CQ

W2FX AUGUST, 1945

The Radio Amateurs' Journal

Published by RADIO MAGAZINES, INC. Subscription $2.50 a year — Single Copy 25¢

"WE USE EIMAC TUBES EXCLUSIVELY IN ALL OUR LARGER GROUND STATIONS"

Says Robert F. Six

PRESIDENT, CONTINENTAL AIR LINES

CONTINENTAL AIR LINES, INC.
MUNICIPAL AIR TERMINAL
Denver 7, Colorado

January 9,
1945

Chief Engineer
Eitel-McCullough, Inc.
870 San Mateo Avenue
San Bruno, California

Dear Sir:

An airline must have a communication system which is absolutely dependable. For that reason, we scrutinize with great care the records we keep on the performance of the various components used in our transmitting and receiving equipment.

Included among these records are those on Eimac transmitting tubes--used exclusively in all of the larger ground stations operated by Continental Air Lines. I am pleased to tell you that these records show that your transmitting tubes are averaging well over 20,000 hours of service in our stations.

Sincerely yours,

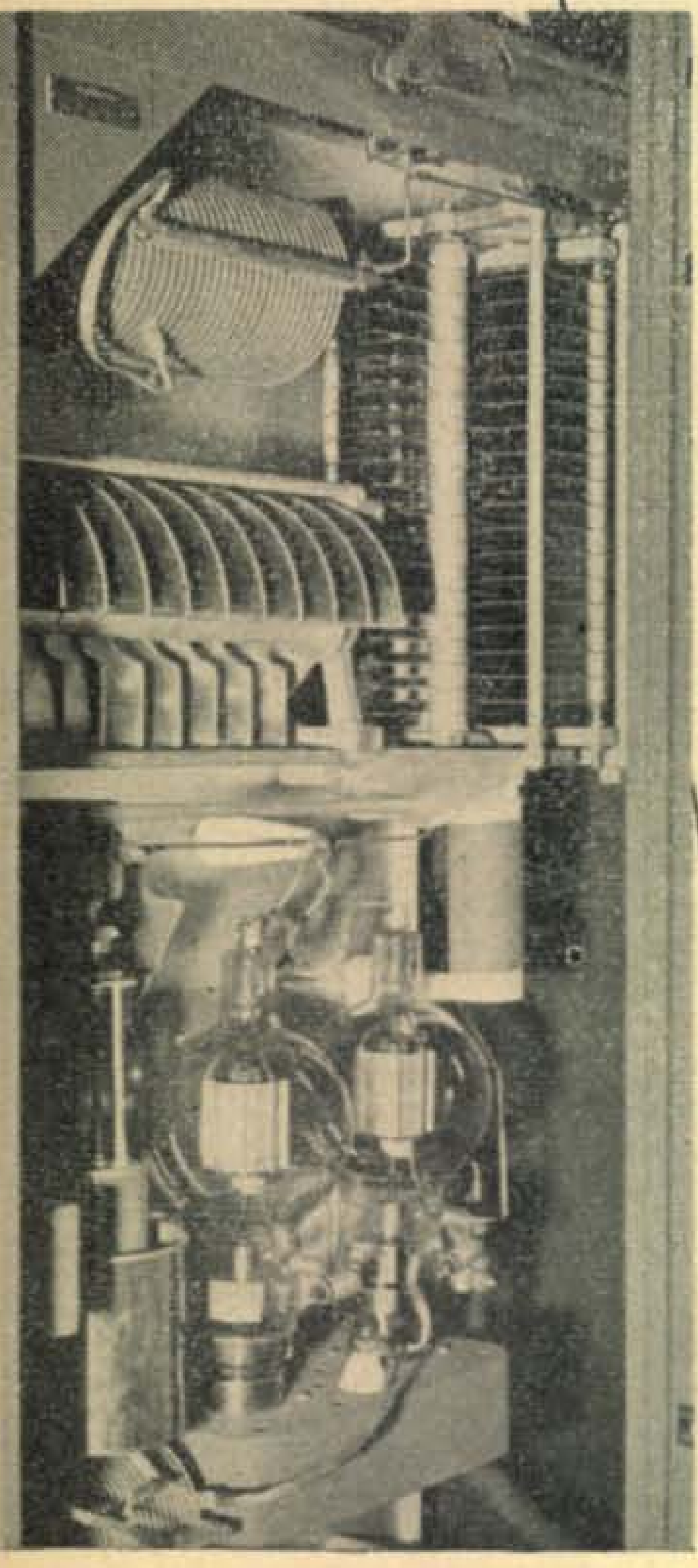
Robert F. Six

Robert F. Six
President

RFS/lad

ROBERT F. SIX
President
Continental Air Lines

Below... a pair of Eimac 450-T tubes in the panel of Continental ground station transmitter built by Wilcox.



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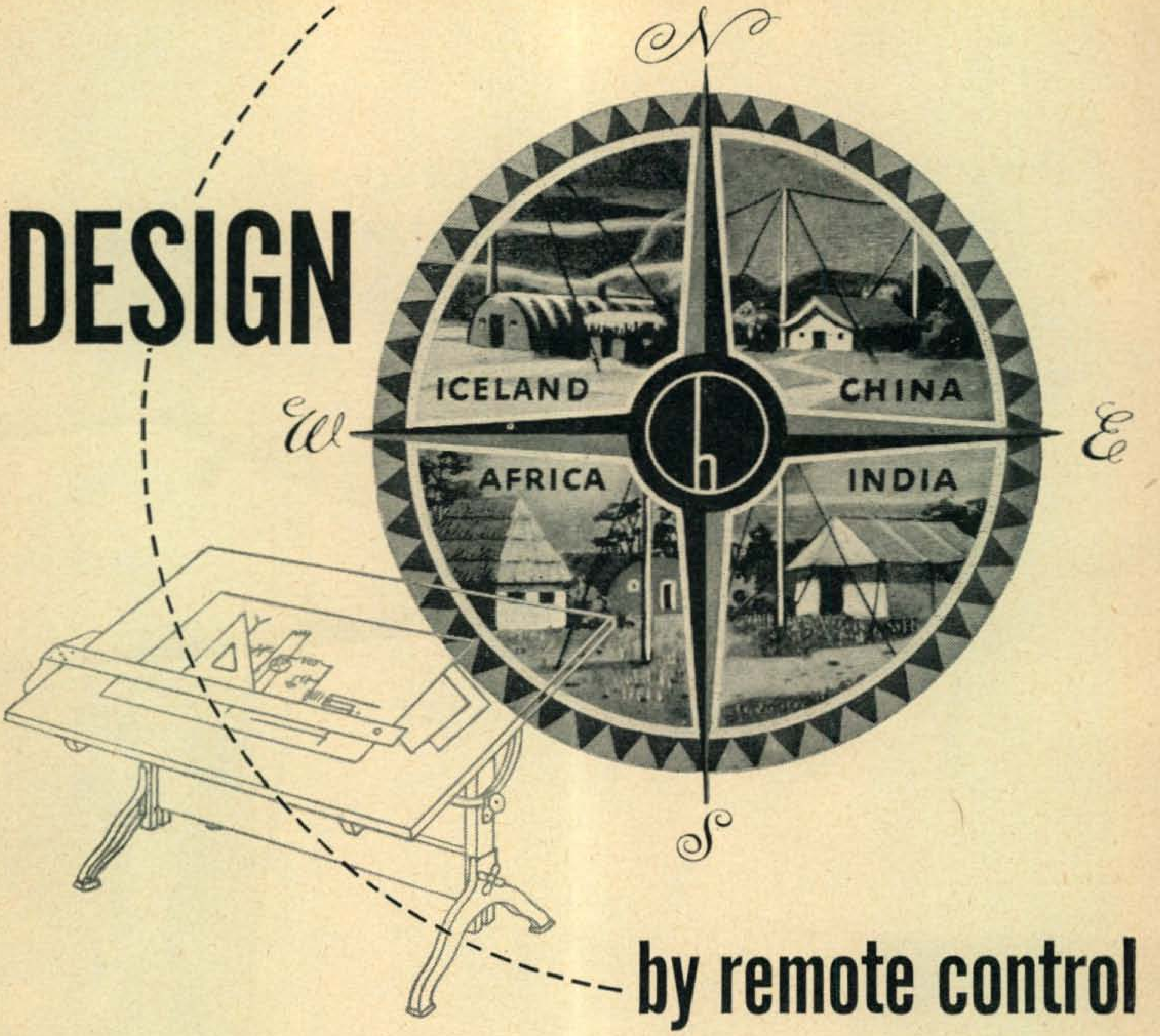
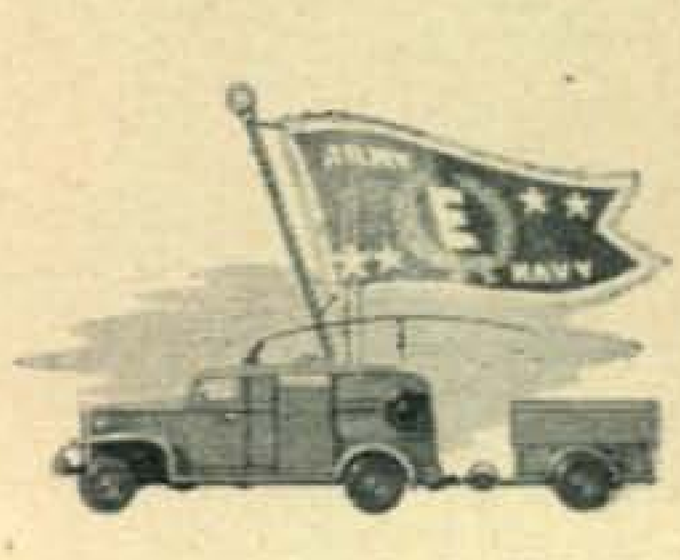
DESIGN



by remote control

The design of radio equipment that will come from Hallicrafters is already shaping up — determined largely by thousands of hams who, from their remote control locations all over the world, are sending advice and suggestions on new radio ideas to Hallicrafters engineering department.

Thousands and thousands of Hallicrafters pieces of high frequency radio equipment are in use in the armed services. In a high percentage of cases this equipment is used by operators with practical amateur experience. From these qualified experts Hallicrafters has received hundreds of letters telling how Hallicrafters-built equipment stands up under the most vicious battle conditions. Hallicrafters receives regularly many valuable suggestions from hams in the field and at home. From this rich deposit of "design by remote control" will emerge Hallicrafters new line — built to meet ham requirements, designed for the world's most exacting users — the radio amateurs.



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The Radio Amateurs' Journal

Published by RADIO MAGAZINES, INC.

John H. Potts..........Editor
Sanford R. Cowan..Publisher

CQ, Published by
RADIO MAGAZINES, INC.

Executive & Editorial Offices
342 MADISON AVENUE
NEW YORK 17, N. Y.
Telephone MUrray Hill 2-1346

Subscription Rates in U. S. and Poss. $2.50 per year. 2 years $4, 3 years $5. All other countries, $3.50 per year in equivalent U. S. currency. Single copies, 25 cents. Subscriber must allow 3 weeks for address changes. Editorial matter contributed and accepted will be paid for at current space rates and will be subject to any revisions or omissions deemed expedient by the Editor. Material submitted must contain a self-addressed, stamped, return envelope and the author must agree to hold the publisher of CQ harmless from any manner of suit or damage claim resulting from the publication thereof and/or any illustrations accompanying same. Publisher reserves right to accept or reject any advertising matter submitted. CQ, printed in U. S. A.

VOL. 1, No. 8 **AUGUST, 1945**

CONTENTS

COVER

Radio operator at his position in the forward compartment of a Consolidated Vultee B-24 Liberator (*Photo courtesy USAAF, Technical Aids Div.*)

ARTICLES

MISCELLANEOUS

ZERO BIAS

THE FCC HAS plugged up the last gaps in its frequency allocations above 25 megacycles, and the 4-mc band between 50 and 54 mc is assigned to amateur radio in place of the 56 to 60-mc pre-war allocation. The ham will be sandwiched between two television bands—a matter, however, of minor importance. He was able to get along with the same neighbor prior to the war, and anyway television will doubtless abandon the 5 to 6-meter region in favor of higher-frequency operation. The reallocation itself is similarly of little consequence, and the old equipment can accomplish the shift with a pinch and a squeeze on a tank coil and a slight Procrustean stretch to the antenna.

Of perhaps more significance is *the rapidity with which these final allocations were made.* It all depended on just where FM was going to go, and the FCC announced late last spring that tests would be made this summer, when sporadic E transmissions were expected to be at their maximum, and the most effective place for FM could then be determined. There was really no hurry about it, the FCC explained, because the war was far from an end and no post-war frequency-modulated and television receivers could be manufactured until the industry was given the green light by the War Production Board. The WPB assured the Federal Communications Commission that no quantity of new FM, AM or television transmitters or receivers would be made "in 1945, or even the first part of 1946, unless Japan capitulates." However, the War Production Board promised the FCC that it would provide ninety days advance notice should the situation alter materially—and apparently it has. On June 29th, Paul A. Porter, Chairman of the FCC, stated that the Commission would "keep in daily contact with the War Production Board."

There's seldom much sense in grasping at straws—unless they happen to be those straws that show in which direction the wind is blowing. Reconversion is an admitted post-war problem—a problem that would be largely solved if industry, such as radio manufacturers, could be eased back into their normal production as the war clouds begin to lighten. Straws are the only thing we have for what Washington, Moscow and London probably know. It is possible that the war may be over sooner than we have been led to expect, and—to get to the point—the government may see fit to remove the ban on amateur radio as soon as consistent with national security.

Perhaps it was only a coincidence, but about the same time the FCC accelerated its final decisions on high-frequency allocations, the British government began preparations for the reissuance of amateur licenses to those who were formerly fully licensed with radiating permits, and for the return of apparatus impounded at the beginning of the war. Applications are now being received by the General Post Office, London. (While a quietus was placed on amateur operation in this country, no licenses were cancelled nor was equipment impounded. Operators' licenses are still valid, and new operators' licenses, but not station licenses, are being issued.)

— . . . —

The FCC is now working on allocations below 25 megacycles. While definite promise has been made that amateur frequencies will be available, the congested character of the low-frequency spectrum suggests that some shaving—such as the 15% cut in the 10-meter band—may be in the cards. With a vastly expanded post-war aviation, it is logical to expect considerable pressure on the 80 and 40 meter bands—our most useful waves for consistent DX and all-around communication. These were also the traffic bands, and consequently of most interest to the c.w. artist and many of the old timers. Naturally every effort will be made to retain these allocations, but if we succeed as far as the FCC is concerned, it will only be to face foreign opposition at the first post-war international radio conference. Other nations have never exhibited the USA's liberal point-of-view and tolerance of the amateur; and many of them have been downright antagonistic to his very existence. All progressive countries will be pressed for *lebensraum* in the lower frequency region, and 40 meters is a bona fide, year-in year-out, international band. Eighty meters is ideal for night aircraft communication—just as it was for short-haul ham traffic and general rag-chewing after the day's work was done.

Amateur radio's toughest tussle will not be with the FCC and domestic services, but over the international conference table.

V-H-F ADAPTER FOR AUTOMOBILE RADIO

Car Radio Serves as Modulator, Amplifier, and Power Supply and Will Still Work on Standard BC

LOYAL STEPHEN FOX, W2AHB

A MADE-TO-ORDER power supply, audio amplifier, and speaker are included in every automobile radio. Since an audio amplifier can readily be converted into a modulator, this set-up provides an ideal foundation for a v-h-f mobile rig. True, its power will be only what the car receiver can provide, but a surprising range of communication can be covered with low power on very high frequencies.

Having a complete audio system and power supply, the only requirement is a v-h-f transmitter-receiver unit designed to connect to the car radio, plus a few minor alterations in the receiver itself. For the transmitter-receiver the primary considerations are frequency stability, maximum output for the power available, compactness, and ease of operation. Also, the v-h-f unit should be easily removed from the car, and, of course, the automobile radio must continue to perform satisfactorily as a broadcast receiver.

The V-h-f Unit

As shown in the photographs, *Figs. 4* to *7*, and the diagram, *Fig. 1*, the v-h-f unit is built around a 955 acorn tube in the receiving end, and uses the so-called "non-radiating" super-regenerative circuit. The transmitter comprises two 3Q4 tubes in push-pull. Capacitor C_1 can be any midget variable stripped down to a single rotor and two stator plates. A concentric line leads to the antenna, while from the opposite side a multi-wire cable terminates in a plug for connection with a socket in the car radio. Thus the entire unit and cables may be readily removed when not wanted in the car. For better visibility of constructional details the photographs were made before the v-h-f unit had been completely wired.

The unit is housed in a metal box 4½" x 4" x 2¾" deep. In the writer's instance a suitable

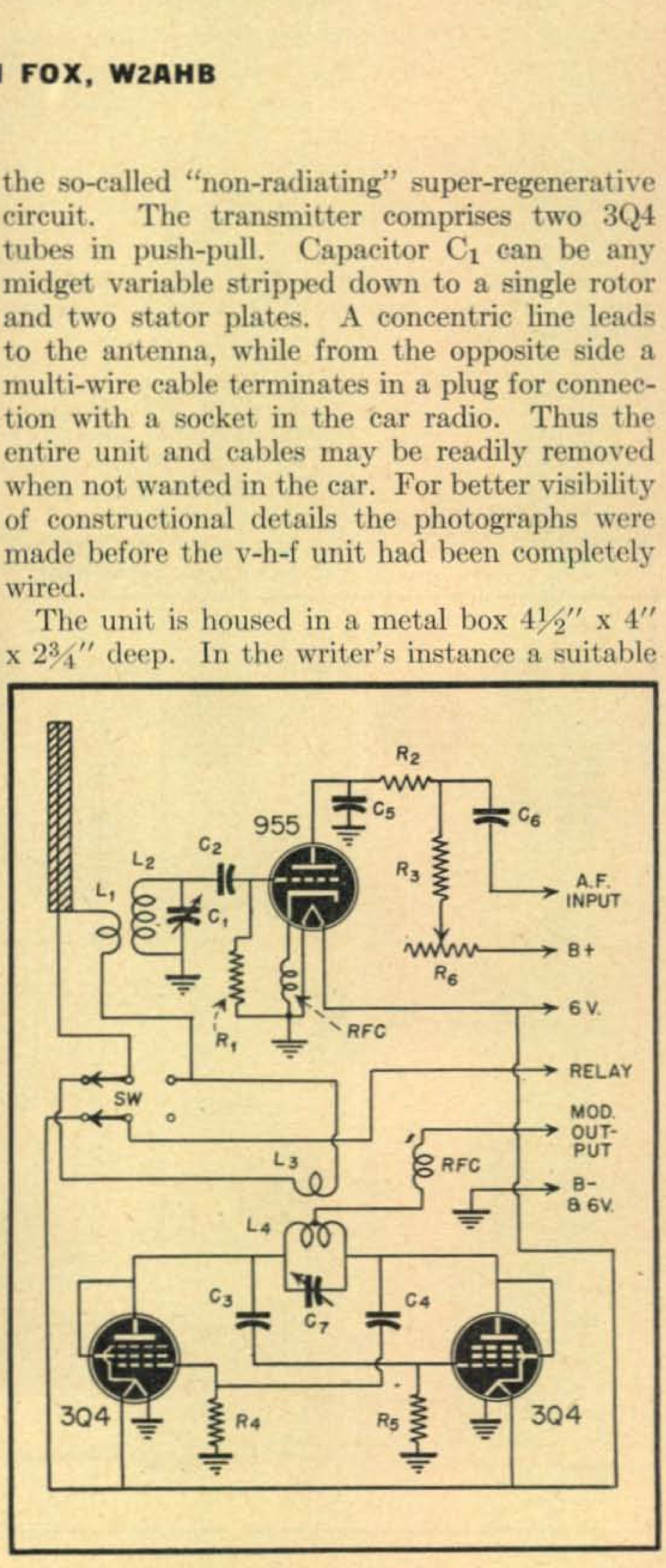


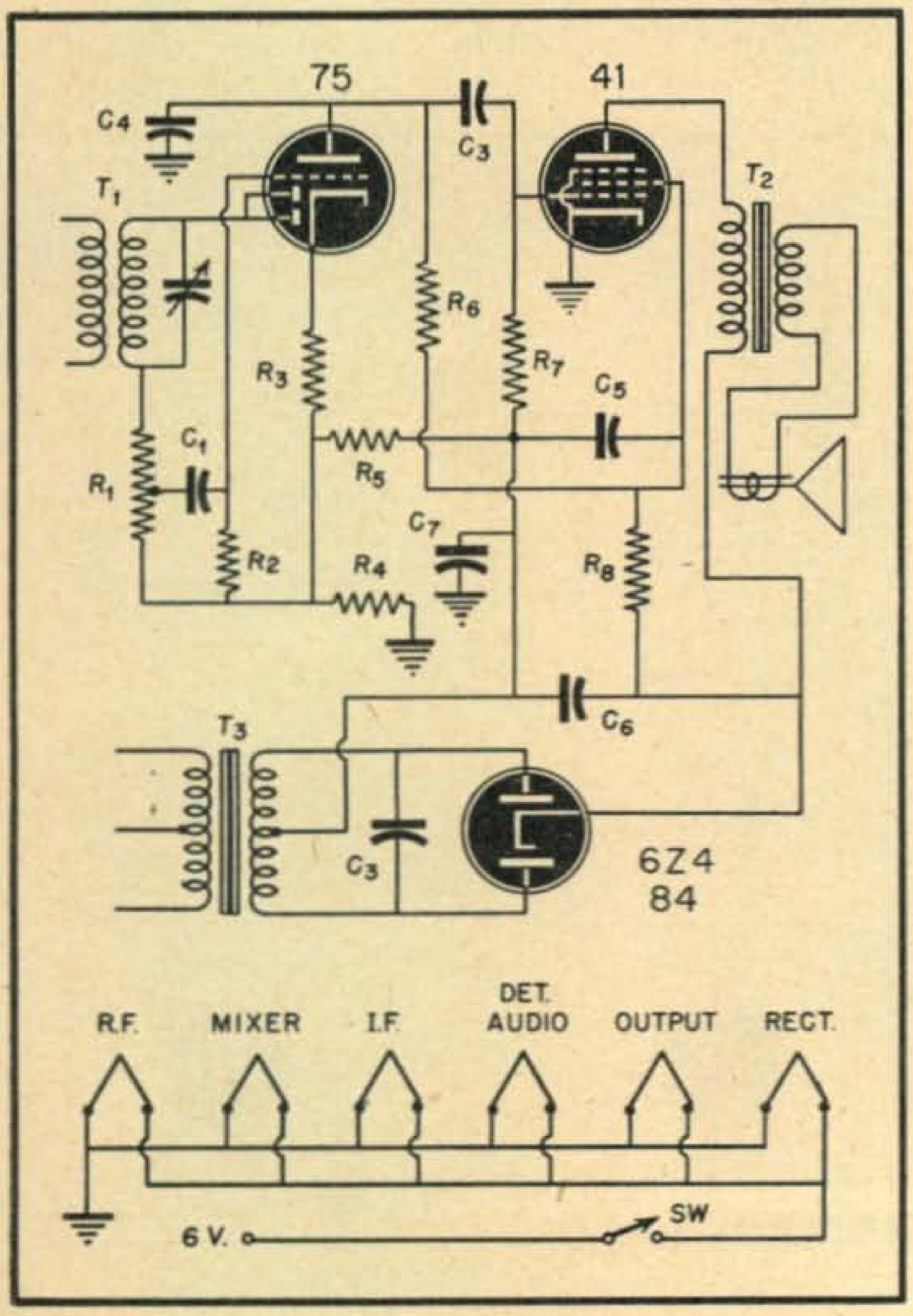
Fig. 1. The transmitter-receiver unit uses the following parts—

- C_1—3-plate midget (see text)
- C_2, C_3, C_4—.00005 μf
- C_5—.004 μf
- C_6—.01 μf
- C_7—3 to 30 μf trimmer
- L_1—1 turn ½" dia. #20 (112 mc)
- L_2—5 turns ½" dia. #14 bare copper (112 mc)
- L_3—2 turns ½" dia. #20 (112 mc)
- L_4—3 turns ½" dia. #14 bare copper (112 mc)
- R_1—3 meg.
- R_2—1000 ohms
- R_3, R_4, R_5—10,000 ohms
- R_6—10,000-ohm potentiometer
- RFC—v-h-f r-f choke
- SW—d.p.d.t. toggle switch

steel "cabinet" happened to be available; but it is not difficult to construct one from sheet metal. The box is provided with a cover, on which all parts are mounted so that the entire unit may be withdrawn from the housing. A horizontal sub-panel divides the compartment—partitioning the transmitting and receiving sections. For rigidity this sub-panel is fastened with sheet metal brackets. The two 3Q4 tubes are mounted above the sub-panel so that their socket connections are underneath. Between these two tubes is the 955, above which is the variable tuning condenser, C_1. The regeneration control, R_4 is in the transmitting compartment, as is the send-receive switch SW. This switch is an ordinary double-pole-double-throw toggle, and even though it is not "low-loss," it performs very well. In any event, nothing else was available which would fit the space. As far as possible all the smaller parts are attached directly to the associated tube socket terminals. Keep r-f connections short and direct, and make all ground connections to a single point in each compartment. The sides of the box are notched out to provide for the two cables. Suitable means, of course, must be provided for mounting the unit inside the car—a matter that each car owner will have to work out for himself due to the variations in body construction.

