CQ

JUNE, 1945

W2FX

The Radio Amateurs' Journal

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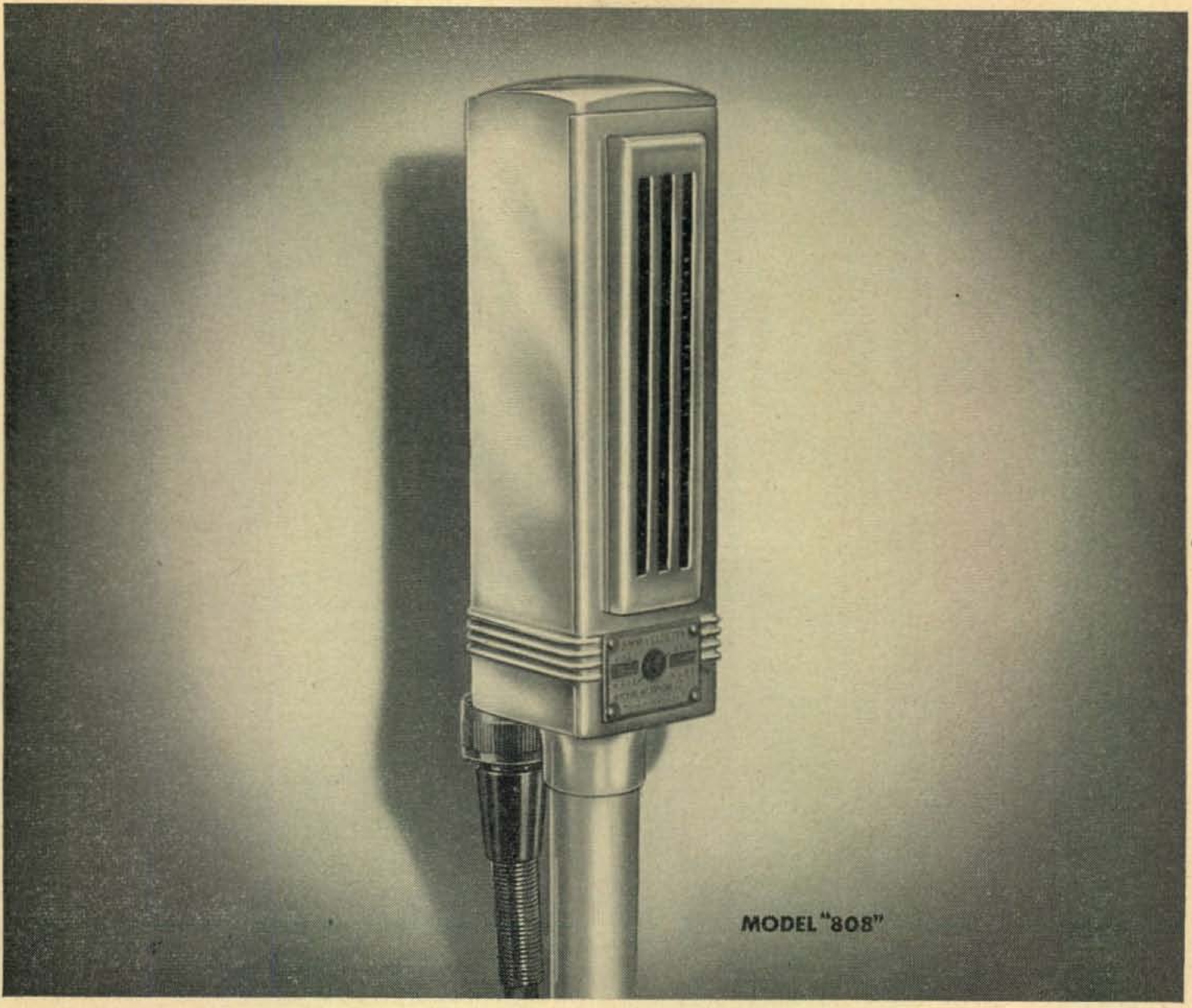

"808" VELOCITY MICROPHONE

TECHNICAL DATA

MODEL 808

IMPEDANCE: 40,000 Ohms (for operation direct to grid of tube)

FREQUENCY RESPONSE: 40-10,000 Cps.

OUTPUT LEVEL: 63 db below one volt per bar.

CORD: 25 feet long. Rubber covered, low capacity cable with locking type connector.

DIMENSIONS: 1 ¼ inches square by 4 ½ inches high.

FINISH: Satin Chrome.

STAND COUPLING: ⅝ inch—27 thread.

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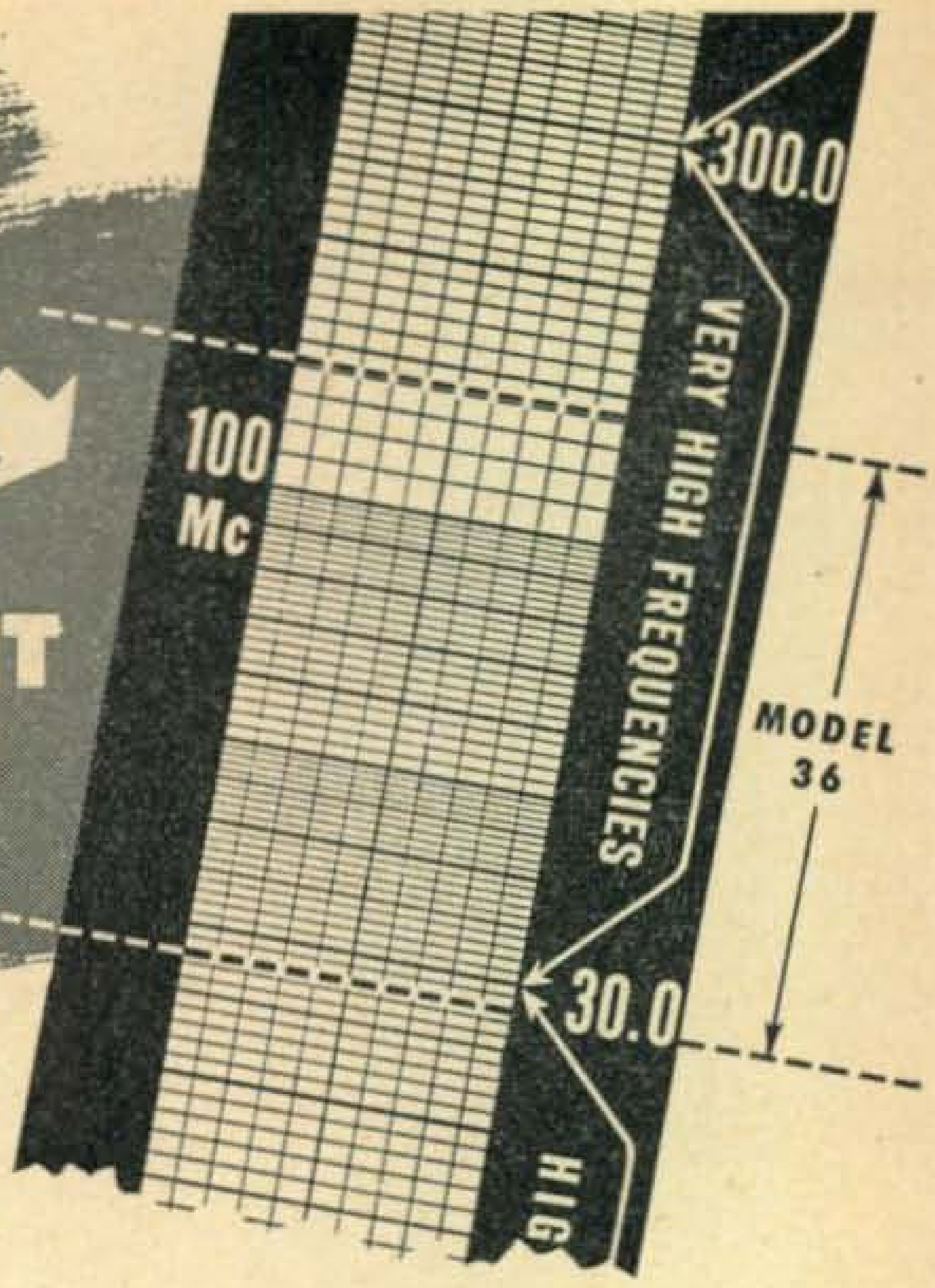

THE Model S-36 is probably the most versatile VHF receiver ever designed. Covering a frequency range of 27.8 to 143 megacycles it performs equally well on AM, FM, or as a communications receiver for CW telegraphy. Equipment of this type was introduced by Hallicrafters more than five years ago and clearly anticipated the present trend toward improved service on the higher frequencies.

Fifteen tubes are employed in the S-36 including a voltage regulator and three acorn tubes in the RF section. The type 956 RF amplifier in conjunction with an intermediate frequency of 5.25 megacycles assures adequate image rejection over the entire range of the receiver. The average overall sensitivity is better than 5 microvolts and the performance of the S-36 on the very high frequencies is in every way comparable to that of the best communications receivers on the normal short wave and broadcast bands.

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27.8 to 143 Mc.

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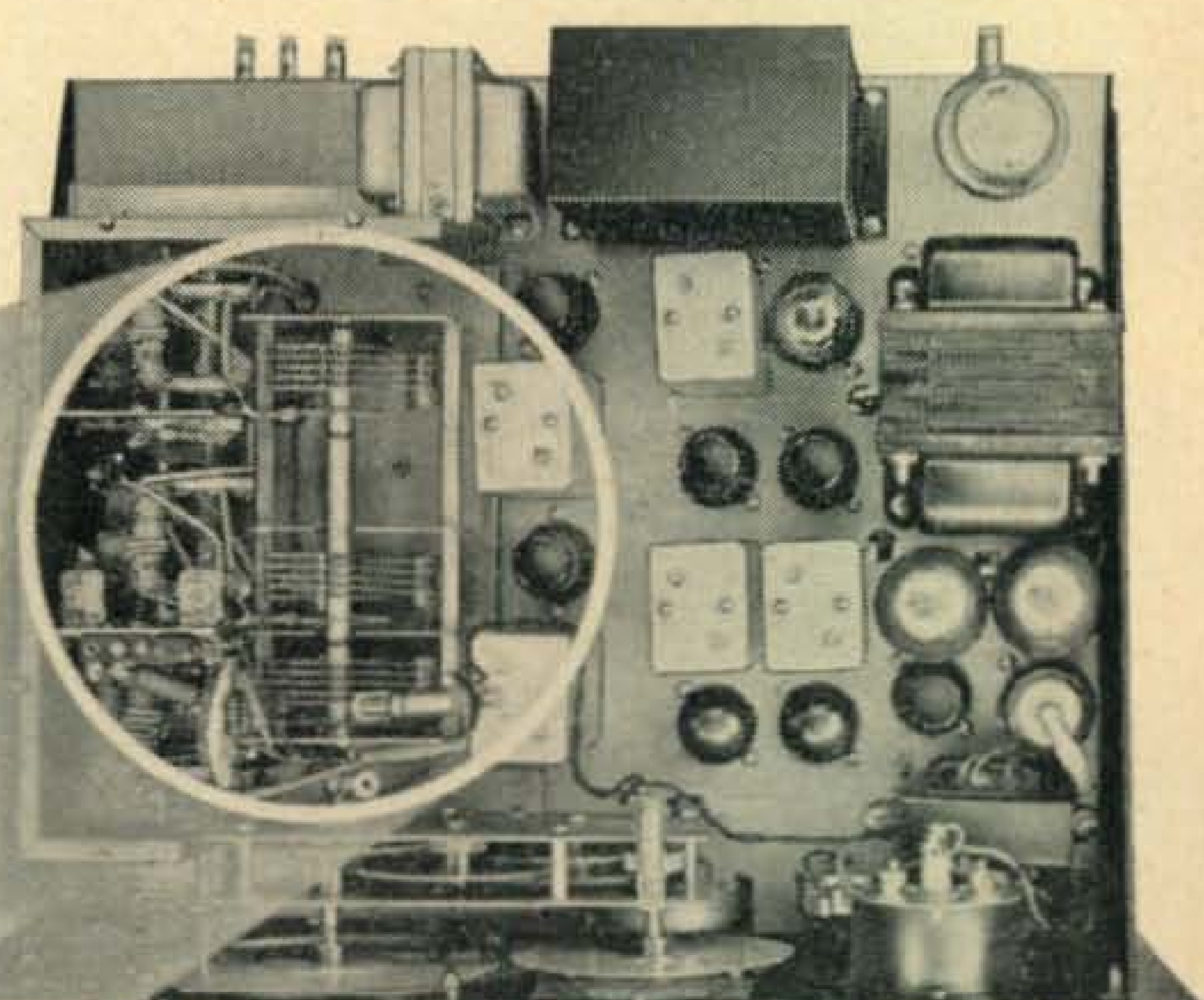

The RF section is built as a unit on a separate chassis which may easily be removed for servicing and incorporates a three position ceramic band switch. The positive action mechanical bandspread dial turns through more than 2200 divisions for each of the three ranges, 27.8 to 47, 46 to 82, and 82 to 143 megacycles.

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VOL. 1, No. 6 **JUNE, 1945**

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COVER

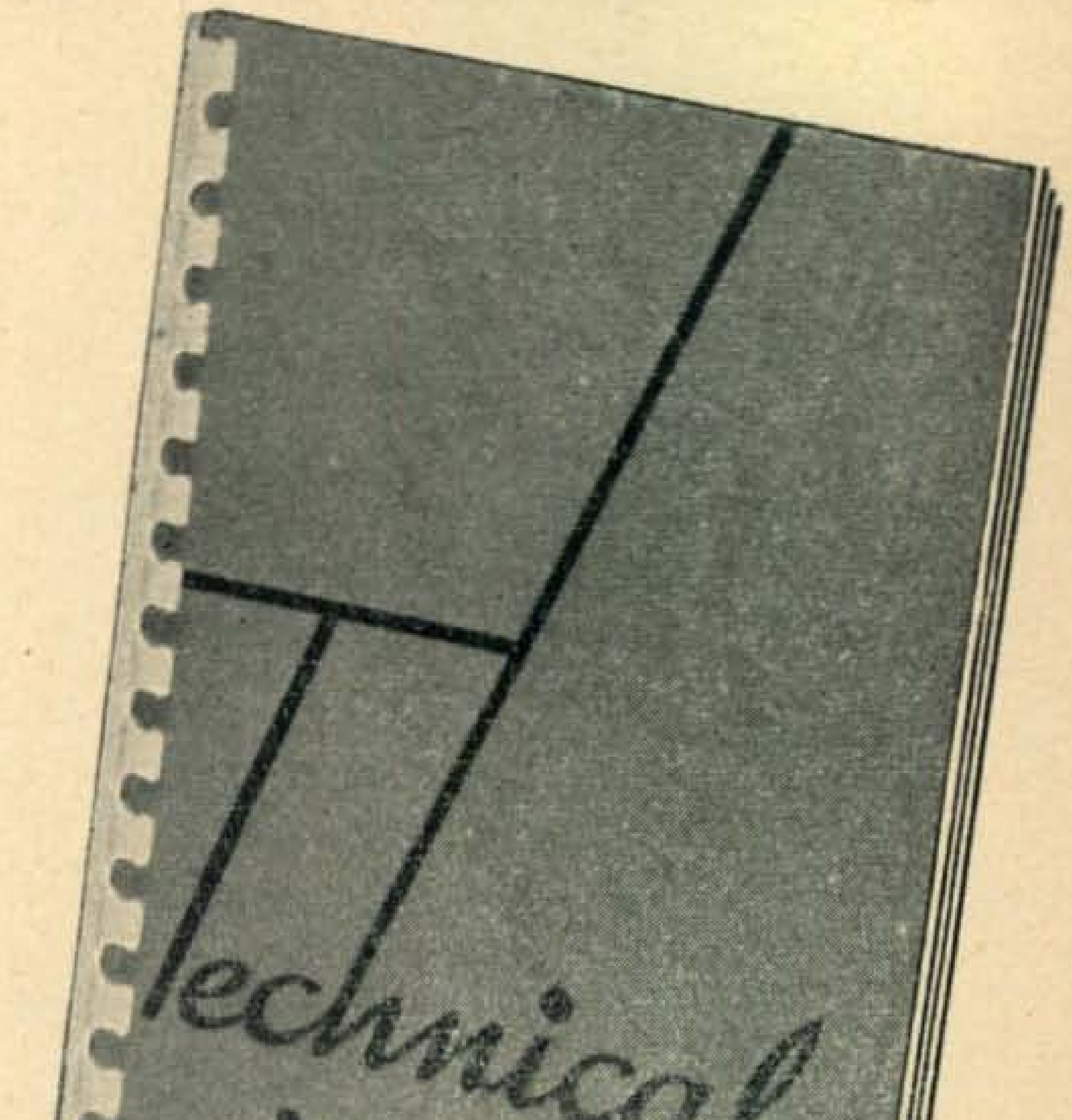
Operating the direction finder are T/4 Leo D. Sanders of Maysville, Utah, and T/4 James Schneider of Seattle, Washington, both of the 41st Div. in New Guinea. (*Signal Corps Photo*)

ARTICLES

MISCELLANEOUS

MSG-FR-BPL

HERE'S ALL THE LATEST DOPE ON RADIO TUBES...



Designed as a handy reference book the *Sylvania Technical Manual on Radio Tubes* gives all the latest details, characteristics, operating conditions and circuit applications for more than *400* types of radio tubes.

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Makers of Radio Tubes; Cathode Ray Tubes; Electronic Devices; Fluorescent Lamps, Fixtures, Accessories; Incandescent Lamps

ZERO BIAS

WHAT AMATEUR RADIO needs is a private Dumbarton Oaks conference if only through the media of introspection and the exchange on paper of a few fundamental ideas. And there's no time like the present, when our bands are dedicated to other services, and dust, instead of cigarette ashes, accumulates in the shack. We venture this suggestion on the assumption that the post-war ham will be pretty much the same as the older vintage—with a crystal blank on his shoulder, and ready to go off on any belligerent tangent that group politics may indicate, whether it be a purely local radio club fracas or national in scope.

Factions, groups, parties—these are all concomitant with our democratic way of doing things, and are probably healthy evidence that matters are progressing along the lines Tom Jefferson and John Hancock had in mind. However, while our major political, labor and industrial groups, etc., may fight it out on a perennial basis, there is little justification for disunity among the ranks of radio amateurs—and schisms in the past have assumed geographical magnitudes! The majority of political differences, from the Ladies' Aid Society up, are selfish in origin and objective—someone or some faction desiring something more or less exclusively for its own benefit. There can exist no such parallel in amateur radio.

Everyone affirmatively associated with our hobby—the ham himself, the publisher, the editor, writers, the radio clubs and larger organizations, paid executives and staffs (the laborer is worthy of his hire), manufacturers—all have one fundamental aim, the betterment of the game. Even if there is anything selfish in their motivation, personal aspirations can only be gratified in proportion to their efforts in behalf of the common cause. If you insist on being a cynic, remember there's no sense in decapitating the goose that lays the golden egg. Should you lean somewhat toward the idealistic, you will not forget that most of us associated with amateur radio have been or are hams—that our interest is fundamental and sincere. If any group exists to which "one for all or all for one" applies, it's the radio amateur. While not denying minor pros and cons to special situations, it should be difficult for any one of us to differ with our fellow amateurs on more than superficialities.

Logging Time

An article is scheduled for an early issue on 24-hour time—a system that has been used in Europe for many years, and in radio communications ever since they became international in scope. There is no excuse for logging 12-hour time in accordance with the usual notations involving the colon and abbreviations for ante and post meridian (a.m. and p.m.). However, for those of us who still must catch the five fifteen (instead of the 1715), the 12-hour system, in a simplified form, has its merits for logging and handling traffic under the "date and time-filed" layouts of our standard radiogram blanks and log books—particularly in intra-continental QSOs. The Army Amateur Radio System (which employs 24-hour time on all long-haul traffic) boils down the 12-hour arrangement to its elements—the significant number, with "A" for a.m. and "P" for p.m. The hour 10:00 a.m. is written 1000A. There can be no confusion between 1000A and 100A, the latter, of course, indicating 1:00 a.m. Fifteen minutes past noon is noted as 1215P—after midnight it is 1215A, etc. The time is always zone standard.

When Johnny Comes Marching Home

A large proportion of our amateurs are in the armed services. Shall we recognize them when they come back—after a year or more of G. I. discipline and training? We mean shall we be able unerringly to pick many of them out, as of yore, in the hotel lobbies, elevators, dining rooms and general environs of hamfests and conventions? Shall we still be able to spot some representatives of this species in pressed pants, tie centered precisely under a shaved chin, fingernails and shoes as a top sergeant would want them, a clean, unwilted collar fully exposed beneath the civilian replica of a G.I. haircut? Perhaps we shall know them only by their speech. It will take more than a world war to alter greatly the ham lingo.

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You'll have more QSO's with the new RME 45 — more schedules that you can keep — more elusive DX that you can enter in your log.

Thanks to CAL-O-MATIC tuning you'll be listening to more stations in the band, too. And you'll log the frequency of these signals effortlessly on a hairline calibrated scale.

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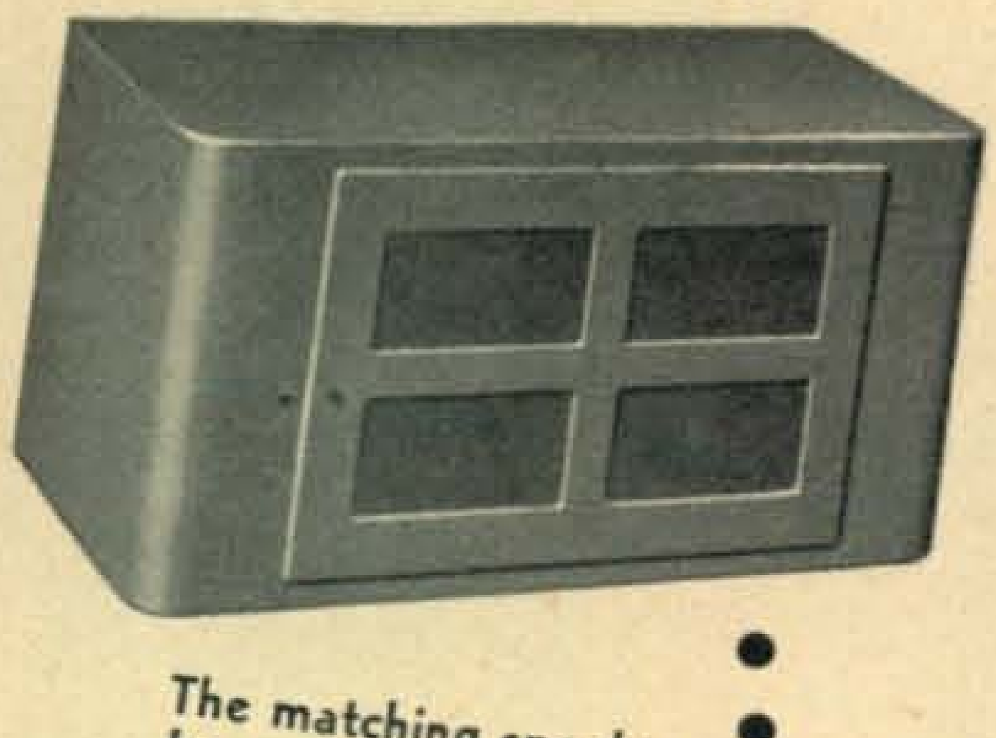
There's bandspread aplenty for the most exacting ham or commercial operator. The 20 meter band, 14,000 to 14,400 K.C., for instance, covers 20 divisions on the translucent dial — equivalent to 72 degrees on a five inch diameter disc.

The appearance of the RME 45 is consistent with its performance. The receiver is housed in a new streamlined two-toned cabinet and supplied with a matched acoustically designed speaker housing.

These and a multitude of additional features make the new RME 45 the receiver that's definitely well worth waiting for.



The matching speaker has an acoustically designed housing.

Literature Describing the New RME 45
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A MOBILE TRANSMITTER-RECEIVER

This Exceptionally Well-Built Unit for the 112-116 MC Band Features a Non-Radiating Super-Regenerator

HOWARD A. BOWMAN, W6QIR

THE CONTINUATION and extension of War Emergency Radio Service in most licensed areas has meant an accompanying refinement in the type and versatility of the equipment used. In many cases the first stations established were for fixed locations, but more recently the number of mobile installations has greatly increased, with a corresponding development and modification of earlier mobile rigs. This has meant, in many cases, a change from a transceiver to a unit embodying separate transmitter and receiver sections. There are many reasons for using a separate transmitter and receiver in mobile. Particularly pertinent are that greater efficiency can thereby be secured in both sections, and the amount of receiver interference generated may be materially reduced. Such a unit is diagrammed in *Fig. 1*. The circuit is largely conventional with the exception of the receiver which will be discussed in detail.

The real problem of building a mobile unit lies in the mechanical design. There are, in general, four types of construction in mobile units, as follows:

Glove compartment. Constructing the rig so as to mount in the glove compartment has the advantage of placing equipment in a lockable position, and of keeping it where it takes up no room in the driver's compartment. It has the disadvantage of limited space, and eliminates a compartment which is extremely useful for holding log book, flashlight, license, maps, writing materials, etc. Further, its use usually necessitates cutting up or removing the compartment in order to obtain access for power cables.

Seat-shelf mounting. Occasionally units are mounted on the shelf behind the rear seat of a coupé. This exposes the rig to tampering, and operation may be difficult when the car is in motion. Also battery and power supply leads must be fairly long.

