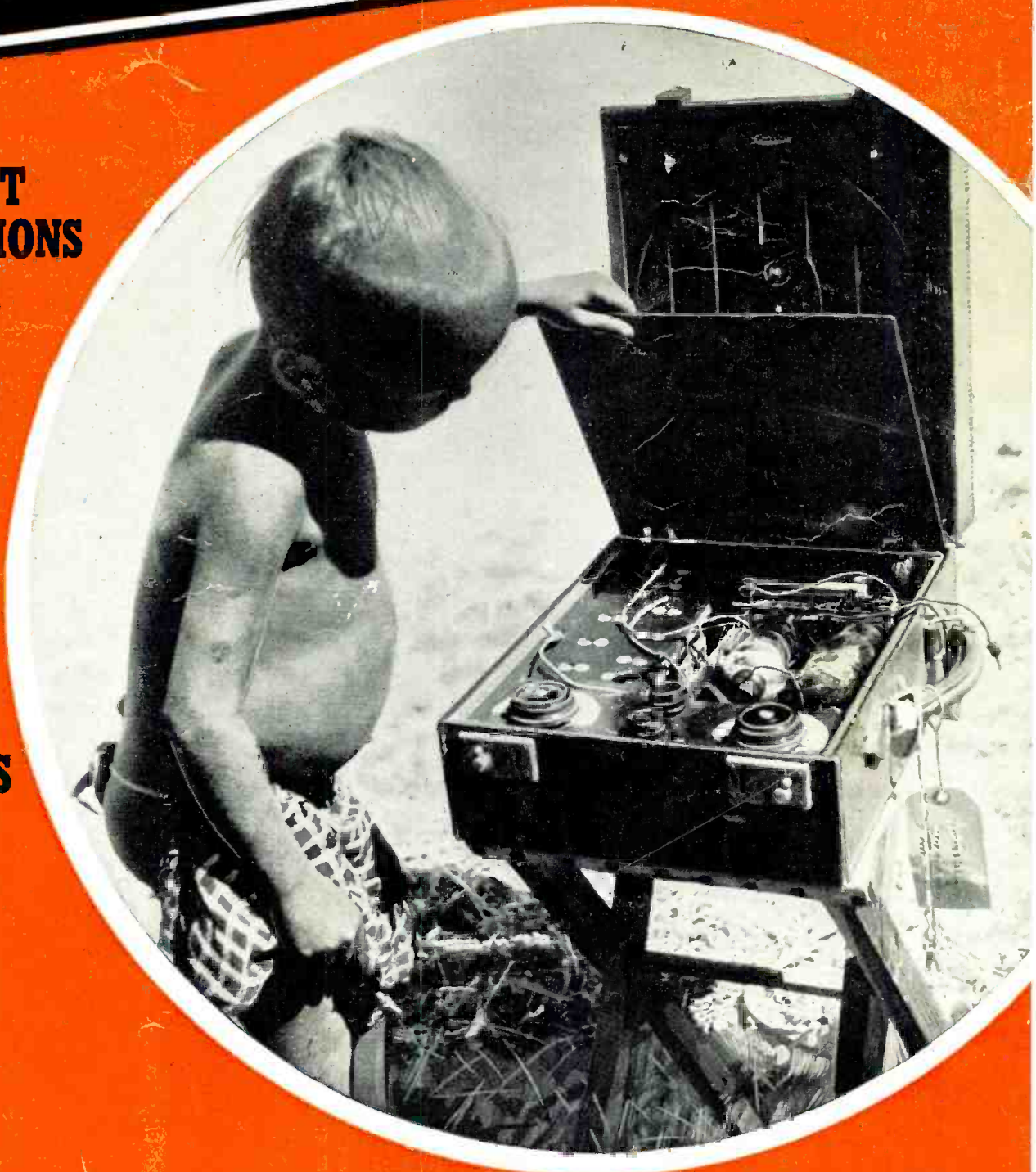
SPECIAL RECE VER SSUE

# RADIO NEWS

MARCH
25c



★

HOME-BUILT
OMMUNICATIONS
RECEIVER

★

ORTSMAN'S
SPECIAL
RECEIVER

★

A SIMPLE
EARING AID

★

VICEMAN'S
ATOR
TESTER

★

OW TO DO
OD WIRING

★

"AS I SEE T" BY OHN F RIDER

AMATEUR DIVISION
63
Cortlandt St.,
New York, N. Y.

# DAVEGA

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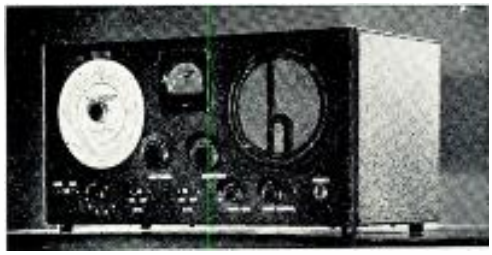

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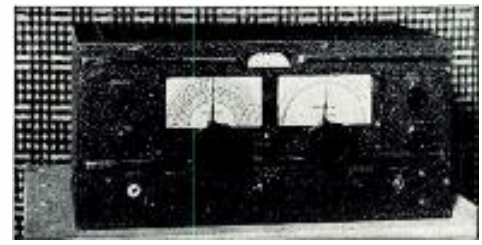

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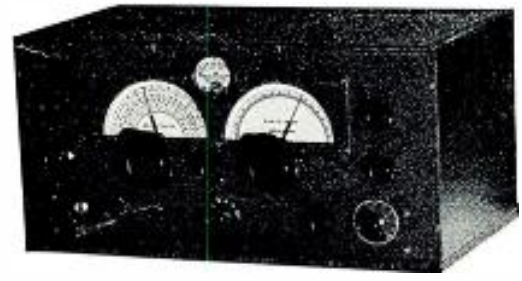

R.M.E. 69. A receiver that is praised by engineers, amateurs and B.C.L.'s throughout the world. One of today's communication standbys.

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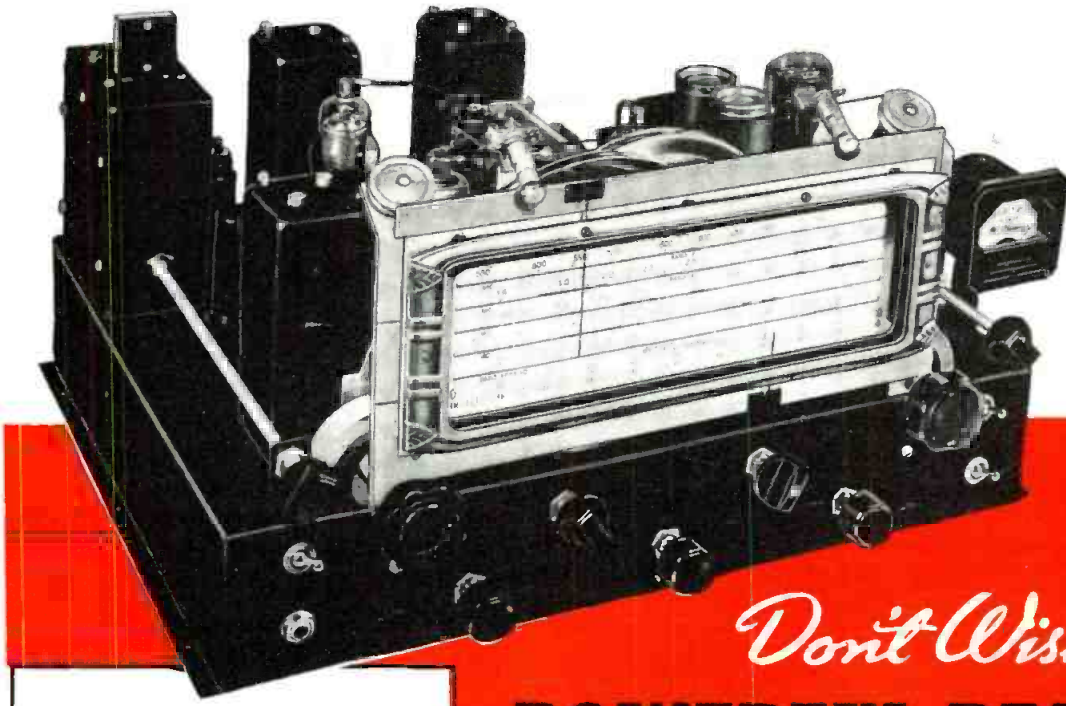

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# POWERFUL RECEIVER

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## 14 Tube—5 Band

# TRAFFIC MASTER

*Communication Receiver*

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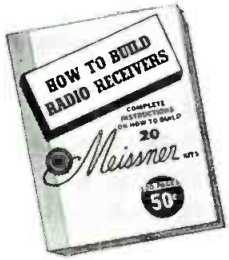


Easy-to-understand theory and technical data, graphs, charts, pictorial and schematic diagrams, alignment data, constructional data and operating instructions for 20 new Meissner receiver kits. Also information on adapters, converters. At Your Parts Jobber—or order direct. Address Dept. N-3. Price 50c.

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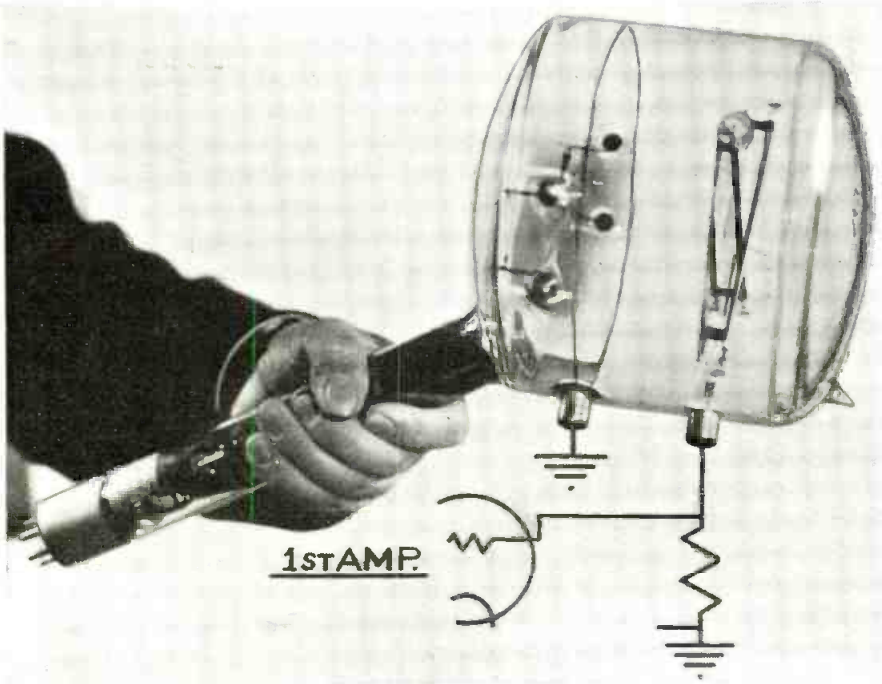
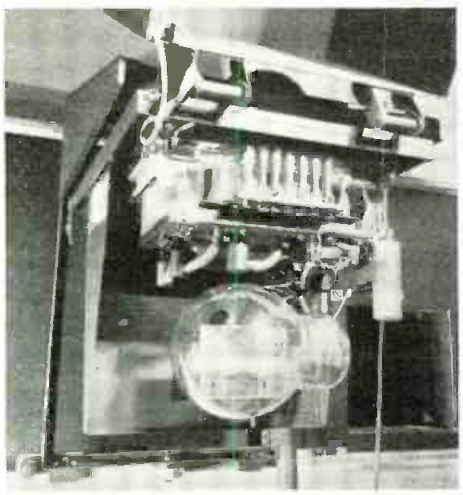
"A FAMOUS NAME FOR TWO DECADES"

# THE Magic OF

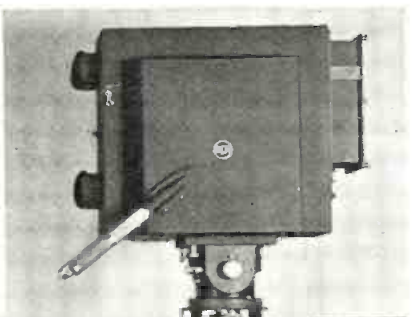


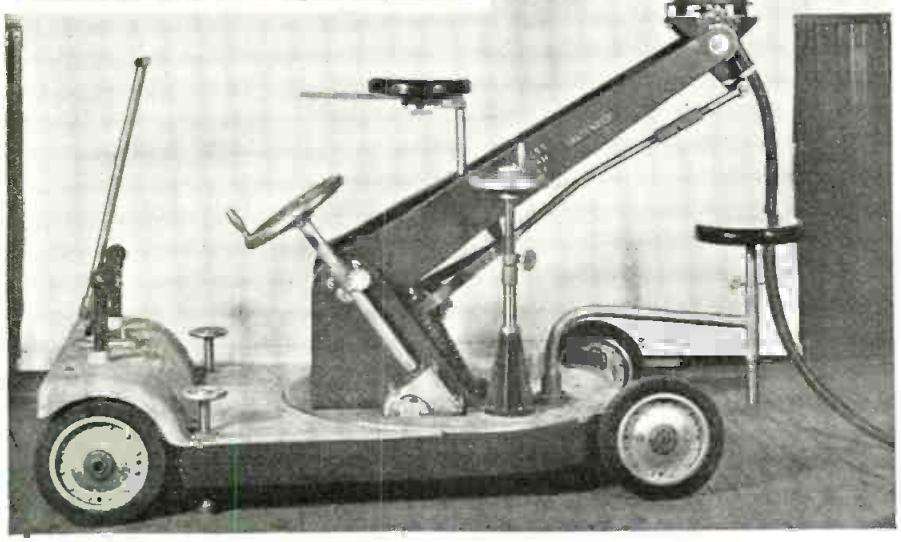

The Iconoscope and the connections to the first amplifier tube. ↑



The inside of the tele-camera with the iconoscope in its proper place.

The tele-camera is moved around by the cameraman by means of a dolly.





***The second part of the modern television student's course of six lessons. Fully describes the transmitting end.***

IN THE first article of this series, which appeared in the February issue, I presented a general, semi-technical view of modern television, as it stands on the threshold of its introduction to the public. Frequency channels for this new art were covered, the reader was introduced to "scanning," then the method of minimizing flicker and known as "interlacing" was explained, and synchronization was broken down into its blanking, pedestals, pulses and serrations. You are strongly urged, if you missed this first installment, to secure the February issue for the groundwork laid, upon which future discussions will be built.

Continuing the investigation of television, as it is unfolding today, it seems only fitting that the first unit considered should be the magical tube that most of us now call the Iconoscope. This name is the copyrighted term of RCA and it appears to have been developed from the Greek words "eikon" meaning image and "scopein" signifying observation. It is, of course, one form of cathode ray tube; to many it is known as Camera Tube, Mosaic Tube or Signal-Generating Tube. Farnsworth calls his pick-up tube the Image Dissector and its construction differs somewhat from the more generally-used Iconoscope.

In any parlor or schoolroom conversation on television, the question is asked "How do they get the picture into electrical currents?" The Iconoscope is an amazing satisfactory answer, open to improvement and development during the next few years, but, right now, a fascinating result of master research and laboratory work. Figure 3 of the first article gave the reader a very general idea of the construction of cathode ray tubes, but now, for the more detailed discussion, Figure 6 is presented.

The Iconoscope's two main parts are, first, an electron gun contained in a long, thin tubular neck, the throat of which opens into a rounded square bulb, and, second, the mosaic which is a thin square plate within the bulb. The tube containing the electron gun is so placed that its axis is 30 degrees below a line drawn straight out from the center of the mosaic. This construction makes it possible to focus an image, through a lens, squarely on the mosaic. The coils from which four leads protrude, shown around the neck

# THE ICONOSCOPE

By M. W. THOMPSON
Television Engineer, Chicago, Illinois

**There is not anything as unusual as the method used to convert a picture into electrical impulses by the Iconoscope. It has been rightly termed, modern magic.**

of the Iconoscope, are the deflecting yoke, by means of which the electron beam is made to scan the mosaic.

Figure 7 depicts the construction of the electron gun, that part of the cathode ray tube which handles the generation, concentration, control and focusing of the electron beam. At the left end is a heater of the usual type, contained within an electron-emitting, flat-topped cathode. In the center of the flat top is a spot of oxide preparation. While frequently termed a "grid" the control electrode takes the form of a short metal cylinder in which is a flat disc with a small opening at its center. This control element is kept at a negative potential relative to the cathode, which has the dual effect of limiting electron emission around the edges of the flat top of the cathode and tending to concentrate emitted electrons in the center.

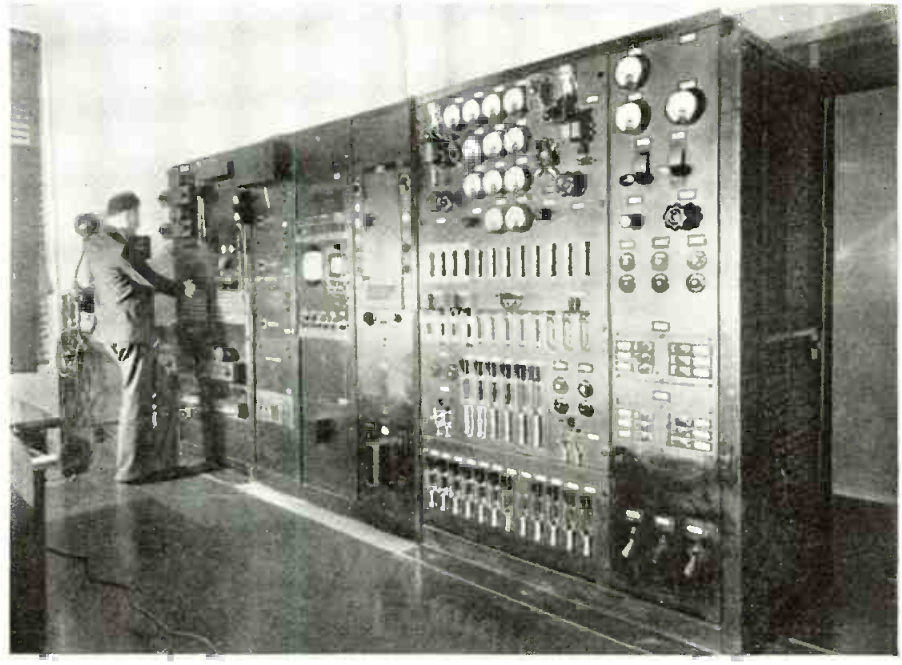
The longer cylinder, identified as the "Accelerating Electrode" (often termed the 1st Anode), is made very positive to both the cathode and grid. The first action of this element is that its electrostatic field "reaches into" the opening in the grid disc and draws the electrons into a beam. This electrode may, apparently, have either one, two or three discs; in the published papers of Messrs. Zworykin, Maloff and Epstein, all three types may be found. Its further action is to accelerate the motion of the electrons, narrow the diameter of the beam, and throw the stream (at its further end) into another electrostatic field.

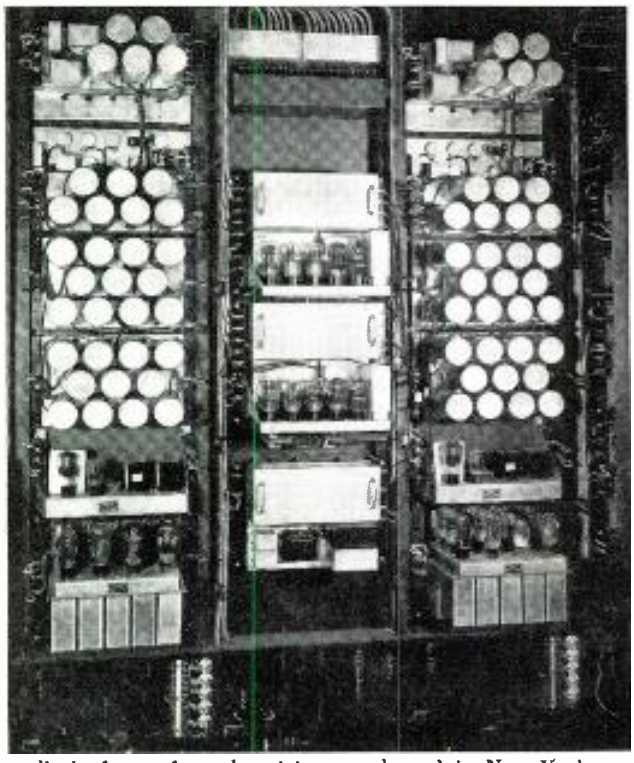
While the Accelerating Electrode and Focusing Electrode No. 2 are connected together, and are therefore at the same potential, it should be noted that Focusing Electrode No. 1 is interposed between them and is at a different potential. There thus will be an electrostatic field affecting the beam as it progresses from the Accelerating Electrode into Focusing Electrode No. 1, and another acting upon it as it passes from this latter electrode into the zone of influence of Focusing Electrode No. 2.

These electrostatic fields have been so developed that they focus the beam to a spot of the desired size on the mosaic. The lines of force of these static fields will force the electrons toward the axis, overcoming the natural tendency of electrons to repel each other. The action is very similar to

Pres. David Sarnoff (c) of RCA opens the 1939 N. Y. Television Programs. ↑

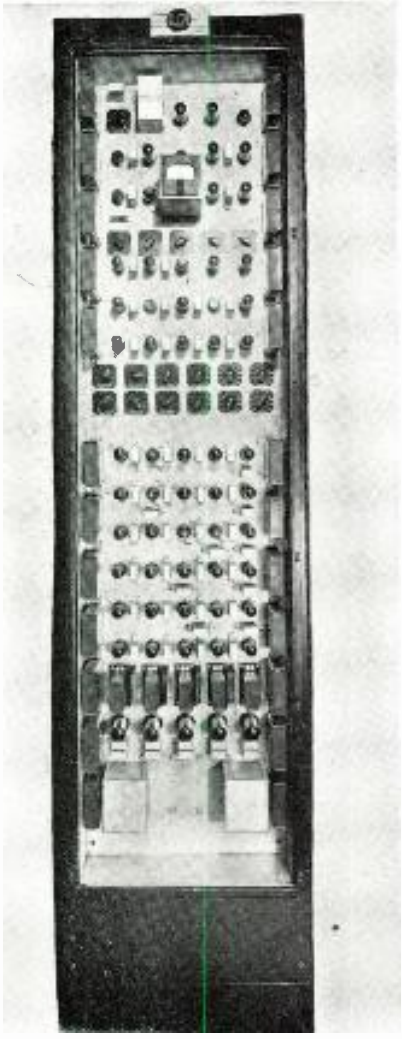
The Empire State Bldg. transmitter control panel is very complicated. ↓





Early form of synchronizing panel used in New York.

Latest form of the same synchronizing generator developed by RCA.



the focusing of light rays with optical lenses. The beam can now be visualized as an extremely fine, high pressure stream, controllable as to direction, and with its negatively-charged particles moving with velocity of the order of 30,000 miles per second.

The mosaic upon which the image is directed by an optical lens, and over which the beam is moved in scanning, is to me one of the finest results of patient research and development to be found in either radio or television.

To analyze its construction, let us consider, first, a sheet of very thin mica, perhaps four inches square. On one side of this mica we deposit millions of little globules of silver, each one separate from the others, a unit in itself. Just how this is done at present its makers do not reveal, but comparatively recent models were made by evaporation of silver oxide in a vacuum, then heat-treating to remove the oxygen content.

The material which makes the tiny globules photo-sensitive is known as cesium. It is introduced into the operation either while removing the oxide or shortly thereafter. Each little bead now possesses the property of emitting electrons, the rate of emission varying *with the amount of light reaching it.* If now, on the reverse side of the sheet of mica, we place a conductive metallic film, we will have millions of little condensers existing between this sheet, known as the

Fig. 9. Keystoning effect.

signal plate, and the multitude of globules forming the mosaic.

While our silver was deposited so finely that there will, very easily, be something like 67,500,000 minute dots of photosensitive material on the mosaic, we are going to consider these in groups of 300, and each 300 will be a picture spot, or unit. This number is arrived at because we are going to have 411 *active* lines vertically (of our 441-line scanning), and about 547 units

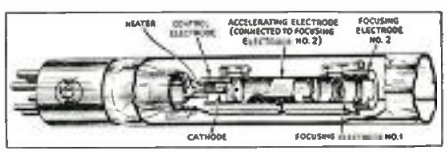



Fig. 7. Cutaway of an electron gun.

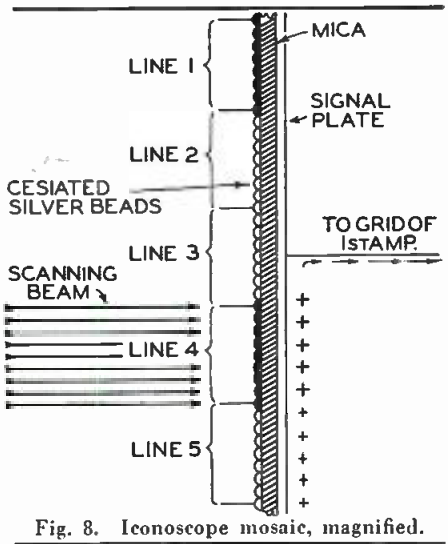



Fig. 8. Iconoscope mosaic, magnified.

horizontally in each line, which means that our mosaic is to be considered as 225,000 scanning spots. If 67,500,000 be divided by 225,000 we have about 300 silver dots per unit.

The mosaic is now placed in the evacuated glass bulb of the Iconoscope, so that it is at right angles to the light striking it from the lens through which the image is secured. The sensitized surface faces the image to be televised; on the reverse side of the mica sheet a connection is made to the metallic surface and brought out through the glass bulb. Figure 8 is a cross section of a mosaic and signal plate,

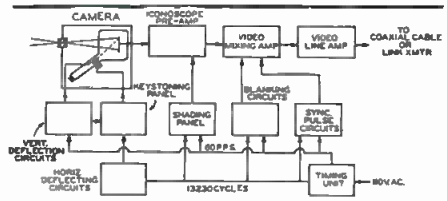



Fig. 1. Telecaster block diagram.

highly magnified, and including a height sufficient for five scanning lines. As drawn, only seven or eight silver beads are shown per horizontal line, although this would actually be 17 or 18 for a 300-beads-per-unit mosaic.

While a long and very detailed technical treatise could be written on the subject of cesiated silver under bombardment, and the secondary emission of electrons, it should be sufficient, for a semi-popular outline on television, to sum up the activity on the mosaic as follows: The scanning beam from the

*(Televise further on page 64)*

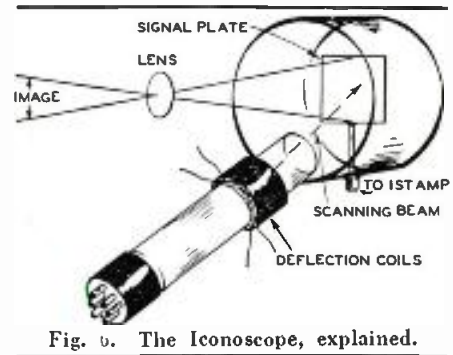



Fig. 6. The Iconoscope, explained.

The receiver uses only one tuning and one volume control.

**An extremely versatile receiver for every type of out-door sportsman. The homing device will be described next month.**

**by JOHN X. UTLEY**
Talkeetna, Alaska

# A Sportsman's Special Receiver

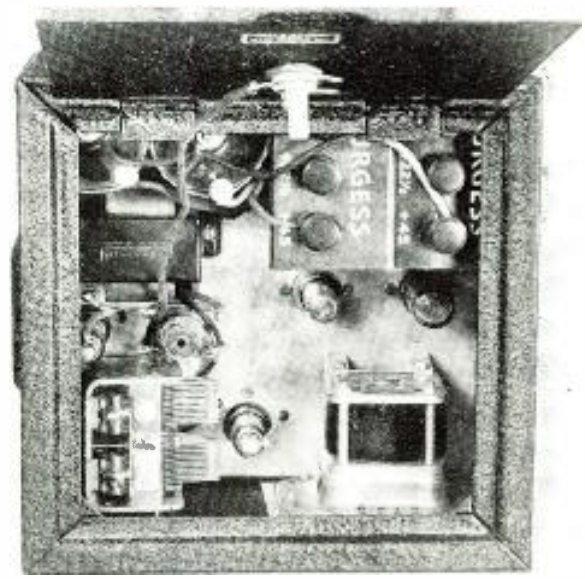
IF a direction finder is to be a flexible instrument, certain requirements must be met which will allow its use in the many applications to which it may be put. The past several years has seen a marked decrease in the physical size of the broadcast receiver which was made possible by developments in vacuum tubes and associated equipment. Inasmuch as this instrument is designed to cover a wide range of applications, it may be used to advantage on water craft, by hikers, in planes and wherever it may be carried. The receiver operates from dry batteries and uses a series of midget tubes that operate with a minimum of plate and filament voltage so that the batteries will give many hours of service before it becomes necessary to replace them.

In the design of this unit, much thought was given to the circuit. At first it was felt that the super-het would give the best performance but unfortunately the tubes that offered the most in compactness were not available in the mixer types or the duals. Added to this, was the fact that a wide range of frequencies had to be covered and the additional coils required by the super would increase the size of the completed unit.

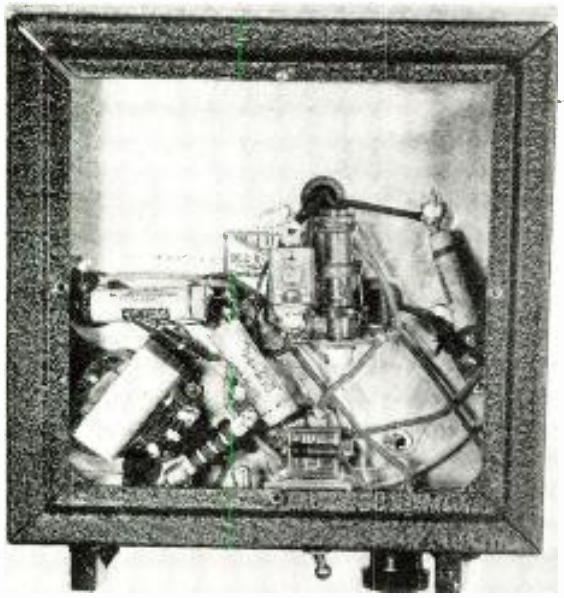
Several tuned-radio-frequency circuits were tried in order to determine whether or not they would provide the desired results. The performance of the final hookup was excellent and further design brought out the fact that if a small amount of regeneration were used, and if the detector was preceded by a stage of r.f. there would be more than sufficient sensitivity to do a good job of receiving weak signals. As far as the average constructor is concerned, it will be much easier for him to build a t.r.f. unit from scratch than a super, as the problem of exact tracking of the tuning circuits is far simpler to adjust.

By keeping the number of tubes down to a minimum, and by using efficient ones that operate on low current drain it is possible to build a direction-finder that really gives a good account of itself, but is light and efficient.

The frequency range is from 175 to 3500 kilocycles. This covers the various beacons: the complete broadcast band and the amateur, police and certain aircraft frequencies. By including these ranges it is possible to find a known station at almost any hour of the day or night. Therein lies the receiver's value to the hiker, huntsman, aviation enthusiast and yachts-



The easy arrangement of the parts shows clearly.



The placement of the component parts.

man — in fact any out-door man.

**Construction**

A standard 60 ma. pilot light makes an excellent fuse to protect the tubes of the receiver in case of shorts. Since the filaments run at 1.5 volts @ .03 amperes, they can be "blown" easily should the 90 volts of "B" be applied to the wrong tap. The 4 tubes draw 120 milliamperes or twice what the "fuse" will use. It is well to caution the constructor against doing any soldering or in making any adjustments while the receiver is turned on. The filaments of vacuum tubes of such low current consumption are, of necessity, quite fragile and therefore cannot stand an overload for even a second without burnout.

It is best to use a vernier type of dial on a receiver of this type as logging and marking is made easier as well as permitting a given setting to be kept on the dial for accurate adjustments, especially if there is vibration. The dial is mounted on the cabinet before the chassis is placed in position. The shaft comes through the dial bushing and the set screw is then tightened. The metal shaft cover may then be snapped in place which covers the end of the shaft.

The openings for the four tube sockets are each of ¾" diameter. It is not absolutely necessary to adhere to the layout shown as long as the respective leads are kept short. Different sizes of variable condensers will require a variation in the final layout used.

Substitutions may be made in the variable condensers as long as the capacity is correct for the particular coils used.

The following controls are all mounted on the chassis with extra mounting nuts so that the entire set may be removed and the controls left intact: band-switch, on-off switch, phone jack and the r.f. gain control. These extra nuts also serve to hold the chassis within the cabinet.

Be sure that the speaker comes right up to the opening and fits snugly. Metal straps may be formed to hold the batteries in place after they are placed in the box and they should not be permitted to come in contact with any of the terminals which might cause a short circuit.

The complete receiver and its associated batteries are mounted on one chassis which measures 7" x 7" and is a standard size carried by all the jobbers. The metal cabinet is 7¾" square and is supplied with a hinged cover and removable bottom plate. Provision for the loop antenna is made by mounting a three-way jack in the cover. This permits the loop to have a free swing and at the same time provides the required contacts to be made to the primary of the antenna coil.

In order that full advantage may be taken of the tubes, it is necessary that *all* of the gain of each tube be used to best advantage. The screen voltage applied to the tubes serves as an effective means of controlling both the volume and sensitivity at the same time. The plate voltage used will provide good room volume on local stations with the midget output pentode used. A phone jack is included for receiving weak signals.

The sockets should be mounted first and one side of each filament connected to ground or chassis. Inasmuch as these tubes do not use the standard type sockets, the connections should be studied carefully before wiring. It will be noted that the plate lead on the two screen-grid tubes is at the top cap in the same manner that the conventional grid leads are made.

The filament glow is so low that it may not be seen in normal room light, so observations should be made in darkness. The two 45 volt B batteries are mounted in the cabinet with the two 1½ volt portable A cells along the back part of the chassis. Instead of using a small C battery, it was thought that if an extra cell were included and used for this purpose that when the A battery became low in service, the two cells could be changed and the old cell used as the C battery.

In order to prevent the screen control from drawing current from the batteries it is necessary to break the connection to the B supply by means of one section of the two-section switch. The filaments are lighted also when the switch is in the "on" position.

Padding condensers are needed to track the circuits properly over the entire range and these are mounted across the coil sections. The capacity of these condensers is 15 mmf.

The audio choke shown in the illustration is wired in the plate circuit of the detector tube, and more gain and better fidelity are realized when this method of coupling is used. It is necessary that one stage of amplification be used ahead of the output tube, and a *Hivac type HD* is placed in this position.

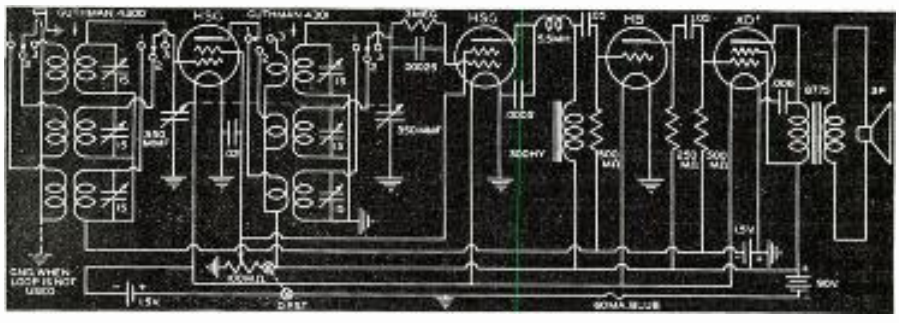
A 3" Utah permanent-magnet dynamic speaker mounts in the cabinet with a baffle-plate of cardboard cemented to the inside of the metal box to assure a tight fit and at the same time provide an additional baffle for the speaker. The cone should be protected by a piece of window screen or wire mesh. A universal output transformer to match the speaker used is mounted underneath the chassis. The secondary is provided with six lugs so that impedance matches can be made to different values of voice coil loads. The two lugs used on this set are numbers 2 and 4 and offer a 15,000 ohm primary to 3 ohm secondary load to be had which is proper.

It is very important that the leads be kept very short in the various tuned circuits as the tubes themselves are not shielded, and the plate leads are unusually long on account of coming from the top rather than the bottom of the tube. Although the use of regeneration is very helpful in a compact set of this kind, it should be obtained in the operation of the receiver and not from long leads or other causes of interstage or other circuit coupling.

A regenerative effect may be had by placing a small capacity between the plate and grid of the detector tube if trial shows that it is desirable.

The receiver is tuned for normal broadcast reception by using the regular antenna and ground. Later on the

(*Tune in on page* 50)

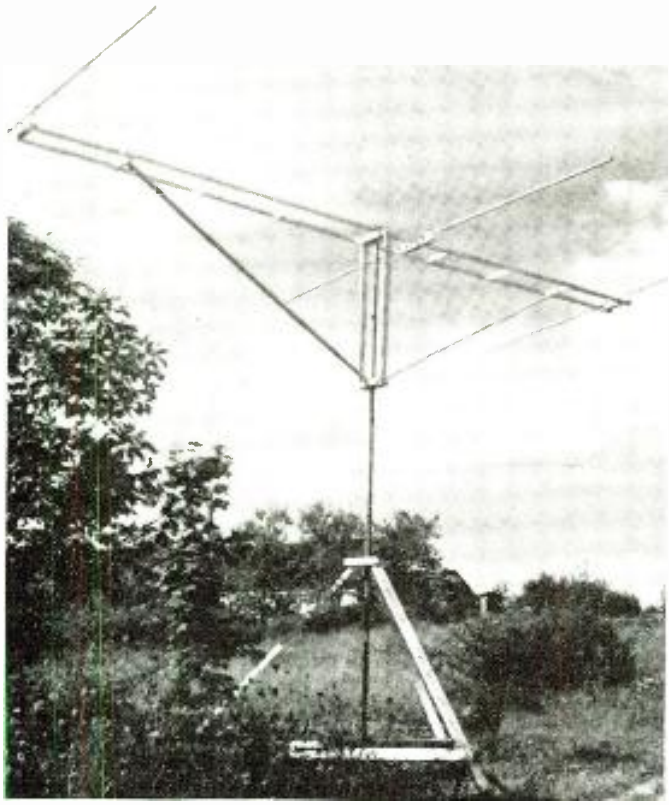


The circuit diagram of the versatile Sportsman's Special.

# Simple Two-Gain 28MC Rotary Beam

By A. H. REISMEYER
W8CHT
New Kensington, Pa.

**This beam uses the feed line as a support and can be turned through a 360° circle without difficulty.**



Set 16' above ground the beam is very effective.

MOST beam antennae which have high gain are of such dimensions that the average amateur has difficulty finding the available space for their erection. Besides, these are for the most part unidirectional or at the best bidirectional, which means only point to point contacts and necessitates more than one antenna for even one band. For high frequency operation the best proposition for the average amateur appears to be a rotary beam antenna which has high gain.

A number of rotary beam antennas for 14 and 28 mc. have been investigated (see footnote) with the idea of finding a system that would give a high gain and warrant its cost. However, it was found that very few gave high enough gain and most all of them had faults which principally centered on (1) method of coupling the feeders which prohibits continuous rotation, (2) cumbersome or large structure and (3) relatively small gain over a single dipole. The only system investigated that came close to filling all the conditions is that described by the Whitney's[8] but their system of coupling the feeders was both costly and cumbersome.

If sufficient gain is to be obtained it is almost necessary to use a dipole with at least a reflector and director, which gives a gain of about 4.5 db. over a single dipole. This is sufficient to warrant its construction. In order to get the maximum gain Brown[12] shows that the spacing of the elements should be between 1/8 and 1/10 wavelength. This is explained more simply by Kraus[10] and Smith.[11] Unfortunately, a change in impedance takes place when the elements are brought that close together and the value usually associated to the center of the antenna decreases from the usual 72 ohms to as low as 14 ohms. If close spacing is used to get maximum gain the problem of matching impedances becomes very difficult. However, when the elements are spaced a ¼ wave or more apart the impedance is 72 ohms and the loss in gain is only about .5 db. This reduction in gain would not be noticed. It was decided after much labor to adjust the elements so as to have this impedance.

Previous work on coaxial cable gave me the idea of using a mast of aluminum tubing as the main support. This tubing, with another tube running coaxially through it, smaller in diameter and insulated from it, would also act as a coaxial feeder. The mast, then having an impedance of 72 ohms, could be coupled directly to the antenna system which is mounted at the top on a superstructure rigidly fastened to the mast. Connections, through sliding contacts at the base of the mast, to similar but smaller coaxial line would couple the transmitter very efficiently. This system will fill all the conditions required as stated before.