Fig. 2. Typical audio circuit of an automobile radio, and the following components fit in nicely for modulation purposes—

C_1, C_2, C_3—.01 μf	R_4—68 ohms
C_4—.0005 μf	R_5—330 ohms ½ watt
C_5—6 μf	R_6—220,000 ohms
C_6—4 μf	R_7—470,000 ohms
C_7—13 μf	R_8—2,000 ohms 1 watt
R_1—500,000 ohms pot.	T_1—i-f transformer
R_2—1 meg.	T_2—output transformer
R_3—300 ohms	T_3—power transformer



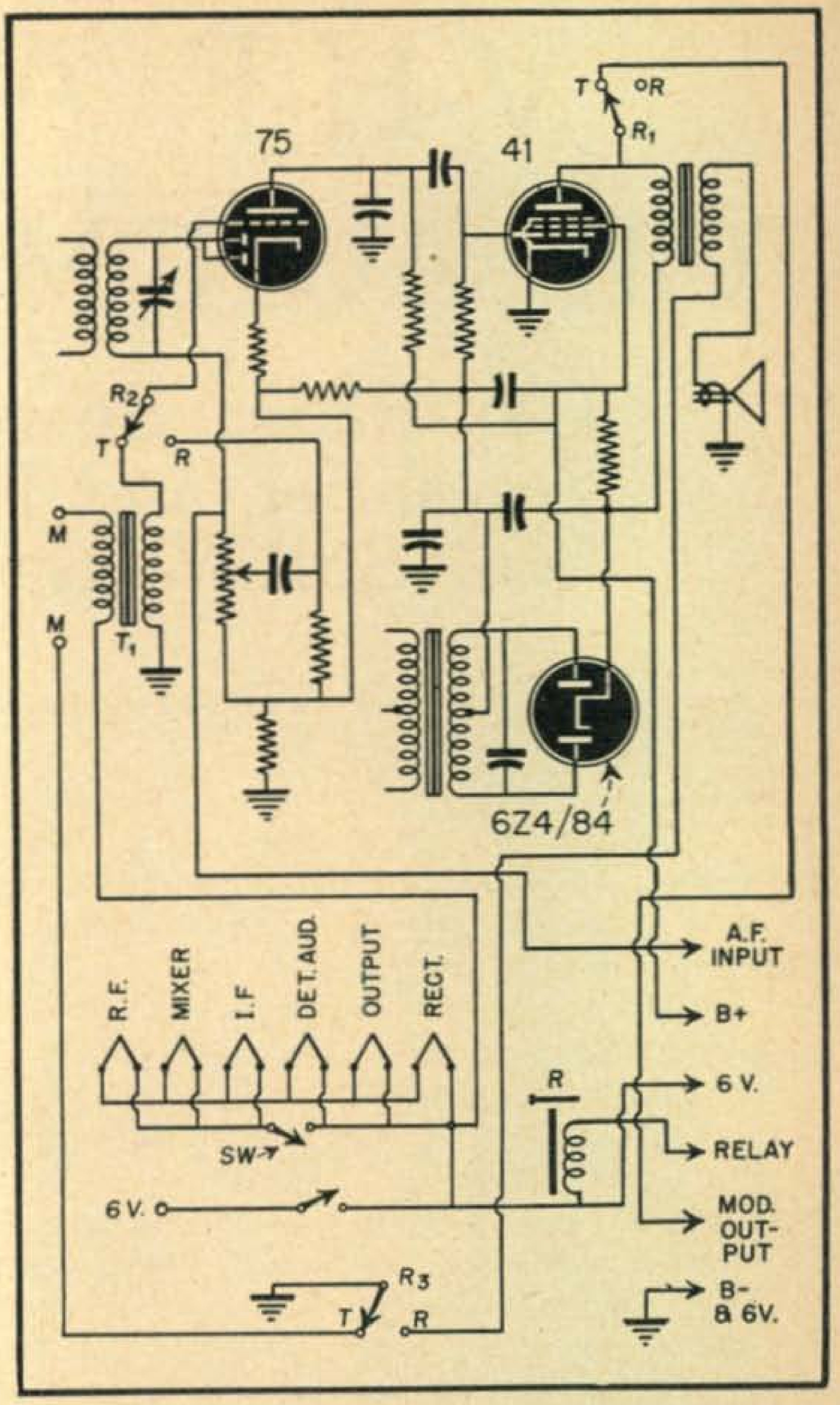


Fig. 3. The audio circuit of Fig. 2 modified for amplifier-modulator operation. M-M is the microphone jack, T_1 the mike transformer (midget size), SW a s.p.s.t. switch, and R, R_1, R_2 and R_3 represent the 3-pole double-contact midget relay

The Car Receiver

How best to adapt the car receiver for use as a modulator-amplifier is a problem presenting a different solution for each different model of car radio. Fortunately, there is not as much variation in the audio circuits of car receivers as there is with household radios. Also, the fundamental modifications are the same for any receiver:

1. Install a switch to open the filament circuit of all the tubes ahead of the second-detector-audio. This kills the r-f, mixer, and i-f circuits so that no broadcast-band signals get through. It also lessens the load on the 6-volt circuit, and

makes a little more B power available. An ordinary a-c toggle switch is satisfactory here.

2. Provide a connection from the v-h-f detector output to the grid circuit of the 1st audio in the car radio.

3. Plug-wire a tap from plus B of the car set to the plate of the v-h-f detector.

4. Provide a connection from the modulated audio output to the plates of the transmitter tubes.

5. Install a jack for the microphone plug, a microphone transformer, and arrange for a connection to supply 5 volts to the microphone.

6. Provide a connection for the 6-volt filament supply to the tubes in the v-h-f unit.

7. Install a 6-volt, 3-pole, double-contact relay to switch the audio circuit of the car radio from the receiving to the transmitting position—with connection from the relay coil to the 6-volt circuit, and to the send-receive switch in the v-h-f unit.

The circuit shown in *Fig. 2* is representative of car radios. There are, of course, variations, but in most cases these will be minor. For example, the set may have octal base tubes, or the vibrator may be of the self-rectifying type—in which instance there will be no rectifier tube. With care and patience you can trace the circuit in your set and draw your own diagram. However, if you have a friend in the radio service business, reference to his manuals will save you time and labor. Diagram *Fig. 3* shows the modifications for the circuit of *Fig. 2*. These particular circuits pertain to the Motorola Model 35.

The actual work on the car receiver isn't as difficult as it may originally seem. First, locate the positions for the relay and the microphone transformer. These should be placed as close to the 1st audio tube socket as possible in order to shorten the connections to the grid circuit of that tube. (If they are long you may run into audio feedback; in which case use shielded-wire connections, and don't forget to ground the shield.) Next, locate the socket for the cable plug connecting to the v-h-f unit. Here again, it is best to place this socket as close to the 1st audio tube as possible. Install the microphone jack, and the switch in the filament circuit. The wiring comes last.

The grounded connection (– B and 5 volts) in *Figs. 1* and *3* is not ordinarily required, as in most cases the v-h-f unit will be attached to some metallic part of the car, and the ground connection will then automatically be made through the body.

Operation

With the transmitter-receiver unit mounted, connected to the antenna, and plugged into the car set, throw the filament switch to the "open" position, and the change-over switch to "receive." Turn on the car set. With proper adjustment of the volume and regeneration controls, you should hear the familiar "rush" sound characteristic of super-regeneration. Adjust L_2 by pushing the turns closer together or spreading them apart until the tuning condenser covers the band satisfactorily. Then adjust the

[*Continued on page 38*]

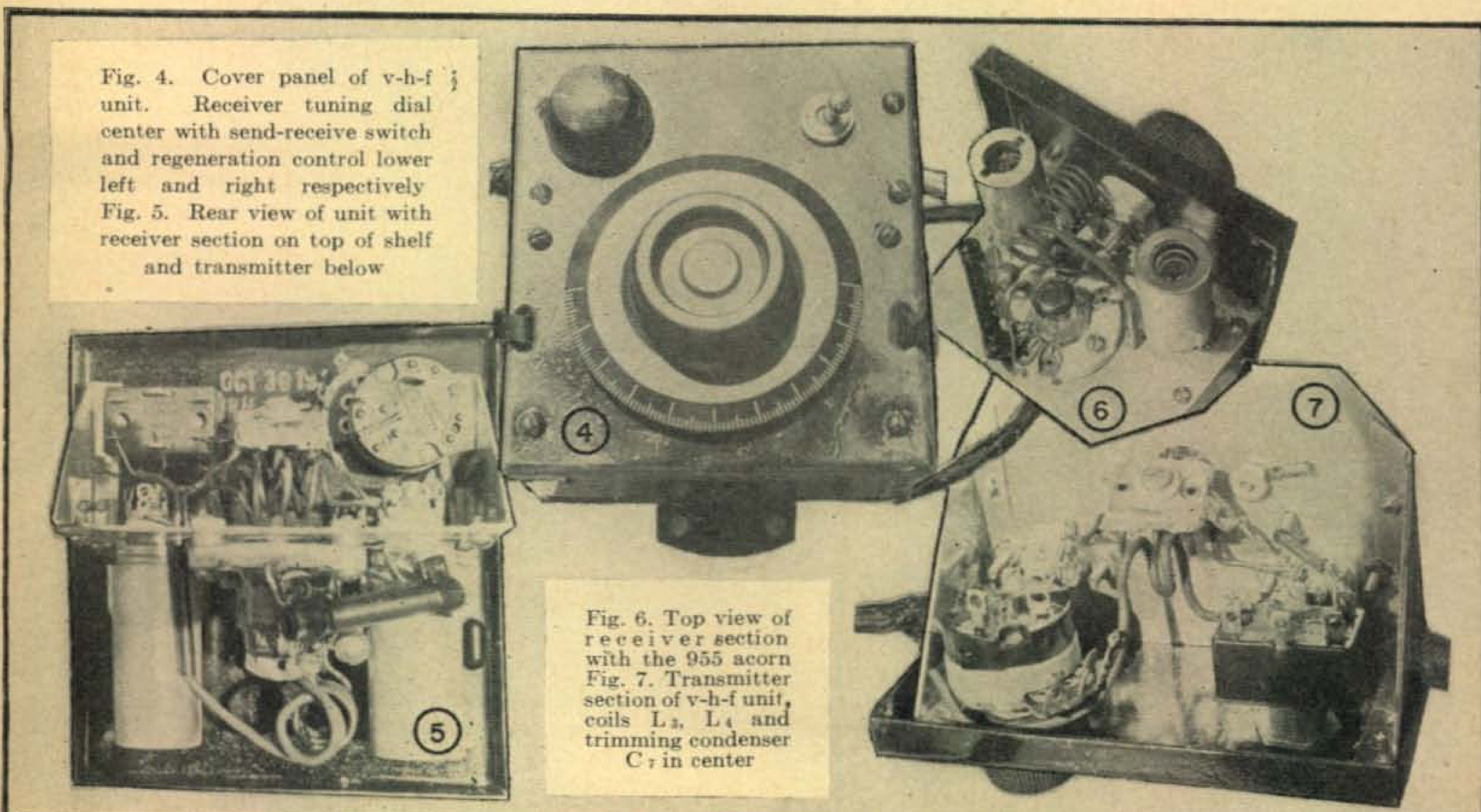


Fig. 4. Cover panel of v-h-f unit. Receiver tuning dial center with send-receive switch and regeneration control lower left and right respectively

Fig. 5. Rear view of unit with receiver section on top of shelf and transmitter below

Fig. 6. Top view of receiver section with the 955 acorn

Fig. 7. Transmitter section of v-h-f unit, coils L_3, L_4 and trimming condenser C_7 in center

FM-AM SUPERHET

AVAILABLE IN KIT FORM, UNIT FEATURES ACORN TUBES, DOUBLE CONVERSION AND PROVISION FOR 10-MC I-F CHANNEL EQUIPMENT

LEROY W. MAY, JR. W5AJG

SINCE THE FINAL FCC allocations have definitely pegged our former 112-116-mc band at the new frequency of 144-148 megacycles, it behooves the v-h-f enthusiast to start at once on his new 2-meter receiving and transmitting equipment. Added emphasis on this point is justified by the fact that it is entirely possible that this band may be open to amateur communication before V-J Day. Equipment components are gradually becoming more available and in some instances complete receiver kits, formerly used for training purposes can now be obtained. The receiver described in this article falls into the latter category and is obtainable from prominent mail order firms—complete with acorn tubes and all hardware, ready for assembly.

Previously these kits were used expressly for the purpose of instruction in FM and AM receiver construction and v-h-f technique. This kit includes 10 tubes and was designed to approximate existing high-frequency commercial and military units from a constructional standpoint. For the amateur, it is an inexpensive and practical way to get started with an excellent high-performance acorn-tube receiver for the new 144-148-mc band.

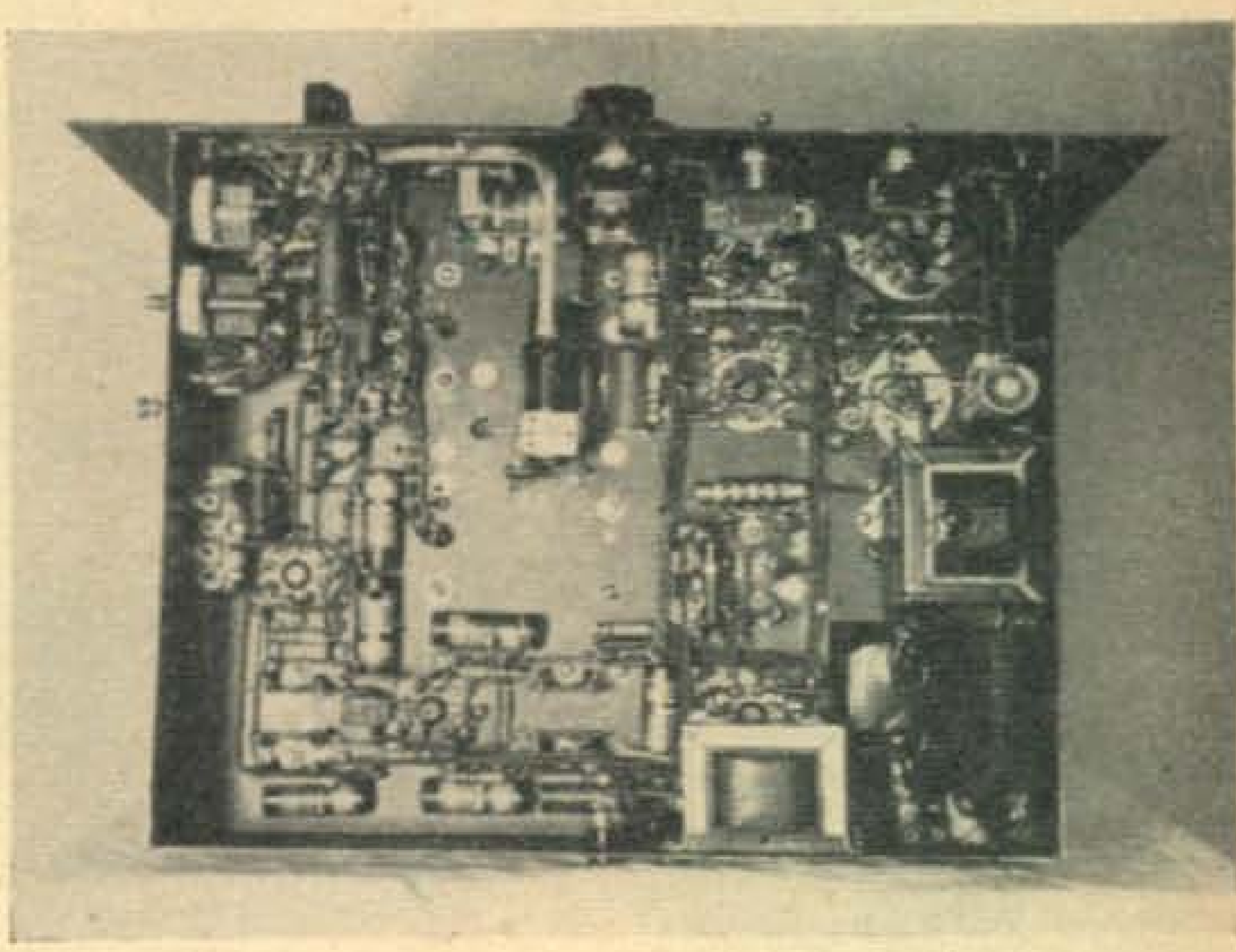
The v-h-f section is contained in a separate shielded box which houses the three acorn tubes and tuning condensers. It càn be assembled separately from the remainder of the chassis, to be mounted and connected with only four screws and the plate and filament wires. A VR-150-30 voltage regulator provides for constant voltage for the high-frequency 955 acorn oscillator and 954 acorn first detector. A 956 acorn is used as an r-f amplifier.

The i-f system comprises two intermediate-frequency stages of standard 4.3-mc design using 6SK7's or 1853's and a third stage (6SJ7) which operates as a low-gain i-f stage in AM operation and as a limiter stage on FM. The 6H6 following the 6SJ7 operates as a discriminator on FM and as a diode second detector on amplitude modulation. A double-pole-double-throw toggle switch controls AM to FM operation and is operated from the front of the panel.

Modifications for Amateur Use

This receiver kit is available in two frequency ranges of 88.6 mc to 107.6 mc and 115 mc to 140 mc. They are identical except for the construction of the tuning coils associated with the v-h-f unit. These coils are modified to cover the 144-148 mc band with approximately 100 degrees of band spread. The receiver employs a 4.3-mc i-f system—that is, the high-frequency oscillator is adjusted 4.3 mc lower than the signal circuits. This is satisfactory since the 144-148-mc band only takes in 4 mc and images will be nil. However, improved results were obtained when the 1st i-f was increased to a frequency of 10 mc and then reconverted to the regular 4.3-mc i-f system. Plenty of room on the original chassis being available, a 6K8 tube was inserted for this purpose. This arrangement provided an additional operating feature which greatly added to the utility of the receiver.

Many amateurs have on hand, or will be able to pick up very easily, certain v-h-f equipment, such as converters and frequency expanders. These devices include DM 36s, 510Xs as well as home constructed converters, all using the heretofore rather standard output of 10 megacycles. In order that these various "front ends" might be used for AM and more especially for FM recep-



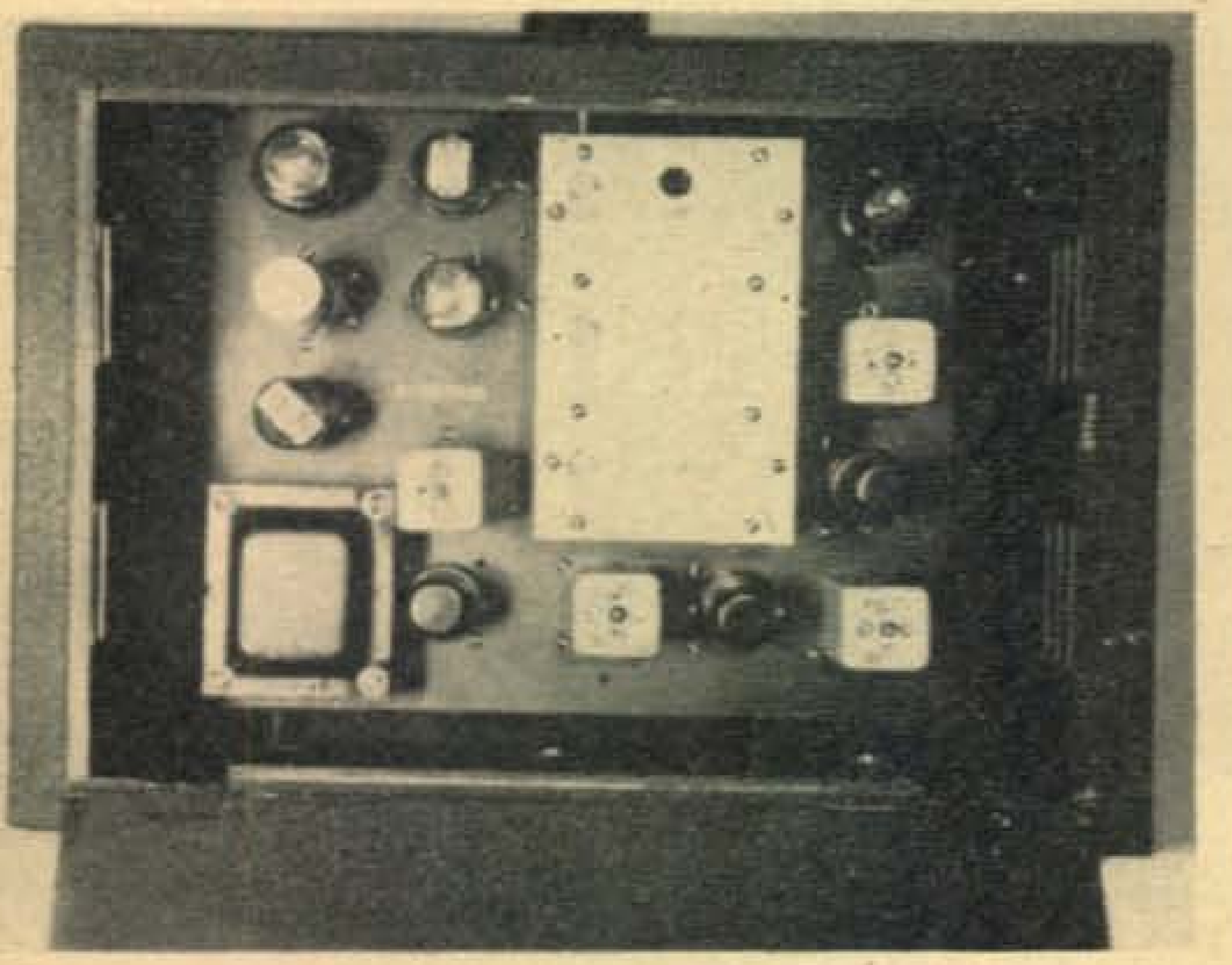
Underneath view of 144-mc superhet. Clean wiring facilitates maintenance. The 6K8 10-mc converter can be seen in upper left with oscillator and detector condensers mounted on lip of chassis tion with the AM-FM channel of the 144-148-mc kit receiver, a separate pair of terminals is brought to the chassis. A switch provided on the front panel for cutting out the 144-148-mc acorn tuning unit by breaking the heater leads, while at the same time allowing the external 10-mc equipment to be used either on AM or FM.

Thus with separate converters covering various bands, the AM-FM, i-f and audio systems are utilized without having to provide additional receivers tuned to the 10-mc frequency. This arrangement will certainly suffice for some time after the war until new ham equipment is developed that will do all but mow the front lawn.

The oscillator portion of the 6K8 tube is tuned to 5.7-mc which is 4.3 mc lower in frequency than the incoming signals of 10 megacycles from either the external unit or from the v-h-f section of the kit receiver.

Assembly

The assembly of the unit is not too difficult as all holes are punched in the chassis except the socket hole for the additional 6K8 converter tube. The first step in the assembly of the i-f and a-f channels is to mount all by-pass condensers and resistors on terminal tie-strips, after which they are bolted to the chassis in the proper places to afford short leads. Next the tube sockets are mounted and the filaments wired—after which the i-f stages are wired and completed one by one. A very neat job may be done with a little patience as the photograph of the under side of the chassis will attest. The v-h-f section may be wired separately and later bolted to the chassis, as previously mentioned.



In the cabinet, with the lid on the v-h-f unit and showing the screw-driver holes for trimmer adjustment

The V-H-F Tuning Unit

This unit is of course the most interesting part of the receiver and accounts for the excellent signals obtainable. As received the three tuning condensers contain 6 plates each. These are carefully stripped to two plates each and with the coil sizes as given, afford a full 100 degrees of band spread over the 144-148-mc band. The padders across each tuning condenser are 3-30 $\mu\mu$f, and when operating on 144-mc will be practically all the way open. Thus the dielectric will be mostly air. Very little drift is noticeable and the unit tunes as if it were on one of the lower frequency bands.

Following modification, the tuning condensers are mounted on brass spacers as furnished, and the by-pass condensers are then soldered to the acorn tube sockets. After assembling the sockets on the partitions, the coils are mounted and the unit bolted together, leaving about 6 inches or so of the terminal strips to hook on the i-f chassis later.

The 10-mc intermediate-frequency output circuit of the 954 acorn first detector is mounted under the chassis of the receiver as shown, and connects to the plate prong by a copper clip extending through a hole in the chassis. It is important that all r-f ground returns for these stages be connected to a single point (such as the condenser rotors) and here grounded to the chassis. If these precautions are observed, unwanted oscillations should be absent. Actually, no trouble of this nature appeared.