Trunk mounting. Trunk or carrier mounting is frequently employed, particularly with units of higher power. So far as space is concerned, it is probably best of all methods. However, trunk mounting requires two antennas or unusually long feeder lines. It generally means duplication of audio systems—one for receiver and one for transmitter, since the receiver must usually be located in the driver's compartment. Invariably it necessitates long power supply or battery leads, and the constructor must usually resort to relay control.

Under-dash mounting. This type of mounting utilizes minimum of space immediately below and behind the dashboard that is seldom used otherwise. The entire unit is close at hand, and leads to antenna and power source may be short. The chief difficulty with this type of mounting is that the construction of the unit must be adapted to fit the nature of the space available, and various mechanical devices must be employed to achieve certain control functions. All things considered, however, we feel that this type of mounting is most practical for the lower power units,

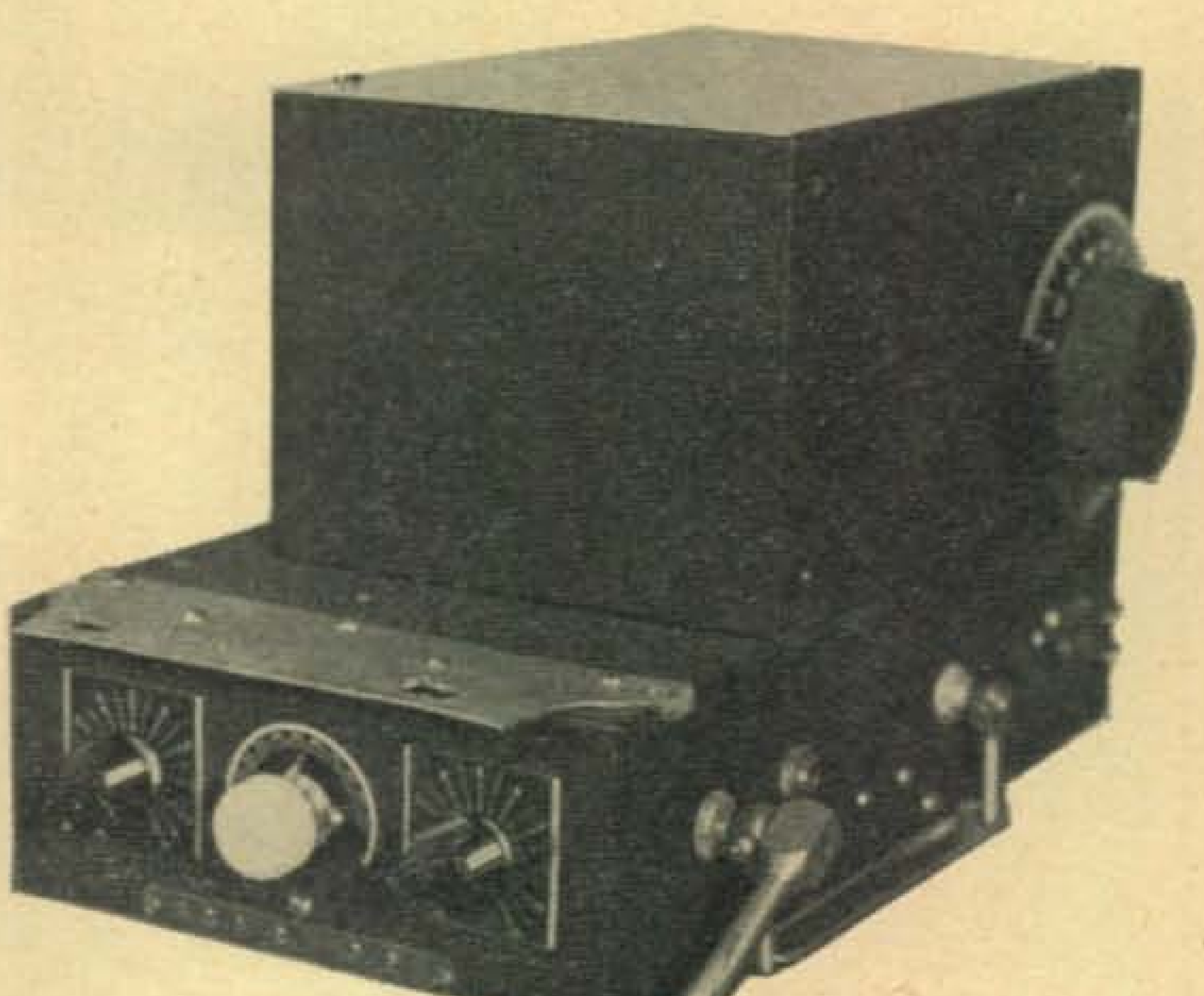


Fig. 2. Front view of the completed unit, showing the ganged switches and operating lever

and the equipment described herewith is so built.

Chassis and Layout

The unit is built in and on a 7″ x 12″ x 3″ chassis with the above-deck components protected by a 5″ x 7″ x 9″ black crackle box (*Figs. 2, 3* and *4*). The entire transmitter section, except for gridleak and filament and plate by-pass condensers, is built on top of the chassis, with the tuning control extending through the side of the shield box. The receiver section, except for the tube envelope, is beneath the chassis. The audio section is common to both transmitter and receiver, and the speaker is mounted on the metal bottom plate.

Ideas have been borrowed liberally from commercial practice. Switching from transmit to receive in a transceiver usually involves only three or four switch sections, found in an ordinary four-pole double-throw switch of the rotary variety. In a transmitter-receiver, however, at least five switch sections must be used, and in order to avoid any possibility of unwanted coupling through the switch contacts, we decided to employ two switches instead of one. This led to the problem of ganging the switches so that they are thrown simultaneously.

Each of the two switches is a conventional non-shorting four-pole double-throw rotary switch, commonly known as a "transceiver switch." The two are mounted with their shafts projecting through one of the long sides of the chassis—one about two inches from the front drop, and the other about two-thirds of the way back. Only two sections of the front switch and three of the rear are used. The front section takes care of the microphone and receiver on-off switching, while the rear section switches the speaker, antenna, and transmitter. The two sections are ganged together by means of a link and lever arrangement.

Transmitter Section

The transmitter employs an HY615 triode in a conventional circuit. The physical layout is borrowed from a commercial 112-mc job. The condenser is mounted on a 3″ x 3″ piece of ¼″ polystyrene with the lugs projecting slightly above the top of the plate. The coil is soldered to the lugs. The plate choke extends down the mounting plate as does the grid choke, but on the opposite side of the condenser. It runs from the stator lug to another soldering lug screwed to the plastic, and from here a lead goes through a grommeted hole to a tie-point. From this tie-point the plate by-pass is connected to the ground on the socket, and a lead runs to the switch.

The antenna coupling on the transmitter must be semi-adjustable and very rigid. The link is wound and cemented to one end of a ½″ lucite

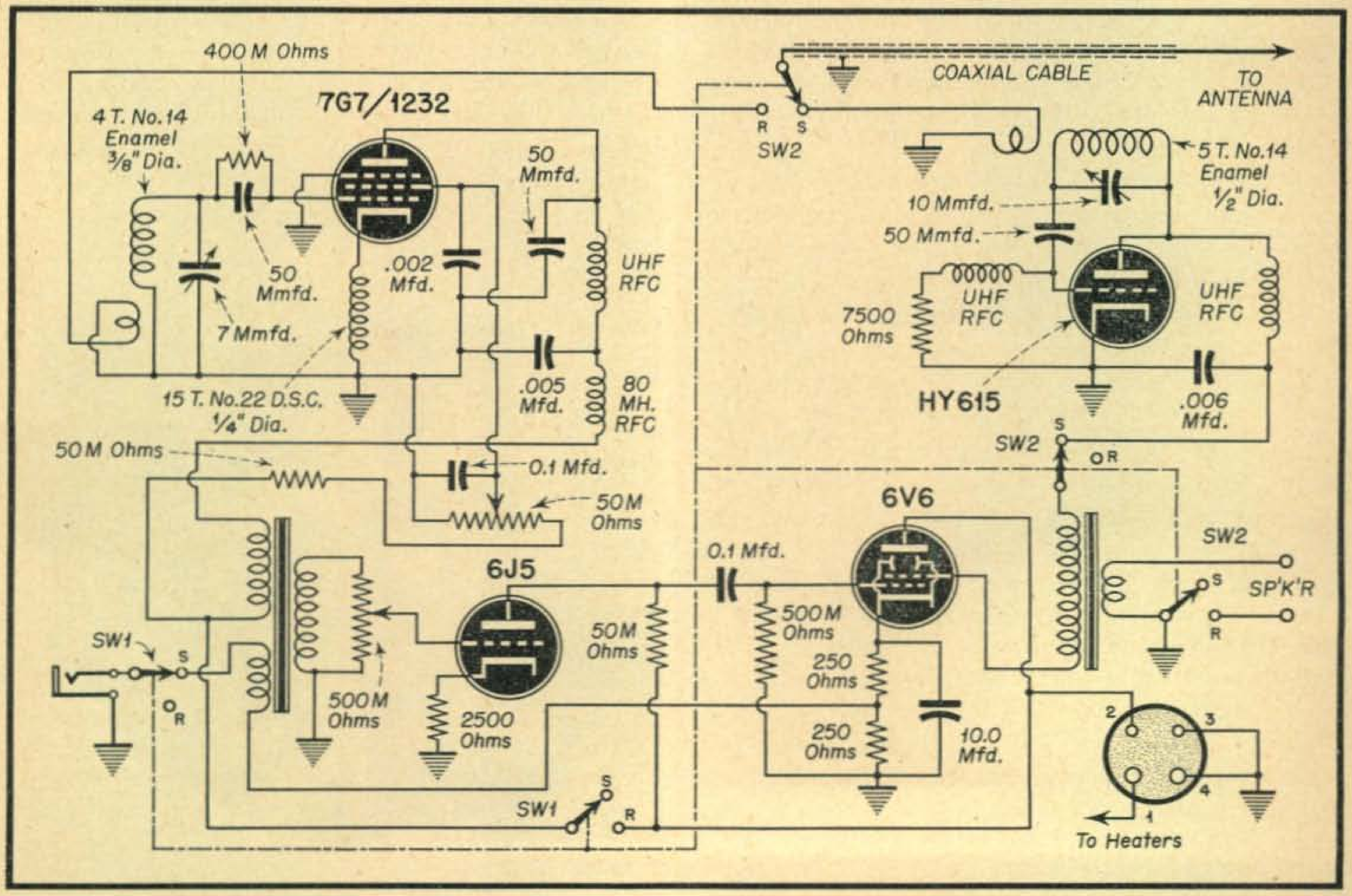


Fig. 1. Schematic of mobile unit. Switches are ganged for single-control operation

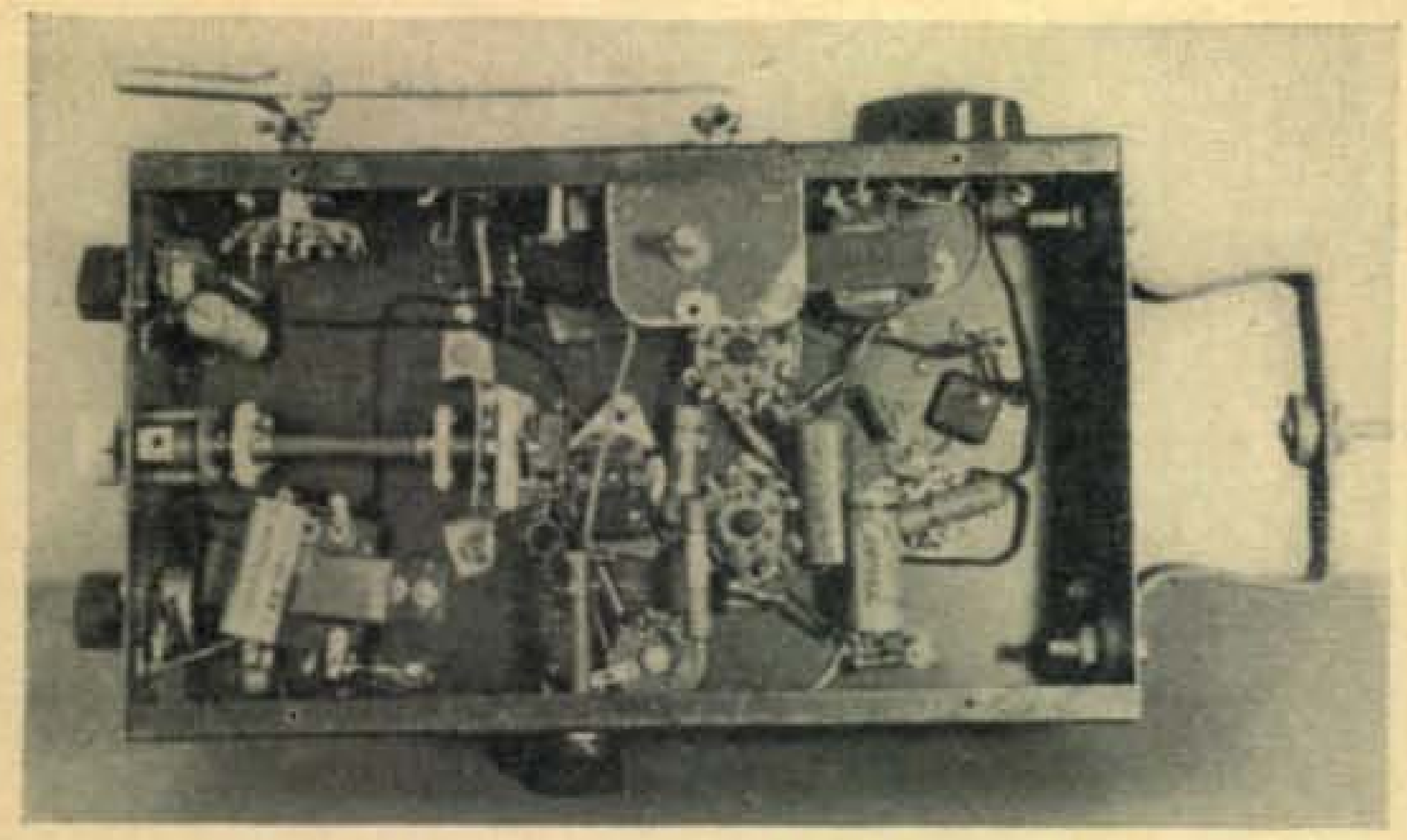


Fig. 3. Bottom view of receiver chassis

rod, the assembly fitting snugly within the plate coil. The opposite end of the rod is drilled and tapped for a long #6-32 screw which passes through a matching hole in the rear wall of the shield box. The coupling can be varied and is maintained at the optimum adjustment with a lock-nut.

Receiver Features

The receiver, as previously mentioned, is built entirely beneath the chassis. Originally we had a conventional super-regenerator with a 7A4 detector. It was not particularly satisfactory and radiated rather badly. When approaching a fixed station we had to shut off the entire rig because our receiver generated so much interference. To overcome this we adopted the circuit shown in *Fig. 1*.

The chief advantage is that the antenna link is at the grounded end of the coil and radiates very little energy. At a distance of less than fifty yards from the antenna, there is no trace of radiation. Super-regeneration is extremely smooth and the receiver is a joy to operate. The screen acts as the plate of the triode detector, and super-regeneration is controlled by varying the screen voltage. The audio component of the signal is picked up from the plate of the detector and fed through a conventional a-f amplifier.

While receiver frequency-determining components may be mounted on metal, since the rotor

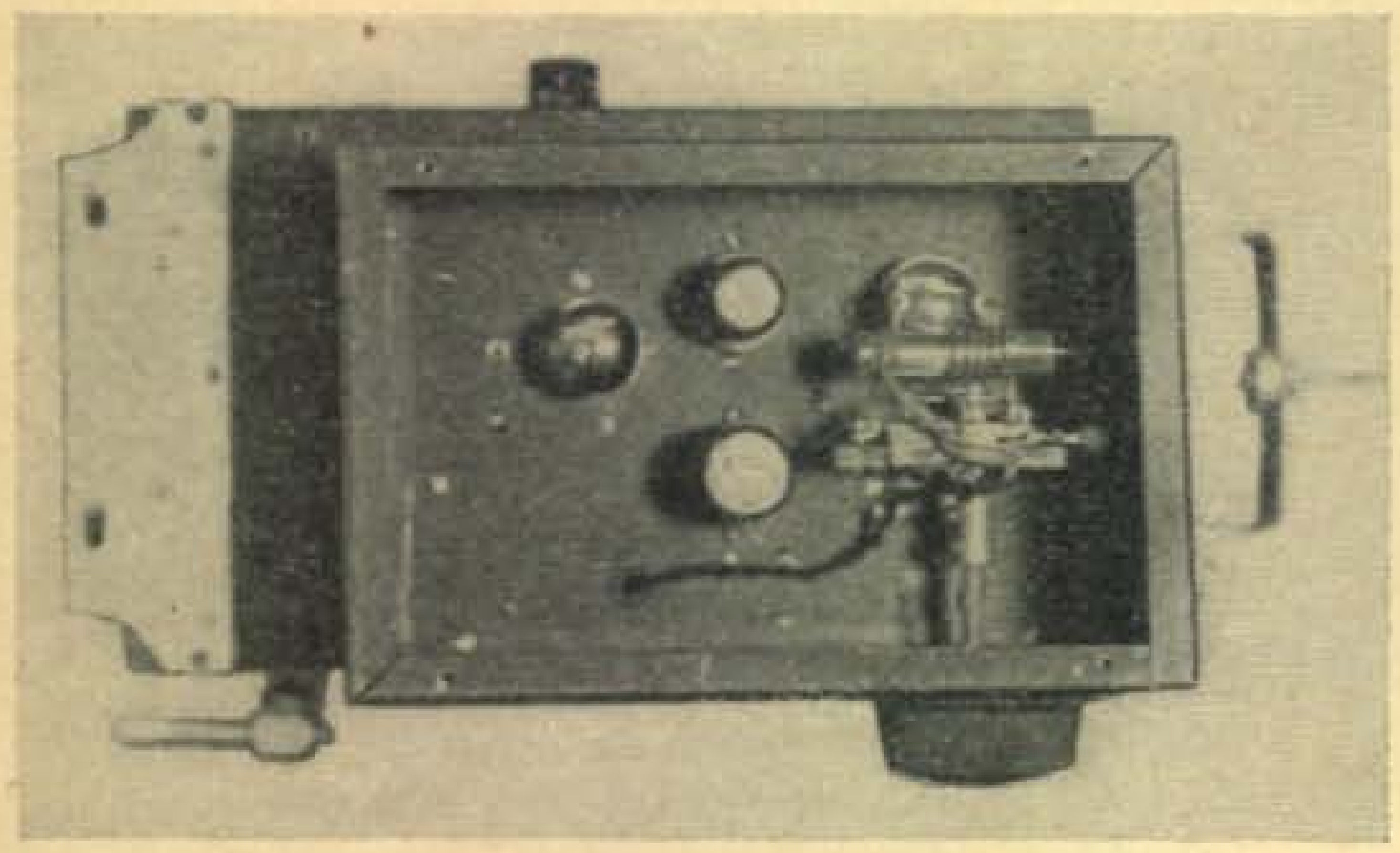


Fig. 4. The transmitter as viewed from the top. Receiver and transmitter tubes are in this compartment

is grounded, we prefer to use insulated mounting and run all grounds to a common point at the tube socket. The socket was mounted about ¾″ below chassis level on studs to locate it near the condenser lugs and the coil for short leads. The cathode coil, which supplies the feedback producing super-regeneration, consists of fifteen turns of No. 22 silk-covered wire close wound ¼″ diameter and self supporting between the cathode socket terminal and ground.

Securing the proper coil dimensions to hit the 112-116-mc band may be tricky. The conventional super-regenerator connects the coil and condenser across the grid and plate of the tube, and this capacity is usually quite small. With the tuning components from grid to ground the situation is changed, and the coil must be altered accordingly to one of smaller dimensions. Those we specify were arrived at by considerable trial-and-error experimenting. Results, however, were more than worth the time spent in changing coils. The gridleak is of considerably lower value than is customary with the super-regenerative detector.

The condenser is coupled to the planetary-type vernier dial by means of a short fiber rod and two flexible couplings. The antenna link is supported on a fiber rod with a 'phone jack as a bearing. Note again that this link is at the ground end of the receiver coil.

The Radio Channel

Care must be exercised in lead and part placement, so that unwanted r.f. is not piped into the audio circuit. We had a bad case of it at first. Our original detector was a straight S-R. The rod connecting the condenser to the dial was of metal and close to the unshielded audio transformer windings. Resulting howls and squeals were very bad. Substituting the fiber rod cured the trouble. Any peculiar noises can usually be eliminated by making appropriate changes in the parts and wiring arrangement.

The 3-1 audio transformer was modified with the addition of a layer of No. 30 enameled wire as a microphone primary. The combined modulation and output transformer is a small push-pull Class A plates to voice coil job. On receive it operates to match a single plate to voice coil, and the proper taps on the secondary are selected by experiment. On transmit this transformer functions with the center-tapped primary acting as a 1 to 1-ratio modulation transformer with the secondary open to kill the speaker. To check the voice quality, remove the HY615 and short the terminals on the voice coil section of the switch. Turn the main switch to transmit and speech into the mike will be reproduced in the speaker.

[*Continued on page 36*]

TWO-TUBE

PRESTON C. YOUMANS, W2OHE

Fig. 4. The author at the controls of WNYJ9

TODAY AFTER nearly three years of successful WERS operation, the need for compact, versatile pack sets is still with us. Their utility has been amply demonstrated, and with our constantly expanding WERS activities these little self-powered two-way communicators are in demand. Of prime importance is their ability to be down front where things are happening—to establish communications from the scene of action. WERS unit WNYJ9 has proven itself in many hypothetical and real emergencies, including the hurricane of September, 1944. After almost three years of faithful service it still performs faithfully.

Basic Requirements

The basic requirements of a walkie-talkie pack set designed for WERS operation are that it must be light, easily portable, self-powered (preferably with batteries), sturdily constructed, easy to operate under adverse conditions by one operator and with a minimum number of adjustments to be made in the field. WNYJ9 was constructed with these considerations in mind. Although this unit is a transceiver the usual shortcoming of the transceiver, its inability to receive and transmit on the same frequency, has been overcome to a large extent by making the coil big and the condenser small providing a rather large bandspread for the WERS frequency allocation of 112 to 116 megacycles. This makes it unnecessary to retune when switching from receive to transmit.

The circuit of WNYJ9 is conventional and requires no trick parts. Even when it was built, components were rapidly disappearing from the dealers' shelves. The only part a bit hard to find now is the transceiver transformer, which is nothing more than a regular audio transformer with a mike input winding. If you can't buy one ready-made it is easy to improvise from an audio transformer that has enough space for a third winding. Removal of some of the excess paper around the original winding will often make room for the additional primary. From 50 to 60 turns of No. 24 to 30 enameled wire will do. I have made several such transformers and the difference in performance between the home-made and commercial products cannot be detected.

Constructional Notes

The junk-box is relied upon for most parts. The schematic diagram (*Fig. 1*), parts list and photographs tell the story of construction better than the proverbial thousand words. Try to keep the r-f leads short and well insulated with the best high frequency materials obtainable. The whole unit, including batteries, is housed in a home-made wooden box (*Figs. 2* and *3*). Leave plenty of room for batteries since sizes obtainable vary considerably. Remember, too, that this unit must be used in all kinds of weather—snow, rain and come what may—so tight joints adequately waterproofed and solid construction should be of prime consideration.

