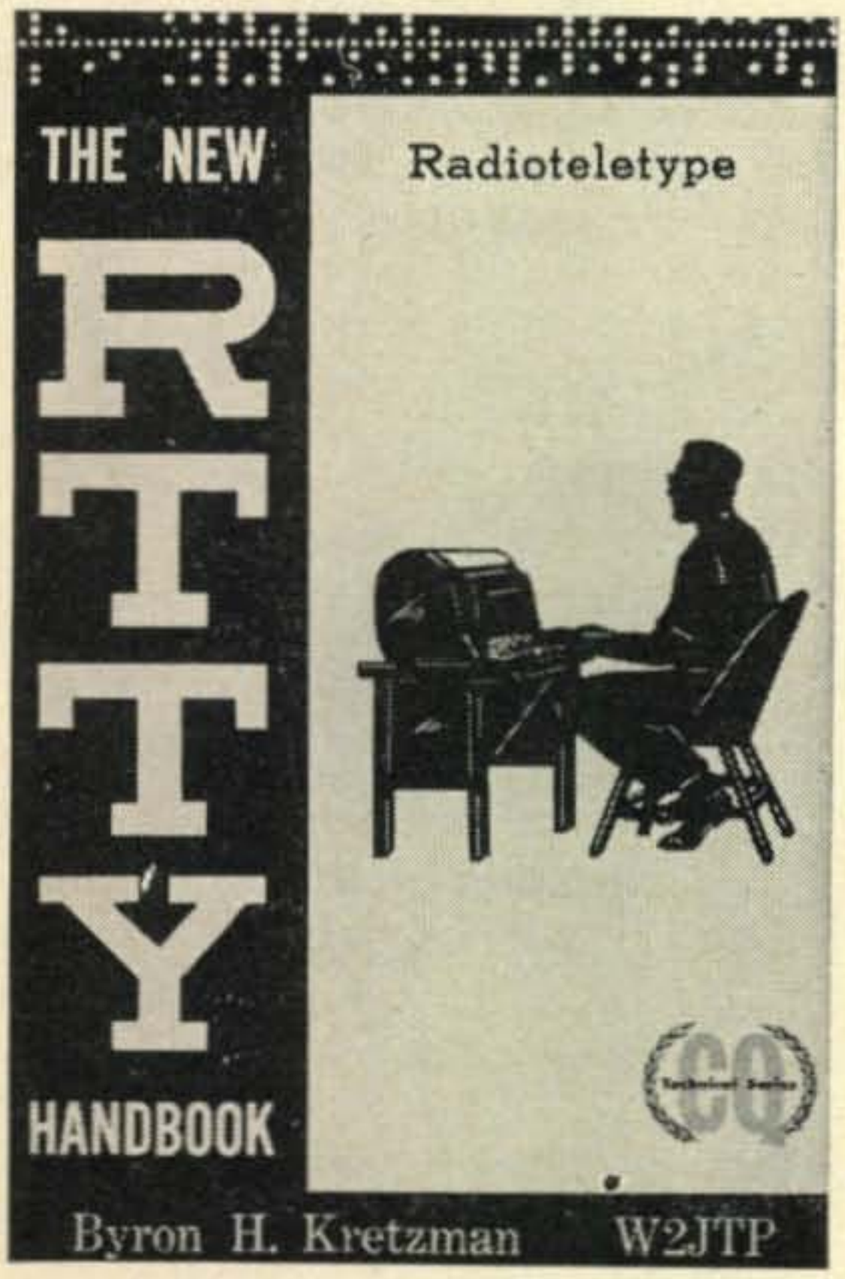

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57/89 on both vert and horiz. Known QSOs G3GRL/W2GGL, KQT, ITX, BHQ; G3OQT/W2KQT. Then VP8GQ came on QSOing many W/VEs and peaking 589. Included were W1-BHQ, 2KQT, VE3EWY, AGK, who got 589 from Peter. VP8GQ/G3GRL QSO, both giving each other 589 report. Following this, HR3HH came on 569 clearly heard by many W/VEs but having receiving troubles; believe no QSOs. A memorable morning it was when W9PNE was delivering 160 meter talk at DXCC meeting Chicago and not able to be on. W8GDQ also attended that DXCC meeting. We expect to hear a lot from 5N2JKO this season. He has now QSOd DL1FF, GI6TK, W1BB, W2KHT and other Europeans using 500' long wire ant. only 20 feet high. He is now working on an inverted V much higher.

K1KSH/KS6, Gary roaming the S. Pacific has QSOd W6MI, ex-6KIP and W1BB from Guam and W1BB from Marcus. *(Tnx to W1BB for 160 meter info)*

Reciprocation

Our Non-Reciprocal Licensing Policy is again manifest in the refusal of permission for W/K Amateurs to accompany Harvey, VQ9HB, on the proposed DXpeditions to sundry Indian-Ocean Islands under British control. Now is the time to again write your Congressmen supporting Senate Bill S.920 to correct this situation.

73, Urb, W2DEC

RTTY [*from page 105*]

WØSV, pioneer RTTYer of St. Cloud, Minn., has become a Silent Keyboard. Bob will be remembered for his motor driven tone standard, described in the September 1956 RTTY Column. KØKBH has moved to Riverside County, Calif. KØHZI of St. Paul, Minn., is on 52.60 f.m. KØSBS of Omaha, Neb., is having problems with his W2JAV TU. (*Can anybody local help?*) WØIPY of Marshall, Minn., is on 20 meters.

Comments

Most of the techniques used by RTTYers in the design of TU's have been derivations of wire line telegraph and carrier practice. Lately there has been a trend towards the younger computer techniques. The latest, and which we believe most significant, approach to TU design has been the "limiterless two-tone" method of Frank Gaude, K6IBE (*RTTY*, June '63, Sept. '63). Illustrative of the RTTYer's typical approach of not just considering the theory, a country-wide group has been trying out Frank's ideas on the air. The results of this independent investigation have been encouraging, to say the very least. W6NRM has modified his Mark III/IV TU (*RTTY*, Mar. '63, Sept. '63). K8DKC, W2PEE, W4MGT, K5AUM, and W5HCS are among those building and trying. You can read their mail on 20 meters most any evening.

73, Byron, W2JTP

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Radio Classics [*from page 80*]

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Space Communications [*from page 91*]

and space-listeners are making important contributions to the world's space effort by manning amateur-built space tracking stations in various parts of the world. From such stations, it has been possible in the past to establish certain orbital characteristics of satellites with precision almost equal to that of the professionally designed and operated tracking networks.

Word has been received recently from Dieter Oslender, operator of an amateur space tracking station in Bonn, Germany, that a world-wide coordinated network of amateur stations is now being formed. With key stations in Germany, Italy, Angola, Argentina and the United States already participating, this network may well be larger in scope than existing professional networks.

Dieter's station (see photos) is capable of receiving satellite signals over a frequency range extending from 3 to 260 mc. He uses parabolic, corner-reflector and spiral receiving antennas, and he has tracked almost every satellite launched since SPUTNIK I. Dieter has copied the voice of every man and woman launched into space from Gagarin to Tereschkova, and he copied Gordon Cooper loud and clear from 85 seconds after blast-off through his final orbit. Among Dieter's biggest thrills were receiving signals from LUNIK as it hit the surface of the moon, and hearing signals from EXPLORER XIV when it was nearly 55,000 miles in space. There will be a complete story on the world-wide amateur satellite tracking network *in this column in* the near future.