Alignment

Alignment is simple and perfectly straight-forward throughout. An amplitude modulated tone from a signal generator is employed. First the tone is applied at a frequency of 4.3 mc through a .01 μf condenser to the plate lead of the 1st i-f transformer. Each stage is then adjusted in the usual manner for maximum output. An output meter may be used but the speaker is satisfactory. When this has been done, the panel switch is thrown to the FM position and the output trimmer of the discriminator transformer is adjusted for a null of the AM signal. As the trimmer is rotated a peak will be apparent, then a null, and finally another peak. This adjustment is quite sharp and must be done slowly. The proper point for FM operation is at the null point. This should complete the alignment of the 4.3-channel system.

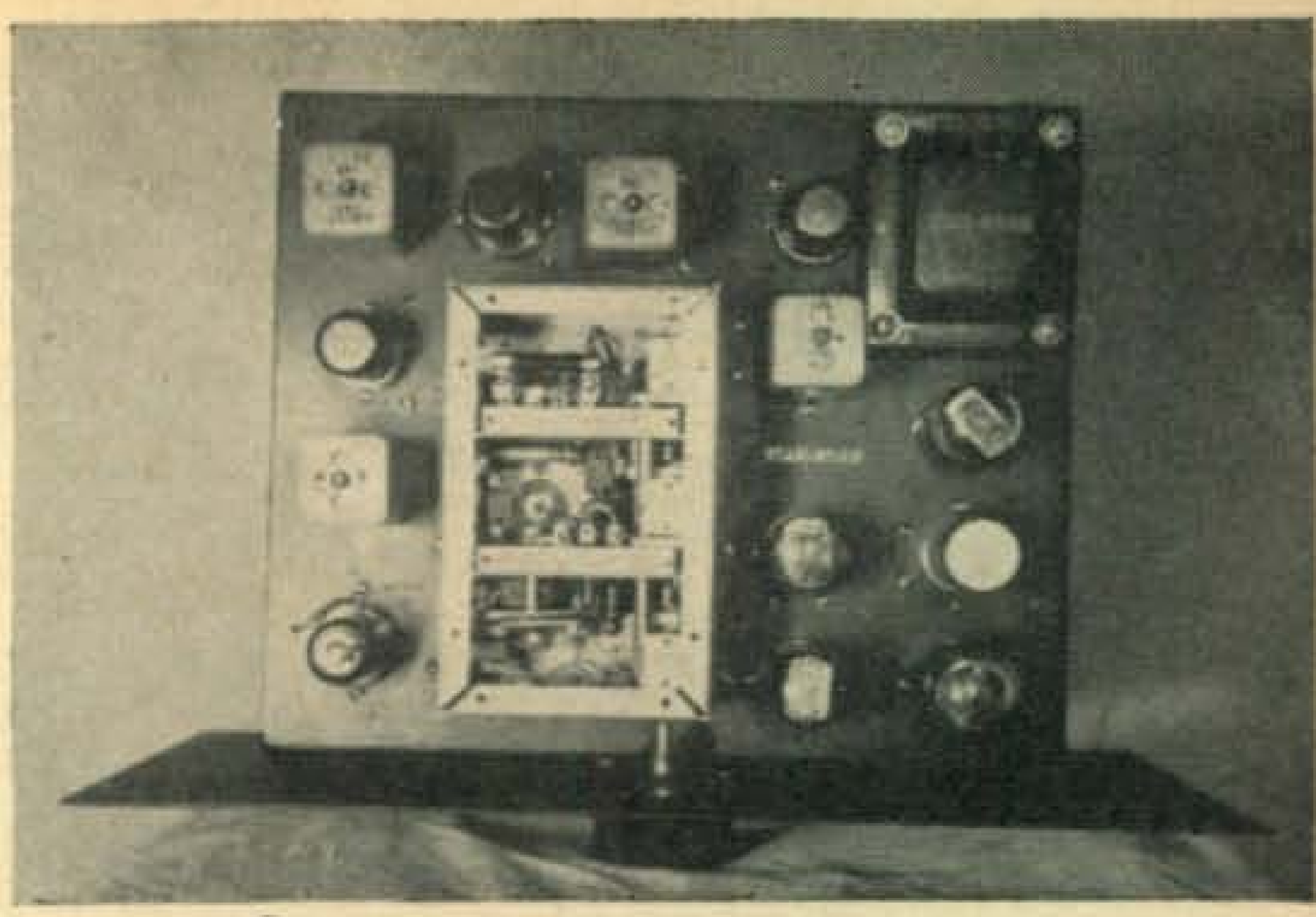
Next, the 10-mc converter stage must be lined up to be sure the 10-megacycle input will be converted to the 4.3-mc system. For this adjustment, apply a modulated test tone of 10-mc to the input of the 6K8 converter stage. Very loose coupling to the input circuit is satisfactory. Next adjust the oscillator condenser to a frequency of 5.7 mc which will produce the necessary 4.3 intermediate frequency. This is done by rotating the condenser slowly until the test tone is heard in the speaker. The input grid tuning condenser of this stage is of course resonated to 10 mc and may be trimmed up when the set is working into either the v-h-f tuning unit or the external converter, if used.

Alignment of the radio-frequency section is equally straightforward. A test signal of 144 mc is fed into the mixer grid (954) by bringing the test oscillator output lead close to the grid cap. With the condenser gang coupling cut loose, the oscillator condenser is rotated until the frequency of the 955 oscillator corresponds to 134 mc. The detector condenser is then brought into alignment and the coupling tightened. The r-f stage is aligned in the same manner. Tests for tracking across the band are next made, and the usual procedure for adjusting the coils follows as with any low-frequency superhet. Details on these adjustments are more or less well known and will be found in any amateur handbook.

Operation

Should the unit be built and no signal is available on the 144-mc band, a great deal may be learned about tuning and aligning by adjusting the padder condensers to hit the 126.1-mc airport control tower frequency. This frequency is used constantly to direct the take-off and landing of aircraft at large airports and provides an excellent means for testing for oscillator injection, antenna coupling, etc. Also, less used aviation frequencies are found at 116 mc and 140 mc. Any of these bands can be covered by adjustment of the oscillator padder condenser and the re-alignment of the detector and r-f stages. Aircraft in flight may be heard up to 150 miles or so most any time. A decent antenna is absolutely necessary to receive the ground control towers up to 40 or 50 miles away, although aircraft in flight require only a short length of wire in the room for strong signals.

The finished job. Professional lettering was done with a regular rubber stamp and white paint



Bird's-eye view with the top of the v-h-f section removed to display the acorn tubes and tuning assembly

The receiver was placed in a cabinet and the front panel lettered with an ordinary office rubber stamp outfit using white oil paint on the rubber stamp pad. A National Velvet Vernier dial drives the tuning condensers.

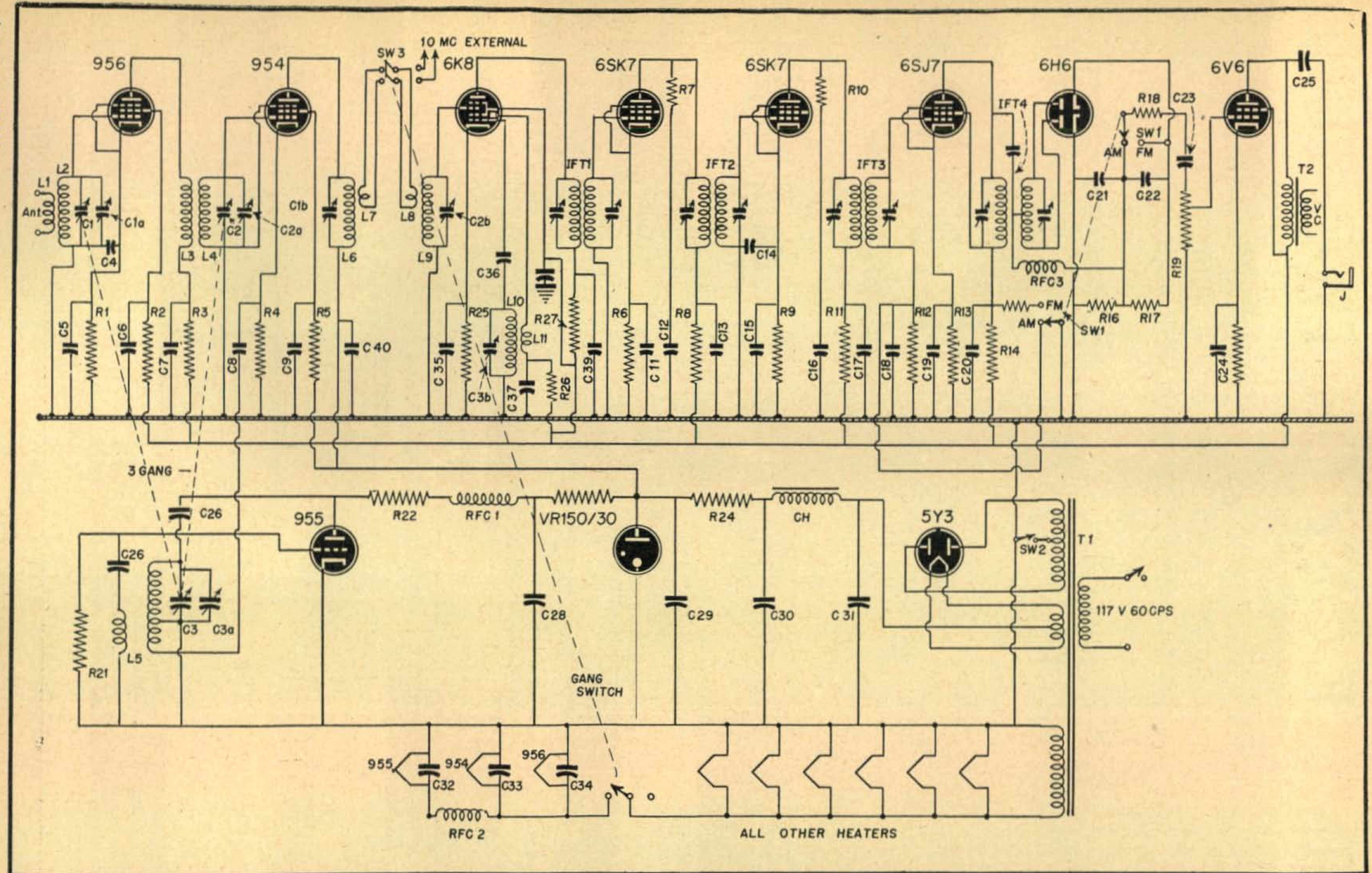
All in all, this kit provides a sensitive 144-148-mc FM-AM receiver which will work the socks off a super-regen and in addition will allow external converters covering other bands to be employed for the reception of AM and FM signals. The quality on FM is excellent if a reasonably good speaker is used, and should one be interested in FM reception of broadcast stations in the new 100-mc region just allocated, this receiver will do the job if the condenser plates are not sheared.

The total cost will be approximately $55 less speaker, but including all the following—

PARTS

L_1—Antenna coil: 3 turns insulated hook-up wire
L_2—R-f grid coil: 3½ turns No. 16 bare tinned wire spaced ⅞ inch
L_3—R-f plate coil: 2½ turns insulated hook-up wire
L_4—Det. grid coil: 2¾ turns No. 16 bare tinned wire spaced ⅝ inch
L_5—Osc. coil: Primary, 3¾ turns No. 16 bare tinned wire spaced ⅝ inch tapped at 1½ turns. Secondary, 2¼ turns insulated hook-up wire
L_6—Mixer Plate coil: 18 turns No. 22 enameled close-wound on a ⅝-inch form
L_7—Coupling link: 4 turns insulated hook-up wire wound on low potential end of L_6

[Continued on page 38]



Circuit diagram of the FM-AM Superhet for the 144-mc band

SIMPLE ONE OR TWO TUBE

RECOMMENDED AS A CONSTRUCTIONAL DIVERSION AND FOR CODE PRACTICE WITH INTERNATIONAL MORSE RECORDS

MANY HAMS ARE marking time waiting for the day when they can, once again, be on the air. The constructional urge hits them occasionally, but the question is what to build. A record player provides an outlet for this itch, and, furthermore, might be thought of as good insurance for the future. When we're back on the air, the XYL can play "mood" music while brooding about "radio windows," etc.

There is a tendency by some to deprecate anything a.c.-d.c.—although a good bit of the scorn is unwarranted. The use of a.c.-d.c. tubes in portable equipment permits a saving in both weight and cost, and fairly good quality can be obtained. An a.c.-d.c. record player is diagrammed in *Fig. 1*. The heart of the unit is a combination rectifier and output tube with a 117 volt filament. Types 117L7GT, 117M7GT, 117P7GT or 117N7GT tubes all work equally well. The convenience of having no resistance cord or filament dropping resistors makes them "naturals" for portable players. They are, admittedly, rather difficult to obtain at present, but no more so than many other tubes. With the grid of the tetrode section fed directly from a high output pickup, the power from these tubes can drive a 3″ or 4″ speaker when playing commercial pressings.

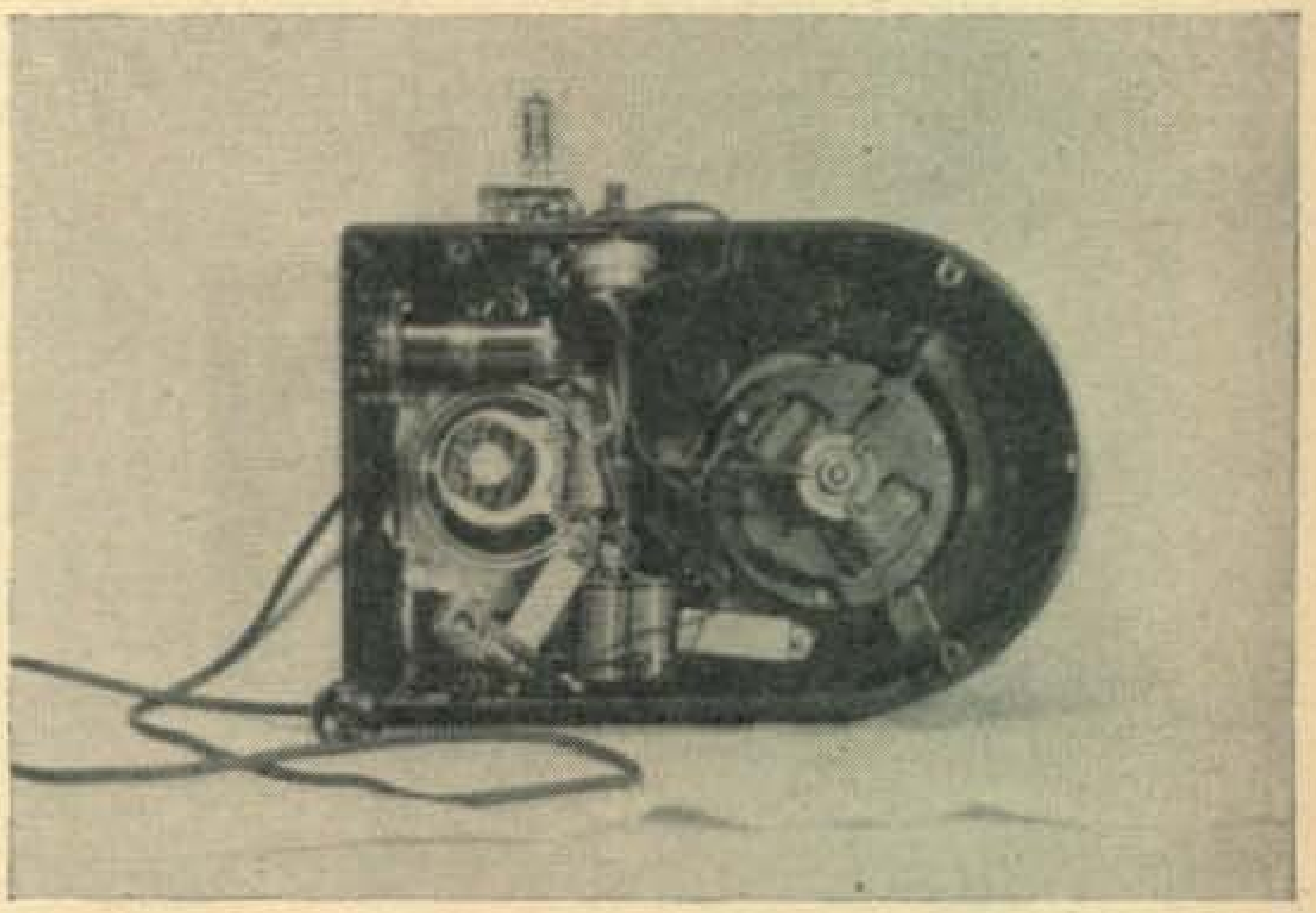
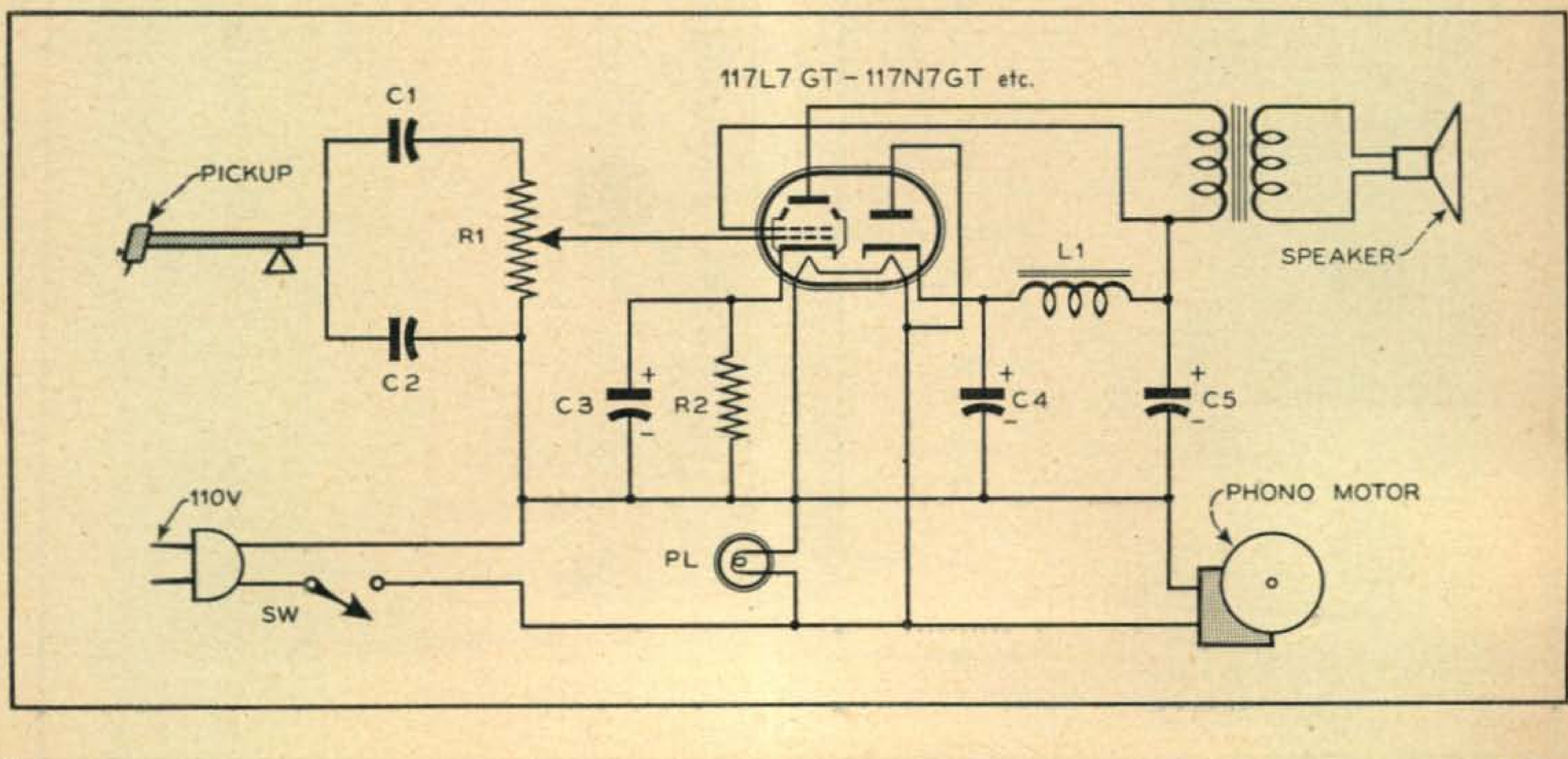


Fig. 3. Bottom view of the record player. The speaker faces the top or deck of the player. The 3S4 auxiliary amplifier is on top

Fig. 1. Wiring diagram of the record player, constructed with the following minimum parts—

C_1, C_2—.01 μf paper
C_3—25 μf 25 volts electrolytic
C_4, C_5—20 μf (or more) 150 volts electrolytic
R_1—500,000 ohms 1 watt
R_2—110 ohms 1 watt
SPKR—3 or 4-inch dynamic with 450-ohm field (L_1). A PM speaker can be used if a 50-ma 450-ohm choke is substituted for L_1.
Pickup—M-22 high-output preferred



RECORD PLAYER

HERBERT S. BRIER, W9EGQ

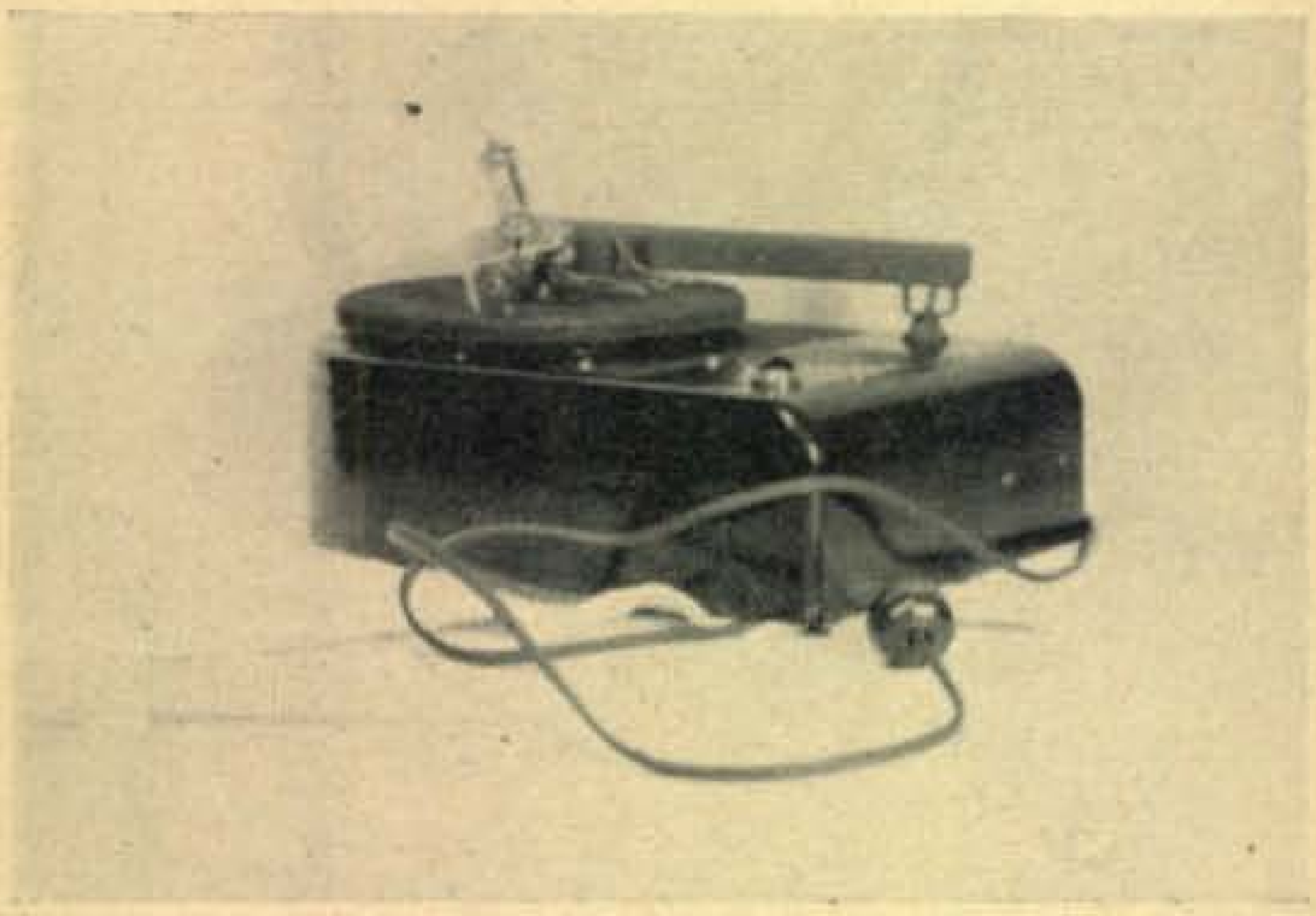


Fig. 4. The completed record player, with the 3S4 amplifier on the turntable. When used, this is mounted inside the case, to the right of the 117L7GT