Preliminary Checks

After the construction is completed it is wise to make some preliminary checks before hooking up the batteries and throwing the switch. The tubes, using only 1.5 volts of A supply, cannot stand any overload. It is good policy first to connect the A battery *only* to see if the filaments

WALKIE-TALKIE PACK SET

WNYJ9 is easy to build and performs beautifully

light when the power is turned on. (These filaments barely glow so look very carefully before making any decision.) If OK, disconnect the A battery and reconnect it *to the B battery* posts. If the filaments light, look for trouble and thank your lucky stars you didn't connect 90 volts across the filaments. Repeat this check, connecting the A battery to the C battery terminals. If everything seems safe, connect the three batteries to their respective posts and turn on the transceiver. For preliminary testing use a piece of heavy wire about 48 inches long for the antenna and when the correct size is found a permanent aerial may be installed. Loosen the antenna trimmer condenser as far as it will go toward minimum capacity. With the regeneration control turned about three quarters of the way to full on, the characteristic super-regeneration hiss should be heard. If the coil and condenser are close to the values given in the parts list you should be very near the WERS band. But since a small variation in either the coil or condenser will make a large difference in frequency and bandspread, it may be necessary to remove or add a turn of wire to the coil or perhaps just squeeze or stretch it out a bit to hit the WERS band. It is best to make these adjustments when the WERS net is on the air (Monday and Wednesday from 9:00 P.M. to 11:00 P.M., and Sunday from 5:00 P.M. to 7:00 P.M., EWT). For the New York City builder there is an experimental radio station just above the 116-megacycle end of the dial (seemingly on the air 24 hours a day) which may also be used for check. When making re-

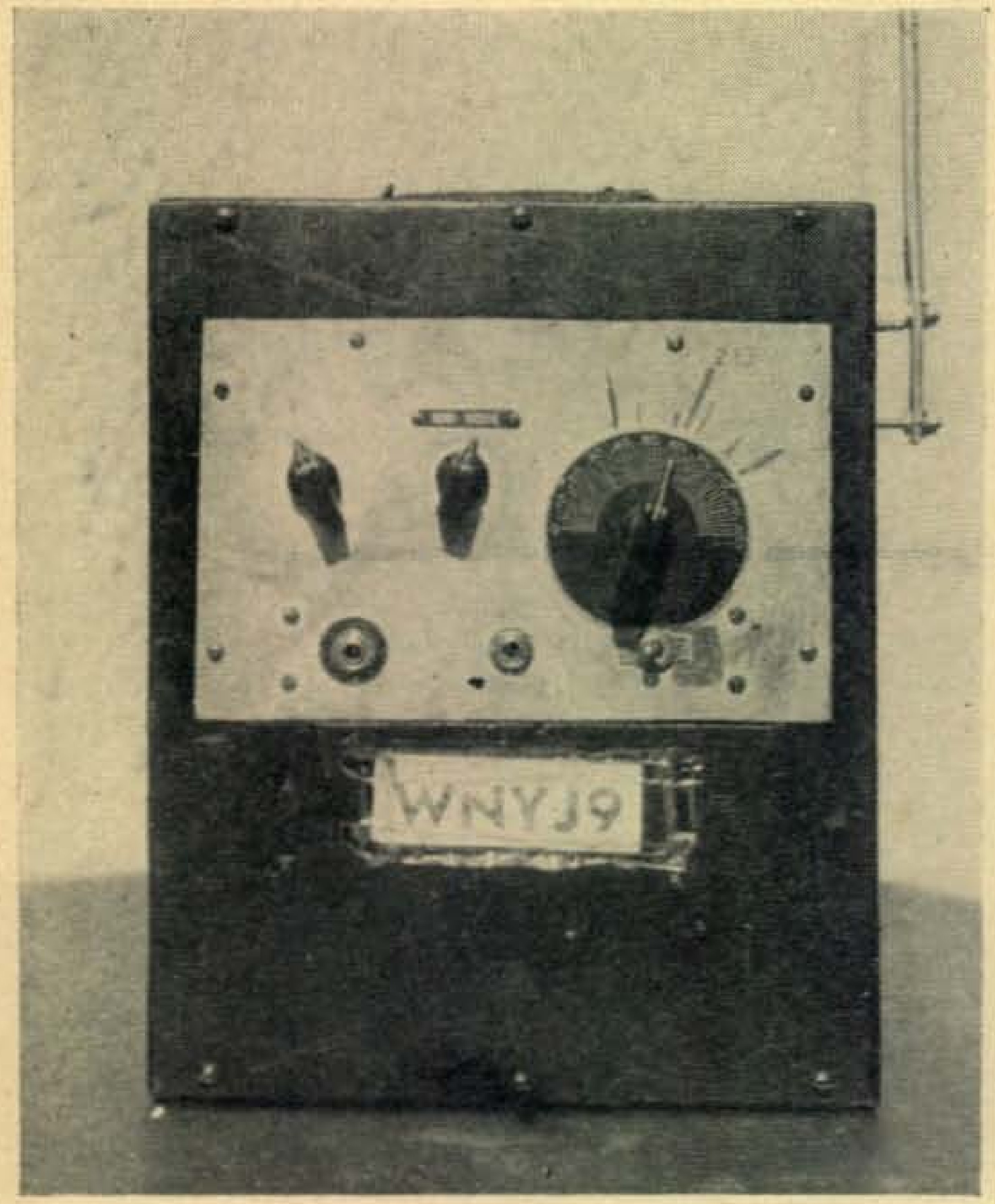


Fig. 3. Front panel of WNYJ9. The rod antenna is permanently affixed to the side

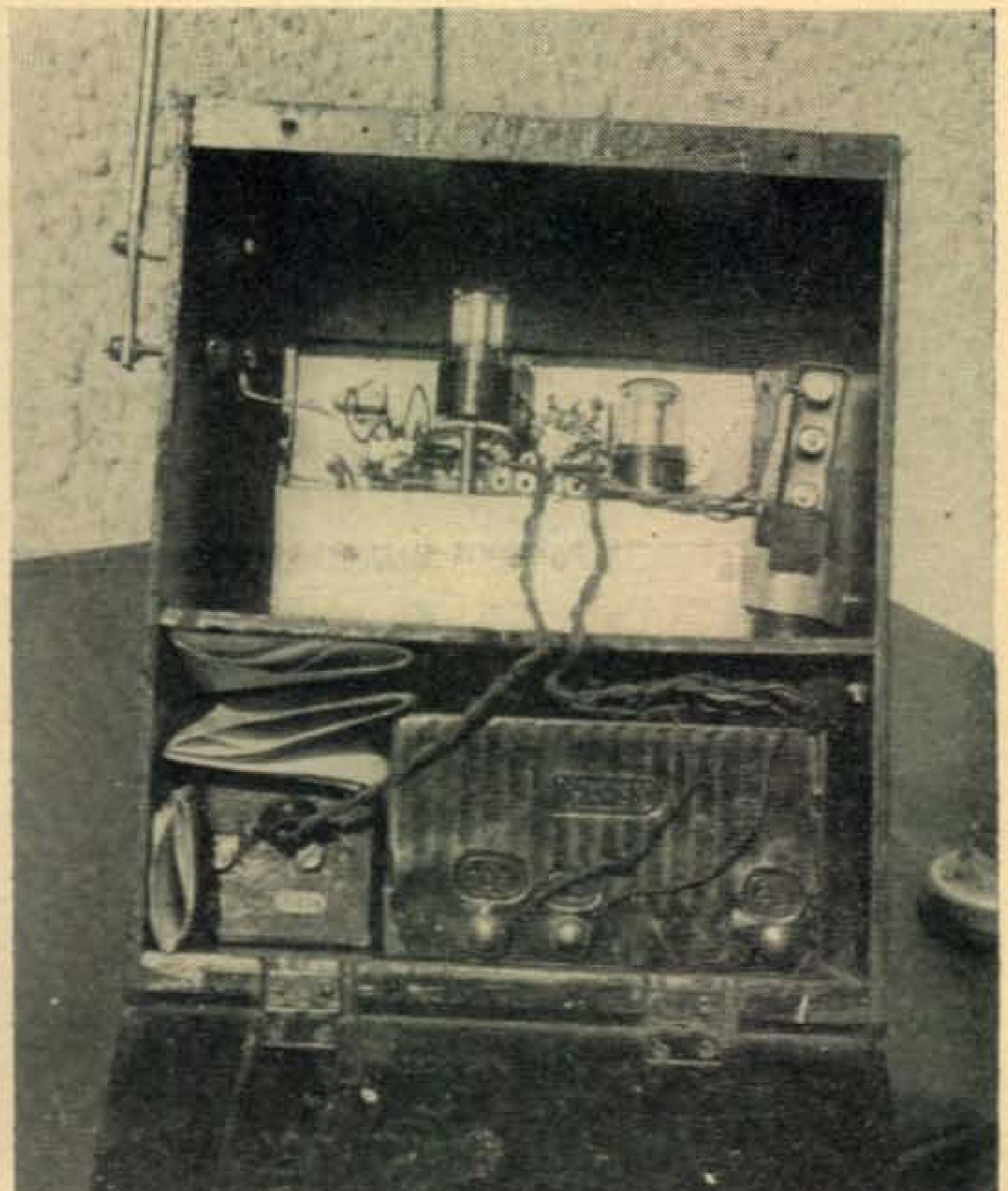


Fig. 2. Rear view of pack set. There is plenty of room for batteries of various sizes

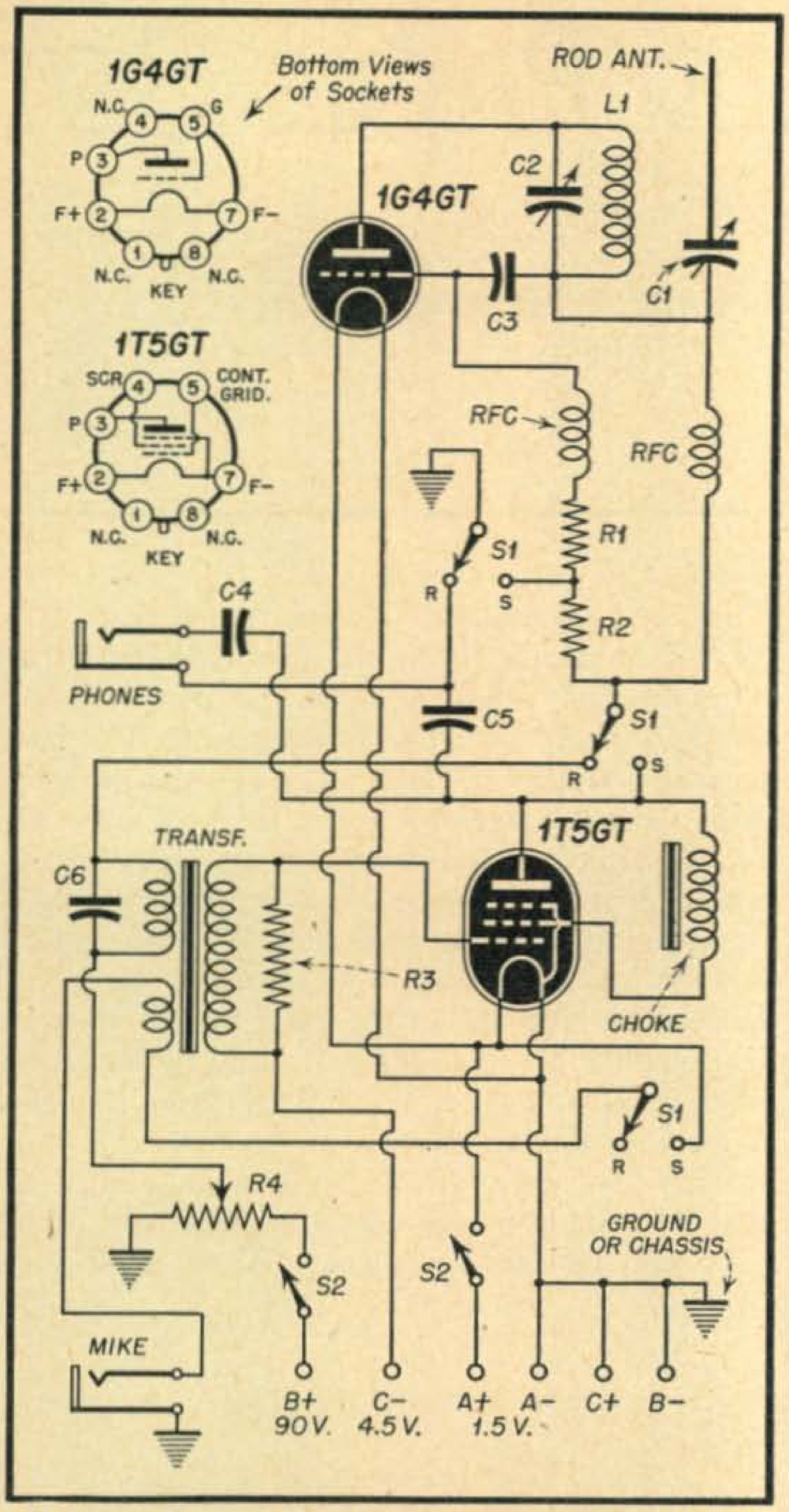


Fig. 1. Transceiver wiring diagram of WNYJ9. Phone jack must be insulated from chassis. Most of the following parts will be found in the junk box

Ant.—rod 36 to 48 inches. See text
C_1—3-30 $\mu\mu$f mica trimmer
C_2—2-plate midget
C_3—100 $\mu\mu$f mica
C_4 and C_5—.1 μf 200 volts d.c.
C_6—.003 μf mica
Choke—30-henry a.c.-d.c. midget type
L_1—3 turns No. 14 wire ½ inch diameter
R_1—30,000 ohms ¼ watt
R_2—1.5 meg. ¼ watt
R_3—100,000 ohms
R_4—100,000 ohms volume control used as regeneration control.
RFC—Ohmite 21
S_1—3-pole D.T. switch
S_2—D.P.S.T. switch
Trans.—transceiver transformer

ceiver adjustments during a regular WERS operating period, should you hear a station complain about a receiver in the vicinity, remember you may be causing the interference and it would be best to shut down. A super-regenerative receiver acts as a miniature transmitter, so be careful not to interfere with regular WERS traffic.

Bandspread Adjustment

After the WERS frequencies are spotted they can be bandspread or condensed to fit the dial by squeezing or stretching the coil. About 50 dial divisions for the entire WERS network is a good bandspread. Next adjust the length of the antenna for maximum signal strength. This is best accomplished by starting with an antenna about 48 inches long and reducing the length in 1-inch steps until the size is reached which gives the best response. While making these adjustments the antenna trimmer condenser must also be varied each time for peak signal strength. Adjustment of the antenna trimmer will also effect the regeneration control. After some experimenting with antenna length and trimmer adjustment, it will be found that the receiver will super-regenerate smoothly over the entire band and provide maximum signal strength. When making these adjustments, it is wise to use a station that doesn't come in too strongly, so as not to block the receiver and result in an improper adjustment. After the optimum antenna length is found, a permanent rod (*Fig. 4*) can be made to replace the heavy wire used for preliminary checks. The two and three-section whip antennas used for regular car radios make excellent aerials, and can be picked up at most any radio store cheaply since the lead-in cable isn't necessary.

As yet, nothing has been said about adjustment for the transmitting side. Why? Remember, and this is extremely important, that unless you are a duly licensed WERS radio operator and the unit you are building has been granted a WERS license by the Federal Communications Commission, you cannot transmit even for test purposes. But if the unit has been carefully adjusted for receiving you can be almost assured that it will function equally well as a transmitter. When the unit becomes a part of WERS, final adjustments can be made for the best all 'round performance during the regular test periods. License requirements for both yourself as an operator and your unit are easily secured and further information can be obtained from your local Office of Civilian Defense.

The case history of WNYJ9 in WERS operation shows successful operational tests, both in receiving and transmitting, with the unit down in the subway, from a subway train in motion, from the inside of buildings of all types of construction, and from ambulances and street cars in travel—truly a remarkable record for a pack set of such low power. This unit was also used in the author's home as a receiver, with the output connected to a receiving amplifier and recorder to make records of WERS operation for future reference.

(*U. S. Maritime Service photo*)*

COMMERCIAL OPERATING IN SIX MONTHS

The Hoffman Island Maritime Service Radio Training System

W. WARNER, W3NJO

HOFFMAN ISLAND, in Lower New York Bay, was established as a radio school on June 2nd 1942 by order of Rear Admiral Randall, USNR, Commandant of the United States Maritime Service. This order was enacted to alleviate the shortage of competent radio officers aboard merchant ships caused by a Navy directive stating, "A continuous radio watch shall be maintained aboard American flag vessels owned by or under charter to the War Shipping Administration and employed under certain operating conditions or in specified services." It was determined that these vessels should be manned by three civilian radio operators rather than a mixture of naval and civilian personnel. These requirements made it necessary to modify the radio training program in an effort to meet the demand for trained men. The radio course previously conducted at the first U. S. Maritime Service Radio School to be established, at Gallups Island, Boston, Mass., was cut from 32 to 20 weeks. This condensed training prepares students to become fully qualified Radio Officers and to pass an FCC Temporary Limited Radiotelegraph operator (T.L.T.) license examination (identical with the Second-Class Radiotelegraph operator test, except that a passing mark of only 50 percent is required on each ele-

***RADIO LABORATORY, HOFFMAN ISLAND —Latest type radio apparatus used aboard merchant vessels is employed to instruct trainees. Harry E. Young at typewriter, Marvin Wimberly, Bourbond, Ind., on right**

(*U. S. Maritime Service photo*)

Ensign Balber instructing trainees in theory, operation, and use of radio direction finder

ment of the written examination). Approximately 85 percent of the students who complete the 20 weeks course at Hoffman Island pass the FCC examination with the grades required for the issuance of a Second-Class license.

Radio Training Course

The Radio Training Course presented at Hoffman Island is designed to provide potential radio operators with sufficient skill in code reception and practical operation of marine radio equipment to assume the responsibility of standing an efficient radio watch aboard a merchant vessel in wartime. The time limitations presented by the current demand for shipboard radio officers has, of necessity, excluded a wealth of detailed material from the radio training course. However, as will be appreciated from the following outline, the training is comprehensive. The student receives 130 hours of theory—10 hours in each subject—covering electronics, ohms law, magnetism (alternators and a-c fundamentals), d-c equipment (generators, motors, control apparatus, meters), resonant circuits (inductance and capacity), power supplies, vacuum tubes, self-excited and crystal-controlled oscillators, r-f power amplifiers, antennas, r-f and a-f amplifiers, detectors, and batteries. Similar time is devoted to individual laboratory subjects—material, direction finders, shipboard transmitters in general, the Mackay "Marine Unit" installation, and the RMCA model 4U. Wartime radio procedure receives 22 hours of concentration, and the course is topped with 40 hours of watch-standing and a final examination.

Instruction Facilities and Equipment

The equipment used at Hoffman Island includes the most up-to-date shipboard installations. Instruction is given on all the transmitters and receivers in common use today. The training staff comprises a specially selected group of commissioned and non-commissioned United States Maritime Service personnel, thoroughly qualified to supervise and instruct the course of training established at the school. The instructors take a personal interest in the students' work, and give a great deal of their off-duty time to assist worthy men with difficulties they may encounter in the course.

Facilities for code instruction are of the most flexible type. All code originates from a central control room where are located 24 variable-speed keying heads patched into 18 trunk lines connecting with the various code copying rooms. An inter-communication system connects the instructors in the individual code rooms with the central control. As many as 5 different code tests are conducted from the central control room at one time, plus the different keying heads sending code to those rooms devoted to practice. Each student has an individual position with a high-speed typewriter, telegraph key, and a selector switch which enables him to copy the speed he desires by selecting the proper tap. All the positions are tied into the instructor's intercom thus enabling him to break-in and talk to individual positions or the group as a whole. Since fast copying is done on a typewriter the student is taught touch typing. The requirement of the school at graduation is 18 words per minute mixed code, and plain language at the rate of 23 W.P.M.

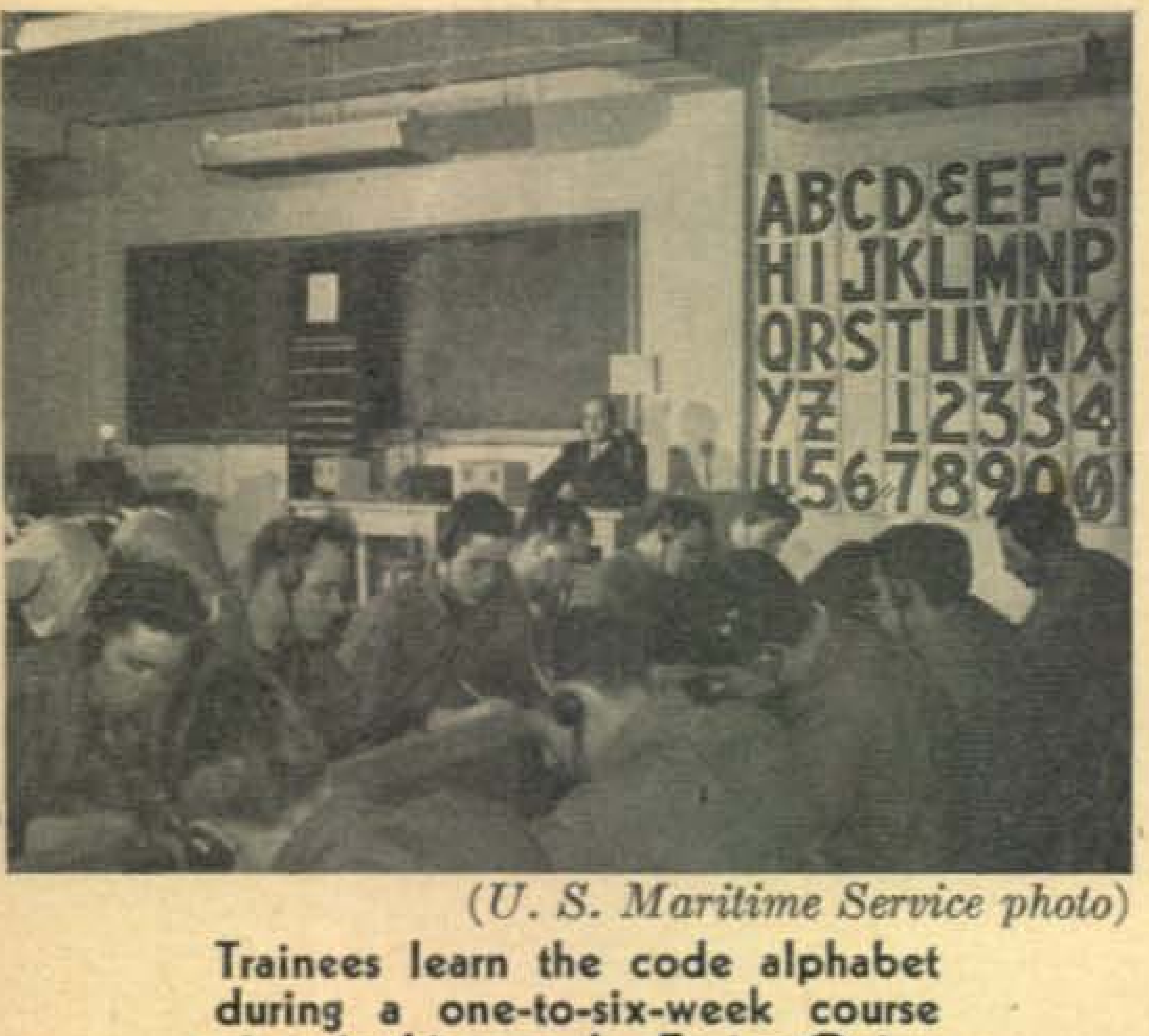
(*U. S. Maritime Service photo*)

Testing component parts of radio units in the laboratory in Hoffman Island training course

The student is instructed in general commercial operating procedure, including laws and regulations "Q" signals, radio time signals, distress calls, etc. He also receives practical operating drills which cover handling communications under adverse conditions of interference and atmospherics, break-in operation, establishing communications and handling traffic in the high-frequency band, and practical demonstrations of typical distress traffic.

In the Lab

The standard marine radio installation laboratory comprises at least one of each type of radio equipment now being installed aboard vessels constructed by the U. S. Maritime Commission including crystal-controlled intermediate and high-frequency transmitters, superheterodynes, direction-finder equipment, standby apparatus, lifeboat transmitting and receiving equipment, small-craft radio-telephone, and radio accessories. In the laboratory the student is taught the care and use of tools, wire splices, shipboard and standard antennas, and advised of the dangers present in working with electrical and radio transmitting equipment. The servicing of marine receivers is covered—continuity and point-to-point resistance measurements, tube testing, identification and location of parts in t-r-f and superheterodyne receivers, receiver failures, remedies, and emergency repairs. A thorough course of instruction covering marine transmitting equipment includes: specifications for shipboard transmitters to meet Federal Communications Commission requirements, theory of operation, identification of essential parts and maintenance of all the standard marine transmitters in use aboard merchant vessels today, marine transmitter power supplies, battery installations and charging circuits.



(*U. S. Maritime Service photo*)

Trainees learn the code alphabet during a one-to-six-week course given in this room by Ensign Quinn

(*U. S. Maritime Service photo*)

Trainees are taught to copy signals off the air and to make up a ship's radio log during the one-week course

During the fifteenth week of the course the student is taught pre-direction-finder theory, methods of determining the position of ships at sea, the properties of the loop antenna, marine direction-finder requirements, balanced circuits, direction-finder errors, and calibration and compensation. He is thoroughly checked in the operation and identification of essential parts and the maintenance of the Mackay 106B and RCA AR8707 direction-finders. A complete direction-finder assembly such as the student will find aboard ship is mounted in the laboratory, and every trainee is given an opportunity to use this equipment under the supervision of an instructor. Throughout the 20th week the trainee receives actual shipboard watch-standing training in the island's well equipped watch-standing room. During this week the student is required to maintain schedules, keep a proper radio log; he copies actual signals from the air, such as those emanating from coast stations handling traffic with ships at sea. He learns how to use his receiver on the frequencies most suitable for communications at various times, and he is thoroughly familiarized with the routine of watch-standing as practiced aboard a merchant vessel.

Upon graduation the student receives a U. S. Maritime Service Diploma, and is raised in grade to Warrant Radio Electrician. He is then sent to the Recruitment and Manning Organization and shipped out as Radio Officer aboard a merchant vessel.

Recreation

Hoffman Island is well provided with recreational facilities. The local theater shows current movies nightly. A well-equipped gym and basket ball court, plus a large indoor swimming pool are also on this island. Intergroup basket ball games are encouraged; small boat work and calisthenics are included as part of the general physical training. A large, well-stocked library is available to the student—books for reference purposes and light reading. The men at Hoffman Island receive complimentary tickets to New York Theaters and social functions.

Religious guidance of the trainee is under the direction of the station chaplains. Catholic and Protestant denominations are represented; the trainee is free to attend chapel services of his particular faith, and call on the chaplains for advice at any time.

Eligibility

Eligibility for radio training at Hoffman Island is limited to Maritime Service enrollees who qualify for such instruction on the basis of competitive examinations. In order to enroll in the U. S. Maritime Service, the applicant must possess certain basic qualifications. He must be a citizen of the United States (and be able to prove it), meet the physical standards for the particular

(U. S. Maritime Service photo)

In addition to their usual radio training trainees at the USMSRTS learn how to use a portable lifeboat radio transmitter, standard equipment in all lifeboats. Instructor is W/RE C. G. King

service desired, have the consent of parent or guardian if under 21, and submit satisfactory character references. Also he must possess a statement of availability, and shall not have reported, received notice to report for induction or have been inducted. (Those desiring to join up should contact their local U. S. Maritime Service Enrolling Office or communicate with the Commandant, U. S. Maritime Service, War Shipping Administration Training Organization, Washington 25, D. C. for the latest complete information on regulations.)