73, George, W3ASK

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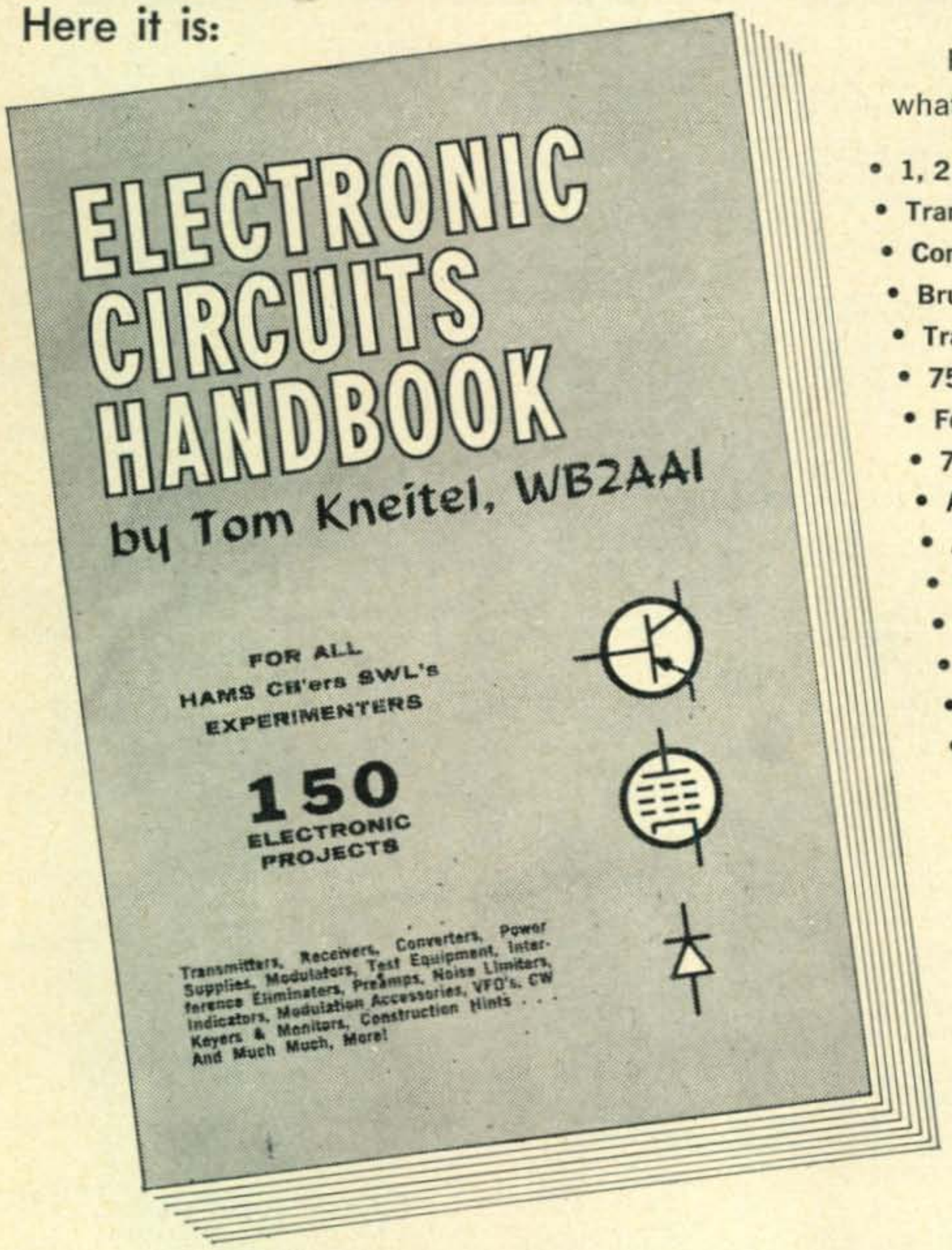

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POWER STAT TYPE 616.52G2 3 Gang VARIABLE AUTO-TRANSFORMER. Input: 199 VAC 380 Cycles. Output 0 to 199 V at 15 Amps. 5.2 KVA Maximum. By Superior Electric Co. 35.00

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TS 452/U MULTIMETER, with MX-815U Multiplier Kit. Made by Weston. Military version of Phaostron Multiplier 75.00

TS 487/U—HIGH FREQUENCY VTVM. Has 3 scales: 0-3V/ 0-10V/-50V. NO BOOK 49.95

PACO MODEL C-20 RESISTANCE—Capacity—Ratio Bridge—No Book 27.20

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JOHNSON DUAL 504 MMFD. VARIABLE CONDENSER TYPE 500DD35. 0.08" Air Gap—$14.95 Jobber Boxed (Reg. Net) 25.50 ..... 14.95

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TS 433B/U ELECTRONIC SWITCH. By Chatham Electronics Corp. 49.00

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3 KVA. STEP-DOWN AUTOTRANSFORMER—Oil filled. Pri: 100-130 VAC at 60 CPS (TAPS) 200-260 VAC at 60 CPS (TAPS). Sec: 117.5/115 or 112 VAC at 30 Amps. 3 KVA Power Rating dimensions: 11-15/16L x 10-9/16W x 11⅜"H. Approx. Wt.: 60 lbs. 49.00

MODULATION DUMMY-LOAD, HAZELTINE MODEL 1735. Oil filled. Approx. 50 Ohms impedance. Frequency response from 0 to 4000 MCS. Average power: rating: 500 Watts, self-cooled. Made by Bird Electronic Corp. (Bird Model 86). Supplied with 7 foot cable and book 125.00

3 KW. DUMMY LOAD. 50 Ohms impedance. (12 non-inductive 600 Ohm Resistors) Internal blower operates from 115 VAC—60 CPS. Mfd. for Air Force by Bird Electronics. Type CAWY-14ACN. 13"H x 10¾"W x 25" D. Wt.: 25 lbs. 55.00

3000 V at 5 MA. Selenium Rectifier 1.25

SIGMA TYPE 5F. 16,000 Ohm sensitive relay. Closes at 3 Ma. Releases at 1 Ma. Plugs into standard octal socket ..... FOB, Georgia 3.95

CHICAGO-COLLINS POWER-TRANSFORMER. Primary 205/210/220/230 VAC—60 CPS. Secondary: 610-0-610 Volts at 350 MA. Use 2 or 3 of these with secondaries in series to obtain higher output voltage ..... FOB, Georgia 6.95

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NON-INDUCTIVE RESISTOR—15 OHMS. 15 OHM-160 Watt wire wound, non-inductive. ..... FOB, Georgia 2.50

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HALLICRAFTER MODEL S-81 "CIVIC PATROL" RECEIVER. Frequency range: 152-173 Mcs. Receives police, fire, ship, taxi, telephone communications. In good condition. 55.00

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RCA MINIATURE TRANSFORMER

Pri: 117 Volts at 60 CPS.
Sec: 150 VDC after rectification at 30 Ma.
Filament winding: 6.3 VAC at 1½ Amps.
1⅞"H x 1⅝"W x 1⅞"D.
Wt.: 14 ozs.
RCA #1470095-1