Additional Amplification

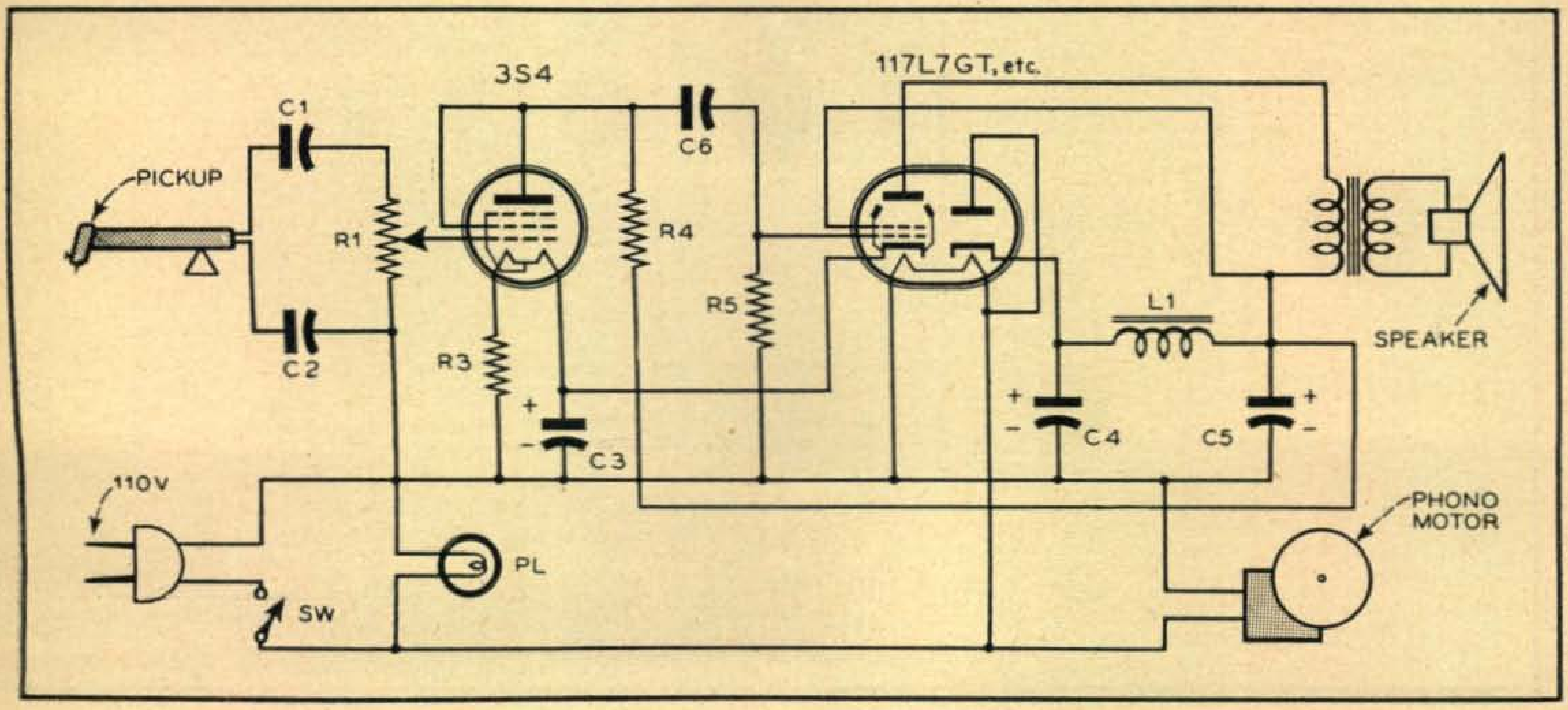
If the pickup is of low output type, or it is desired to play home recordings, a resistance-coupled triode stage can be added as shown in *Fig. 2* and get something almost for nothing. The total cathode current of the amplifier section of the 117L7-M7-P7 tubes is 47 milliamperes, and the filament current of many dry cell tubes is 50 milliamperes. So we just put the filament of such a tube in series with the cathode. A 3S4 with its plate and screen grid tied together is shown. Types 1E4G, 1G4G, or a 1LE5 could be used just as well except for their larger size.

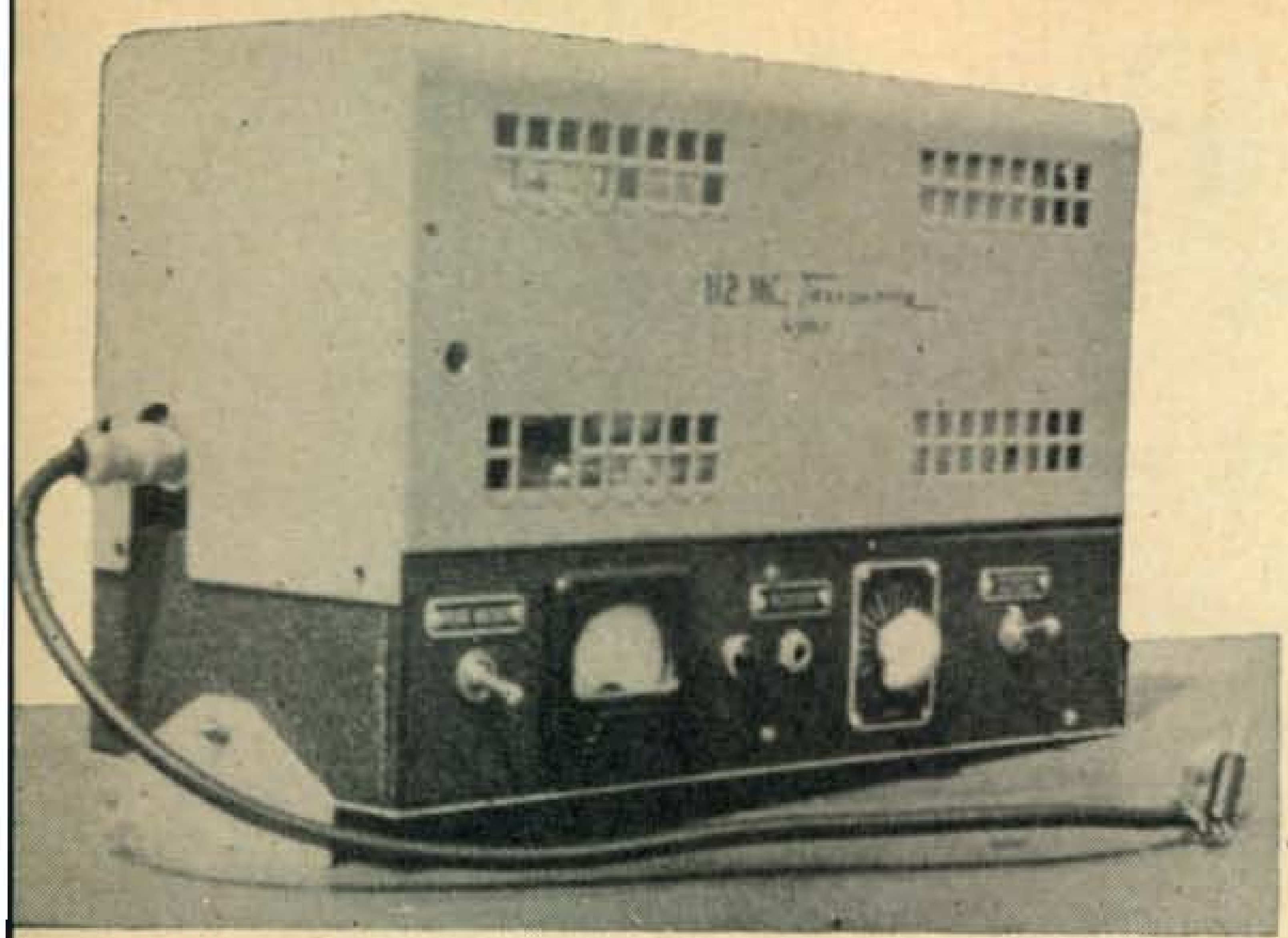
No curves have been run on the 3S4 used as a triode, but listening tests indicate a gain of about what would be expected from a resistance-coupled triode. The filament is connected on the cathode side of the bias resistor in order to use the drop across this resistor to bias the 3S4.

The only precaution to be observed is to use enough capacity for C_4. While 10 μf will do, 20 μf or more is better. Insufficient capacity will result in a sustained audio howl. If this system is used with a 117N7GT, or other tubes whose total current runs slightly over 50 milliamperes, it would be advisable to insert a meter and adjust the value of R_2 so the no-signal current is 50 milliamperes or slightly less. The only other detail in the diagrams that might be thought un-

[*Continued on page 36*]

Fig. 2. Providing an extra stage for a low-output pick-up. Parts additional to those of Fig. 1 are—
C_6—.01 to .1 μf 400 volts paper
R_3—50 ohms ½ watt for 3S4, 75 ohms for 1E4G, 1G4G or 1LE5
R_4—100,000 ohms ½ watt
R_5—250,000 ohms ½ watt





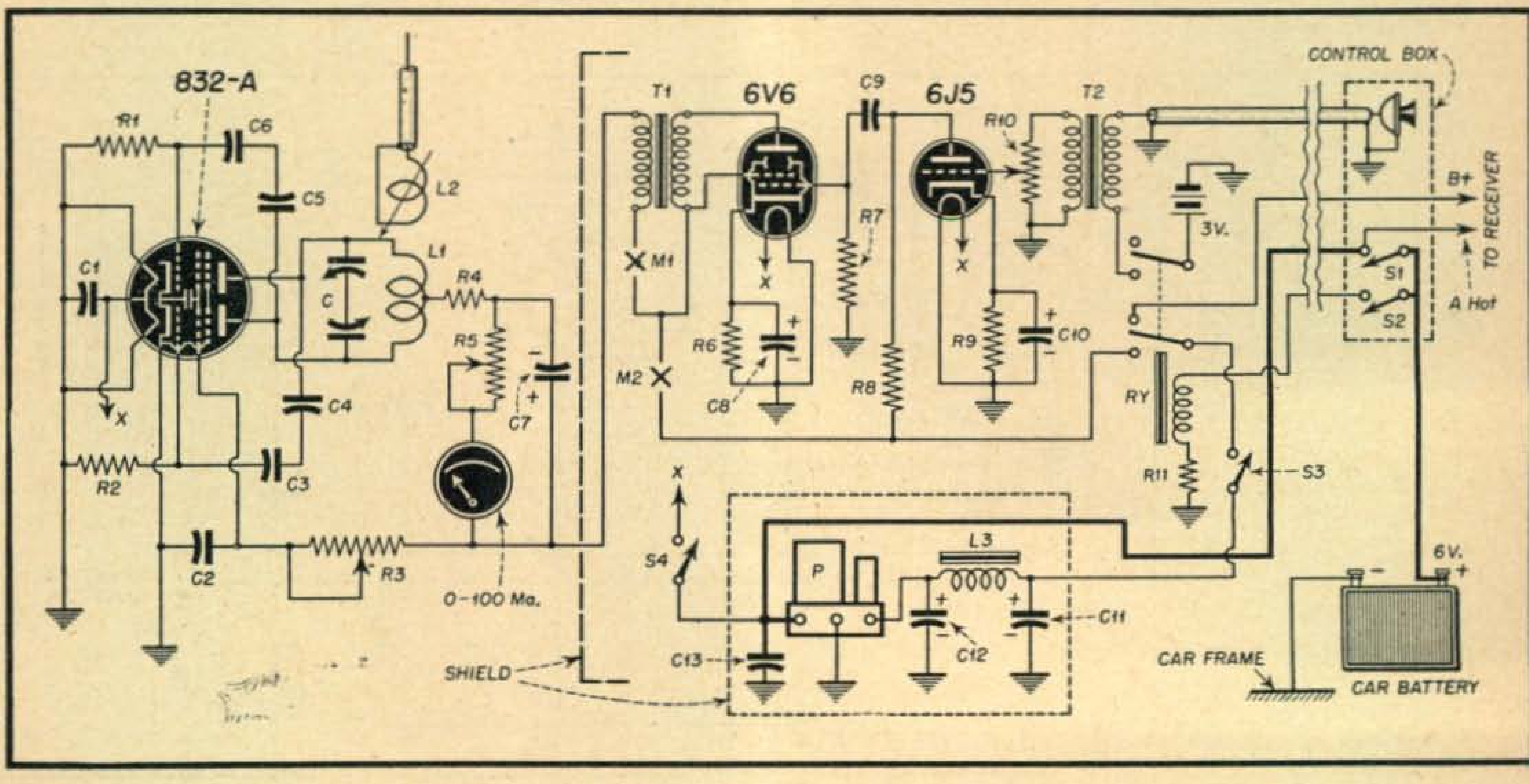
PORTABLE

JOHN WONSOWICZ, W9DUT
and
HERBERT S. BRIER, W9EGQ

RELIABILITY, EASE OF OPERATION, and compactness are the features of this transmitter. These requirements, in conjunction with our determination to use a standard 100 milliampere vibrator supply for plate power, immediately eliminated crystal control with all its attendant complexities. The various pictures and sketches show how we achieved our goals by using an 832-A. Before going into constructional details, let us examine the circuit diagram, *Fig. 1.* Two

Fig. 1. The 832-A transmitter uses the following parts, which are also keyed with Fig. 2

C—Cardwell ER-25-AD, 1 plate removed from each section
C_1, C_2—500 μμf mica
C_3, C_4, C_5, C_6—25 μμf (Erie) ceramic
C_7—8 μf 150 volts, electrolytic
C_8—10 μf 25 volts, electrolytic
C_9—.1 μf 200 volts
C_{10}—25 μf 25 volts, electrolytic
C_{11}—30 μf 450 volts, electrolytic
C_{12}—8 μf 450 volts, electrolytic
C_{13}—1 μf 50 volts
L_1—3 turns #8, 5/8" dia., 1" long
L_2—1½ turns #16, 5/8" dia., close wound
L_3—15 h filter choke
P—Mallory Vibrapack VP-554 300 volts, 100 ma
R_1, R_2—50,000 ohms, 1 watt
R_3—10,000 ohms, 10 watts, semi-variable
R_4—25 ohms, 1 watt
R_5—1,000 ohms, 10 watts, semi-variable
R_6—600 ohms, 2 watts
R_7—250,000 ohms, ½ watt
R_8—50,000 ohms, ½ watt
R_9—2,000 ohms, ½ watt
R_{10}—250,000 ohms potentiometer
R_{11}—2 ohms
RY—D.P.D.T. 6-volt relay
S_1—heavy-duty switch
S_2—stand-by switch
S_3, S_4—S.P.S.T. toggle switch
T_1—UTC S1B mod. transformer
T_2—UTC S6 mike transformer



MOBILE XMTTR

A Practical Rig for Present 112-mc WERS Operation and for Ham Work on the 144-mc Band

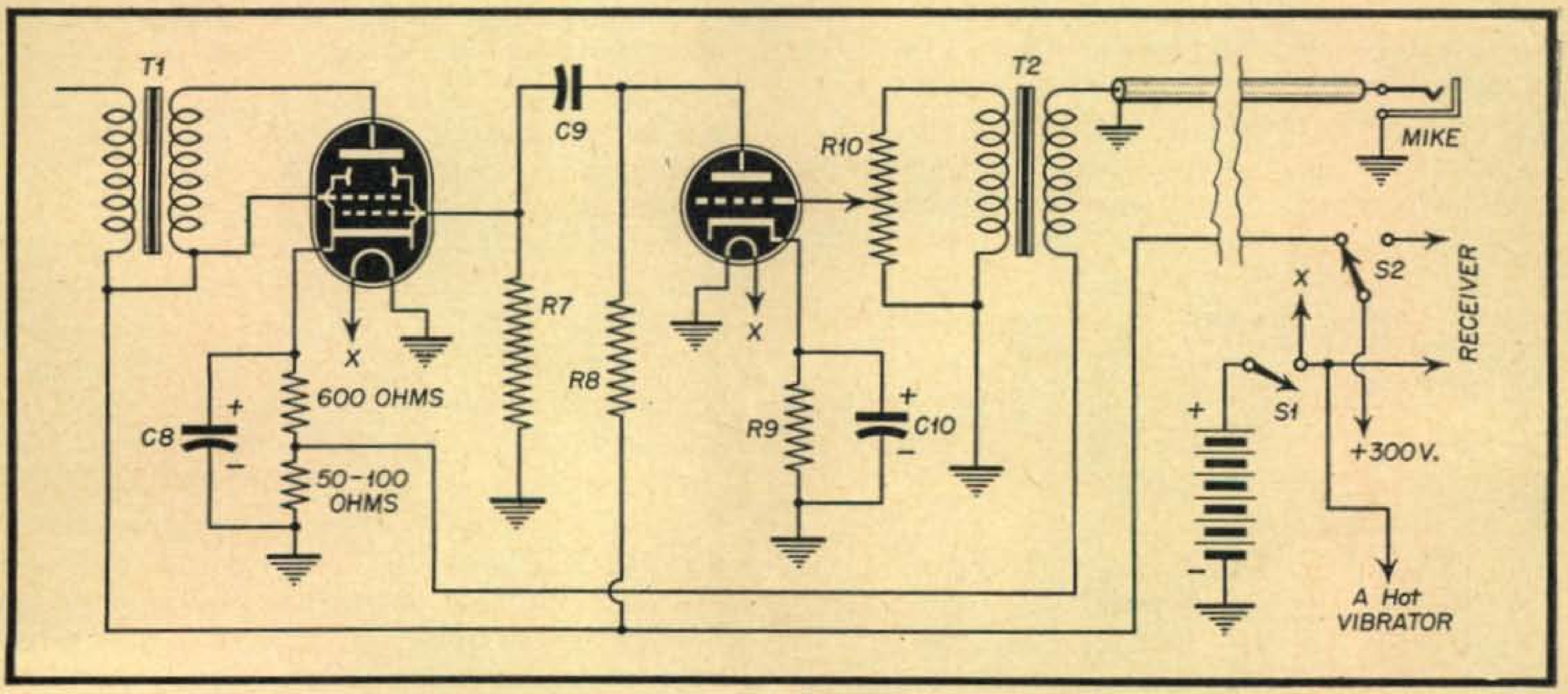


Fig. 2. Alternate switching and microphone circuit which eliminates the relay. Values are the same as in Fig. 1

unusual things are immediately apparent, the use of dual condensers in series for feed-back in the oscillator, and the absence of r-f chokes.

The series connection of feed-back condensers C_3-C_4 and C_5-C_6 minimizes the effects of lead inductance, and works well in practice. Several other methods of obtaining feed-back voltage were also tested. The best of these was twisting together two insulated wires about four inches long, and connecting one end of one wire to the plate, and the opposite end of the other wire to the opposing grid. The main objection to this system is the difficulty of obtaining the correct capacity, which is rather critical for best results. Less than ten $\mu\mu$f gives insufficient excitation and low output. More than 15 $\mu\mu$f causes the tube to operate erratically, the plate current decreasing with increased antenna loading, with high output on one frequency and low output on a slightly different one. The indicated value of 12.5 $\mu\mu$f works very well.

Circuit Analysis

Carbon resistors are used to keep the r-f currents where they belong—and, being non-inductive, no trouble with resonating chokes is encountered. Resistors R_1 and R_2 supply grid bias, and maintain the r-f on the grids. R_4 is the r-f blocking resistor in the plate circuit. Don't let its low resistance fool you; it does the trick. (Use uninsulated resistors in the radio-frequency). Resistor R_5 reduces the no-load plate current of the 832-A to 50 milliamperes, and its actual value may vary somewhat. A 1,000-ohm semi-variable resistor can be used here.

The cathode resistor R_6 of the modulator tube is somewhat higher in resistance than usual in order to hold the total plate and screen current of this stage to 30 milliamperes.

Condenser C_7 by-passes the modulation currents around the meter and R_5. Its exact value is not critical and anything over one $\mu\mu$f works well.

In fact, omitting it entirely has little effect on the operation of the unit.

The meter is placed in the plate lead of the 832-A, because it shows the effect of varying the antenna coupling most clearly at this point. M_1 and M_2 show alternate positions. At M_1 the combined plate and screen current of the 832-A is shown, while at M_2 the total current drawn by the oscillator and modulator is indicated. Each position has its advantages; so it is a matter of personal preference which is used. At any rate, all these currents should be measured when the unit is first placed in operation.

Using a universal modulation transformer at T_1, instead of the more conventional audio choke, permits the r-f load to be matched properly to the modulator. Taps are chosen to match the 9,000-ohm load resistance of the 6V6 to the 4,300-ohm load represented by the oscillator. A choke can be used, of course, with some increase in distortion (to be expected with more than a 2:1 impedance mismatch).

Diagram *Fig. 2* shows an alternate switching and microphone circuit, which eliminates the relay and the microphone battery. Incidentally,

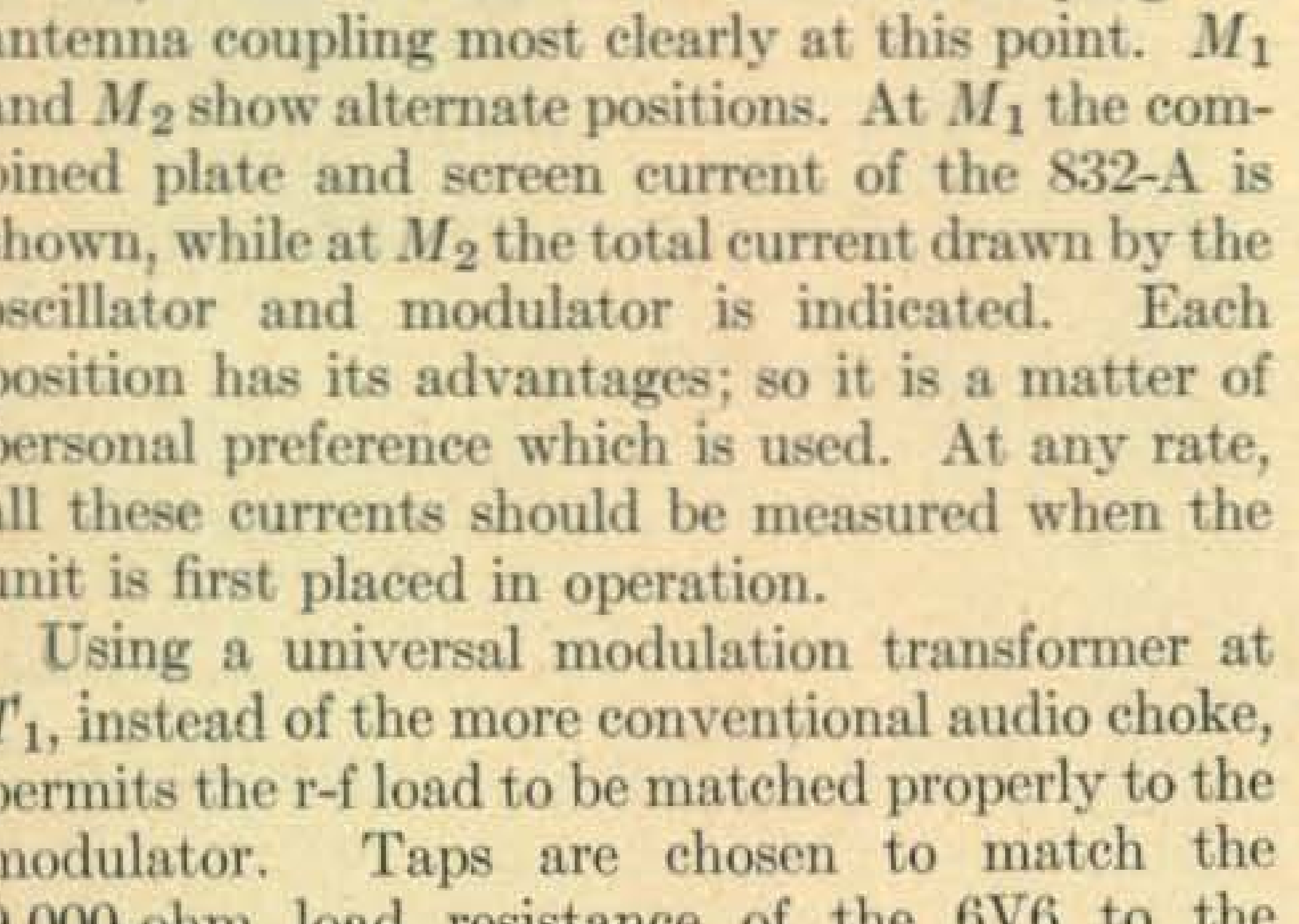


Fig. 3. Detailed sketch of the antenna coupling system, showing method of varying coupling. The Lucite rod pivots on the screw through the aluminum frame. Flexible leads connect to the transmission line socket

all of the variations we mention have been tested, and found to work in practice as well as in theory.

Constructional Details

The actual construction is straight-forward, as indicated in *Fig. 3* and the photographs *Figs. 4, 5* and *6*; so only a general outline of the steps is given. The unit is built on a 6″ by 14″ by 3″ chassis, and is supplied with a dust cover. The inside height of this cover is 6½ inches and determines the height of the shield can for the vibrator supply and the baffle shield between the audio and r-f sections. Putting the shield can over the vibrator supply reduces hash pick-up considerably, and is recommended.