Having satisfactorily passed the physical examination, the applicant is enrolled as an Apprentice Seaman and shipped to one of the three training stations located at Sheepshead Bay, N. Y., St. Petersburg, Fla., and Avalon Santa Catalina Island, Calif. Married men are required to have the written consent of their wives. Transportation to the Training Station and meals while traveling are furnished by the United States Maritime Service. Upon arrival at the training station, the enrollee is provided with uniforms, miscellaneous apparel, excellent subsistence and quarters. The enrollee receives free medical and dental care by a top-grade staff of officers while he is on active duty in the Maritime Service. Every precaution to safeguard the health of the trainee is rigidly observed.

All enrollees receive the 6 weeks' basic or preliminary training. The purpose of this training period is to teach general seamanship, water and sea safety, physical fitness, boatmanship, hygiene, gunnery fundamentals (necessary to all seaman regardless of branch, department or rating), to instill a knowledge of discipline, teamwork, group activity and to prepare for the hardships and isolation of life in the merchant marine.

Following the completion of at least six weeks preliminary training, candidates for Hoffman Island are examined in general scholastic ability, mechanical comprehension, arithmetic, algebra, code aptitude and swimming. Stability, conduct, previous education and occupational experience are all evaluated, and the applicant is interviewed. Every effort is made to select the highest proportion of men who will eventually pass the FCC examination with colors flying.

On arrival at the radio school, selectees are advanced in grade to Seaman Second Class, and upon satisfactory completion of twelve weeks radio training, the student is upped to Seaman First Class and paid accordingly. Later, as a Radio Officer, he will earn from $150 to $180 per month—exclusive of bonus and overtime. He is accorded the privileges of an officer, and his quarters and mess are commensurate with his position.

Should he desire to further his studies, the operator is eligible to receive extension courses, including Practical Radio Engineering, from the Maritime Service Institute. These courses, costing several hundred dollars if purchased privately, are available to members of the Maritime Service for a registration fee of $3.00.

The current Maritime Service Radio Training program presents a golden opportunity to men desiring to learn radio and serve their country at sea. In presenting this brief picture, the author extends his appreciation to Captain Manning, USMS Superintendent of Hoffman Island, Commander Fraser, Executive Officer, Lt. Commander Hickey, Administrative Officer, Lieutenant Wilson, Training Officer, and to Lieutenants (j.g.) Garcia and Stano, and members of the administrative staff for their co-operation in furnishing material for this article.

WIRED WIRELESS TRANSMITTER

This Electron-Coupled M. O. P. A. Rig Will Put You "On The Air" During the Duration

J. D. POTTER, W3IKM

Wired wireless offers the ham an intriguing substitute for the real thing. CQ will publish additional data—on receiving systems and DX.

SINCE THE CLOSING of the ham bands more and more of us have turned to wired wireless as an inspiration and outlet for our desire to be "on the air." For those of us who have kept the ham spirit awake and desire to proceed beyond the vintage 1930 oscillators, we present a logical and practical advancement in carrier-current transmitters. The rig described in this article incorporates many old ham ideas plus several new and novel features. The electron-coupled oscillator is fully as useful on the light lines as it was in the 40-meter band. Instead of dodging QRM from 60,000 other hams, we now find ourselves in the position where we must pick the most noise-free spot in the line. In addition, it is possible to boost the signal strength at a distant receiving point by as much as two to three R's when a proper impedance (line match) is obtained. Many of us have experienced considerable difficulty in loading into the power lines at such low frequencies. The author has found that variable-frequency control with an r-f output stage materially assists in overcoming the majority of these loading problems.

The rig has been designed with several thoughtf in mind. First, it had to be compact, with most os

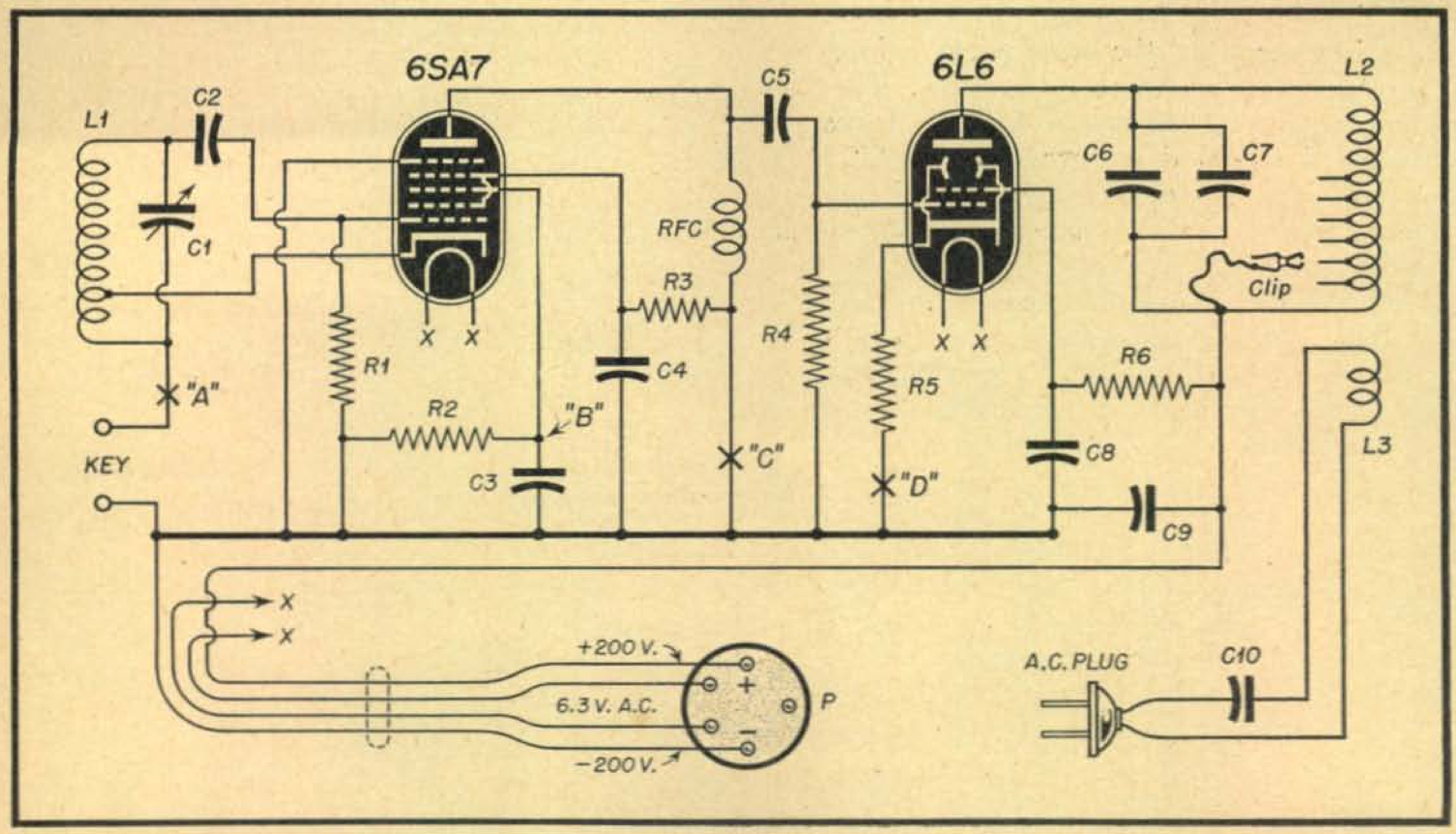


Fig. 1. Circuit diagram of the wired wireless transmitter which uses the power lines instead of the ether. Parts list below

L_1, L_2 and L_3—see text
C_1—Solar #38634-.002 µf
C_2—.0001 µf mica
C_3—.005 µf mica
C_4 and C_5—.01 µf 400 v. tubular
C_6—.0025 µf 1000 v. mica
C_7—.0015 µf 1000 v. mica
C_8 and C_9—.05 µf 600 v. tubular
C_{10}—.1 µf 400 v. tubular
P—5-prong Amphenol power plug
R_1 and R_5—25,000 ohms 1/2 watt
R_2—100,000 ohms 1/2 watt
R_4—5000 ohms 1/2 watt
R_3—300 ohms 2 watts
R_6—25,000 ohms 1 watt
RFC—80 mh

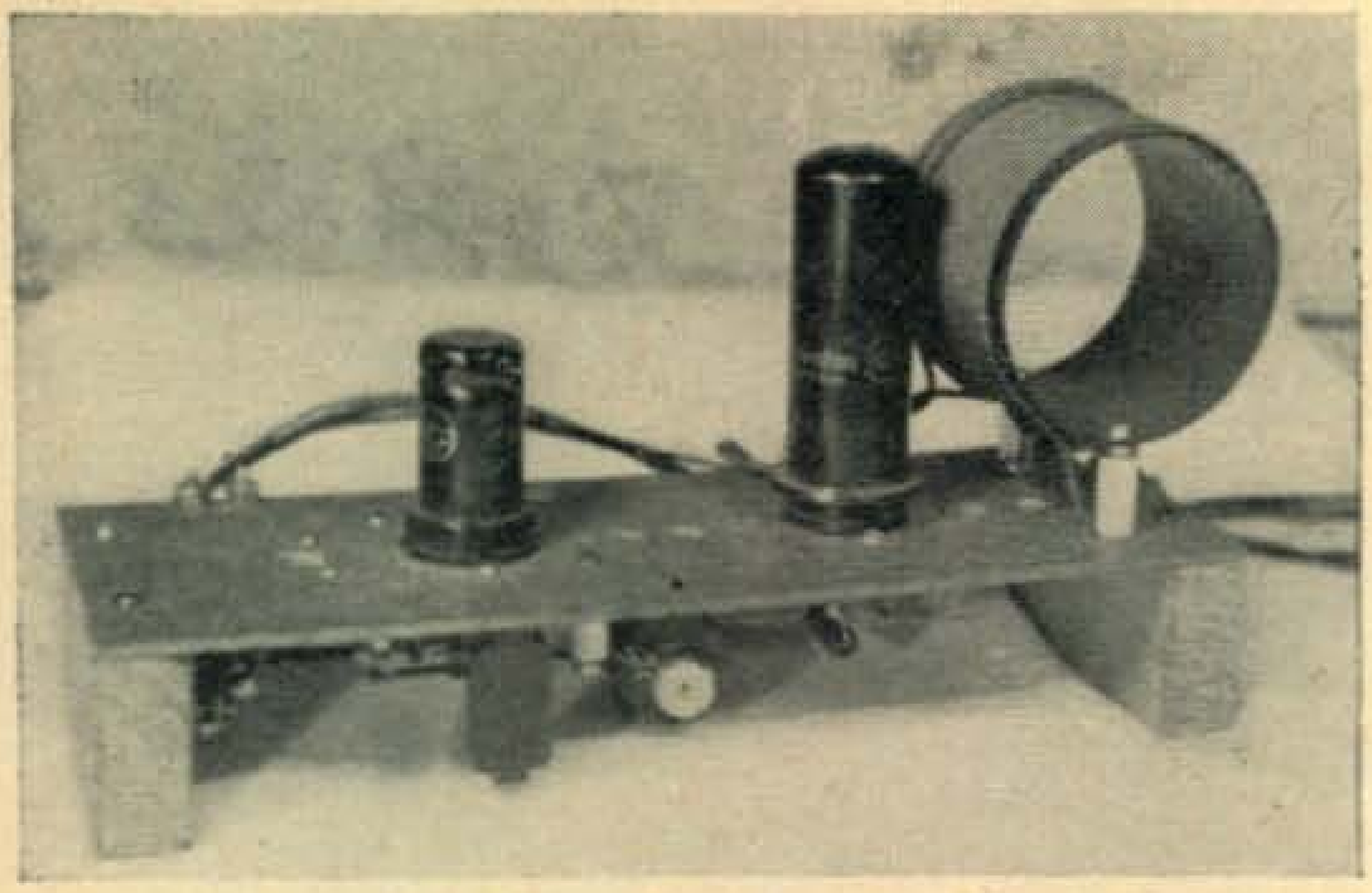


Fig. 2. Showing the simple and compact layout. Metal chassis construction may be used if preferred

the parts obtainable from the "junk box." As it was to operate from the receiver power supply, voltage regulation had to be incorporated in the transmitter so as not to affect normal receiver performance. Provisions should be made so that a high-impedance crystal pick-up can be used to modulate the transmitter when operated as an induction type unit for remote phono control. The transmitter shown in *Fig. 1* and accompanying photographs incorporates these considerations, plus providing variable frequency, e.c.o.-m.o.p.a. operation from 165 to 200 kilocycles.

Mechanical Details

As is clear from the front view photograph, *Fig. 2* this unit is extremely compact. The base, which measures 11 inches by 4 inches, is made of Prestwood mounted on two strips of 2″ x ¾″ wood 4″ long. Metal chassis construction may of course be used, but, for the average ham, without a stock of metal working tools, the old stand-by is still the easiest material to work. The 6SA7 oscillator buffer stage is located on the left side of the chassis with the 6L6 r-f amplifier stage on the right. Key leads are connected to the two #6/32 machine screws protruding through the left rear edge of the base. The amplifier tank circuit, L_2, C_6 and C_7, is mounted on two ¾″ x 3/8″ Isolantite stand-off insulators. The plate and B plus leads are routed from the tank circuit through ¼″ diameter holes in the base. These leads are self-supporting and centered in the ¼″ holes.

The photographs of the underside of the chassis *Figs. 3* and *4*, reveal the symmetry of the parts arrangement. By properly locating the components, wiring has been so simplified that the resistor and condenser pigtails complete most of the circuits. All grounds are made to a common bus running between the two tube-socket mounting bolts. This permits direct ground connections and eliminates lengthy leads. All power connections are brought to the transmitter through a 2½″ cable consisting of four No. 18 insulated stranded wires terminating on a small insulated strip mounted on the left-hand wooden base support. The other end of the power cable is made up into a standard five-prong male plug shown in *Fig. 3*. The use of quick-disconnect power plugs has proven extremely useful to the author. When ideas for equipment modification arise there is no delay while soldered leads are disconnected. In addition, by having two or three sockets wired into the power supply, it is possible to operate several different units simultaneously with the single supply by merely plugging in the desired units.

Under Chassis Layout

A brief description of the under chassis lay-out follows. Viewed from left to right (*Fig. 4*) are: power cable terminating strip, e.c.o. tank condenser (C_1), the e.c.o. oscillator coil (L_1), 6SA7 tube socket, oscillator plate r-f choke (RFC) and the 6L6 tube socket. The e.c.o. grid condenser (C_2) and grid resistor (R_1) are directly below the 6SA7 tube socket and to the right of the oscillator coil (L_1). The injector grid by-pass condenser (C_3) and the injector grid resistor (R_2) can be seen above the oscillator tube socket. The 6SA7 r-f plate choke (RFC) is mounted on two ¾″ x 3/8″ Isolantite stand-off insulators. The bottom stand-off insulator is also used as the common terminal of the positive high-voltage connections to both the oscillator and amplifier stages. Screen grid resistor (R_3) is between the lower stand-off insulator and the 6SA7 tube socket. Condensers, C_4, C_5 and C_9 are located between RFC and the bottom of the chassis. The balance of the parts (R_4, R_5, R_6 and C_8) are grouped around the 6L6 tube socket.

The Circuit

As shown in *Fig. 1*, the transmitter consists essentially of a 6SA7 (pentagrid converter) operating as an electron-coupled oscillator with untuned plate circuit driving a 6L6 (beam power)

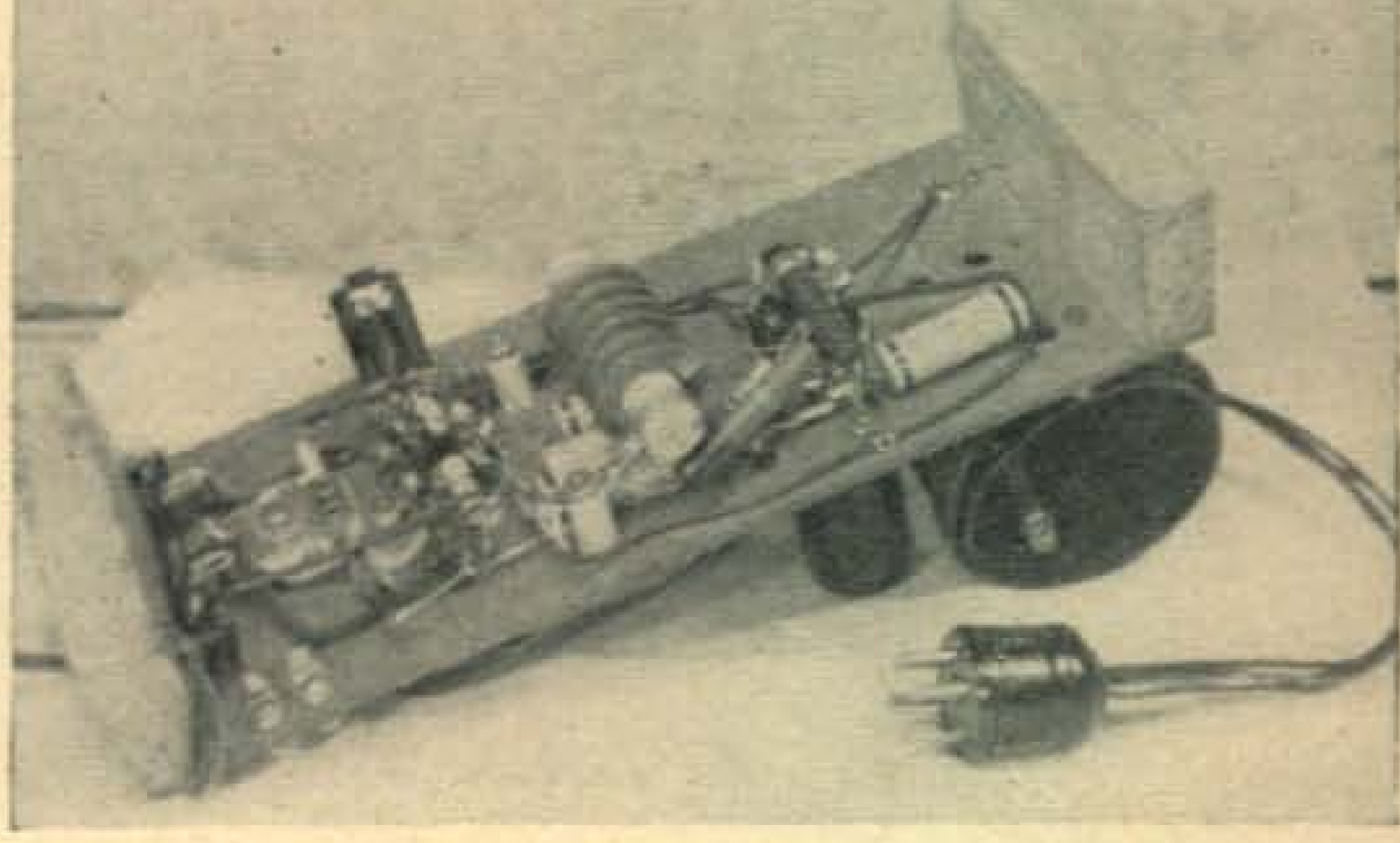


Fig. 3. Bottom view of the wired wireless transmitter, with the power plug on the lower right

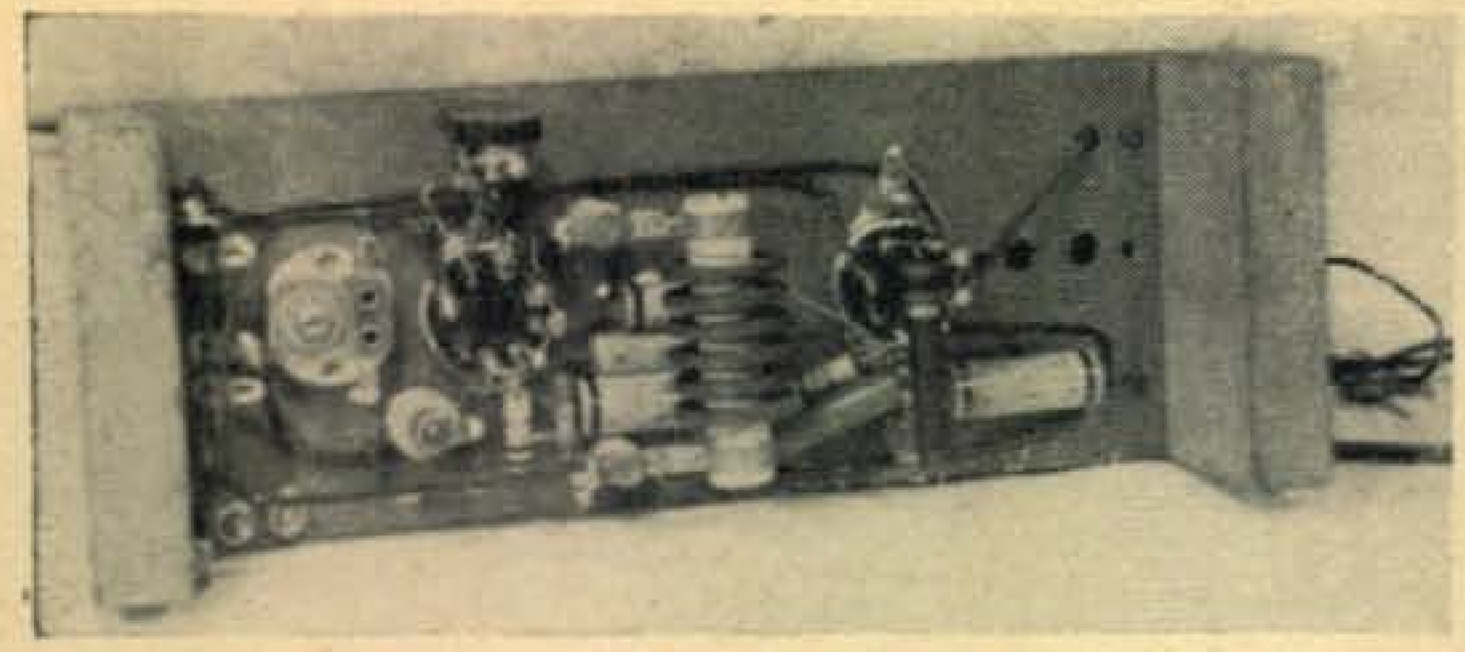


Fig. 4. Symmetrical and logical arrangement permits most under-base connections to be completed by component pigtails

r-f amplifier. The power supply circuit is not shown as practically any receiver power supply delivering from 200 to 300 volts d-c may be used. The filament circuit requires 6.3 volts a-c. This may also be taken from the receiver provided the current rating of the receiver filament winding is not exceeded with the additional current drain of the two extra tubes (1.2 amperes).

By utilizing a 6SA7 for the e.c.o. we have obtained several advantages that are not available with a standard screen-grid tube. The extra (injector) grid, which is r-f by-passed to ground, acts as added isolation between the oscillator and amplifier circuits. It also serves as the modulating element when using a phono pick-up connected between point "B" and ground. The 6SA7 has been designed specifically as an oscillator-mixer and is noted for its excellent frequency stability characteristics. In most standard broadcast receivers, the 6SA7 injector grid is operated at the signal frequency with the oscillator circuit connected similarly to *Fig. 1*. For the favored few possessing signal generators, it is simplicity itself to make frequency checks on this transmitter, by connecting the signal generator from the injector grid to ground. When the signal generator is swept across the oscillator operating frequency, an audio beat note will be heard. The e.c.o. fundamental frequency may then be read directly from the signal generator after the two have been adjusted to zero beat.

Coil Data

Coil L_1 is a standard two section 175 kc i-f transformer from which one of the windings has been removed. Cathode excitation is obtained by winding an additional 100 turns directly adjacent to, and in the same direction as the remaining section of the i-f transformer. This coil is tuned by a $2000\mu\mu f$ mica trimmer condenser (C_1, Solar #38634). The frequency range of this combination is from 160 to 200 kc. Maximum frequency stability is obtained at the low-frequency end of the band (maximum capacity). We suggest that, when selecting the 175-kc i-f transformer, prospective builders of this type of oscillator obtain the transformer manufacturer's specified tuning capacitance.

The transmitter is keyed in the cathode return circuit of the 6SA7 tube through the cathode winding of coil L_1. If the keying leads are over three feet long, it may be necessary to connect a suitable keying filter at point "A" to minimize r-f pick-up in the key leads and to provide a direct r-f ground for the e.c.o. tank. The total oscillator cathode current is 10-12 ma and may be measured by connecting a milliameter across the key.

The amplifier coil, L_1, consists of 75 turns of #20 D.C.C. wire, close-wound on a 3″ diameter bakelite tube 3″ long. This coil is tapped every turn for the first 10 turns from the low potential r-f end, and also at the 15th, 20th, and 25th turns. The antenna coil, L_3, is made by winding four turns of No. 18 stranded insulated hook-up wire over the bottom end of L_2. Leads from the antenna coil are terminated in an a-c male light plug with C_{10} in series with one leg.