$1.40

CERAMIC MOBILE MICROPHONE

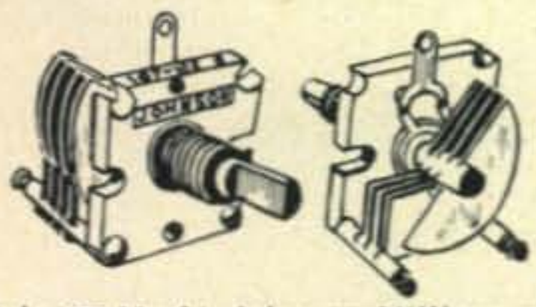
Grey Cast Metal case with SPST switch for push to talk. 5 ft., 4 cond. coil cord and Amphenol MC4M connector, and mounting bracket included. Similar to Turner SR9 and Shure 405.
Wt.: 1 lb.
Cat. #CMMH1.
In original packing

$7.95

CERAMIC ANTENNA INSULATOR SALE

Length Overall	Dia-meter	Stock #	Weight	Price
4¼"	½"	CSJ 61192	1 Oz.	.10¢
7½"	½"	CSJ 61191	2 Ozs.	.15¢
6⅛"	¾"	CDP 61047A	4 Ozs.	.20¢

JOHNSON SINGLE SECTION MINIATURE VARIABLE CAPACITOR, TYPE "L"



Capacity: 3.5 to 27 Mmfd. Johnson Military number 167-102-6 (Equivalent to Johnson Catalog number 167-2). 7 Plates per section. 1¼" depth behind panel. Standard ¼" shaft. Ceramic steatite Insulation. Smooth capacity variation. Rugged, vibration-proof frames. Reg. net price: $1.70. Special surplus purchase allows us to offer these at the following price ..... 75¢ each
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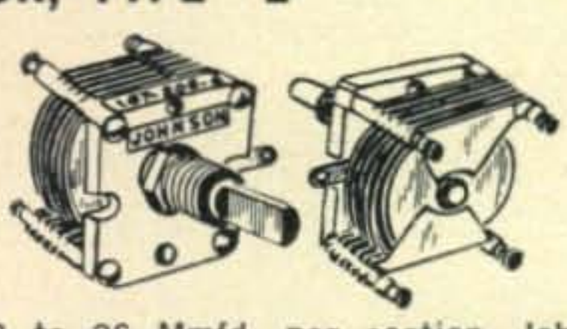
JOHNSON MINIATURE BUTTERFLY CAPACITOR, TYPE "L"



Capacity: 4.3 to 26 Mmfd. per section. Johnson Military #167-202-6 (Equivalent to Johnson catalog #167-22). 12 Plates per section. 1¼" depth behind panel. Standard ¼" shaft. Ceramic steatite Insulation. Smilth capacity variation. Rugged, vibration-proof frames. A superior quality general purpose VHF Capacitor. Reg. net price: $2.25. Special surplus purchase allow us to offer these fine units at only.... 95¢ each
In lots of 10 or more ..... 95¢ each
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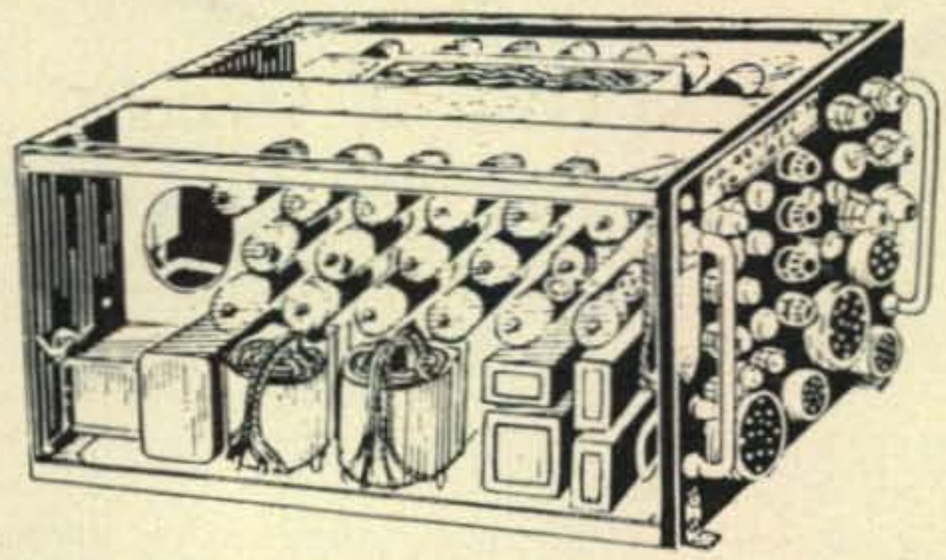
38 TUBE AIRCRAFT ELECTRONIC GUN CONTROL UNIT



Unit contains many precision parts for the experimenter. Tubes include: (1) OA2, (1) 2D21, (1) 6AQ5, (2) 6AH6, (1) 6AS6, (2) 6J6, (5) 6X4W, (2) 12AT7, (5) 12AX7, (2) 5654, (4) 5670, (1) 5725, (3) 5726, (8) 6005/6AQ5W. Parts include: (6) tube 30 Mc. I.F. Strip, 28 VAC or DC dual squirrel cage blower with R.F. filter, (5) hermetically sealed relays, (11) potentiometers, (5) BNC chassis connectors, 5 & 10% Allen Bradley resistors. Metallized paper capacitors, silver mica capacitors, 1% precision resistors and many other parts too numerous to mention. GOOD Used Condition. Type #PP493/APG30. Size: 8⅜"H x 10⅝"W x 16½"D. Wt: 35 lbs. Cat. #4-APG3. Shipped from Atlanta, Ga. Warehouse

$12.00 FOB Ga.

Shipped from New York..... **$14.95** FOB N.Y.

DELUXE PORTABLE ELECTRONIC MEGAPHONE TYPE PAE-2

Consists of 6 tube amplifier, operating from modern built-in 6 volt (non-spillable) plastic wet-cells. Units comes complete with power supply and built-in charging supply to recharge batteries from 115 VAC. Charging supply has timing switch. Furnished with dynamic microphone in horn assembly with trigger switch, cord, and plug. Complete w/book - - - Unit is strictly "Rolls-Royce" throughout. Ideal for ship operation (unit is waterproof).
Output stage 4 tubes in push-pull parallel.
Voice capable of operation up to one mile.
All brand new and in original cartons.
Order Remler Type PAE-2.

$55.00

CAPACITORS

Capacity Mfd.	Working Voltage D.C.	Manufacturer	Number	Dimensions	Price
120	350	Sprague	3DB120-2	4¼" x 1⅜"	$1.00
250	350	Mallory	C117	4⅜" x 2"	1.25
500	200	Mallory	C-36MC	4½" x 2"	.90
500	200	Solar	C-36	4⅜" x 2"	.90
530	165	Sprague	D26274	3" x 1¾"	.90
800	150	Mallory	C109	4⅜" x 2"	1.00
800	165	Mallory	20-79007	3⅛" x 1¾"	1.00
1000	150	Mallory	C-109AMC	4½" x 2"	1.00
1250	175	Mallory & Sprague	1BM515386	4½" x 2"	1.00
1250	180	Mallory	3040578	4½" x 2"	1.00
1500	80	Mallory	C-306MC	4½" x 2"	1.00
2000	50	Aerovox	E67A16	4½" x 2"	1.00
2000	75	Aerovox	E9A10	3½" x 2"	1.00
2500	70	Cornell Dubilier	1BM218704	4½" x 2½"	1.95
2500	80	Mallory	3040574	4½" x 2"	1.00
2500	100	Mallory	20-71795	4½" x 2"	1.00
3000	40	Mallory	C-279	4⅜" x 2"	1.00
3500	55	Mallory	3040575	4½" x 2"	1.25
4500	40	Mallory	3040575	4½" x 2"	1.25
5000	25	Mallory	C-278MC	4½" x 2"	1.25
8000	55	Mallory & Sangamo	1BM328589	4½" x 3"	2.95
10,000	25	Sangamo	3040631	4½" x 2⅛"	2.25
13,500	15	Sangamo	3040632	4½" x 2"	1.95