Locating the power supply on the extreme

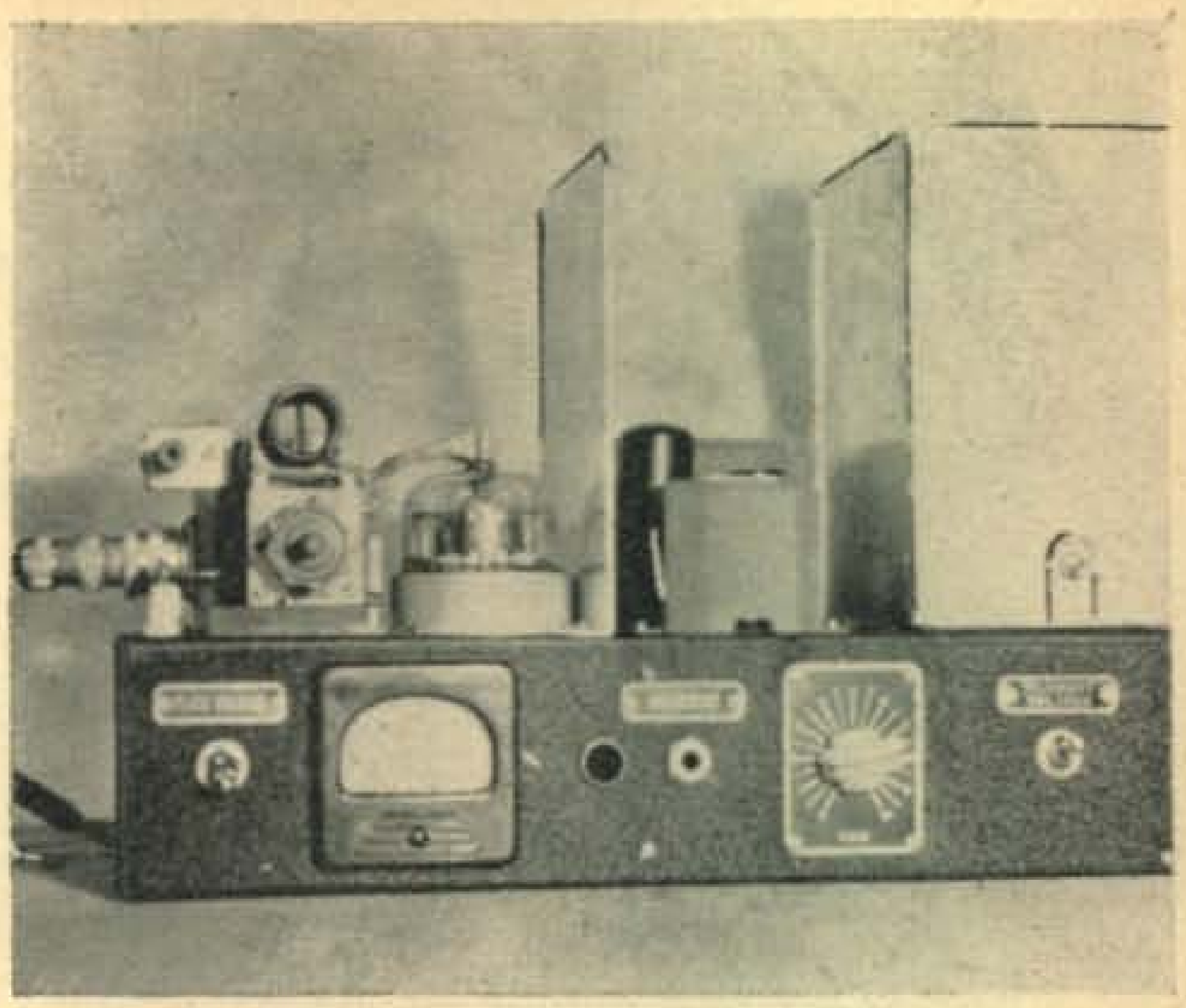


Fig. 4. Controls from left to right are—plate voltage switch (meter and pilot light) microphone jack, gain control and filament switch. Directly above the filament switch is the vibrator voltage adjustment

right of the chassis practically determines the position of the other components. A 2-inch diameter hole for the 832-A is next cut with its center 4½ inches in from the left-hand edge and 3 inches from the front. The tube socket and the tube shield, which is two and five-sixteenths inches in diameter and three-quarters of an inch high, are then temporarily mounted, while the positions of the lateral shields above and below the chassis are determined. Punch the audio tube socket holes along the center line of the chassis in the space between these shields and the power supply. Mount the microphone and modulation transformers in front and back of these tubes.

The entire radio-frequency section, with the exception of the 832-A, is mounted on a 2″ by 4″ by ½″ piece of bakelite, which, in turn, is fastened to the chassis by means of two screws. Note that the rotor of the tank condenser is *not* grounded.

Details of the system for varying the antenna coupling, and general layout of parts for this section are shown in *Fig. 3* which also shows the position of the connector for the coaxial feed-line to the antenna. This connector is similar to a crystal microphone plug, but is supplied with low-loss insulation.

Sockets for the microphone battery, control leads, and A battery cable are mounted along the rear lip of the chassis. It is essential that the 6-volt terminals make firm low-resistance contacts. A standard 120-volt a-c plug and receptacle do a good job. There is nothing sacred about the position of the meter and controls. However, the pictures show a convenient arrangement. Wiring is simple point-to-point with no attempt made to make it look "pretty." All grounds are soldered to a heavy bus which runs the length of the chassis. If the 832-A socket is mounted so

Fig. 5. A worm's eye view of the works. Radio-frequency section to the left of the center shield, with the antenna cable connected

the plate terminals of the tube parallel the tuning condenser, it will take a real effort to use anything but short leads in the r-f section.

Similarly, in the audio section, if the major components are mounted in the positions suggested, short leads are almost obligatory. The only long lead is the one from the output transformer to the radio-frequency section. As the greater part of it is shielded from the rest of the audio components, its length is unimportant.

Tuning Up

After the wiring is completed, first check the plate and screen voltages, and the plate current of the 832-A. The screen voltage should be approximately 70% of the plate voltage, and the unloaded plate current about 50 milliamperes. If the current exceeds this value, vary the plate and screen voltages by adjusting R_3 and R_5. It might be thought that full plate voltage could be run on the tube, and the plate current adjusted to the required value with R_3. This can be done, but the ratio of plate and screen voltages is rather critical for maximum output. Reducing the plate voltage approximately 25 volts actually reduced the output less than running full potential and reducing the plate current by dropping the screen voltage. However, it is interesting to experiment with the screen voltage.

Once the no-load current is adjusted, a dummy load, such as a 6-watt, 120-volt bulb, may be coupled to the tank circuit. An output of more than six watts is indicated with a plate current of 60 milliamperes.

Running 60 ma on the plates makes the total current drain on the power supply about 104 milliamperes. This slight overload does no damage to the supply, but under no circumstances should the total current exceed 108 ma. A 125-milliampere supply allows the unit to be operated without the dropping resistor, and with normal bias on the modulator. However, the practical benefits of the increased power are extremely small—not enough, in our opinion, to warrant the extra drain on the car battery.

Antennas

Two different antennas have been used with this transmitter—a three-quarter-wave radiator, and the present "J." The "J" works slightly better, and the matching stub fastened alongside the three-quarter-wave section increases the rigidity of the assembly. It is conventional practice when feeding a "J" with low-impedance cable, to connect the cable in place of the shorting bar. However, we have found that using the bar, and connecting the flexible 59-ohm line about seven inches from the bar more than doubled the signal as measured on a field strength meter. No doubt there are standing waves on the line, but its short length makes losses negligible.

Results have been most satisfactory. Mounting the transmitter on shock mountings picked up in an Army-Navy surplus store for 25 cents, contributes to mechanical stability. Drift from a cold start is too slight to be detected by ear, using a superhetrodyne receiver with 100-kilocycle selectivity. Employing this same receiver on FM, it is necessary to detune from the center

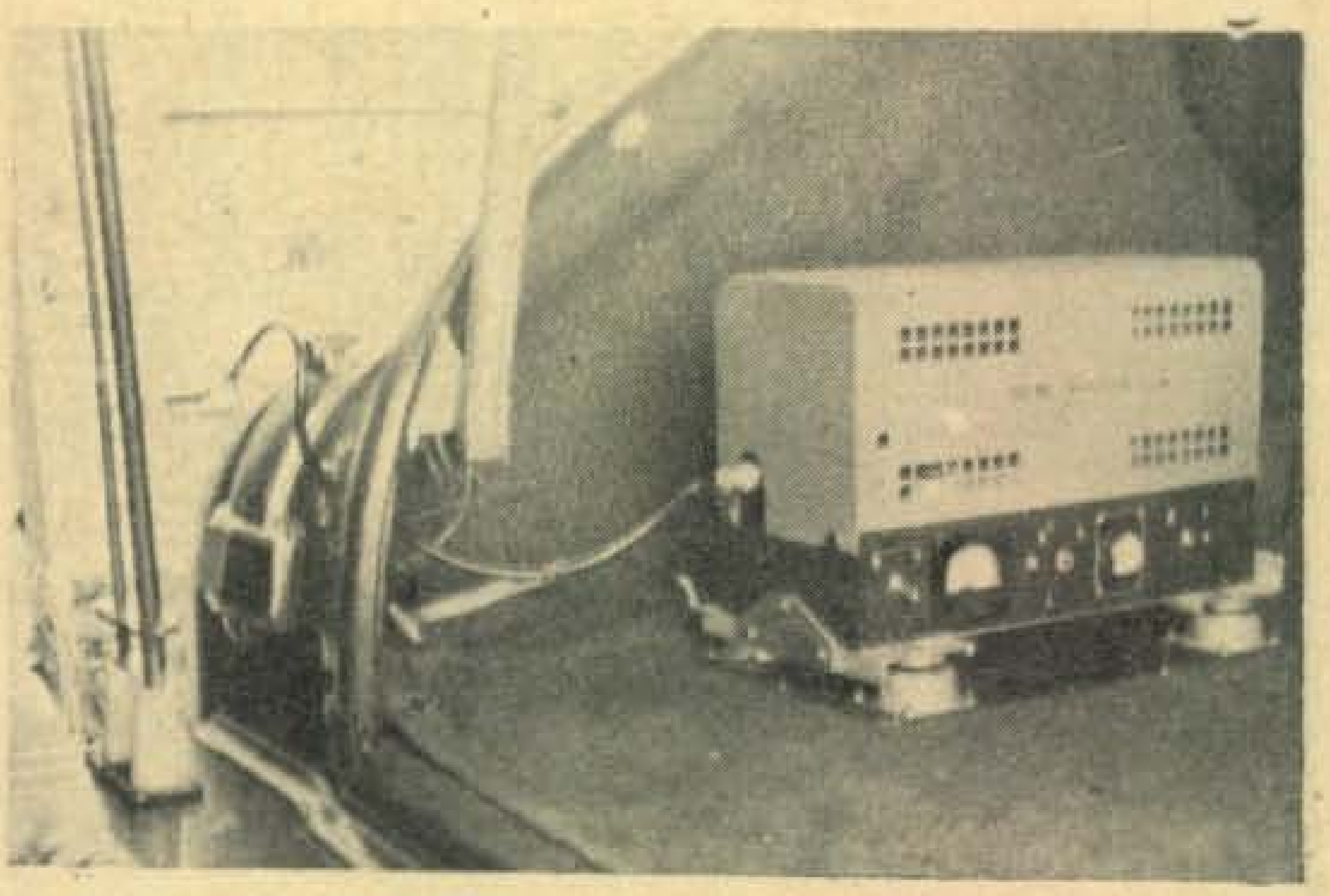


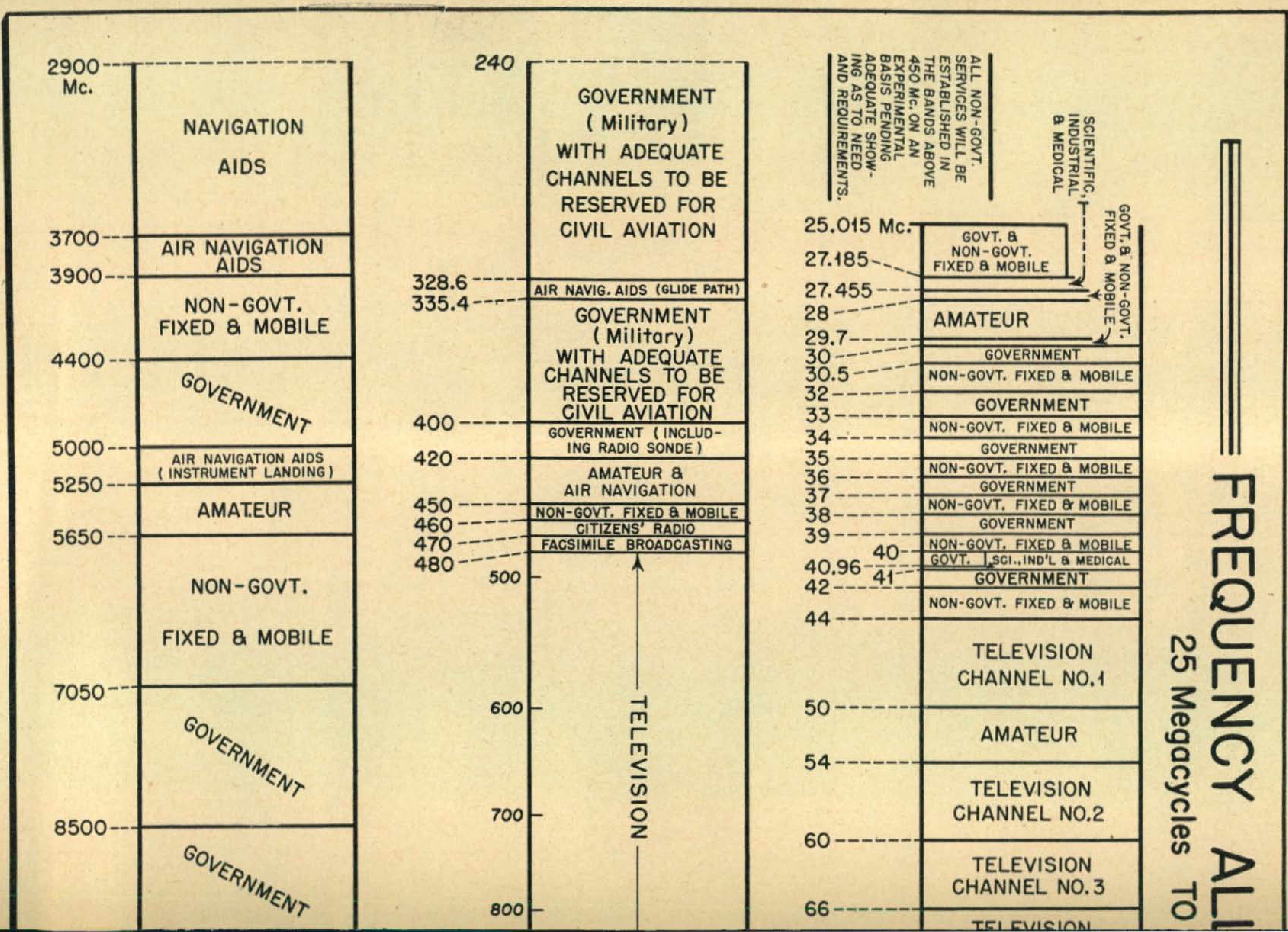
Fig. 6. The 832-A transmitter (WKMR-10) installed in the car carrier and ready to go. The shock mountings are Army-Navy surplus at 25c each

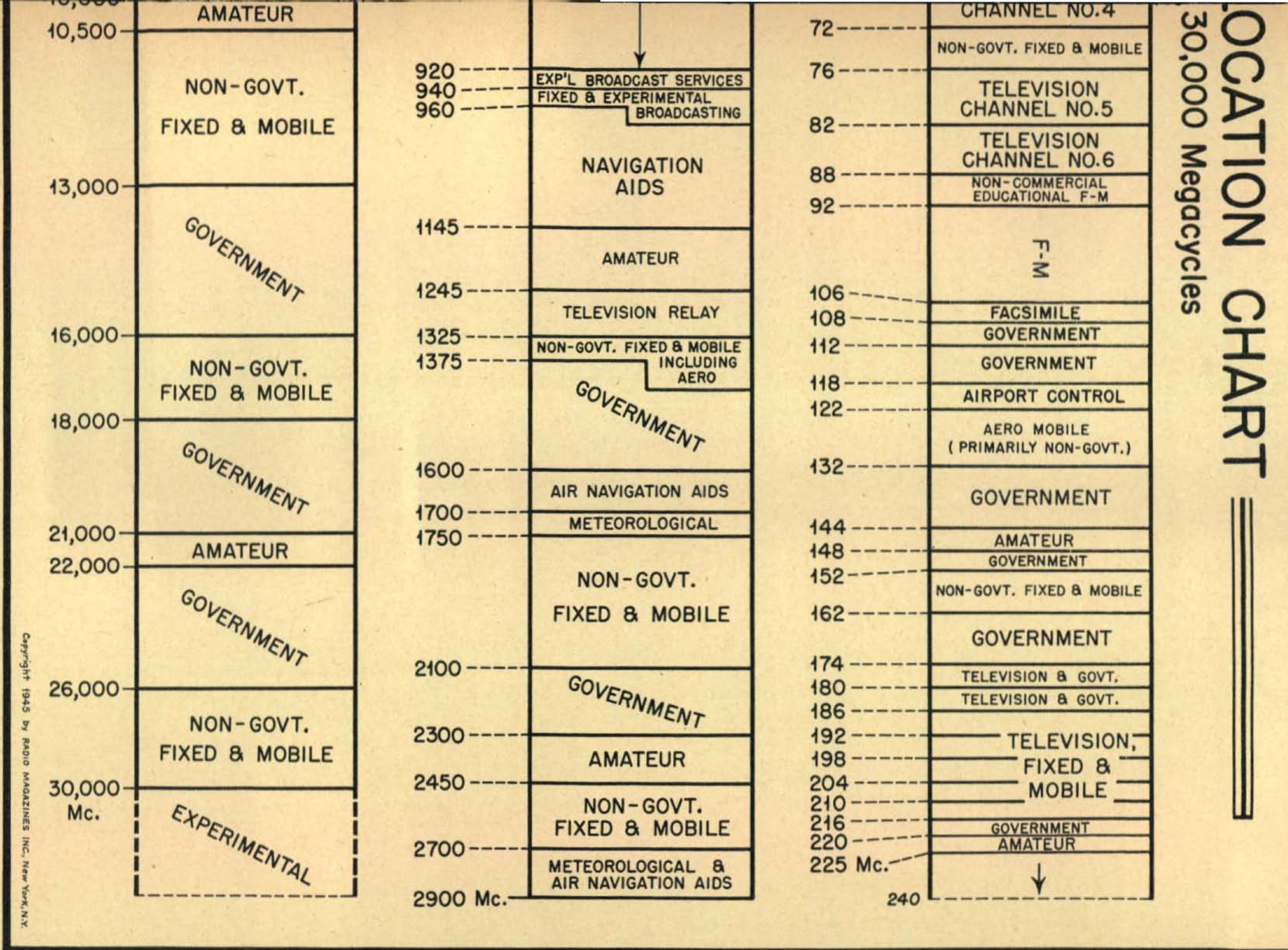
of the carrier to understand the modulation, which indicates that frequency modulation is not very pronounced. (Most modulated oscillators are copied "right on the nose" in the FM position). Two way contact can be made with control almost anywhere within 15 miles, and even greater distances have been spanned from favorable locations.

No mention is made of any method for switching the antenna to the receiver, because the receiver uses the regular car aerial. Adjusting its length to a quarter wave gives very good results. The receiver used in conjunction with this transmitter employs a super-regenerative detector with a t-r-f stage. The tube line-up is 9003, 9002, 6J5 and a 6G6G.

FREQUENCY ALL...

25 Megacycles TO





OCATION CHART
30,000 Megacycles
AMATEUR
10,500
NON-GOVT. FIXED & MOBILE
13,000
GOVERNMENT
16,000
NON-GOVT. FIXED & MOBILE
18,000
GOVERNMENT
21,000
AMATEUR
22,000
GOVERNMENT
26,000
NON-GOVT. FIXED & MOBILE
30,000 Mc.
EXPERIMENTAL
920
EXP'L BROADCAST SERVICES
940
FIXED & EXPERIMENTAL BROADCASTING
960
NAVIGATION AIDS
1145
AMATEUR
1245
TELEVISION RELAY
1325
NON-GOVT. FIXED & MOBILE INCLUDING AERO
1375
GOVERNMENT
1600
AIR NAVIGATION AIDS
1700
METEOROLOGICAL
1750
NON-GOVT. FIXED & MOBILE
2100
GOVERNMENT
2300
AMATEUR
2450
NON-GOVT. FIXED & MOBILE
2700
METEOROLOGICAL & AIR NAVIGATION AIDS
2900 Mc.
CHANNEL NO.4
72
NON-GOVT. FIXED & MOBILE
76
TELEVISION CHANNEL NO.5
82
TELEVISION CHANNEL NO.6
88
NON-COMMERCIAL EDUCATIONAL F-M
92
F-M
106
FACSIMILE
108
GOVERNMENT
112
GOVERNMENT
118
AIRPORT CONTROL
122
AERO MOBILE (PRIMARILY NON-GOVT.)
132
GOVERNMENT
144
AMATEUR
148
GOVERNMENT
152
NON-GOVT. FIXED & MOBILE
162
GOVERNMENT
174
TELEVISION & GOVT.
180
TELEVISION & GOVT.
186
192
TELEVISION, FIXED & MOBILE
198
204
210
216
GOVERNMENT
220
AMATEUR
225 Mc.
240

YL OPERATORS

ANITA CALCAGNI BIEN, W8TAY

"Nita"—or "Tay" if you prefer—has been an officer with the YLRL for many years. She modestly refrains from mentioning her own wartime radio chores with the Acoustic Lab of the Brush Development Corp. W8TAY suggests that YLs interested in the YLRL contact Secretary Lou Lacy, W5IKO, Box 1332, Bartlesville, Ohlahoma.

While the Japanese pyrotechnics of December 7, 1941, definitely put an end to hamming for the duration, it didn't stop hams from being "born." The amateur radio fraternity has a brand new influx, known as "LSPH" (licensed since Pearl Harbor) members, all embryonic hams. Naturally, many are radio-minded women, eager to tangle with the OM on the airwaves. But don't get the idea that they are going to be a "bunch of lids." True, some of the boys and girls aren't too familiar with the magic of the "Q" code and they haven't experienced the thrill of their first QSO; but, on the other hand, some have a radio jargon and knowledge that might shame an OT. Others are already highly skilled operators, with enviable records of achievement on the home and battle fronts. And many are competent electronic technicians, cryptographers, teachers and radio researchers.

The YLRL

The YL infusion has been particularly noticeable in the ranks of the YLRL (Young Ladies' Radio League), an international organization composed strictly of government-licensed feminine radio amateurs—phone and c.w. operators. Wars have a way of disrupting the usual procedure of things, so has it upset the generally accepted idea of newly licensed hams. Ordinarily it would be very difficult to share a hobby with someone who has never practiced it. Through the YL HARMONICS, lively little YLRL house-organ, some of the LSPH gals are learning the ropes and getting proper stimuli. A constant emulous spirit goes on among the girls and occasionally a newcomer far excels the seasoned op in radio skill.

Many of the LSPH's are relatives, friends and sweethearts of amateur operators. Constant exposure to the elements involved, resulted in the amateur "bug." Some of these people have gone so far as to have QSL's printed and have quite a collection of exchange cards from hams—a practice discouraged by a few dyed-in-the-wool ops, who honor a QSL strictly for the purpose for which it is intended. Nevertheless, it furnishes an exicting new hobby to these avid collectors, even if it nettles a minority of the pre-LSPH period.

A W2LSPH, who will furnish lively competition, is Ann Gray. She was a high speed telegraph op during World War I and switched to International Code during the 1941 emergency. Self-reliant and alert, she's the kind you are glad to welcome to the bands. She received her early telegraph training at Western Union in Chicago, but it was at Postal Telegraph that fate stepped in. She married the office manager, Harold Gray, later in charge of Zenith Radio Corporation equipment enroute to the Arctic with Admiral Byrd. Ann and Harold, the latter holding several commercial licenses, comprise only part of this typical radio family. There's a charming daughter Gloria Gray, W2LSPH, who graduated with the same class as her mother. Gloria was in fact the youngest YL member of the group. Then there's Ann's son, a radio Navy gunner, also an operator. Ann learned telegraphy in 1917, when in her early teens. She's worked all types of commercial wires—press, brokerage, races, special events, including confidential Air Corps operating. As members of the American Women's Voluntary Services, both of these W2LSPH licensees are in turn teaching code to other op aspirants.