Tuning Up

The 6L6 amplifier stage is resonated by shorting turns in L_2. A 3-inch length of flexible #18 insulated wire (with an alligator clip on one end) is used to select the proper tap for the desired operating frequency. No provision has been made in *Fig. 1* for neutralization. The low internal grid-plate capacitance of the 6L6, the isolation of the oscillator from the amplifier tank, and the low operating frequency of the transmitter combine to allow continuous operation of the 6L6 without self-oscillation taking place in the amplifier. This stage also acts as a voltage regulator on the receiver power supply when properly adjusted. With a d-c plate potential of 200 volts, the 6L6 cathode current is adjusted to 40 milliamperes without v-f grid excitation. When the key is depressed and excitation is applied to the 6L6, the resonant cathode current is 10-12 ma. By loading the amplifier to 30 ma (connecting L_3 to the power lines) and operating the oscillator at 10 ma, we draw a total cathode current (both tubes) of 40 milliamperes. As the current drawn with the key either up or down is 40 ma, the drain is constant on the power supply and the transmitter functions as a voltage regulating device when keying.

The plate potential of the transmitter may be increased to 300 volts without changing any of the circuit components. If over 300 volts is applied, it will be necessary to add a series dropping resistor in the oscillator high-voltage supply line at point "C" to keep the screen grid potential of the 6SA7 under 100 volts. In addition, the cathode resistor, R_5, will have to be increased to 200 or 300 ohms. As the plate voltage and 6L6 cathode current are increased, the final amplifier must be re-adjusted to maintain the voltage

[*Continued on page 34*]

AN EMISSION TYPE

This Simple Unit Belongs In Every Amateur Shack

THIS PAPER describes an emission type tube tester that can be built by the average radio amateur at not too great expense. Parts are generally available from radio distributors, even under war restrictions. The builder should have little difficulty procuring the necessary components inasmuch as many substitutions can be made, both in the general design of the entire unit and in the selection of individual parts. The basic circuit should of course be followed.

It is well to understand that compromises must be made between efficiency, convenience and versatility in the design of any of the tube testers in common use. The only real test for a tube is its performance in the circuit to which it is applied. For example, we have an audio amplifier in perfect working order. The output tube is removed and other tubes of the same type are inserted, one at a time. The tonal quality and volume are compared aurally with the first tube. If no difference in performance can be noted, one tube is considered as good as the other. However, it may be found that one or more characteristics of one tube may differ from the others to quite an extent when checked in a tube tester. It is obvious that to test the many types of tubes in general use, the tube tester must be extremely versatile and cannot be the absolute authority on the condition of a tube. It would be quite impractical to simulate the many thousands of possible circuit conditions to which all existing tubes are subjected. Not even considering the tremendous number of different tubes, any particular type may be operated in many varied uses and circuits.

In the example of the audio amplifier cited above, it was assumed that the unit was in perfect working order and therefore was really a tube tester in itself, inasmuch as the operating condition of tubes could be checked directly. If the amplifier failed, however, and one of the tubes was suspected as the cause, it would be necessary to have on hand a complete spare set of tubes for the unit if the substitution method were to be employed in locating the faulty tube. This method is impractical as it would necessitate an inventory of one or more each of the over four hundred types now available in order to service all kinds of equipment. In addition, each tube

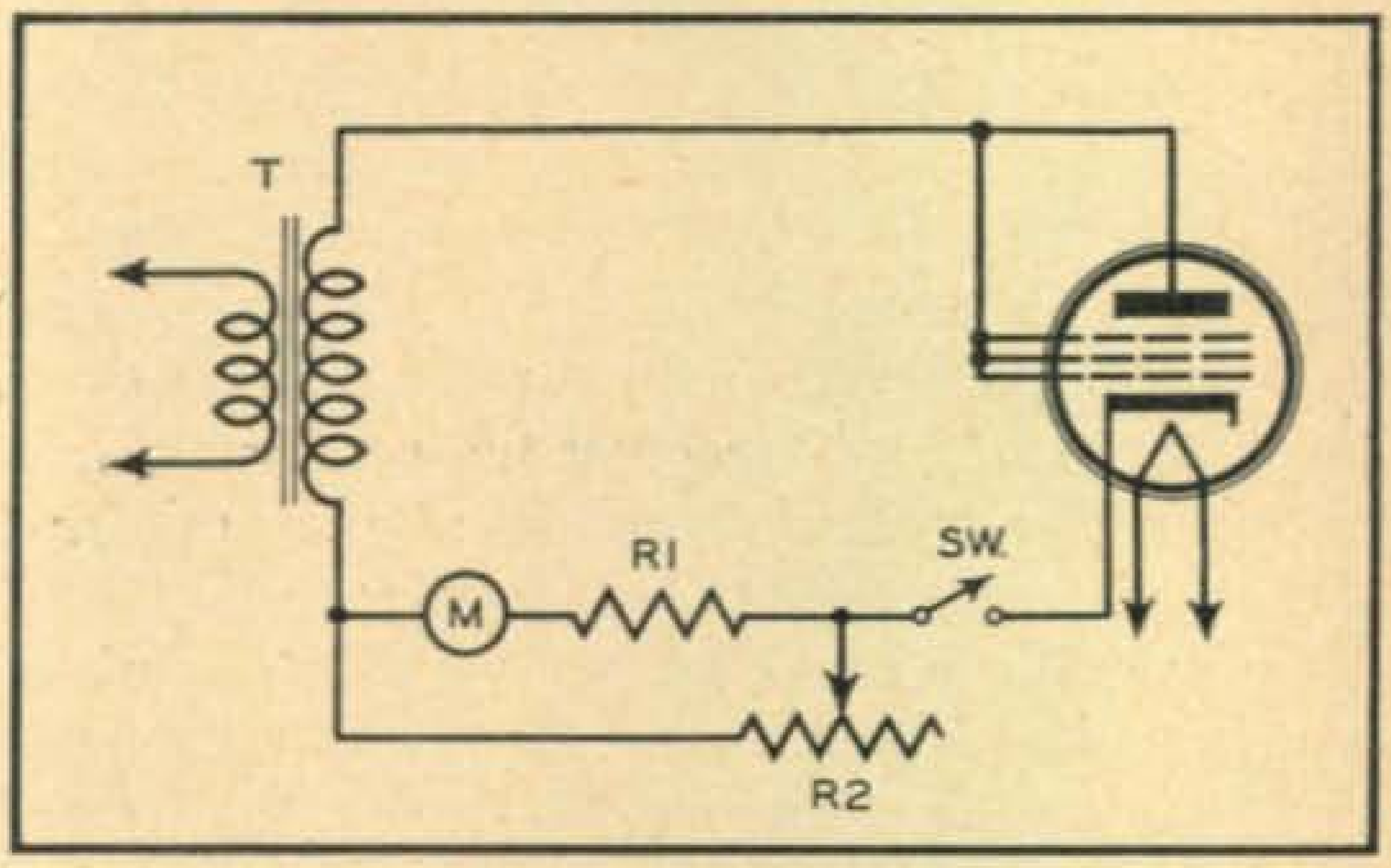


Fig. 1. Basic emission test circuit

would have to be in perfect operating condition. It is here that the value of the tube tester asserts itself.

The various characteristics of each particular type of tube are controlled to very close tolerances in manufacture. By establishing a means of measuring one or more of these characteristics a relative indication of the tube's condition may be had. By arbitrarily selecting values plus and minus a certain amount of the normal value for a particular characteristic, a tube may be classed as good if it falls within this range. According to the extent of swing above or below this range, the tube may be classed as doubtful or bad. It should be understood there is no exact dividing line, judgment and experience yielding the final decision.

For reasons of economy, versatility and simplicity of operation, the common tube tester measures only one tube characteristic. It remains to decide which characteristic will be selected for measurement. A charactertistic providing a most valuable indication of a tube's worth is transconductance. This may be measured by means of static or dynamic tests, the latter being the more truly indicative. The check providing the closest correlation with actual tube performance is the power output test. While these tests indicate more accurately than any others the actual operating condition of a tube, their embodiment in a single tube tester designed to test all available types of receiving tubes would lead to such complexities and expense as to make its construction impractical for the average radio amateur or serviceman.

TUBE CHECKER

RICHARD E. NEBEL, W2DBQ-WLNB

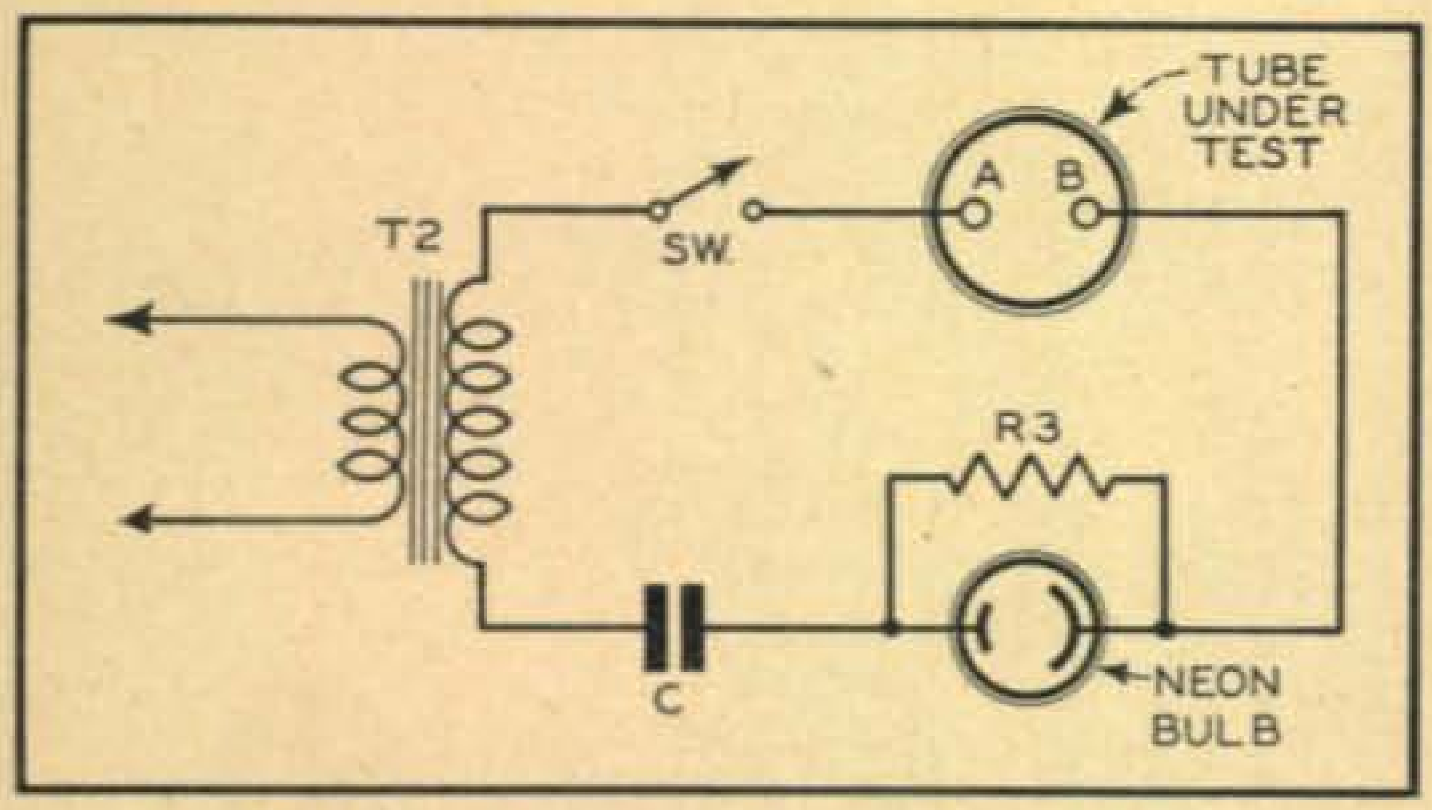


Fig. 2. Basic short-circuit test. A and B represent any two tube elements except heater

The remaining characteristic, common to all tubes, is emission—the phenomenon which is the basis of vacuum tube action. A means of comparing the emission of a tube with the normal emission of a new tube of the same type will reveal the relative condition of the tube under test (keeping in mind that certain limitations exist as pointed out earlier). A unit embodying this check, as well as a test for short circuits between tube elements, is described herein and shown in the accompanying illustrations.

Emission Test Circuit

The basic emission test circuit is shown in *Fig. 1*. A potential of 30 volts a.c. is applied between cathode or filament and all the other elements tied together. A d-c milliammeter in the circuit indicates the emission current, this current being undirectional due to the rectifying action of the tube. A potentiometer shunt control across the meter is provided so that the normal emission of all tube types may be set at the same point on the meter scale.

By applying a.c. in series with a neon bulb, condenser and any two tube elements, short circuits and high resistance leakages may be detected. This fundamental circuit is shown in *Fig. 2*.

Circuit Description

Nine sockets are provided to accommodate all types of tubes including loktal, the four different heater connections found in octal base tubes, and the testing of pilot light bulbs incorporated in the combination 7-prong socket. Referring to the schematic of *Fig. 3*, T_1 is a tube tester filament transformer providing 15 different voltages. The emission test voltage is taken off the 30-volt tap of this transformer. Transformer T_2 is an ordinary 2-to-1 ratio audio type used to step up the 110-volt a.c. for the short and leakage test circuit.

Switches SW_1 to SW_9 inclusive are tube-tester push-button switches, normally closed on one contact which, on depression, momentarily throw to the other contact. It is thus observed that all tube elements are normally connected together. No meter reading will be had until the proper push-button is depressed. Whichever button this is, that tube element will be disconnected from the other elements and connected to one side of the test potential, the other voltage lead being permanently connected to the heaters or filaments and back to the push-button bus through SW_{11}. On heater-type tubes it is only necessary to press the cathode button for a full emission test. This will apply the voltage between cathode and all the other elements tied together. The same meter reading may be obtained by letting the cathode button alone but holding down all the other element buttons simultaneously. Likewise, any one element alone may be checked by depressing its associated button. The individual readings, however, do not have great significance. SW_{11} serves the purpose of a heater-element short test. With the cathode button down and the meter indicating emission, SW_{11} is depressed. If there are no short circuits between any of the tube elements and heater, the meter reading will drop to zero.

Switch SW_{10} is thrown to FIL. TYPE side when testing filament type tubes. This makes it unnecessary to depress any buttons for full emission test. Without this switch it would be necessary to depress all element buttons simultaneously requiring the development of a piano player's "span"! SW_{14} is self-explanatory in the schematic shown in *Fig. 3*. It is thrown one way for short-leakage test and the other way for emission test. SW_{15} is a meter-reverse switch. With certain types of tubes the meter may deflect downward. In this case it is only necessary to throw SW_{15} to reverse the meter connections.

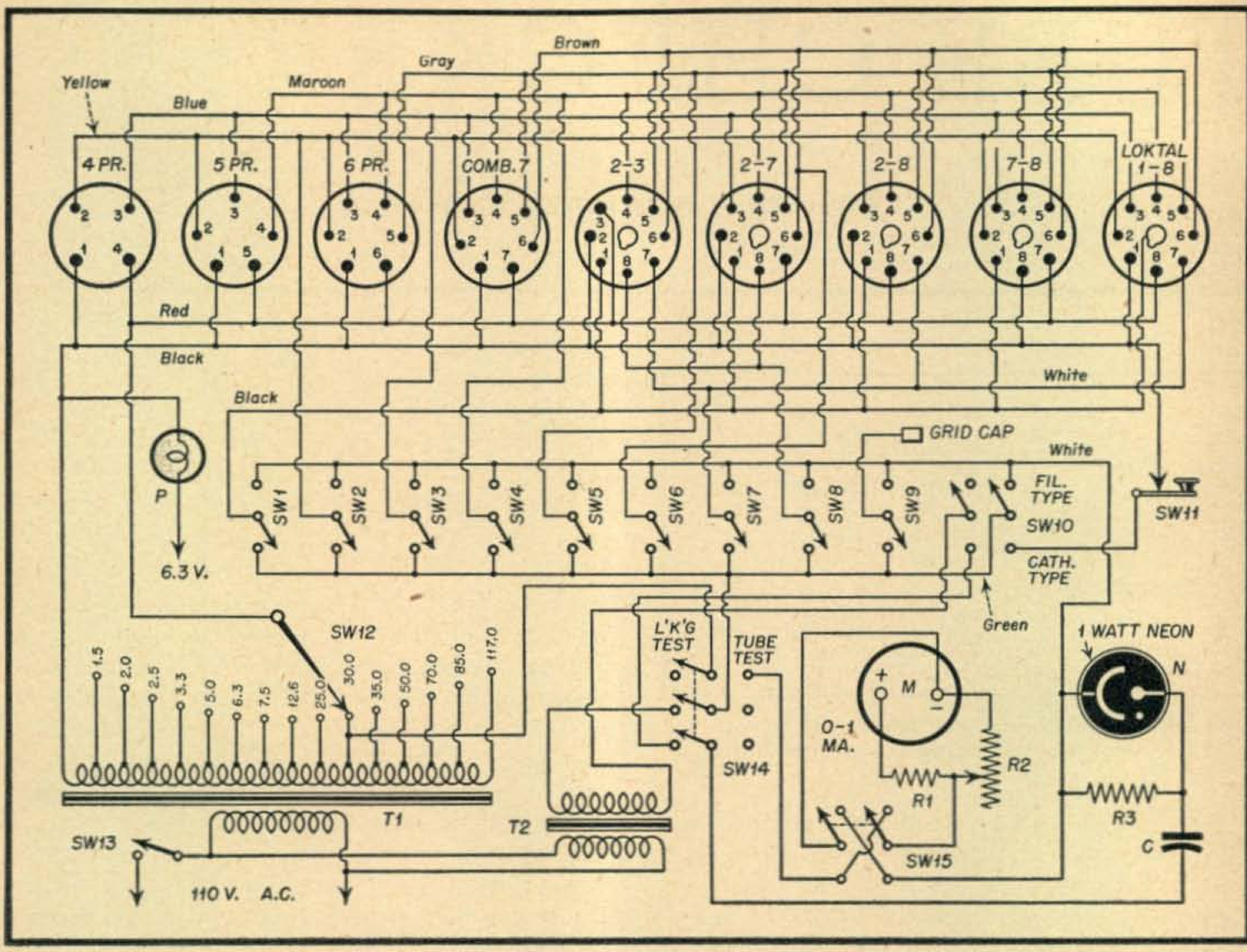


Fig. 3. Schematic diagram of emission type tube checker. Parts list below

C—.25 µf paper 450 volts
M—0-1 milliammeter
N—1-watt neon bulb, no base resistor
P—pilot bulb 6.3 volts
R_1—4000 ohms ½ watt
R_2—400 ohms wire-wound potentiometer
R_3—40,000 ohms 1 watt
SW_1-SW_9—push-buttons S.P.D.T. momentary
SW_{10}—D.P.D.T. toggle switch
SW_{11}—push-button S.P.S.T. switch
SW_{12}—15-position non-shorting rotary switch
SW_{13}—S.P.S.T. toggle switch
SW_{14}—T.P.D.T. rotary switch
SW_{15}—D.P.D.T. toggle switch
T_1—15-tap tube tester transformer
T_2—2-1 a-f transformer

The last push-button, SW_9, is connected to a tip-jack on the panel in which is plugged a flexible grid lead having on its other end a combination large and small grid cap for use when testing tubes with grid connections on top.

Meter Scale

The meter scale may be colored as suggested in *Fig. 4* for the sake of appearance. The lengths of arc given to each of the three categories good, doubtful and bad, have been determined mainly through experience. As previously mentioned, there can be no exact dividing lines.

A receiving tube manual should be on hand in which to note down the setting of R_2 necessary for each particular tube type. This setting is found by use of a known good or new tube. (A dial scale will be observed on the panel under the R_2 knob.) The setting for each type is determined by turning R_2 until the meter reads nine tenths of full scale. If the original 0-1 ma meter scale is used, this point will be at .9 milliamperes. For example, a good 6C5 tube might read 42 on the dial of R_2 when the meter is at .9 ma. Thus 42 is the setting of R_2 for all future tests of 6C5 tubes and this figure is jotted down next to the 6C5 description in the manual.

It will be noted that the instrument cannot be calibrated immediately for all tube types unless good or new specimens happen to be on hand. While this is a slight inconvenience, it is surprising how fast the manual will fill up with settings if the user always remembers to calibrate for every new tube that comes into his possession. Tentative calibrations can also be made on the various types found in the home broadcast receiver, the amateur station equipment, etc. Even without calibration the user, as he acquires the "feel" of the instrument, will be able to approximate the condition of a tube. There

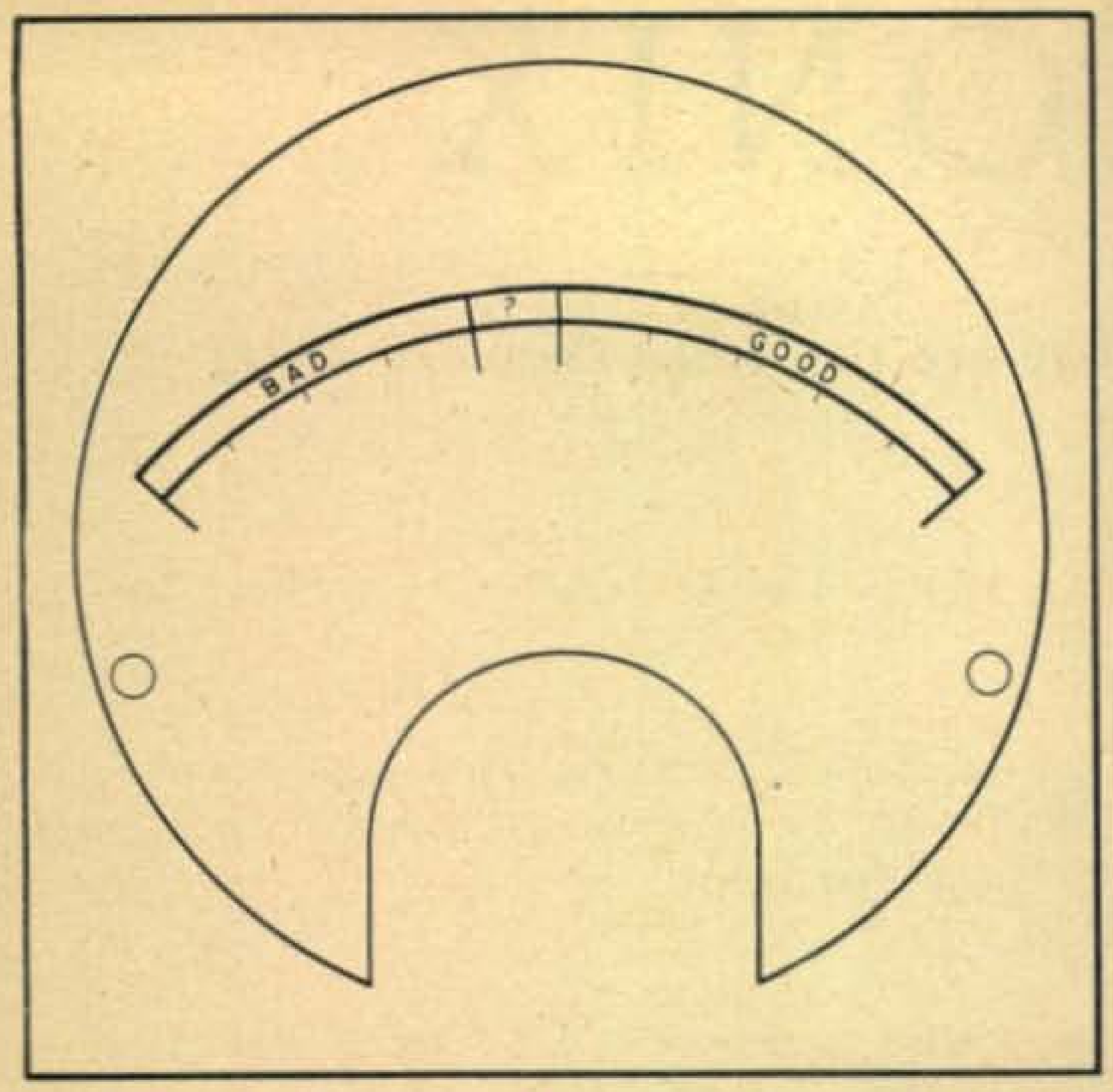


Fig. 4. Meter scale. Sections marked bad, questionable and good may be colored in order, red, yellow, and green.