Propagation [*from page 89*]

40	07-09(0-1) 09-12(2-4) 12-14(3-4) 14-16(2-4) 16-18(1-2) 18-20(0-1)	07-09(1-3) 09-14(4-2) 14-16(4) 16-18(2-4) 18-20(1-2) 20-00(0-2) 00-07(0-1)	07-09(3) 09-14(2-1) 14-16(4-2) 16-18(4) 18-20(2-4) 20-00(2-3) 00-03(1-2) 03-07(1-3)	07-08(3-2) 08-09(3-1) 09-14(1-0) 14-16(2-1) 16-17(4-2) 17-18(4-3) 18-20(4) 20-00(3-4) 00-03(2-3) 03-07(3)
80	08-17(4) 17-20(2-4) 20-22(1-3) 22-07(1-2) 07-08(2-3)	08-09(4-2) 09-16(4-1) 16-18(4-2) 18-20(4) 20-22(3-4) 22-07(2-4) 07-08(3)	08-09(2-1) 09-16(1-0) 16-18(2) 18-06(4) 06-07(4-2) 07-08(3-1)	08-09(1-0) 09-16(0) 16-18(2-0) 18-20(4-3) 20-04(4) 04-06(4-2) 06-07(2-1) 07-08(1)
160	09-17(1-0) 17-19(3-2) 19-07(4) 07-09(3-2) 09-11(1-0)	17-19(2-1) 19-05(4) 05-07(4-3) 07-09(2-1)	17-19(1-0) 19-21(4-2) 21-04(4) 04-05(4-2) 05-07(3-1) 07-09(1-0)	19-21(2-1) 21-04(4-3) 04-05(2) 05-07(1-0)

HAWAII TO:

*Openings Given in Hawaiian Standard Time**

	10/15 Meters	*20 Meters*	*40 Meters*	*80/160 Meters*
Eastern USA	08-12(1)† 07-08(1) 08-09(2) 09-11(3) 11-12(2) 12-14(1)	06-08(2) 08-11(1) 11-13(2) 13-14(3) 14-15(2) 15-16(1)	16-18(1) 18-02(3) 02-04(1)	18-20(1) 20-01(2) 01-03(1) 18-21(1)‡ 00-02(1)‡
Central USA	08-13(1)† 06-07(1) 07-08(2) 08-12(3) 12-14(2) 14-16(1)	06-07(1) 07-08(3) 08-12(2) 12-15(4) 15-16(2) 16-17(1)	16-18(1) 18-00(3) 00-02(4) 02-03(2) 03-04(1)	17-20(1) 20-02(2) 02-04(1) 18-20(1)‡ 00-03(1)‡
Western USA	08-10(1)† 10-12(2)† 12-13(1)† 06-07(1) 07-08(2) 08-13(4) 13-14(2) 14-16(1)	05-07(1) 07-08(3) 08-13(4) 13-15(3) 15-16(2) 16-18(1)	06-08(3) 08-09(2) 09-14(1) 14-16(2) 16-02(4) 02-04(3) 04-06(2)	16-18(1) 18-20(2) 20-04(3) 04-06(2) 06-07(1) 19-00(1)‡ 00-04(2)‡ 04-06(1)‡

ALASKA TO:

*Openings Given in Alaskan Standard Time**

	15 Meters	*20 Meters*	*40 Meters*	*80 Meters*
Eastern USA	10-14(1)	08-12(1) 12-14(2) 14-16(1)	20-04(1)	*Nil*
Central USA	09-11(1) 11-13(2) 13-14(1)	09-11(1) 11-14(2) 14-16(1)	20-04(1)	*Nil*
Western USA	10-12(1) 12-14(2) 14-16(1)	09-11(1) 11-14(3) 14-15(2) 15-17(1)	15-17(1) 17-22(2) 22-08(1)	18-23(1) 05-07(1)

Forecast Ratings

The numerical ratings appearing in parenthesis following each predicted time of opening indicate the *total* number of days during each month of the forecast period the opening is expected to occur, as follows:

*Hawaiian Standard Time is 5 hours *behind* EST; 4 hours *behind* CST; 3 hours *behind* MST; 2 hours *behind* PST and 10 hours *behind* GMT.

†Indicates possible 10 meter openings.

‡Indicates possible 160 meter openings.

§Alaskan Standard Time (from Skagway to 141 degrees west longitude), is 4 hours *behind* EST; 3 hours *behind* CST; 2 hours *behind* MST; 1 hour *behind* PST and 9 hours *behind* GMT.

For further information, check number 75, on page 158

(1) Less than 7 days; (2) Between 8 and 13 days; (3) Between 14 and 22 days; (4) More than 22 days.

On the Short-Skip Propagation Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the longer distance.

For the *specific* days of each month on which a particular opening is most likely to occur, as well as a day-to-day forecast of reception conditions (signal quality, noise and fading levels), see the "Last Minute Forecast" which appears at the beginning of this column.

All times are shown in Local Standard Time, using the 24-hour system. In this system midnight is shown as 00, while 01 is 1 A.M., 02 is 2 A.M., etc. Noontime is shown as 12, while 13 is 1 P.M., 14 is 2 P.M., etc.

The *CQ* Short-Skip Propagation Charts are based upon a c.w. effective radiated power of 75 watts from a half-wave dipole antenna, a half-wave or higher above ground. The Charts are valid through December 31, 1963. These forecasts are based upon basic propagation data published monthly by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

Contest Calendar [*from page 90*]

the usual signed declaration that all rules and regulations have been observed. This is important.

8—Certificates will be awarded to the leading stations, single operator and multi-operator, in each country and call areas in the following: U, VE, VK, W/K, ZL and ZS.

9—There is also an SWL section. Rules are the same as listed above, except that the bonus points listed under Rule 3 is 20 points. CQ and test calls will not count. The station logged must actually be working someone, and the call and report of the station worked must also be listed.

10—Logs go to R.S.G.B. Contest Committee, 28 Little Russell Street, London, W.C.1, England. Postmark deadline is December 2nd.

Ed. Note

George Jacobs said there was a good chance that conditions for the Phone week-end would be normal. We'll settle for that; can't be too choosey these days. Hope George's prediction was correct for you phone men (and YLs); he's been better than 75% correct. Keep your fingers crossed for the coming c.w. week-end.

We have received inquiries regarding the status of DXpeditions that are manned by club members. It it's a station set-up and completely operated by club members, the score can be claimed as part of the club score. The station *must* be licensed by a club member.

And while on the subject of clubs, your club score don't mean a thing if your secretary doesn't send us a list of the participating members and their claimed scores.

The Israel Amateur Radio Club has confirmed that the 7 mc Trophy for the highest score on c.w. will be an annual donation. The 1962 Trophy has already been sent to VK3AZZ.

It's a bit late but still possible to get log sheets for the c.w. week-end. A rush Air Mail request with sufficient postage for a return by the same route should do the trick.

And is it necessary for me to remind you again? Your logs please, no matter what your score may be. Let's break last year's record, conditions notwithstanding.