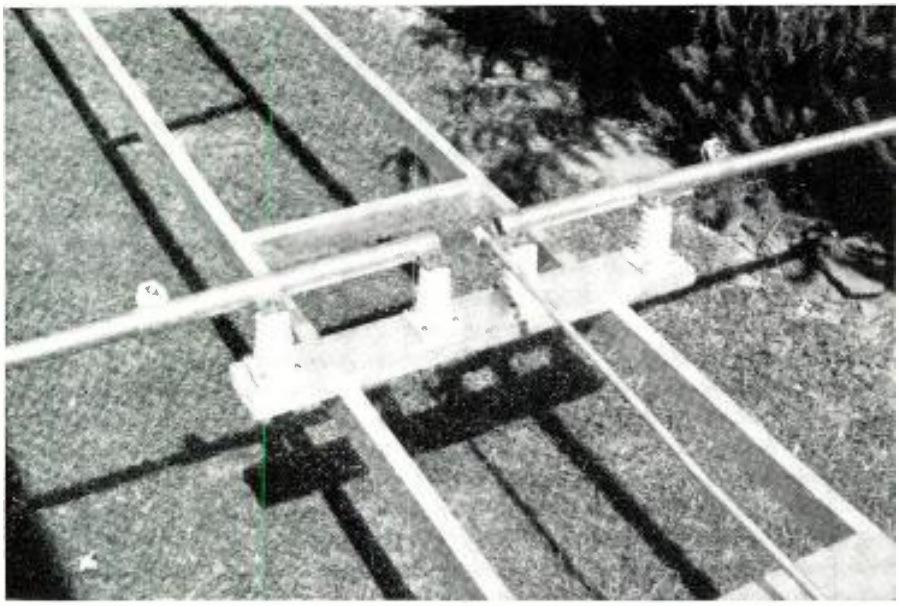
### Coaxial Line-Mast

To calculate the sizes of tubing to be used for the mast, a number of considerations must be taken into account. Besides the impedance, the wind velocity usually encountered, weight of superstructure and length of tubing to be used must be considered so that a good stiff breeze wouldn't put a permanent kink in the mast. These factors can be easily included in the calculations after certain conditions are decided upon by the use of common mechanical engineering formula for bending moments.

It was found that a 1.5 inch aluminum pipe (I.P.S.) would be large enough for average conditions. By using a .5 inch aluminum tube for the inside conductor the mast would have an impedance of 72 ohms. The mast can be any length provided an adequate brace or support is placed at least 12 feet from the top. The main bearing and bushing on which the whole structure rests are at the lower end of the mast. If they were placed at the top support, the holes, into which the set-screws are placed, would weaken the structure at the point where maximum stress occurs.

The length of the inside conductor is cut slightly longer than the outer conductor so that it extends about 2 inches at either end. This provides a

1. M. P. Mims—*Q.S.T.* Vol. XIX, No. 12, page 12. "The All-Around 14 Mc. Signal Squirter."
2. H. J. Breuer—*Q.S.T.* Vol. XX, No. 4, page 28. "A 28 Mc. Rotary Beam."
3. William Fritz—*Q.S.T.* Vol. XXI, No. 6, page 50. "A Simple and Inexpensive Rotary Beam Antenna for 28 Mc."
4. John L. Reinartz—*Q.S.T.* Vol. XXI, No. 10, page 27. "Half-Wave Loop Antenna."
5. Burton T. Simpson—*Q.S.T.* Vol. XXI, No. 10, page 29. "A Square 'Signal Squirter' for 14 Mc."
6. C. W. Lugar—*Q.S.T.* Vol. XXI, No. 12, page 25. "A Rotary Spider-Web Loop Antenna With Reflector."
7. John D. Kraus—*Q.S.T.* Vol. XXII, No. 1, page 21. "Directional Antenna With Closely-spaced Elements."
8. L. H. and G. W. Whitney—*Q.S.T.* Vol. XXII, No. 5, page 20. "New Ideas in Rotatable Antenna Construction."
9. Don C. Wallace—*Q.S.T.* Vol. XXII, No. 7, page 32. "A Ten-Meter Rotatable Alfred Beam."
10. John D. Kraus—*RADIO*, June 1938, page 15. "The Flat Top Beam."
11. W. W. Smith—*RADIO*, June 1938, page 38. "Practical Design of Close-spaced Unidirectional Arrays."
12. George H. Brown—*IRE Proc.*, January 1937, page 94. "Directional Antenna."



The radiator center connection. The thin stub connects to the top of the feeder.

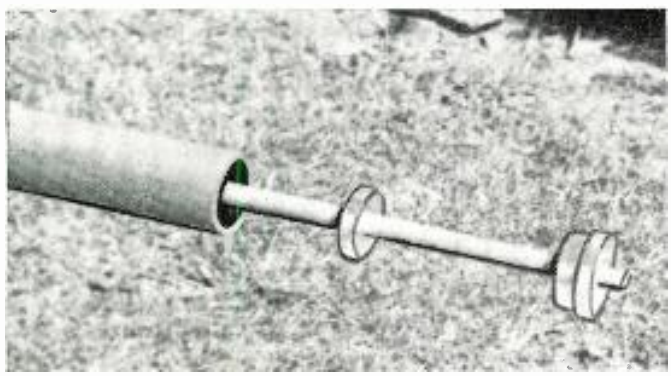
means for connecting the antenna at the top and the sliding contacts at the bottom. These contacts are made of springy aluminum sheet (17ST) and are about ½ inch wide and 6 inches long. They are supported on stand-off insulators near the base of the mast.

The inside conductor is insulated from the outer tube by means of special molded Lucite spacers. This material is a special thermoplastic having exceptionally good properties at high frequencies and is used in a number of applications where high strength, zero water absorption and high dielectric strength are needed. These spacers were molded for me by *R9 Crystals Arnold, Pa.* and can be obtained at a reasonable cost. They have an outside diameter of 1.6 inches and a hole through the middle of .5 inches. They are spaced about 2 feet apart and cemented to the inside conductor with Lucite cement. Special end over-lapping spacers were also molded to fit over the ends of the outer conductor and act as support for the inside tube as well as to prevent entrance of water. The construction of the mast showing the spacers and end overlapping insulators is shown in the figure.

The mast is rotated as a whole by means of a small electric motor coupled through a suitable speed reducer mounted near the base of the mast. This keeps the 110 volt line away from the radiating elements. Its proximity to the coaxial line does not affect its (coaxial) characteristics as the outer conductor is usually grounded. If the mast is mounted on top of the shack the tubing could be run through the roof and rotated by hand very easily since the whole structure does not weigh more than forty pounds.

**Construction of Superstructure**

The superstructure must be made as light and sturdy as possible because any additional weight or bulk will necessitate a larger mast. The supporting structure is made up of two pieces of 1 x 2 inch pine 21 feet long. These pieces are separated 12" apart and held in place with wooden blocks spaced 4 feet apart. This makes a fairly rigid and light structure and doesn't offer very much wind resistance. Stand-off insulators are mounted on blocks to support the elements. Putting the insulators close to the center of the elements reduces the losses usually encountered if they were placed further out toward the ends. The method of mounting the tubing to the insulators is shown. The reflector and director are mounted at the ends of the superstructure and the antenna is mounted 8 feet 6 inches in front of the reflector (for 29.0 mc.).



The special beads make fine coaxial feeder-support.

It is expected that with such close spacing of the insulators it would cause the aluminum tubing to deflect downward at the ends. It was found that by using ¾ inch tubing with only 1/16 inch wall thickness and made of 17ST aluminum alloy a deflection would occur of only 1 and ¾ inches. This slight amount can be corrected by slightly bending the tubing in the opposite direction before mounting. This tubing has sufficient strength and flexibility to withstand a 50 mile an hour wind without putting a permanent bend in it, but would sway, of course at such velocities. This is not considered serious. The length of these tubes are cut slightly less than the lengths specified in the Handbook. Larger telescopic tubing fitted in the ends are used to make the final adjustments. The best way to fasten the tubes to the insulators is by means of clamps made of aluminum sheet bent the diameter of the tubing. Do not drill holes through the tubes as that materially weakens them.

**Adjustment Procedure**

The antenna, reflector and director are adjusted to give the maximum ratio of forward to backward radiation. A field strength meter or a friend amateur living about a mile away having a receiver equipped with an S meter is almost necessary to determine the results of the alterations.

When the beam is all set up and the transmitter coupled to it through the transmission line the field strength meter is placed in front of the director element about a hundred feet away. The meter is adjusted to give about half scale reading and after once set it should not be changed.

With the reflector and director adjusted to approximate correct lengths, the antenna is adjusted by sliding in or out the small tubes in the end until the final amplifier plate current is the highest. The small tubes in the reflector are then adjusted to give the highest reading on the field strength meter. A small r.f. meter or flash light bulb coupled across the center of the reflector will be some help. The proceeding adjustment should correspond to the maximum indication on the r.f. meter. This will also reduce the amplifier plate current, so the antenna is readjusted to give the maximum reading and the reflector is again readjusted. The director is then adjusted to further increase the signal in the forward direction. Any change in this element will of course upset the balance of the other adjustments and they must be corrected but these changes are very slight. The main thing is to have the antenna properly adjusted so that no standing waves appear on the transmission line.

**Constructional Changes for Maximum Gain**

If maximum gain by closer spacing of the elements is desired there are two methods that can be used without altering the construction materially.

In the first method the mast dimensions are kept the same as given and a proper match of impedances is made by inserting a small coil in the center of the antenna and tapping the mast line to it on either side of center.

The other method necessitates

*(Pse QSY to page 57)*

# AS I SEE IT!

By JOHN F. RIDER
*Dean of the Servicemen*

**We take pride in presenting the first of a series of exclusive articles dealing with the serviceman and his unique problems.**

The author, well-known John F. Rider

### Voltmeters

CERTAIN changes are due in the contents of service manuals released by some of the receiver manufacturers. These changes relate to the operating voltages. No doubt upon hearing what these changes will be, certain people will raise a clamor on the grounds that we have a personal axe to grind. Frankly, this personal business is just so much bunk. There is nothing personal in the suggestion, because one particular set manufacturer, realizing the value of actual operating voltages at the various tube elements in a radio receiver, has time and again published such information in their manuals. I am referring to RCA. Now it is a matter of bringing this point to the attention of the other set manufacturers in the hope that future voltage tables given in service manuals will show the actual d.-c. operating voltages and NOT the measured voltages.

In the past it has been customary, due perhaps to the nature of the measuring devices, to quote measured values of voltage, as for example with a 1000 ohms-per-volt meter. Does it not seem somewhat strange to quote a measured d.-c. voltage of 50 volts, when actually 145 volts or even more exists at a tube plate or screen? We appreciate the fact that the majority of voltage measuring devices in use are those which cannot establish the actual operating voltage at a tube's elements in high resistance circuits. That, however, does not mean that the practice should be continued.

In order that effective servicing and positive identification of defects be accomplished with greatest ease, d.-c. voltmeters intended for service work should be capable of measuring the actual operating d.-c. voltage. This means that instrument manufacturers will have to produce d.-c. voltmeters which will indicate such voltages in high resistance circuits and servicemen will have to discard the 1000 ohms-per-volt meter.

Take one concrete example, the grid bias voltage applied to output tubes. The majority of the receivers made during the past few years employ resistance coupling to this stage. The bias is secured from the cathode circuit or from the power supply and applied to the control grid. Does it make sense to check the cathode voltage or the voltage across the power supply voltage divider and then hope that this voltage is present at the tube grid? Not by a long shot. If the voltage is applied to the control grid, it should be measured at the control grid.

To assume that the correct voltage exists at the control grid just because it is correct at the cathode or at the power supply voltage divider is taking too much for granted. Altogether too many chances for incorrect bias voltage at the control grid exists in modern receivers. Resistance measurement means nothing in this case because a leak of several million ohms across the coupling capacity in such circuits will change the control grid voltage by as high as 25 to 50 per cent. Positive identification of such coupling capacity leakage is possible without first removing the coupling condenser by using a voltmeter which measures the actual operating voltage at the control grid.

This is not the only example. I can quote many more, but I do not think it necessary. It's plain common sense to understand the need for an instrument which will measure the actual operating d.-c. tube potentials without misleading the man who makes the test. It's also reasonable to criticize a measurement of 10 or 20 volts on the 500-volt scale of an instrument. There should be no need for such measurements in these modern times. Test instruments design must keep pace with receiver design and servicemen must appreciate the need for and purchase such equipment.

Some manufacturers raised the sensitivity of their d.-c. voltmeters, but not high enough. There is no reason why d.-c. voltmeters should not have a sensitivity of several hundred thousand ohms-per-volt and even more. I cannot speak officially, but I feel that in time to come receiver manufacturers will discontinue the practice of presenting service data in such form as to foster servicing methods which are not consistent with the modern design of their receivers.

### A Machine That Talks

THERE does not seem to be any limit to what the Bell Telephone Labs cannot do. On the 5th of January, 1939, in Philadelphia, a woman seated at a table provided with two sets of small black and white keys, eleven in all, made a machine talk. These eleven keys controlled a number of oscillating circuits. As the various keys were depressed words issued from the instrument and the spoken voice was created by electrical means. Not only were female and male voices created, but words in all languages were audible. As a matter of fact tongue-twisters in any language were

produced with equal facility, with any inflection, desired and requested by the audience.

Words consist of certain frequencies in a certain harmonic relation and with a certain amplitude relation. These oscillators generated the frequencies and they were combined in such manner as to produce not only words but actual sentences.

The device is called a *Voder,* which is an abridged term derived from the three words "voice operation demonstrator." Not only will it produce sounds of the human race, but animal sounds as well.

Maybe the day is not far distant when such an instrument may enable an individual who has lost the power of speech to occupy his normal role in the daily course of human relations. And it is not too far fetched to imagine that such a device will be manufactured for such a purpose and that the specialized serviceman may find another field.

### Service Guarantees

HERE is a sweet problem for some of the servicemen of the world: What about this guarantee situation? . . . What does it mean? . . . What can a serviceman do when he knows that the customer is wrong in demanding that a receiver be repaired for the second time when the second defect has no bearing upon the first which was repaired and the work guaranteed?

I admit that I have no solution to offer, that is when I consider all of the ramifications of the problem. On the one hand the serviceman wishes to keep the customer's good will; on the other hand he must of necessity take a loss on the job. If he takes a loss, what assurance does he have that he will again find the opportunity to make up that loss upon the same customer? The customer may move out of the neighborhood.

The customer knows nothing about radio. How can the serviceman convince him of the fact that the second defect is not related to the first? Should the serviceman identify the various parts which have been replaced and the exact nature of the repair? Should the serviceman return the defective parts to the customer? Should the serviceman identify the parts replaced in the receiver?

One thing I feel certain of, the blanket guarantees now being given by service organizations are wrong. . . . How can a shop advertise a year's guarantee and offer that guarantee on a receiver which is 5, 6 or even 8 years old? What is the guarantee on the replacement parts which were used in the repair? . . . Is there a guarantee on such replacement parts?

Does it mean anything to guarantee the work done? . . . How can it be identified to a person who knows nothing about radio? . . . Does such a guarantee afford any protection to the customer? . . . To the serviceman? . . .

(*Continue on page* 58, *please*)

# The VIDEO Reporter

**by W. C. DORF**

FOR the first part of January and up to the time this column went to press, television in the eastern part of the United States was marking time. After many personal interviews, with a bit of information here and a word dropped there, this reporter found that video activities were in general, being held under wraps, in other words, toned down, only awaiting the advantageous moment for the introduction of the particular advancement or instrument.

Naturally, the lack of scheduled programs is a drawback to the complete situation, but this is only a temporary condition and there is a rumor that one of the chains will put on a series of television transmissions as a rehearsal to the regular sked to take place with the opening of the World's Fair.

Behind the scenes the National Broadcasting Company and the Columbia Broadcasting System are working no-end on their latest transmitters, new antenna systems, etc. and the receiver companies and parts manufacturers are not sitting idly by, no sir, you will read in this column about the latest RCA cathode-ray tubes with the white screen, a new DuMont "Aquarium" set with a 14 inch tube, and the Andrea 16-tube picture and sound receiving kit. Also, there is the NBC announcement on the appointment of Miss Thelma A. Prescott who is to handle the interests of the feminine video fan. This brings up the thought that when television is on a regular schedule, there should be a much greater number of female sight and sound fans over the other gender. Why? Because it would appear that television holds the greater possibilities for them, the pre-view of a Paris hat or a gown, a new dance step, a digest or sketch from a new play, a front row seat at a smart social event, etc. However, when a championship boxing match is telecast, well, that's something else again.

### NBC Looks to the Women's Interest

TELEVISION'S first woman program director, Miss Thelma A. Prescott, has been added to the staff of NBC to represent the feminine interest in the new art. The new tele-director's job will be to produce fashion shows and other programs appealing primarily to women.

Mr. Thomas H. Hutchinson, director of television programs for NBC, states that the addition of Miss Prescott rounds out a small but competent staff that has been preparing for two years for the inauguration of a public television service. "When NBC television goes on the air regularly next spring, we shall appeal to as wide an audience as possible. Because of Miss Prescott's academic training and subsequent experience in art, fashions, journalism and photography, we feel that she will be particularly competent in staging programs of unusual appeal to women."

### Low Price Kit for the Experimenter

MR. ANDREA of the Andrea Radio Corporation recently stated that it was the set-builders and servicemen who led the parade for radio broadcasting back in 1923 and he believes it will be this same group who will form the nucleus of the audience for the new video art. This company, therefore, is making available the table model KT-E-5 television receiver in kit form, as shown in the accompanying illustrations.

It is a sixteen tube outfit, employs a 5 inch short-neck cathode-ray tube and it is supplied with complete step-by-step assembly instructions. There are six controls, three to regulate the sound and the remaining three to adjust the position, brilliance and contrast of the images. Production is well along on this kit and it is set for delivery this month. [See page 34. Ed.]

### Two New White Screen Kinescopes

RCA just brought out two new electrostatic-reflection type television tubes which feature a white fluorescent screen. They are types 9061P4 and 18021P4. The first is a 3 inch tube designed primarily for use by amateurs and experimenters for the reproduction of experimental television pictures. It can also be used for oscillographic applications. Heater voltage 2.5 volts, heater current 2.1 amp. and high voltage electrode 1500 max. volts. The type 18021P4 is a 5 inch tube to provide excellent quality television pictures. The heater voltage of this number is 6.3 volts, current 0.6 amp. and anode No. 2 voltage max. 2000 volts.

### More Truth Than Poetry

NOW that television is about to make its bow to the American public, unscrupulous promoters are edging up front, to peddle their get-rich schemes to the gullible public. The financial sections of the several New York papers and periodicals have run excellent articles on the subject, cautioning the public to beware of stock promoting rackets. There is a lot of truth in what they say—that the established companies should be looked to for guidance, not the overnight concerns with bales of fine embossed paper to sell.

### New Video Set with 14 Inch Tube Attracts Crowds

IN order to acquaint the public with the intricacies of a television receiver, the Allen B. DuMont Laboratories, Inc., have made up several of their standard table-model sight-and-sound receivers with glass sides, back and top instead of the solid-wood cabinets. The interior of these "aquarium" sets as they are called, are illuminated by means of concealed mercury-vapor tube lights. These sets are attracting crowds in the Davega-City Radio stores and elsewhere where they are on display in Metropolitan New York.

### Mr. Public Gets the Low-down on Television

FROM last account the NBC television tours are still being received with a great deal of interest by the public. These conducted tours at Rockefeller Centre provide a 30 minute demonstration on how television works from the television eye or camera with its iconoscope to the received image on the kinescope or cathode-ray tube. Pages directing the tours report that Mr. Public wants to know when the receivers will be ready, how much will they cost and why can't they just put a picture box on their present set?

### Mary Eastman as Tele-Test Signal

BECAUSE Monotron tubes are in rapidly-growing demand by television engineer and tele fans, particularly in areas not served by experimental video transmitters the National Union Radio Corp. has just brought out a new Monotron picture CR. tube containing a sharp half-tone

(*Follow over to page* 61)

# Practical Limiting Amplifier

By GEORGE W. BROOKS, W1JNO
Engineer, Station WLNH, Laconia, N. H.

**With the unit described, the modulation is kept around 85% and this effectively increases the power output by at least 3 db or double.**

AMATEUR radio is supposed to have given the radio industry most of its greatest improvements, but at present the broadcasting industry has a device that would be a material increase to amateur radiophone transmitters. Any amateur would like to increase his signal without the necessity of increasing power. The Limiting Amplifier as used in broadcasting does this and is the largest advancement since Class B Modulation as it gives a 3 db increase in power output or effectively doubling the power output. Its operation is such that by placing the amplifier in place of the usual speech amplifier before the modulators it acts as an automatic audio volume control.

At a preadjusted level the unit goes into operation and reduces the audio input to the modulator grids so that a large increase in sound at the mike produces only a small increase in the input to the modulator grids. This results in being able to employ a higher audio level and a higher percentage of modulation without the corresponding overmodulation. It takes about 12 times as much audio input to go from 80 percent to 100 percent with the Limiting amplifier as without.

With a higher percentage of average modulation the transmitter has a more readable signal and expressed in powers, a 100 watt transmitter *with* the limiting amplifier sounds like a 200 watt job without the unit. The cost of such an instrument is low and can take the place of your present speech amplifier.

The diagram is self explanatory with one or two exceptions in the operation. T-1 need not be a transformer but could be resistance coupled to a pentode preamplifier so that a crystal mike could be used. Likewise the output transformer can be replaced with resistance coupling to the grids of the following stage so that tubes like the 6L6 could be used as either drivers or a low power modulator.

There are plenty of suggestions that could be used in place of the parts given, such as the 6N7 could be replaced with a couple of triodes in fact the complete line-up is flexible throughout. The 6R7 could be replaced by a 2.5 volt series tube and the combinations are limitless.

The operation is such that with the 6R7 acting as an audio amplifier and rectifier supplying a bias voltage to the grids of the 6K7's an audio frequency AVC is formed. Resistor R-1 controls the input to the grids of the PP 6K7's and R-2 controls the input to the triode amplifier.

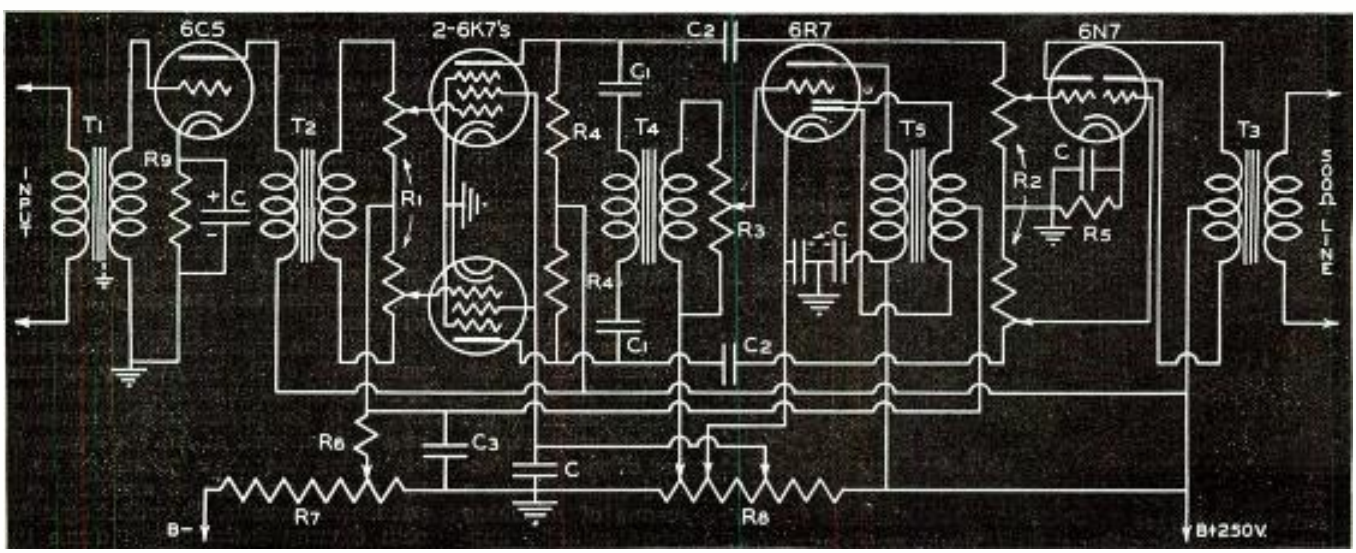
In operation R-3 is adjusted for zero setting keeping any audio voltage off the grid of the 6R7. Then section R-7 and R-8 are adjusted to give correct values of voltage on the tubes. R-8 consists of a 500 ohm section of R-7. The screen of the 6K7's are given between 70 and 100 volts. The grid of the 6R7 is given about 3 volts bias from ground and the cathode given about 9 volts bias in respect to the grid.

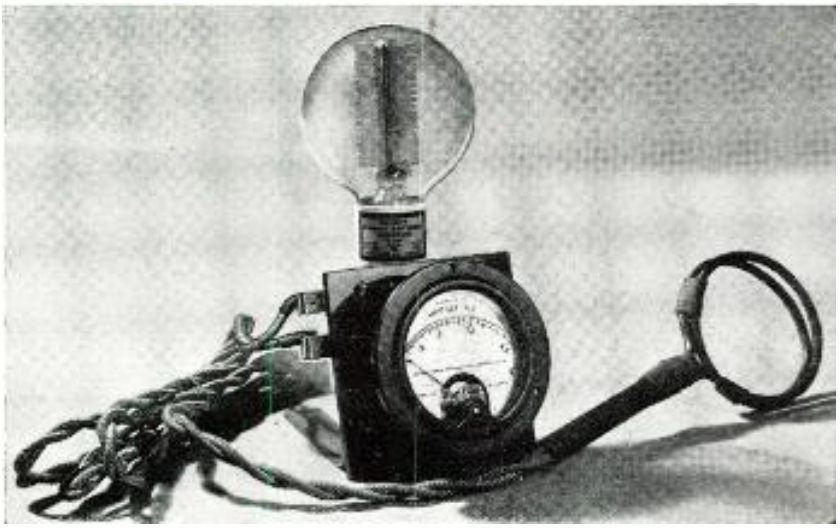
R-8 is adjusted so that the 6K7's receive about 1.5 volt bias without any signal input to the grids. Now with the limiting amplifier connected in the circuit and the transmitter connected to a dummy antenna, a signal is applied to the grids of the 6K7's and the input adjusted with R-1 so that with R-2 at ¾ scale the transmitter is modulated approximately 85% with a constant sine wave input. Now R-3 is adjusted so as to bring the modulation percentage down to 50 or 60% Now R-2 is adjusted so that the transmitter is again modulated roughly 85 percent. The 6R7 circuit is now adjusted that the modulation percentage has a peak percentage of roughly 85 at the input employed and any percentage increase in the input will be reduced in proportion to its increase. In operation, with a certain input at the grids of the 6K7's, the reduction or limiting action depends upon the setting of the control R-3. The time constant of the circuit is very important as it is not supposed to work on

(*Modulate further on page* 51)

Component parts list.

T-1. Input transformer to grid. (See Description)
T-2. Pushpull input transformer.
T-3. Pushpull output to 500 ohm line. (See Description)
T-4. 1 to 1 interstage transformer.
T-5. Pushpull input transformer.
C- 8 Mfd. Condensers (electrolytic). Cathode circuit can have 25 Mfd.
C-1. .01 Mfd. Condensers 600 volt.
C-2. .01 Mfd. Condensers 600 volt.
C-3. .5 Mfd. Condenser. Value gives time constant with R6.
R-1-2. 500,000 ohm dual potentiometers.
R-3. 500,000 ohm potentiometer.
R-4. 150,000 ohm 1 watt resistor.
R-5. 600 ohm 2 watt resistor.
R-6. See text.
R-7-8. 25,000 ohm 20 watt fixed resistor.
R-9. 1500 ohms.





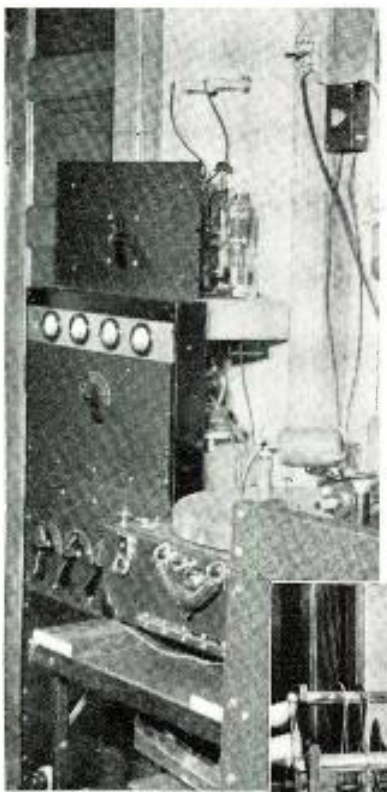
The matching instrument: an r.f. meter and a dummy antenna.

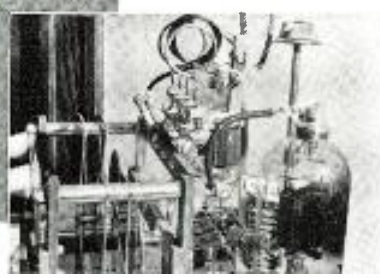
**An excellent way to raise the output of your rig without a change in input, is to improve the match with the antenna.**

**By GORDON E. GRAY, W9CG**
Sales Engineer, Ohmite Mfg. Co.
Chicago, Illinois

# Boosting Your Rig's Output

IN last month's article it was demonstrated that a Dummy Antenna in connection with an r.f. ammeter offered a practical means for the measurement of radio frequency power. With a simple and practical means of measuring r.f. power, not only can the plate circuit efficiency of the various stages of a transmitter be determined, as previously outlined but also additional data about the complete installation, from crystal stage to antenna which more or less have been assumed in the past, can be determined within practical limits.





The use of the described theories were tested by the author at W9UAQ with gratifying results.

For example, consider the ½ wave doublet which has theoretically a 73 ohm impedance at the center. The presence of trees and other objects in the vicinity may alter this value appreciably. Obviously the greatest and most efficient transfer of power would be obtained using a transmission line with the same surge impedance as the point of feed in the actual antenna under consideration with all of the factors of nearby objects accounted for. There is no question that some amateurs have locations which make it virtually impossible to string up an antenna in say more than two or three ways. One of these possibilities may be better than the other two and an actual rough determination of the impedance of the radiating system in each of the cases will help determine which of the systems to use as far as transfer of power is concerned.

Other considerations, such as directional effects, may also alter the choice. *Considerable* mismatch between the transmission line and antenna can be tolerated without too serious an effect on the transfer of power or the overall efficiency between final amplifier input and antenna. How much mismatch can be tolerated in a given arrangement will depend upon a number of variable factors and without a means of *watching* what actually happens to the power while the matching procedure is being followed, extremely bad yet not apparent mal-adjustment of the system can be the result.

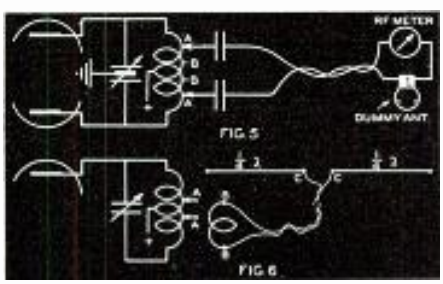
There is a tendency to overcouple, especially on 'phone transmitters, in order to bring up the plate loading to twice the audio output capability of the modulators at the required load impedance. An extremely poor antenna system might be incapable of loading the final to the correct figures yet overcoupling as far as the plate milliammeter reading is concerned will make it appear that the final is loading properly and the antenna is taking the load. Further, an r.f. ammeter in the feeders will mean little since strong standing waves in the feeder which would accompany overcoupling (overcoupling is in reality a mismatch) might also give the false impression that high feeder current represents the maximum transfer of energy to the radiator. Actually a current loop might shift to the exact location of the r.f. meter, in which case there would be a high reading.

Under the conditions just described it would be better to couple loosely and be satisfied with a lower plate input and readjust the audio input and matching transformer to the new plate impedance. It can be demonstrated that more r.f. power may be actually delivered to the antenna with the loose coupling and reduced plate input as follows:

A 73 ohm transmission line terminated with a 73 ohm dummy antenna is adjusted for maximum transfer of energy to the dummy with the match on the final tank at AA (in Figure 5) employing the same procedure as in the previous article on amplifier output measurements. Substituting a 600 ohm dummy antenna will cause the

plate input to reduce and the power being transformed into heat in the 600 ohm dummy antenna will be less than that which was transferred to the 73 ohm dummy antenna. By clipping farther away from the points AA on the tank, points BB on the tank can be reached which will bring the plate loading up to the original figures. The power delivered to the 600 ohm dummy antenna will have dropped practically to nothing and most of the plate input can be charged up to a now inefficient amplifier and also high losses in the transmission line. This is no longer serving this purpose, but acting as an extremely poor radiator. As a matter of fact the transmission line does of itself not have its rated nominal surge impedance unless *terminated by an impedance* equal to its rated nominal surge impedance. By virtue of this fact, standing waves will exist when the line is terminated otherwise.

It is true that a point somewhere between AA and BB can be found where power delivered to the 600 ohm dummy antenna will be greater than delivered to it when the clips are at AA, the correct points for the 73 ohm match. The power will be nowhere equal to that delivered to the 73 ohm dummy antenna but it will be greater than that delivered at the point BB where the plate loading appeared to be correct even though at this intermediate point the plate input will be down considerably. Under these conditions the former 73 ohm, either twisted pair or concentric line, probably becomes part of the load since it will be serving as a poor radiator and any power absorbed by the dummy exists by virtue of the dummy being a part of the poor radiating system. It might be well to state at this point that in addition to the 600 ohm termination to the 73 ohm line (which in this case was a flexible concentric cable), the writer tried two 73 ohm units in series for 146 ohms as a termination and also two 73 ohm units in parallel for a 36.5 ohm termination. Both the latter cases represented a 2 to 1 mismatch, yet the power delivered to the load after readjustment of the coupling for maximum transfer of energy was better than 90% of the amount delivered to the correct 73 ohm termination. Strangely enough, the overall efficiency from plate input to




load remained practically the same and the slight reduction in power delivered was accompanied by a similar reduction in plate input. Here again any attempt to overcouple and bring up the plate current to the previous value noted for the 73 ohm termination was accompanied by a noticeable decrease in power. It cannot be stressed too strongly that overcoupling results in a reduction in power output and an increase in input. This obviously causes the overall efficiency to decrease rapidly since, as stated before, percent efficiency equals

$$\frac{\text{output}}{\text{input}} \times 100$$

With the above facts at hand, one should be able to make some practical measurements on a given installation. Realizing that antenna types are as numerous as tubes, a book of procedure as large as a service manual would be necessary to cover all cases. It is hoped that the following actual determinations on a typical amateur array will suffice to illustrate the "point of attack" which would be similar in all types in gaining better antenna and feeder efficiency.

(f) Determination of the efficiency and impedence within limits of the antenna system itself.

Figure (6) illustrates a typical means of coupling a final amplifier to a ½ wave doublet antenna. As previously described, the r.f. power delivered at AA, BB and CC can be determined. In a particular case measured by the writer, the plate input was 140 mils at 1080 volts or (1080 x .140) 151 watts. The power measured at AA was 91.5 watts as evidenced by a current 1.12 amperes in the 73 ohm dummy load.

$I^2R = (1.12)\ (1.12)\ (73) = 91.5$

The efficiency of the final was $\frac{91.5}{151} =$ 60.5%.

The power at BB was the same but at CC for the same plate input the current was 0.96 in the dummy indicating (0.96) (0.96) (73) = 67 watts being available for delivery to the antenna.

Note the *overall* efficiency was $\frac{67}{151} =$ 44.5% and the obvious loss in power in the transmission line was 91.5 — 67 = 24.5 watts.

Substitution of the antenna for the dummy made absolutely no visible change in plate input or adjustment of the transmitter indicating that all impedance matches were substantially correct.

A ½ wave antenna has a 73 ohm theoretical impedance at the center, and the presence of trees or other objects in the vicinity may lower this value appreciably. (To all intents and purposes the antenna impedance at the center is equal to the radiation resistance.)

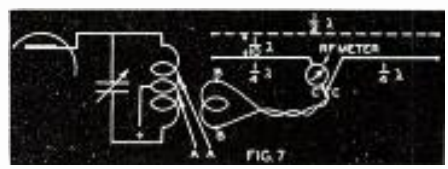
An approximate calculation of the impedance of the antenna system just illustrated can be made, however, several assumptions which may not be entirely correct have to be made and the technique of the experimenter has to be taken into consideration.

The following illustration (Fig. 7) will serve to indicate what is meant and no doubt will re-open an avenue of

W9TKD, where some tests were made.

experimentation which will eventually solve many of our antenna problems which of late have been of major interest to most amateurs.

As illustrated before, power measurements at AA, BB and CC can be made to determine exactly what amount of r.f. power can be delivered to the antenna at point CC regardless of the overall efficiency of the transmission line, etc. The transmission line can have considerable losses without effecting *this experiment* just as long as we know what they are and what power is delivered at CC. In the particular experiment made by the writer, substitution of the antenna for the 73 ohm dummy at CC made absolutely no changes in plate input, transmitter adjustment or coupling arrangement and it reasonably could be assumed that the antenna was taking all the power previously delivered to




the dummy. Insertion of the r.f. ammeter, as shown, revealed exactly the same r.f. current that flowed in the dummy indicating that the antenna radiation resistance and hence impedance was to all intents and purposes 73 ohms. (This is one of the assumptions which may be incorrect. Theoretically the ammeter would have to be in the exact center of the antenna at the current antinode or loop. It is felt that the ammeter was sufficiently close to this point to be within the errors in reading the ammeter.) The actual figure was 0.96 amperes indicating

*(Pse QSY to page 44)*

# Serviceman's Experiences

by LEE SHELDON
Chicago, Illinois

**Income is figured by deducting the amount of expenses from the sum taken in. Books sometimes lead to trouble.**

THE other day, while I sat in the back of the shop, resting my eyes, - - my partner startled me with:

"Hey, wake up! What are you doing —gathering wool to pull over our customers' eyes?"

"I am not," I replied, indignantly. "I am simply realizing, in my quiet way, that it's about time we put some system into *Salutary Sales & Service!*"

"*Oh*—oh," Al said. "Something gamey is in the wind—probably another of your foul ideas. Against what little judgment I have after long association with you, I am going to flush your covey."

He slid a Victor 32 pack to the center of the floor, squatted on the filter block, and said: "Come now, my setting son—tell papa what you saw in the funnies."

Those who know my partner recognize these remarks as typical. Those who don't are lucky. The only time he spoke decently to me was on August 17, 1934. He bid me good morning, and it frightened me so much I withdrew from the partnership. I returned to work on the nineteenth, after I learned he had not gone crazy, but was only drunk.

"Hey!" Al yelled. "Don't live *all* your life in the subconscious! When you borrow my ear, I don't want it left empty!"

"I stayed up late last night," I patiently replied, "reading an article by a fellow who explained how servicemen should keep an exact record of the money they take in on every job."

"Midnight oil does not always grease the wheels of commerce," he interrupted. "Get to the point."

Even I lose my temper at times. "Why," I asked him, changing my tone, "do you keep me as a partner, when you think so little of my opinions?"

"One and a half heads are better than one," he answered. (You see what I mean? The man was born with a knife in his mouth!) "But what's this idea of yours?"

"Well, this fellow showed how to figure a repairman's hourly rate; how a certain amount must always be added to what you are really worth per unit of time to take care of things like greasing the car next Tuesday and depreciation of talent."

Al interrupted again: "I'm no expert in child psychology, but it sounds like you are about to sell yourself some paper-work. Is that the idea you would arrive at if I let you wander long enough?"

"Yes," I admitted, "although it's a very crude way to refer to a basic business truth. We need better records of our business functions. The only ones we keep now are those few which are necessary to keep us out of striped clothing. Do you, for instance, know what ratio we had between net and gross income for the fiscal year ending yesterday?"


"He's inventing something! A radio bar . . ."

"Stop talking like an income tax blank," Al said. "I'm more interested in rations than ratios. Are we in business to make profit, or to write history? What value, over that of baled paper, would a detailed accounting system have in our work?"

"It would let us understand our profession better. I would know how much to charge for each call to show the proper profit over inventory and overhead, multiplied by a correction factor of 1.28—which represents an index of probability for a return to the gold standard."

"Your flights of fancy leave me dizzy," Al said, "and it sounds foolish to hear you say you are willing to write up your mistakes, when usually you won't even admit them. No, I don't think much of your plan."