Recruits From The AWVS

Not all the LSPH's were inoculated with the ham spirit because of present or potential family relationships. Some in Signal Corps jobs have hams as their superior officers or instructors and the infection set in. Patriotism prompted the study of radio in many instances, since it is playing such a vital role in winning this war. Civic-minded New Yorkers, and other coastal inhabitants, have been particularly defense-conscious. The ever-present enemy threat inten-

Introducing the LSPH'S

Right: Veterans of 2nd District YLRL who coached many LSPH's. Standing, left to right—Carolyn McKee (W2NGO), Vi Grossman (CQ writer, artist (W2JXZ), Eleanore (W2MWY), Marjorie (W2NRC); seated—Lenore Conn (W2NAZ), Marge Fisher (W2NAI), Violet (W2NIN) and Wilhelmina Grabner (W2MEG)

Left: Recent grads of the N. Y. AWVS radio classes in code room at headquarters. Left to right—Louise Willomitzer, Marguerite Reed (operator at a Governors Is. c.w. circuit), Edith Silverstein, Annette Dorfman, Rita Wittman, Marion Hart, Jean Grabscheid, Lenore Kingston Conn (Chief Instructor and Chairman of the radio classes), Edna Geist and Ann Gray (mother of Gloria)

sified radio training programs all over the country. YL hams have given unstintingly of their time and energy to help create a reservoir of new ops to fill the country's needs. Many LSPH boys and girls in the armed forces can thank radio for giving them a better break, plus a grand hobby to enjoy in post-war days.

In 1942, one of New York AWVS group graduated 66 new YL hams, all rarin' to go. None was more eager to do her bit to help establish the peace than Mrs. Maria Mendes, who received her amateur license at the age of 78. She had been a licensed radio operator in the first World War and the fever never deserted her.

Lenore Kingston Conn, W2NAZ (ex-W9CHD), then Second District Chairman of the Young Ladies' Radio League, inaugurated the first N.Y.C. American Women's Voluntary Services radio class. That was in April 1941. Lenore lives in a radio atmosphere. She is a radio actress and has recently turned script writer. A former brass-pounder, she was familiar with code and traffic procedure. With her chief assistant, W2OJT, Virgiline Heffernan, and other 2nd District YL and OM ops, they plunged into an extensive radio training program, designed primarily for civilian defense purposes. New York WERS and other War Emergency Radio Service stations, have since been manned by many experienced hams and LSPH operators, among them the untiring Lillian Ruocco, Jeannette Grabscheid and Ann Diamond—all capable operators. When Lenore's OM, W2MSC, Joseph Conn, former NBC television engineer, became a Navy Lieutenant, she followed him about the country and was last reported in Washington.

Constance Kilbourne, Rita Wittman and Doris Levy received training in the Press Wireless School. On Constance's maternal side lurks the spirit of Samuel F. B. Morse, who was her great-great-grand uncle. Then too, an old flame used to send her letters with snatches of code in them and both of these factors may have stimulated her interest.

LSPH's as Teachers

In the days before aviators were glorified, the railroad telegrapher was a special kind of hero. Such a man was the uncle of Catherine McFadden, W2LSPH, who listened in wonder to the tales he told. But her real interest was aroused when Orrin Dunlap of RCA was coaching Catherine's cousin, now with WHLD of Niagara

[*Continued on page 36*]

Radio Amateurs' Worksheet

No. 3. NOTES ON PUSH-PULL MODULATORS OR DETECTORS

In Fig. 1 is shown a vector OA in which the arrow indicates sense, and the direction is indicated by the line itself. The length of vector OA represents the magnitude of current or voltage. Vectors may be added or subtracted by a

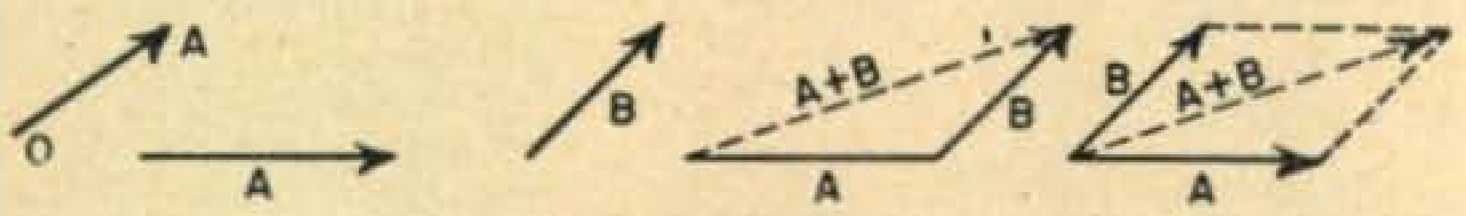


Figure 1

number of methods, one of which is shown in *Fig. 1*. In this case the vector sum of A and B is obtained by placing them end to end without altering their relative direction, sense, or magnitude. The vectors may also be added by making their origins coincident and completing the parallelogram as shown in *Fig. 1*. In this case the vector sum is represented by the diagonal of the parallelogram.

Vectors may be subtracted in like manner by reversing the sense of one of them, as shown in *Fig. 2*. Sense and direction usually represent relative phase of vectors in communication circuits. Thus the phase of B leads A and the phase of C lags A in *Fig. 3*. This is in accordance with

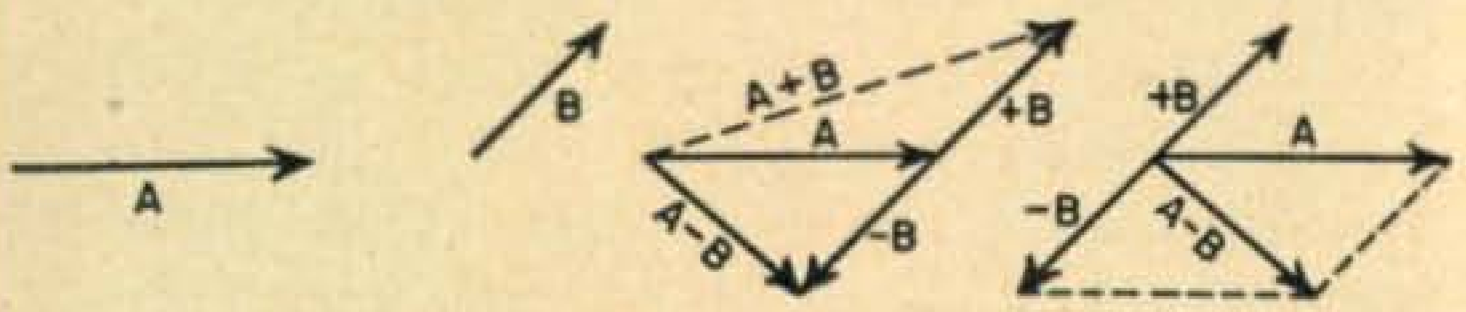


Figure 2

accepted conventions in which the vectors are considered to rotate in a counter-clockwise direction for alternating current or voltage.

An alternating current (or voltage) may also be represented by a sine (or cosine) wave of simple harmonic motion. The sine wave is generated by plotting the tip of the vector's vertical component as it rotates. This is shown in *Fig. 4*. The position of any vector relative to any other vector may also be shown by the angular rotation of the vector in radians, as indicated by the two sine waves of *Fig. 4*. Here the vector B is shown leading vector A by $\frac{\pi}{2}$ radians (90 electrical degrees). Vectors A and B in sine wave form may also be added or subtracted by arithmetically adding the ordinates of the two sine waves.

Fig. 5 illustrates schematically a generalized push-pull tube circuit using triodes, with power supply circuits omitted for simplification. There are two input circuits *1* and *2* and two output circuits *3* and *4*. If an alternating voltage, $A_1 =$

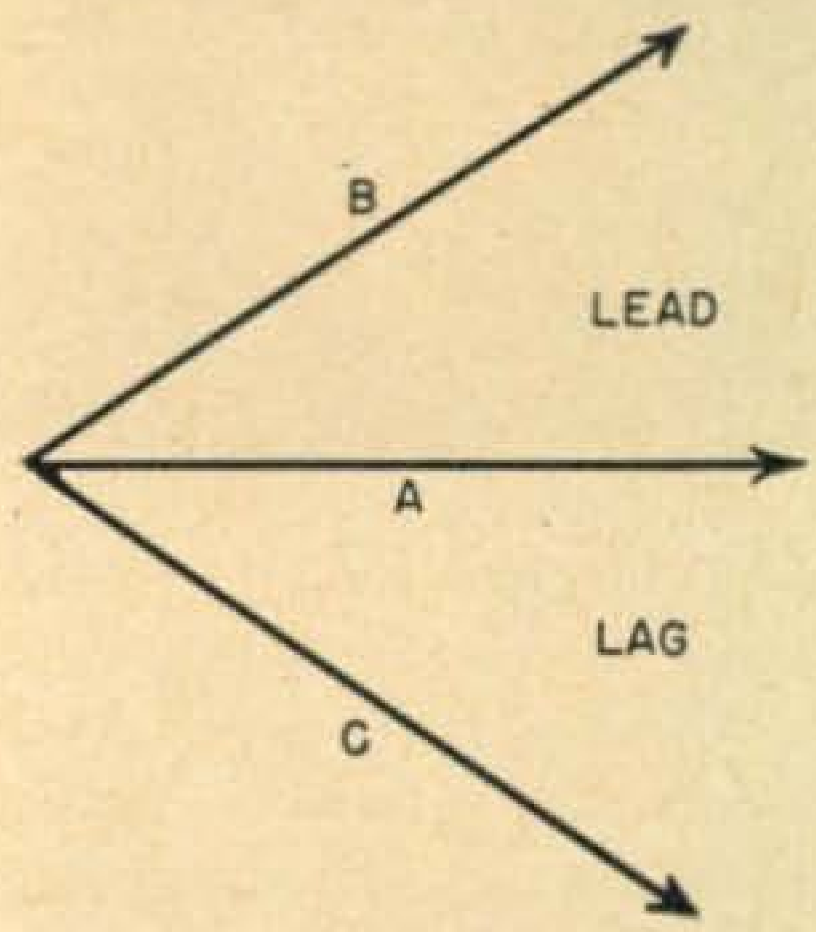


Figure 3

$A \sin \alpha$ is introduced at *1* the grids of the two triodes will be energized in phase opposition. That is, the grid of one tube will be positive maximum at the instant the grid of the other tube is negative maximum, and vice versa. The plate currents of the two tubes will bear the same phase relation to each other as the grid voltage. The windings of transformer *3* are assumed to be connected in such manner, the two voltages will be additive in the secondary. This is indicated by the arrows in *Fig. 5*.

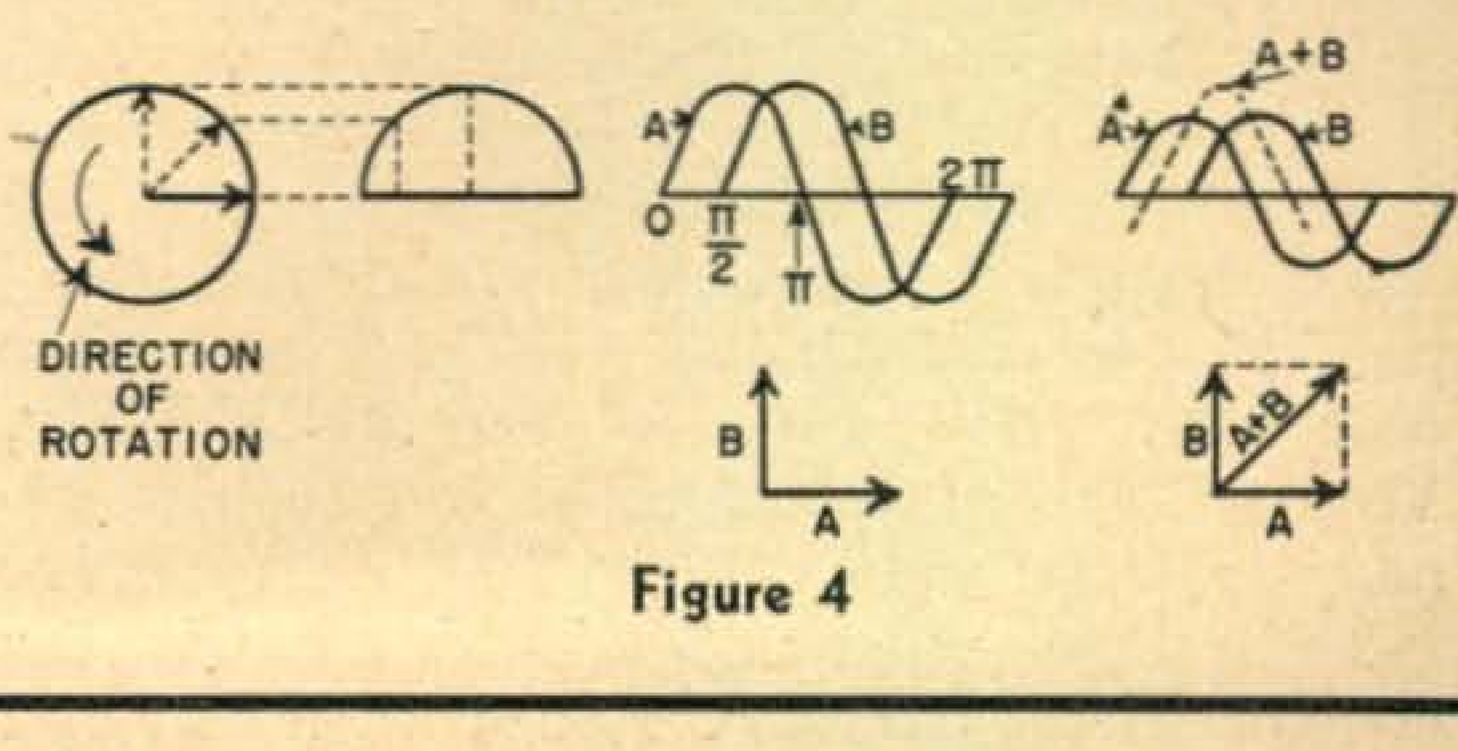


Figure 4

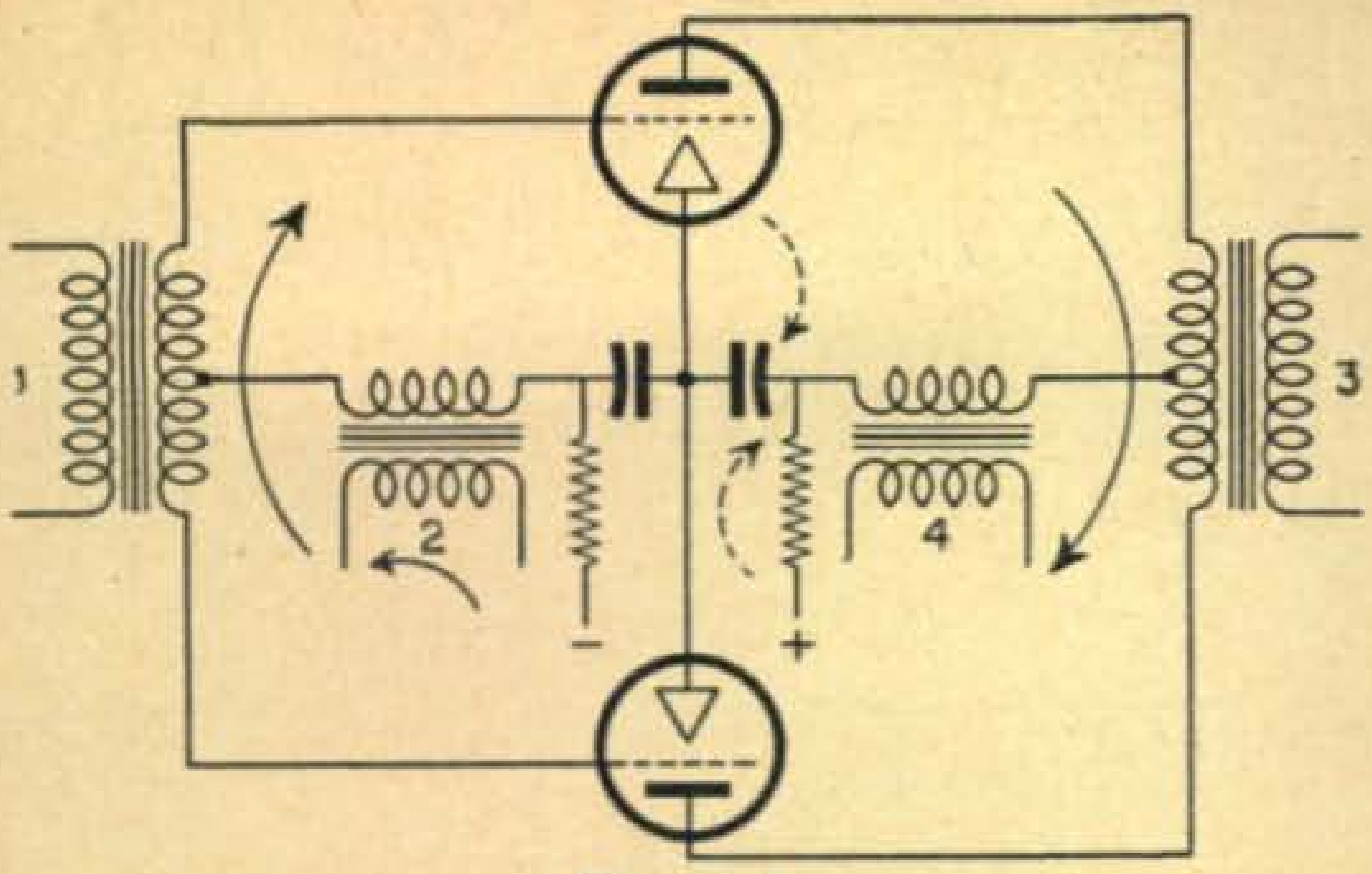


Figure 5

Fig. 6 shows what happens to the output currents assuming identical tubes and perfectly balanced transformers. As a result even harmonics are balanced out as shown in *Fig. 6*.

The dotted arrows in the triode plate circuits of *Fig. 5* indicate that the fundamental voltage across the primary of transformer *4* is zero for the conditions just discussed. However, as may be deduced from *Fig. 6*, the even harmonics will not be balanced out across the primary of transformer *4*. Thus we find that when a sine wave is introduced in the primary of transformer *1*, the fundamental and odd order harmonics (present in the triode plate currents) appear at *3* and the even harmonics appear in transformer *4*. The

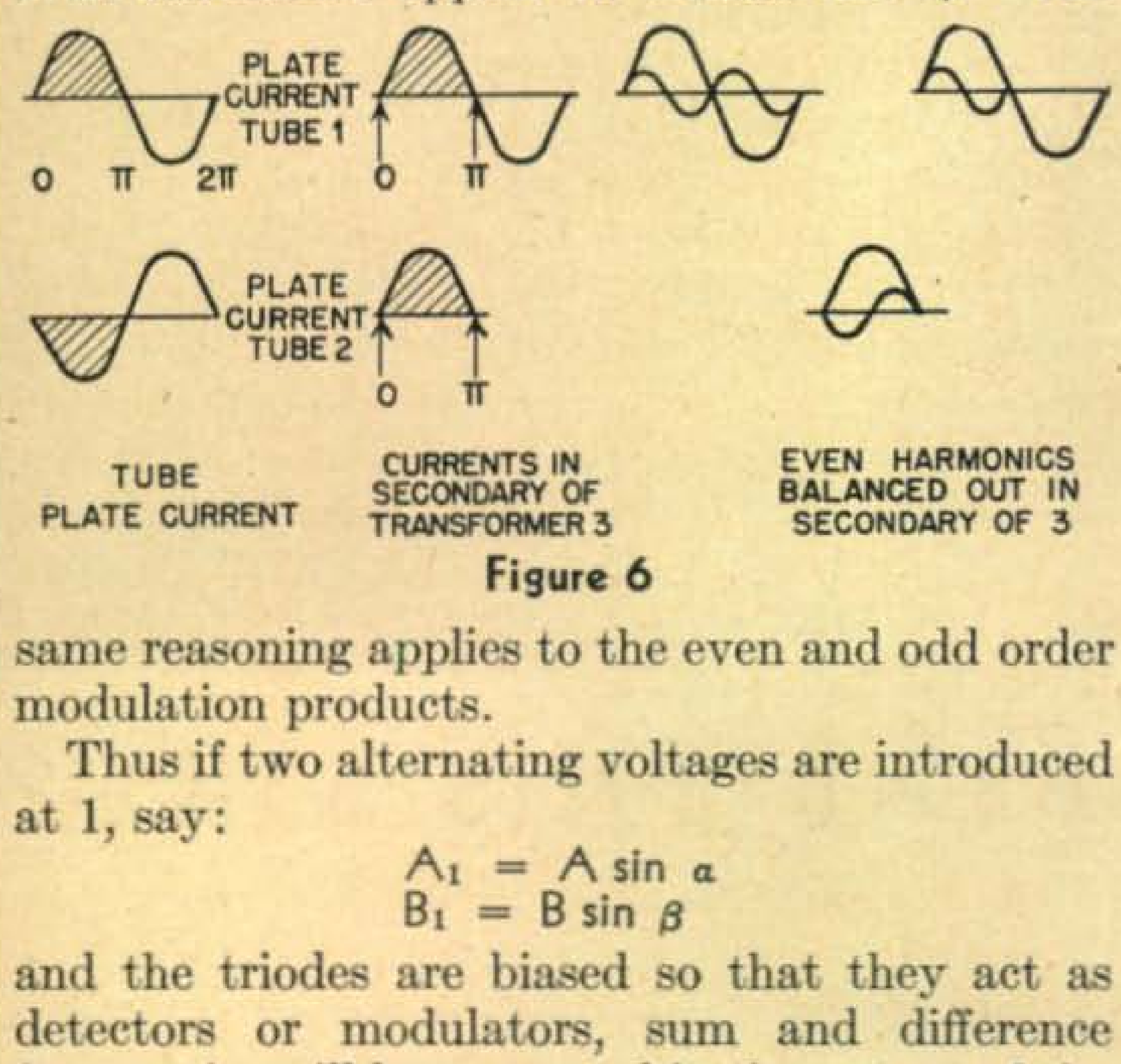


Figure 6

same reasoning applies to the even and odd order modulation products.

Thus if two alternating voltages are introduced at 1, say:

$$A_1 = A \sin \alpha$$
$$B_1 = B \sin \beta$$

and the triodes are biased so that they act as detectors or modulators, sum and difference frequencies will be generated in the output of the circuit of *Fig. 5*. Even order modulation products will be

$$(A_1 + B_1)\,(3A_1 + B_1)\,(3A_1 - B_1)$$
$$(A_1 - B_1)\,(3B_1 + A_1)\,(3B_1 - A_1)$$

Odd order modulation products will be

$$(2A_1 + B_1)$$
$$(2A_1 - B_1)$$
etc.

By much the same reasoning as that applied to even and odd order harmonics above, it may be shown that even order modulation products behave as do even harmonics and odd order modulation products as odd harmonics. Consequently, for the case in question

$$(A_1 + B_1)$$
$$(A_1 - B_1)$$
etc.

will appear at output *4* and odd order products:

$$(2A_1 + B_1)$$
$$(2A_1 - B_1)$$
etc.

will appear at output *3*.

If an alternating voltage is applied at *2* instead of *1*, then the grids of the triodes will be

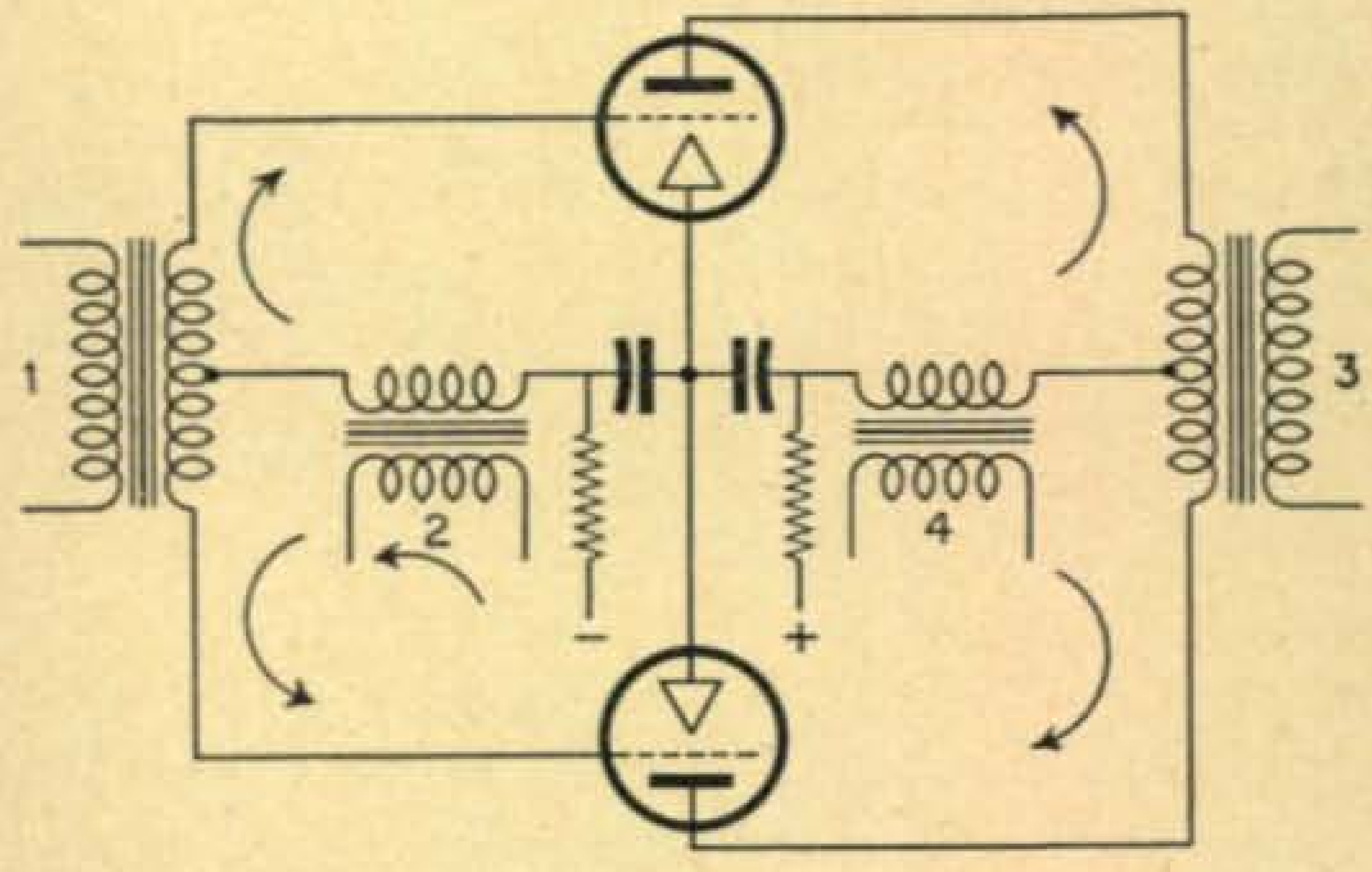


Figure 7

excited in phase instead of in phase opposition. The plate currents of the triodes will likewise be in phase and balance out at differentially connected transformer *3* and be additive at transformer *4*. Since transformer *4* is connected to the triode plates in parallel instead of differentially as in transformer *3*, the second and other even order harmonics will balance out at transformer *3* and be additive at transformer *4*. If two alternating voltages are introduced at *2* then the modulation products will also appear at *4* and be balanced out at *3*. This is illustrated by the arrows in *Fig. 7*.