If you come up with a good score, shoot it

to me Air Mail, so that we can list it in an early issue. Good luck, see you in the pile-ups.

73 for now, Frank, W1WY

USA-CA [*from page 103*]

1 kw limit as *dangerous* to the public and the national interest.

Today, amateur radio contributes over $40,000,000 to U.S. gross sales, which is an average of about $150 per ham annually. Two-thirds of these gross sales are materials, components and equipments developed and produced because the power limit is 1 kw. Also, the components and parts developed and designed for high-power applications in a much higher percentage of cases are adaptable and immediately available for use in government specification usage. The research, design and development maintained by manufacturers of amateur radio equipment, under 1 kw power limitations, in major port directly supports national security as well as national economic growth.

On the factor of training manpower, whether it be communications or technical phases of the art, one cannot dispute considerably more training and knowledge accrues through use of high power so this also provides greater contribution to the public interest.

We would suggest that those advocating reduction to universal use of low power (federally regulated) limits are thinking in terms of personal and economic desires and not the public interest.

What's Cooking Department

The bands are full of chatter from county expeditions and hunters seeking counties . . . one can hear about every other QSO inquiring of one's county. Also, reports show considerable improvement in U.S. hams naming counties on QSL cards for which the DXers are expressing much gratitude. Let's face it, the USA-CA has brought greater desire on the part of DXers to work U.S. hams, and has provided U.S. hams greater purpose for W/K contacts. No question about it, most U.S. hams are grateful that their QSL card, because of advent of USA-CA, now has significant value. Many award programs and QSO parties are now being orientated in support of and to get support from the USA-CA program. We will continue to bring you these developments, all of which contribute to the public interest through greater publicity of amateur radio affairs. Tell others about the USA-CA Program and keep the letters coming.

Old Man, K6BX

UHF Roundup [*from page 116*]

stir up more activity. Take WA4GHK and W4EMB for example. These fellows are separated by 150 miles, but yet maintain nightly schedules on 220 mc. On July 13, though, they switched to 2 meters and worked crossband duplex between 144 and 220 mc. Quite a few of the 2 meter gang in the Palm Bay area were snooping, and it appears that a good number of these are now constructing equipment for 220 mc to get in on the fun. By the way, WA4GHK runs

a 5894 (48 watts input) to a 6 element Yagi up 40 feet.

As Promised, More "5HPT"

"Things here are working fairly well. 432 between my QTH in Bedford, Texas and Houston is solid most of the time, with phone possible a great deal of the time. I am only on c.w. at my end, however. Still continue to be puzzled by 432 being better than 144 mc, time after time. Power at this end is about 200 watts input and K5SDM at Houston runs far more power on 144 than he does on 432. Have had 432 contacts also with W5LDV, K5TUP, and K5TPG at Houston. Not a too successful contact with W5LUU at San Antonio. W5SWV at Denton, Texas, has a real respectable signal on 432. His J beams, 117 feet up, shoots out over the countryside. W5UND, in Dallas also has a 432 rig now on the air, so things are perking up in that area. K5JHG, Atlanta continues to be active and W5ML, Oil City, La. gets on from time to time.

"As before, on Ham TV there is no activity. If W5AJG should get so inclined, well then I would have it made. However he is assistant chief at the CBS Channel 4 outlet in Dallas, and gets his fill of TV during working hours." [*Give him another push. We worked for WOR-TV in New York for quite a while and still got the ham TV bug.*] "Can't find anyone else that is interested. I would like to go vidicon, but haven't the tube, etc., to get started. As it is, I have too many icons in the fire already."

73, ALLEN, K2UYH

VHF Report [*from page 114*]

elements up 55 feet. You fellows who need West Virginia please note: WA4EBN/8 has been spending his time atop a mountain near Elkins in Randolph County. W8CKY has also been active from here portable. K8PEJ reports another good skip month. K8OLB's running a pair of 4CX150As on the low edge, and, needless to say, has been working the fall ground wave into Michigan and Pennsylvania.

Push-pull 24Gs are employed by K9DWR to 10/10 antenna to work his DX, which, by the way, included W8KNC/Ø on August 24. Good tropo condx reported by K9YGR at Milwaukee whose worked K8ZGP, K8NUH, WA8BGY and W9DIE to prove it. Harry wants skeds to Indiana on 50.150 mc c.w. Sundays at 2000 CST.

W8KNC/Ø is still offering South Dakota to the DXers. Ira's in Lawrence County with his time-proven portable station. WØNYF in Overland, Missouri, is now sporting a T-Bolt. He is heard nightly in Kentucky, Tennessee and Indiana from all reports. KØEMO in Cedar Rapids, Iowa, has a fine six meter s.s.b. signal with his homebrew mixer and KWS-1.

Sign Off

Soon to appear in these pages will be results of the 50 mc tropospheric experiments conducted in the last few months by WA2IHY and K2ZSQ. Studies aren't complete yet, so if you hear either of us (50.160-50.200 mc) transmitting directional CQs, be sure to give us a call. As a point of interest, at this writing we have already proven to our own satisfaction many theories of the past regarding normal working radius on these frequencies with medium power equipment. Results, we feel, will be surprising. In the meantime we'd enjoy hearing from readers who *consistently* work stations several hundred miles away to add to our report.

73, BOB, K2ZSQ

Ham Shop

Rates for the Ham Shop of 5¢ per word for advertising which in our opinion, is non-commercial in nature. A charge of 25¢ per word is made to all commercial advertisers or organizations. Since we do not bill for Ham Shop advertising, full remittance **must** accompany all orders.

Closing date is the 15th of the 2nd month preceding date of publication. Your copy should be typewritten, double spaced on one side of the page only.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein. We reserve the right to reject advertising which we feel is not of an amateur radio nature.

QSL's?? WPE's?? CB's?? Largest variety samples 25¢ (refunded). Sackers, W8DED, Holland, Michigan.

QSL's, CB, WPE SAMPLES, 10¢. Nicholas & Son Printery, P.O. Box 11184, Phoenix, Arizona. 85017.

QSL CARDS Largest selection-Lowest prices. Samples & catalog, 25¢. Refund or 25 extra cards with your first order. Debbeler Printing, 1309-C North 38th Street, Milwaukee, Wis. 53208.

QSLs Large selection styles including photos. Fast Service. Samples Dime. Ray K7HLR, Rte. 3, Twin Falls, Idaho.

QSL's-SWL's or what have you. You name it and we will do it for you as you wish. Expert art work at nominal cost, enough said? R. McGee, 6258-103rd St., Jacksonville, Fla. 32210.

1964 QSL-size calendars, 100—$7.00. Samples 25¢ Morgan, W8NLW, 443 Euclid, Akron, Ohio.

PICTURE of yourself, home, equipment, etc., on QSL cards, made from your photograph. 250—$7.50 or 500—$10.00 postpaid. Samples free. Write to Picture Cards, 129 Copeland, LaCrosse, Wis.

QSLs SWLs XYL-OMs (Sample assortment approximately 9¾¢) covering designing, planning, printing, arranging, mailing, eye-catching comic, sedate, fantabulous. DX-attracting. Protopay, snazzy, unparagoned cards. (Wow!) Rogers, KØAAB, 961 Arcade St., St. Paul 6, Minn.

QSLs free samples. Fast service. Bolles, 7701 Tisdale, Austin, Texas.