He walked to the till, and handed a piece of paper to me. "Here," he pointed, "I'll show you the ideal bookkeeping method for a shop of this size. At the beginning of each week, draw a vertical line through the middle of a piece of paper. Label the left side OUT, and the other IN. As our money moves to and fro, jot it down in the proper column. On Saturday, subtract the total OUT from the total IN, and lay aside a few bucks for routine expenditures like rent, light, telephone, and chug-juice for the delivery truck. Divide the residue by two, and that's the amount we each draw in salary. IN minus OUT equals KEEP. Simple, direct, and honest. A more elaborate system would not increase our salaries—besides, we're servicemen, not accountants."

"I suppose Standard Oil—" I began.

"There are only two reasons for an extensive bookkeeping routine in a business as small as the average two-man repair shop; mistrust, or a need to bolster up an inferior business sense. Charges for repair work depend more upon what a customer thinks of the serviceman than on what the serviceman thinks of his paper-work. Right now, if your figuring hadn't dulled your business acumen, you would be on your way to Heathstead —where you are soon due to repair a record-changer!"

"What about—"

"Oh, well—do your arithmetic if it keeps you happy, but don't let it interfere with your work. Ledger conscience be your guide."

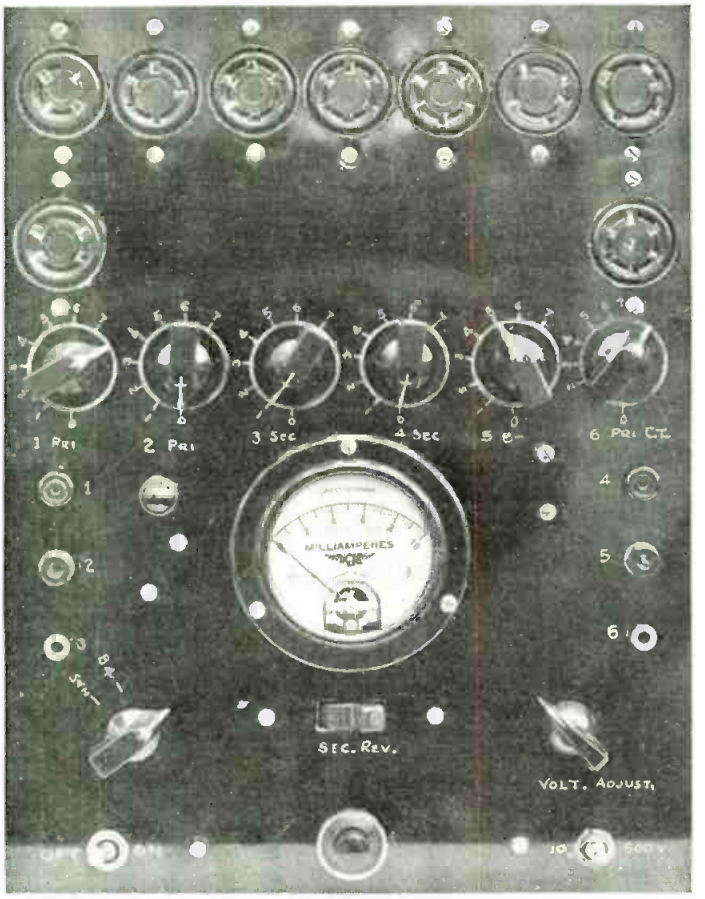
The record-changer call was from Bishop's Mortuary. I had plenty of time to lay out my future accounting plans while I drove. In fact, I became so enthusiastic I stopped at a stationery store. The owner showed me a very fine binder measuring 12 by 18 inches, very professional-looking, and as heavy as a guilty conscience. Each sheet had 36 columns in 4 colors.

"How much?" I asked.

"Seven-fifty, plus freight," he replied. "Shall I crate it?"

"No," I told him, "I have a truck

*(Please adjust to page 55)*




The front panel contains all the needed controls.

# A Serviceman's Vibrator Tester

By FRANK H. BARNHART
Fostoria, Ohio.

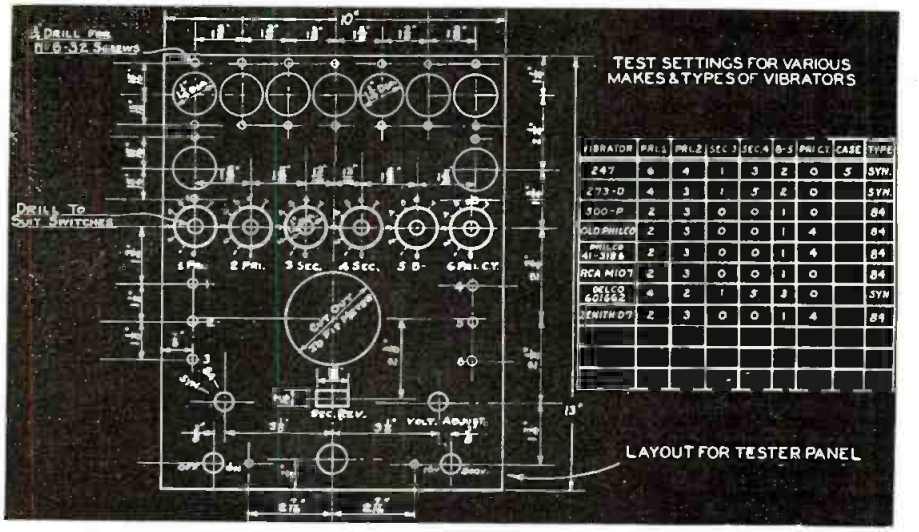
**Many hours are wasted trying to test vibrators without proper equipment. The author describes a unit that will cut this time to a minimum, efficiently.**

HAVING spent many uncertain hours guessing whether one vibrator after another was the cause of trouble in auto radio sets and, after all the effort, still being uncertain as to whether or not the vibrators were up to par, I came to the conclusion that a vibrator tester was just as essential as a tube tester in radio servicing, and that it was just about as satisfactory to guess if the vibrator was all right as it would be to guess what the condition of a certain tube in the set might be. Of course, a new vibrator could be substituted for the old one, to see if the set functioned any better, but a new vibrator of the required type was not always available and this test would not disclose the condition of the old vibrator, and unless the condition of the old vibrator was known, there was always an uncertainty. No one wants to replace a vibrator unless it is needed, and yet is unsatisfactory to turn out a set and have the feeling that the vibrator might give trouble in just a short while after the set leaves the shop.

In a manual of a condenser company was published the circuit of a vibrator tester which could be built for a very nominal sum and yet offered every test necessary to ascertain the condition of any 6 volt vibrator in a few moments and entirely eliminate the guess work. Checking through this circuit, however, disclosed the fact that it would be necessary to have several sockets of each kind, to be able to accommodate the different pin connections of the various vibrators, since there is no uniform connection for the different socket pins. To overcome this difficulty and make it possible to use one set of sockets for all vibrator connections, a switching arrangement was developed which does this satisfactorily and also will take care of any type of sockets to be added in the future.

As there has never been a numbering system adopted for the various odd vibrator socket terminals, a numbering system corresponding as near as possible to the RMA numbering of standing tube socket terminals was worked out and used in this tester. This system is shown in the schematic and gives the bottom view of the sockets.

Our vibrator was able to supply us with a complete set of vibrator sockets. Six rotary type, twelve contact switches were used, providing plenty of extra contacts for all additional re-




The vibrator tester panel layout.

Rear view of the vibrator tester.

quirements. An examination of the schematic will disclose that this switching arrangement makes it possible to connect any of the vibrator socket terminals to the three transformer primary connections (numbered 1 Pri., 2 Pri., 6 Pri. C. T.) to either outside connection of the transformer secondary (numbered 3 Sec., 4 Sec.), or to negative (numbered 5 B-). Six pin jacks also connect to these same circuits and are numbered 1, 2, 3, 4, 5, and 6. These were added to make possible tests on externally connected vibrators. The switch positions are numbered to correspond to the socket terminals.

The potentiometer used for voltage adjuster was taken from an old "A" eliminator, while the secondary reversing switch is of the toggle type and was taken from an old "B" eliminator. This is mounted in the small rectangular hole directly below the meter. This hole should be made to fit the type switch used. A pilot light taken from a discarded Kolster receiver was used and mounted to the left of the meter to indicate when the tester is on. The meter is a 0-1 milliameter with shunts as indicated in the schematic. Any good vibrator transformer will be suitable for the job. The syn.-rectifier (84) switch in this tester was made of two sections salvaged from a defective gang switch properly hooked up.

The wiring is very simple and is clearly shown in the photographs. The panel used was black enameled wall board. The back panel is of the same material and was made just large enough to accommodate the transformer, 5,000 ohm load resistor, and the 84 tube and socket. The 8 mfd. condensers are the new midget type and are mounted under the back panel. The back panel is held to the front panel by two small right angle brackets. The completed instrument was then housed in a light metal case.

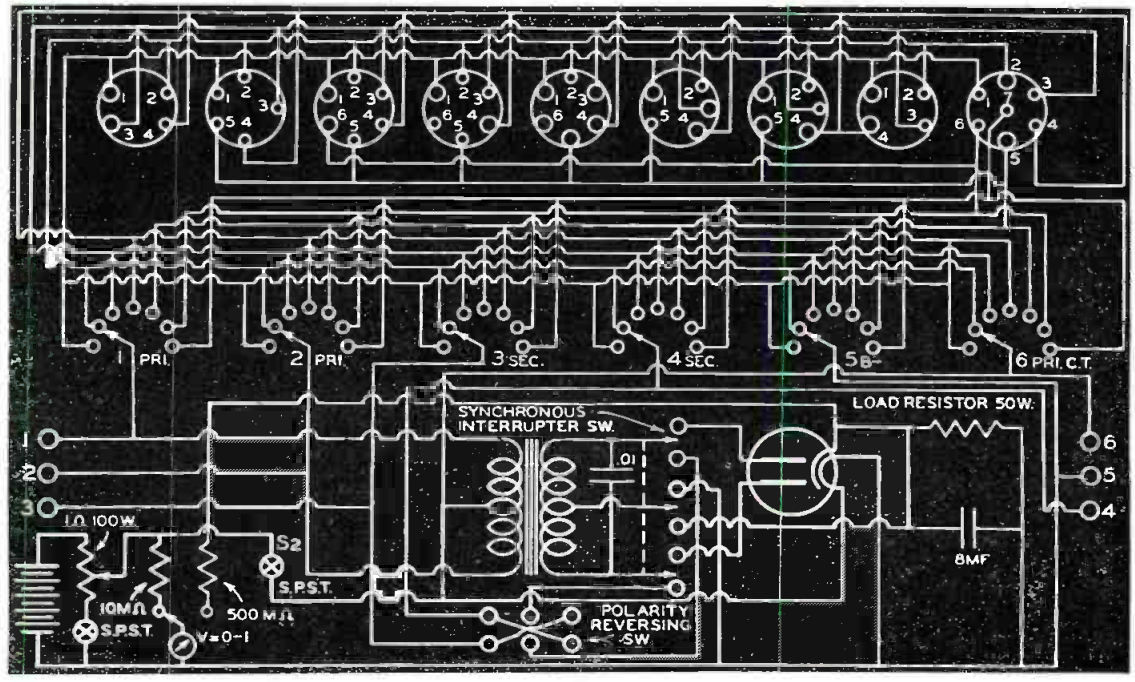
Before a vibrator can be tested it is necessary to ascertain the proper socket connections of this vibrator. To make this easier the writer went through the vibrator diagrams in the *Mallory Yaxley Encyclopedia* and numbered all vibrator socket contacts to correspond with the aforementioned numbering system. When a vibrator is to be tested it is only necessary to look up the proper replacement in the Encyclopedia and set the switches according to the numbers of the socket terminals. This tester has operated so satisfactorily that it should be a great boon to anyone doing auto radio servicing.

While the pin jacks were added to make possible the testing of vibrators with external connections, it was later found that these jacks are absolutely necessary for the testing of some vibrators. Once in a while the connection from the vibrator to the B- is completed through the wiring in the auto receiver. In this case a short lead with a phone tip on one end and an alligator clip on the other end is used to connect pin jack 5, or B-, to the case of the vibrator being tested, thus completing the wiring that is done in the receiver. The pin jacks may also be used for connecting the different terminals to an oscilloscope and observing the wave form on the screen.

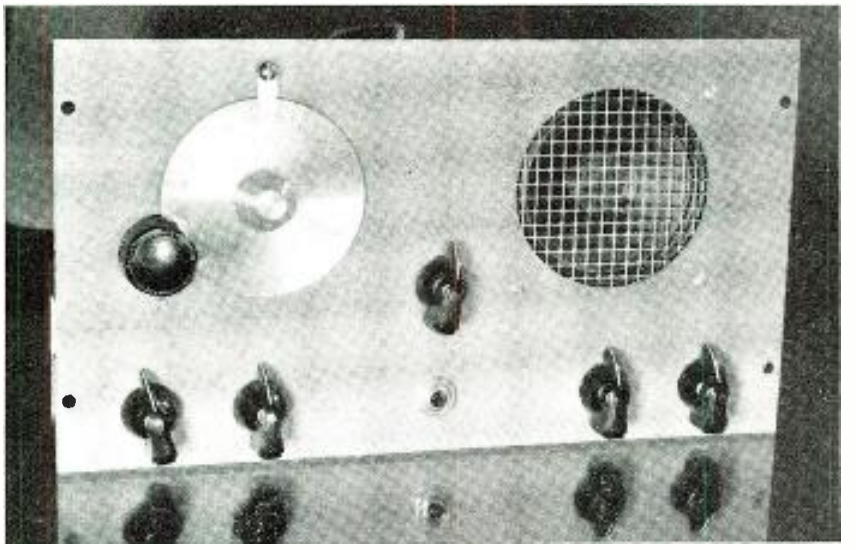
The only other difficulty encountered was the fact that the shunt connection is not shown in the diagrams of some of the vibrators. This shunt coil is connected into the primary center tap, and unless this shunt coil connection is made the vibrator will not operate and one might be led to believe that the vibrator is defective. The writer has found, in cases of this kind, that if switch 6 Pri. C. T. is set on the proper number, and in most cases this is number 4, the shunt coil will receive current and the vibrator will start.

To test a vibrator, first determine whether the vibrator is a synchronous or rectifier type and set the syn.-84 knob accordingly. Determine the socket contact numbers of the primary contacts, the secondary contacts if synchronous, the B-, or negative, contact, and set the switches to these numbers. Place the 10v-500v switch in the 10v position, then press the lower center push button switch placing the potentiometer (volt. adjust) across the battery. While depressing this switch adjust the volt. adjust knob until meter reads .55. Place the vibrator in the proper socket and turn tester on. If vibrator does not start, tap it lightly. If it starts with tapping, it is unfit for further use and should be replaced. When vibrator has started readjust volt. adjust knob for six volts and place the 10v-500v switch in the 500v position and read the vibrator output voltage on the meter. If the vibrator is of the synchronous type it may be necessary to change the Sec. Rev. switch to make the meter register properly. The output of a good vibrator reads just about half scale on this tester and is fairly constant, while a poor vibrator causes the

(*Test further on page* 48)




Circuit of vibrator tester.



The single dial is for bandspread. The unit operates AC or batteries.

**Covering the 5 through 10 M. band without plugin coils or bandswitch, this set is a new solution to n.h.f. reception.**

**By OLIVER READ, W9ETI**
Technical Editor, Radio News.

# 5 Through 10 Meter Receiver Without Bandswitching

WITH spring "just around the corner"; with the memory of "flood emergency" still in our minds, it seems well to get at that portable equipment with an eye to the future. Many circuits covering transmitter construction have appeared in RADIO NEWS and elsewhere. Receiver circuits, on the other hand, have been far-and-few between. The one described herein is a composite of many of the good qualities of the commercial manufacturers, plus those special characteristics which are demanded of a compact set of this design. The auto radio has been steadily improved upon from year to year and it has reached a state of perfection as compared with the sets of but a few years back. Like these auto receivers, which are designed for a specific purpose, a set which is to be used for a portable-mobile must incorporate certain refinements in order to meet the requirements of this type of service.

Most all cars that have come out during the past few years have a glove compartment which is located on the dash-board. This location is ideal for the housing of a mobile receiver, providing we can make it small enough to comfortably mount within the space available. We therefore decided to utilize this as the best possible solution to the problem of being able to lock the compartment when the receiver was not in use, and at the same time, have the controls within easy reach of the driver's seat.

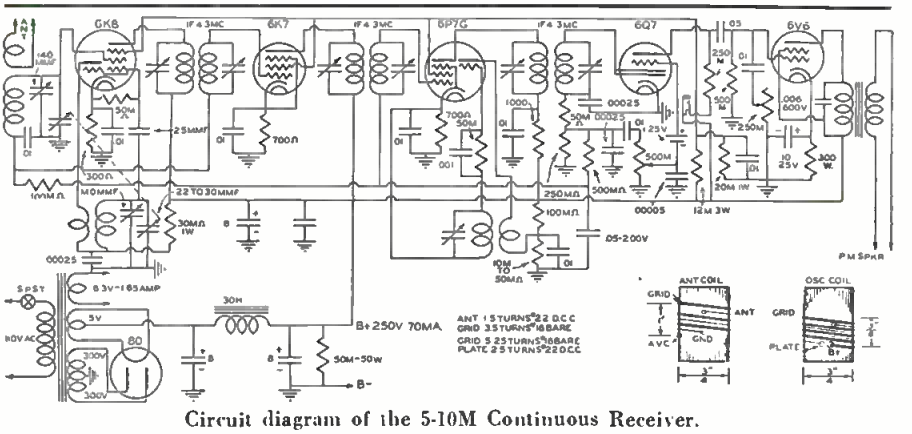
Unlike some of the commercial sets on the market, this little super can be easily duplicated by any amateur, as all standard parts are used in a tried-and-proven circuit. The outstanding features are: compactness, sensitivity, continuous frequency coverage of from 28 to 60 megacycles without coil switching or the use of plug-in coils, automatic volume control, bandspread, tone control, good selectivity and excellent general overall performance.

Inasmuch as this receiver includes the 7.5 meter police band, it will be necessary that the amateur determine from his local police department whether or not his possession of the receiver in his car will be within the law. Some communities require them to be registered.

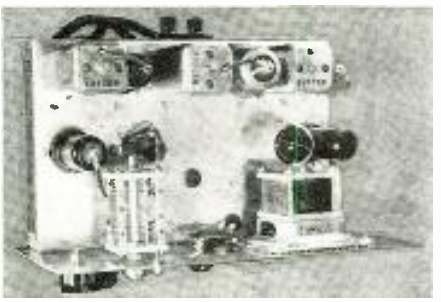
First of all, an intermediate-frequency had to be chosen that would give sufficient gain in the i.f. stages. Other reasons indicated that it would be desirable to limit the tuning capacity to as small a range as possible without a sacrifice in performance. A choice of an i.f. frequency of 4.3. megacycles was thought to be the one most adapted to the purpose and design was started around this choice.

Other reasons for the choice of 4.3 mc. were as follows: 3 to 3.5 mc. was too low an i.f. frequency when using a 6K8 translator tube in the first detector-oscillator. Interaction occurred between the oscillator and antenna circuits when this was tried and was therefore eliminated. 4.0 mc. could have been used but the final choice of 4.3 mc. kept the signal out of the 3.5 to 4.0 mc. band. A higher frequency was undesirable as the tendency toward tuned-grid, tuned-plate oscillation in the i.f. amplifier will increase with an increase in frequency and this was not wanted.

The oscillator circuit is so designed




Circuit diagram of the 5-10M Continuous Receiver.



Simplicity makes construction easy.

as to be able to be tuned to a higher frequency than the signal on the 10-meter band and to a lower frequency than the signal on the 5-meter band. Furthermore, it will tune to either a higher or lower frequency than the signal when operating on the 7.5 meter band. This need not be confusing once a few frequencies are spotted on the dials. With an intermediate frequency of 4.3 mc., no signal in any one band can produce an image within the same band, as the image frequency is 8.6 mc. away from the signal.

It may seem rather odd that the oscillator is tuned above the signal frequency on 10 meters and below the signal frequency on 5 meters. This procedure makes the frequency range of the oscillator rather small and keeps the oscillator strength most uniform over the tuning range. If an attempt is made to cover the range, keeping the oscillator signal always on the high side of the signal, the variation in L/C ratio causes the oscillator to be too strong at the high frequency end and too weak at the low frequencies. This would not be good practice for optimum performance.

At first it was felt that the power supply should be contained on the same chassis as the receiver, but the additional size required did not warrant its inclusion. Furthermore, it was not to be confined to any particular type of supply as it then would not be adapted to emergency services if batteries were not available. By choosing the proper type of output tube for the receiver, any standard type of vibrator pack may be used or the conventional a.c. power supply for home use.

Next came the mechanical requirements and they were tackled in order of importance. A receiver which is to be used in a moving vehicle requires that all wiring be tied down in order to offset the tendency for the various parts to vibrate and eventually break off. The band-spread condenser must be driven by some sort of a vernier so that the dial cannot shift from continuous vibration. Lockwashers should be used under all nuts to offer further protection.

### Antenna System

The antenna coil primary is designed for a low-impedance transmission line. The writer uses the new Amphenol coaxial cable with its 73-ohm impedance to a quarter-wave antenna mounted on the driver's side of the car. This antenna is an ordinary telescoping variety which can be extended to a maximum of 8 ft. It is then possible to adjust the length of the rod to the band of frequencies most used.

In order to get good sensitivity on the high frequencies, high "Q" coils are used in both the oscillator and antenna circuits. Without an antenna load, some instability results due to the interaction between the oscillator and antenna circuits in the mixer tube. However, with any reasonable antenna, or with a 400 ohm dummy load, the receiver is perfectly stable. It was designed to match the low-loss transmission line as stated in the above paragraphs, when connected to the center of a half-wave Hertz antenna or at the ground end of a ¼-wave Marconi antenna.

### Circuit Design

The tube line-up for the receiver is as follows: A 6K8 combined detector and oscillator, 6K7 i.f. amplifier, 6P7G combined i.f. amplifier and beat-frequency oscillator, 6Q7 second detector and AVC tube, and a 6V6 tetrode beam amplifier. The use of the type 6V6 in the output stage provides more than sufficient audio power for the small p.m. dynamic speaker. A headphone jack can be added ahead of the output tube as shown on the diagram. The inclusion of a beat-frequency oscillator is handy if used for no other reason than locating weak signals and should be included. The 6P7G is a combined pentode and triode with a common cathode and is ideal for the purpose. Unfortunately there is no metal type 6P7 at this time, and a shield must be provided for the tube as shown.

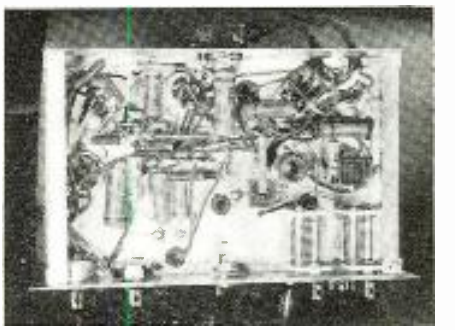
It is recommended that no change be made in the layout of the i.f. amplifier parts as any doubling-back within these stages would be hard to eliminate. The b.f.o. is an electron-coupled oscillator and the output signal of this tube is injected into the i.f. stage as shown. The small round can contains the complete assembly which includes the coil and the grid leak and condenser, as well as the tuning condenser.

It is not necessary to mount the assembly where it can be tuned from the front of the panel, as a change in pitch can easily be made by slightly de-tuning the signal.

### Construction

The size of the chassis does not make much difference as long as the parts are not crowded. The one used by the author measures 9x6x1½". The panel is optional and may be changed to fit a particular installation. Looking down on the chassis illustration, the aluminum can mounted on the left-back corner of the chassis is the first i.f. transformer. Next in line are the 6K7, second i.f. transformer, 6P7G, the i.f. output transformer and the 6Q7 detector tube.

To the front of the 6Q7 is mounted the 6V6 output tube. The speaker is a 3½" Utah dynamic with a permanent magnet field pot. Any similar type may be used providing the output transformer will properly match the voice coil winding, which in this case is 3 ohms. A decided saving in current is had by eliminating the current drawn by the regular wire-wound type of speaker field coil.



Short, direct leads must be used.

The two-gang band-spread condenser may be seen at the front left-hand part of the chassis. It is important that a rugged condenser be used in this type of set as twisting of the frame from vibration would detune the signal as tuning is very sharp. The rotor plates of the variable condensers are grounded in all cases.

The antenna coil is mounted alongside the band-spread condensers where short grid leads can be made to the tube and condenser. The remaining parts are all mounted underneath the chassis and may be clearly seen by referring to the illustration. Some spare room was left on the front part of the chassis so that a suitable relay might be later added for a remote control push-to-talk system in connection with a high frequency transmitter that will appear in a future issue of RADIO NEWS.

As mentioned before, the wiring should be tied down wherever possible and this also applies to the small parts such as the resistors and condensers. The liberal use of terminal lug strips makes this type of assembly easy. The connector cable to the power supply may be seen coming out of the rear side of the chassis. It is advisable to use a cadmiumed chassis as its use will make the wiring a bit easier as the connections may be made directly at each socket. It is best to use heavy stiff copper wire for the leads in the r.f. circuits as de-tuning effects will be greatly reduced. Ordinary push-back wire is used for the remainder of the wiring.

One side of the filaments are grounded. Hum is at a low value even when the receiver is being operated on a.c.

### Power Supply

The power requirements for the set are about the same as for the average table model b.c. receiver and are as follows: For the filaments, 6.0 to 6.3 volts at 1.65 amps. and 200 to 250 volts at 70 ma. Vibrator packs are to be had which will deliver this plate voltage up to 100 ma. which is more than sufficient for this receiver. The input leads from the storage battery to the vibrator supply must be heavy enough to carry both the filament current of the receiver as well as the current drawn

*(Please tune in page 52)*

# BENCH NOTES

**by LEE WARD**
Service Manager, San Francisco, California

**The question of "Do you play mousetrap?" and have you got "Savvy" are determining success factors.**

- - RIOR to my entanglement in the - coils of a typewriter ribbon, I - - wondered how so many authors of servicemen's articles unerringly missed the spirit of the business. They seldom mentioned the things which gave *me* the most pleasure or pain in my daily routine. I cynically attributed this lack to the fact the fellow was a writer, not a repairman; and made a mental note to the effect that, if I ever got a chance to express my views on the maintenance of musical machinery, I should inject some true life into them.

And so, caught in full effulgence, I was told to do it. My idea of writing a column was simply to switch my cigar from my right hand to the left —which held the highball—and, one night a month after I had come home from the shop, to pound out the stint effortlessly before the drink went warm, or the cigar cold. Then, after I sprinkled the piece with commas, the month's work would be over, and I would have an article in perfect syntony with the profession.

There are, I have since learned, various reasons why nothing can be written which will resound down the corridors of radio repairing. The main reason is the presence of more than one corridor; our business is like a thousand radial and cross-corridors, and a person voicing opinions in one direction from a central point will not ring true in them all.

There are over forty thousand servicemen in this country; of these, perhaps ten thousand work for our sixteen thousand dealers. (Some men handle the work for more than one dealer.) The remaining thirty thousand are "independent"—an euphemistic qualification which means they are not on a fixed payroll, and are therefore free to starve if they don't rustle up their own work.

Among the dealers' servicemen, there are many conditions of servitude: some have fixed salaries and fixed hours; some work on commission; some by special appointment at so much per call. Many share rent or other overhead with the owners of other stores; and the business arrangements are probably as numerous as the businesses. (A sign in a small Indiana town, for instance, advertises: "Cigars, Cigarettes, & Radio Repairs.") It is true they all earn a living from radio—but from there on any group classification is necessarily inaccurate. So is group advice.

### Another Man's Poison

These diverse stata are a restriction against the use of generalities that occur to any one serviceman-writer or serviceman-speaker. If I wish to point out, as a result letters describing repair shops suffering from financial coma, that canvassing for trade would have a reviving effect, here's what happens: the rural serviceman, whose business is nothing if not conducted huckster-fashion, tells me the suggestion is worthless because he has canvassed all his working life. The urban repairman, in a section so ritzy that door-knocking is only a warning between rooms of a duplex apartment, tells me he would go out of business in a week if he Connellied his way past a spangled doorman to get his knuckles on some rich oak paneling.

Between the two extremes are many servicemen in stores which should have a certain amount of door-to-door in their sales set-up; but those who believe in it are already sending tappers out; and those who don't because they are too indolent, snarl when I mention it, and tell me I'm not familiar with their part of the field.

Judging by the majority of letters from repairmen, the most common fault in the profession is a shortage of business instinct. This is true of some of the men in all the servicing classifications, and is perhaps the only generality that can be addressed to the entire profession. (Please don't write to ask me why—if I'm so damned smart—I don't go out and get rich repairing sets, instead of wasting my time at a typewriter. The answer is that I *do* make my living by reconditioning radio equipment, and that I pass along advice, not to be abusive, but helpful. Remember that if writers cared what people thought of them, there wouldn't be any.)

### Do You Play Mousetrap?

To illustrate, here is a composite letter, typical of those read on this desk: "I am a graduate of Blank Radio School. I have so-and-so meters; such-and-such data sheets; a complete line of this-and-that stock; and, although I stay open 12 hours a day, business is very dull."

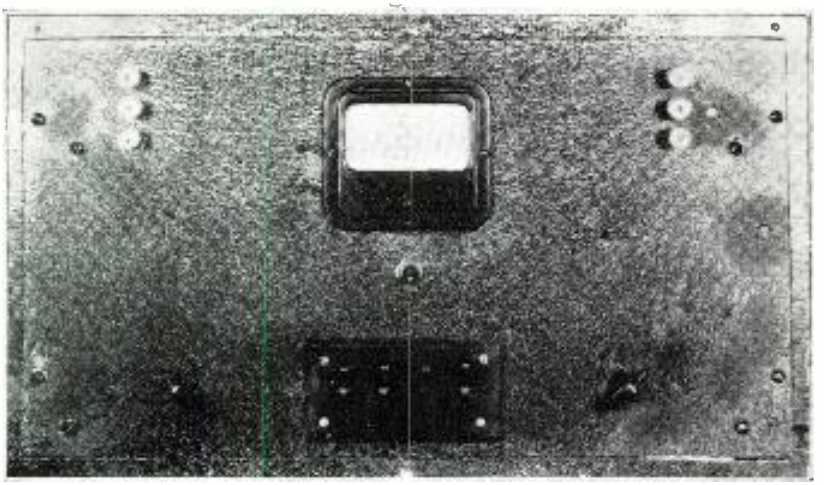
Too many of us have come to depend on our static, rather than our dynamic, business assets. It is an easy mental lethargy into which to fall—this anticipation of a beaten path to the door. But no one is going to drop in to look at our diagrams, or stop by to open his eyes and pocketbook in admiration of our test equipment. Such assets might be the best in the country, but they are for our use, not the customer's; and they are of no value unless we find a way to put them into motion.

The cause of the "waiting-for-customer" attitude is not obscure. Many of us have come into servicing because we felt naturally inclined toward radio, and because repairing receivers seemed to be the cheapest route to a career. We had made various minor repairs for our friends and relatives, who not only paid us willingly, but burned our ears with flattery. Here, we thought, was a purely scientific

*(More Notes on page 49)*

The equipment of Wrightson's Radio Shop, Stormont, Va.

# Hi-Fi Distortion Meter



The percentage is read from the meter on the unit's panel.

By **WILLIAM BREEDON**
Los Angeles, Cal.

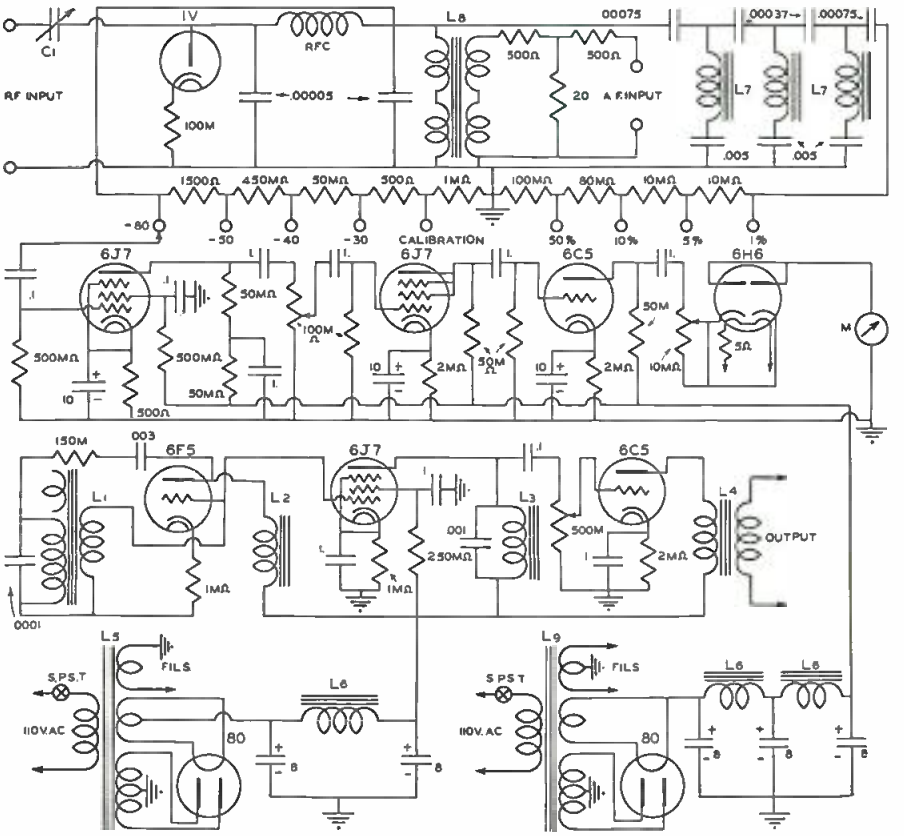
**This unit will tell what the distortion percentage of an amplifier is. Easy to build, and a useful serviceman unit.**

RADIO engineers and amateurs are awakening to the fact that to do good work they must have adequate testing equipment. Distortion, perhaps the most important characteristic of any audio system, is also the most difficult to measure. This article is to give complete details for the construction of a distortion meter. As the additional cost is practically negligible, it is, at the same time arranged for noise measurements down to –70db.

The diagram explains in a general way the modus operandi of the meter. The test signal is generated by a 1,000 cycle oscillator. The standard frequency for distortion measurements is 400 cycles, but it is very much harder to build a distortion meter for 400 cycles and there will be very little difference in distortion between 400 and 1,000 cycles. The oscillator is connected to the input of the amplifier or whatever is to be tested. The output of the device under test is connected to a loss or T pad. This pad is merely to absorb the power from the device under test as the maximum power that may be put into the meter is plus 20db. or 0.6 watts; power in excess of this will make the meter inaccurate. The 1,000 cycle fundamental is then filtered out with a high pass filter. Since all harmonics, which cause distortion, are higher in frequency than the fundamental, the high pass filter will pass them on to the amplifier, where they will be amplified and measured by the meter.

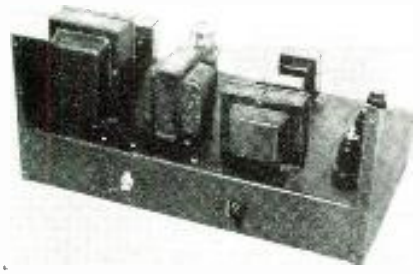
The construction of the distortion meter is not difficult and no trouble should be encountered in making it work properly if it is built carefully and instructions are followed explicitly. There are many resonant circuits in the meter and these circuits were very carefully worked out in a very well equipped laboratory with standard parts. Regular parts that are available anywhere at a low price were then tested until parts which were exactly like the standard units were found. These parts are specified by the manufacturer's name and part number, and absolutely no substitution may be made. The accuracy of the capacity of all condensers below .1 mfd. is important.

All the chokes except the three in the two power supplies have the spacer removed. To do this the case is removed. It will then be found that one side of the iron core can be lifted and under it is a piece of fiber. This piece of fiber should be removed and the core put back in place. The choke can then be put back in the case with the piece of fiber between the core and the case so as to hold the core tight in the case. It is important to push the piece of core that is removed tightly against the rest of the core when the choke is reassembled. It will be found far easier to build the oscillator and the meter part on separate chassis with separate power supplies. A diagram shows the circuit of the oscillator and



# ercen a g e?

the picture shows the layout of the parts. This arrangement may be varied. The only important considerations in the layout are to keep the power supply separated from the oscillator and to keep the wiring short. The filter condensers are 8 mfd. Electrolytic condensers may be used, but paper replacements are preferable. The volume control is a 500,000 ohm potentiometer and should be tapered. A *Centralab* pot with a number 6 taper is very good for this. It may appear odd to have grids of the first two tubes connected together, but it is correct. The output transformer L4 may be any transformer whose primary will match a 6C5. The secondary must match the device to which it is connected. The transformer specified in the parts list will be found to be suitable in most cases. $L_1$ is designed as a power transformer, but it works very well the way it is used. The filament winding and the center tap of the high voltage are left blank and must be protected so they cannot short.

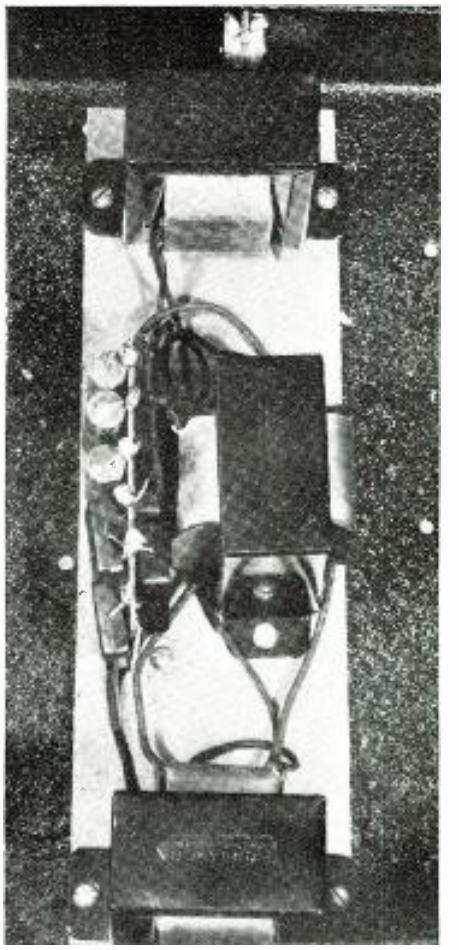


The 1 kc. oscillator with panel off.

The circuit of the meter is shown. It consists mainly of a good amplifier and a high pass filter. Anyone knowing how to build an amplifier should have no trouble with it. The most important thing is to keep the noise level very low or the noise in the amplifier will make the distortion appear higher than it is. It is important that every connection shown as grounded should be connected together with copper wire and insulated from the chassis. The chassis is then connected to B— or ground at only one point. This is to make it absolutely certain that no current flows through the chassis. The gain control should be a *Centralab* control with a number 6 taper. A 5 ohm resistor is connected in series with the filament lead of the 6H6 only. The chokes $L_2$ and the associated condensers form the high pass filter. These three chokes and seven condensers should be shielded from the rest of the parts and kept as far as possible from the power supply. The illustration of the filter shows the parts mounted on a separate base. This base is then mounted underneath the chassis at one end so that the chassis forms part of the shield. The spacers are taken out of the chokes $L_2$. The input transformer $L_5$ is an expensive transformer, but if higher order harmonics are to be measured a cheaper transformer cannot be used. The r.f. lead should be brought into the instrument through a stand off insulator.

An isolantite socket should be used for the 1v rectifier. The illustration shows a satisfactory layout. The anti-capacity switches in the center bottom of the panel were used for an additional feature that was thought to be desirable. After the instrument was used for a while it was found that they were more of a nuisance than a help, so they were omitted in this article. The three resistors connected to the primary of $L_5$ form the loss pad. The values shown for the three resistors will be satisfactory when the meter is used on amplifiers that have an output greater than 0.5 but less than 20 watts. Below 0.5 watts no pad is necessary. The design of any other pad for higher power can be obtained from *U.T.C.* main catalog or any good radio book. It will probably be found most convenient to make up the pad in a small box with terminals on it and connect it to the meter when it is necessary.