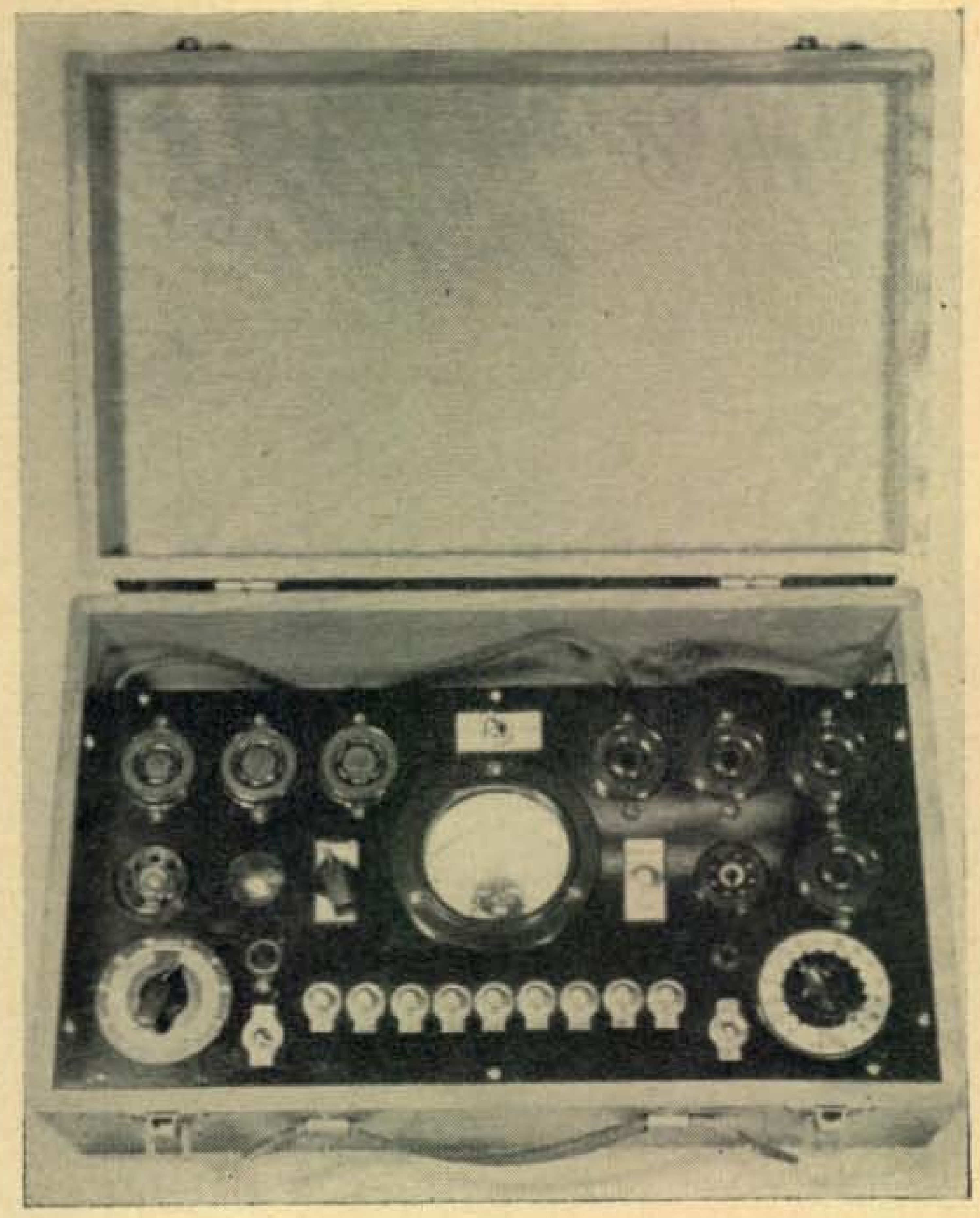


Fig. 5 (right). Completed tube checker showing recommended panel layout

are also many tubes similar in all respects except for heater voltage. One calibration may therefore apply to three or four tubes.

Construction

The entire unit is built on a 7" x 14" bakelite panel and mounted in a standard oak instrument case, the cover of which is equipped with slip-hinges. The panel layout is indicated in the photograph, *Fig. 5*, of the completed tester. Top Row: 4, 5 & 6 prong sockets, meter-reverse switch (SW_{15}) and three of the octal sockets having respectively the heater connections 2 & 3, 2 & 7, 2 & 8. Middle Row: Combination S & M 7-prong socket containing pilot light test in center, neon bulb showing through hole in panel, meter, heater-element short test switch (SW_{11}), loktal socket and the fourth octal socket having the heater connection 7 & 8. Bottom Row: Potentiometer R_2 with dial scale, a-c line switch with pilot jewel above it, the push buttons numbered 1 to 9 which correspond to the pin connections on all sockets, the FIL. TYPE-CATH. TYPE switch (SW_{10}) with the jack for the flexible grid lead above it and the filament voltage selector switch (SW_{12}) with home-made escutcheon plate.

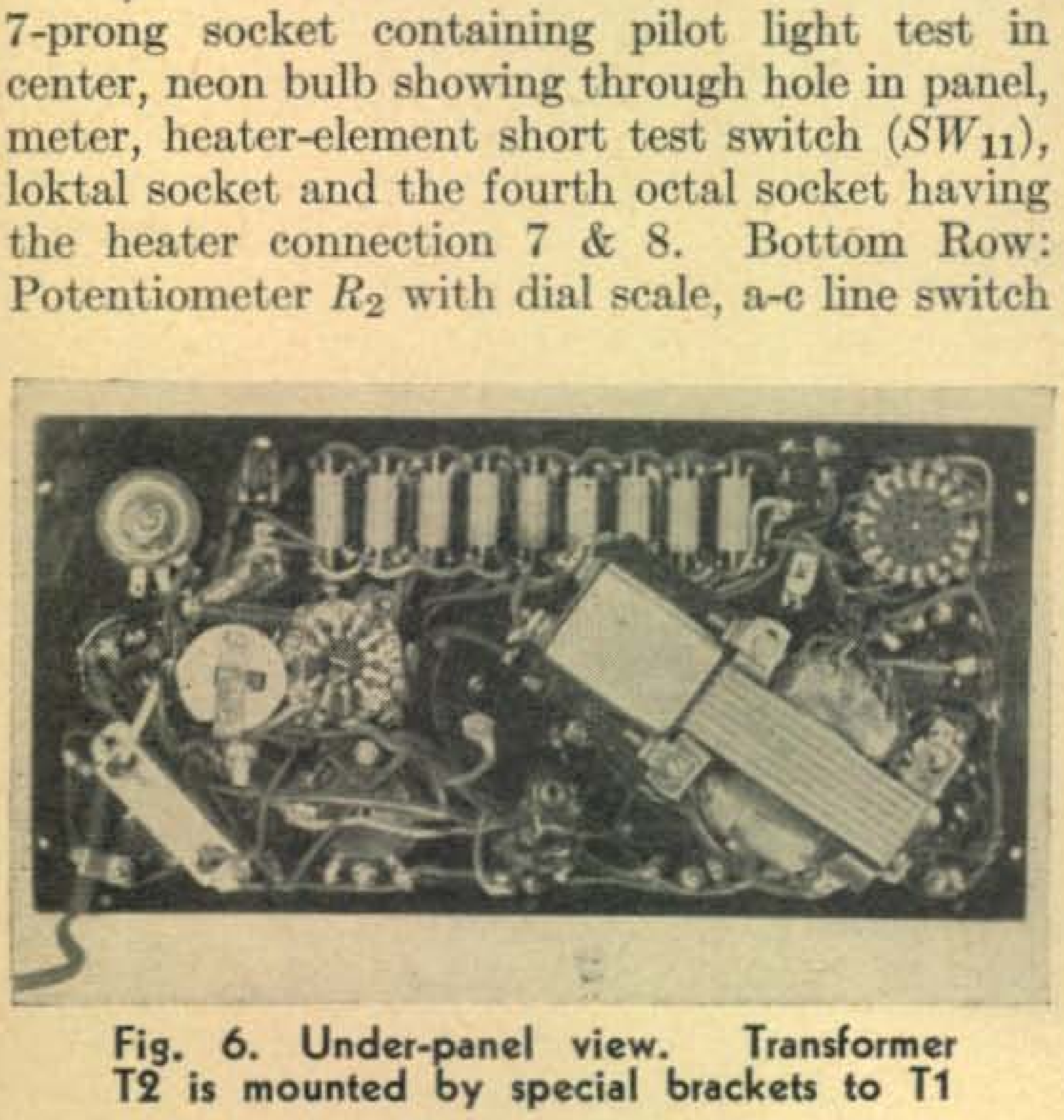


Fig. 6. Under-panel view. Transformer T2 is mounted by special brackets to T1

Fig. 6 shows a rear view and parts may be located by reverse comparison with *Fig. 5*. The filament transformer T_1 is mounted in the lower right corner on specially made brackets and the audio transformer T_2 is hung on the end of T_1. A bracket must be made for mounting the porcelain neon bulb socket the correct distance behind the panel.

Direct point to point wiring is employed and it is of great help to use hook-up wires of various colors as suggested in *Fig. 3*. This reduces confusion that might result in one-color wire is used and also helps to trace circuits if the unit does not perform properly at any time.

Operation

Before inserting any tube the filament voltage selector switch must be set at the proper tap. This is important from the standpoint of tube protection. The tube is then inserted in the proper socket and allowed to warm up for at least one minute. It is well to refer to the pin connections of the tube under test which may be found in the tube manual. This is necessary in the case of an octal base tube in order to determine which socket is to be used. Experience, of course, will commit these data to memory.

[*Continued on page 34*]

HARMONIX

Hams you may know . . . where they are . . . what they are doing

Henry Geist, W3ACH, one of the old contributors to *Radio* and *R-9* magazines, is doing supervisory work for Raytheon at Waltham, Mass. He checks the technical group in the field engineering division, and his staff numbers a long list of outstanding amateurs from all over the country.

– . . . –

J. N. A. Hawkins, W6AAR, is General Sales Manager of the Industrial and Electronic Division for Sylvania. The best of luck to Johnny—one grand ham.

– . . . –

Director of Engineering, *Dale Pollack*, W2AEC, doubles as Vice President of the Templetone Radio Corp., New London, Conn.

– . . . –

A junior op to *John B. Knight, Jr.*, W2JJ, and Commanding Officer of the U. S. Navy Underwater Sound Laboratory. Seven pounds of YL.

– . . . –

H. Hultgren, W91R, has just rejoined RCA. Hult has been in New England for a long time, and recently ran into Cy Read, W9AAA, at New London, Conn. They hadn't met since school days, and the reunion was mutually pleasant. Incidentally, Cy is back at Hallicrafters—and our thanks for keeping up the morale among the gang at home. We know that movie of yours, Cy, is going to be great convention entertainment one of these days!

– . . . –

The Submarine Signal Company of Boston, Mass., has signed up *Travis Baird*, W9VQD, for field engineering. *** W6HI, *H. L. Bumbaugh*, has returned to the west coast. Hal has been doing a fine job for the Columbia University Division of War Research. *** *Herb Becker*, W6QD, is with Universal Microphone.

– . . . –

Formerly with the ARRL, and beyond doubt one of the League's most popular field representatives, *C. C. Rodimon*, W1SZ, is now Director of Field Engineering with Raytheon.

– . . . –

Bill Volkommer, W2HO, is back in NYC with Western Electric. *** *Joe Gardner*, W8LNM, has joined up with the Bell Labs in Jersey. *** W1lOW, *Ray Rast*, is with the Sangamo Electric Co. *** You'll find *J. Bougher*, W3AMD, with the Applied Physics Laboratory in Silver Springs, Md.

– . . . –

Fred Schnell, relieved from active duty with the Navy, is back at work with the Chicago Police Department.

– . . . –

The Shadow knows. In this instance, the shadow is that of Augustio E. Osorio, LU2AO, and his ham shack in Buenos Aires

The McMurdo Silver Laboratories at Hartford, Conn., has taken on *Owen Sheppard*, W1IJ. Owen has made quite a name for himself among the WERS gang with his antenna development. They tell us that two plus two plus two plus two is more than just the sum total of eight. Pass the dope around, Owen (CQ pays for articles).

– . . . –

We take this corner of the column to pay tribute to an old friend and fellow ham, the late *Arthur Hebert*, W1ES, who visited more conventions and hamfests than any other representative from ARRL headquarters. We've never known anyone more congenial than Arthur. He was never too big to find time to tell the youngest kid at a convention what was new and old in amateur radio, or stay late at the office entertaining a visitor to Headquarters. We wish he were alive today if only to see what those kids he encouraged have done! A few months ago, out in the Pacific, I met *Horace Young*, W1CAB, and our conversation gravitated to ham radio. Horace explained that the Providence gang always felt that Arthur Hebert was ARRL to them. Their

[*Continued on page 34*]

A Voltage Regulated Power Supply

A Dependable Unit You Can Build From Readily Available Parts

ATHAN COSMAS

IN EXPERIMENTING with r-f and a-f oscillators, receivers, various types of test equipment or low power transmitters, a source of filament and stabilized plate voltage is of considerable help. A voltage regulated power supply is also very useful for operation of low power WERS transmitters, and will be equally applicable to similar equipment in post-war days. Since a very efficient electronicly regulated power supply can be easily constructed from the old reliable junk box or non-priority "bargain counter" components, there seems no valid reason for not having such a useful piece of equipment in the ham shack.

Fig. 1 shows a circuit which delivers a constant plate voltage through the controlled range. The dual triode provides compensation for line fluctuations as well as load variations. For example, at the critical control point, the output voltage remains constant, under load, for input variations from 95 to 130 volts. Likewise, the

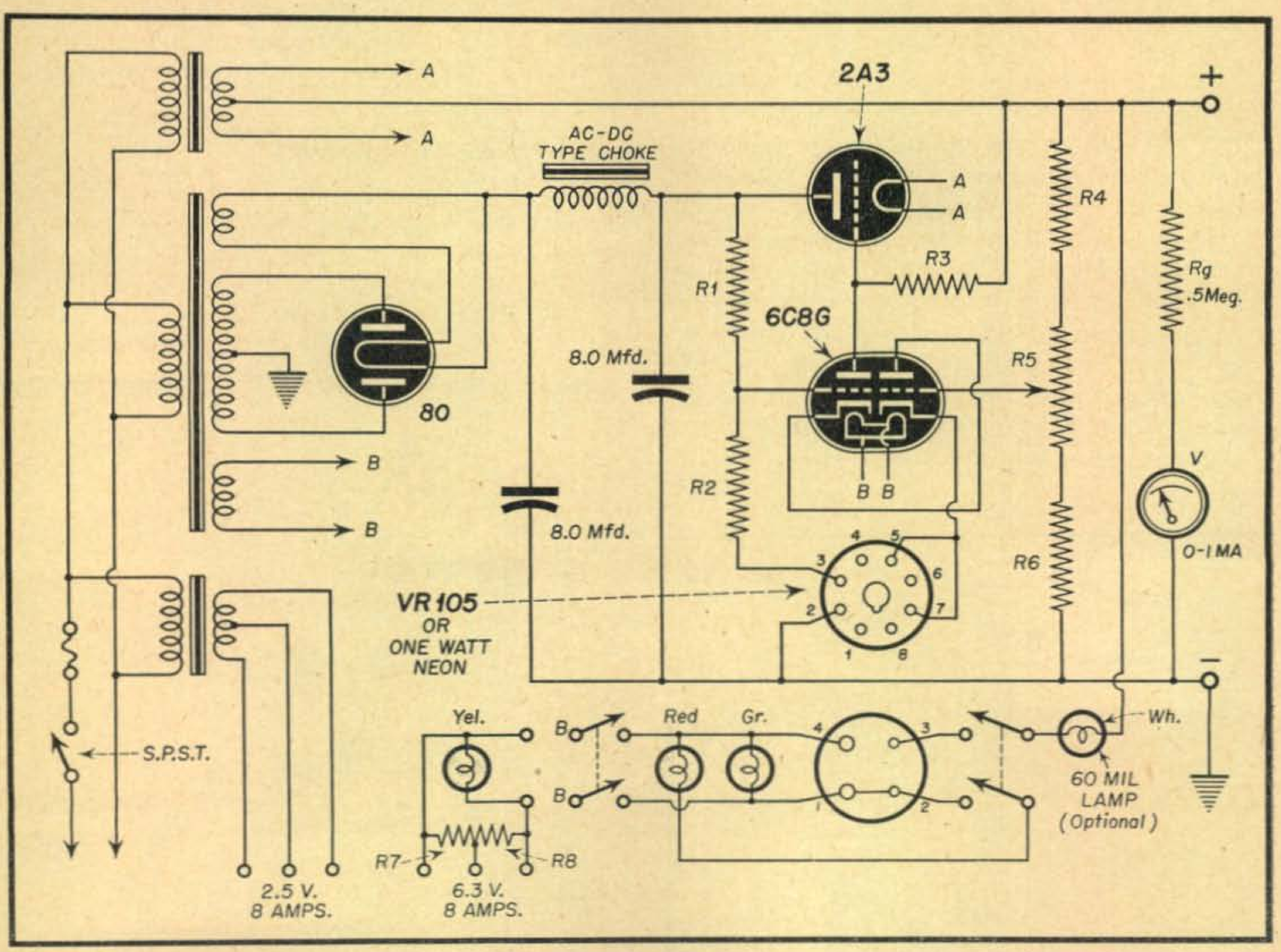


Fig. 1. Schematic of regulated power supply. The following parts are easily obtainable:

C_1 and C_2—8 μf 450 volts
R_1—200,000 ohms 1 watt
R_2—100,000 ohms 1 watt
R_3—500,000 ohms ½ watt
R_4—50,000 ohms 2 watts
R_5—50,000 ohms wire-wound potentiometer
R_6—15,000 ohms 2 watts
R_7 and R_8—30 ohms

output voltage is unvaried from no load, 35 ma load to 70 milliamperes. In the circuit shown, I salvaged an old broadcast receiver power transformer with a high-voltage secondary, five-volt rectifier filament winding and one 6.3-volt winding. The latter was used for the dual triode and as an external filament source. Two "bargain counter" 2.5-volt, 8-ampere filament transformers are employed—one for the filament of the 2A3 and the other as a 2.5-volt source. If a transformer having two 6.3-volt secondaries is available, then a 6A3 might be substituted for the 2A3. It should be obvious that the secondary supplying filament power for the series tube cannot be used as a heater source for any other purpose. If you have a transformer permitting the use of a 6A3 you may dispense with one or both of the 2.5-volt filament transformers. This will best be determined by your needs, plus the tubes and transformers you have on hand.

Neon Lamp Substitute

The filament and plate voltages are wired to binding posts. The standard four-prong socket, with its associated pilot lamps, filament and plate switches is an added convenience, particularly for operating ham and WERS equipment. The 60-ma lamp, if used, will serve as an adequate war-time substitute for a current-indicating device. The voltmeter, while a great convenience, is not absolutely essential, as the potentiometer can be calibrated against a standard voltmeter.

If a VR105 is not obtainable and a one-watt standard base neon lamp is an inexpensive and effective substitute. The brass base is carefully removed and the internal resistance disconnected. Leads are soldered and the bulb is wired and mounted in an octal base, connecting the neon lamp between pins two and five, as in the VR series (*Fig. 2*). If you can obtain the one-watt resistorless neon lamp (bayonet base), that too should be mounted in an octal base and also connected as shown in *Fig. 2*. The reason for suggesting the use of an octal base will be evident from an examination of *Figs. 1* and *2*. When the VR tube is used, the 100,000-ohm resistor connects (through the tube base) from pin three to seven, and, on the socket, from seven to five. When the neon lamp is used, the 100,000-ohm resistor connects from pin three (through the tube base) to pin two on the socket and then to ground. Thus, either the octal mounted resistorless neon lamp, or a VR tube can be used, without circuit changes. The neon lamp works very well, and when considered from a cost and priority angle, is an excellent substitute.

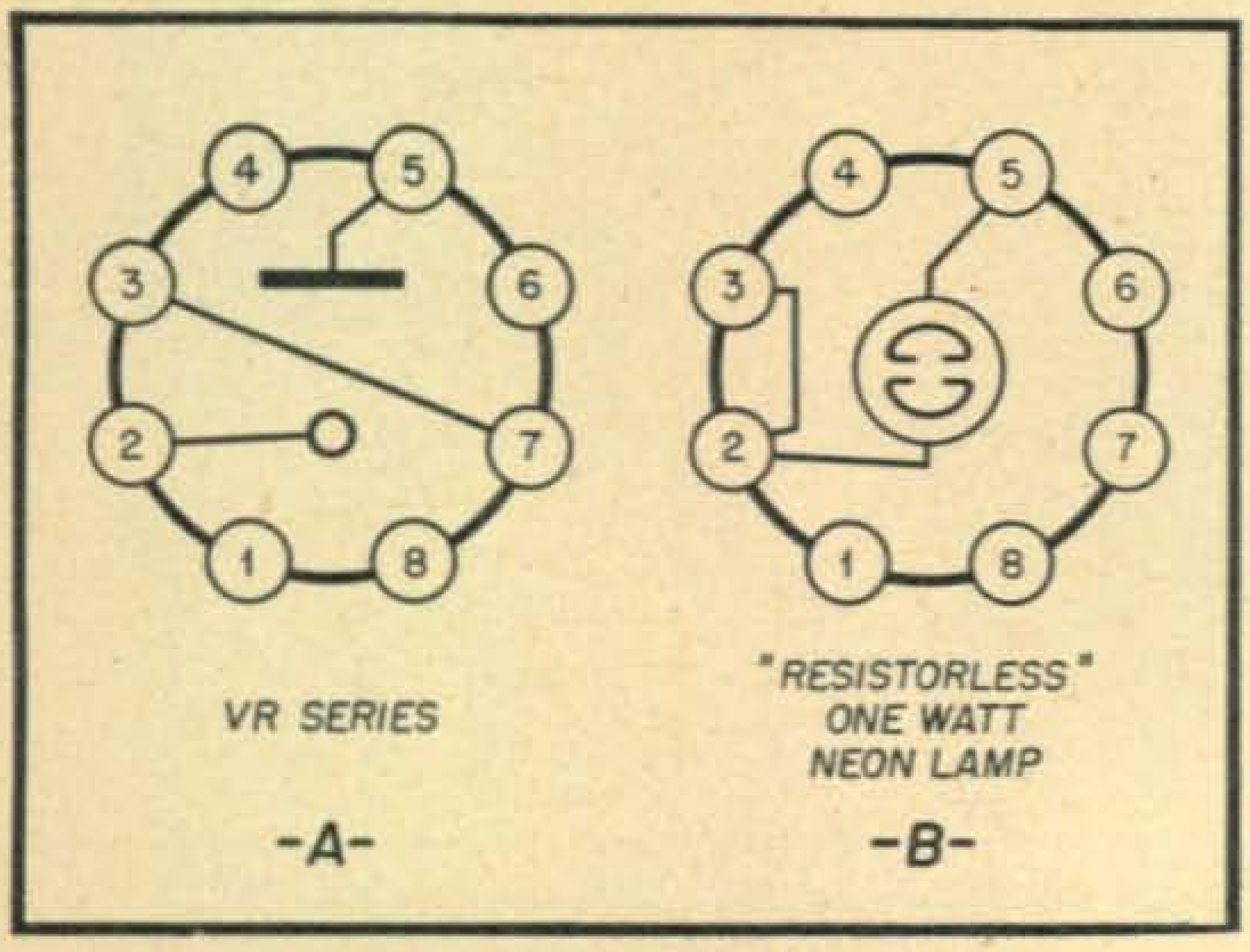


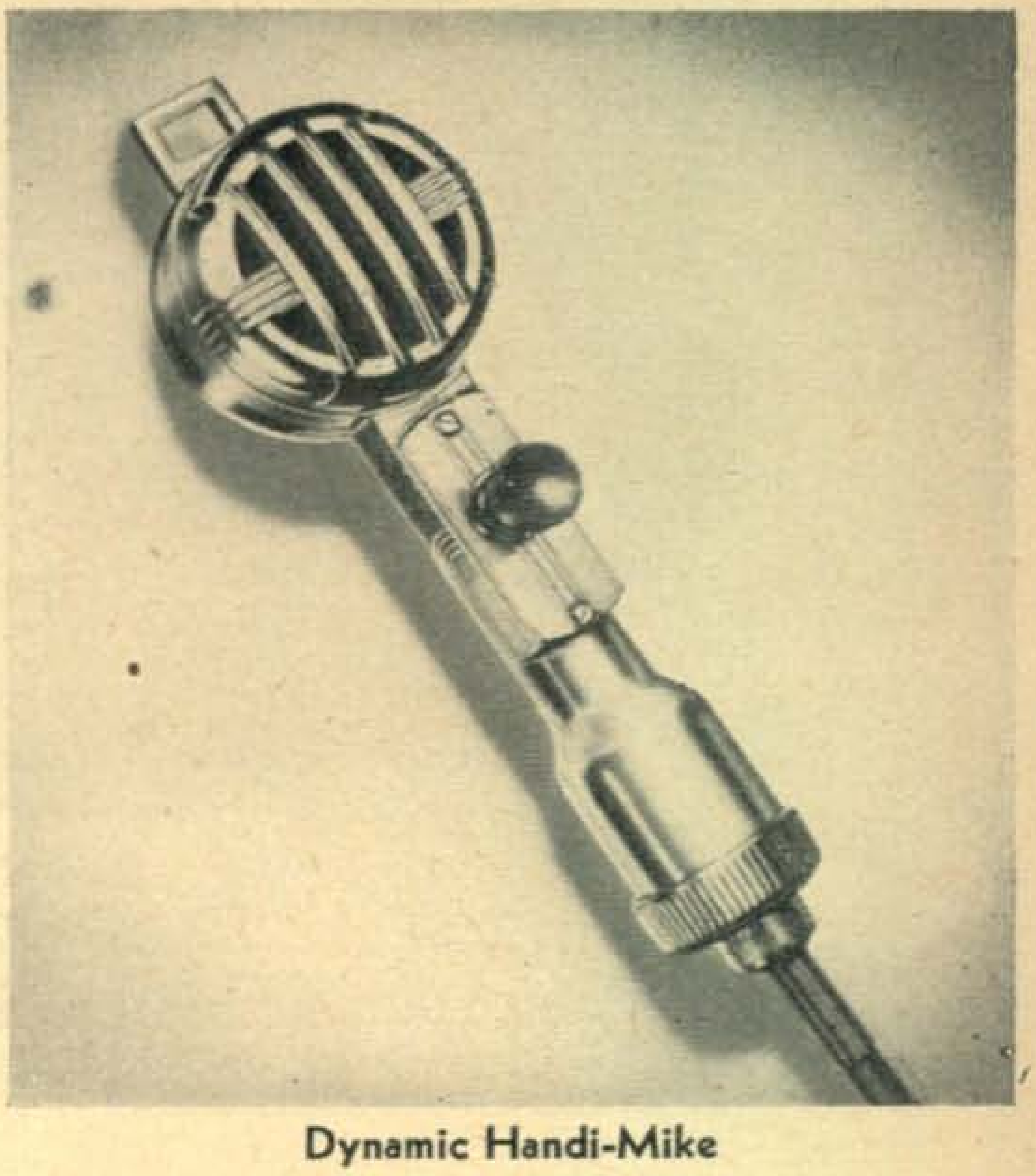
Fig. 2. Tube base connections. *A* shows normal connection of VR tubes, and *B* the arrangement for the resistorless neon lamp

Operation

Operation, in brief, is as follows: Input and output variations are applied to the grids of the dual triodes, and, after amplification, to the grid of the 2A3, thus controlling the flow of plate current. The dual triode can be a 6C8G, 6F8G, 6SN7, etc. The ratio of R_1 and R_2 determines the control point. When used with a 6C8G or 6F8G, the values indicated provide good control from about 200 to 300 volts. If a larger power transformer is used, the only requirement is the parallel addition of series tubes (2A3s). For example, for a 125-milliampere transformer, use two 2A3s; for a 200-ma transformer three 2A3s are required, etc.