QUESTION Want to design a QSL card? Sampler Instruction Kit 25¢. Wow! what cards you can create. $1.50 and up 100. Samco, Box 203, Wyantskill, N. Y. 12198.

QSL's—100—$2.50. Samples. Dime. AMEE's Printery—W9FXQ—Box 138, Oak Lawn, Illinois.

RUSPRINT QSLs—SWLs 100 2-color glossy $3 postpaid. QSO file cards $1 per 100. Rusprint Box, 7507 Kansas City 16, Mo.

QSL's 3-color glossy. 100 $4.50. Rutgers Vari-typing Service. Free Samples, Thomas Street, Riegel Ridge, Milford, N. J.

CALL CARDS Badges, decals, goodies, illustrated literature with samples 25¢. Errol Engraving Att: K1VRO, Westfield, Mass.

QSL's. . . . Nifty . . . Thrifty . . . Dime. Filmcrafters. . . . Martins Ferry, Ohio

QSL's new designs. Free catalogue. Longbrook, Box 393-Q, Quakertown, New Jersey.

QSLs Samples, dime. Print Shop, Corwith, Iowa.

QUESTION: Want to design a QSL card? Sampler Instruction Kit 25¢. Wow! What cards you can create! $1.50 and up, 100. Samco, Box 203, Winanskill, New York, 12198.

NEW QSL PRINTER with new designs. "2-color" $2.25 per 100. 10¢ for samples. Corneilson, 321 Warren, N. Babylon, N. Y.

75A-1 receiver, speaker, manual, immaculate, $190; Viking II transmitter, excellent condition, all mods incorp., full crystal deck, mike, antenna relay, baluns, folded dipole kit, spare tubes, manual, $115; Morrow 5BR1 converter, mont condition, cables, manual, orig carton, $30; AR-88 RCA recvr., vy good; Super-Pro, power supply, speaker, vy good; write. WØLWZ, 1030 So. Dudley, Denver, Colorado, 80226.

GALAXY sales have brought in hundreds of trades. Cash: KWM-1 $329.00; Champ 300 $199.00; King 500 C $439.00: GSB-100 $229.00; HX-50 $299.00; Apache $189.00; Valiant $225.00; Pacemaker $169.00; 75A-1 $199.00; 74A-4 $375.00; SX-111 $169.00; SX-101 $179.00; HRO-50T $149.00; HRO-60T $249.00; and many more. Write for list N-3. Leo, WØGFQ, Box 919, Council Bluffs, Iowa.

SELL Hallicrafters SX 100, R-46B speaker, Heach SIXER. Good condition. Make offer. Will pay shipping. K8NOO, 1501 Howard, Petoskey, Michigan.

EXCELLENT ham receiver broadcast through 6M, many operating features, $95. Complete 50 w. phone-c.w. transmitter, $35. VFO, recorder, other items. WA2TVG, 457 Havana, Egg Harbor, N. J.

SACRIFICING excellent Valiant & HQ-160 for quick sale. Complete information on request. K4KJK, Box 6080, Charlotte, N. C. 28207.

ATTIC CLEANOUT partially modified surplus; ARC-5 transmitter 3-4 mc, $7.50; R26/ARC-5 receiver 3-6 mc, $5.00; ART-13 transmitter unit, $15.00; SCR-522 transmitter, $10.00; SCR-522 receiver, $7.50; all with tubes. Like-new items: Seco squelch-noise limiter, $5.00; two 4CX300A tubes, $50.00; two sockets for same, $5.00; used Gonset Super Six converter and Super-ceiver unit with control, $40.00. W2LWO, 12 Whitford Ave., Nutley, N. J.

SPECTRUM ANALYZERS. Fit your receiver. Brochure. Halco, Box 283, Saxonville, Mass.

ELECTRONIC BARGAINS Discounts from net, free brochure. Franklin Electronics, Box 51C, Brentwood, N. Y. 11717.

Wanted: Transmitting tubes, test equipment, ham gear. Will pay sensible prices. Write or visit Rex Radio, 84 Cortlandt St., N. Y. 17, N. Y.

CRYSTALS: FT-243's ± 2 KC . . . $1.00—3500 to 8650. Hundley Crystal Co., 2947 North 35th, Kansas City 4, Kansas.

FT-243 CRYSTALS: 3400 to 8700 kc—± 2 KC $1.00 each. Nets $2.00 each. Denver Crystals, 776 South Corona, Denver 9, Colorado.

PRINTED CIRCUIT BOARDS. Hams, Experimenters. Silver Sentry VFO, $2.85; Converter March CQ, $1.50. Free catalog. P/M ELECTRONICS. Box 6288, Seattle, Washington. 98188.

TECHNICAL MANUALS For surplus electronics. Free list. W3IHD, 4905 Roanne Drive, Washington, D. C. 20021.

XTALS subminiature, Type FM-1, 43 to 47 mc, order to nearest mc, $1.00. Also 452.5 kc, $1.00, similar to F605. WA2LGR, 208 Darwin Ave., Rutherford, N. J.

BARGAINS! Read The Ham Trader. Free copy or 25¢ for current issue. Box 153Q, Franklin Square, New York 11010.

WILL PAY any reasonable price for first class copies of CQ for May and December 1945 and January 1946. Want old regional, local or club ham publications, call books. A. R. Marcy, W4ID, 461-3rd Ave., Sea Park, Eau Gallie, Florida.

SELLING Halli. SX-42 AM/FM receiver. Needs minor work, clean exterior. Best offer. Also Grommes 10 w. mono hi-fi amplifier Model 55C, excellent condx inside & out, in metal cabinet. Only $20. Box TK2, CQ, 300 West 43rd St., New York, N. Y. 10036.

UHF GEAR WANTED: Need transmitters for 220 and 432 mc (with modulators and power supplies). What have you? Write: Bob Brown, K2ZSQ, Box 528, South Rahway, New Jersey.

Wanted Army sets or parts, GRC, PRC, FRR/URR, TCC, SB, SCR. Send listings. Quick cash. Anker Electronics, 1617 So. Main St. Box 26Q, Wilkes Barre, Pa.

CLUBS New illustrated literature, badges, decals—All the "goodies." Errol Engraving, Att: K1VRO, Westfield, Mass.

WANTED: Commercial, military, all types, ARC, ARN, ARM, GRC, PRC, URM, TS, 618S, 17L, 51R, 51X, APN, others. . . . RITCO, P.O. Box 156, Annandale, Va.

I NEED AN OLD Zenith or Chicago Radio Labs radio. Can anybody supply one? Will also buy other pre-1925 radios. Worcester, R.D. 1, Frankfort, N. Y.

CAN ANYONE supply an old Murad radio? Will also buy other pre-1925 radios. Worcester, R.D. 1, Frankfort, N. Y.

DOES ANYBODY have an old radio made by Jewett? Will also buy other pre-1925 radios. Worcester, R.D. 1, Frankfort, N. Y.

I AM LOOKING for the best performing old radio (pre-neutrodyne). Does anybody have a candidate? Will also buy other pre-1925 radios. Worcester, R.D. 1, Frankfort, N. Y.

TOROID RTTY KIT Mark-Space discriminator and bandpass filters. Includes 4-88 mh and 1-44 mh uncased, like new toroids; information sheet, mounting hardware and six mylar capacitors. $5.00 Postpaid. Toroids: Specify 88 or 44, less capacitors, $1.00 ea. 5/$4.00 Postpaid. KCM Products, Box 88, Milwaukee 13, Wis.