When the meter is put into operation there may be a small reading of the meter due to the filament emission of the 6H6 and this must be compensated for. To do this the meter is turned on and the 6C5 is pulled out of the socket. The meter is then set to zero. It may possibly be necessary to bend the needle slightly to do this. Accurate calibration of the meter is difficult without a well equipped laboratory. However, a good calibration can be made by feeding a —6db. signal of any audible frequency directly into $L_5$ without the pad connected. This signal might be from the 1,000 cycle oscillator if it is built first. The meter is turned on and the *Yaxley* switch is turned to the calibrate position, and the volume control is turned full on. The 5,000 ohm pot is then adjusted until the meter reads exactly full scale. The pot should then be fastened so that it cannot turn and the meter is calibrated. If no method is available for measuring the —6db. signal just set the pot for maximum resistance and the meter will be fairly accurate. The accuracy of the meter is not of great importance because an amplifier is usually adjusted until the distortion is the lowest possible and that is all that can be done. *The meter will be absolutely accurate on comparisons.*

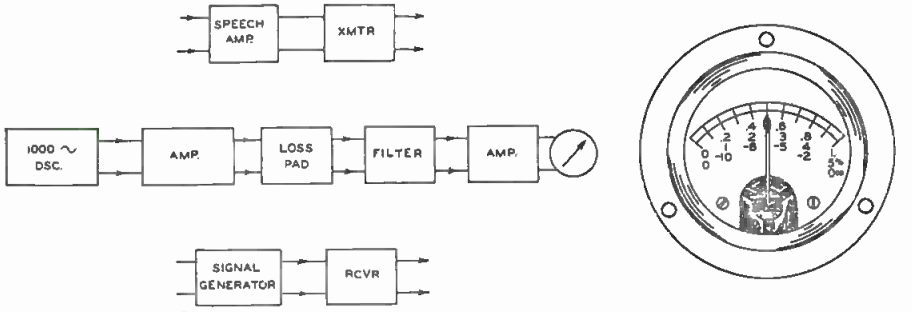


The high pass filter. Note spacing.

The distortion meter without panel.

When making measurements on au-

*(Measure on page 60, please)*




Block diagram of the distortion percentage measurer.


THE following are the recent awards of the RADIO NEWS Seal of Acceptance:

**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.00**
**Product:** Supreme 512 Pocket Multimeter
**Description:** A pocket multimeter with 24 ranges. Size 3"x6"x2". All ohmmeter ranges including 2 Meg. range use small self-contained batteries furnished with the instrument.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.1 and No. 101.1A**
**Products:** Model 506-P and 506-C, portable and counter Tube Tester.
**Description:** A flexible, easy-to-read tube tester. Uses push-button method. Tests for shorts and leakages. A separate check for dual section tubes is provided.

---

**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.2**
**Product:** Model 546 Oscilloscope.
**Description:** A portable oscilloscope using the 3" C-R Tube. Contains high gain vertical and horizontal amplifiers. Built in linear sweep circuit. Built in "Snap Lock" synchronizing control. Provisions for internal or external sweep and synchronization. High Impedance, low capacitance amplifier circuit giving flat frequency response to 90,000 cps. Sweep circuit linear from 15 to 30,000 cps, permitting observation of frequencies on screen up to 300,000 cps. Furnished complete with tubes.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.3 and 101.3A**
**Products:** Model 582 and 582A Signal Generators.
**Description:** Model 582 has not any push buttons; 582A has. The unit with the buttons gives instantaneous button selection of any of the popular IF frequencies. Wide frequency coverage from 85KC to 15MC on fundamentals, and up to 60MC on harmonics. Air tuned trimmers give accurate calibrations. Four types of output available. Automatic "Lock-Center-Synchronize" electronic frequency modulation. Razor edged tuning on giant dial. Scale length 8'. Attenuator circuits specially designed for constant 100 ohm impedance. May be attenuated to ½ microvolt. Attenuator controls marked in approximate output so that gain per stage may be measured.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.4**
**Product:** Model 596 Substitution Box.
**Description:** Contains variable resistor for any value to 50,000 ohms and fixed values of 100,000, 250,000, 500,000 and 1 Meg. All available through push-buttons. Also 3 buttons for condenser values of .1, .5, and 8 microfarads. Both resistance and capacitance can be used jointly.

**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.5**
**Product:** Model 594 Tube Tester.
**Description:** To be used with a separate 1 milliampere meter as a tube tester. Tubes are checked 5 ways. Tests for "hot", short, open element, and leakage between any two elements. Tests all tubes including, M, MG, G and GT types, etc.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.6**
**Product:** Model 593 Push Button Analyzer.
**Description:** For use with a multimeter to test any receiver and tube inserted in the unit. Makes measurement on current, voltage and resistance without disturbing radio chassis. Spreads out the receiver circuit on the analyzer panel.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.7**
**Product:** Model 592 Push-Button Set Tester.
**Description:** Has 47 ranges and functions. Completely self-contained, no AC supply needed. Both 1000 ohms and 25,000 ohms per volt on the same unit. Resistance ranges to 50 megohms with internal batteries. Only two pin jacks used for all functions. 14 push-buttons in two rows control all 47 functions.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.8**
**Product:** Model 503 Tube Tester.
**Description:** Roll chart tube tester including a loctal socket. Filament return selector system. Uses new improved Ratio Load Circuit. Uses 1 mil. 4" square meter. Needs no separate chart or booklet, etc. Standard tests. Positive visual check for open filaments, standard sensitivity tests, all element quality tests, etc.

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**To:** Supreme Instruments Corporation, Greenwood, Miss.
**Awarded Seal of Acceptance No. 101.9**
**Product:** Model 571 Signal Generator.
**Description:** 20% drift in line voltage results in less than 1/100 of 1% RF drift. Allowable error in any selected frequency is less than ½ of 1%. Wide frequency range from 65KC to 20.5MC on fundamentals and unlimited range on harmonics. Has only 2 basic scales. No parallex present on dial. Two modulation levels, 30% and 75%. 400 cps note free from frequency change on switching from one to other modulation level. Full 0.1 volt RF on all bands, fully controllable down to 0.5 microvolt. Non-shorting ladder type double shielded attenuator. Produces 5 types of signals: Straight CW; 400 cps @ 30% modulated RF osc.; 400 cps @ 75% modulated RF osc; externally audio modulated RF osc.; external frequency modulated RF osc; 400 cps fixed audio note for testing audio amplifiers. etc.

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**To:** Triplett Electrical Instrument Company, Bluffton, Ohio.
**Awarded Seal of Acceptance No. 103**
**Product:** Model 233, 0-1 Milliammeter.
**Description:** A rugged, accurate, durable, easy reading and simple 0-1 milliammeter.

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**To:** Triplett Electrical Instrument Company, Bluffton, Ohio.
**Awarded Seal of Acceptance No. 103.1**
**Product:** 0-1.5 AC Voltmeter.
**Description:** An accurate, rugged and durable 0-1.5 AC voltmeter.

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**To:** American Phenolic Corporation, 1250 Van Buren St., Chicago, Ill.
**Awarded Seal of Acceptance No. 104**
**Product:** Amphenol Super-Mip Socket.
**Description:** A low loss socket with the following characteristics: Power factor at 1 megacycle—.0002; dielectric constant at 1 megacycle—2.6; loss factor at 1 megacycle—.00053; dielectric strength per mil.—500; tensile strength, lbs. per sq. in.—5000.

(*Continued on page* 50)

# EMERGENCY VOLUME CONTROL REPAIRS

During the twenty-two years of my service experience, there have been many times when it would have been a great advantage to have been able to make at least temporary repairs to a volume control. This is especially desirable out in the rural districts where, if the proper replacement is not at hand, one must await the return of an order from some distant point before the anxious customer can be returned his entertainment.

By accident I blundered upon a solution when my own receiver required attention at a time when it was paramount that I have a certain program. I removed the control from the set which had been giving a little trouble for several days, and upon opening it found the strip to be worn until the strip foundation could be seen through the resistor compound. Prior to this happening I had tried various combinations of graphite, carbon and other materials that promised conductivity, but with no great success, so it was with a hopeful heart that the bottle of drawing ink was picked up and scrutinized.

The label propounded the fact that its base was carbon and, having had experience in erasing it from unwanted spots on diagrams, there appeared no reason why it should not last at least one evening on a volume control.

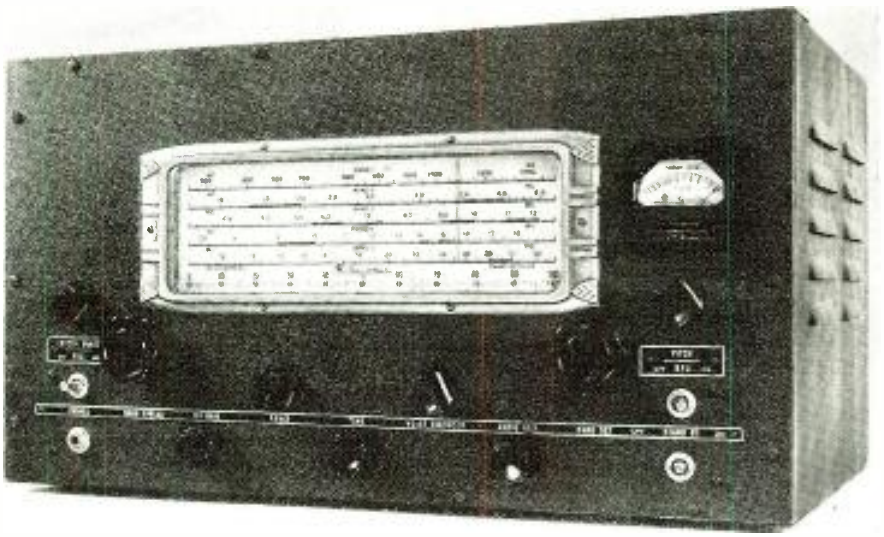
A small water-color brush was appropriated and the resistance of the control noted, then the control was given a coat of the India Ink and dried over an electric light globe where the temperature would not be too high. After the drying process the resistance was again noted and found to have changed 500 ohms from what it had measured when removed from the receiver, at which time it had shown 3000 ohms shy from the manufacturer's rating.

Coat after coat of the ink was applied to the resistor strip and after each operation the resistance was tried. After this the volume control was assembled, placed back in the receiver and checked. To all appearances it was the equivalent of a new control and the receiver functioned perfectly. Needless to say we were quite elated at being able to get our desired program and while an order was placed for the new unit, it has not been replaced as yet and the emergency operation took place sixteen months and five days ago, still there is no trouble apparent in the control.

Since the mentioned operation extensive experiments have been carried on with all types and makes of volume control having the impregnated re-

(*Repair further on page* 49)

# B[illegible] w[illegible] Communications Receiver



This receiver, built by the experimenter, will give excellent results.

By RAYMOND P. ADAMS
Laguna Beach, Cal.

**Now you can build a fine Communications Receiver, covering .5 to 32.4 MC, and expect good results.**

WHILE the home-building of communications receivers using plug-in coils in the "front-end" stages has been common enough practice among experimenters having limited workshop and laboratory facilities at their command, the construction "from the ground up" of multi-coil superhets employing band-switching has been attempted—and successfully engineered—by only those amateurs possessing precision equipment. To design and wind three coils of proper form factor, for each band of a five-band job (maintaining the desired band coverage, a necessary close limit match between r.f. inductances, and a proper relation between these inductances and the associated ones for the oscillator circuit), to assemble all fifteen coils in such a way that absorption effects and inter-stage coupling are eliminated, to calibrate the dial scale for all five bands (scale calibration for band-set is really imperative in a switched-coil receiver, which generally covers an extremely wide range of frequencies), and to insure an exact track—well, this is a very, very difficult business, at least where the average ham is concerned.

But this doesn't mean that if you want a switched-coil all-band super you'll simply have to purchase one tailor-made, or that if you can't afford a factory-built job you'll necessarily have to do the next best thing and develop a plug-in coil affair. You very definitely *can* construct your own all-band set, turning out a receiver which will feature every modern refinement —*if* you forget for once and for all any plans for the home-engineering of the r.f. coil assembly—and *if* you consider such an assembly (complete with dial, coils, switch, band-spread tuning condenser, and related small items) a single component part, to be acquired ready for use just as is any other familiar item such as an i.f. or power transformer.

Anyway, this writer has done it. He has built up—almost overnight and using only those tools and aligning apparatus found in the average experimenter's possession—a perfect communications receiver. It has just about everything: crystal filter; beat oscillator; noise limiter; flywheel tuning; signal level indicator; bandswitching; and a tuning range which includes both the standard broadcast and the ten meter band frequencies.

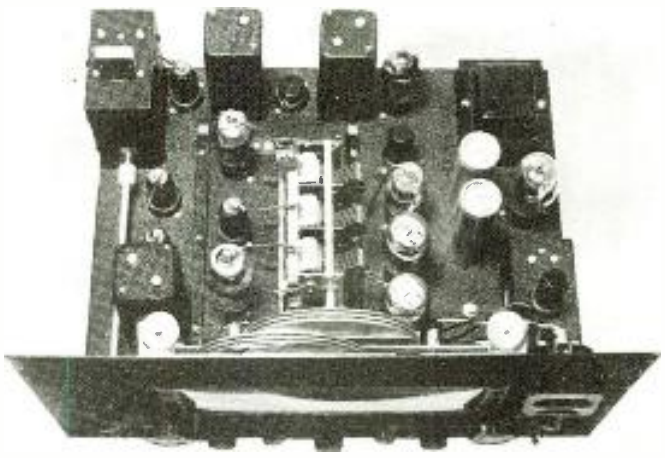
Let's get on to a brief description of this lately completed and extremely satisfactory communications receiver.

The "heart" of the layout is the built-up, pre-aligned r.f. coil assembly with its matching band-spread condenser, its calibrated, inertia-controlled dial, and its self-chassis with sockets for the r.f., Mixer, and h.f. Oscillator tubes. This provides for a total coverage of from 530 kc. to 320 mc., the extension split up into 5 switching bands:

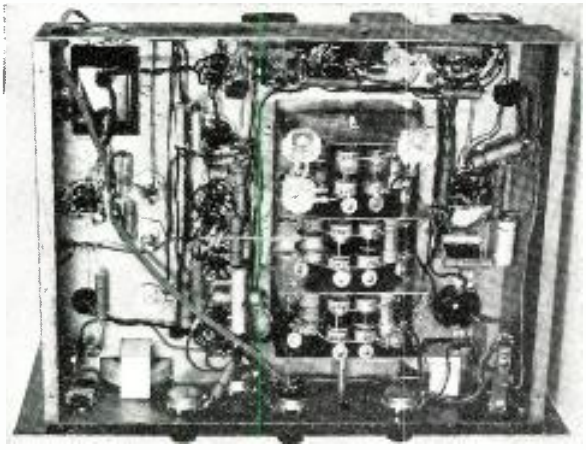
1. 530-1,575 kc.
2. 1.5-4.6 mc.
3. 4.18-12.5 mc.
4. 7.3-18.5 mc.
5. 11.2-32.4 mc.

Controls are provided for r.f.-i.f. gain, a.f. level, bfo. pitch, phasing, and noise silencing. (The crystal switch is controlled by the phasing knob, and is closed with the associated condenser at maximum mesh.) Toggle switches are also provided for avc. on-off, bfo. on-off, and stand-by or communications. Two large knobs, one for bandset, one for bandspread, control the two pointer dial, which is of flywheel design.

The circuit is in part conventional, in part unusual—altogether a most practical hook-up for a receiver of this type. The unit is a communications job which provides for efficient



The chassis layout is professional in looks.



Under the chassis of the receiver.

reception on all amateur bands of both 'phone and c.w.—and under the worst and the best of general operating conditions.

This circuit, as a careful study of the diagram will indicate, has: doublet input; elimination of coil absorption effects (the band-switch shorts out unused coils lower in frequency than those in actual selective use); the use of the efficient 6K8 mixer; elimination of shock excitation of the crystal through the positioning of the 6L7 noise silencer tube *ahead* of the filter stage; inductance tuning of the input and output coils of the low-impedance crystal filter circuit; beat oscillator pitch control; forward reading signal level indication; controllable noise circuit "take off"; transformerless driving of the Class A 6V6s in the output a.f. stage by means of a simple and effective 6C8G phase inverter; and a new and very satisfactory means of headphone plug-in and simultaneous connecting together of the 6V6 plates, thus preventing any possible speaker reproduction.

### Construction

It is first suggested that any reader contemplating the duplication of this design acquire the stamped and drilled chassis mentioned in our list of parts. This chassis will simplify the business of construction immensely, and particularly because the cutouts are arranged so that the proper positioning of all parts becomes immediately self-evident. Of course, the metal base may be drilled and cut in your own worshop if the proper tools are available, and in that case it is advisable that a standard 13" x 17" x 3¼" chassis be employed and that it be very carefully marked before any mechanical attentions are given it. Remember — the layout suggested by the illustrations relates to really functional parts positioning and permilogical, straightforward wiring.

The crystal filter and bfo. units should, like the r.f. "front end," be acquired as complete, wired assemblies. The alignment of none of the three assemblies should be tampered with, by the way, until the construction has been completed and the receiver is ready to be adjusted for peak efficiency.

Install the r.f. coil unit and the various potentiometers. Mark all shafts to proper length for knob control—remembering that there must be considerable shaft extension between the front of the chassis and the front panel of the cabinet which you are to use—or simply the front panel if no cabinet is to be employed. Remove these units, then cut the shafts. Do not replace the coil assembly on the chassis until the other parts have been mounted and the most of the receiver wiring completed.

Mount the power transformer, electrolytic condensers, i.f. transformers, beat oscillator and crystal filter units, the potentiometers, speaker socket, etc. As the panel will extend away from the chassis quite a bit, to provide for proper dial face clearance, the toggle switches and phone jack should not be similarly positioned—but should be reserved for panel mounting directly. Leave long enough leads.

Install plenty of tie-points. These should be secured, as required, by the mounting nuts for the sockets and i.f. transformers.

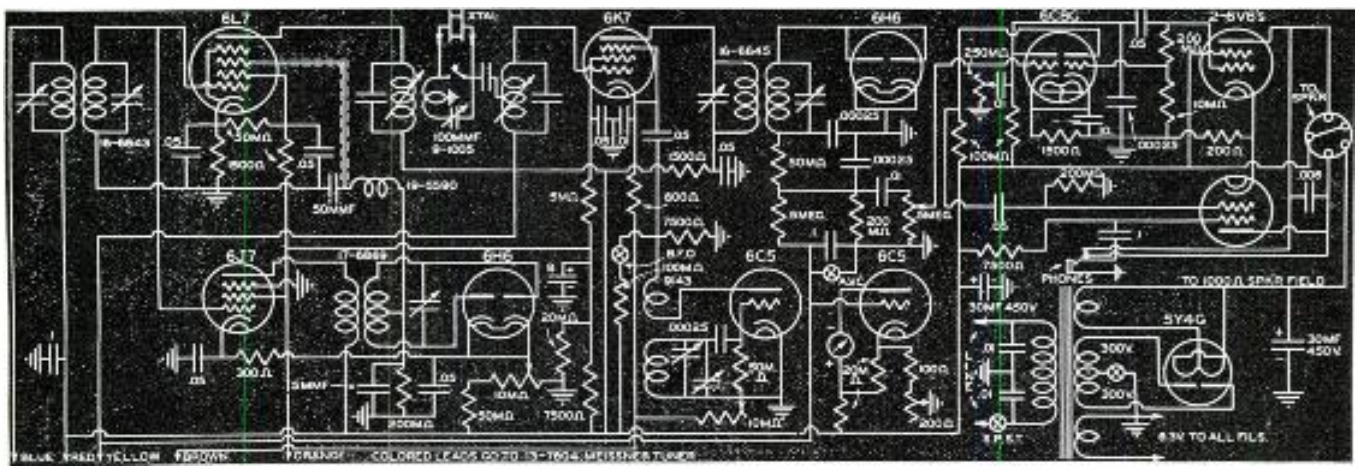
Now, *before* replacing the r.f. assembly and dial, which might be injured during the wiring process, connect up the various circuits. Sound policy here is to feature color coding so that leads may be readily distinguished. Use brown for cathode circuits, yellow for AVC, red for B+, orange for screens, black for grounds and twisted pair filaments, blue for plates. No leads from front-of-chassis components (or leads to be connected to items positioned on the front panel) need be shielded. However, leads from the phone jack should be brought straight across the front of the chassis to the output stage and those in the tone control and audio level control circuits brought to the rear of the chassis on the 6V6 side of the r.f. assembly cutout.

With the wiring completed but for the connections from r.f. assembly to power and other points, set the front-end in place and bring out color coded leads from the coil unit (Meissner) to these specific ties:

1. Blue lead from the middle assembly section to the P terminal of the input i.f. transformer.
2. Orange lead from this same section out to the number 4 terminal (screen potenial terminal) of the 6J7 noise circuit amplifier tube.
3. Brown lead from the forward section to the 10,000 ohm sensitivity control.
4. Yellow lead from the forward section to the AVC bus.

*(Please tune in page 53)*

Wired and pre-aligned tuning unit—Meissner type 13-7634
Input i.f. transformer—Meissner type 16-6643
Output i.f. transformer—Meissner type 16-6645
Noise transformer—Meissner type 17-6869
Beat oscillator unit—Meissner type 9143
Crystal filter unit—Meissner type 9-1005




Circuit diagram of the home-built communications receiver.

There are not any controls, except a switch.

# Aid for HEARING

By ALFRED W. BULKLEY
Hannibal, Mo.

**A table-mounting unit for aiding the hard of hearing. Will also do well as a simple battery pre-amp.**

THE use of the vacuum tube in a modern hearing-aid has made it possible for the user to enjoy a much finer reception of the original sounds entering the microphone. A marked improvement in fidelity is realized that was not present in the older versions of this type of equipment. Although primarily designed for the pickup and amplification of sound sources, the unit to be described may be used in conjunction with a vibration type pickup for direct connection to a violin or other such similar instrument.

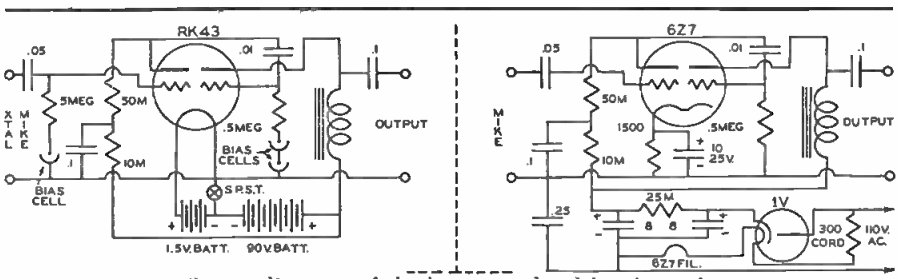
A hearing-aid can only be practical if it may be operated over many continuous hours without replacing batteries for its operation. The unit herein described fulfills this requirement by using a type of vacuum tube which operates with a minimum of plate and filament supply.

Reference to the illustrations will show the simplicity of construction of this unit and by following the layout shown, no trouble should be had in duplicating the results obtained on the original.

This unit is of wide utility which features compactness, convenience and economy in construction and operation. It may be used with any high impedance, low level microphone. The output is 200 ohms at a relatively high level, so long shielded microphone cables are unnecessary. Ordinary twisted lamp cord can connect the pre-amplifier with the main amplifier if one is used.

The aid uses the Raytheon RK43 which is a double triode, so that only one tube is necessary. The filament is rated at 1½ volts with a current drain of 120 milliamperes. One small size dry cell lasts for months of intermittent service. The B supply consists of two Burgess No. 5303 45-volt portable type batteries. The drain on the B batteries is only 3½ milliamperes.

A cabinet measuring 6"x10"x7" contains the amplifier. To make the chassis for the amplifier take the regular chassis designed for this cabinet and cut it lengthwise down the middle. Bend up a ½" lip and fasten to the front panel with three bolts as shown in the illustration. This arrangement leaves just enough room for the B batteries to fit in the back of the cabinet. On one end of the chassis mount the tube socket. A *cushion* socket is preferable. On the other end of the chassis is the output transformer which is Thordarson's No. 5515 plate to line. The "A" cell sits on top of the chassis between the tube and the transformer and the switch mounts in the center of the panel.




Circuit diagrams of the battery and AC hearing aid.

Underneath the chassis mount a bakelite strip to hold the resistors and condensers. One Mallory bias cell supplies the grid bias for the first triode and two cells for the second triode. Close to the tube mount a phone jack on the front panel for microphone input.

Three binding posts mount on the panel close to the output transformer. The two lower posts connect to the 200 ohm output winding. The top posts connect through a coupling condenser to the second plate of the tube for high impedance output when the pre-amplifier is used within a few feet of the main amplifier. Since the center tap of the 200 ohm winding is grounded to the chassis, either of the lower binding posts then supplies the ground connection.

The .05 mfd. condenser shown on the diagram at the input of the pre-amplifier would not be necessary with a crystal mike, but with a conductive type of microphone it prevents shorting the bias cell.

Two self-taping screws fasten the lid of the cabinet, and a chromium plated handle on top adds a finished appearance.

On several occasions the output of this pre-amplifier or hearing-aid has been run over telephone line for distances up to several miles with satisfactory results.

Another form of this amplifier may be constructed if it is to be used in a permanent location and this version is shown in the schematic illustration. It operates on either 110 volts a.c. or d.c. and uses a type 6Z7 dual triode and a 1V rectifier. Due to the small plate current requirements the use of a filter choke will not be required and a 25,000 ohm resistor will provide the needed filtration. —30—

No chance for feedback here.

## TECHNICAL BOOK & BULLETIN REVIEW

*Taylor Tubes Inc.* new tube and transmitter manual is now available through all Taylor jobbers. This manual is an excellent source of information for the amateur and a wealth of data is included to determine proper tank capacity ratios. Several designs are given for the construction of various transmitters. Complete tables and characteristics are listed for all of the Taylor line.

THE NATIONAL RADIO NEWS, published by the *National Radio Institute* of Washington, D. C. in the Dec.-Jan. issue covers the many 1939 Remote and automatic time control units. This article was written by Paul H. Thomsen and is a timely radio topic in these days of new gadgets appearing on the market.

The RADOLEK PROFIT GUIDE for 1939 is now available to all servicemen, amateurs, sound men, institutions, etc. who request a copy from the *Radolek Co.*, 601 W. Randolph St., Chicago. This book features over 3000 new items and there are, of course, nearly 10,000 other parts, complete P. A. systems, electrical appliances, auto-radio parts, clocks and shavers.

RADIO SERVICING written by M. N. Beitman of Chicago and published by *Supreme Publications*, Chicago, covers the requirements that the serviceman must know if he is to understand the many problems that confront the service of modern radio receivers. The lessons are not intended to cover the subjects in detail or at great length. but rather to cover the most common sources of trouble that are generally found in the every-day shop.

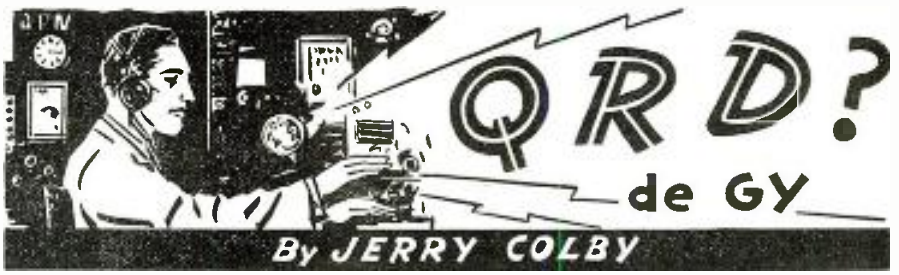
A DETERMINATION OF THE ABSOLUTE OHM, a research paper published by the *U. S. Department of Commerce*, is available at the price of 15 cents per copy and may be had by sending this amount to The Superintendent of Documents, Washington, D. C. This booklet contains a complete analysis on the measurement of such a small resistance and is recommended for the more advanced reader. Another paper is also in print, RP1136, entitled PRODUCTION OF ACCURATE ONE-SECOND TIME INTERVALS. A copy may be had for 10 cents.

PICK-UPS for December, 1938 contained a complete article on the new Western Electric "Cardiode" Microphone. This booklet is published by *The Western Electric Co.*, 195 Broadway, New York. Other interesting articles include *The Public be Served*, *Transmission Lines*, and *Marine Radio*. The description of the microphone will be of particular interest to the sound man as it tells how many of the obstacles are overcome in difficult pickups.

ELECTROLYTIC CAPACITORS. written by Paul McKnight Deeley and published by *The Recorder Press* at Plainfield. N. J., is one of the finest books that has printed material on this subject. A complete analysis on the various types of electrolytic capacitors is presented and deals with the phases of design that the average radio man seldom knows. This interesting book contains 275 pages, all devoted to the electrolytic capacitor in its various forms and types.

TRICKS OF THE TRADE, a publication of *Radio Retailing*, 33 W. 42nd Street. New York City, contains a wealth of handy remedies for a host of receivers. The comments and hints cover practical tips applying to the most common troubles found in the popular receivers.

(*More review on page* 52)




KLEINKLAUS. gen. sec.-treas. of the *CTU-Mardir*, moans that indicative of peaceful times might be the high mortality rate among the members. He sez. "We no sooner turn around than some member is getting married. That is what security does for them." Men are notably sticking to their marine jobs. something unheard of in past years. Well. if this is what unionism does for men. women and the country, let's have more of it, sez we.

* * *

WELL. 'tis nice. 'tis nice. indeedy. to hear an occasional word of cheery approval of our efforts. So when Brother (JF) Hill. after being away on a cruise for four months. received his first copies of *RA* upon his arrival in the states, he wrote us . . . quote . . . finding your column sure was like seeing a good friend after an unwarranted absence . . . unquote. and we blushed all over with pride. He mentions, in passing. that this trip on the *MS Gulfhawk* (WJCO) was his first experience of standing a watch in oilskins. Seems as how the recent hurricane which damaged the whole Eastern seaboard caught them right square to middling. almost in its dead center. The heavy seas and winds of hurricane force kinda played old Ned with the tub and after about six hours of being blown all over the ocean. the seams in the overhead of the radio shack spread wide. "And the water began merrily tumbling in on him." Rawthah. pity a poor sailor on a nite like that. what. matey! But better the incoming salt sea saturating him than the spark job, eh?

* * *

IF Don Hekking (DH) Ham op *W8OZT*, formerly of Buffalo. N. Y., is anywhere within eyeshot of this column. how's to quiz ye Ed for an important message. Come on, all you embryonic sleuths. get busy.

* * *

IN spite of protests from the *ARTA* officials, the Navy. imitating the Marines, had the situation well in hand when they stepped into the strike-bound *RCA. Mackay* and *Globe Wireless*. and handled all messages going to Honolulu and the Orient. The *American Communications Association* had begun a boycott against all westbound press msgs. which threatened to stall plenty of traffic. until the Navy. under orders from Washington. put their crack radiops on the job. It wasn't long before the *Commercial Pacific Cables* resumed handling traffic and the Navy then turned the watch over to them.

* * *

MR. J. F. SATTERTHWAITE of 544 Colonial Ct., Toledo, Ohio, wants to hear from all you guys and gals who worked for the *Tropical Radio Telegraph Co.* around 1926. He sez it's to your advantage if you communicate with him. So it might be a good idea to drop him a penny postcard.

* * *

KENNETH CONROY. *W8DYH*, Police Station *WCK*, has broken out with a new idea which promises to expand and become a leading arm of our various law enforcement agencies. That is. if present plans materialize. It is a network of police radio technicians who own their own equipment and would like to band together for the purpose of exchanging news and information and general brotherly goodwill. They might even help in apprehending criminals if the main police apparatus should fail—Heaven help the technician in charge —! So if you gadgets on police duty want to get together. there's KC who'll be only to happy to tell all.

* * *

IT IS noted with pleasure that most of the mail coming over the mahogany these wintry days appreciates the balance we are showing in ref to the *ARTA* and the *CTU-Mardir*. *We wish to again pass the remark, as we did more than four years ago. that this department takes an unbiased attitude towards all organizations, always keeping a weather eye on the radiops' well-being.* We again stress the fact that if "both organizations are working toward the end of giving radiops and radiotechs a liberal wage. best working conditions possible such as are enjoyed by every type of professional man. and peace of mind." this column will extol their virtues. For years radiops banded together to better themselves. but there was always that fly in the ointment. human nature. which eventually upset the applecart. Now that we have two organizations ready to take up the sword for radiomen, we will do our best to keep harmony and sweetness between them. Keep up the good work!

* * *

DID you ever remininisce about qrd? qrd? qrd? in radio operating? Do you remember the days when the radiop was looked up to with the same adulation and awe that is bestowed on an aviator today? A man who carried the spark insignia on his uniform was king. until the teletype systems displaced many operators when they were installed in stations. After this came the high speed machines that cut down the working hours or manpower per working hour. And then came the *Automatic Alarm* equipment which was designed primarily as an ever-present watch on the distress frequency. but which stopped the argument for a three-man watch aboard ship. Then came the 'phone installations with regulations permitting a third class ticket to handle high power xmtrs as long as there was a second class ticket around to adjust the xmtr. Then came the mixer which gives a direct person-to-person private phone line. And now one of the boys brings out a phone job that even a child can operate by pulling a small switch . . . and one wonders what the future holds for a radio-telegraph operator? Of course. they didn't throw out the wire operators when the telephone came into use . . . but they sure put an awful hole into the number employed. So, are you studying?

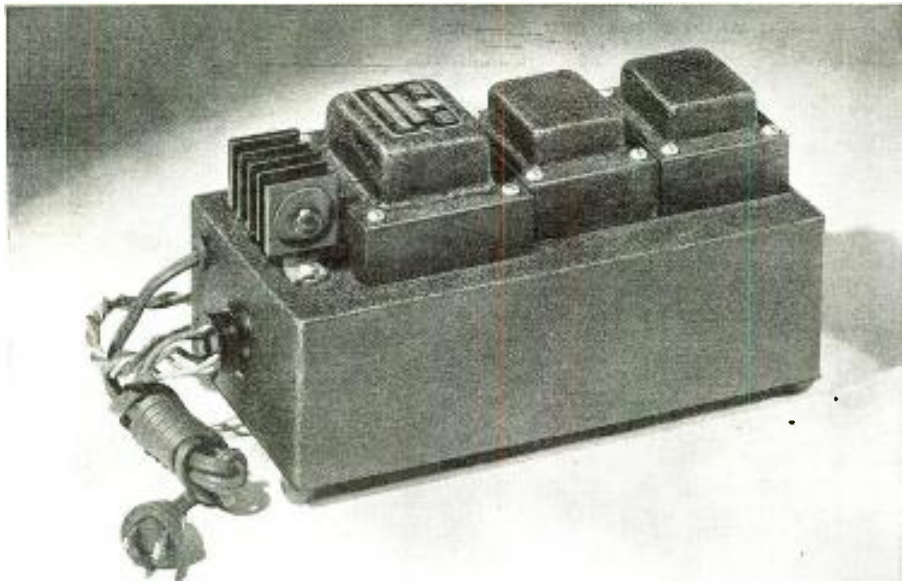
* * *

IN the December issue. a paragraph anent the building of radio equipment by radiops under a *WPA* project allowance. was misinterpreted by a brother op in Chicago. The item states it *was rumored* that under a *WPA* project. the *FCC* may hire radiops to build the equipment needed for the practical examinations. That is. if the bill for the five year ticket becomes a law. But let's make one thing clear. please. *This is just a rumor.*

* * *

AH, yes. mail. And here are a few . . . Don Cassio. formerly with *WNCW*, had to get away from fake holdups. riots. brickbats and such. so he joined the police department to get the real thing . . . just like JW Whitely. who now guards the gold in the *Chase Natl Bank*. after getting a 1st class crow in the Navy. . . . Paul Amsterdam, former op on the *M&M Line*, is

(*Pse QSY to page* 58)



A commercial unit adopting the principles set down by the author.

**The farmer can change his radio from battery operation to power packs following the author's design.**

**By LOUIS J. GAMACHE**
**W9RGL**
Development Engineer
Standard Transformer Corp.
Chicago, Illinois

April 1935 - 31

# FARM POWER PACKS

WITH the advent of rural electrification, the subject of packs to convert the present battery operated farm radios to a.c. operated radios is very important. Everyone who has had to keep storage batteries in condition realizes the amount of trouble that a storage battery gives in the way of fumes, spilling of acid, and the uncanny ability of the acid salt to seem apparently dormant, but when moisture comes in contact with this salt,—clothing, rugs, etc., are ruined.

The modern farm radio may be classified in the following four groups:

First, the set that uses the 5-volt type of tubes, a storage battery for filament, and "B" and "C" batteries for the plate and bias source. The second type is the set that uses 2-volt tubes with an air cell for the filament supply of these tubes and both "B" and "C" batteries for the plate and bias supply. The third type of farm radio set is that which incorporates a vibrator type power supply and is operated from a 6-volt storage battery which supplies both the filament and vibrator power. The fourth group of farm radio sets may be called the duplex type; that is, it uses a 6-volt storage battery, but utilizes only one cell of this battery or 2 volts for the filaments of the tubes, and the remaining 2 cells, or 4 volts, for the vibrator and transformer combination which replaces the "B" battery.

In discussing the various power supplies to be used with these radios, the first group will be considered first. It is found that these supplies were very common approximately ten years ago, before the advent of the all electric radio, but are not generally available today. These units consist of an "A" and "B" eliminator. The "A" eliminator, as it was called, consisted of a dry or jar type of rectifier. This supplied the filaments of the tubes through a large filter choke and two large electrolytic condensers, which constituted the filter. It may be well to say at this time that there have been large improvements in electrolytic condensers since the appearance of the original "A" eliminator. In these early condensers there was considerable leakage both in the form of the active electrolyte and in electrical capacity. Therefore, these condensers lost their efficiency very rapidly, and consequently this produced considerable hum.

The "B" eliminator, as it was called, consisted of a power transformer, a rectifier consisting of a group of jars or a gas filled tube of the *BH* type, and a filter. The filter consisted of two filter chokes and three or more filter condensers. The circuit of both a jar type "A" and "B" eliminators and one using a dry disc rectifier and a BH tube is shown in Figs. 1 and 2.

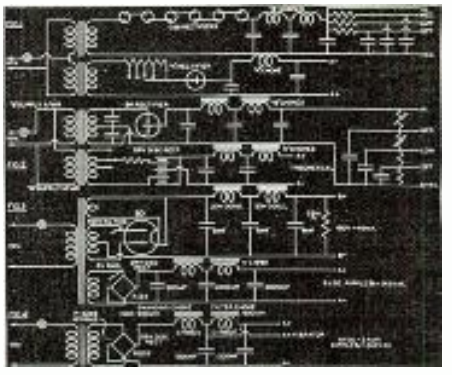
The second type of farm radio set which utilizes 2-volt tubes, utilizes the same fundamental circuit with the exception that dry disc rectifiers are used and that the power transformer has windings for both the plate supply and the filament of the rectifier tube, as well as for the dry disc rectifier. A circuit of one of these units is shown in Fig. 3.

In the third group of farm sets it is found that the power supply for this group consists of a power transformer which supplies energy to a dry disc rectifier, and a swinging choke and filter choke plus two electrolytic condensers. This unit requires good filtering because of the variable load placed upon it by the vibrator and the farm set (vibrators draw approximately five times contact current at the instant of contact; they draw very little current when the reed is traveling from one contact to the other). For this reason radio manufacturers of farm radios use four leads to a battery. Two go into the positive, one to the vibrator and one to the filament; and two go into the negative of the battery, one being for the vibrator and the other for the filament.

In constructing a pack where this system is used, it is advisable to connect the vibrator portion to the junction between the two chokes and filter network. This will give an isolation of the filaments from the vibrator circuit and help eliminate any possible hum. However, sets that do not use this system, using both chokes, will work satisfactorily in the majority of cases. A circuit, Fig. 4, and illustration for this power supply is illustrated.

In the fourth group of farm radio sets, where a part of the battery is used to supply filament power and part to supply the vibrator, this presents

(*Design further on page* 53)



# "RADIO Gadgets"

### Stopping Lamination Hum

HERE is a handy way to overcome the tendency of certain transformer laminations from vibrating. This method is particularly effective on the Silvertone model 6110 "Rocket" but may be applied to any receiver using the half shell type of transformer. The vibrating laminations may be stopped by means of the following procedure: Use an ordinary pair of auto pliers and set the jaws to the widest open position. Kink the outside core laminations as shown in the illustration and twist to force the individual pieces together. The corner bolts should not be loosened during this procedure.


Another effective remedy to overcome this kind of hum is to allow the transformer to reach maximum operating temperature and then to tighten the long mounting bolts while the transformer is still warm. As the unit cools off, the laminations will become even more secure due to the fact that heat expands the metal and cold contracts. If the hum is unusually bad, and if the serviceman is very careful, the transformer may have a filament winding temporarily shorted to bring up an excessive heat. The winding should only be shorted for a few seconds at one time. Caution: do not leave the short on too long or the transformer will burn out from overload.