UNIVERSAL HANDI-MIKE

The Universal Microphone Company, Inglewood, Calif., announce that Handi-Mikes are now available in carbon and dynamic types. The Model 204-TC shown has a rated impedance of 35-50 ohms. Output level, -44 db for 100-bar signal.



Dynamic Handi-Mike

RADIO AMATEURS' WORKSHEET

No. 1. NOTES ON RECTIFICATION

LET the circuit of *Fig. 1* represent a half wave rectifier circuit minus the load. If this circuit is connected to the alternating current mains and it is assumed current will flow through the rectifier to charge the condenser when terminal *1* is more positive than terminal *2*, then a positive charge will be built up on condenser *C* as shown in the figure. We may choose either side of the alternating current mains as a reference. Let us choose the side connected to terminal *2* as a

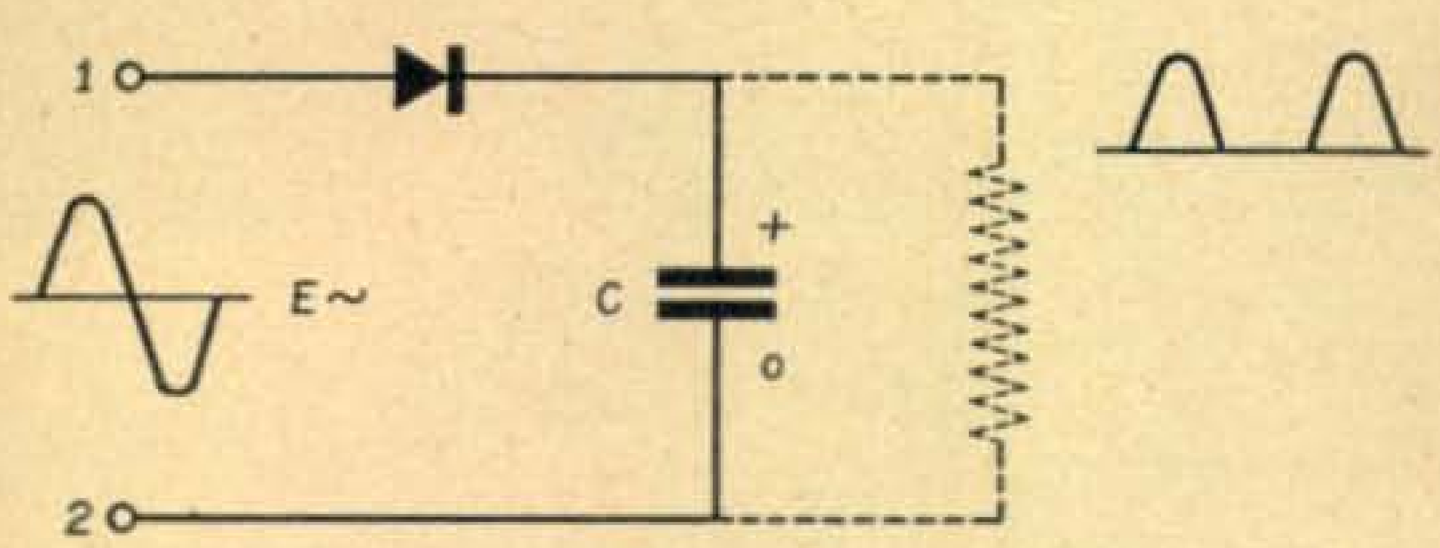


Figure 1

reference point and assume terminal *1* becomes alternately positive and negative with respect to terminal *2*.

When terminal *1* is at the same potential (i.e. zero) as terminal *2* no voltage difference exists across the rectifier and consequently no current flow occurs. As terminal *1* becomes more positive, current will flow to the condenser charging it as indicated in the figure. As terminal *1* becomes less positive the current decreases and finally ceases to flow through the rectifier as the potential of *1* approaches zero. When terminal *1* becomes negative no current flows since the rectifier is assumed to be unilateral so that current can flow in only one direction. We have, therefore, built up a charge on condenser *C* which is proportional to the peak voltage of the power line. Now, if a load resistor is connected across the condenser terminals, the condenser charge will result in a d.c. flowing through the load resistor.

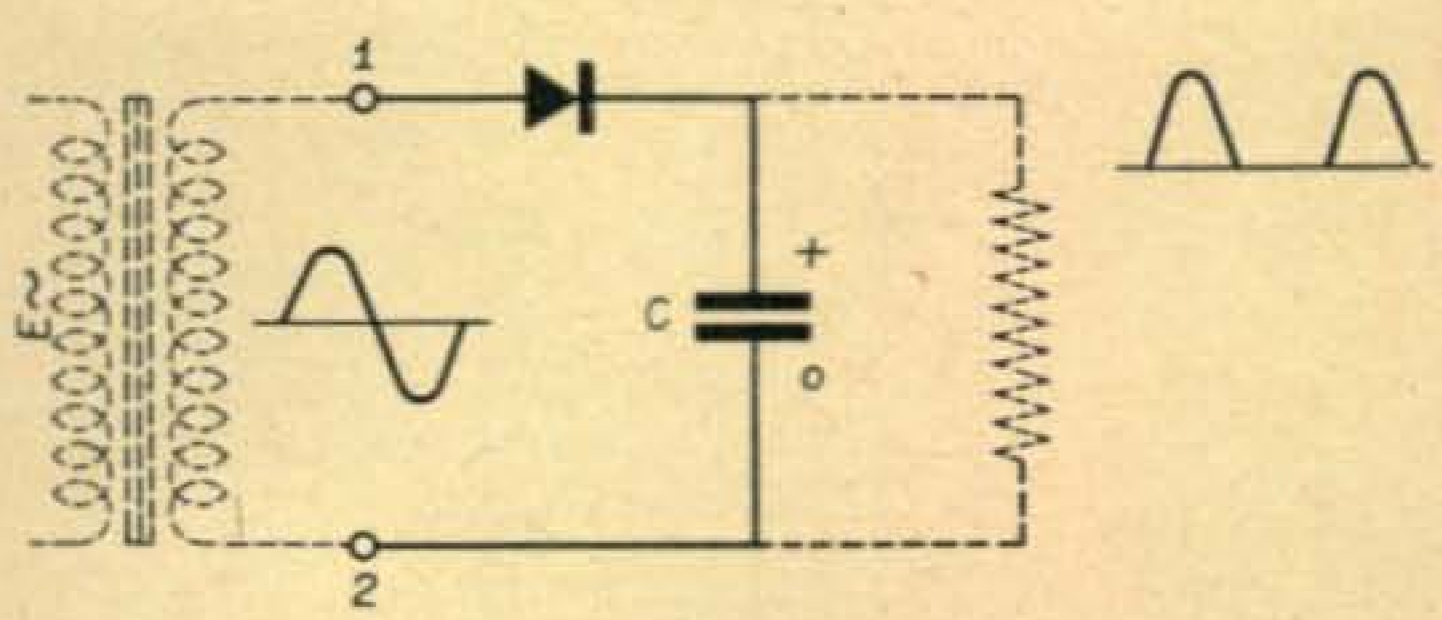


Figure 2

Now if it happens that the voltage to which *C* is charged is too small to meet the requirements, a transformer may be used as shown in *Fig. 2* to increase the voltage applied across terminals *1* and *2*. However, it is usually cheaper to supply an additional rectifier and condenser than a transformer. If a voltage of something less than double line peak voltage is required, then the circuit of *Fig. 3* may be used and the step-up voltage transformer of *Fig. 2* is not required. This circuit is called a voltage doubler circuit. Similar circuits known as voltage triplers and voltage quadrupler circuits are possible, and will be discussed in forthcoming worksheets. *Fig. 4* is a common form of voltage quadrupler.

The operation of voltage doubler and tripler circuits is very similar to that discussed above in connection with *Fig. 1*. Again use terminal *2* as a

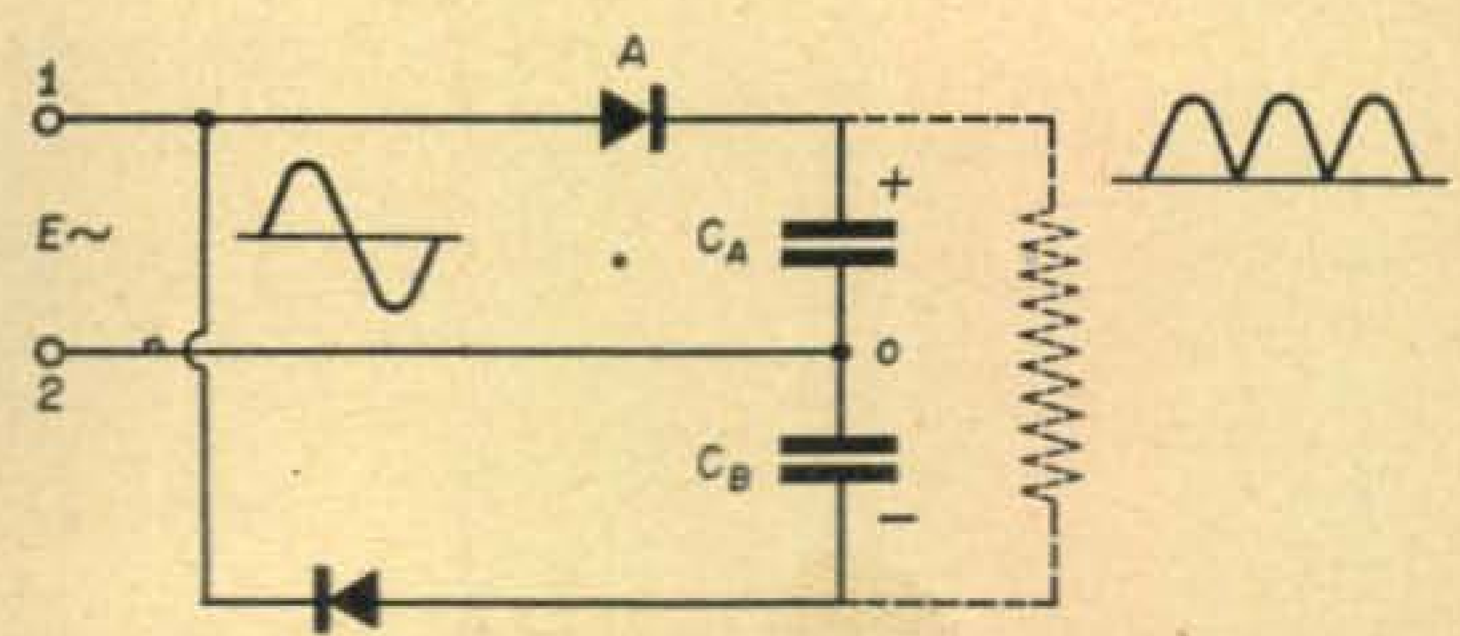


Figure 3

reference point. When the voltage of terminal *1* becomes sufficiently positive, current will flow through rectifier *A* to charge condenser *Ca* as indicated in the figure (i.e. it will be charged positive with respect to terminal *2*.) However, no current will flow through rectifier *B* as condenser *Cb* remains unchanged. When terminal *1* becomes negative with respect to terminal *2* no current flows through rectifier *A* but current will flow from condenser *Cb* through rectifier *B*. This causes *Cb* to build up a charge negative with respect to terminal *2*. Thus the charge on the condenser *Ca* and *Cb* in series will result in a voltage across these condensers of twice the peak line voltage. If the condensers are infinite in capacity or the load resistance is infinite, then the d-c

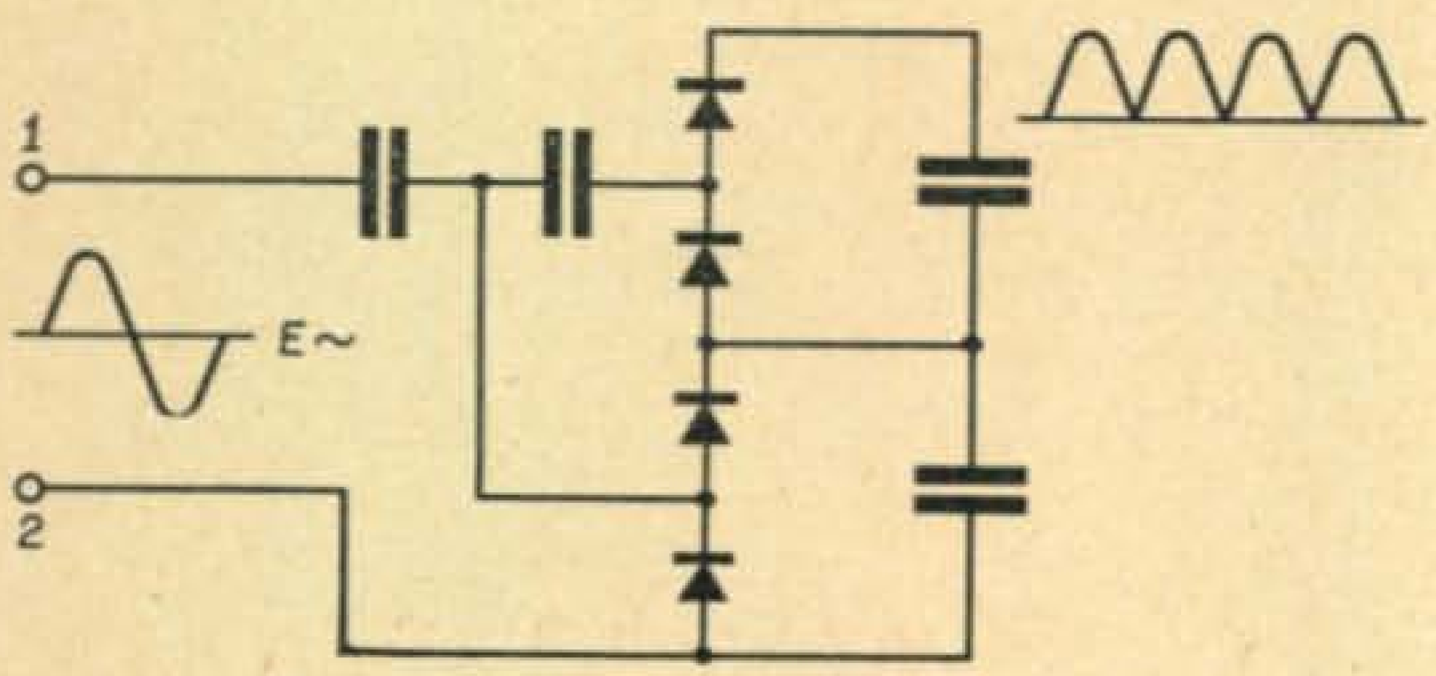


Figure 4

voltage across the two condensers will be exactly twice the peak line voltage. However, since neither of these conditions obtain in practice, something less than twice the peak line voltage results. The final rectified voltage is of course a function of the capacity of condensers *Ca* and *Cb* and of the load current drawn from the rectifier circuit. In practice the capacity of the condenser must be very large and only relatively small currents can be drawn from the voltage doubler circuit if the high voltage is to be retained.

Another less common type of voltage doubler circuit is shown in *Fig. 5*. In this arrangement rectifier *B* charges condenser *Cb* to a positive voltage equal to the peak value of *E* when terminal *1* becomes negative with respect to terminal *2*. Hence rectifier *A* has impressed a voltage varying from zero to twice the peak value of *E*.

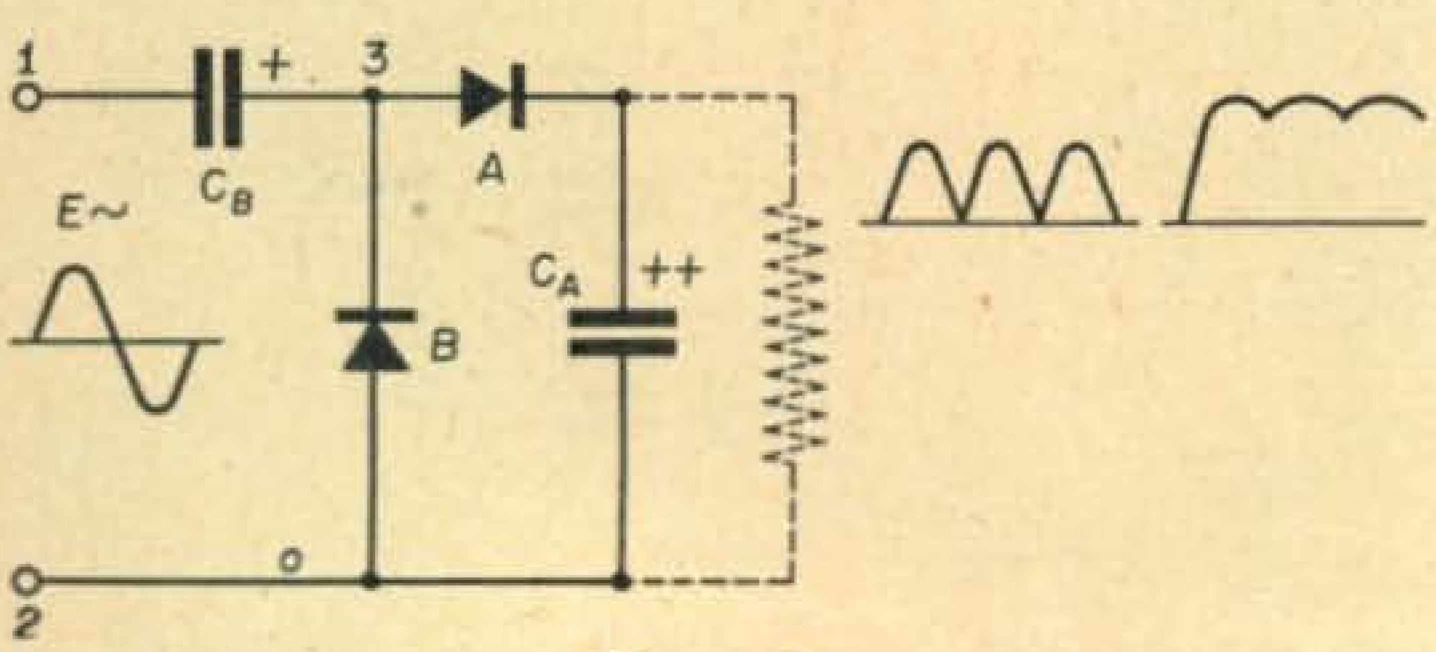


Figure 5

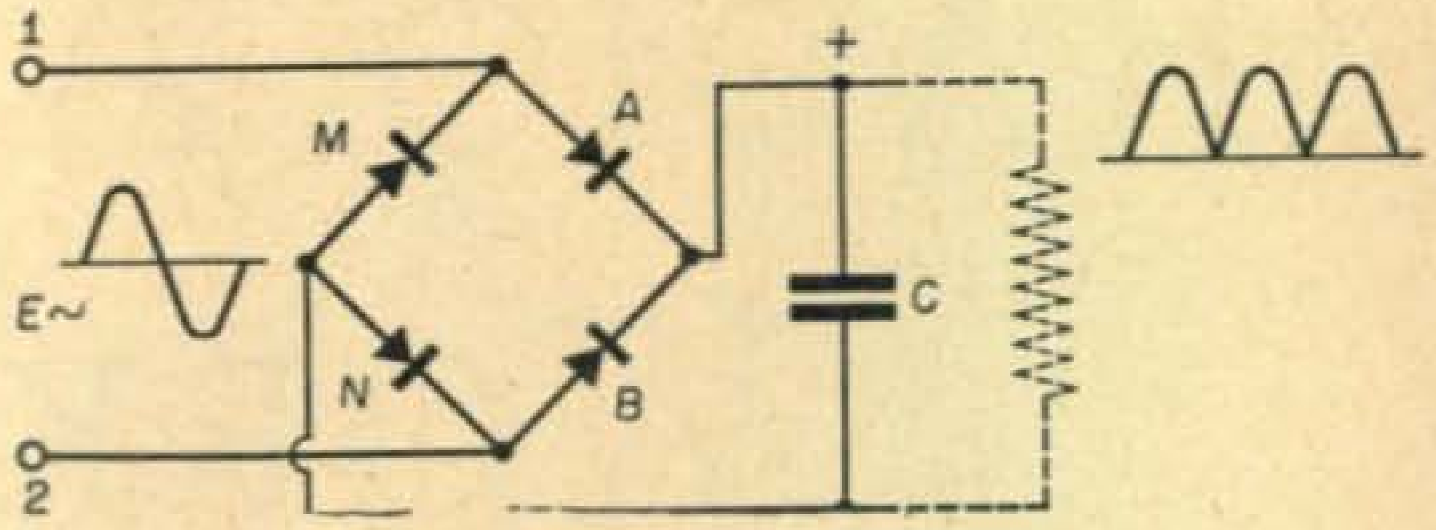


Figure 6

As a result *Ca* is charged to twice the peak value of *E*. The voltage quadrupler of *Fig. 4* is an adaptation of this circuit. In all the foregoing figures the input is shown as a sine wave and the output as a wave indicating whether only positive half cycles or both half cycles are rectified. The input wave shown is that which would be impressed across a resistance load with the smoothing capacitor disconnected. Actually the capacitor acts as a storage tank for the charge and as a result smooths out the ripple of the rectifier wave as indicated in *Fig. 5*.

Fig. 6 illustrates a bridge type rectifier circuit which has been popular for non-tube type rectifier circuits such as copper oxide and selenium rectifiers. This type circuit subjects the rectifier to lower inverse voltage and delivers more d-c power

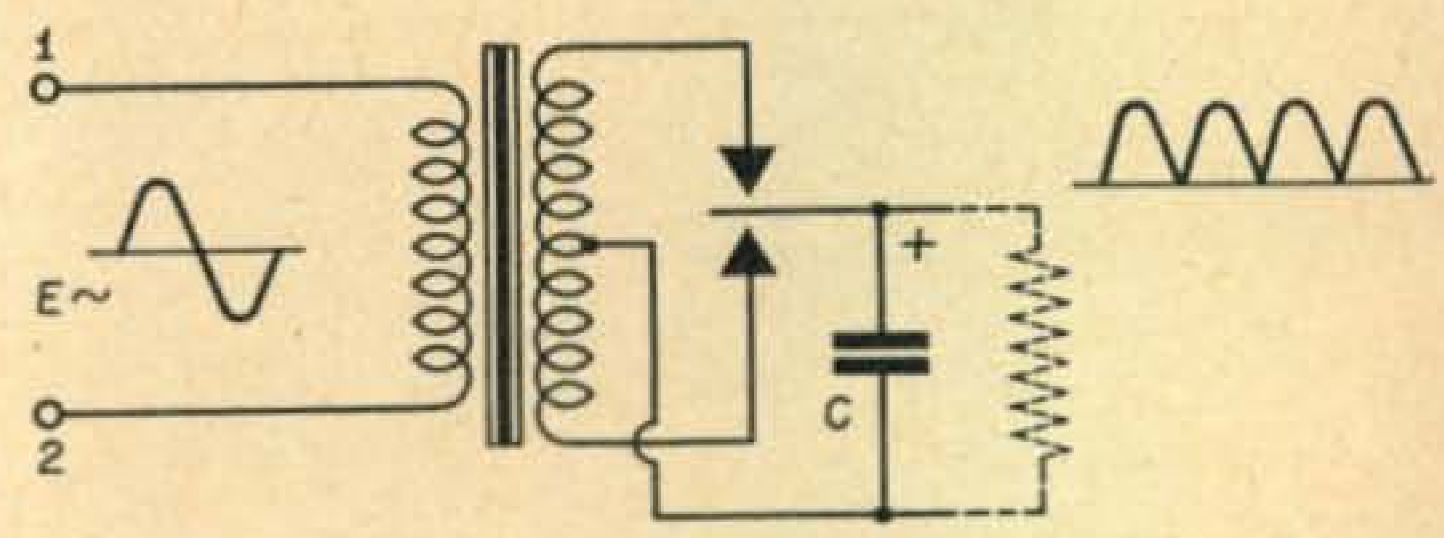


Figure 7

than is the case with the usual full-wave rectifier. The conventional full-wave rectifier circuit is shown in *Fig. 7*.

The circuit of *Fig. 6* operates in much the same manner as preceding circuits. When terminal *1* is positive with respect to *2*, rectifier *A* charges *C* positively. Any positive charges on the other plate of *C* leaks back to the power line through rectifier *N*. When *1* becomes negative any positive charge in the negative plate of *C* leaks back to terminal through rectifier *M*, while rectifier *B* adds to the charge on *C* from the terminal *2* side of the line.

Polyphase rectifiers, power supply filters and some of the less common types of voltage multiplying circuits are to be treated in forthcoming design worksheets. In forthcoming worksheets operational characteristics of some of the circuits d scribed above will appear.