STEAM ENGINE driven ac/dc generators, burn wood, coal, etc., 500 watts. Kits $34.50 up; catalog $1.00 refundable, Richcraft Engineering, Sterling, Virginia.

COLLINS KWS-1 #959. Looks new, guaranteed perfect. Includes antenna relay, instruction manuals, spare tubes. Will ship. Best offer above $700 or trade for KWM-2. Will accept NCX-3, SR-150 as part payment. Al Weiss, W6UGA, 2370 Knob Hill, Riverside, California, OV 3-3149.

ELECTRONICS, radar, unusual surplus bargains, free flyer. MDC—923 W. Schiller, Phila. 40, Pa.

WIND DRIVEN ac/dc generator system, kits, $19.00 up: catalog $1.00 refundaable; Richcraft Engineering, Sterling, Virginia.

COMPLETE STATION HQ170C—Spkr; GSB-100 (Both mint condition); D-104; SWR meter; Drake low pass; SCR-522 xmitter. $600.00. W3OQX, D. Bachman, 1030 Walnut St., Allentown, Pa.

Wanted PL-172, AX9909 tubes, no duds. Also good rig. Fast cash for fast deal. Al Claff, Box 7565, Mexico City, Mexico.

Wanted Tower, beam, rotor. Leo Severe, R.R. 2, Box 5, Wilmington, Illinois.

For Sale NC-300, speaker, 6M. Converter, $200. Leo Severe, R.R. 2, Box 5, Wilmington, Illinois.

Collins 75S1 late model, serial number 2812, $325; HT 32A, $350; Gonset GSB-101 Linear amplifier, $175. All equipment perfect mint condition, no scratches, instruction books included. W7YAM, 4545 E. 8th St., Tucson, Arizona.

WANTED Pre-1955 editions of the ARRL Handbook to add to collection. Only interested in clean copies (no tears, dog-ears, or stains). Write: Richard A. Ross, K2MGA, 45-12 217th St., Bayside, L.I., N.Y.

SELL DX-100, SB-10, HQ-150, Johnson Matchbox, D-104, good condition $400.00. Gary Sundstrom, K2LXL-K1YQE, P.O. Box 232, Camden, Maine.

TRADE Motorola 30D 12v. FM xmtr & receiver 146.94 mc. Excell. cond. For a 1 KW power supply, John J. All, 1767 Oak St., Portage, Ind.

Collins 32S1 & 75S1 sold as pair for $700.00. No scratches—perfect condition. Hal Franks, K7BIX, 841 E. 6th Ave., Helena, Montana.

RTTY Sell Model 15 printers, AN/FGC-1 terminal unit. Model 14 keyboard brand new. Write. 255A relays $3.25 PP. Sockets 75¢. Rudolph, 3431 Douglas Drive, Murrysville, Penna.

LAFAYETTE HE-56 Converter. Like new! $25.00. Drake TV-100-LP Filter. $4.00! S. Tobias, 5101 S. 8th Rd., Arlington 4, Virginia.

ESTATE of K9DMZ Heath HX-30, 6 meter SSB, used only 2 months. Johnson 6N2 and Eico modulator, factory wired, reasonably priced. Contact K9PRB, 329 Dwight, Joliet, Illinois.

SWAP equipment, components with other hams! Many offers in "Equipment Exchange." Interesting sample copy free! Write; Brand, Publisher, Sycamore, Ill.

SALE, TRADE Teletype parts, equipment, typing reperforator, motors, Collins terminal unit, HT-37, 32V2. Wanted: Teletype transmitter-distributor parts, model 14 tape reels, end-of-line indicators, General Radio synchroscope, comparison oscilloscope, other frequency standard components, back issue catalogs (General Radio, Hewlett-Packard, Measurements, Boonton, etc.) Also want books of U.S. Navy history, U.S. Naval Institute Proceedings. W4NYF.

SELL Hallicrafters HT-40, $49; Elmac PMR-7, $69; VXO (QST, July, 1963) all new parts, $49; AMECO CB-6 $10; new nuvistor CN-50W in factory carton, $45, PS-1, $5; JT-30 microphone, $5; assorted tubes; pictures of equipment available. CARL, WA2-IMG/2, 199 Kartes Drive North, Rochester 16, N. Y.

JUNKER DuMont 303 scope wanted with good power transformer. Write W8YAE, Donald F. Cameron, 1619 Milburn Ave., Toledo 6, Ohio.

WANTED: Buyer for Gonset G-66B and 3-way supply, both in perfect condition. Excellent receiver for AM-CW-SSB, BC through 10m. $110 prepaid. J. M. Kootsey, Physics Dept., Brown Univ., Providence 12, R. I.

FOR SALE Spotless NC-300 with NC-303 vernier dial drive and new tubes, $176; Hycon-Eastern type 2215KA receiver if passband crystal filter, $24; for National NC-303 owners, XCU-303 Deluxe WWV-100 kc xtal calibrator, can also be used with NC-300, $24. K8BFI/4, 4605 N. 17th St., Arlington 7, Va.

ATTENTION CANADIANS HT-33 Hallicrafters kilowatt linear amplifier. Only a few hours operation. Specially priced to move fast, $490.00. Gaspard & Sons Ltd., 143 Smith Street, Winnipeg 1, Ca.

WANTED ARB rcvr, must cover original freqs. Trade Dow Key, HV plate Xfmr, or cash. Hollis Button, 675 W. Parr, Campbell, Calif.

HEATHKIT MOHAWK RECEIVER professionally wired—brand new and never been used! Thoroughly tested and calibrated. Guaranteed in perfect condition. Not a scratch! Will back and ship express collect or deliver within 50 miles. W/manual, $275.00. A. B. Rogers, WB6CPD, 619 Shotwell St., San Francisco 10, Calif.

FOR SALE HQ-180C, excellent condition, s.n. 4416. Purchased Dec. 1962; aligned Aug '63. Also, S-2000, excellent. Both for $283. Cary Green, Box 393, Lexington, Va.

SELL SX-101A, like new, $250.00; Eldico SSB-1000, $300.00; Collins 32S1 & a.c. power supply, like new, $575.00; Sony CS-300 stereo tape recorder with 2 mikes, like new—$250.00; Concertone stereo recorder, five heads, 10½ inch reels—perfect—$500.00; Transtenna TR switch outboard—$50.00. Lamb, 1219 Yardley Rd., Morrisville, Pa.

MUST SELL Collins KW-1 transmitter. Excellent condition. Will sell to best offer over $1000. Friar Tom, Saint Anthony, Friary, Hudson, N. H.

SACRIFICE Halli SR-34 deluxe 6/2 mtr transceiver, AC model. Excel op condx & clean outside. Best offer. Box TK2, CQ, 300 West 43rd St., New York, N. Y. 10036.

FOR SALE Knight R-55 communications receiver. Excellent condition. Perfect for beginner. $55. John Lough. 422 Jefferson Ave., Urbana, Ohio.

INTERESTED in becoming a member of the Continental VHF DX Association (no fee)? To be eligible, you must be currently active on at least one band above 50 mc and preferably have had experience in some of the more popular VHF contests. Membership is open to enthusiasts in all 50 states by application. After June 1, 1964, membership will be by appointment only. For further information write: Continental VHF DX Association, Box 528, South Rahway, N.J.