### Push-Button Protection

The removing or replacing of some of the new chassis which have push-button tuners from their cabinets presents a problem when these buttons protrude enough to strike the cabinet as they slide in and out. Most service shops have some celluloid sheet lying around, such as is used as window glass in old cars and as a sleet remover in new cars. Cut a strip about 2" wide and 5" long, and insert it in the round opening in the cabinet. Adjust this strip so that it passes over the push-buttons. Now slide the chassis into the cabinet and as the buttons come in contact with the strip they will be forced down and the unit will fit into the cabinet very smoothly.


Some receivers are equipped with a key which fits on the condenser shaft and holds the dial to proper position. Be very careful not to lose this key as it is needed and a substitute is hard to make.

### Noisy Control Remedy

The following will be helpful in the servicing of the Philco model 17 receiver. As is, this set comes with a 350,000 ohm tapped potentiometer, which is used as the tone control. It also serves as the diode load resistor. This control becomes noisy in service and in the particular case at hand required a new control. This replacement did no good and the noise continued as before. Observation showed that the diode resistor might be replaced with a fixed carbon resistor of the same value as the tone control and that the audio component could be fed through a condensor to the tap on the v. control. Upon completing the above, the noise disappeared completely.

Note R1 and C1 are added to the original circuit.

### Soldering Iron Kinks

Many a piece of good equipment, a hard-to-get schematic, or possibly a burn has resulted from the soldering iron coming in contact when hot. To eliminate this hazard, the following gadget was improvised and proved its worth many a time. The idea is to provide some means of a soldering iron holder which may be mounted under the bench instead of on top.

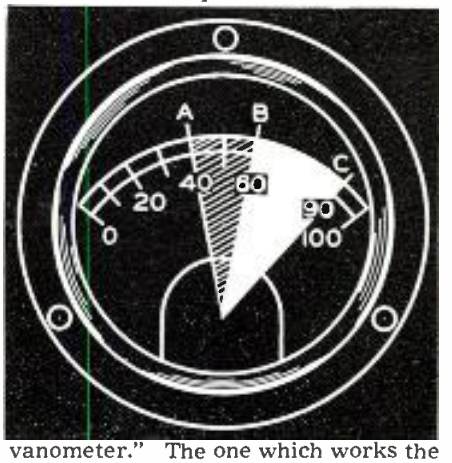

Take a piece of tin, galvanized iron or some other metal and cut to 10" wide by 12" long. Bend to the shape shown in the illustration and screw into place under the table or bench. A piece of sheet asbestos should be tacked to the bench as shown to protect the bench from the heat of the iron.

Additional protection may be added to the ordinary iron holder by extending the sides of the holder so that if a piece of paper were dropped on top of the iron, it would not burn. This kink will be useful with the holder in the usual position on top of the bench.

Many servicemen do not realize that the temperature of the soldering iron tip may be regulated by simply setting the tip so that it is either far in the element or set out away from the heating surface. Of course, this only applies to the irons which have a removable tip. By allowing the iron tip to become too hot, it will not keep tinned very long and maximum life to the copper will be had if the temperature is kept to just enough heat for good soldering.

### Simple Modulation Meter

There are many amateurs who wish that they could be able to tell approximately the percentage of their modulation without recourse to expensive instruments. There is a meter,—a standard one that can be used for this purpose as well as a neutralizer. It is the "Current Squared Thermo Galvanometer." The one which works the most satisfactorily has a resistance of 4.5 ohms, and will safely pass a current of 115 milliamperes. It is made to work on radio frequency only.




Couple the meter with a turn or two to the final tank circuit. BE SURE AND PLACE THE COUPLING TURNS FAR AWAY FROM THE TANK so as to avoid burning out the meter. This cannot be stressed too strongly. Then move the link closer and closer to the tank until the meter reads either 40 or 60. Using the tables below, and whistling steadily into the microphone will give an increased reading which can be converted into percentage modulation by using the charts below. ALL READINGS ARE APPROXIMATE, ONLY.

Although the meter is not very cheap, it makes one of the handiest instruments to have around the ham shack.

**TABLES**

*For reference point AB on the scale:*

| Meter | % Modulation |
|---|---|
| 40 | 0 |
| 42 | 10 |
| 44 | 20 |
| 46 | 30 |
| 48 | 40 |
| 50 | 50 |
| 52 | 60 |
| 54 | 70 |
| 56 | 80 |
| 58 | 90 |
| 60 | 100 |

*For reference point BC on the scale:*

| | |
|---|---|
| 60 | 0 |
| 62 | 6.66 |
| 64 | 13.32 |
| 66 | 19.98 |
| 68 | 26.64 |
| 70 | 33.30 |
| 72 | 39.96 |
| 74 | 46.62 |
| 76 | 53.28 |
| 78 | 59.94 |
| 80 | 66.60 |
| 82 | 73.26 |
| 84 | 79.92 |
| 86 | 86.58 |
| 88 | 93.24 |
| 90 | 99.90 |

(Gadgets further on page 49)

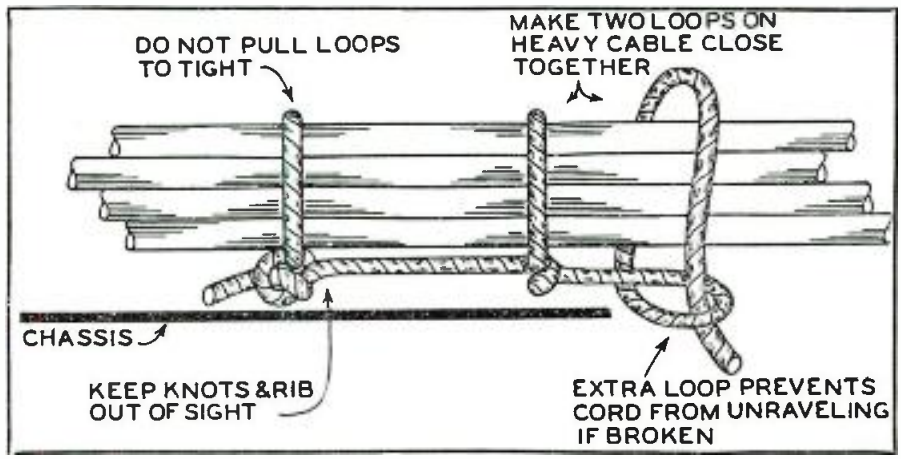
# IT'S AN ART!

By J. KOSKI, W2JRZ
Staten Island, N. Y.

**Following the directions of the author will make a "professional" wirer out of even you. There is not anything difficult about it.**

HOW many times have you wired up an oscillator, amplifier, or some other piece of radio equipment and had it function properly on the first trial? I'm willing to bet it doesn't happen very often. Even if a fellow has all he can desire in the way of parts, and a complete shop in which to build his equipment, he might not obtain satisfactory results. Yet some other fellow over in the next block can salvage a couple of old broadcast sets, and swap some unneeded parts for some needed ones. Then, working with a few cheap tools, he can turn out something which really "goes to town." Why? Because he was luckier than the other fellow? No, Sir! It's probably because he has a better knowledge of the fundamentals in the art of radio wiring. We say "art," because that's actually what it is. An artist painting a landscape couldn't get very far if he didn't know how to hold his brush or mix his paints. Neither can a radio constructor expect good results if he doesn't know how to lay out and wire his parts for a maximum efficiency and a minimum of headaches.

So, as the painter divides his work into portraits, stills and landscapes, let us divide our art of wiring into Power Supply, Audio Frequency, and Radio Frequency sections. Each of these requires its own special technique. We'll start with Power Supply wiring, which is probably the simplest type. Since feed-back and other such disturbances very rarely occur in power supplies, the leads can be wired in cable form without fear of trouble. By selecting a clear section of the chassis where parts won't interfere, a neat cable arrangement can be visualized, with leads branching off neatly to the various parts. The cable should

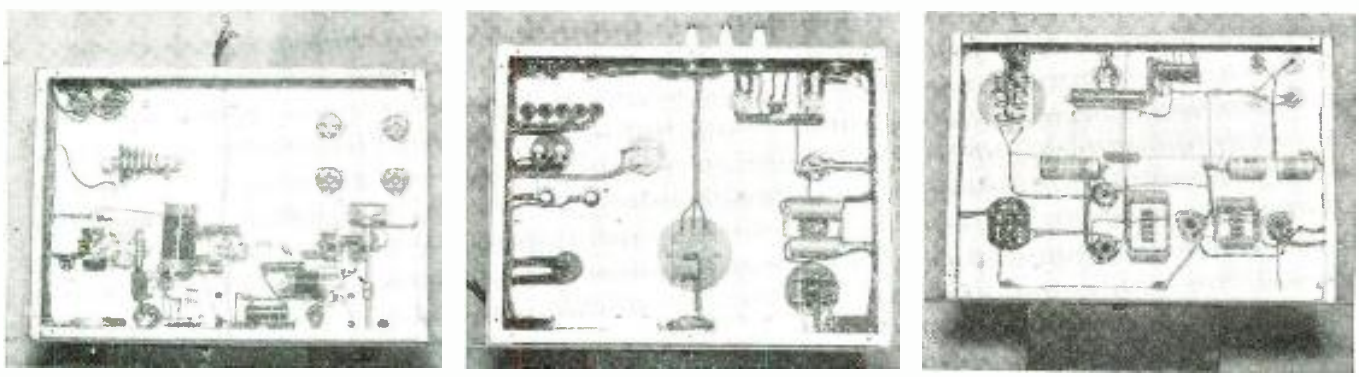



Making that fancy-looking lacing!

be kept well clear of bleeder resistors, tubes, and other parts which heat during operation. A single large cable is to be preferred to a group of small ones, as it simplifies lacing and adds strength and appearance. Also, in terminating the leads, it is a good idea to leave a slight hump, or loop in the end before soldering. This will prove very helpful if replacement of a part is necessary, besides adding a sort of "shock absorber" effect and thereby lessening the chances of a broken connection. Where leads are brought directly out of transformers or other parts without terminal connections, the good wireman makes use of the so-called "cinch" or "dummy" lugs, which should be procured with a considerable number of terminal lugs. The leads from the part are brought out to these lugs, and any other necessary connections can be terminated at the same point. The resulting neat wiring is well worth the few extra pennies involved in purchasing the lugs.

When working with any high voltage value (1,000v or over), it is a good plan to incorporate the high voltage leads in a separate cable. If the voltages are in excess of 1,500v, automobile high tension ignition cable is best, since it has a high voltage breakdown rating, and lends itself nicely to bending and cabling. Output terminal leads are more or less determined by the intended use of the power supply. If for experimental work, where considerable connecting and disconnecting is necessary, regular binding post strips are the solution. However, should the supply be part of a larger piece of equipment, such as a transmitter, plug and socket connections are best. A word of warning, though, will not go amiss. Bring all leads carrying 600 volts or over out separately to small feed-through insulators, or similar terminals, and on leads carrying between 400 and 600 volts, use ceramic sockets. More than one Ham has lost parts due to overload caused by an arc way down deep in

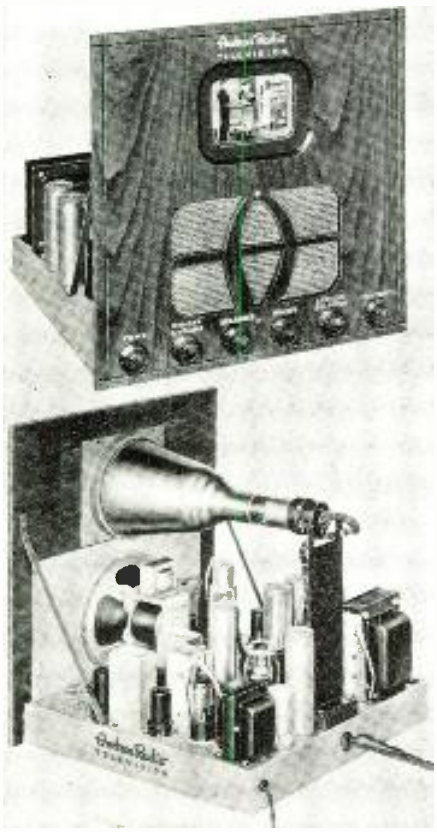
(*Wire further on page* 61)



Examples of the wiring "art."

# What's NEW in Radio

The Andrea Radio Corporation of Woodside, Long Island, New York, have made available a new Television receiver in kit form which will appeal to those entering this fascinating form of entertainment. By actually building the set, the constructor



may gain certain benefits from the knowledge secured. The set has been named the "Sharp Focus" and includes table, console and automatic phonograph combinations for sight and sound reception.

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The David Bogen Co. of 663 Broadway, New York have solved the problem of demonstrating amplifier equipment where space is at a premium by offering to the trade a compact shelf type assembly which has room for four amplifiers and a phonograph turntable. A switching panel is so arranged that it includes two microphone inputs, a four point selector switch, and another changeover switch to shift the speakers.

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The Operadio Mfg. Co. of St. Charles, Ill., announce a remote volume control unit which is intended to be used in conjunction with the 1938 series of amplifiers so that the volume may be controlled from any convenient position in the audience. The level is set to the maximum desired at the amplifier and then all further adjustments are made at the remote position. The entire unit fits nicely into the palm of the operator's hand.

The Radolek Co., 601 W. Randolph St., Chicago, distribute a small record player with its self-contained amplifier. It incorporates a crystal pickup with catch holder, self-starting constant-speed motor, and a power amplifier with 6 inch electro-dynamic speaker. The tube line-up is as follows: 6C5, 6F6, and an 80 type rectifier. Volume control, tone control and on-off switch are provided.

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The Thordarson Electric Co., Chicago, Ill., announce their new T20W08 4 tube beam type amplifier which is self-contained in a portable type carrying case together with its associated speaker. This unit features individual control of microphone or phono. for complete mixing. The power output is 8 watts and provision has been made to properly match the output impedances to various loads. Field excitation is also provided up to 6 watts to the speaker field.

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The Triumph Mfg. Co., 4017 W. Lake St., Chicago, have a new cathode ray oscillograph using a 3" cathode-ray tube. This model 830 features the alignment of tuned r.f. circuits by the resonance curve method. Over-all analysis of audio amplifiers is also provided in addition to the other usual functions of this type of instrument. The dimensions of this scope are 7⅛"x10"x14". An input sensitivity of 0.4 volts R.M.S. has been achieved through the use of a type 6SJ7 tube and a new thyratron saw-toothed oscillator provides a continuous range of 7 to 30,000 cycles.

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The Ohmite Mfg. Co., 4835 Flourney St., Chicago have developed a new hermetically sealed Attenuator which affords an accurate substitution to be made in the proper testing and adjusting of various line impedances by the substitution method. This new attenuator is furnished in different impedance ratings to meet different conditions and to give any desired decibel loss from .25 to 40 decibels. This unit is essentially a "H" pad but can also be provided as a "Pie" or as a "T" pad.


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The Brush Development Company of 3322 Perkins Avenue, Cleveland, Ohio, has made a new high fidelity pick-up, Type S16, available. True reproduction with needle pressures as low as ¾ of an ounce, and permanent needle points whose life is greater than 10,000 playings on shellacked records together with true tracking by means of an adjustable arm length from 12" to 16" which, once adjusted for a particular table will remain fixed, are featured.

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Amperite Co., 561 Broadway, New York, have designed a new *"Kontak"* microphone to be used as a pickup medium with string instruments for reproduction in connection with suitable amplifiers. The range of the unit is sufficient that high-fidelity may be realized. The pickup microphone feeds into the amplifier in the conventional way and the rating is —30 decibels. The response is 60 to 8000 cps, plus or minus 1 db. An adjustable clamp is furnished so that the unit will fit various applications.

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Webster Electric Company of Racine, Wisconsin, have brought out their new mellow-tone series X78 crystal phonograph pick-ups featuring a solid wood phone arm and a standard rubber steel cartridge. A metal outer shell serves as an electro-magnet, or electro-static shield as well. The tone arm is designed to minimize tracking errors down to 3 or 4%.

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The Noggle Products Company of Ann Arbor, Michigan, are furnishing the Add-a-Bin, which is a metal-type cabinet for the storing of small parts, to the average radio serviceman. The bins may be assembled in various desired combinations or shapes and are of welded construction, using 26 gauge steel, with green enamel finish.

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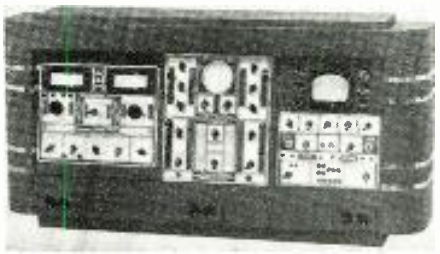
The Hickok Electrical Instrument Co., Cleveland, has developed a new radio service panel to aid radio dealers and servicemen in merchandising radio tube and set service. All instruments are in line and



when the panel is placed on a counter it gives eye-level accuracy. The panel has a Hickok Microvolter, ROF-4 Oscillograph, and 51-X Radio Tube and Set Tester.

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The Drake Mfg. Co. of Chicago have a unique new counter display designed to simplify ordering and to increase jobbers' sales. Fifteen different types of dial and jewel light assemblies are mounted on this display. An ingenious feature of this new display is the "Eye" of the Drake trademark which is actually a pilot light and may be operated from an external battery supply.

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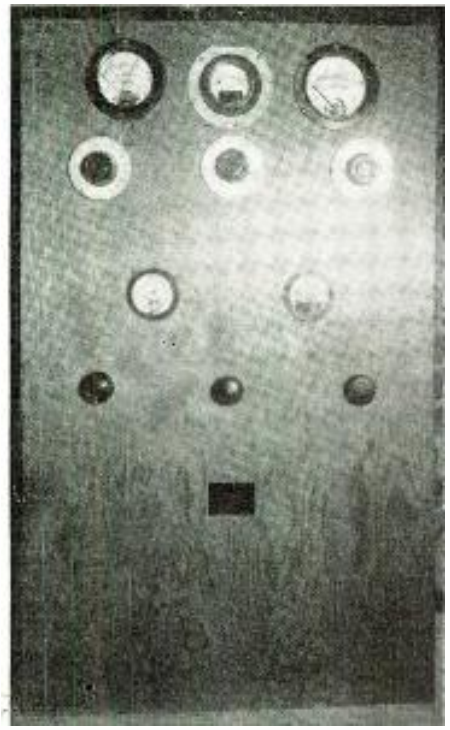
The International Radio Corporation announces a new model Kadette Autime electric clock and receiver. The radio dial is placed in an inconspicuous position at the lower right hand corner of the clock dial.

# 0 20M Transmitter From Receiver Parts

By L. B. ROBBINS
Harwich, Mass.

**The average "Junk Box" will yield sufficient receiver parts to build this very excellent transmitter, capable of good distance range.**



In spite of a wood panel, and the odd meters, the rig is really fb.

THE transmitter shown in the photographs was constructed for less than ten dollars because receiver parts were used almost throughout. A dollar bill bought four old battery type receivers and another dollar bought a good a.c. type receiver. From these were obtained parts enough to almost build the entire job. The other eight dollars went for meters, lumber, a couple of new tubes and a few little parts used in the hook-up. Plenty of good 27, 45, 210 and 250 type tubes were found in the purchased sets and in the spares around the shack. Some chokes were home made, as was the mike transformer, and the tuning coils.

The hook-up is commonplace. The r.f. portion uses a 53 tube as 40 meter oscillator and 20 meter doubler. A 2A3 or 45 is used as a buffer and a 210 as final amplifier. Class A speech was utilized because all standard parts and tubes could be used to advantage. The power supply is a simple "brute force" affair using standard receiver power parts. Altogether the transmitter is efficient for its design and cost and any amateur will be pleased with its performance. In nearly two months' use all reports have been "excellent signal and voice quality, good volume and stable frequency." No one could ask for more.

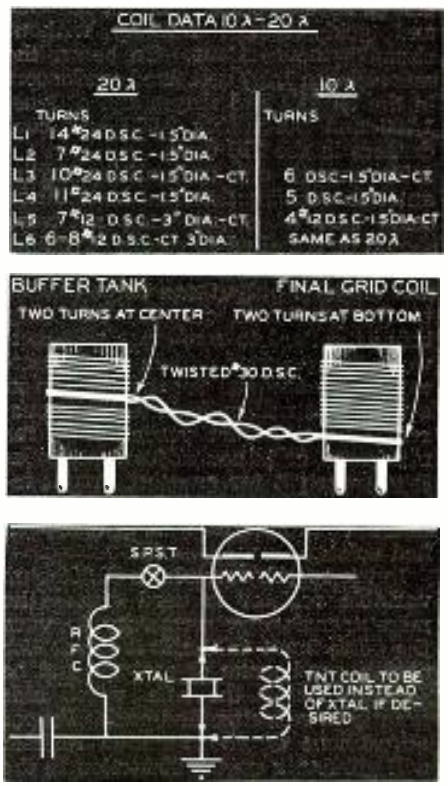
It was planned to construct the transmitter in three sections, so a cabinet was built with three shelves. The front was ¼" plywood, the frame of ¾" pine and the shelves of ½" stock. Panel is 30" high by 18" wide and the shelves are 18" x 10" and slide in on the framework. The builder can use his own idea about the exact arrangement and construction.

Each shelf was shielded on the bottom with sheet copper to which all ground connections were made. The power supply was built on the bottom shelf, the speech equipment on the middle shelf and the r.f. portion was placed on the upper. The exact arrangement of parts is immaterial so long as coil fields are kept apart and leads are as short as possible. Condenser and tank leads should be especially watched. All coils—L1-L2-L3-L4—were wound on tube bases with No. 30 DSC wire and "doped." Old four prong sockets were used for plugging in the coils. The link coupling the 2A3 to the 210 was twisted No. 30 DSC wire and fed much more current to the 210 grid than larger wire usually specified. The final (L5) 210 tank coil was wound of No. 12 bare copper wire and made plug-in with banana plugs and sockets close to the tuning condenser terminals. L6, in the antenna net-work, was also of bare copper wire with a clip for tapping off the required number of turns.

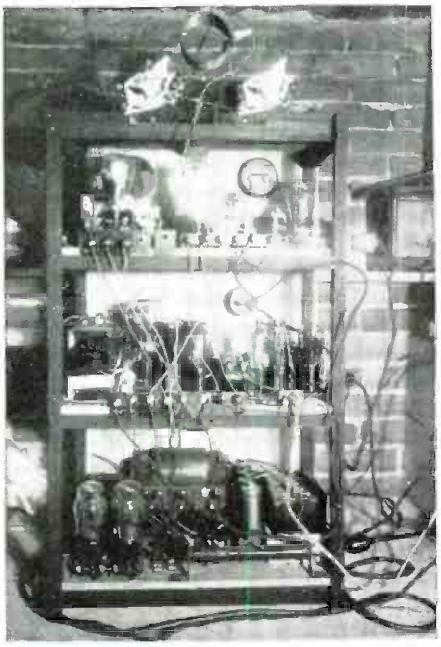
The speech equipment is perfectly simple, being a two stage amplifier with the second stage push-pull. The mike transformer was made by removing the primary from an old audio transformer and substituting a scramble wound primary of approximately 200 turns of No. 32 DCC wire. The ratio of turns will then be high and the quality is surprisingly good. A single 30 hy choke was used with a 500 ohm dropping resistor to the final, which appeared to distribute the current between modulator and amplifier about right.

In the power supply a heavy duty 1,200 volt center tapped transformer was obtained which also contained a 5 volt rectifier supply. Two 5Z3 rectifier tubes were employed, their plates being tied together. The regulation is excellent and repays for the use of the extra tube. All other filament supplies are from separate transformers as shown. One power switch turns on the primaries of all transformers and the minus power lead is cut with a switch for supplying the tubes with the high voltage when needed. A Christmas tree bulb in the high power minus also acts as a safety fuse in case anything goes "haywire" in the filter system. The filter condensers should be at least 1,500 volts working test and the voltage divider should be 100-watt to prevent heating.

Now to return to construction. In the 53 stage the crystal was of the usual plug-in type using a five prong socket. If a crystal is out of the question for ten meter operation, a TNT coil can be plugged into the socket instead, making the oscillator self-excited. The detail sketch shows this




Transmitter Details.



Rear view of the 'Junk Box Special.'

arrangement and is made by opening the crystal choke by a switch. The number of turns in the TNT coil will have to be determined by experiment. Solder all ground leads direct to the copper shield below. Meters are installed permanently in the panel. Clips on the leads are used for attaching to their terminals to make removal of the shelf easy. Also all condenser shafts are wood dowels attached to the dials and tuning shafts by flexible couplers. Jacks 1, 2 and 3 should also be wired to ground from similar terminals so the milliameter can be used in either jack for cathode and grid current reading without changing connections. To be on the safe side use 1,000 volt fixed condensers in the 53 and 2A3 stages and at least 1,500 and preferably 2,000 volt condensers in the 210 final.

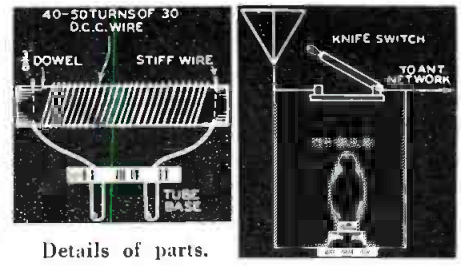
To smooth out inequalities in the antenna construction and installation some sort of a matching net-work should be installed as shown. Troublesome harmonics are thus eliminated and antenna output can be controlled to the maximum output. In using, bring the final to resonance with network disconnected. Then attach network and antenna. Set the coil clip on a turn that will indicate antenna current. Then adjust condenser A for maximum and then adjust condenser B to match it for greatest output indication in the final milliameter, which should be around 100 mils at the specified voltage.

In the speech amplifier a 50,000 ohm variable resistor is used across the mike transformer secondary to vary the voice input to the first tube. Use only a good make of resistor and be sure to install the r.f.c. which aids greatly in reducing feed-back. Proper adjustment of the variable resistor will eliminate speech distortion to the first grid. The 1,500 ohm grid resistor in the 250 modulator may have to be altered to properly reduce grid current. At a 500 volt input to the 250, plate current should not exceed 100 mils.

No mention has been made of any definite dimensions or measurements because of the varying types of parts, etc., used in any one individual construction. Arrange all parts as you choose, keeping in mind as before stated, coil fields and short leads. A shield behind the panel would, of course, prevent hand capacity when making tuning adjustments, but by using tuning shafts of wood or fiber such shielding is unnecessary.

In tuning this transmitter proceed as follows. Disconnect all power leads except to the 53. Turn oscillator condenser until oscillation of crystal takes place indicated by a decided dip in meter pointer. Reduce condenser setting slightly. Then tune doubler condenser to resonance, which will raise meter reading to greatest value. When adjusted to maximum, light the 2A3, but keep plate power off. Turn neutralizing condenser until neutralization is proven by checking 2A3 tank circuit against a neon bulb in the usual manner. When this is done connect plate power and tune the tank until this circuit is in resonance with the 53 doubler.

Light the 210 and neutralize that in the same manner as the 2A3. First, however, plug the grid meter into jack No. 3 and turn 210 grid coil condenser until the maximum number of mils is being fed in by the 2A3. This should be around 15 mils. When the 210 is neutralized apply the plate power and tune to resonance indicated by a decided dip in the meter. For phone



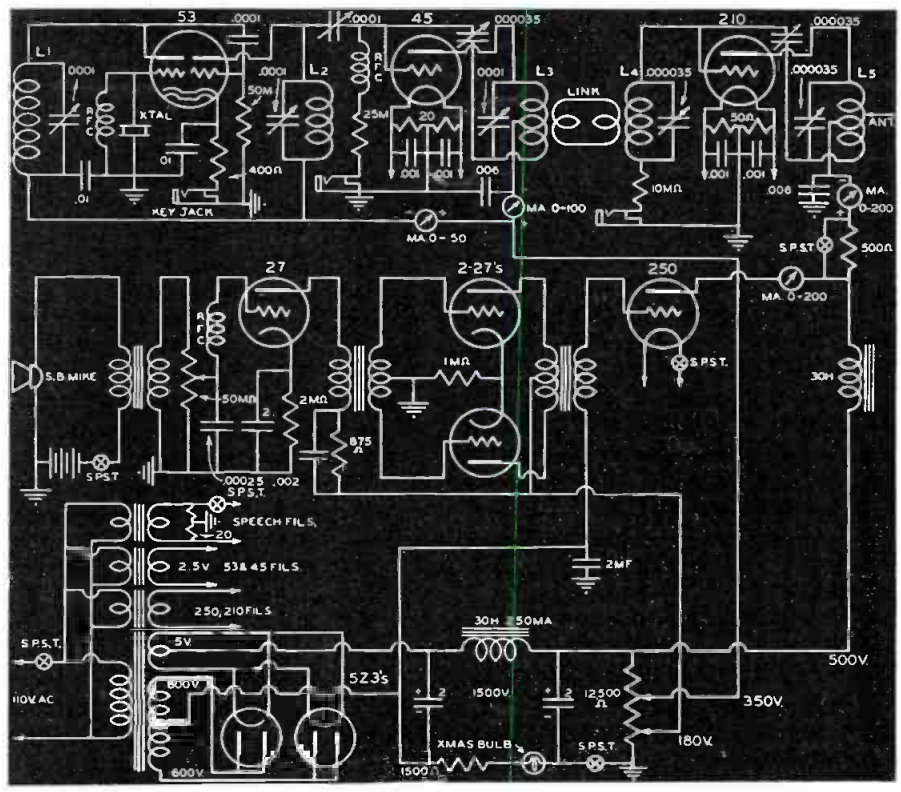

Details of parts.

work the grid resistance should be at twice cut-off value or about 20,000 ohms. For c.w., 10,000 ohms is sufficent for bias. This should show practically no mils flowing in the plate meter when there is no load on the tank. A happy setting will be found when setting the 53-2A3 coupling condenser where a maximum amount of mils show up on the grid meter in jack No. 2. The cathode current of the 53 when oscillating properly will range around 30 to 35 mils. When all grid currents are at a maximum and tank circuits indicate maximum resonance, adjust the antenna network with antenna attached. The final 210 plate tank reading will be a dip to about 95 to 100 mils at 450 volts.

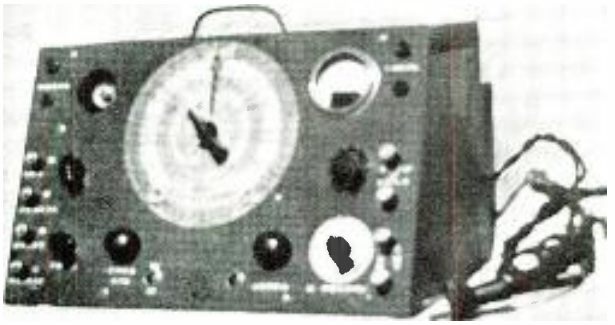
Turn on the speech amplifier and switch on the mike. Speech will swing the antenna meter *up*. If it goes *down* look for poor current supply to plates, too small chokes or defective condensers. Monitor the speech quality by speech input control at the mike transformer.

For c.w. work substitute the 10,000 ohm 210 grid-leak for the 20,000 ohm one and close the plate input resistor switch to the 210. This puts the full

*(Pse QSY to page 48)*




Circuit diagram of the 10-20M Transmitter.



This tester is very easy to use and construct.

**A unit that can make at least seven different tests will always be a most welcome adjunct to the serviceman's tools.**

By FRANK J. FALKNER
Ogden, Utah.

# A UNIVERSAL TESTER

IT is rather hard to understand that in these days when certain servicemen are finding spare moments around the shop, that they do not undertake the construction of up-to-date test equipment by using up some of the many spare parts usually found in any establishment. Test instrument circuits have been published widely but few have combined the many features to be found in the unit here described.

Practically all of the parts needed to construct this tester are made up of replacement components of standard makes and tolerances so that they may easily be duplicated. To be an up-to-date unit, the tester must include as many measurements as possible and at the same time be of compact construction so that it will be portable when taken out on a service call.

This instrument offers the following tests with a good degree of accuracy:

1. Condenser leakage from 0 to 15 megohms. (with 8 volts)
2. Condenser leakage from 15 to 100 megohms. (with 275 volts)
3. Capacity on direct scale from .00005 to 40 mfd.
4. Capacity up to 160 mfd. when used with external standard, or 20 times standard. (Note that 1/20th of the .0001 standard is .000005 mfd. At these low capacities the readings will be upset somewhat by the test leads.)
5. Power factor to 50%.
6. Resistors of 25 to 10,000 ohms on scale of bridge using built-in 500 ohm standard. (Note that suitable multipliers increase the range to 10 megohms.)
7. Uses magic eye for testing electrolytics.

### Operation

To operate the tester as an output meter, open the eye of the 6E5 tube to full. Connect the receiver being tested to the proper terminals and set the "selector switch" to the second position. Maximum signal closes the tuning eye and the stronger the signal, the more the eye will close. If the output is blurred, the sensitivity should be reduced by means of the control provided by reducing the shadow to full and by adjusting the sensitivity to get proper indication.

To measure leakage, either of paper or mica condensers, insert the test leads in the AVA terminals. Use the zero adjuster to get a narrow shadow. Now by shorting the test leads, the shadow should open to full width. The condenser is now tested by applying the test leads to the condenser. If high capacity, the shadow will fly open and then close. If the condenser is in good condition, the shadow will immediately return to the closed position. This indicates about 100 megohm resistance.

If the condenser is not in good condition, the eye will not close, and the width of the shadow will indicate the approximate leakage of the unit. A 15 megohm resistor will open the shadow in the same manner as would a shorted condenser. Small values of capacity will charge very quickly. The discharge of a .0001 mfd condenser will be very fast but may readily be seen on the tuning eye. It is sometimes desirable to reverse the test leads to off-set capacity effects.

Resistor measurements are made as follows: the fundamental scale range is from 25 to 10,000 ohms with the 500-ohm standard wired permanently in the circuit. Connect the test leads to points B-B. Widest angle of the magic eye will indicate balance of the resistor bridge. By connecting external resistors of known values at the points shown on the drawing, the ranges may be increased to read values up to 10 megohms.

Using a 5,000-ohm standard, it is only necessary to add the figure 0 to the scale markings. The range is now from 250 to 100,000 ohms.

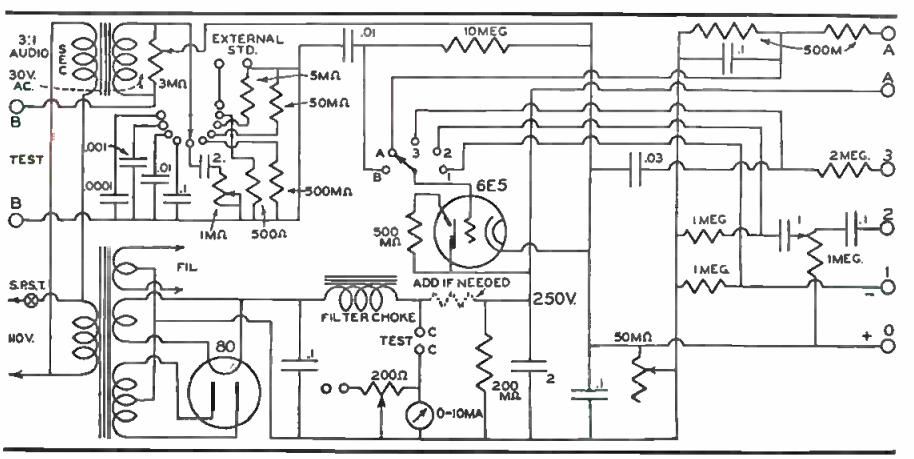
Using 50,000 ohms for the standard, the multiplying figures will be 00 and are added to the scale reading.

Now using 500,000 as a standard, add 000 to the reading shown, scale then reads 25,000 to 10,000,000 ohms.

By using the primary of an audio transformer for a standard—and measing the secondary with test leads, we get the ratio, if less than 20-1. If of 1 to 1 ratio, then bridge balances on 500 of ohms scale, and if 3 to 1 step up, then bridge balances at 1,500 ohms which is sec. × pri. (3 × 500). If transformer is step down then the secondary reading will be less than 500. For example, the ratio of 2 to 1 will read 250 ohms, etc. Using this same method we can test a.c., 60 cycle impedance or reactance of chokes, speakers, etc., by the comparison method.

In testing condensers we use .0001

(*Construct further on page* 54)



# "S RELA"
# —A UNIVERSAL RADIO LANGUAGE

by E. STANTON BROWN
Associate Editor, RADIO NEWS

**This month there is further news of programs in the Spatari Radio Language and the section on General Program Data is completed.**

Professor Carlo Spatari, inventor of the Spatari Universal Radio Language (SIRELA).

AS promised last month, the lower halves of the last columns of the General Program Data are given in this issue. On the next page you will find Reference Column B, also. It will be well if you cut the page from this issue and attach it to page 39 of the February issue.

A further suggestion is that you secure a large sheet of paper. Cut the General Program Data from the January, February, and current issues and paste the columns on it in their proper order. This may be determined by the sequence of the numbered sections. Then you will have the entire subject on one sheet for easy reference.

Unfortunately RADIO NEWS was on the press when the Spatari programs mentioned last month, on TG-1, TG-2, CFAC, CMHJ, and CMHM, were on the air. Consequently no report can be given at this time. We would like to hear from those who tuned in the programs and sent in verification requests in **SIRELA.** As many as possible of those who receive verifications from the above stations will be mentioned in this department if you will notify us.

We have just received a letter from Harold B. Clein of stations W6XKG and W6XRE in Los Angeles. The former operates on a frequency of 25,950 kc. and the latter on a frequency of 120,000 kc.

Mr. Clein writes in regard to the "Good Will Broadcasts" over these two stations, "On these programs we are giving a brief explanation of Spatari, and then station announcements, etc. in Spatari.

"These 'Good Will Broadcasts' were originated by Earl G. De Haven, short wave commentator of W6XKG and W6XRE and the first was put on in May, 1938, and directed to Costa Rica . . . station TI4NRH. The program was well received in Costa Rica . . . On January 4, 1939, the program was directed to Guatemala. Spatari was used and an explanation was read on the air. Time for Spatari, about six to ten minutes on the broadcast. Time of broadcast thirty to forty-five minutes.

"Future broadcasts are:

February 15th, 11:00 a.m., PST, directed to Mexico.

February 22nd, 12:00 noon, PST, directed to Nicaragua . . ."

Appropriate programs consisting of music for the country to which the broadcast is directed, and talks by the country's consul will be broadcast. An explanation of Spatari will be given on each program and a message in Spatari will be read.

Another western station is also broadcasting regularly in Spatari. Every Thursday morning at 2:45 a.m. to 3:00 a.m., E.S.T., a Spatari broadcast may be heard on station KSL, Salt Lake City, Utah, according to Mac Elwyn Van of that station. KSL is a 50,000 watt station operating on a frequency of 1130 kc.

The **SIRELA** code words for the stations mentioned above are:

**MIREBO**—*W6XKG*, (25.95 meg.) 1417 South Figueroa, Los Angeles, Calif.

**DOMILA**—*KSL*, (1130 kc.), Vermont Building, Salt Lake City, Utah.

It is interesting to note that in one day there were reported nineteen Spatari verifications from station YV3RD, *Radio Barquisimeto,* Bariquisimeto, Venezuela. YV3RD operates on a frequency of 6465 kc.

For those who got in late on the series RADIO NEWS is running on **SIRELA**, the Universal Radio Language, it may be well to mention that the series started in the November, 1938 issue. An explanation of the theory and functioning of the language has been given and complete details as to its use for verification correspondence. In the December issue the *Universal Radio Time Chart* was published and its used explained. For the past two issues, and in this issue, General Program Data, such as meets great use in station announcements, has been presented.

So far RADIO NEWS' presentation of the Spatari Radio Language has been confined to an explanation of the language itself together with portions of the book which might be used immediately.

It seems not amiss at this time to say something about Professor Spatari, the inventor of **SIRELA.** Born in Italy, he came to this country in 1905, when he was seventeen years old. He was an accomplished musician and was immediately offered the directorship of an orchestra.

He was impressed with the fact that, though his knowledge of English was limited, he had little difficulty in exchanging ideas with fellow musicians. Music seemed a universal language.

The idea occurred to him to construct a language built on the notes of the musical scale—syllables which were phonetically the same in almost every language. Out of this grew the Spatari Radio Language — designed and built primarily for radio because that is the medium by which contact of the people of the world with each other is most common.

A single, simple language which might be understood simultaneously by everyone, everywhere, would indeed prove a boon to international understanding. It could exert a subtle influence for peace, brought about by breaking down barriers set up by language difficulties.

Today the Spatari Radio Language is well on the way toward its goal. Interest has been awakened in many countries, and radio stations, many of which have been mentioned here, are promoting its use.