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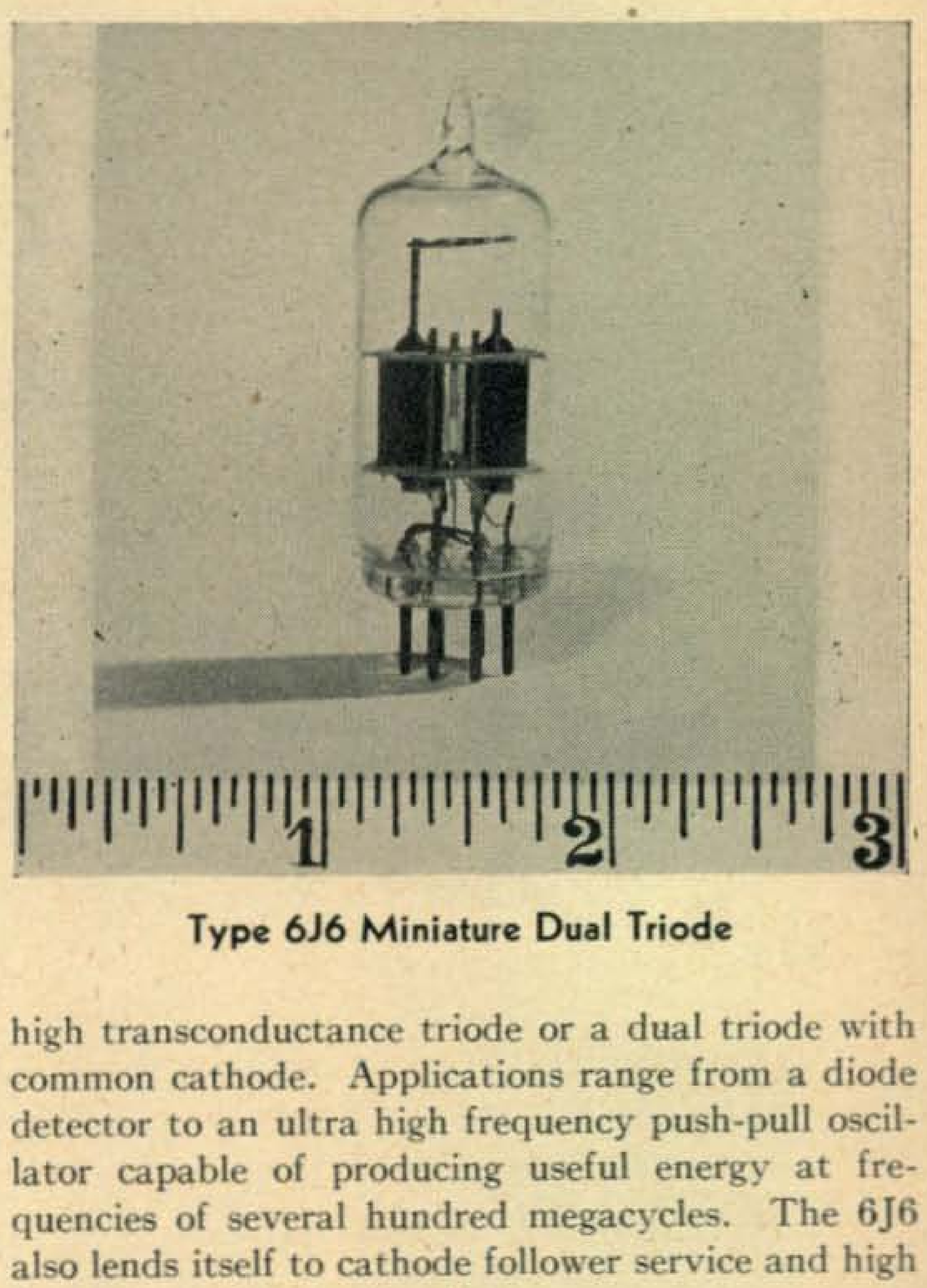
MINIATURE DUAL TRIODE

For a considerable time Raytheon has been assigned a major role in supplying the essential requirements for a versatile, miniature, dual triode tube called the type 6J6.

The precise manufacturing techniques which must be maintained are obvious from a consideration of the physical structure of this tube. Two high transconductance triodes are obtained from a single relatively large flat cathode which also acts as a shield to prevent interaction between two separate half-grids. These are wound with extremely fine wire and accurately spaced a few thousandths of an inch on either side of the cathode. Two individual half-plates complete the tube.

The applications utilizing 6J6 tubes are varied and numerous. Its unique construction lends itself to connection as a high perveance diode, a single very



Type 6J6 Miniature Dual Triode

high transconductance triode or a dual triode with common cathode. Applications range from a diode detector to an ultra high frequency push-pull oscillator capable of producing useful energy at frequencies of several hundred megacycles. The 6J6 also lends itself to cathode follower service and high frequency mixer applications.

Following are the 6J6 characteristics:

Dimensions

Maximum Overall Length	$2\frac{1}{8}$	inches
Maximum Seated Heighth	$1\frac{7}{8}$	inches
Maximum Diameter	$\frac{3}{4}$	inches

Ratings

Heater Voltage	6.3	volts
Heater Current	0.45	amperes

[*Continued on page 32*]

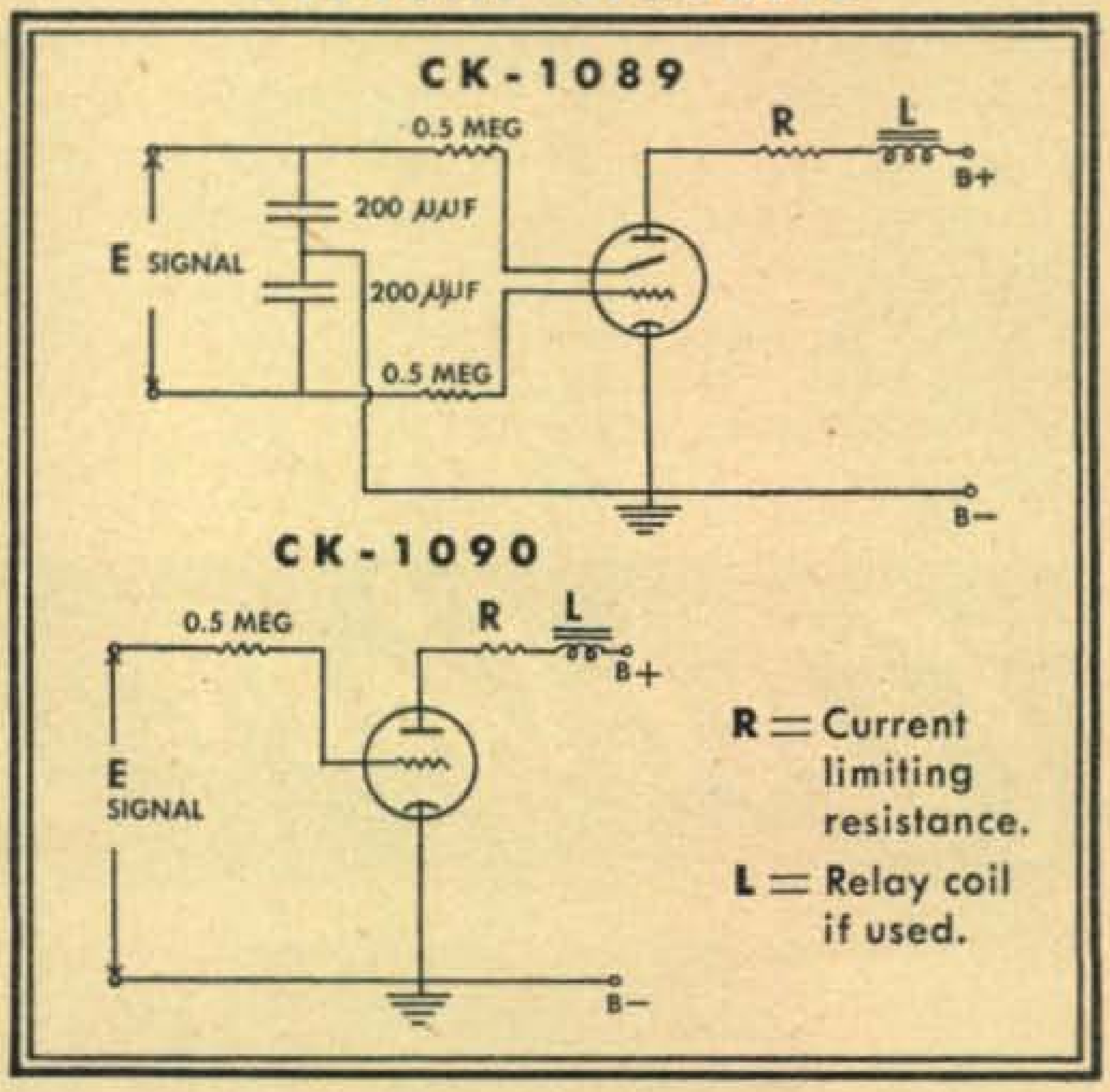
• Outstanding recent development by Raytheon's research laboratories are two visual-glow cold cathode thyratrons, types CK-1089 and CK-1090.

The former is a tetrode incorporating two starter electrodes and so can be operated from a balanced line, whereas the latter is a triode with a single starter electrode for grounded line or unbalanced operation. In addition to normal grid controlled thyratron performance these neon-filled tubes are engineered to produce a good visual glow near the top of the bulb.

This characteristic, and their small size, make them admirably adaptable to telephone switchboard applications where they can be wired directly as a combined relay and indicator lamp. It is also possible to actuate a separate relay in the anode circuit by the initiation of plate current, which, of course, is coincident with the glow. The resulting simplicity and the reduction in weight and size are highly desirable.

Thousands of Raytheon CK-1089 and CK-1090 tubes are now giving dependable service in just such an application – even under the worst climatic conditions. Convincing proof, indeed, that Raytheon builds fine tubes . . . tubes that you should consider for your postwar products!

TYPICAL CIRCUITS



SPECIFICATIONS OF CK-1089 AND CK-1090

Minimum Peak Anode Breakdown Voltage (No. Signal)	225 volts
Peak Positive Starter-Anode Breakdown Voltage Across Starter Electrodes on CK-1089 Starter Electrode to Cathode on CK-1090	75 min. volts 170 max. volts
Approximate Starter Electrode Voltage Drop	90 volts
Maximum Peak Cathode Current	20 ma
Maximum Aver. Cathode Current	15 ma

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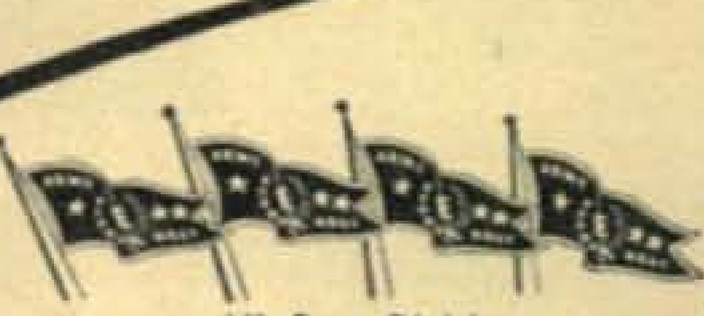

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Maximum Plate Voltage	300	volts
Maximum Plate Dissipation (per unit)	1.5	watts

Direct Interelectrode Capacitances (Approx. for each unit)—Unshielded.

Grid to Plate	1.6	$\mu\mu$f
Input	2.2	$\mu\mu$f
Output	0.4	$\mu\mu$f

Class A_1 Characteristics (Each triode)

Plate Voltage	100	volts
Cathode Bias Resistor—Both units operating	50	ohms
Plate Current	8.5	ma
Transconductance	5300	umhos
Amplification Factor	38	
Plate Resistance (Approx.)	7100	ohms

CRYSTAL CHIRPS

A lot of folks are allergic to mathematics—including the printer of our April issue. War-time restrictions do not permit us to reprint the article "Line of Sight" in its entirety (which would be about the only way to straighten it out 100%), but here, at least, is how the equations should have read

$$d^2 = (r + h)^2 - r^2$$

$$d = \sqrt{(r+h)^2 - r^2} \qquad (1)$$

$$d = \sqrt{r^2 + 2rh + h^2 - r^2}$$

$$= \sqrt{2rh + h^2}$$

$$= \sqrt{h(2r+h)} \qquad (2)$$

Eliminating h within the parenthesis as being negligible, we have

$$d = \sqrt{2rh} \qquad (3)$$

$$d = \sqrt{42 \times 10^6 \times h}$$

$$= 6500\sqrt{h} \qquad (4)$$

$$d = \frac{65}{53}\sqrt{h}$$

$$= 1.23\sqrt{h} \qquad (5)$$

$$D = d + d'$$

$$= 1.23\sqrt{h} + 1.23\sqrt{h'}$$

$$= 1.23(\sqrt{h} + \sqrt{h'}) \qquad (6)$$

The example should read

$$D = 1.23(\sqrt{h} + \sqrt{h'})$$

$$= 1.23(\sqrt{81} + \sqrt{100})$$

$$= 1.23(9 + 10)$$

$$= 1.23 \times 19 = 23\tfrac{1}{2} \text{ miles}$$

And in compliance with equation (5), change the concluding sentence in the article to read—"However, while waiting for a mirage, just keep in mind that distance equals the *square root of height* multiplied by 1.23."

There's no let down in MT. CARMEL

Though the war news is good . . . and getting better every day . . . the men and women of Meissner's famed "precision-el" haven't let down. As you can see, in the photographs on this page, they devote the same concentration to their work now as they did when the going was tough. This stick-to-it-iveness is one more reason for Mt. Carmel's rapid rise to prominence as one of the centers of an exacting industry, electronics.

They Listen to a news broadcast during their lunch hour. Then it's back to work with a determination to equal military victories with new production records on the home front . . . without loss of Meissner quality.

"Precision-el" at Work. They're building Meissner quality into this vital electronic war material. After victory that same pride in a job well done will give new meaning to Meissner's slogan, "Precision-built by Precision-el."

His Skilled Fingers have mastered many of the secrets of electronics. After victory, he and many of Meissner's "precision-el" like him will pass this knowledge and tradition of precision to a new generation.

His Smile is a Reflection of the hundreds of smiles he sees each day as the men and women of Meissner pass through the gates he guards. If you ask him, he'll tell you it's the smile that helps put precision into "precision-el."

"Step Up" Old Receivers!

These Meissner Ferrocart I. F. input and output transformers are getting top results in stepping up performance of old worn receivers. Special powdered iron core permits higher "Q" with a resultant increase in selectivity and gain, now available for frequency range 127-206. Ask for numbers 16-5728 input, 16-5730 output. List $2.20 each.

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HARMONIX

[Continued from page 24]

guidance in club and individual problems, W1ES and W1MK (now W1AW) seemed to go along together.

– . . . –

It won't be long before the Big Parley comes up that will largely decide the destiny of ham radio. A National Convention ahead of time would help—by setting down a few principles representative of amateurs from Maine to Florida, Washington to California and of hams back from India, England, Australia, etc., who, while making their contributions to the war, have visited amateurs in other lands.

– . . . –

WIRED WIRELESS SET

[Continued from page 19]

regulating characteristics previously mentioned. For those who do not require voltage regulation the 6L6 cathode circuit may be routed to point "A."

The author has been resonating the amplifier by selecting the proper amount of inductance in L_2 and swinging the oscillator to resonance with the amplifier (as indicated by cathode current dip in the 6L6). Coil L_2 will resonate to approximately 170 kc when 70 turns are used. By shifting the alligator clip from tap to tap on L_2 and re-resonating the oscillator to the amplifier, we have eliminated a large and bulky variable tuning condenser in the output tank circuit. The use of a high "C" tank circuit in the amplifier facilitates matching the power line with a small pick-up coil.

TUBE CHECKER

[Continued from page 23]

Switch SW_{14} is thrown to LEAKAGE-TEST side and the cathode button is then depressed. Reference to the pin connections of the tube under test will reveal which button to press. If the cathode is pin number 8 then button number 8 is correct. If no shorts exist between cathode and any of the elements the neon bulb will flash momentarily and go out. This is due to discharge of condenser C through the bulb. Holding the button down or pressing it very rapidly in and out will not flash the bulb again as the condenser must be given time to charge. However, if the neon bulb remains lit a short circuit is indicated. If it flashes now and then while the cathode button is depressed an intermittent short is the diagnosis. While holding the button down

the tube should be tapped with the finger to see if shorts develop due to vibration. Any short circuits of course mean that the tube must be discarded, but it is interesting to note just which element is shorted by depressing the various element buttons, one at a time. The one which causes the neon bulb to remain lighted is the shorted element.

When no shorts are found, SW_{14} is thrown to TUBE TEST position after having set R_2 at the proper predetermined point for the tube under test. If a heater type tube is being checked SW_{10} must be on the CATH. TYPE side and the cathode button is then depressed. The meter will indicate the emission of the tube in comparison with the normal value for that type which should equal nine tenths of full scale as mentioned previously.

If emission is satisfactory hold down the cathode button and at the same time depress the HTR-ELEMENT short test switch (SW_{11}). If there are no shorts between any of the elements and the heater the meter reading will drop to zero. Direct short will be shown by the meter reading remaining as is, while leakage of varying degree will be indicated by the meter reading dropping partially to zero.

TRANSMITTER RECEIVER

[*Continued from page 9*]

Microphone voltage is obtained by a tap on the cathode resistor on the 6V6 modulator. The voltage does not seem to be critical, but additional by-passing at the tap may be necessary to eliminate unwanted a-f components. The 6J5 cathode may or may not be by-passed as one chooses. Omitting the by-pass results in degeneration and slight loss of gain, but this is immaterial since more than enough is available.

With parts scarce, power supplies these days are pretty much individual. The circuit employed was conventional and is described in the ARRL *Handbook*. The voltage output is 250 at 65 milliamperes. The battery leads should be No. 10 or larger.

Mounting the Rig

The power supply for the outfit is conveniently mounted on the bulkhead or fire-wall between motor and driver's compartment. It is out of the way here, and yet accessible. Two mounting pieces are cut for the rig itself after careful measurements are made. The first is a flat piece of heavy (about 18 or 20-gauge) galvanized iron or auto-body steel. It may be trapezoidal in shape. One base of the trapezoid should be equal in length to the width of the chassis. The other

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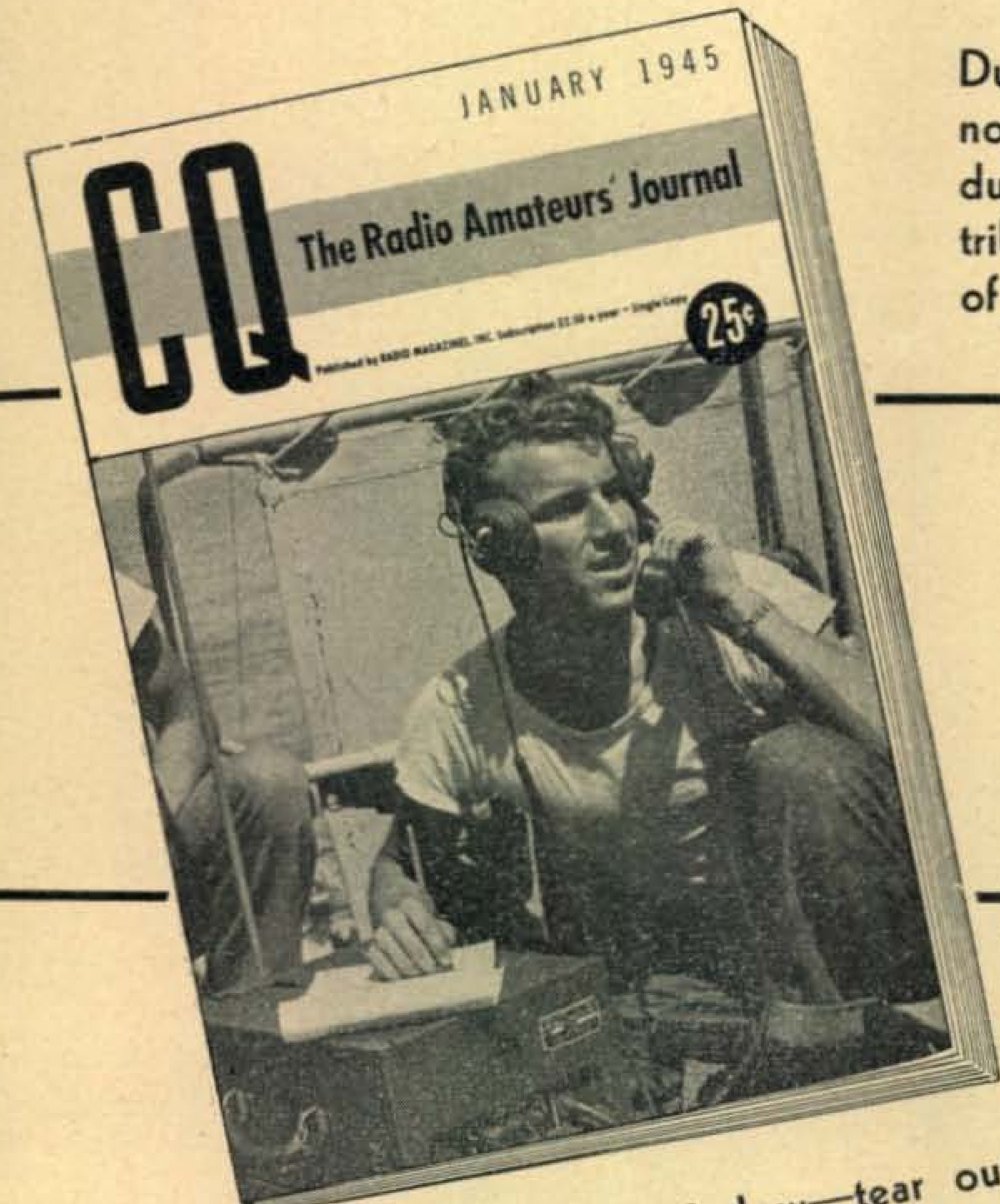

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should be as long as the available flat space under the dashboard. This piece is fastened to the chassis by means of #6-32 machine screws and nuts, and projects over the front of the chassis far enough so that, when the mounting piece is fastened to the dashboard lip by means of a pair of ¼″ bolts, the whole chassis comes about even with the rear edge of the dashboard lip. This recesses the controls so they do not obstruct free movement in the car.

The other mounting piece, securing the rear drop of the chassis to the bulkhead, is a U-shaped strip of ½″ band iron with the tops of the U bent outward at right angles for bolting to the rear drop of the chassis. This bracket can be seen in *Fig. 3*. The depth of the U should be slightly less than the distance between the back drop of the chassis and the fire-wall. A 3/16″ hole is drilled through the center of the bottom of the U and a corresponding hole located in the bulkhead. A bolt is then passed through these holes and the whole assembly drawn up tight.

Antenna Adjustments

The antenna is a three section, 66-inch BC aerial. It seems to resonate best at about 40 inches for our use. The feed line is a short length of 59-ohm coaxial cable. While this doesn't match anything in particular in our set-up, so far as we know, it puts the power where it belongs—into the antenna.

The antenna may be resonated by tuning in a station at or near net frequency. The regeneration control is set so that the hiss is barely audible and the antenna shortened or lengthened. At some point the hiss will disappear. The control is reset to bring in the hiss again and the adjustment carried further. Two or three checks will peak the antenna "on the nose."

The antenna connector on the bottom plate of the rig consists of a polystyrene bushing carrying a brass stud turned to fit the cable connector. The lead from the antenna section of the rear switch connects to this stud, and the other side of the coaxial antenna cable is grounded to the bottom plate by means of a flexible wire and a soldering lug under a convenient screw also used to hold the bottom plate to the chassis.

The usual methods of frequency and modulation checking should be employed before a signal is put on the air. The modulator is capable of modulating the r-f signal considerably more than 100%, so careful operation is necessary to avoid over-modulation and consequent frequency modulation. An additional refinement would be the inclusion of separate gain controls for transmission and reception, but the small size of the end of the chassis, which serves as a panel, prevented the inclusion of more variable controls in the rig described.

To those who wonder why we need still bigger War Loans

IN THE 7th War Loan, you're being asked to lend 7 billion dollars—4 billion in E Bonds alone.

That's the biggest quota for individuals to date.

Maybe you've wondered why, when we've apparently got the Nazis pretty well cleaned up, Uncle Sam asks you to lend more money than ever before.

If you have, here are some of the answers:

This war isn't getting any cheaper

No matter what happens to Germany—or when—the cost of the war won't decrease this year.

We're building up a whole new air force of jet-propelled planes and bigger bombers.

We're now building—even with announced reductions—enough new ships to make a fair-sized navy.

At the time this is written, our casualties are nearing the million mark in dead, missing, and wounded. Wounded men are arriving in this country at the rate of over 30,000 a month. The cost of caring for these men at the battle fronts, transporting them home, and rehabilitating them when they get here, is mounting daily.

No—this war isn't getting any cheaper. And won't for some time.

This year—2 instead of 3

We need as much War Bond money this year as we did last. But there will be only 2 War Loans this year—instead of the 3 we had in 1944.

Each of us, therefore, must lend as much in two chunks this year as we did last year in three. That's another reason why your quota in the 7th is bigger than before.

The 7th War Loan is a challenge to every American. The goal for individuals is the highest for any war loan to date. The same goes for the E Bond goal. Find your personal quota—and make it!

THE MIGHTY 7th WAR LOAN

ALL OUT FOR THE MIGHTY 7th WAR LOAN

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