SELLING COMPLETE STATION. HT-32A, $400; Model A slicer, $35; Model DQ "Q" multiplier, $12; 12" speaker in matched cabinet, $10; Hammarlund HQ-129X, $110; Heath s.w.r. bridge, $10; Ant. tuner, plug-in coils 80-10, $10; Eico Model 324 Sig. Gen. fact. wired, $20; Eico Model 950B Res.-Cap.-Comparator bridge, $20; Heath OM-3 scope, $20; Bob Casey, KØGWK, 104 E. 18th Street, So. Sioux City, Nebr.

SWAP Electric train equipment for ham gear. Rodney Robbins, WN2JQS, 4 Washburn Avenue, Franklinville, N. Y.

HALLICRAFTERS SR-150 mobile power supply, mounting rack, astatic mike and Nutronic antenna—used less than four hours. Make an offer. Best offer accepted or will trade for a coin collection of equal value. Dick Morgan, 1602 Royalton Rd., Apt. #7, Broadview Heights, Ohio.

FOR SALE: Drake 2B, perfect, best offer. DX-100 with apache P1—net, $130.00. K9FLU, 4524 Cross St., Downers Grove, Ill. WO 8-2003.

LIKE NEW HT-37, RME-6900, matching speaker. Perfect condition 6 mo. old. Will include mike, bug, relay, cables, etc. Pick up for $600. W2EUQ, J. H. Gray, RD #1, Painted Post, N. Y. 607-96-25924.

GOING COLLEGE Must sell. DX-100 $125.00, RME-6900 $250.00, RME DB-23 $35.00. Terms. K6ICS, Mike Gauthier, 10425 San Jose Ave., South Gate, California, 213-LOrain 9-1865.

MODEL 26 teletype with table, $75; T.U. $25, Viking VFO with Freq. shift, $25. Fred Beggs, 1803 Rose, Port Townsend, Wash.

IMMACULATE HQ-170, $225; Speedex bug, $7; Kwick-Patch, $10; B&W low-pass, $9. Jim Perry, 65 Hemenway, Boston, Mass. 02115.

WANTED A complete set of Radio. State the price and condition. Write: Editorial Dept., CQ, 300 West 43rd Street, New York, N. Y. 10036.

FOR SALE Ameco TX-86 transmitter, 60 watts, 80 thru 6 meters. Perfect condition with power supply, $99. Also Tecraft 2 meter transmitter, new tubes, 20 watts, 2 Novice band crystals, with power supply. Perfect condition, $79. Write: Ron Brown, WB2AOG, 513 Linden Avenue, Rahway, New Jersey.

READ Spark Gap Times, journal of the Old Old Timers Club. Entirely different from all other radio publ. Free to members. Eligible for membership if you made a two-way contact at least 40 years ago. Initiation fee covers life membership. No further dues. Sole publisher of exact copies of first 1913 Gov't Call Book ($3.00), supplements 1-2-3 ($3.00) and 1909-1910 Blue Book ($3.00). Write Secy-Treas., W2EG, 507 Wayside Road, Neptune, New Jersey.

WANTED: 1945 CQ magazines—Jan., Feb., May, Sept., Alan Dorhoffer, K2EEK, 75-15 177th St., Flushing 66, N. Y.

For further information, check number 68, on page 158

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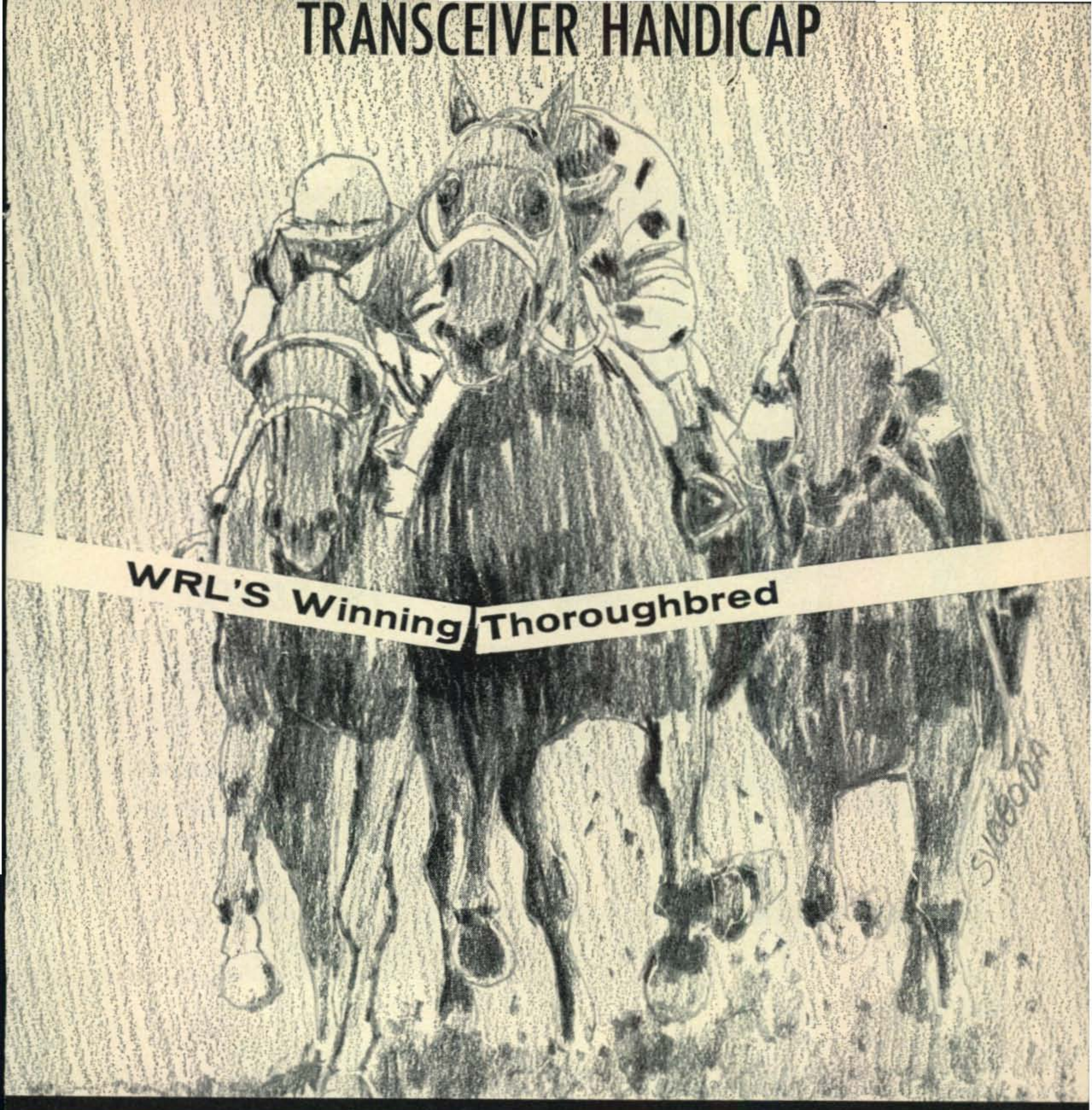

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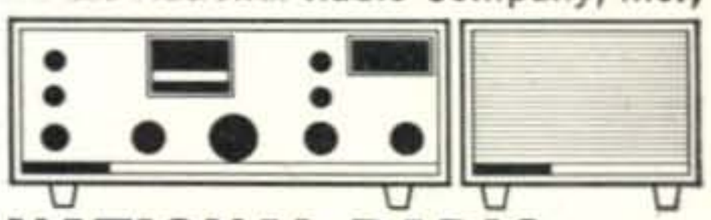

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