37
MISOSO —SPECIAL PROGRAM (Future)
MISOSODO—This radio station and the following radio station:
" " RE—Will feature a special program from: (B
" " MI—The program will come to you as a presentation of this radio station.
" " FA—The program will be dedicated to the memory of: (A
" " SO—The program will be in honor of: (A
" " LA—This radio station will broadcast a special program in celebration of: (A
" " SI—This radio station will mark the Spatari Language's Anniversary: (B
" " BO—This radio station will broadcast an anniversary program in honor of the birth of a great man: (A

38
MISOLA —SOUVENIR, PHOTO, GIFT, ETC.
MISOLADO—This radio station will send an illustrated booklet to persons reporting our programs.
" " RE—This radio station will send a souvenir to persons reporting this program.
" " MI—We will send a picture of our station to persons reporting our program.
" " FA—We will send to persons reporting our program a souvenir pertaining to: (A
" " SO—We will send an anniversary souvenir to persons reporting our program.
" " LA—We will send a commemorative souvenir to persons reporting our programs.
" " SI—A photograph of our staff will be sent on request.
" " BO—This radio station will send an interesting souvenir pertaining to our country to persons reporting this program.

39
MISOSI —SOUVENIRS (Continued)
MISOSIDO—We will send a picture of our artists to persons reporting our programs.
" " RE—We will send a booklet of artists of our country to persons reporting our program.
" " MI—This offer is only for listeners of the following countries:
" " FA—The persons reporting our programs will receive a picture of our featured artists:
" " SO—Persons reporting this special program will receive an interesting souvenir.
" " LA—According to date of mailing this offer is only for the first: (B
" " SI—We will send a gift for the best reports on Spatari broadcasts.
" " BO—The following number of listeners from each country who are first in reporting this program will be awarded this special gift.

40
MISOBO —STATION POLICY
MISOBODO—This radio station is dedicated to commercial programs, we invite all those interested to communicate with us.
" " RE—We invite all those interested in the following subject to cooperate with us as:
" " MI—We dedicate this station to the development and welfare of: (AJ
" " FA—The policy of this radio station is: (J
" " SO—We invite cooperation from persons interested. This station is dedicated to: (J
" " LA—This radio station is dedicated to world-wide peace. You are invited to cooperate.
" " SI—This station hopes to promote universal understanding by using the Spatari Radio Language.
" " BO—This station is dedicated to world-wide peace and international understanding and we invite all those interested to communicate with us.

44
MILAFA —VERIFICATIONS
MILAFADO—Please take notice that this radio station will in due time answer all correct verifications received.
" " RE—Please take notice that we cannot undertake to answer requests for verifications.
" " MI—This radio station will not verify any more reports after: (B
" " FA—Listeners want to know the reason for the delay in answering verifications.
" " SO—We answered all correct verifications in the order received.
" " LA—We will answer all remaining verifications as soon as possible.
" " SI—For information of DX'ERs, this station is operated as an experimental unit.
" " BO—We do not issue QSL verifications but will be glad to verify reception by Special Letter.

45
MILASO —REBROADCAST OFFERING
MILASODO—This radio station will permit rebroadcast of its program to stations of the following nations:
" " RE—This radio station will permit foreign stations to rebroadcast its programs.
" " MI—This radio station will permit all stations to rebroadcast this program.
" " FA—This radio station will permit foreign stations to rebroadcast our program:
" " SO—The following stations are authorized by us to rebroadcast our programs:
" " LA—Rebroadcasting of this program is permitted only for:
" " SI—We allow rebroadcasting upon request.
" " BO—This radio station will permit rebroadcast of this program to radio stations of the following nations:

46
MILALA —CONFIRMATION, RELAYS
MILALADO—This station cannot confirm any matters which takes place on the commercial telephone circuits.
" " RE—The originators of this program are members of the organization of: (A
" " MI—A new radio organization has been formed under the name of: (A
" " FA—This station will soon be relayed by station:
" " SO—This station is relayed by station:
" " LA—This program will be relayed by radio station:
" " SI—This broadcast is relayed by station:
" " BO—This program is to be retransmitted by:

47
MILASI —FREQUENCY AND CHANGES
MILASIDO—This radio station has changed its frequency to k.c.: (B
" " RE—This radio station has changed its frequency to m.c.: (B
" " MI—This radio station has changed its kilocycles to: (B
" " FA—This radio station has changed its megacycles to: (B
" " SO—This radio station has changed its meters to: (B
" " LA—This radio station has changed its watts to: (B
" " SI—This radio station has changed its wavelength to: (B
" " BO—We are discontinuing transmission on this frequency.

48
MILABO —FREQUENCY AND SCHEDULE CHANGE
MILABODO—This station broadcasts alternately on the following frequencies: (B
" " RE—We are discontinuing transmission on this frequency: (B
" " MI—This station operates on this frequency on all days but: (B
" " FA—This station operates on this frequency on: (B
" " SO—We are rebroadcasting the program of radio station:
" " LA—This program will also be transmitted on: (B
" " SI—This station has changed its schedule to every: (B
" " BO—Please change time for the program scheduled for tomorrow at: (B

53
MISISO —CHANGES, POSTPONEMENT AND SUBSTITUTION OF PROGRAMS
MISISODO—The program announced for this period has been cancelled in order that we may broadcast a special feature.
" " RE—This period will be substituted by the following:
" " MI—Part of this program has been cancelled in order to broadcast a special feature.
" " FA—Part of this program for unavoidable reasons has been changed.
" " SO—The program scheduled for this period has been postponed for: (B
" " LA—Please note following change of program previously announced for: (B
" " SI—A special program in the Spatari Radio Language will substitute the broadcast originally scheduled.
" " BO—The program originally scheduled for this period has been cancelled due to unforeseen difficulties. We bring to you the following:

54
MISILA —GENERAL CHANGE AND POLICY
MISILADO—This station will continue its regular policy.
" " RE—This radio station operates under a new administration.
" " MI—This radio station will have talks in the language of:
" " FA—This radio station has changed its policy to: (A
" " SO—Please change our previous announcement to read as follows:
" " LA—Our policy is to do the utmost to please our listeners.
" " SI—A change of schedule is to be made shortly.
" " BO—This radio station is under a new management. The new staff is formed as follows: (A

55
MISISI —BROADCASTING REPLIES TO COMMUNICATIONS
MISISIDO—We will answer in regular order all correspondence received.
" " RE—We are grateful to all listeners reporting our programs.
" " MI—Your correspondence received. We send our thanks to you: (A
" " FA—We will soon answer all correspondence received.
" " SO—Letters regarding the Spatari Radio Language should be sent to: (A
" " LA—Listeners wish to know why we have not sent souvenirs.
" " SI—Winners want to know why we have not sent prizes.
" " BO—Thanks to listeners. Your reports were of great value in determining the range of the transmitter and the skip distance of the frequency used.

56
MISIBO —ACKNOWLEDGMENT OF CORRESPONDENCE
MISIBODO—We received a communication from: (A
" " RE—We will forward the item in question very soon.
" " MI—We are glad to state that the item in question was forwarded.
" " FA—We expect a new supply very soon and will send them at once.
" " SO—The reason for the delay is that we had none on hand.
" " LA—We will send them as soon as they are ready.
" " SI—We thank the following listeners for their correspondence: (A
" " BO—We cannot undertake to answer questions regarding artists heard on this station.

COLUMN B
DO—0 (th
RE—1 (first
MI—2 (second
FA—3 (third
SO—4 (fourth
LA—5 (fifth
SI—6 (sixth
BO—7 (seventh

DO —FREQUENCIES
DODO—8 (eighth
DORE—9 (ninth
DOMI—Frequency in kc.
DOFA—Frequency in mc.
DOSO—Kilocycles
DOLA—Megacycles
DOSI—Meters
DOBO—Watts

RE —ARTICLES, LANGUAGES REFER TO:
REDO—And (or)
RERE—From (with)
REMI—To (at, in, for, of)
REFA—On (are, is, our)
RESO—In the language of:
RELA—In Spatari Language
RESI—Native language
REBO—Refer to column A

MI —CHANGE, SCHEDULE, ANNOUNCER, ETC.
MIDO—Change our:
MIRE—Schedule (for, of, on)
MIMI—This is our:
MIFA—Also (on, at, in)
MISO—Between (after, around)
MILA—Your announcer is:
MISI—Only (on, at, in)
MIBO—Irregular. (on, at, in)

FA —DAILY AND DAYS OF WEEK
FADO—Daily (on, at, in)
FARE—Sunday (and)
FAMI—Monday (and)
FAFA—Tuesday (and)
FASO—Wednesday (and)
FALA—Thursday (and)
FASI—Friday (and)
FABO—Saturday (and)

SO —DAY, LAST AND OCCASIONAL
SODO—Day (s)
SORE—Last (day or month)
SOMI—Today (on, at, in)
SOFA—Tomorrow (on, at, in)
SOSO—Yesterday (on, at, in)
SOLA—This is radio station
SOSI—Occasional (on, at, in)
SOBO—With occasional Broadcasts (on, at, in)

LA —NEXT, WEEK, MONTH, YEAR
LADO—Next
LARE—Week (s)
LAMI—Month (s)
LAFA—Year (s)
LASO—January
LALA—February
LASI—March
LABO—April
SIDO—May
SIRE—June
SIMI—July
SIFA—August
SISO—September
SILA—October
SISI—November
SIBO—December

BO —DAILY EXCEPT, AND, IN A FEW
BODO—Daily except Sunday
BORE—Daily except Monday
BOMI—Daily except Tuesday
BOFA—Daily except Wednesday
BOSO—Daily except Thursday
BOLA—Daily except Friday
BOSI—Daily except Saturday
BOBO—In a few:

# WORLD SHORT WAVE TIME-TABLE

Compiled by the Editors of RADIO NEWS

Hours of transmission for the World's Short Wave Broadcast Stations

HOURS OF TRANSMISSION

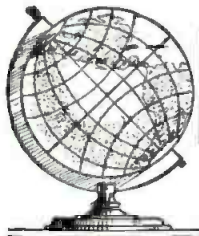
8 9 10 11 M 1 2 3 4 5 6 7

EASTERN STANDARD TIME

| Wave-length Meters | Call Letters | Frequency Kc. | City Country |
|---|---|---|---|
| 13.93 | W8XK | 21540 | Pittsburgh, Pa. |
| 13.93 | GSJ | 21530 | Daventry, England |
| 13.91 | W2XE | 21520 | New York, N. Y. |
| 13.96 | W2XAD | 21500 | Schenectady, N. Y. |
| 13.97 | GSH | 21470 | Daventry, England |
| 13.99 | DJS | 21450 | Zeesen, Germany |
| 15.77 | HS8PJ | 19020 | Bangkok, Siam |
| 16.86 | GSG | 17790 | Daventry, England |
| 16.87 | JZL | 17785 | Nazaki, Japan |
| 16.87 | W3XL | 17780 | Bound Brook, N. J. |
| 16.88 | PHI2 | 17770 | Huizen, Holland |
| 16.89 | DJE | 17760 | Zeesen, Germany |
| 19.56 | DJR | 15340 | Zeesen, Germany |
| 19.57 | W2XAD | 15330 | Schenectady, N. Y. |
| 19.60 | GSP | 15310 | Daventry, England |
| 19.62 | LRU | 15290 | Buenos Aires, Arg. |
| 19.63 | DJQ | 15280 | Zeesen, Germany |
| 19.65 | W2XE | 15270 | New York, N. Y. |
| 19.66 | GSI | 15260 | Daventry, England |
| 19.68 | TPA2 | 15243 | Pontoise, France |
| 19.71 | PCJ2 | 15220 | Huizen, Holland |
| 19.72 | W8XK | 15210 | Pittsburgh, Pa. |
| 19.74 | DJB | 15200 | Zeesen, Germany |
| 19.76 | GSO | 15180 | Daventry, England |
| 19.79 | JZK | 15160 | Nazaki, Japan |
| 19.82 | GSF | 15140 | Daventry, England |
| 19.84 | HVJ | 15121 | Vatican City |
| 19.85 | DIL | 15110 | Zeesen, Germany |
| 19.89 | RKI | 15090 | Moscow, U.S.S.R. |
| 20.04 | LZA | 14970 | Sofia, Bulgaria |
| 20.08 | PSE | 14935 | Rio de Janeiro, Brazil |
| 20.64 | HBJ | 14535 | Geneva, Switzerland |
| 22.00 | SPW | 13635 | Warsaw, Poland |
| 24.52 | TFJ | 12235 | Reykjavik, Iceland |
| 25.00 | RNE | 12000 | Moscow, U.S.S.R. |
| 25.21 | XEWI | 11900 | Mexico, D. F. |
| 25.24 | TPA3 | 11885 | Pontoise, France |
| 25.27 | W8XK | 11870 | Pittsburgh, Pa. |
| 25.29 | GSE | 11860 | Daventry, England |
| 25.34 | OLR4A | 11840 | Podebrady, Czech. |
| 25.36 | W9XAA | 11830 | Chicago, Ill. |
| 25.36 | W2XE | 11830 | New York, N. Y. |
| 25.40 | 2RO4 | 11810 | Rome, Italy |
| 25.42 | DJZ | 11801 | Zeesen, Germany |
| 25.42 | JZJ | 11800 | Nazaki, Japan |
| 25.45 | WIXAL | 11790 | Boston, Mass. |
| 25.49 | DJD | 11770 | Zeesen, Germany |
| 25.51 | OLR4B | 11760 | Podebrady, Czech. |
| 25.53 | GSD | 11750 | Daventry, England |
| 25.58 | CJRX | 11720 | Winnipeg, Canada |
| 25.60 | TPA4 | 11718 | Pontoise, France |
| 25.60 | CR7BH | 11718 | Lourenzo, Marques |
| 25.63 | SBP | 11705 | Motala, Sweden |
| 25.64 | HP5A | 11700 | Panama, Pana. |
| 25.66 | XTJ | 11690 | Hankow, China |
| 26.01 | SPD | 11535 | Warsaw, Poland |
| 26.24 | COCX | 11435 | Havana, Cuba |
| 26.31 | HBO | 11402 | Geneva, Switzerland |
| 27.17 | CSW | 11040 | Lisbon, Portugal |
| 27.27 | PLP | 11000 | Bandoeng, Java |
| 29.04 | ORK | 10330 | Ruysselede, Belgium |
| 29.24 | PMN | 10260 | Bandoeng, Java |
| 29.35 | PSH | 10220 | Rio de Janeiro, Brazil |
| 30.43 | EAQ | 9860 | Madrid, Spain |
| 30.52 | IRF | 9830 | Rome, Italy |
| 30.81 | CSW | 9737 | Lisbon, Portugal |
| 31.02 | W3XAL | 9670 | Bound Brook, N. J. |
| 31.06 | LRX | 9660 | Buenos Aires, Argentina |
| 31.09 | CS2WA | 9650 | Lisbon, Portugal |
| 31.10 | HH3W | 9645 | Port-au-Prince, Haiti |
| 31.14 | 12RO3 | 9635 | Rome, Italy |
| 31.20 | HJ1ABP | 9616 | Cartagena, Colombia |
| 31.25 | RAN | 9600 | Moscow, U.S.S.R. |
| 31.28 | VK6ME | 9590 | Perth, Australia |
| 31.28 | W3XAU | 9590 | Philadelphia, Pa. |
| 31.28 | VK2ME | 9590 | Sydney, Australia |
| 31.28 | PCJ | 9590 | Huizen, Holland |
| 31.28 | HP5J | 9590 | Panama City, Pana. |
| 31.32 | GSC | 9580 | Daventry, England |
| 31.32 | VKVLR | 9580 | Lyndhurst, Australia |
| 31.35 | WIXK | 9570 | Millis, Mass. |
| 31.37 | OAX4T | 9562 | Lima, Peru |
| 31.38 | DJA | 9560 | Zeesen, Germany |
| 31.41 | W2XAD | 9550 | Schenectady, N. Y. |
| 31.42 | OLR3A | 9550 | Podebrady, Czech. |
| 31.42 | XEFT | 9550 | Veracruz, Mexico |
| 31.45 | DJN | 9540 | Zeesen, Germany |
| 31.48 | W2XAF | 9530 | Schenectady, N. Y. |
| 31.48 | LKC | 9530 | Jeloy, Norway |
| 31.49 | ZBW3 | 9525 | Hong Kong, China |
| 31.51 | OZF | 9520 | Skamlebak, Denmark |
| 31.55 | GSB | 9510 | Daventry, England |
| 31.55 | HJU | 9510 | Buenaventura, Colom. |
| 31.55 | VK3ME | 9510 | Melbourne, Australia |

HOURS OF TRANSMISSION

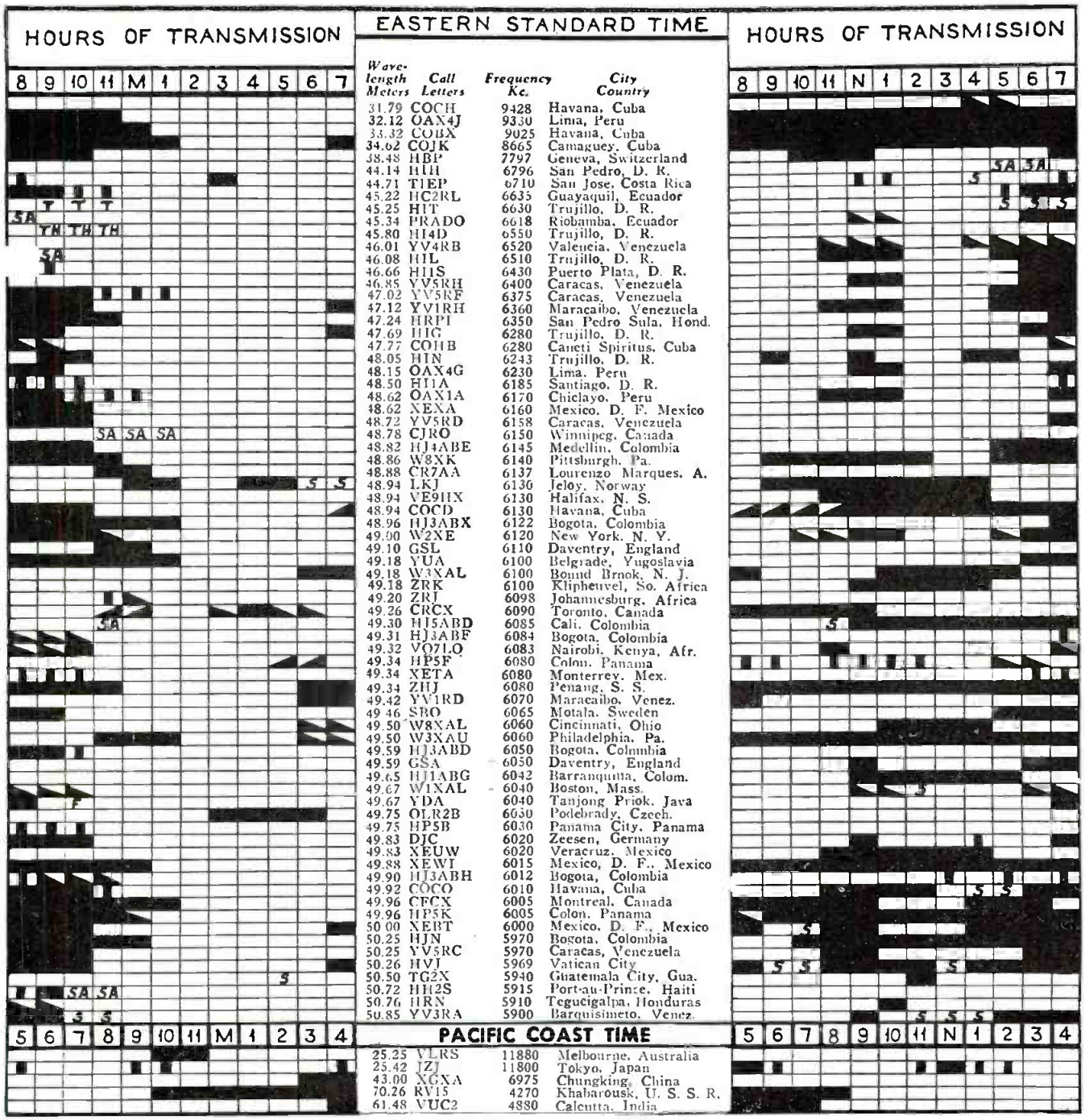
8 9 10 11 N 1 2 3 4 5 6 7



# WORLD SHORT WAVE TIME-TABLE

*Compiled by the Editors of RADIO NEWS*

**Hours of transmission for the World's Short Wave Broadcast Stations**




| Wave-length Meters | Call Letters | Frequency Kc. | City Country |
|---|---|---|---|
| 31.79 | COCH | 9428 | Havana, Cuba |
| 32.12 | OAX4J | 9330 | Lima, Peru |
| 33.32 | COBX | 9025 | Havana, Cuba |
| 34.62 | COJK | 8665 | Camaguey, Cuba |
| 38.48 | HBP | 7797 | Geneva, Switzerland |
| 44.14 | HIH | 6796 | San Pedro, D. R. |
| 44.71 | TIEP | 6710 | San Jose, Costa Rica |
| 45.22 | HC2RL | 6635 | Guayaquil, Ecuador |
| 45.25 | HIT | 6630 | Trujillo, D. R. |
| 45.34 | PRADO | 6618 | Riobamba, Ecuador |
| 45.80 | HI4D | 6550 | Trujillo, D. R. |
| 46.01 | YV4RB | 6520 | Valencia, Venezuela |
| 46.08 | HIL | 6510 | Trujillo, D. R. |
| 46.66 | HI1S | 6430 | Puerto Plata, D. R. |
| 46.85 | YV5RH | 6400 | Caracas, Venezuela |
| 47.02 | YV5RF | 6375 | Caracas, Venezuela |
| 47.12 | YV1RH | 6360 | Maracaibo, Venezuela |
| 47.24 | HRPI | 6350 | San Pedro Sula, Hond. |
| 47.69 | HIG | 6280 | Trujillo, D. R. |
| 47.77 | COHB | 6280 | Caneti Spiritus, Cuba |
| 48.05 | HIN | 6243 | Trujillo, D. R. |
| 48.15 | OAX4G | 6230 | Lima, Peru |
| 48.50 | HI1A | 6185 | Santiago, D. R. |
| 48.62 | OAX1A | 6170 | Chiclayo, Peru |
| 48.62 | XEXA | 6160 | Mexico, D. F. Mexico |
| 48.72 | YV5RD | 6158 | Caracas, Venezuela |
| 48.78 | CJRO | 6150 | Winnipeg, Canada |
| 48.82 | HJ4ABE | 6145 | Medellin, Colombia |
| 48.86 | W8XK | 6140 | Pittsburgh, Pa. |
| 48.88 | CR7AA | 6137 | Lourenzo Marques, A. |
| 48.94 | LKJ | 6130 | Jeloy, Norway |
| 48.94 | VE9HX | 6130 | Halifax, N. S. |
| 48.94 | COCD | 6130 | Havana, Cuba |
| 48.96 | HJ3ABX | 6122 | Bogota, Colombia |
| 49.00 | W2XE | 6120 | New York, N. Y. |
| 49.10 | GSL | 6110 | Daventry, England |
| 49.18 | YUA | 6100 | Belgrade, Yugoslavia |
| 49.18 | W3XAL | 6100 | Bound Brook, N. J. |
| 49.18 | ZRK | 6100 | Klipheuvel, So. Africa |
| 49.20 | ZRJ | 6098 | Johannesburg, Africa |
| 49.26 | CRCX | 6090 | Toronto, Canada |
| 49.30 | HJ5ABD | 6085 | Cali, Colombia |
| 49.31 | HJ3ABF | 6084 | Bogota, Colombia |
| 49.32 | VQ7LO | 6083 | Nairobi, Kenya, Afr. |
| 49.34 | HP5F | 6080 | Colon, Panama |
| 49.34 | XETA | 6080 | Monterrey, Mex. |
| 49.34 | ZHJ | 6080 | Penang, S. S. |
| 49.42 | YV1RD | 6070 | Maracaibo, Venez. |
| 49.46 | SBO | 6065 | Motala, Sweden |
| 49.50 | W8XAL | 6060 | Cincinnati, Ohio |
| 49.50 | W3XAU | 6060 | Philadelphia, Pa. |
| 49.59 | HJ3ABD | 6050 | Bogota, Colombia |
| 49.59 | GSA | 6050 | Daventry, England |
| 49.65 | HJ1ABG | 6042 | Barranquina, Colom. |
| 49.67 | W1XAL | 6040 | Boston, Mass. |
| 49.67 | YDA | 6040 | Tanjong Priok, Java |
| 49.75 | OLR2B | 6030 | Podebrady, Czech. |
| 49.75 | HP5B | 6030 | Panama City, Panama |
| 49.83 | DJC | 6020 | Zeesen, Germany |
| 49.83 | XEUW | 6020 | Veracruz, Mexico |
| 49.88 | XEWI | 6015 | Mexico, D. F., Mexico |
| 49.90 | HJ3ABH | 6012 | Bogota, Colombia |
| 49.92 | COCO | 6010 | Havana, Cuba |
| 49.96 | CFCX | 6005 | Montreal, Canada |
| 49.96 | HP5K | 6005 | Colon, Panama |
| 50.00 | XEBT | 6000 | Mexico, D. F., Mexico |
| 50.25 | HJN | 5970 | Bogota, Colombia |
| 50.25 | YV5RC | 5970 | Caracas, Venezuela |
| 50.26 | HVJ | 5969 | Vatican City |
| 50.50 | TG2X | 5940 | Guatemala City, Gua. |
| 50.72 | HH2S | 5915 | Port-au-Prince, Haiti |
| 50.76 | HRN | 5910 | Tegucigalpa, Honduras |
| 50.85 | YV3RA | 5900 | Barquisimeto, Venez. |

**PACIFIC COAST TIME**

| | | | |
|---|---|---|---|
| 25.25 | VLRS | 11880 | Melbourne, Australia |
| 25.42 | JZJ | 11800 | Tokyo, Japan |
| 43.00 | XGXA | 6975 | Chungking, China |
| 70.26 | RV15 | 4270 | Khabarousk, U. S. S. R. |
| 61.48 | VUC2 | 4880 | Calcutta, India |

## LIST OF SYMBOLS

S—Sunday

M—Monday

T—Tuesday

W—Wednesday

Th—Thursday

F—Friday

SA—Saturday

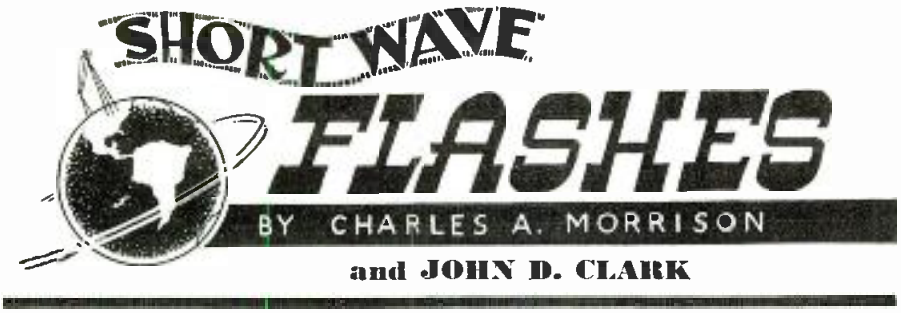
SS—Saturday, Sunday

—Daily

—Irregular

—Daily Except Sunday

—Daily Except Saturday, Sunday




**By Charles A. Morrison**

*Frequency in megacycles* *Time is Eastern Standard*

## Short-Wave International Friendship Programs

SUNDAY, February 12, from 10 to 10:15 a.m. over YL2CD (28.08) of Riga, Latvia (to be repeated on Sunday, February 26, at the same hour, if conditions are favoralile). Send reports, accompanied by an IRC, to Arvids Vitolins, Miera iela 52-6, Riga, Latvia.

Wednesday, February 15, at 2 p.m., over W6XKG (25.95) of Los Angeles, California, dedicated to XEBR, and Mexico *(program will include good-will message in SIRELA)*.

Monday, March 20, 1 to 2 a.m., over YSD (7.894) of San Salvador, El Salvador.

## Official Colombian Short-Wave List

| *Kc.* | *Watts* | *Call* | *Owner, Province and City* |
|---|---|---|---|
| 9.63 | 650 | HJ7GAD | Emilio Montoya, "Radio Bucaramanga," Bucaramanga |
| 9.616 | 608 | HJ1ABP | Lequerica, "Radio Cartagena," (Bolivar), Cartagena. |
| 8.65 | 250 | HJ4DAU | Universidad de Antioquia, (Antioquia), Medellin. |
| 6,15 | 700 | HJ4DAE | Carlos Escobar P, "Voz de Antioquia," Medellin. |
| 6.105 | 500 | HJ6FAB | Alberto Hoyos, "Radio Manizales" (Caldas), Manizales. |
| 6.065 | 150 | HJ4DAG | "La Voz de Choco," (Choco), Quibdo. |
| 6.05 | 600 | HJ1ABG | Andres Jimeno, "Emisora Atlantico" (Atlantico), Barranquilla. |
| 6.01 | 750 | HJ3CAX | "La Voz de Colombia," (Cundinamarca), Bogota. |
| 4.895 | 720 | HJ3CAH | Manual J. Gaitan, "La Voz de Victor," Bogota. |
| 4.885 | 500 | HJ4DAP | Alberto Estrada, "Emisora Claridad" (Antioquia), Medellin. |
| 4,875 | 600 | HJ6FAH | Hoyos y Gutierrez, "Voz Armenia" (Caldas), Armenia, |
| 4.865 | 750 | HJ2BAJ | Julio A. Sanchez, "Voz de Santa Marta," Santa Marta, |
| 4.855 | 750 | HJ3CAF | Jiminez de Quesada (Cundinamarca), Bogota. |
| 4.845 | 720 | HJ3CAD | Carrera 8a. No. 15-91, (Cundinamarca), Bogota. |
| 4.835 | 525 | HJ1ABE | Jose M. Fuentes, Laboratorio Fuentes, (Bolivar), Cartagena. |
| 4.825 | 720 | HJ5EAD | Eduardo Cordoba, "Voz del Valle" (Valle), Cali. |
| 4.815 | 250 | HJ2BAC | Pompilio Sanchez, "Voz de Cucuta," Cucuta. |
| 4.795 | 500 | HJ6FAC | Cesar Arango M, "Voz de Pereira," (Caldas), Pereira. |
| 4.785 | 600 | HJ1ABB | Clara E, de Buitrago, "Voz de Barranquilla, Barranquilla. |
| 4.775 | 500 | HJ6FAI | Lamus, Rivera, Barrios, "Ecos del Combeima," (Tolima), Ibaque. |

## DX TIPS

### Broadcasts

*Tuesdays*, 5:30 to 6 p.m., over W2XAD (15.33), and W2XAF (9.53), of Schenectady, New York.

*Tuesdays*, 8 to 8:15 p.m. and *Fridays*, 12 midnight to 12:15 a.m. over W2XJI (26.3) of Newark, New Jersey.

*Wednesdays*, 10:30 to 11 p.m. over W8XWJ of Detroit, Michigan.

### Short-Wave Station W9XA

W9XA (26.45), one of the most interesting and best received stations on the "eleven meter band," power 1,000 watts, is owned by the *Commercial Radio Equipment Company*, 7134 Main St., Kansas City, Mo. Besides producing many programs of its own W9XA often relays broadcasts from KCKN, WLW, KSL and KITE. Daily at 12:30 and 6 p.m. EST., a world-news commentary is given. Mondays, Wednesdays and Fridays, at 12:45 p.m., press releases of the F, C. C. are broadcast, while on Tuesdays and Thursdays at the same hour, short-wave and dx tips supplied by various short-wave clubs are radiated. Although this station has only been in operation for a few months, reports of reception have been received from Australia, New Zealand, South Africa, England, Ireland, Scotland, Holland, Dominican Republic, British West Indies, Haiti, Colombia, Mexico, Ecuador and Canada. All reports on reception sent to W9XA will be promptly verified.

### New Short-Wave Stations (On the Air)

*CHILE*—Ray Shaffar of Waterloo, Iowa, reports reception of CB960 (9.6). "Radio La Americano, Compania de Seguros de Vida," P.O. Box 1-B, Santiago, nightly from 8 to 11:30 p.m.

*CHINA*—XGRV (approximately 11.4), Chungking, broadcasts war news in Chinese and Japanese from 1 to 1:30 a.m. and in French and English, from 8 to 8:30 a.m. daily. This latter period is the "Voice of China" program formerly heard over XTV of Hankow. XGOX (15.19) of Chungking, is heard evenings from 7 to 9 p.m. irregularly. Reports on either station should be sent to Hollington K. Tong, Chairman, China Information Committee, Box 90, Hankow, China.

*COLOMBIA*—New stations given in the latest official Colombian list are: HJ4DAG (6.065), "La Vos de Choco," Choco, Quibdo, and HJ6FAI (4.775), "Ecos del Combeima," owned by Lamus, Rivera and Barrios, of Ihaque in the province of Tolima.

*IRELAND*—"RADIO EIREANN," built by the Marconi Company at Moydrum, near Athlone, power 2,000 to 5,000 watts, is testing on the following authorized frequencies: 6.19, 9.595, 11.74, 15.12 and 17.84.

*JAPAN*—According to the National Radio Club, the following commercial transmitters have been added to the JV network: JVW (7.255), JVW2 (9.655), JVW3 (11.725 and 17.825).

*NEWFOUNDLAND*—A new commercial transmitter VOFB (12.31) of St. Johns, has been heard irregularly from 4:30 to 6:30 p.m.

*NORWAY*—The new 5,000-watt transmitter of the Telegraph Dept. at Oslo, has been heard testing on 11.73, early in the morning, and on approximately 15.19, near 7:40 p.m. Announcements in English were made, and reports requested.

*NEW ZEALAND*—ZL4ZB of Dunedin, is operating weekends. Fridays from 9 p.m. to Sundays at 7 a.m., on a frequency of 4.3. (This frequency may be altered soon.)

*POLAND*—SP31 (9.52), and SP48 (6.14), Warsaw, power 5,000 watts each, are operating simultaneously from 3 to 5:30 p.m.

*ROUMANIA*—"RADIO BUCARESTI" (8.572), Bucharest, power 250 watts, is operating daily from 8:15 to 10:30 a.m. and from 4 to 7 p.m.

*VENEZUELA*—"Radio Moderno," Valencia, heard testing at 2 p.m., on a frequency of approximately 11.8.

### Under Construction

*BURMA*—The Government is installing a new 10,000-watt short-wave transmitter at Rangoon.

*UNITED STATES*—The General Electric Company has applied to the F. C. C. for permission to extend the completion date for W6XBE (which was to have been opened on Treasure Island at San Francisco, Calif. in February), for another six months.

The Crosley Corporation of Cincinnati, Ohio, is installing two new 50,000-watt transmitters to replace the 10,000-watt one now in use by W8XAL. The new station when completed will be capable of operating on six different frequencies, while the dual transmitter set-up will make it possible to shift from one wave-band to another instantaneously.

*U.S.S.R.*—A powerful new short-wave transmitter, nearing completion at Moscow, will be put into operation soon.

### Notes of Interest

Roger Legge of Binghamton, New York, writes the following stations usually do not verify reception reports: HI1S, HI1A, HI5N, TIGPH, YN1GG, HPF, ZFB, HJ1ABB, HJ2ABJ, HJ3ABF, HJ6ABB, YV1RD, YV3RA, LSN, HC2ETC and CEC.

According to a confidential report it may soon be practical to transfer electrical energy and power over short-wave circuits instead of the conventional power lines.

*CANADA*—CHNX (6.132), Halifax, is now operating weekdays to 11:15 p.m. (Saturdays to 11:30 p.m.). Its QSL card is pink and blue, picturing a small map of Nova Scotia in the center. VE9CA (6.03), Calgary, Alta, is now announcing as CFCN.

*CHINA*—Short-wave station XTV (9.49), uses the call XGOY when broadcasting near 2:30 a.m.

*CZECHOSLOVAKIA*—OLR5G (15.16), a rarely used frequency for the Prague station, is now in operation daily near noon.

*D.R.*—H13C, Romana, is being heard on 6.73, after a long absence from the air.

*ECUADOR*—HC2CW (9.13), Guayaquil, has been using increased power since December 9, according to the Spatari Language Foundation. The Amers of Pomona, California, have notified me that the Guayaquil station on 4.56 is HC2ET.

*FINLAND*—OIE (15.19), a new 10,000-watt transmitter at Lahti, is being heard weekdays from 5 to 6:30 and 10 a.m. to 5 p.m.

*FRENCH INDO-CHINA*—Saigon (9.76), is reported to be off the air.

Maurice Gardner of Philadelphia, Pennsylvania, writes he heard the *anti-Nazi* "Deutsche Freiheits Sender," just to the high frequency side of W1XAL (11.79) at 3:30 p.m.

*GUADELOUPE*—Roy Waite of allston Spa, New York, writes "Radio Guadeloupe" (7.05), announces in English just before sign-off as follows: "This is Radio Guadeloupe calling, P.O. Box 125, Pointe a Pitre, Guadeloupe.

*INDIA*—The 62-meter Indian stations, namely VUD2 (4.995), Delhi; VUM2 (4.95), Madras; VUB2 (4.905), Bombay, and VUC2 (4.88), Calcutta, are all being well heard in the United States between the hours of 7 and 8 a.m. John DeMyer of Lansing, Michigan, suggests a good time to log VUC2 (4.88), is on Sundays from 7:30 to 8:30 a.m. since church services in English are broadcast at that time.

*ITALY*—2RO5 (15.3) is being heard from 11:15 a.m. to 12:15 p.m., from 2 to 4 p,m. and intermittently throughout the day. . . . The mystery Italian station on 9.67 is now being heard with very loud signals daily from 3 to 6:40 p.m. It relays 2RO3 irregularly. This is probably one of the powerful new transmitters of the Imperial Short-Wave Center at Prato Smeraldo, operating experimentally.

*MEXICO*—XEBF (6.09), Jalapa, unreported for a long time, was recently heard with loud signals near 9 p.m. by John Larsen of Alleghany, New York. . . . XEWW (9.503), sometimes drops back to 9.5, to avoid interference from GSB (9.51).

*PANAMA*—HP5A (11.7), Panama City, is now operating from 7 to 8:30 a.m.; relays the Jamaica program broadcast of HH2S (5.955), Port-au-Prince, Haiti, at 8:30 p.m. . . . HP5F, Colon, now being heard in the vicinity of 6.137 to 6.147, operates in parallel with HP5A. . . . R. B. Oxrieder of Corozal, Canal Zone, reports that HP5I (11.9), Aguadulce, is permanently off the air, the transmitter having been sold to another station.

*PERU*—Reports to OAX1A (6.334), Chiclayo, are now being verified by letters, in Spanish. . . . OAX4C (15.3). "Radio Nacional del Peru," at Lima, was the station reported by so many listeners to be relaying the sessions of the Pan-American Conference, which was held in Lima, recently.

*SWEDEN*—According to a letter from SM5SX (15.155), received by W. A. Byrn of Nashville, Tenn., that station will not verify reports unless the exact time, frequency and program details are given since their programs are frequently confused with those of the "Kgl.Telegrafstyrelsen" stations.

*TANGIER*—The international short-wave station scheduled for erection in this country will not be built.

*UNITED STATES*—*NBC* has installed new short-wave antennas that will swing beams over South America like the rays of a searchlight at the mere touch of a button. . . . As soon as the two new directional beams now under construction for W3XAU are completed that station will operate on three new optional frequencies, namely, 15.27, 21.52 and 25.72. . . . W2XGB (17.31), Press Wireless of Hicksville, N Y., is said to be testing with W9XDH (12.862), Press Wireless at Elgin, Ill., almost daily near 11:30 a.m. . . . WBOE (41.5), the first non-commercial educational transmitter, to be operated by the City Board of Education of Cleveland, Ohio, will soon be on the air.

*U.S.S.R.*—RV59 (6.030), Moscow, is audible daily from approximately 9 a.m. on, on the West Coast. . . , G. C. Gallagher of San Francisco, Calif., reports reception of an unusual station, RCH (15,01)

*(Tune to page 45)*

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## Transmitter Efficiency

(*Continued from page* 17)

67 watts being delivered to the antenna.

The results being so close to theory the writer then was curious to see the effect of something in the field of the antenna. Accordingly another half wave antenna was placed approximately 1/10 wave away. No attempt was made to tune it either as a reflector or director since we were only interested in the effect on the antenna impedance. The antenna ammeter reading immediately rose to 1.2 amperes. The plate input was down to 138 watts, no doubt due in part to the mismatch between the new system, the 73 ohm line, and the final. This reduced plate input would undoubtedly result in a slightly different efficiency for the final as well as a different amount of line loss, however, in view of previous experiments on 2 to 1 mismatches the overall efficiency (amplifier, coupling and line) was assumed to be the same as before and the delivered watts calculated to be (138 × .445 = 61.5) 61.5 watts.