From the above we may construct the following chart for the push-pull modulator circuit. This chart is useful enough that it should be preserved for future reference.

IN AT		OUT AT	
1	2	3	4
A_1	—	A_1	$2A_1$
A_1 B_1	— —	A_1 B_1 $2A_1-B_1$ $2A_1+B_1$	$2A_1$ $2B_1$ A_1+B_1 A_1-B_1
A_1	B_1	A_1 A_1+B_1 A_1-B_1	B_1 $2A_1$ $2B_1$ $2A_1+B_1$ $2A_1-B_1$
— —	A_1 B_1	Everything	Nothing

Lieut. Colonel Talley—somewhere in England, 1944

A BRIEF for the HAM

LIEUT. COL. DAVID TALLEY
Sig. Corp., W2PF-WLNA

THE WORTH OF the radio amateur to his community during floods, fires, hurricanes is well-known, and many stories have been written about the services rendered by amateur radio stations in handling important messages during such emergencies. Public services performed by hams at other times have not been equally publicized. The following is a true story taken from the files of the old Second Corps Area AARS Bulletin which illustrates an important personal service rendered by a group of Army Amateur radio operators.

In September, 1934, a Mr. X (name on request) of Lynbrook, Long Island, N. Y., appealed to the Nassau County Police at Mineola, to find his son and junior partner who was touring somewhere in Alabama or Georgia. It was necessary for this man to get in touch with his son the same afternoon in order to execute a bond transfer involving $250,000. The police informed him that they could not send the information to the Southern States (they did not have teletype connections at that time). The Chief Operator of the Nassau County Police broadcasting station was informed of the matter. He called a local member of the AARS, W2CHK, who immediately prepared a message with the details, and sent it to his State Net Control Station, W2DBQ. Within a matter of minutes, W2DBQ changed to the Army Net frequency and passed the message along to the Fourth Corps Area Net.

In the town of Birmingham, Ala., two hours later, Mr. Y, the son of Mr. X, was parking his car in front of a hotel on the main street, when a policeman approached and inquired if he was Mr. Y of Lynbrook, New York. The startled young man acknowledged his identity and he was told to call his father by long distance at once. He did, and then sent the transfer papers by air mail. Mr. X subsequently thanked the Army Amateurs involved and stated that the quick action resulted in preventing the forfeiture of the $250,000 bonds.

The local amateurs had notified their police headquarters who were able to track down the wanted Mr. Y. Several other amateur stations cooperating in this effort were: W2AMP, W3ADM, W2BGO, W4ABS, W4BJA, W3CXL-WLM, W4NCX, W8BWY, W3BIP and W2BMB.

—AND CAN YOU BEAT THIS ONE?

We'll match Talley's yarn with one about W4DVO-WLRB, Tampa, Florida. On the Army Net one night he was asked by a station to the north if he thought he could deliver a message to a passenger aboard the Silver Meteor the next day before the train was shuttled to its ultimate destination, St. Pete, across the Bay. Cy said he'd try to get away the following afternoon and meet the streamliner when it pulled in, and so ZOT (go ahead with your transmission). The text — JUST TO RELIEVE YOUR MIND NELLIE IS FEELING MUCH BETTER — seemed reasonably urgent, and so W4DVO knocked off work at 300p (losing a half day's pay from Amoco) and was on the platform when the Meteor snaked its way around Ybor City. He tipped a porter to page the addressee, who shortly appeared—one of those elderly perennials who occupy the green benches of St. Peterburg four months of the year. Beaming with smiles, the old chap asked Cy what he owed him, and when DVO naturally said "nothing," tried to press a dime into his hand. This, too, the ham refused — on general principles, the magnitude of the sum, and the fact that amateurs cannot accept compensation for handling traffic. But the old gent made up for it with his profuse thanks. "I couldn't sleep last night," he said, "worrying about Nellie. My daughter fed her potatoes which everybody knows is indigestible for dogs."
—Ed.

AFTER THE WAR— *MORE* THAN BEFORE!

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YES, a greater peacetime profit plan is coming ... to build new business for radio service dealers and parts jobbers. This plan to build more business for you is backed by the resources of a great and growing company, with front rank engineering and production facilities. National Union can and does *assure* you ... "*After the War,* More *than Before!*"

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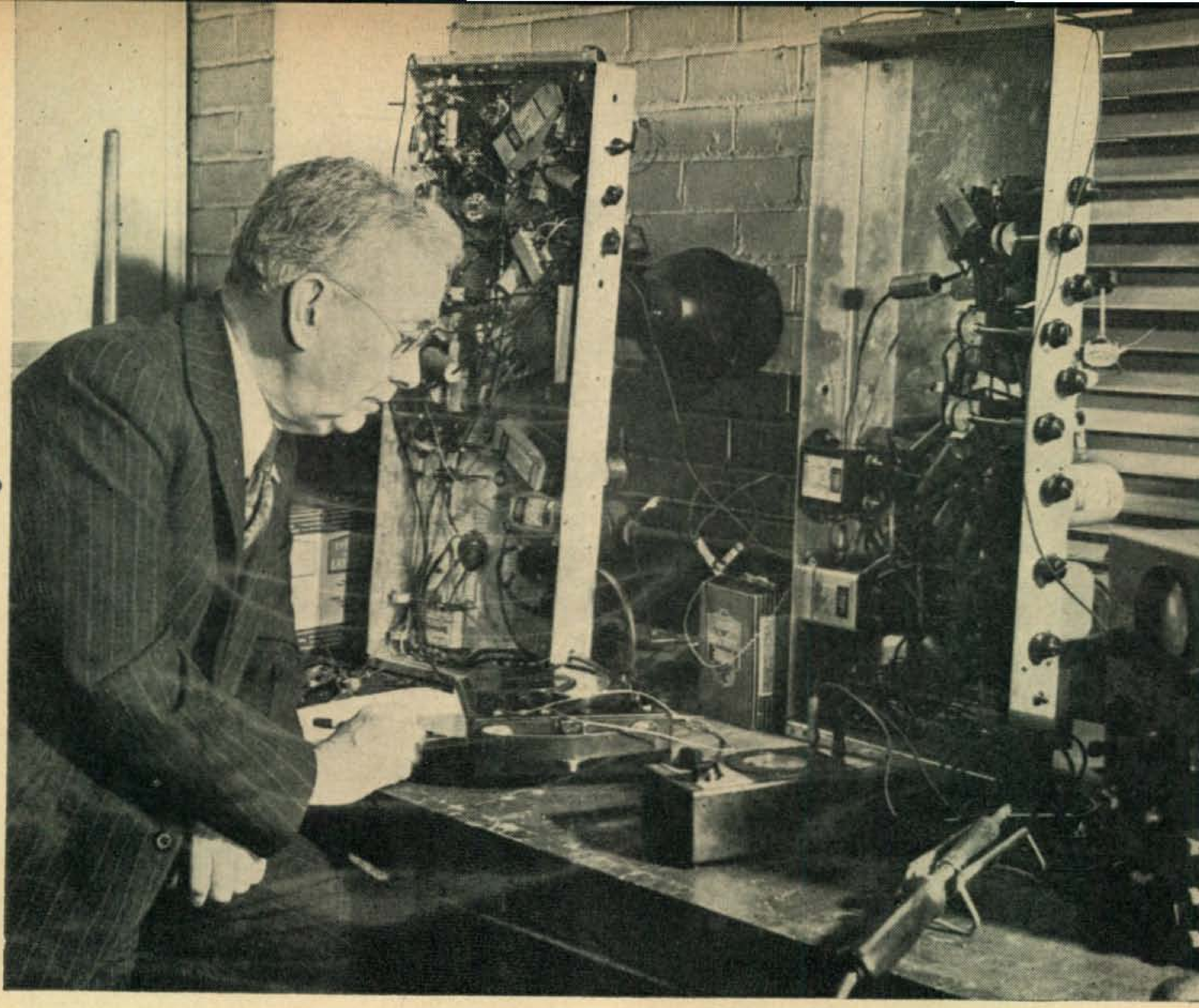


[*Courtesy Westinghouse Electric & Mfg. Co.*]

The late Dr. Frank Conrad, world-renowned radio pioneer and assistant chief engineer of Westinghouse Electric and Mfg. Co., at work in his laboratory

RUSTY RIGS

How they used to build them in the old days

FROM DEEP DOWN in our files, we dig up this one — labeled "1SL, a modern amateur and experimental station, Allston, Mass., 1923." Ultra modern would have been the better word for it in those days, for it still doesn't look too hoary. It's dated only through the magnifying glass and an old timer's memory. Those Magnavox-type speakers certainly aren't modern — but the one to the left is probably electro-dynamic. A few spare 43-plate tuning condensers, in cases, are to the right of the speaker. Yes — 43 plates, and big ones too. Tuning capacities of 500 and 1000 $\mu\mu$f weren't unusual in those days. If you look closely you can see the send-receive switch (not toggle!) mounted on the window panel just right of the big transmitter. The receiver was home-made and ranged around a bit judging by the lattice-wound plug-in coils draped about the clock.

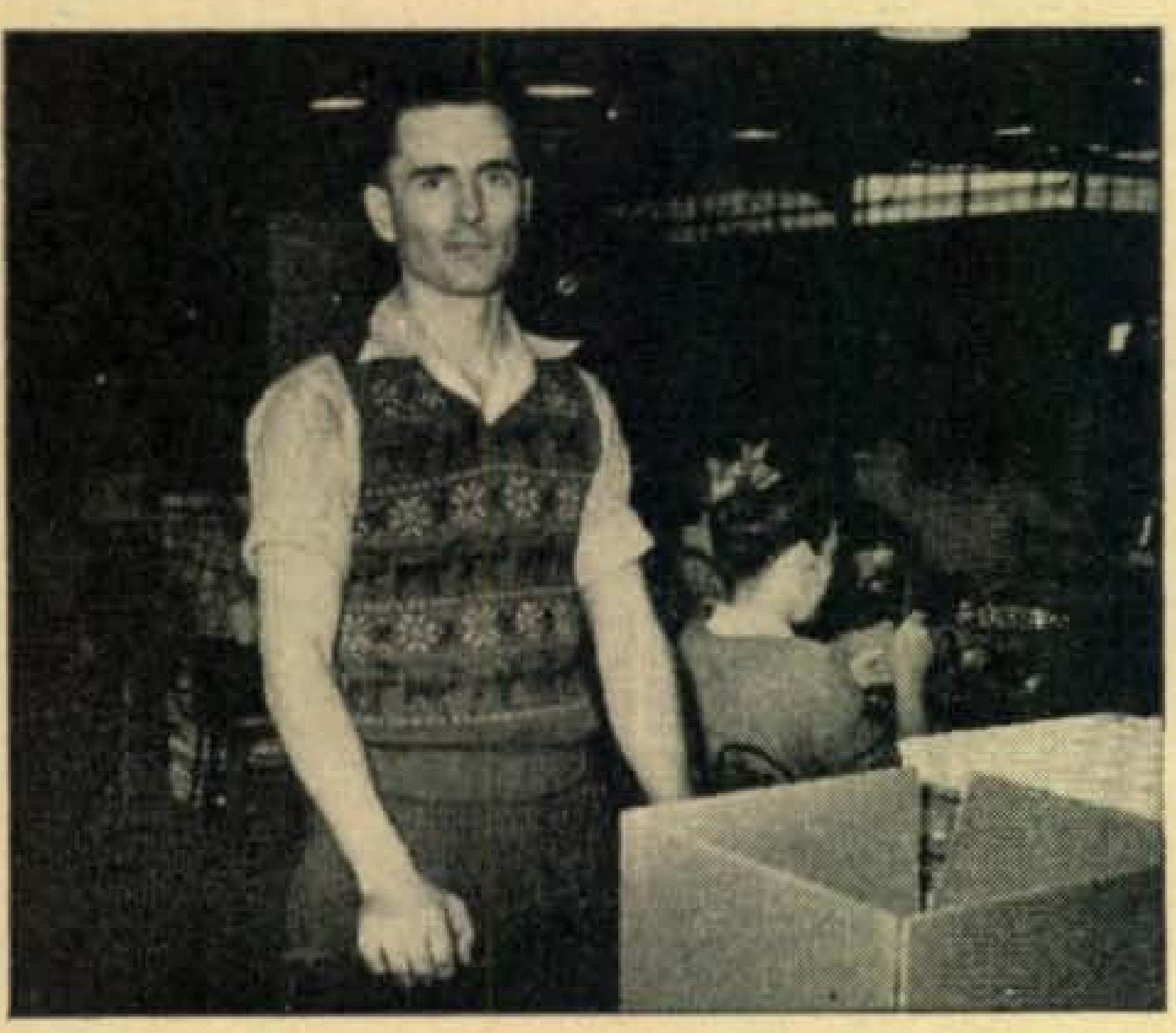
If 1SL will send us his name, and anything more he can recall about the old shack, we'll trade with a year's subscription to *CQ*. (And that goes for any of you fellows who have photos of RUSTY RIGS we can use.)

1SL, the "modern" amateur and experimental station at Allston, Mass.

PRECISION is a weapon in MT. CARMEL, ILL.

They use it effectively, too, these men and women who make up Meissner's *precision-el*, for many of them have sons, brothers and loved ones on the battle fronts. The photographs on this page show a few of these precisioneers who fight on the home front with precision and electronic skill as their weapons.

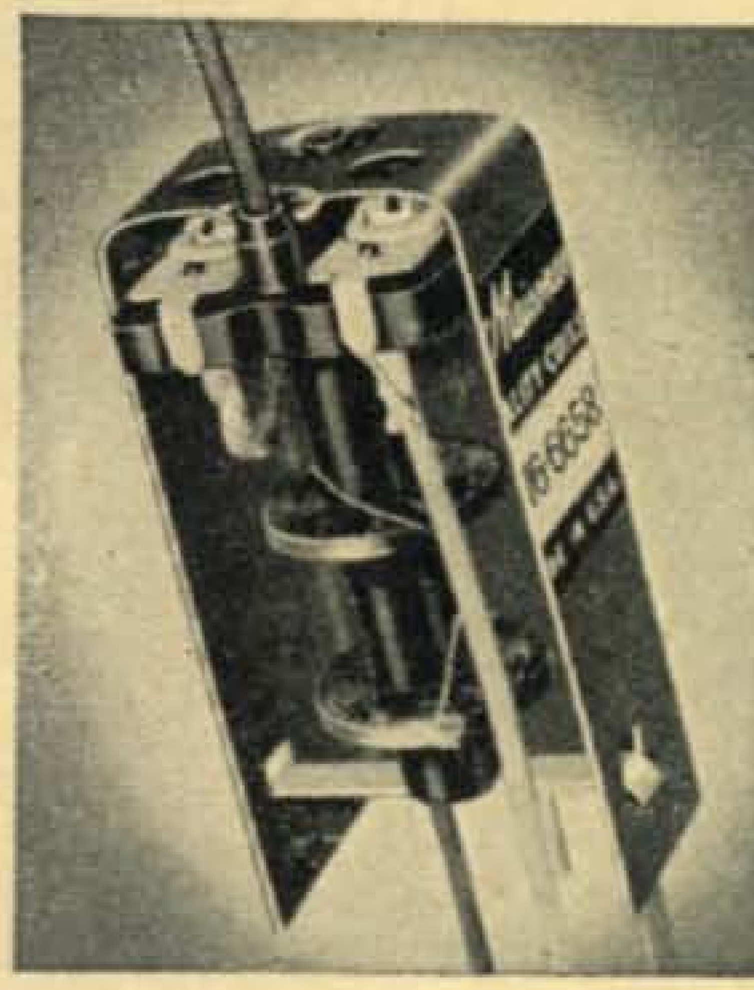
Precision is a family affair at Meissner. Here a letter from the front lines affects two families, and you can see that it's good news that will be reflected in the quality of their work when their rest period is over.



He's a veteran back from active service in the Pacific, but he's still fighting—this time on the home front with the men and women of Meissner. The traditions of precision quality he's learning here will be a weapon he can use after peace.

He splits thousandths of an inch as he does his war job. The "know how" that he and hundreds of Meissner *precision-el* have acquired is one more reason why you will be able to depend on Meissner quality after V-Day.

On the way to battle are these cartons of electronic war equipment. He sends them off with a smile, for he knows that the work of Meissner's *precision-el* will help bring his family together again soon.



"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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3. 3 through 1200 volts d.c. full scale in 6 ranges at 50, and in 6 added ranges to 3000 volts at 125, megohms input resistance.
4. 3 through 1200 volts a.c. full scale in 6 ranges at honest effective circuit loading of 6.6 megohms and 8 mmfd.
5. 0.2 through 2000 megohms in six easily read ranges.
6. —10 through +50 db. (0 db. = 1 mw. in 600 ohms) in 3 ranges.
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8. Complete signal tracing from 20 cycles through over 100 megacycles by withdrawable r.f. diode probe.
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MEMO PADDING

Short cuts . . . kinks . . . shack notes . . .

Storing Small Parts

Glass containers may be fastened to a shelf by a screw through their covers, to provide valuable storage space for small parts in an otherwise wasted area. It isn't an especially new idea, but too few hams take advantage of its space-saving feature. Rapid identification of parts is possible because of the glass jars. Additional information may be painted on the edge of the lid, where it is not likely to rub off.

Laying Out Panels

Layout work on panels and chassis is greatly simplified by utilizing the original wrappings. In almost every case the panel or chassis will be securely covered by a heavy coat of paper. Marking can be done on this with ordinary pencil and the paper will not interfere with punching, drilling, sawing, etc. In the case of front panels, should any question arise as to which side is the face, a small tear for inspection will prove satisfactory. The finished job will emerge free from scratches and other blemishes.

Protecting Transmitters While Tuning

Initial tuning of a transmitter, with high off-resonance current, can do serious damage to tubes and other associated components. This is especially true in power amplifiers where higher

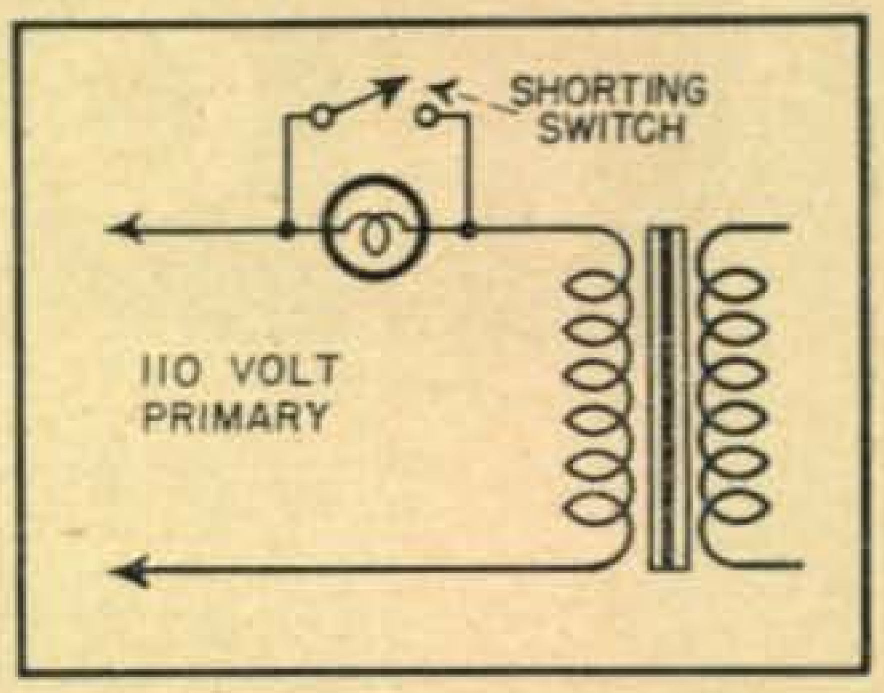
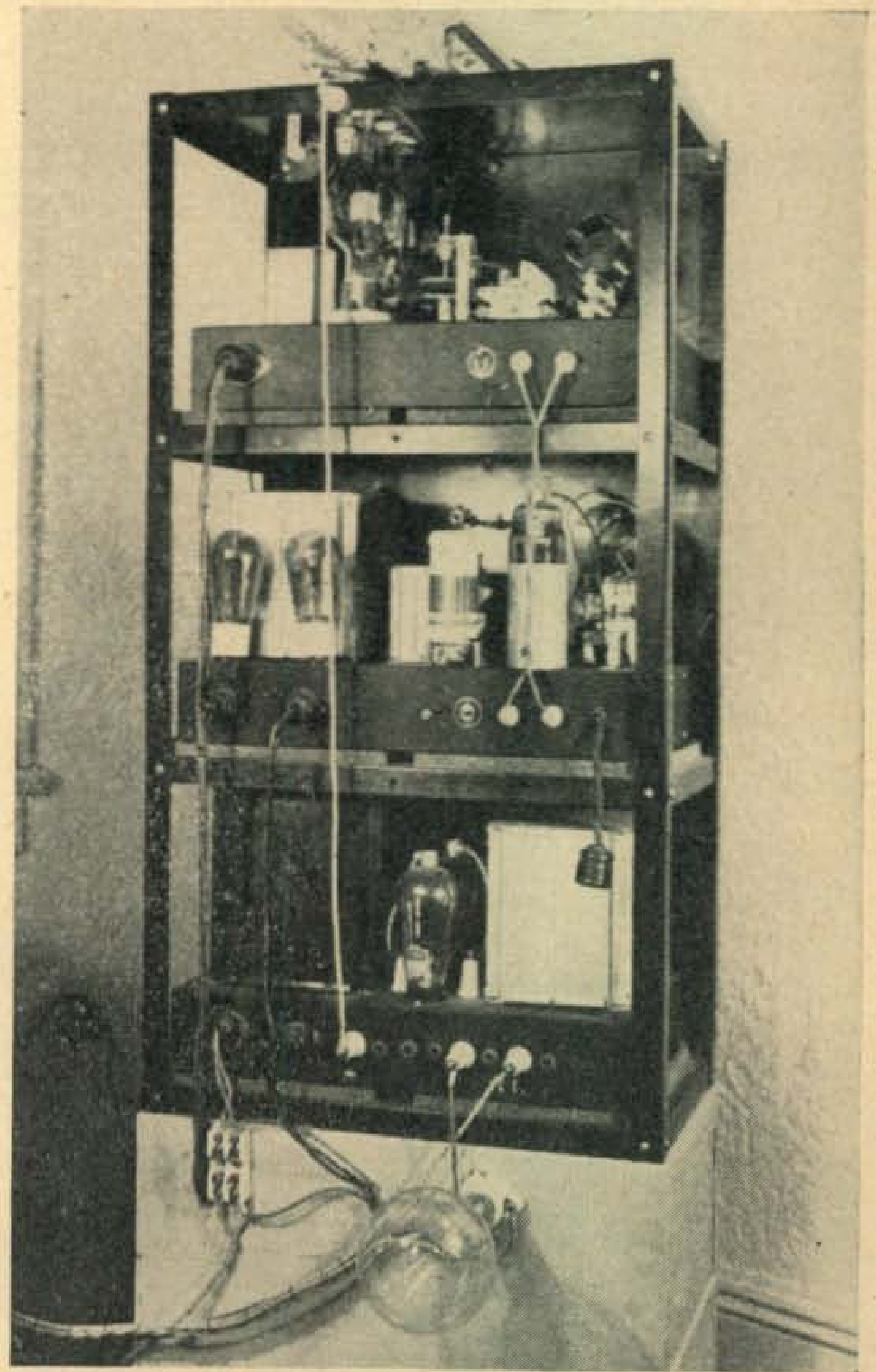


Figure 1

voltages and currents are encountered. While an overload relay offers equipment protection, it does not assist in actual tuning.