Actually with a well regulated plate supply the plate efficiency for various plate currents could be measured and a curve made between input amperes and percent efficiency for more accurate determinations. The new impedance was therefore roughly,

$$Z = \frac{61.5}{(1.2)\ (1.2)} = 42.6 \text{ ohms.}$$

Due to the lack of time (and a low impedance line) the determination of a more correct figure of impedance was not made since curiosity in regard to the effects of nearby objects was satisfied. A reasonably accurate determination could have been made by substituting a 30 to 40 ohm line for the 73 ohm line using two 73 ohm dummy resistors in parallel for 36.5 ohms and repeating the measurements as in the case of the single half wave determination.

While it may be argued that the ordinary tungsten filament lamp has fairly low inductance at radio frequencies, and consequently might be used in the measurements just described, it is also true that the d.c. resistance reduces to less than one-half at "black out" which corresponds to zero light and about 12 volts across a standard 115 volt lamp. At this point also there is still about 2.5% of the nominal wattage of the lamp flowing through the lamp. Absolutely cold, with no current flowing, the d.c. resistance is about 1/12 of the hot resistance. Assuming that the inductance and skin effect are negligible, the d.c. resistance corresponds to the r.f. impedance.

To the amateur attempting to use an ordinary lamp as a dummy antenna (strictly speaking lamps can never be a *true* dummy antenna as will be shown later) this means that in addition to the lamp or bank of lamps he must have some means of knowing the brilliancy of the lamps compared to the normal brilliancy before he can make an intelligent assumption as to the actual wattage being consumed by the bank. In addition he must have pre-calibrated the lamp bank on d.c. using a wattmeter to obtain a reference curve of the relationship between the brilliancy and the watts input, and he must also have at hand the characteristics of the lamps. Figure 8, showing the resistance and, therefore, the impedance at the various percentages of brilliancy.

Incidentally, the curves in Figure 8 apply only to 110 volt tungsten lamps above 40 watts and are *average* characteristics. 110 volt lamps below 40 watts will not follow these curves nor will lamps at other voltages such as 32 volt, 6 volt, etc. Additional curves for these other sizes and voltages would be needed if low wattages and impedances are required.

In the latter case he would, of course, use an r.f. ammeter in series with the bank of lamps. To obtain the watts consumed he would then multiply the current obtained by itself and then multiply by the resistance of the lamp (obtained from the characteristic curves) at the determined brilliancy ($I^2R$ = Watts).

While this method gives a fair idea of the output of a transmitter it still has the objection that the impedance match necessary for maximum transfer of the impedance resulting at full brilliancy may be a bad mismatch at the new impedance resulting at the lower brilliancy. Also during modulation in "phone" transmitters, a lamp bank dummy actually represents a changing impedance due to the fact that the watts input is increasing as much as 50% (100% modulation). The adjustments obtained on the transmitter, therefore, are of little value as the antenna represents entirely different load conditions. Keying checks for thumps, etc., on c.w. or code cannot be definitely made either since the filaments of the lamps will cool off between dots and dashes lowering the impedance. E.G. the initial thump at the start of the dot or dash will undoubtedly appear different to the lower impedance of the cooling lamp bank than it would to either the antenna or *true* dummy load.

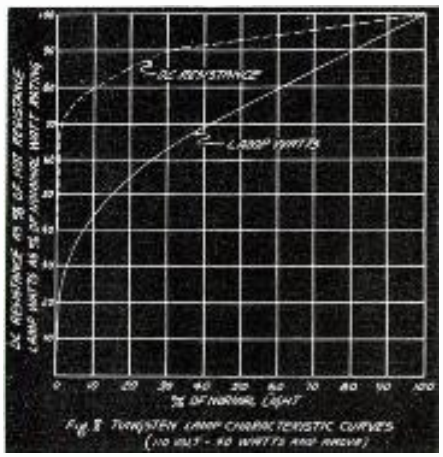


Fig. 8 TUNGSTEN LAMP CHARACTERISTIC CURVES (110 VOLT - 40 WATTS AND ABOVE)

While it is admitted that a readjustment of the coupling or matching scheme can be made to obtain the maximum transfer for measurement of the overall efficiency of the amplifier or oscillator being measured, this latter objection on radio telephone and keying checks on c.w. cannot be overcome and further, the actual efficiency of the *coupling scheme itself which is to be used eventually to couple to the antenna or transmission line* cannot be determined. Even this latter objection would be overcome to some extent by the use of the proper size lamp or lamps for the expected wattage to give the desired impedance corresponding to the amateur's choice on his particular coupling or transmission line scheme.

Inspection of the hot resistance of the standard lamps available, Figure 9, will show immediately that unless the amateur is lucky, a mathematical genius, or has plenty of valuable operating time to spend in working out the necessary combination of series, parallel and series-parallel combinations to use which will result in the impedance of his choice and the wattage he hopes to get out of his transmitter, the use of a lamp bank dummy load will neither reveal any reliable or useful information, nor be more than a minor help in the transmitter adjustment.

| Watts | Volts | Amps. | Hot Ohms | Approx. Cold Ohms |
|---|---|---|---|---|
| 7 | 110 | 0.063 | 1750 | 146 |
| 15 | 110 | 0.136 | 810 | 675 |
| 25 | 110 | 0.227 | 485 | 40 |
| 40 | 110 | 0.364 | 303 | 25 |
| 60 | 110 | 0.545 | 202 | 17 |
| 75 | 110 | 0.682 | 161 | 13.5 |
| 100 | 110 | 0.910 | 121 | 10.0 |
| 150 | 110 | 1.360 | 110 | 9.2 |

For example, in making a laboratory test using the *true* dummy antenna on a 14 megacycle transmitter of the 125 watt input variety and a 72 ohm coupling system, it was found that by making a few minor adjustments in grid bias and driving power the efficiency was improved from approximately 33% to 75%!! No change was made in the coupling scheme during the

(*Continued on page* 48)

## QUESTIONS and ANSWERS

**J. S. C., Davenport, Ia.: What is the wobbly signal that I hear on the very short waves which sounds like very much distorted speech?**

Probably transatlantic telephone. These transmissions are both put through a frequency inverter and are frequency modulated to insure privacy. There is not any easy way to decipher them.

**U. P. W., Tallahassee, Fla.: How do submarines receive radio signals?**

They are received on a regular antenna similar to that used on all ships. The one exception is that that used on a submarine is heavily insulated against contact with the water, while those used on ships are usually bare copper wire.

**I. T. Y., Baxley, Ga.: I have devised a means of sending signals through the air for a short distance which uses only two coils placed in magnetic relation to each other. There is not any radio frequency current nor carrier. Do I need a license?**

No.

**K. I. V., Waycross, Ga.: Is the high voltage in my receiver of fatal power?**

Ordinarily not, but it is advisable to stay away from it. Persons with bad hearts may be so startled with the surprise of the shock as to seriously injure themselves when inadvertently stepping away from the set.

**T. P. L., Brownsville, Tex.: I have an ordinary broadcast receiver, but want to hear the foreign shortwave broadcasts. How can I do this?**

You may build up, or purchase any one of several shortwave "converters" which may be placed ahead of your receiver to bring in ultra high frequency waves. They are not as satisfactory as a regular receiver designed for that use, however.

**C. A. S., Munsey, Ind.: How can I find the grounded side of an a.c. lighting line.**

Answer: There is an inexpensive special neon indicating device on the market which can be connected between a grounded object and each one of the a.c. terminals in turn to show the circuit grounded side of the line. An experimenter can easily rig up a device of this type using a small neon bulb or a 10 watt lamp, socket and connecting wires.

**O. R., Chicago, Ill.: I hear a steady beat note in my receiver at the very top of the dial mixed in with the last broadcast station. What is this?**

Answer: Your set is probably out of alignment, and you are picking up one of the various airline or marine beacons. Take your set to a serviceman and have it re-aligned.

## Short Wave Flashes

(Continued from page 42)

of Kerbi, at 1:30 a.m.

### Special Transmissions of Interest

*Daily*—12:15 to 1:15 p.m., Arabic transmissions, over GSC (9.58) of Daventry, England.

*Sundays*—7 to 8 p.m., "Hour of Mexico," over XECR (7.38), and XEWW (9.503).

*Mondays*—8 to 8:30 p.m., North American transmission from Brazil, over PSH (10.22) of Rio de Janeiro.

### Revised Schedules

*HOLLAND*—The following schedule is now in effect: over PCJ (9.59), Sundays 2 to 3, 7:15 to 8:15, 8:25 to 9:25 p.m.; Tuesdays 1:45 to 3:30, 7:15 to 8:45, and 9 to 10:30 p.m.; Wednesdays 7:15 to 8:15, and 8:25 to 8:40 p.m. and Fridays 8 to 9 p.m.; PCJ2 (15.22), Tuesdays 3 to 4:30 a.m. and Wednesdays 9:30 to 11:30 a.m. . . . Over PHI (11.73), weekdays except Saturdays 6:15 to 6:45 p.m. and on Saturdays 7:15 to 7:45 p.m.; PHI2 (17.77), Sundays 6:25 to 9:40 a.m., Mondays, Thursdays and Saturdays 7:40 to 8:40 a.m. and on Tuesdays, Wednesdays, and Fridays 7:40 to 8:55 a.m.

*JAPAN*—The following revised schedule is now in effect: Daily, over JZJ (11.8), 12:30 to 1:30, 7 to 7:30, 8 to 9:30 a.m., 2:30 to 4, 4:30 to 5:30, and 8 to 8:30 p.m.; over JZI (9.535), daily, 2:30 to 4, and 4:30 to 5:30 p.m., and over JVP (7.51), daily 8 to 9:30 a.m.

*UNITED STATES*—The following schedule is now in effect over W2XE of New York City: Mondays through Fridays, on 21.57, 7:30 to 10 a.m.; on 15.27, 1 to 3 p.m.; on 11.83, 3:30 to 6, and 6:30 to 10 p.m., on 9.68, 10:30 to 11:30 p.m., and on 6.17, 12 mid. to 1 a.m. . . . Saturdays and Sundays, on 21.57, 8 a.m. to 1 p.m.; on 15.27, 1:30 to 2:30 pm., on 11.83, 3 to 6, and 6:30 to 11 p.m., and on 6.17, 11:30 p.m. to 1 a.m. All programs up to 6 p.m. are beamed on Europe, those after 6:30 p.m. are beamed on South America.

### Frequency Changes

*CANADA*—CJRO (6.147), Winnipeg, has been testing early Sundays, on 6.175.

*COSTA RICA*—TIGPH2, San Jose, to 5.883; TI2XD, San Jose, to 11.935; TI4NRII, Heredia, to 9.692.

*CUBA*—COBZ to 9.025; COCD, variable between 6.13 and 6.14; COCM, highly variable, at present near 9.81; COCQ, to 8.83.

*MADAGASCAR*—"Radio Tananarive," to 6.063.

*NICARAGUA*—YN1GG to 6.54.

*PANAMA*—HP5J, Panama City, variable between 9.59 and 9.61.

*PARAGUAY*—ZP8, Asuncion, to 9.64, where it badly QRM's CXA8.

*U.S.S.R.*—RV15, Khabarovsk, back to 4.275.

### Data

*AUSTRALIA*—VLR3 (11.88), Melbourne, operates daily intermittently from 3:30 p.m. to 3 a.m.

*ALBANIA*—The call for the new Albania transmitter mentioned in last month's issue is ZAA.

*BECHUANALAND*—Bob Hetzel of Milwaukee, Wisconsin, writes station ZNB (5.9) of Mafeking, verified his reception report in two months with a red, blue and white QSL card.

*BORNEO* (Dutch)—YCP (9.12), Balikpapan, verifies promptly with a neat black on buff QSL card, signed by L.F.J. Verboeket, Java Wireless Stations, Bandoeng, Java, N.E.I.

*BRAZIL*—PRA8 (6.01), "A Voz do Norte," Pernambuco, signs off at 9 p.m. QSL card is white and blue picturing a lighthouse and antenna mast at night. . . . The Amers of Pomona, Calif., report a verification from "Radio Bras," (PPU 19.26 and PUS 19.97), which states that PUS, radiating a power of 50,000 watts, is the most powerful commercial station in South America.

*BURMA*—XYO (6.007 and 3.488), Rangoon, operates weekdays from 9 to 11 p.m. (Saturdays from 9:30 to 11 p.m.), and from 7 to 10 a.m.; on 3.488 only, 6:30 to 7 a.m. and from 11 to 11:30 p.m. News in English is radiated from 8:15 to 8:30 a.m. and from 9 to 9:15 p.m. Reports should be sent to the Officer-in-Charge, Burma Independent Wireless Sub-Division, Rangoon.

*CANARY ISLANDS*—The programs of "Radio Nacional," Burgos, are transmitted over EAJ43 (10.37), Tenerife, daily from 3 to 4:30 and from 5 to 7 p.m. for Europe, and from 7:45 to 8:45 p.m. for South America, and from 9 to 10 p.m. for North America; over EAJ43 (7.5), from 4 to 4:30 and from 9 to 10 a.m., from 1:30 to 4:30, 5:30 to 8:45, and 9 to 10 p.m.

*CHILE*—Mailing addresses for the main Chilean stations are as follows: CB1170 (11.7), Casilla 706, Santiago; CB1174 (11.74), Orlandini y Raggio Ltda, Casilla 3455, Santiago; CB1180 (11.97), Soc. Nacional de Agricultura, Casilla 40-D, Santiago; CB1185 (11.85), Jorge Echegoyen, Santiago; CD1190 (11.-

913) Radio Sur., Alberto Carrasso, Casilla 642, Valdivia; CB970 (9.73), "La Cooperative Vitalicia," Calle Lira 543, Valparaiso.

*CHINA*—Ashley Walcott of San Francisco, Calif., writes that XPSA (7.01), Kweiyang, Kweichow Province, is now broadcasting daily from 6:10 to 10:10 a.m. News in English is read at 9 a.m. by a man with a British accent. The rest of the program consists of news and speeches in Chinese dialects.

*COSTA RICA*—TIEM (10.05), Apartado Postal 1049, San Jose, operates daily 4:30 to 8 p.m.; verifies with a black and gold card.

*DENMARK*—J. Pedersen of Bridgeport, Conn., reports that the Danish Short-Wave Station is now broadcasting Sundays from 8 a.m. to 1:30 p.m., over OZH2, on a new frequency of 15.32. A time signal is broadcast at 1 p.m.

*DOMINICAN REPUBLIC*—After two years of waiting, HI9B (6.67), Hotel Mercedes, Santiago, verified with a white card printed in blue, having grey borders, and the call in grey. . . . A. Tuff of London, England, reports hearing an HI40 (6.56) in Trujillo City, nightly from 6:10 to 7:40 p.m.

*FRENCH SOMALILAND*—FZE8 (17.28), Djibouti, will test next on Thursday, March 2, from 8 to 8:30 a.m.

*INDIA*—Schedules for the India stations on the 62-meter band are as follows: VUD2 (4.995), Delhi, 7:30 a.m. to 12:30 p.m.; VUM2 (4.95), Madras, 7 a.m. to noon; VUB2 (4.905), Bombay, 7 a.m. to 12:30 p.m. and VUC2 (4.88), Calcutta, 6:36 a.m. to 12:05 p.m. VUD2 and VUM2 read the news in English at 7:30 a.m. Send Calcutta reports to the Indian State Broadcasting Service, 1 Garstin Place, Calcutta, and Madras reports to the Director of Programs, Office of Station Director, All-India Radio, Madras.

*IRAQ*—YI5KG (7.15 to 7.2), Baghdad, power 1,000 watts, is broadcasting daily from approximately 9 a.m. to 3:30 p.m. Reports should be mailed to I. Hassan, Supervisor Wireless Station, Civil Airport, Baghdad.

*KWANTUNG*—According to a QSL card received from JDY (9.925), Darien, by Eugene Reinhard of Locust, New Jersey, this station operates daily from 7 to 8 a.m. with a power of 10,000 watts. Music and news in Japanese is given up to 7:45 a.m., and news in English for the balance of the period.

*MACAO*—According to the QRC, CRY9 (6.08), Macao, operates Mondays from 8:30 to 10 a.m. and on Wednesdays from 8:30 to 9:10 a.m. Station identification is made in Portuguese and English.

*NICARAGUA*—YNOP (5.46), Managua, power 1,000 watts, operates daily from 8 to 10:30 p.m. and on Sundays from 2 to 3 p.m.

*PANAMA*—HP5G (11.78), Panama City, power 1,500 watts, operates nightly from 6 to 10 p.m.

*PHILIPPINES*—KZIB (9.5), Manila, is being heard from as early as 6 to as late as 9:05 a.m. The interval signal is similar to the NBC chimes.

*PORTUGAL*—CSW7 (9.735), Lisbon, is transmitting to North America, nightly from 5:45 to 9 p.m.

*UNITED STATES*—WAGQ, Genesseo, Ill., KIPQ, Beatrice, Neb., KIPR, Redoak, Iowa, and KIPI, Harper, Iowa, all on 2.76, and owned by the Natural Gas Pipe Line Co. of America, Telephone Dept., Beatrice, Nebraska, power 50 watts each, test at 11 a.m., 4, and 9 p.m. . . . W9XEI, Lake Bluff, Illinois, 300 watts, can often be heard in telephone communication with W10XJF (WOGK), the Moto-Sail Ship *Mako*, 15 watts, on frequencies of 6.425, 8.665 or 2.118, near 6:30, 9:15 and 11:15 p.m. The *Mako* is making an extended cruise through the West Indies.

*U.S.S.R.—SCOOP:* A complete and authentic schedule of Soviet short-wave transmissions follows: RV96 (15.18), daily 3 to 4 a.m. in English; RKI (15.083), Sundays 1 to 2 p.m. in German, daily 7 to 9:15 p.m., in English; (14.96), Thursdays, 6 to 7 p.m., in Dutch; RNE (12), Sundays, 6 to 6:30 a.m., in English, 6:30 to 7 a.m., in English (Sun. and Weds.), 7 to 8 a.m. in German, 8 to 9 a.m. in Dutch, 9 to 10 a.m. in French, 2 to 3 p.m. in German, weekdays, 6 to 7 a.m. in German, Mondays and Fridays, 8:30 to 9 p.m. in Portuguese, Tuesdays, 3 to 4 p.m. in Italian, Wednesdays 8:30 to 9 p.m. in Dutch, and Saturdays 7 to 8 a.m. in Dutch; (11.71), daily, 2:30 to 3 p.m., in Czech; RAN (9.6), Sundays, 4 to 5 p.m. in English, daily, 6 to 7 p.m. in Spanish, 7 to 9:15 p.m. in English, 9:15 to 10 p.m. in French; RV96 (9.52), Sundays, 10 to 11 a.m. in English, daily, 2 to 3 and 4 to 5 p.m. in German; RKI (7.52), Sundays, 1 to 2 p.m. in German, and 2 to 3 p.m. in English, weekdays, 2:30 to 3 p.m. in Czech; RV96 (6.03), Sundays, 10 to 11 a.m. in English, daily, 2 to 3 p.m., and 4 to 5 p.m. in German; RV59 (6), Sundays, 10 to 11 a.m. in English, 6 to 7 p.m. in Spanish, Sundays and Mondays, 4 to 5 p.m. in English, Sundays and Fridays, 5 to 6 p.m. in French, daily, 1 to 2 p.m. in French, and 3 to 4 p.m. in Italian, Mondays, 5 to 6 p.m. in Hungarian, Mondays, Wednesdays, Thursdays, Fridays and Saturdays, 3:30 to 4 p.m. in German, Tuesdays, 5 to 6 p.m. in Portuguese, Tuesdays, Wednesdays, Thursdays, Fridays, and Saturdays, 4 to 5 p.m. in French, and Thursdays and Saturdays, 5 to 6 p.m. in English.

*VATICAN CITY*—The following schedule of transmissions is now in effect over HVJ: on 6.19 or 6.03, Mondays, 2 to 2:30 p.m. in Dutch, Mondays and Thursdays, 2:30 to 3 p.m. in Italian, Tuesdays, Thursdays, and Fridays, 2 to 2:30 p.m. in English, Tuesdays and Fridays, 2:30 to 3 p.m., Wednesdays and Saturdays, 2 to 2:30 p.m. in French, Wednesdays and Saturdays, 3 to 3:30 p.m. in Spanish, Saturdays 2:30 to 3 p.m. in Russian; on 9.66 or 9.55, Sundays, 5 to 6 a.m. in French; on 11.74, Wednesdays, 2:30 to 3 p.m. in French; on 15.12, Sundays, 1 to 1:30 p.m. in English.

*VENEZUELA*—YV3RD (6.465), verifies promptly with a red, white and blue QSL card.

## Amateur Reception Notes

According to the *NNRC*, the Ellsworth 1938-39 Antarctic Expedition on the *Wyatt Earp* has been heard on 14, using the call LDUC, with W2MQ and VE2IC at the key. This expedition is out to explore the Enderby Quadrant in Antarctica, and will keep in touch with New York by its short-wave transmitter. . . . Harold Clein of Los Angeles, California, reports hearing an amateur identifying himself as XAR2LA (14.37), at 1 a.m. The operator stated his name was Gunnar, and that his rig was aboard a Norwegian freighter in the Panama Canal, at the time. . . . ZX9AM (14.12), operated by W9AM, is a 15-watt amateur transmitter, aboard the oil tanker *S.S. California* on a whaling expedition to Antarctica, approximately 1,800 miles south of Cape Hope. The ship will be in southern waters about five months. Reception of ZX4M has been best near 4 to 6, and 8 to 9 p.m. The transmitter is also equipped to operate on 10 meters and commercial frequencies.

*BELGIAN CONGO*—Charles Lebouef of Webster Mass., writes he has received a QSL card from OQ5AA, after a year's wait, which states that he has been off the air since March, 1938 but hopes to be on again soon and that his new QRA is Kole, in Stanleyville Province, almost in the center of the Congo.

*GREENLAND*—The British Shortwave Magazine lists the call of the Oxford University Expedition in Greenland as OX7OU (14). Reports on reception should be sent to A. Croft, Esq., Leckhampton House, Cambridge, England. . . . Harold Clein of Los Angeles, California, reports hearing OX7ZL (14.02), at 9:30 p.m. The operator, Stilling Berg, said the location was Angmagssalik, East Greenland.

*HOLLAND*—PI1J (7.088 and 14.164) of Dordrecht, Holland, can usually be heard playing records and calling the Netherland Indies, on weekends between 10 a.m. and 2 p.m.

*INDIA*—VU2CQ, Bombay, using a new frequency of 14.18, may often be heard just before the American phone band opens up at 7 a.m.

*UNITED STATES*—Gerry Sayre, operator for the recent MacGregor Arctic Expedition, now at home at 250 College Street, Milton, Rock County, Wisconsin, states that all reports on reception of OX2QY and W10XAB have now been confirmed with QSL cards, but that anyone wishing to send in a belated report may still do so. Mr. Sayre is anxious to line up with some commercial radio firm as operator. He has certainly had abundant experience to qualify him for such a position.

## Last Minute Notes

*CZECHOSLOVAKIA*—Frank Sekach of Detroit, Michigan, writes OLR3B (9.67), is now on the air weekdays except Saturdays from 7:55 to 10:50 p.m. with the North American program. This frequency probably will not be used long since W3XAL's powerful new transmitter operating on the same frequency completely blankets OLR4B.

*ETHIOPIA—SCOOP:* "Stazione di Addis Abeba," of Addis Abeba, is now operating on a frequency of 9.65, daily from 1 to 3 p.m., and occasionally a little later.

*HUNGARY*—Frank Sekach of Detroit, Mich., writes that HAT4 (9.125), Budapest, is now broadcasting daily except Saturdays from 7 to 8 p.m. and on Saturdays from 6 to 7 p.m. The power of the station is to be greatly increased in the near future.

*ITALY*—The powerful Italian station on 9.67 afternoons, has been definitely identified as 2RO9.

## By JOHN D. CLARK
### All times are Pacific Standard

### U.S.S.R.

ONCE more the Soviets are shifting stations all over the dials. As we go to press, station RV15 is missing again from its 4.27 meg. frequency, and a powerful new transmitter has appeared on approximately 6.49 meg. between 2 and 8 a.m.

To complicate matters further, this 6.49 meg. fre-

quency apparently is being used simultaneously with 9.525 meg., and both stations have been reported with tremendous volume. Male and female announcers alternate at the mike, and programs seem to consist mostly of lectures and talks. Occasionally there is a pause of more than five minutes between announcements.

The 31-meter station has been responsible for a signal so strong that it often completely blocks Hongkong's ZBW which operates on 9.53 meg. Several reports indicate that it has been on the air as early as 12:30 a.m. and as late as 8:30 a.m.

Evidently the extensive experimental transmissions begun several months ago are still being carried out, and it is impossible to state at this time which frequencies will be used during the coming month. Look for the stations on 4.27, 6.00, 6.03, 6.49, 6.80 and 9.525 meg.

### China

The new Chinese station XGOX, mentioned in this column last month, is still conducting experimental transmissions, attempting to find a suitable frequency for regular broadcasts to America. For a period of several days, a frequency of 17.80 meg. was used from 3 to 9 p.m., and this was followed by a shift back to 15.19 meg. with broadcasts on the same time schedule. These experimental transmissions are very intermittent, and are usually made without advance notice. To date only the 16- and 19-meter bands have been used, but it is understood that the station will try 25 meters in the near future.

An unconfirmed report indicates that a station XOY, located in Chengtu is broadcasting special programs directed to North America on 9.37 meg. from 6:45 to 7:30 a.m., and that XOZ of the same city is releasing programs for Europe on 15.51 meg. at the same time. XOY is using only 1,000 watts, but should be heard on America's Pacific Coast without difficulty.

Station XGAP of Peking has evidently changed its call to XUD, and is now on 9.56 meg. from 1 to 6 a.m. with native Chinese programs and occasional English news releases. The best time for reception of this one is near 4 a.m., since volume is too weak before this time, and Germany's DJA begins to interfere seriously after this hour.

XGXA of Chungking has shifted its frequency slightly more than once during the past 30 days. It has been reported on 6.97, then 7.01, then 6.99, and is back at present on 6.97 meg. Although it is supposed to commence transmissions at 1 a.m., XGXA is rarely audible in this country until 4 o'clock, and volume is best usually just before sign-off at 7:20.

### Straits Settlements

Despite the fact that its schedule is still printed in many short-wave logs, station ZHP has abandoned its frequency of 9.69 meg. until next summer, and the Singapore transmissions will be continued only through ZHO on 6.127 meg. (not 6.1 meg.). At the present time, the schedule for ZHO is from 1:40 to 6:40 a.m. Monday through Saturday, and from 2:25 to 6:40 a.m. Sunday. The last hour usually is the best for reception in North America.

ZHJ of Penang is being received again on 6.06 meg. after being unreported for several months. The schedule is 3:40 to 5:40 a.m., but not until the last 30 minutes of transmission is the station able to break through the signals of W8XAL. The Cincinnati broadcaster blocks ZHJ very effectively until it begins to fade out near 5 a.m., PST.

### Japan

The Broadcasting Corporation of Japan is still not following its printed schedules. JZK (15.16 meg.) continues in use from 5 to 5:30 p.m. despite the fact that the latest program release from Tokyo gives JZJ as the carrying station for this transmission.

Evidently JZJ (11.8 meg.) is not in use at all between 5 and 6:30 a.m.—at least it is inaudible in this region. JVP (7.51 meg.) continues to be received with excellent volume, however.

JVH (14.6 meg.) is relaying the JBC programs again at irregular intervals throughout the afternoon and evening. Although not on the air continuously, listeners have reported reception of JVH at 2:30 p.m., 3:10 p.m., 4:30 p.m., 5:15 p.m., 6:50 p.m., 7:40 p.m., 8:30 p.m. Since it uses a non-directional antenna, this station is usually weaker than most of the other Nipponese transmitters.

JVN (10.66 meg.) usually phones KWV of Dixon, Calif. at 8:45 p.m., then closes down until 10:40 when it relays a 40-minute broadcast from JOAK.

### Philippines

Several listeners have reported KZRM on 9.50 meg., but we believe this was KZRG which operated for a few weeks on this frequency and then suddenly vanished.

An unidentified Philippine broadcaster was heard three times on 11.53 meg. between 6:30 and 7 a.m., but it gives no announcement of call letters and is certainly not using any regular schedule.

### Late Western Tuning Tips

*AUSTRALIA.* The transmissions of VLR3 on 11.88 meg., which commenced a short time ago, are no longer taking place on a daily schedule. It seems that this Melbourne broadcaster now operates the 25-meter wave on only Sunday and Friday from 10 p.m. to midnight.

*JAVA.* A new Javanese broadcaster is supposed to be operating on 8.00 meg. near 11 p.m. or midnight, but reception is so weak that it is extremely difficult to make identification.

*DUTCH GUINEA.* The station on 6.43 meg. which was unidentified for almost a month is now believed to be PO6ZA of Dutch New Guinea. Reports vary as to the exact time schedule, but most listeners receive best signals near 11 p.m.

*SOUTH AFRICA.* Surprising and almost unbelievable reception has been experienced from Johannesburg's ZRK (9.61 meg.) during the past 30 days. This station now shakes the antenna masts every evening from 8:45 to 9:45, and every morning from about 6 to 7:30. The first fifteen minutes of the evening transmission are always devoted to morning exercises, and the station may be easily identified by the announcement "Johannesburg Calling," and by frequent bugle calls.

*UNIDENTIFIED.* A new and unidentified station has been logged on approximately 6.485 meg. (just under TGWB). It is believed to be located in the Dominican Republic, and frequently rings chimes, similar to those of *NBC*, before announcements.

*CUBA.* Two Cuban stations have shifted frequencies again to avoid interference. COCQ, which only recently moved from 9.72 to 8.83 meg., is now working on 8.70 meg., while COCO has lowered its frequency from 6.01 to 5.96 meg.

*BURMA.* Hundreds of listeners are now reporting excellent reception from the British station in Rangoon, Burma. Programs of recorded music conclude shortly after 7 a.m. daily, and the station closes down with *God Save the King*. Although a frequency of 3.49 meg. is supposed to be in use simultaneously with 6.01 meg., the lower frequency is always considerably weaker.

*MISCELLANEOUS.* Our listeners tell us: that HJ4ABE of Medellin Colombia has changed its call to HJ4DAE, and that HJ7ABD of Bucaramanga has changed call to HJ7GAD . . . that VE9CA, the "Voice of the Prairies" on 6.03 meg. has changed call to CFVP, and is still broadcasting old-time music on Thursday from 8 to 11 p.m. . . . that an announcement from Czechoslovakia indicates "Radio

Journal" will shortly be operating on 9.67 meg. (a frequency now occupied by W3XAL) . . . that JDY of Darien, Kwangtung, is heard on 9.92 meg. from 5 to 6 a.m. daily . . . that VUD3 of Delhi, India, is now on the air from 6:30 to 8:30 p.m., instead of from 5:30 to 7:30 p.m., and that news in English is released at 7:30 p.m., instead of at 7:10 p.m. (VUD3 is now using a directional antenna beamed on North America, and is being received with excellent volume during the first hour of its transmission) . . . that the country of Albania has just completed construction of a short-wave transmitter and is sending experimental broadcasts to America on 15.765 meg. . . . that PSH of Rio de Janeiro is now on 10.22 meg. daily from 3 to 4 p.m. . . . that a new Colombian station, using the call HJ4DAU is working on 8.65 meg. during the early evening hours . . . that the new Saturday transmissions from PHI, Huizen, Holland, on 11.73 meg. from 4:15 to 4:45 p.m. have weakened considerably in volume and are often inaudible . . . that the station on 6.11 meg. near 6:30 a.m. is not VPB of Ceylon (as reported by many), but is definitely located in Siam, and uses the same announcer employed by HS8PJ on 9.50 meg. every Thursday from 5 to 7 a.m. VPB is evidently still on the air, but has not been heard locally for some time.

### Daytime Europeans

For the first time in many months, European stations are now being received on the Pacific Coast with good volume throughout the morning and early afternoon.

Peculiarly enough, the best English station at noon is GSB (9.51 meg.) and at 2 p.m. is GSC (9.58 meg.). GSI, and GSG are all fair at 10 a.m., but fade out by 11:30. GSD, however, often holds up all afternoon until the end of transmission 5.

In sharp contrast to the conditions a few months ago, the 25- and 31-meter bands are now best for daylight European reception, while 19- and 16-meter bands are useful only between 7 and 10 a.m. It is expected, however, that the lower wavebands will improve considerably during the next 60 days.

### Treasure Island

Before long, the new short-wave station on Treasure Island, San Francisco Bay, will be broadcasting regular programs directed to the Far East. It is expected that transmissions will commence with the opening of the World's Fair in February.

The station will operate from 9 p.m. to 3 a.m., so as not to conflict with broadcasts from W2XAD and W2XAF, and will use the same frequencies of 15.33 and 9.53 meg. which are now in use by these Schenectady transmitters.

Visitors to Treasure Island during the Fair will be given the opportunity of inspecting both studios and transmitting equipment of this modern short-wave broadcaster.

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### 10M Transmitter

(*Continued from page* 36)

voltage on the 210 and halves the bias. Plug the key into jack No. 1 and key in the cathode. Turn off the speech amplifier for c. w. work.

It will be noted that filament switches have been inserted for every stage, which will be found of advantage when testing out any one portion of the set.

Coil data is shown for 10 meter operation. This is for 40 meter crystal and 20 meter doubling. Double again in the buffer stage and amplify in the final. In winding any coils remember that a turn or two may have to be added or subtracted from those given due to circumstances.

-30-

### Vibrator Tester

(*Continued from page* 20)

meter to fluctuate and the reading is low. By comparing different vibrators it is easy to set up standards of good, fair, and bad vibrators.

*[The fundamental vibrator tester circuit is reproduced by express permission of P. R. Mallory & Co., Inc., Indianapolis, Ind., U. S. A.—*ED.*]*

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### Transmitter Efficiency

(*Continued from page* 44)

tests after the initial adjustment for maximum transfer was made upon firing up the amplifier. Further, no additional adjustment was found necessary after the 75% efficiency figure was attained showing that because of the constant impedance characteristics of the dummy antenna the coupling system could be once adjusted and forgotten eliminating one of the questionable factors in the subsequent adjustment of the amplifier for improved efficiency.

Referring to Figure 8 let us see just what difficulties would be encountered when using lamps for the same experiment. Note that for 72 ohms it is impossible to choose a combination of lamps so that 40 to 50 watts of lamps would be used with 72 ohms or thereabouts, as the impedance or resistance. We, of course, would not be aware that the efficiency was going to be as poor as 33%. We would probably choose a 100 watt lamp and hope for an 80% efficiency which would result in normal brilliancy of the 100 watt lamp providing our impedance match is approximately correct. At the actual original efficiency of 33% the output was approximately ($125 \times .33 = 40$) forty watts. Characteristic curves (Figure 8) will show that forty watts into a 100 watt lamp results in a brilliancy of 8% of the normal and a resistance of 78% of the hot resistance or ($.78 \times 121 = 94.5$) 94.5 ohms. While this value is not sufficiently different from the 73 ohms desired, and while, as a matter of fact, tests show that impedance mismatches as great as this on the *true* dummy load can be tolerated, it will be noted that as the efficiency of the amplifier is increased by the various adjustments, the mismatch gets worse instead of better and would in some instances necessitate a readjustment of the coupling device for maximum transfer of energy.

If we had been contemplating the use of a 500 ohm system, we would probably have chosen two 60 watt lamps in series for the expected 100 watt output and resultant impedance of 384 ohms (from the characteristic curve for 83% of 120 watts or 100 watts each lamp has 95% of the hot resistance or 192 ohms each) which represents a mismatch in the other direction from the desired value. At the initial 40 watt output, which actually resulted, 304 ohms (from the characteristic curves for 33% watts each lamp has 75% of the hot resistance or 152 ohms each) would be the impedance of the bank under this reduced wattage. Four 25 watt lamps in series-parallel would have been a better choice but there you have it; with a box full of various sized lamps, probably including those from the xyl's favorite floor lamp, a photo electric system, a wattmeter, a slide rule, an excellent education in algebra, a good foundation in Ohm's Law, two sets of curves, a sure-fire coupling system for variable impedances, along with plenty of time and mental gymnastics, and we can conclude that lamps make fair dummy loads. For accurate, reliable results with a minimum of time and manipulation it would seem that a constant impedance dummy load and an r.f. ammeter constitute the answer to the amateur's prayers for an r.f. wattage indicator.

-30-

## Phonograph Records Make Good Insulators

Convenient, high insulating mounting panels for 5 meter rigs and other experimental layouts can be easily made from old phonograph records. Two records glued together make a very serviceable and rigid panel. Records faced on one side only can be glued to give a smooth front panel. These improvised panels should be at a temperature of 70 degrees or more for easier drilling and workability.

## Gadgets

(*Continued from page* 32)

For neutralization purposes, cut off the B to the stage being neutralized, and slowly approach the tank coil of the stage being neutralized with a two or three turn link. If you get any sort of reading, the stage is *not* neutralized. Proceed with the usual neutralization method until there is not any reading on the meter. The stage will then be neutralized perfectly

There is great danger that the experimenter will forget to remove the meter when he has finished neutralizing a stage and turn on the high voltage. Naturally this increased r.f. power will burn out the meter. In order to remember this, it is best to tie the meter to your wrist! Hi! —30—

## Emergency Repairs

(*Continued from page* 26)

sistor strips, and where the resistance runs a thousand ohms or better the strips impregnated with the India Ink have given entire satisfaction.

Perhaps just a few words of advice would be appropriate in closing. Measure the control to be repaired when it is removed and taken apart, be sure the various coats of the HIGGINS WATERPROOF INDIA INK are put on evenly with a camel's hair brush.

Note the manufacturer's technical data for the control as found in your service manuals, for while the value will not be critical above 15,000 ohms, the closer one can approach original specifications the better the operation of the receiver. The heat for the drying process should not go higher than 170 degrees fahrenheit as there is danger the newly applied coating will raise blisters on the surface of the resistor strip. Dry the final coat thoroughly before putting the control into operation. —30—

## Bench Notes

(*Continued from page* 23)

pursuit that paid off well in adulation and money—why not turn pro? And so we went from an avocation composed of 90% science and 10% business ability smack into one requiring 90% salesmanship and 10% science. Small wonder we began to sweat when the heat of competition—borrowed from other professions—began to beat down on us! Those of us who could take it went out and got some business through the nose; those who couldn't went back to sit out the depression in the old man's delicatessen.

We must continually find new methods of getting business; better ways of applying our experience than shelving ourselves like an item in the inventory. A moving display is always more attractive than one standing still. Show a prospect a pickup, and he is politely awed; play it through his radio, and he becomes a customer. Develop the business instinct—the feel—the *savvy* you have by an active use of your stock and imagination. *Savvy* is the intangible quality all old-timers use in solving conditions they meet every day, in every profession. It is something which marks the ordinary worker from the exceptional one, and it cannot be learned from a printed page, nor from pouring over diagrams.

Don't be discouraged if you have a tough time getting it—none of us get it without suffering: it is acquired only through long use of qualification, equipment, and imagination. Look about carefully when calls are too infrequent: work can be ferreted out of your territory, whether or not your neighborhood has become so commonplace to your eyes that they no longer see obvious possibilities. I have had business taken away from under my nose in my own territory more than once by some competitor with more imagination than I had myself. Some of the cases are surprising.

### Petty Cash

Certain streets near my shop are restricted against the use of speakers playing into the street, and for that reason I gave up the idea of selling amplifiers to store-owners. Nevertheless, one of my competitors sold a mike job in a pet shop which was painfully close to my place of business. Not only that, he painted the name of his business over the speaker grill, facing the street!

His microphone was installed in a large canary cage; the amplifier was laid in the owner's office, and the speaker broadcast canary noises to the passers-by, who looked for the source of sound, and saw the ad. The sounds were pleasant, and no one objects, as they surely would if speech or music went out into the street.

We meet frequently, this competitor and I, to compare notes and to knife each other in a friendly way. How, I asked him, did he manage such a contract, in such an unusual application? He told me *four* pet shop owners gave him the bird before he in turn finally gave the birds something to think about in the fifth prospect's aviary.

He's no genius, but he has got *savvy* and a practical imagination, and he deserves—doggone it!—plenty of credit. He netted more than a week's salary by an installation in a neighborhood I thought was dead—and that ain't birdseed! —30—

## Sportsman's Receiver

(*Continued from page* 10)

loop may be added for direction finding and complete instructions for this application will be given in the next issue of RADIO NEWS.

When the selector switch is turned to the long-wave position, the complete windings of the coils are used. When thrown to the broadcast position the top portion only is unused. The short-wave position uses the minimum number of turns and the rest are shorted out.