An extremely simple and inexpensive method of overcoming this trouble is to place an electric bulb or heating element in series with the primary of the plate transformer. As the size of the bulb or heating element decreases, the internal resistance increases, with a resulting increase in the

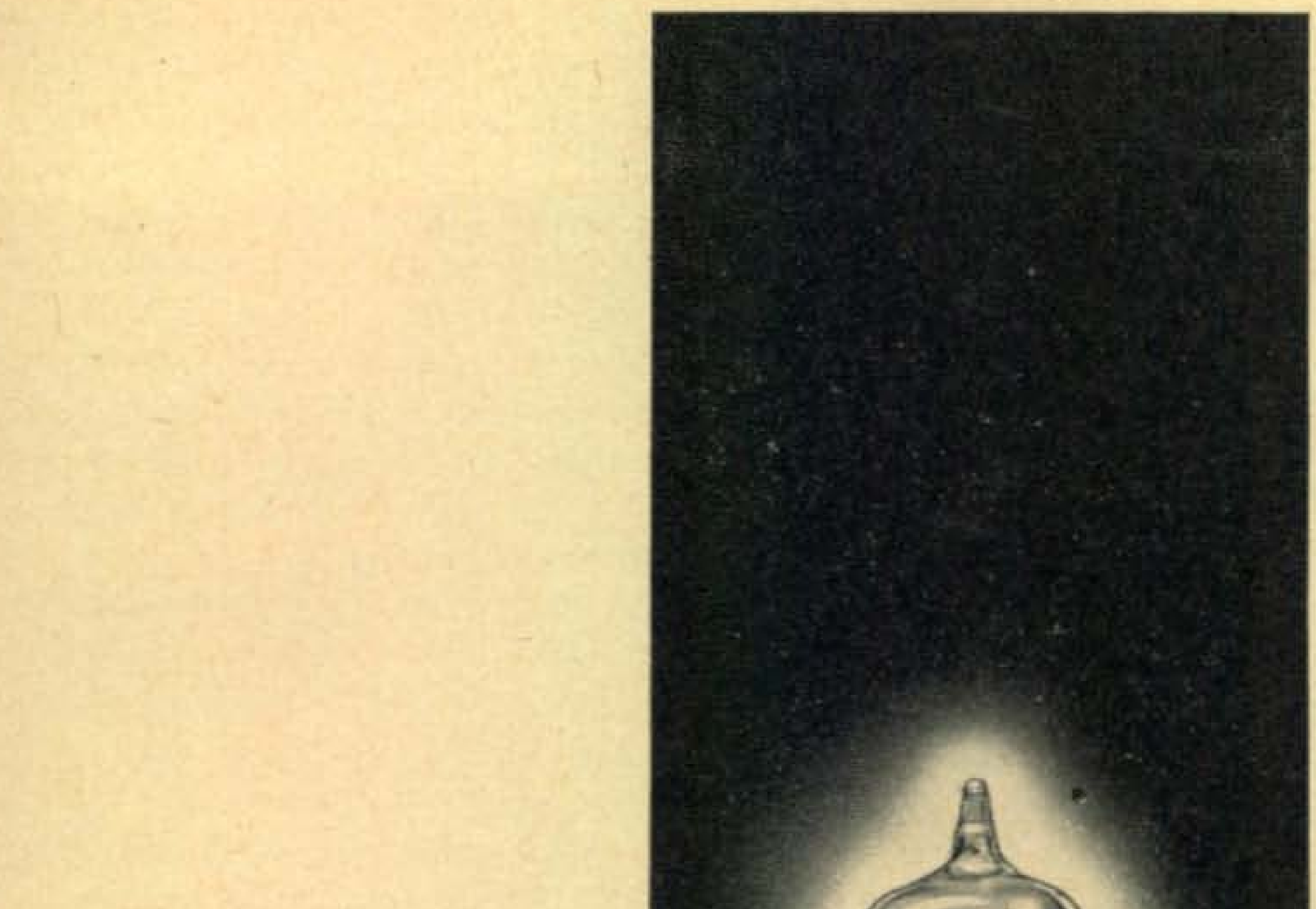


One-kw ham transmitter showing bulb at bottom

voltage drop. Too high a resistance will reduce the voltage below a satisfactory tuning level. For all around work, a 300 watt lamp will give good results. A simple knife switch or relay can be provided to short out the resistance element when it is not desired in the circuit. Don't make the mistake of using this system if the filaments are taken off the same transformer!

QSL Cards

QSL cards always will be an integral part of amateur radio. Novel methods of displaying them, both on the wall and in scrap books, are always of interest. Hams and SWL's who have found time to sort and assemble pre-war QSL collections will find some of the stamp collectors' accessories of value. Many of the larger dealers have for sale, printed and gummed labels bearing the names of all the countries and possessions of the world. Normally they are to label home made stamp album pages. As a means of identifying individual cards in a book, they are unsurpassed



SPECIFICATIONS OF 6N4

DIMENSIONS:		
Maximum Overall Length	1¾	inches
Maximum Seated Height	1½	inches
Maximum Diameter	¾	inches
RATINGS:		
Heater Voltage	6.3	volts
Heater Current	0.2	amps.
Maximum Plate Voltage	180	volts
Maximum Plate Dissipation	3	watts
DIRECT INTERELECTRODE CAPACITANCES:*		
Grid to Plate	1.1	μμf
Input	3.0	μμf
Output	1.6	μμf
TYPICAL CLASS A CHARACTERISTICS:		
Plate Voltage	180	volts
Grid Voltage	−3.5	volts
Plate Current	12	ma
Amplification Factor	32	
Transconductance	6000	μmhos

**Approximate — with close fitting shield connected to cathode.*

• An important contribution by Raytheon tube-design engineers to the efficient generation of ultra high frequency power is a miniature triode designated as type 6N4.

This cathode type tube combines the desirable features of reduced interelectrode capacitances and lead inductances with high transconductance. Thus the inevitable internal losses are minimized, making the 6N4 particularly adaptable as an amplifier, doubler, or oscillator at frequencies up to approximately 500 Mc.

The foregoing characteristics can be used to advantage in many types of equipment which may not be publicized. However, such important functions as those performed by the local oscillator in a u-h-f television or FM receiver are readily visualized possibilities.

In addition, Raytheon type 6N4 will be an ideal tube for civilian "walkie-talkies" and other portable radio equipment of the future. It has moderate heater power requirements and performs efficiently in the 460-470 megacycles region of the spectrum which is expected to be approved, by the Federal Communications Commission, for civilian use.

Whether or not Raytheon type 6N4 fits your particular plans, be sure to consider Raytheon High-Fidelity Tubes for your postwar products. There's a Raytheon tube that will fill your need efficiently and dependably.

All Four Divisions Have Been Awarded Army-Navy "E" with Stars

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AMERICAN BROADCASTING CO.
Every Monday Night
Coast to Coast
181 Stations

DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES AND EQUIPMENT FOR THE NEW ERA OF ELECTRONICS by anything yet available. These same stores may have sets of the various seals and coats-of-arms, which may be attached near the card to give an additional touch of color to the page.

When a QSL card is mounted in a scrap book, a note next to it, concerning the conditions under which the station was worked, especially if it is a "catch," will add reader interest. Such a project requires reference to either a good log or an excellent memory, so it is a good idea to make brief notations of any unusual circumstances at the time the QSL is requested.

An ordinary folding screen, covered with QSL cards selected for their interest and color, will be an unusual decoration as well as a useful piece of furniture in a ham shack. Cards should be secured with a good grade of cement and painted with a protective coat of high grade clear varnish. For the best effect, QSL's should not be fastened in any definite pattern.

[*The apparently minor but such important things that have enabled you to save a few minutes or a few watts—to do a better job with ham radio—will help others. Pass 'em along, brother—pass 'em on. We'll buy them.* —Ed.]

NEW PRODUCTS

Featherweight Plywood Radio Masts

Hurricane-proof radio masts made of molded plywood have been developed during the present war and are effectively used by the U. S. Army Signal Corps. In post-war years they may also prove to be the answer to the radio "ham's" demands for greater transmitting range in stations of simple construction.

For a considerable period the height of radio masts was not considered of great importance because short waves and skywave reflections emphasized the value of other features in the transmitter station, but the development of Ultra High Frequency (30,000 to 300,000 kilocycles per second) and micro-waves has once again stressed the need for height. This, in turn, has made the lightness and strength of masts important.

The new molded plywood is so light that a single man, using boom and tackle, can erect a 55-foot mast, and two men can erect a 75-foot or even a 90-foot mast, yet it is so strong that when properly guyed it will withstand a gale of 125 miles per hour.

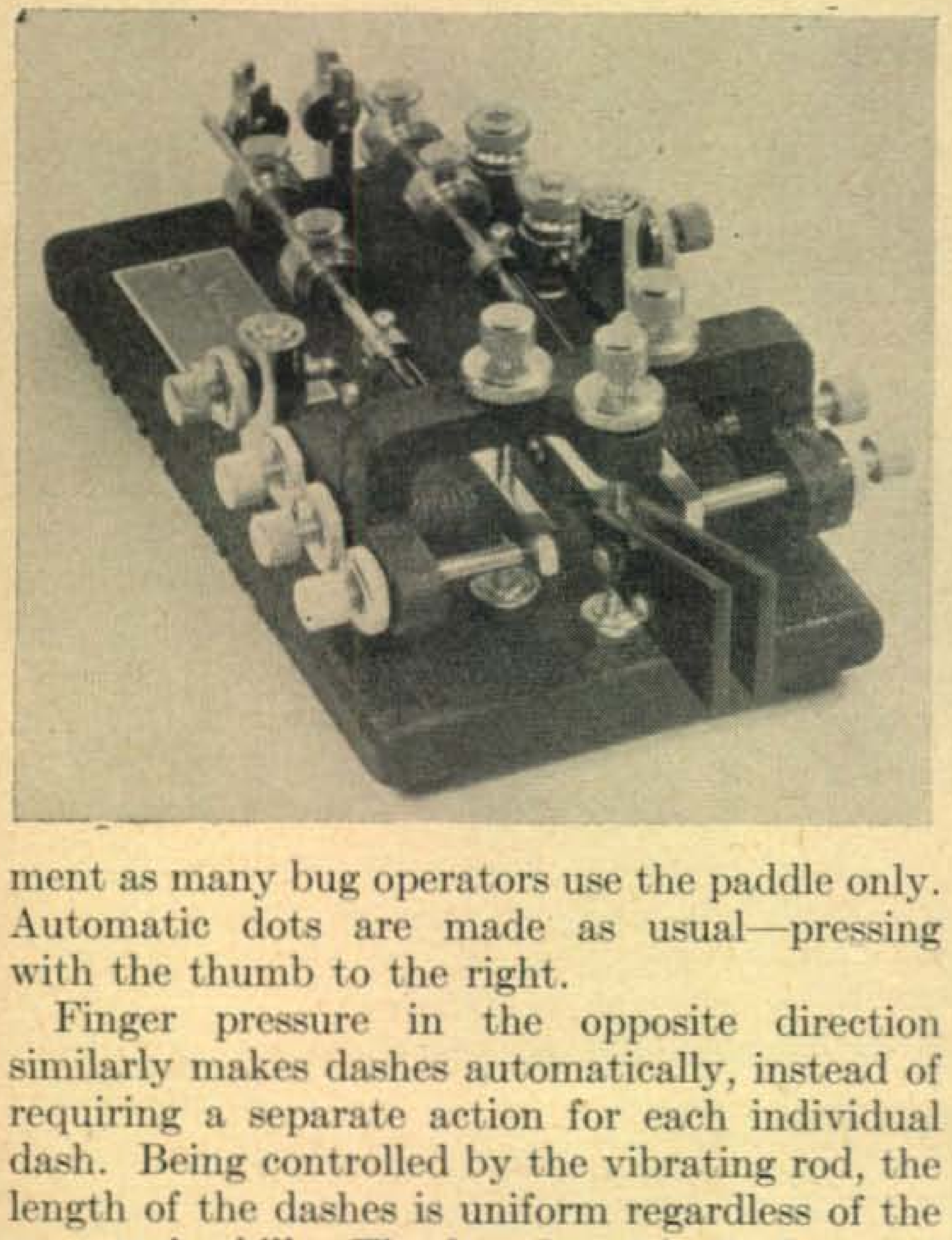
Impregnated plywood molded in tubular forms is far stronger than old fashioned galvanized pipe. It is indeed considered to be virtually proof against any wind that blows. When used with long rhombics plywood masts can withstand a horizontal pull of 10,000 pounds, as has been proved by tests. Built for Ultra-High Frequency arrays they have successfully passed tests with three hundred pounds at the head.

A 55-foot mast weighs only two hundred pounds packed for shipment. The sections are arranged to telescope into each other and can be packed in sections twelve feet long. It is easy to assemble or dismantle and can be erected over and over again in different locations.

Not the least of the advantages of the featherweight mast of molded plywood is its cheapness of manufacture.

A Double-Action Bug

A high-speed double automatic transmitting key has been announced by the Melehan Radio Co., 821 Main Street, Huntington Beach, Calif. Known as the "Valiant" it is actually a double bug with dual rods, weights and dampers, one set controlling dots and the other dashes. Two paddles are provided instead of the usual paddle and knob—which is probably the better arrangement as many bug operators use the paddle only. Automatic dots are made as usual—pressing with the thumb to the right.



Finger pressure in the opposite direction similarly makes dashes automatically, instead of requiring a separate action for each individual dash. Being controlled by the vibrating rod, the length of the dashes is uniform regardless of the operator's skill. The lengths of both dots and dashes are adjustable over a wide range, and only spacing (except in dot sequences and dash sequences) remains to be controlled by the operator.

Speeds from 15 to 80 words per minute are claimed by the manufacturer, and conversion from bug to double-bug technique is said to require from a few minutes to several hours, depending on the individual operator. The key was designed by an amateur, Melvin E. Hanson, W6MFY, and is available, without priority, in standard and de luxe models. *CQ.*

RECORD PLAYER

[*Continued from page 15*]

usual is the use of C_1 and C_2 to eliminate the possibility of getting a shock from the pickup.

Constructional Details

The pictures, *Figs. 3* and *4*, show the result of putting these ideas to work in a salvaged Silvertone player that originally consisted of just the motor, pickup, volume control and case. The cartridge in the pickup was damaged and was replaced with an M-22 cartridge which has a fairly high output. A hole was cut in the plastic case to accommodate a three-inch speaker (a four-inch one will fit with a little judicious crowding) with a coping saw. The plastic, although slightly ore brittle, works much like bakelite. If ordinary care is taken, no trouble should be encountered in cutting and drilling the holes. A metal grill, backed with a piece of cloth, keeps fingers and needles out of the speaker cone.

The volume control was moved from its original position on top of the case, and mounted on the side in the hole provided for the former output lead. The hole originally occupied by the volume control was then enlarged with a file to take a 117 volt pilot light assembly, wired in parallel with the motor and tube. This particular motor is not of the self-starting type; so the pilot light indicates when the unit is "on." With a self-starting motor the whirling turntable will give sufficient indication of this fact, and the pilot light may be omitted if desired. An alternate pilot light arrangement would be a 1.4-volt 50-milliampere bulb in series with the cathode of the output tube.

Neither the quality nor the power output of this player compares with push-pull A3s driving a twelve-inch speaker, but the gadget is remarkably satisfactory, well worth constructing, and many uses will be found for it.

[*Photos for this article by John Wonsowicz, W9DUT*]

YL OPERATORS

[*Continued from page 23*]

Falls. The teaching cycle continues with Edna Eames as Junior Instructor at Scott Field, Ill., and other LSPH's teaching Air Force boys. A few have even married their pupils—but that's another story.

Many go on learning radio in forms other than operating. Pauline Gantert is a Cryptographist. Helen Moffett, has trained as a radio mechanic in the Signal Section of the U. S. Army Air Corps in Oklahoma. Esther Zionson, a WAC Private, is serving in the 2nd Signal Service, Washington, D. C. The Seventh District produced Phyllis

Coe, 30 wpm operator and a speedy teletypist. Kay Samargie, W8LSPH, is a 2nd Lieutenant in Civil Air Patrol and says she has about 200 members in her code class. W8LSPH, Peggy Henry, attended the University of Cincinnati's electrical courses and works part time recording meters every hour for a local concern. Not content with a ham license, Anna Friedmann, W2-LSPH, already has her second class commercial. Many of the OM LSPH's own commercial firsts. All in all, the new ham "ain't what she used to be"—not by a long shot.

If any returning G.I. starts painting a picture of the far flung corners of the earth to Ines Olivieri, W2LSPH, she'll be able to hold her own in a chin-wagging or c.w. QSO for she's traveled the world o'er as a member of a girls' orchestra, and she saw the places in recent spotlight news in all their glory. She visited China, Japan, Burma, Ceylon, Gibraltar, Italy, France and many other colorful and beckoning DX spots.

That women will play an important part in the post-war world has never been questioned. It is obvious that the YL will be more and more active in amateur radio, and will do her share in fighting for the national and international allocations which will make the hobby interesting to the ham, and beneficial to the radio art and the nation in general.

V-H-F ADAPTER

[*Continued from page 9*]

coupling between L_1 and L_2 until the receiver regenerates across the band without dropping out at any point. If regeneration stops the coupling is too tight.

Now switch over to transmit, and set C_7 close to maximum capacity. Adjust L_4 in the same way with L_2, and make the final adjustment to the desired frequency with very small changes of C_7. The coupling adjustment is best made by checking with a suitably distant receiver. The frequency will change somewhat when the v-h-f unit is replaced in its housing and allowance should be made for this.

When the car radio is to be used for broadcast reception, merely throw the filament switch to the "closed" position and pull out the v-h-f unit plug.

FM-AM SUPERHET

[*Continued from page 12*]

L_8—Coupling link: 4 turns insulated hook-up wire wound on low potential end of L_9
L_9—Ten-mc input coil: 11 turns No. 22 D.C.C. close-wound on 1-inch form
L_{10}—Osc. coil: 14 turns No. 22 D.C.C. close-wound on 1-inch form
L_{11}—Osc. coil: 2 turns insulated hook-up wire wound around L_{10}
IFT_1—First i-f transformer
IFT_2—Second i-f transformer
IFT_3—Third i-f transformer
IFT_4—Discriminator
} Carron 4.3 FM type transformers
C_1, C_2 and C_3—National Type UM stripped to 2 plates each
C_{1A}, C_{2A}, C_{3A} and C_{1B}—3 to 30 $\mu\mu f$ compression mica trimmers
C_{2B}—50 $\mu\mu f$ screw-driver adjustment variable
C_{3B}—100 $\mu\mu f$ screw-driver adjustment variable
C_4, C_{14}, C_{18}, C_{21} and C_{22}—.0001 μf mica
C_5, C_7, C_{37} and C_{40}— .002 μf
C_6, C_8, C_9, C_{27}, C_{28}, C_{32}, C_{33} and C_{34}—.00025 μf
C_{10}, C_{11}, C_{12}, C_{13}, C_{15}, C_{16}, C_{17}, C_{19}, C_{20}, C_{23}, C_{35}, C_{38} and C_{39}—.01 μf paper
C_{24}, C_{30} and C_{31}—10 μf paper
C_{25}—.1 μf
C_{26}—.001 μf
C_{29}—8 μf
C_{36}—.00005 μf mica
CH—Filter choke
J—Open circuit 'phone jack
R_1, R_{25}—250 ohms 1 watt carbon
R_2—100,000 ohms 1 watt carbon
R_3—30,000 ohms 1 watt carbon
R_4 and R_{15}—2,000 ohms 1 watt carbon
R_5 and R_{12}—100,000 ohms 1 watt carbon
R_6 and R_9—200 ohms 1 watt carbon
R_7, R_{10} and R_{27}—25,000 ohms 1 watt carbon
R_8 and R_{11}—7,500 ohms 1 watt carbon
R_{13}—100 ohms 1 watt carbon
R_{14}—20,000 ohms 1 watt carbon
R_{16} and R_{17}—100,000 ohms 1 watt carbon
R_{18} and R_{26}—50,000 ohms 1 watt carbon
R_{19}—500,000 ohms volume control
R_{20}—500 ohms 1 watt carbon
R_{21} and R_{23}—3,000 ohms 1 watt carbon
R_{22}—5,000 ohms 1 watt carbon
R_{24}—3,000 ohms 10 watts wire-wound
RFC_1 and RFC_2—5.7 μh
RFC_3—2.5 mh
SW_1—DPDT toggle switch
SW_2—SPST send-receive switch
SW_3—Triple-pole-double-throw switch
T_1—Stancor power transformer
T_2—6V6 plate-to-speaker transformer

CLASSIFIED ADS

Advertising in this section must pertain to amateur or experimentation radio activities. Rate—20c. per word per insertion. Remittance in full must accompany copy. No agency or term or cash discounts allowed. No display or special typographical ad setups allowed. "CQ" does not guarantee any product or service advertised in the Classified Section.

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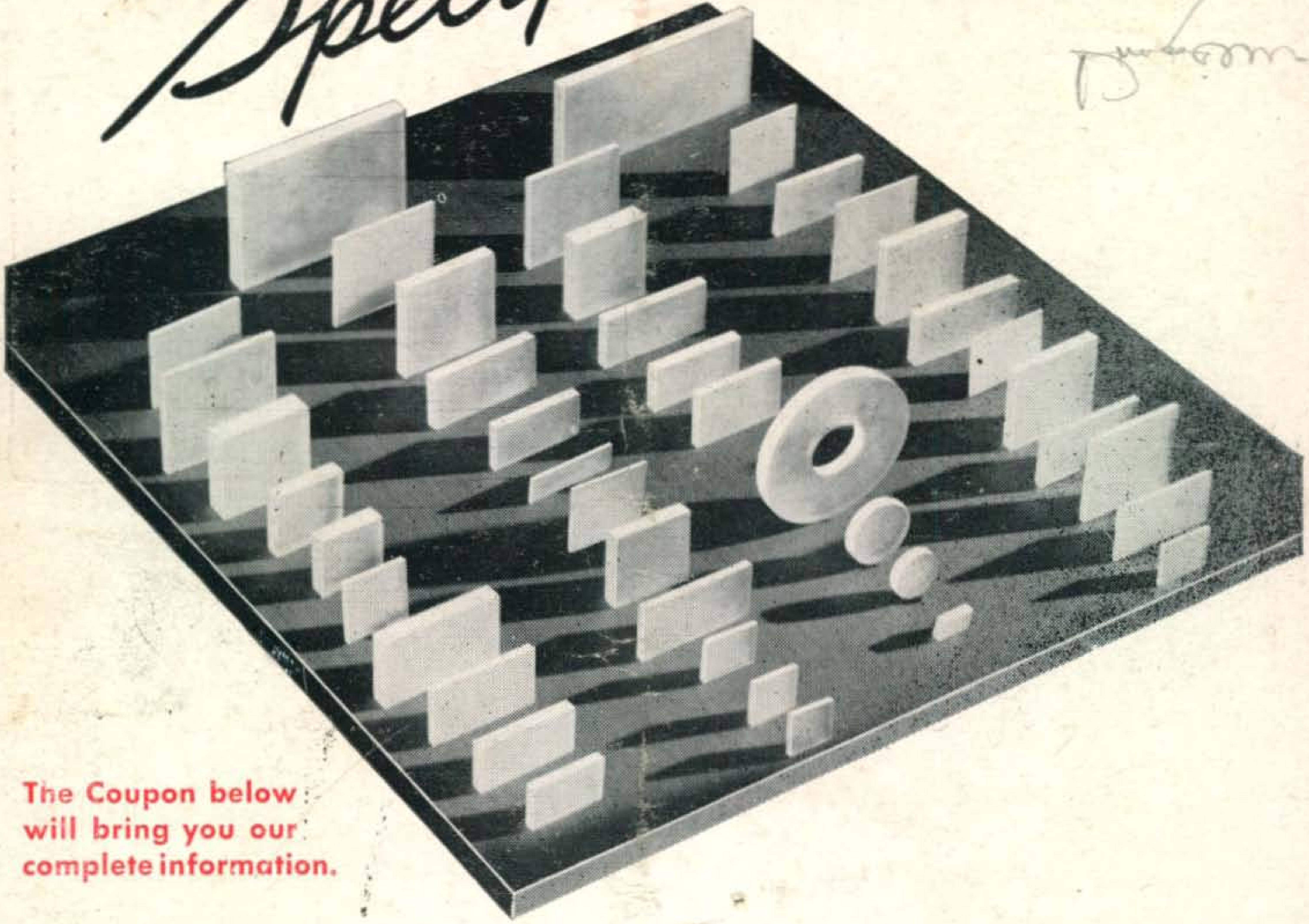

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