Trimming of the various bands can be done best by using a test oscillator. Begin with the short wave portion. Set the signal to 3000 kc. and tune the receiver to this frequency. Adjust the padding condensers across this coil for the maximum signal. Tuning over the low end of the short wave band will be properly tracked when this adjustment is properly made. The same procedure is followed in aligning the other bands.

All of the resistors used have a rating of ¼ watt and are small enough to fit in the limited space available. The by-pass condensers are "200 volt test" and the mica condensers should be of the small "postage stamp" variety to conserve as much space as possible.

The English and other foreign tube manufactures have specialized in the midget type tubes for some time. Receivers have even been sold for the express purpose for operating from a motorcycle or from a bicycle. In remote places where power lines are not available, the battery operated receiver is most commonly used. Some of the more modern folk own a battery eliminator, but these users are made up of the stay-at-home variety. One of the most common uses for this set up here in the woods is on the dog team sled. Due to its small physical size, it is easily carried about and the economy afforded through the use of the Hivac midgets permit several weeks of operation.

The Alaskan stations have scheduled news periods that are looked forward to by all of the people in these parts and so the battery set can be used by anyone, no matter where they may live.

Many of the American tubes were used in the first versions of this receiver in an attempt to find the combination that would best fit this particular purpose. The one outstanding feature of the Hivacs was the small space required to mount them on the chassis. The diameter of the tube base is only ⅝" and this is quite a bit less than the metal type tubes commonly used. The length of the tube pins are also very short in comparison with the others and this permits more parts to be used under the base.

The camper that uses a receiver of the small battery-operated type should consider certain fundamental requirements before setting out on a trip if optimum use is to be made of his radio set. These can be tackled by seeing to the batteries first to make sure that they are in good operating condition. If the B batteries show a drop of two volts for each 45 v. unit, they must be replaced with fresh stock, and likewise, if the A cells are low fresh ones should be substituted.

The set will only perform efficiently when a good antenna and ground is used when in service distant from any station. The antenna used will play an important part in this respect and in no case should the set be expected to do a good job unless a suitable skywire is provided. Hang it as high and as long as possible and keep well clear of trees or any other obstacles. The loop to be described is also effective to several hundred miles.

A good ground must be used on a battery set, as this is the only return to earth for the signal. Many servicemen and constructors overlook the importance of a good ground after they install the modern *a.c.* receiver, and forget that there is *no* inductive ground in the *battery* set. It is good practice to carry a grounding rod to which a connection has been clamped. This rod is driven into the soil. If ice or snow covers the location drive several rods into it, or bury a coil of bare copper wire beneath the surface. The rod should be long enough to go down at least a foot or two.

—30—

## Seal of Acceptance

(*Continued from page* 26)

**To:** American Phenolic Corporation, 1250 Van Buren St., Chicago, Ill.
**Awarded Seal of Acceptance No. 104.1**
**Product:** Amphenol Co-Axial Cable.
**Descriptions:** A co-axial cable made of Amphenol "912" beads, and other parts. Electrical characteristics: Impedance—82.5 ohms; loss per ft.—.0009 db; inductance per ft.—.1 microhenry; capacity per ft.—11.5 mmfd; resistance per ft.—.024 ohms. All measurements made at 1MC.

**To:** American Phenolic Corporation, 1250 Van Buren St., Chicago, Ill.
**Awarded Seal of Acceptance No. 104.2**
**Product:** Liquid Amphenol "912".
**Description:** 100% non-hygroscopic form of solid Amphenol "912". Increases breakdown voltage to 20%. Used for doping coils, paper tubing, fibre, ceramics, etc.

**To:** American Lava Corporation, Chattanooga, Tenn.
**Awarded Seal of Acceptance No. 106**
**Product:** Alsimag.
**Description:** A ceramic insulating material. Material covered by Seal is: AlSiMag 35, 196, 197, 211, 72, 202, 203, 190, 192, Lava Grade "I," "M," "A." Report on properties on file with RADIO NEWS, as determined by Hans Thurnauer, M.S.C. under A.S.T.M. specifications.

## Within Earshot

(*Continued from page* 4)

will come into its own, and the big chains be shorn of their audience-drawing power? Time will tell. One thing is sure. The biggies have certainly been giving the consumer finest in entertainment. It is a question whether we would ever have heard Arturo Toscanini, or any of the operas

(to mention a few outstanding programs) were the methods of the chains to be altered materially.

* * *

WE hear much that the field of the serviceman is overcrowded. With over 25,000,000 receivers in the hands of listeners today, the most optimistic figures of 100,000 servicemen are not enough to handle the trade. This does not take into consideration the outside-of-radio work that the average serviceman can and does do. No, we cannot agree that the field is overcrowded. Servicemen--good servicemen are still needed.

Naturally, the question arises, "What is a good serviceman?" We term such a man who has had the proper training and experience . . . who has learned the intricacies of his profession not only from actual work in the field but also from application to the books. For those, there will always be a lucrative field.

* * *

THE airlines have finally caught up with radio as a use for preventing ships losing themselves. We have it on good authority that they will install direction finders at some of their midwestern ground stations. With these sets it will be possible to determine exactly where any ship in the air is located, and thus the ground crew will be able to give instructions should the airman become lost. Once again, radio is helping out another industry. We freely predict when radio will be the *leading* industry—one on which we will depend for almost everything. Certainly it was never a thought of the honorable Herz that his waves would some day be the *quid pro quo* of communications, health, safety, entertainment, and even a control. On the other hand, neither did he expect that it would become the instrument of vicious dictators spreading seeds of oppression and hate!

* * *

OF late there has been a marked increase in publicity devoted to the radio amateur operator and his equipment. However, it has not all been good. In Brooklyn, an *AP* dispatch suggested that a loud and earsplitting noise heard over the sky of Flatbush was the work of amateurs. In Los Angeles, the sheriff is said to have stated that he wanted the frequencies he used for emergency work kept secret "to avoid interference of the hams." In Utah an amateur was credited with a part of the Navy wild goose chase after the late Amelia Earhart, when he was reported to have heard signals from her ship down in the Pacific. None of this helps the ham. Rather it creates a feeling in the High Places that the hams are useless busybodies minding everyone's affairs except their own. What the ham should do, is to stick to his knitting, and see to it that the false and incorrect reports are straightened out, and that he gets good publicity.

* * *

BCNU next month.--KAK.

## Canadian Police Transmitter Frequencies

Canadian Police Transmitters

| *Megacycles* | | |
|---|---|---|
| 1.690 | CJR | Belleville, Ont. |
| | VDM | Halifax, Nova Scotia |
| 1.698 | CZ6F | Hamilton, Ont. |
| 1.706 | CY4M | Moncton, N. B. |
| | VYR | Montreal, P. Q. |
| 2.310 | CY6A | Cornwall, Ont. |
| | CY6U | Brantford, Ont. |
| 2.318 | CYQ | Toronto, Ont. |
| 2.326 | CZ9Z | Sherbrooke, P. Q. |
| 2.342 | CY2J | Westmount, P. Q. |
| 2.358 | CY6D | Sudbury, Ont. |
| | CZ7S | St. John's, P. Q. |
| 2.366 | CZ5O | Ottawa, Ont. |
| 2.390 | CGZ | Vancouver, B. C. |
| | CJW | St. John, N. B. |
| | CJZ | Verdun, P. Q. |
| | CY2G | New Westminster, B. C. |
| 2.396 | VYW | Winnipeg, Man. |

## Limiting Amplifier

(*Continued from page* 15)

sybilic operation but should take hold rather rapidly and have a more gradual release. R-6 and C-3 control this factor and experimentation with these values may be beneficial although with a value of 500,000 ohms for R-3 and 0.5 Mfd. for C-3 are good and give excellent operation.

Now a word in regards to installation the unit has many advantages but all adjusting should be done on a dummy antenna as improper adjustment can have a severe interference to others on the air.

—30—

## Book Review

(*Continued from page* 30)

The new HAMMARLUND CATALOG FOR 1939 is now available and copies may be obtained by writing direct to Hammarlund Manufacturing Company, Inc., at 424 W. 33rd Street, New York, N. Y.

An interesting little booklet has recently been brought to our attention which bears the title of "HOW TO HUNT A JOB," by C. R. Rasmussen. It is published by the Extra-Curricular Publishing Company, of Keokuk, Iowa, and copies may be obtained for 25c. Although written primarily for the High School student, it deals with the requirements of the average layman in finding and holding a job,—even a radio job.

THE RADIO DICTIONARY by Leonard Lewis which is published by The Dahls of Stamford, Connecticut, deals with the terminology and jargon of broadcasting and also contains a complete listing of broadcasting stations. The contents include a chapter on the dictionary of terms, studio language with message and gesture, directory of broadcasting stations in the United States and Canada. The price of the booklet is 50c and may be obtained by writing to the publisher at Haviland Road, Stamford, Conn.

The National Union Radio Corporation, of 57 State Street, Newark, N. J., has published a RADIO FOTO LOG. This booklet contains the complete listing of stations in the United States together with a generous supply of photographs showing all of the favorite artists of Radio. Also is listed a television broadcast station list.

*The Westinghouse Technical Press Service*, East Pittsburgh, Pa., have compiled a large GENERAL CATALOG. It is interesting to note that the publishing required 26,000 man-hours of work, a ribbon of paper 11,000,000 feet long, to print the 82,000 copies. The catalogue contains over twelve hundred pages. A copy has been placed within the *Time Capsule* at the New York World's Fair Grounds.

*United Transformer Corp.* of 72 Spring St., New York, have a new catalogue of TRANSFORMER COMPONENTS, bulletin PS-403, and copies may be had by writing to UTC.

*The Beck School for Radio,* 1208 Second Ave. South, Minneapolis, Minn., publishes a booklet describing various courses in Radio Announcing that will be of interest to those seeking information on a school devoted to this branch of radio.

*Kenyon Transformer Company, Inc.*, 840 Barry St., New York, announce a new KENYON REPLACEMENT CATALOGUE. A copy of this new release R-3 may be had by sending a postcard to any Kenyon jobber or diret from their home offices. —30—

## 28—60MC Receiver

(*Continued from page* 22)

by the vibrator and its associated transformer. Filtering will be necessary to eliminate vibrator "HASH" which might be bothersome at these high frequencies used.

### Tuning

The two 140 mmfd. variable condensers are used to locate the band to be covered and once they are set will not require any re-adjustment for full coverage on any one band. The 10-meter band may be covered by single dial control of the band-spread condenser and the 5-meter band is covered at the low capacity part of the condensers. It would be worthwhile to provide small dial plates for the two bandsetting condensers so that more accurate settings could be made.

The receiver is lined up in the following manner: A signal generator is best for precise adjustment. Remove the grid lead from the 6K8. Connect the signal generator lead to the tube cap and adjust the trimmers on the i.f. transformers to maximum signal output. The frequency of 4.3 mc. being used. After the i.f.'s are properly tuned, the generators output is connected to the antenna binding post and the grid connection restored. The oscillator bandsetting condenser will be set at approximately 115 on a O-180 degree scale. The antenna condenser will be at about 91 on a similar scale.

These setting will be close enough for initial adjustments for the 10-meter band. The band-setting condensers are set as follows for operation on the 5-meter band: Oscillator condenser at 45 and antenna condenser at 46. For the 7.5 meter police band the settings will be approximately halfway between these two points. Once the proper settings have been determined they may be logged or a mark made on the dial scale for reference.

The tone control is helpful in reducing tube and other noises. Automatic volume control is provided for in the design and its worth is appreciated when one is operating mobile or when receiving a fading type of signal.

The constructor of this little receiver may easily duplicate its fine performance by using good parts and keeping the values to the ones stated in the article. The one important caution is to use a good antenna, as poor results are often traced to poor match between receiver and antenna. The writer has copied phone stations from Africa, Ireland, England, Belgium and many other countries with good speaker volume and all were amateur phone stations. Five-meter signals are copied with good stability and volume.

## NEW ANTENNA

A new aerial which goes up without any poles, supports, or guys is being offered by the Ward Products Co., 1501 Euclid Ave., Cleveland, Ohio. The new aerial mast is made of nickel plated, super-sized bronze tubing, four sectional, 12 ft. high.

## Farm Power Packs

(*Continued from page 31*)

difficulties that are very hard to eliminate. One of the difficulties is the elimination of the hum in the dual power supply. This hum is due to common coupling in the power supply circuit, and for sets of this type it is advisable to use the same power supply as used in the second group, eliminating the vibrator section which supplies the "B" power to the radio entirely. This may easily be done in most farm radio sets in a few minutes. One thing must be borne in mind when a farm set has been converted from batteries to a.c., and that is the presence of a small percentage of ripple. People accustomed to a.c. radios will tolerate this slight ripple, but people used to battery sets will have to get accustomed to this ripple.

When changing a farm radio from batteries to an a.c. operated one, it is advisable to short out the battery switch.

-30-

## Communications Receiver

(*Continued from page 28*)

5. Red wire from the middle section to the B-- terminal of the output filter electrolytic condenser.

6. Twisted pair black leads to the nrs. 7 and 2 terminals of the nearest 6V6 socket.

Install the dial. End supports are first tightened, then the screws holding the tuning-shaft bracket tightened to clamp that bracket to the r.f. assembly sub-chassis. Making sure that there is no stiffness or binding in the bearings of the tuning condenser (the dial pointer and condenser should move with a sort of free-wheeling momentum across the scale as the control knob is given a twist or spin), tighten the hub set screw against the condenser shaft, checking for pointer reading at the low frequency scale-limit marker (condenser plates at maximum mesh). On the band-spread scale the reading will be zero for maximum capacity in the condenser's spreader section.

### Alignment and Operation

The measured B-- voltage should read 240v to ground at 115 ma. with a speaker field of 1 000 ohms in use. It is not definitely necessary to use a field of this precise resistance. Anything between 800 and 1,250 ohms will be satisfactory.

The i.f. should be roughly aligned to 456 kc. and then precisely to crystal frequency. The crystal may be used in an external oscillating circuit for the preliminary adjustment, but it is *not* suggested that the effected alignment be considered permanent, as few crystals oscillate at the exact frequency at which they work as series resonators. It's much better practice to do the peaking with the crystal in

its proper place, tuning in a signal for a sharp ringing or chirping response in the speaker, or swinging a modulated signal from an oscillator back and forth between, say, 450 and 460 kc. until crystal frequency is indicated by the characteristic and—remember—extremely sharp and sometimes hard-to-find "chirp," then re-aligning the overall channel to this frequency by means of the i.f. trimmer condensers and the filter unit inductance regulators.

As for the r.f. circuits, these should not be aligned unless or until a very accurate signal generator is available. The receiver will very probably work well enough "as is" once the i.f. channel is itself properly peaked. If you do re-trim them, connect the D and G input posts together and then to the service oscillator's "low" output post, then the A post to the "high" terminal *through* a dummy antenna which should be a 200 mmfd. fixed condenser for the broadcast band alignment and a 400 ohm resistor for alignment on all other bands.

In adjusting the BFO circuit, set the screw trimmer in the shield can for zero-beat, first adjusting the front-panel pitch control to approximately mid-setting. Maximum pitch variation will then be allowed for. As for the noise circuit, the adjustment is effected by trimming up the noise i.f. transformer against a signal of R5 to R8 level, first advancing the noise control until the level indication decreases slightly, then seeking as sharp a peak as possible through repeated adjustment for maximum signal decrease—backing off on the manual control each time to keep the circuit effect at minimum (in other words, maximum attenuation with trimming and minimum attenuation with bias control). R Meter checking involves first the turning of the zero adjuster for extreme right-hand-line needle positioning (with the a.c. switch on the tone control in "off" position), then, with the set turned on, the AVC on, the r.f. gain control wide open, and the antenna and ground posts shorted, the adjustment of the cathode circuit rheostat on the chassis until the needle coincides with the extreme *left hand* line.

In operating the receiver, use the left hand large knob for band-spread, the right hand for band-set tuning, the others, of course, for general circuit adjustments suitable to general receiving conditions and the character of the signals being received. Remember, by the way, that the noise limiter is not particularly effective in attenuating other than sharp noise peaks of the ignition-interference variety above signal level in intensity. —30—

## W. U. Sends 96 Msgs.

WESTERN UNION CO. announces that it can now send 96 telegrams over one wire at the same time. They do it with music. By using a musical note as a type of carrier and spacing the notes 300 cycles apart they are able to accomplish this extraordinary feat.

## Universal Tester

(*Continued from page* 37)

mfd, .001 mfd, .01 mfd, .1 mfd as standards for smaller units and can get 3 readings on many values. If the condenser is shorted or open then the bridge will indicate and register in the magic eye.

Widest angle of magic eye shadow indicates balance when testing for ohms, capacity, transformer ratio or matching of units by use of external standard.

Condenser capacities are tested as follows: Using .001 mfd. standard, we set .001 on scale of bridge and if balance shows .0005 we know that the condenser measured is .0005 mfd or ½ of standard. This line, if followed outward to ohms scale, shows 1,000 ohms (twice the a.c. resistance to standard).

Now if we are testing electrolytic units, put wet units in position they normally occupy and set standard on 2 mfd power factor knob at zero p.f. and then balance bridge to widest shadow, then adjust power factor rheostat to widest shadow possible. Read capacity on bridge scale and power factor on p.f. scale. Shorted or open units will balance one side or other. If power factor shows above 10%, we can figure that the condenser has series resistance.

Now to measure leakage, we can shunt the meter and use test leads to measure condenser leakage current opening shunt if leakage is small or as condenser becomes charged. The voltage rating of condensers should not be exceeded. The meter should be a 1 ma. meter used as a voltmeter or condenser current meter; or ½ ma. or less per mfd for good condensers.

Using the test leads on No. 0 and No. 1 and observing polarity, we can measure approximate leakage of low voltage condensers. Also, if capacity reading is too high for rated value, it will indicate a doubtful or bad condition, except in case of new units that almost always test slightly above. An 8 mfd condenser may test 10 mfd. These are okay, but if an old unit tests 12 to 16 mfd for an 8 mfd unit, well that's bad. If it tests less, then it's dried out or worn out, or has power factor.

Using 0 and 2 we have an a.c. voltmeter using magic eye as indicator and is sensitive to approximate 1/15th volt a.c. Useful as output meter, signal meter, hum level indicator, etc. It may be calibrated from a.c. voltages in a tube checker (fil. circuit, also, 110 v. a.c.). It shows efficiency of various filter condensers, and associated ripple and will detect changes not noticed by the ear when the shadow narrows.

Using 0 and 3 for test leads, we have a d.c. vacuum tube voltmeter, sensitive from fractional voltage to approximate 8 volts. Tied in on AVC line to grid return of controlled tube we have a magic eye tuning indicator,

useful for balancing a radio receiver on local stations. This can be used to demonstrate the usefulness of "magic eye" for tuning. It also checks up AVC circuit.

Using 0 and 3, we can check condition of "C" bias cells, which cannot be measured on an ordinary voltmeter. Check with or against an ordinary flashlight cell battery. The "C" cell shows less voltage than a 1½ v. dry cell.

Those who would like to use meter test of condensers on various voltages can use a heavier transformer and a heavy duty tapped bleeder plus a selector switch or jacks to bring out desired voltage, all on panel 9" x 14".

-30-

**Serviceman's Experiences**
(*Continued from page* 18)

outside, and I want to start using the book this afternoon. It's expensive, though. Do you think paper-work is worth while?"

"Worth while?" he smiled. "Why, man—I just left a job in a company that couldn't *exist* without paper-work!"

"What company?" I asked, feeling greatly encouraged.

"The Whistling Waterbowl Corporation."

"Sold!" I said, knowing my money would be well-spent.

I was a little late on the job, and Bishop himself was waiting for me at the chapel door.

"Hurry," he pleaded. "A very important burial ceremony starts in about twenty minutes, and you must be finished before then!"

Bishop's is not a large outfit, taking care of only the local send-offs. They could not afford a pipe organ, and had bought the changer to supply slow organ music as a low ceremonial background. The amplifier was rated at fifteen watts, but—as the noise level in a funeral parlor is very low, the speaker—behind a settee—was run at a very low level.

The machine and amplifier were in the basement. The changer mechanism was working, but someone had evidently tried to wind it up with the volume control knob, as it had been twisted so far the contact arm was broken. I got a similar replacement from the truck, and had started a pile of 15 ten-inch records just as the first of the mourners arrived. Bishop heard the music, and ran half-way downstairs to cue me on the volume adjustment.

"This is a *very* important affair—can you stand by the apparatus until it is over?" he asked.

"Sure," I said, "I have some accounting to do, anyway. Go back and enjoy yourself." I took my ledger into the next room, where there was a long table, and began to compute the charges for the work under my new system.

It was very intriguing, this cost accounting. After totaling the call at $12.93, I noticed with great satisfaction that I had filled every column on the first page, and had at the same time broken down the total into divisions which protected *Salutary Sales & Service* against every eventuality until August, 1942.

A crash from the next room interrupted me. I ran to the machine. Bishop was there, swearing, and trying to pull the pickup arm out by the roots. On the floor was a pile of broken records. When he saw me, he slowly grasped the tails of his formal coat in each hand, and, with a single motion, tore it up the back. I sensed something amiss.

"Where were you?" he yelled. "We paid $200 dollars for the machine, and the first time we get down to the fifteenth record, what happens? Why didn't you listen to the music, as I asked you to?"

"It was in order when I began my accounting—"I explained.

"The thirteenth record—I counted them—was a lovely rendition of *Bells of St. Mary's,*" he said, in a voice that was unusually baleful, even for an undertaker. "The fourteenth, when everything was still peaceful, was the beautiful *Rock of Ages.* And then—" he removed his wing collar without unbuttoning it—"then came the fifteenth: *Tiger Rag!"*

He extended his arms and approached me as if I were a customer. I have not seen him since. The next day I read of the disrupted requiem in the Heathstead *Hue & Cry.* They reported that Bishop faced 30 lawsuits, following the only musical atrocity on record.

My $7.50 ledger is in Bishop's basement, where it can rest in peace, for all I care. I have lost interest in accounting, for—as Al says—the only important paper-work in our business is the collection of Federal engraving.

-30-

## RADIO PHYSICS COURSE

*(Continued from last month)*

If a stream of electrons, or in other words an electric current, is made to oscillate or flow back and forth in this circuit, radiation of quanta into space takes place at the same frequency as that of the electric current employed. If the frequency of the current lies between about 10 kc. and 300,000 kc. per second, the radiations produced will exhibit all of the properties which we associate with the so-called radio waves. One of the most important of these is that these radiations will travel over long distances through space without excessive diminution in strength, so they may be used for the transmission of messages.

The frequencies found useful for radio transmission are far below those which our eyes or skin respond to directly, therefore we are compelled to construct artificial receiving instruments. When radio rays strike a receiving antenna or loop of metal they induce an e.m.f. in it and this causes a minute electric current to flow back and forth in the wire at the same frequency at which the energy has radiated. This minute electric current can be greatly strengthened by tuning the receiving circuits to electrical resonance at the frequency of the induced e.m.f. or current, and may be further amplified thousands or even millions of times and then converted into sound by the radio receiver.

Naturally the actual amount of energy picked up by a receiving antenna is extremely small. It has been estimated that the amount of energy picked up by an average receiving antenna, coming from a broadcasting station 2,000 miles away, if made continuous day and night for thirty years, would about equal the energy expended by a common house fly in climbing up a wall a distance of one inch. The e.m.f. induced in an average receiving antenna by the radiations from a nearby broadcasting station of average power, is in the neighborhood of 50 microvolts (.00005 volts). Many modern radio receivers will produce a standard output of 50 milliwatts of power when as low as 5 microvolts is induced in the receiving antenna system of average dimensions connected to them (say 4 meters high and about 60 feet long).

This conception of the electromagnetic radiations employed in radio work, while still incomplete in many details, is probably far nearer to the actual facts than the older theory of a simple wave-motion in a hypothetical substance called the "ether of space," the actual existence of which has never been directly proved, while recent experiments seem strongly to indicate that it does not exist.

We do not know everything there is to know about r.f. radiations.

*(To be continued)*



turn to page 53 for full details about the new amazing model T-70 signal generator.

## Simplified Rotary Beam

(*Continued from page* 12)

changing the diameter ratios of the mast tubes so that the mast will have the same impedance as the antenna and then couple the system through a coil at the base of the mast to the transmission line running to the transmitter.

It is a question which method is the most desirable, but in either case it was found that careful adjustment at the coil had to be made to get the proper match. In most cases the method to be decided upon will depend upon the location and the ease of making the adjustments.

### Adaption for 56 mc. Operation

The type of construction used in the 28 mc. beam can be very readily adapted for 56 mc. operation. The use of Yagi beam antenna in this band permits higher gain together with rotation which can not be obtained with any other type of antenna system.

The only necessary change in construction is the mounting of the elements to the vertical position instead of horizontal and possibly mounting a cross arm on the superstructure for additional reflectors on either side of the antenna element. Of course the spacing and the length of the elements are reduced to conform with 56 mc. measurements. Much smaller size tubing can be used for the elements when they are mounted in the vertical position and for this use only ⅜ inch tubes are needed.

### Adaption for 14 mc. Operation

The type of mast construction can be readily adapted for 14 mc. operation, but of course the necessity for greater distances between the elements, if all three elements were used, would require a much stronger mast. This means that the diameter must be almost double. However, if only a reflector is used as in the Mims (1) beam, no change would be necessary, but it would be advisable to widen the superstructure to give the proper support to the longer elements. These elements should also be made of slightly larger diameter tubing to obtain the rigidity.

### Conclusions

The type of beam described eliminates all the difficulties usually found in rotary beam antenna and lends itself very well for 28 and 56 mc. operation and could be used with fewer elements for 14 mc. operation. The cost of such an antenna system is not prohibitive though the mention of aluminum to some people always brings to mind high costs, but this is not the case as this antenna costs only $25.

## BAKELITE REVIEW

BAKELITE REVIEW, January, 1939, contains many interesting photographs showing the many applications of bakelite. Of interest is the photograph of the interior of the Ontario Power Co., where this material recently went through a baptism of 7,000 tons of ice without major damage. The many uses to which this material is applicable is apparent as one reads through its pages.

**QRD?**
(*Continued from page* 30)

now control op at *WBN*. . . . Marv Rodin from Findley, Mass., writes in for information about circuit diagrams for a new type of transmitter which, of course, is being forwarded to him by mail . . . which just goes to prove you can't stump that RADIO NEWS gang. So just keep shipping in those questions, and the answers will be dispatched en pronto . . . and 73 . . . ge . . . GY.

—30—

**John F. Rider**
(*Continued from page* 14)

I know that thousands of servicemen want answers to these questions. There is no one general answer. . . . Maybe the answer is found in the use of sales psychology. . . . Maybe some men sell the customer on the integrity of the service shop and do not give any guarantee. . . . Maybe some shops give guarantees in accordance with the age of the receiver. . . . Maybe some men give guarantees because they are such good salesmen that they sell a complete check-up of every part in the receiver and therefore feel that they can gamble.

Maybe the local association gets its men together and they have a definite policy upon such guarantees. . . . Maybe some men have kept records of such return calls due to guarantees and have found certain methods of operation preferable to others. . . .

How about telling your answers to these questions? . . . I most certainly would welcome such letters and I know that many men associated with the servicing industry would find such facts of invaluable aid in the conduct of their business . . . RADIO NEWS will pay $5.00 for the best letter each month, and I feel that the gratitude of many will be forthcoming.

This problem has existed for years and it is high time that an attempt at finding a solution was made.

### Electrical Appliances

I understand that many servicemen feel that servicing of electrical appliances is prostitution of the art of radio servicing. . . . Maybe that is so but if it is, then it is difficult to find a reason to explain why those men who do appliance servicing in conjunction with their radio servicing are making more money than those who do not.

Add to this the fact that many men who do appliance servicing are also selling appliances. . . . Here is a thought that comes from a small town. A serviceman who has had experience with vacuum cleaners buys up second-hand cleaners, repairs them, and has sold quite a number to some of his radio service customers at a handsome profit. . . . One thing I cannot forget, no matter how hard I try and that is, that the radio serviceman already is in the home, whereas the other appliance salesmen are trying to get in.

The present flood of motor mechan-













turn to page 53 for full details about the new amazing model T-70 signal generator.

isms in tuning systems and phonograph turntables makes it necessary for the modern radio servicemen to understand the operation and repair of motors. . . . Why not make the most of that knowledge? There is nothing to be ashamed of in handling electrical appliances in conjunction with radio service. . . . If some of the most successful radio dealers are able to combine radio receiver sales with electrical appliance sales, why can't the service shop combine both service operations?

### Television

I have read a great deal about the subject and it would appear as if the entire nation is going to be blanketed by television stations during the coming year. . . . Such is not the case. . . . Public interest is being aroused. Experimental stations are going on the air and experimental kits are scheduled for April, 1939.

However, the servicing picture for several more years to come is not going to change, although the question is being asked "Who will service the television receivers?" . . . Some servicemen have expressed alarm at the possibility that when television receivers are announced, the public will cease having their receivers serviced because they will not consider the expenditure worthwhile.

That is ridiculous. . . . There are more than 25,000,000 radio receivers in use in the nation today. . . . With the experimental stations on the air in a few cities of the United States during 1939, there will still be more than 25,000,000 receivers available for service in the United States.

The erection of television stations is no trifling expense. . . . With the high cost of coaxial cable connections between cities, that will mean not only the erection of a station for the purpose of transmission, but also the erection of televising studios.

Television may be here, but it is still very far from displacing the modern radio receiver as a form of entertainment . . . and we are not speaking about the expense of the forthcoming television receiver. . . . People are speaking about the production of perhaps 40,000 television receivers during 1939. . . . Maybe 1949 will see the production of 100,000 or even 200,000 receivers. . . . That still is not 25,000,000—and the man who buys a television receiver will still use the conventional receiver. . . . I hazard the guess that servicing, as I find it today, is still good for years. . . . My daughter Janet now is 7 years old and I feel that she will be quite a way past 10 if not in her 'teens before television will put any dent into the radio receiver business. . . . As a matter of fact why should it? . . . Someone will have to service television receivers—why not the present-day radio serviceman who has acquired the proper knowledge. . . . "Ah, there you have something," as the man said when he pointed to the elephant.

—30—

## What's the Distortion?

(*Continued from page 25*)

dio frequency it will be necessary to disconnect the r.f. section from the meter. A switch could be inserted between r.f.c. and $L_8$, but the presence of this switch on r.f. measurements is objectionable. The only easy way around this is to pull the 1v out of its socket when a.f. measurements are to be made. If no r.f. measurements are ever to be made the 1v and the r.f.c. can just be left off. To make a.f. distortion measurements on an amplifier the oscillator is connected to the input of the amplifier and the gain controls adjusted until the output reaches the level at which it is desired to make the measurement. A pad that will absorb proper amounts of power is connected to the output of the amplifier and the meter is connected to the pad. Then the *Yaxley* switch is set to the calibrate position and the gain control of the meter is adjusted for full scale reading. The switch is then turned to the 50% distortion position. If there is no reading, turn the switch to the next position until there is a reading.

The illustration shows how the meter should be read. The regular scale may be used for the 1% and 10% distortion scales. A scale will have to be added for the 5% and 50% distortion. For noise measurements the meter is calibrated in the same manner as for distortion measurements. The 1,000 cycle oscillator is then turned off. The *Yaxley* switch is then turned to the noise positions until a reading is obtained. The noise level will then be the number of the position the switch is in minus the meter reading. If the switch is in the —50 position and the meter reads —8, the noise level of the amplifier is —58db.

If it is desired to measure the distortion of a transmitter the oscillator is connected to the microphone input of the transmitter and the gain controls are adjusted until the desired degree of modulation is obtained. A pickup coil consisting of several turns of wire is placed in the field of the tank coil of the final. The ends of the coil are connected to the r.f. input of the meter. The coil and variable condenser should be adjusted until sufficient r.f. voltage is picked up to calibrate the meter. The procedure is then the same as for amplifier distortion and noise measurements. Distortion and noise measurements on receivers should be obvious from the above discussion.

### Transformer List

$L_1$—Thodarson type T-67R97
$L_2$—Thodarson type T-68C08
$L_3$—Thodarson type T-57C54
$L_4$—Thodarson type T-62A26
$L_5$—Thodarson type T-70R20
$L_6$—Thodarson type T-68C08
$L_7$—Thodarson type T-57C51
$L_8$—Amertran type D81CB
$L_9$—Thodarson type T-70R61
M—Triplet 0-1 Ma. Model 421

—30—

## The Video Reporter

(*Continued from page 14*)

photograph of Mary Eastman, popular radio vocalist. It is actually a signal generator cathode-ray tube with the fixed image mounted in the tube at the time of manufacture. It is used in place of the conventional test-pattern line drawings.

### Tele-Casts

YOUR scribe is endeavoring to run down the story on the rumored $60,000,000 new radio chain set-up for broadcast and particularly television. No doubt some of our readers have noticed the scoop items (very vague) on this, in the columns of the tabloid newspapers.

An experimental television transmitter construction permit has just been granted by the Federal Communications Commission to the Allen B. DuMont Labs., Inc. The permit covers a power rating of 50 watts, and a frequency range of 42,000-56,000 kc. This application was made for the purpose of establishing an experimental television transmitter to aid in the practical development of visual broadcasting and reception.

It was recently reported that Mr. Soloman Sagall, managing director of Scophony Ltd., England, is now in New York with plans to launch an American plant to produce its own receivers and possibly erect its own chain of transmitters. It is said that their set differs from ours, in the fact that they do not use the cathode ray tube.

## It's an Art!

(*Continued from page 33*)

the bakelite of a socket where it couldn't be seen.

As for the actual lacing, this can be better explained by a simple drawing than a thousand words. The diagram shows the main points to watch. The rib, or cord connecting the loops, should be kept underneath, out of sight. This adds immensely to the final appearance. Also, the idea of a knot under each loop is to prevent all the lacing from unraveling, should one loop break. If the cables are more than one-half inch thick, it is a good plan to make two loops at each point, separating one set of double loops from the next by about three-quarters of an inch. Any light, strong cord will do, preferably waxed. [*Fishing-line makes fine lacing material.*—ED.]

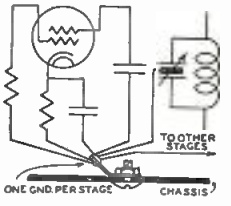
Now let us go on to Audio Wiring. In this type, high gain stages are likely to give the most trouble, since any slight disturbance in the grid is greatly amplified in the plate circuit, and feed-back and self-oscillation are very common. The safety rule to remember is to keep the grid circuits of a stage well isolated from its own following plate circuit. It is permissible to have the plate circuit components of the preceding stage close, since theoretically they are at the same audio potential as the grid components they are driving. In making coupling leads to gain controls, or any other low level leads, it pays to shield the leads well, grounding the shielding very solidly by returning it with a piece of hook-up to a point as near to the cathode by-pass condenser ground as possible. Never have more than one direct chassis ground to a stage, returning all grounds for that stage, and that stage alone to the one point.

The ground points for each stage are then wired together with a common lead, and brought out to a terminal for connection to other chassis. The reason for this is the fact that the chassis is never a very good conductor, and stray currents can cause plenty of havoc to be wrought in the way of feed-backs, howls, and "motorboating." The point in bringing all the grounds for one stage alone to a certain spot is to make the grounds in that one stage as short as possible, thereby shortening the audio, or a.c. paths for that stage, and eliminating any unwanted eddy currents.

The problem of what to do with power leads, such as primary a.c., B+ and Screen, can very easily be solved by placing them in cables, well clear of any grid leads. Of course, they must be by-passed at the stages, to keep any unwanted audio components out of them. Although not absolutely necessary, a good precaution is to twist the a.c. leads, thereby helping to cut down the field around them. If bias leads must be brought out in the cable, be sure they are well by-passed.

Radio Frequency wiring, the last, and most trying type, gives us a chance to bring out all our technique in this 20th century art of radio construction and use it to the utmost. This so-called "r.f." can do funny things, due to its ability to "float through the air with the greatest of ease." Peculiarities such as stray capacities, inductive coupling, and other such phenomena can cause plenty of headaches. Once again, as in audio, our grounds play a very important part. Only in r.f. the effects are much more pronounced. Remember, then, we must have only *one* actual chassis ground per stage; this to be as near the ground end of the cathode by-pass condenser as possible. To this point all the grounds for the stage must be returned. Don't forget that condenser shafts touching the panel are also ground points and, while they may have very little effect in some cases, in other cases they may mean the difference between 25% efficiency and 70% efficiency, or they might tell whether a stage neutralizes or not.

In one case, to cite an example, a local Ham couldn't get his final to neutralize, even after several re-wiring jobs and new layouts. Investigation showed that he had the rotor of the final tank condenser grounded to the chassis through the mounting brackets, and these in turn were tied back to the common ground with a piece of bus wire. When the condenser was mounted on stand-offs and the rotor lead brought directly to the common ground point, without touching the chassis anywhere else, the stage neutralized perfectly. So remember, if you want to be a master of this radio art, *one chassis ground per stage* is plenty! (*Next page, please*)










turn to page 53 for full details about the new amazing model T-70 signal generator.

Once again, as in audio, the grid leads are most important, and should be kept as short as possible. R.f. Chokes are a frequent cause of low-frequency parasitics, due to inductive coupling, and should be placed well apart, at angles to each other. In fact, it is a good plan to use as few r.f. chokes as possible. Cabling in an r.f. deck is permissible, if not absolutely necessary to keep the work neat, and in the "master" class. Cables, of course, must be limited to power leads, such as B, filament and meter leads. Needless to say, they should be well by-passed at the stage which they feed.

Stray capacity plays an important part in Radio Frequency work. Particularly on the higher frequencies. Coupling condensers if improperly mounted can cause great losses, due to capacity effect between them and ground. If the condenser is not to be fastened down, wire it in so it stands on its side, presenting the smallest area possible to ground. If it is to be fastened down, mount it on studs, sufficiently clear of the chassis to minimize capacity. In one case, lifting the coupling condenser to a 150-watt Class C amplifier onto a pair of studs raised the grid drive on 10 meters from 25 to 40 ma. for the tube. The effects are more noticeable in higher powered stages, of course.

A few hints on bus bar work would not be misplaced here. First of all, bend loops in the ends of the leads, rather than use lugs. Also, in rounding corners, or passing other parts, the good artist does not bend sharp angles in the bus with his pliers. Rather, he bends a smooth curve without using any tools but his fingers, his thumb serving as a form. The key to the "master's touch" then is a happy medium between straight symmetrical wiring (where leads and parts are kept parallel to one side or another of the chassis) and the short, direct leads necessary for highest efficiency.

In closing, let us say that a few good, well kept tools are better than any number of poor, ill-used ones. Artists can't paint with paint-hardened brushes. Neither can a radio builder work with rusty, nicked cutters. Another point, more important than any, is that patience and forethought are as important in our radio art as in any other art. What if DX will be rolling in about an hour from now? It will be rolling in again tomorrow, or the next day, or next week. Better to work it with a rig which you *know* will stand up, rather than having to lose that elusive Asian because a connection broke in your rig. Remember, also, that no apologies are necessary to visitors for poor workmanship and you won't have to be afraid to turn the rig around to show the wiring. Yes, Sir! You can stand up as a master of the art of wiring and say, "Yep. I built that rig, and she certainly is working FB. Wanna see what she looks like behind?"

—30—

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## Television Course
(*Continued from page 8*)

electron gun is, at the moment, on a scanning spot in line 4. It is presumed that the image being scanned is dark on lines 1 and 4 (for that reason I have made the beads black in those lines) and light on lines 2, 3, and 5.

Due to the photosensitive characteristics of our cesiated beads, the charge on the beads in lines 1 and 4 will be greater than on those in lines 2, 3 and 5.

As the beam strikes each scanning spot, the 300 little condensers contained in the spot release their charge into the conductive signal plate and thence to the grid of the first amplifier. As the beam moves over the image on the mosaic, there is generated at the signal plate a voltage whose magnitude, at any instant, depends on the image brightness at the point where the beam is at that instant. Very dark spots provide a stronger current, grays produce a medium current, and whites hardly any, comparatively. These currents are all in the neighborhood of only a few tenths of a microampere.

And that, my readers, is how a visible scene is converted into 225,000 little impulses chasing each other along a wire so fast that they are all out of the way in 1/30-second, and our scanning beam is ready to do it all over again.

It might, perhaps, be appropriate, at this point, to go into the circuits and tubes that are used to deflect the beam of electrons from top to bottom and left to right (or vice versa, as is sometimes necessary) for scanning. The subject is, however, so important, complex and essential to construction of a receiver that I believe it better to handle it, fully and in detail, in another article. There are several types of oscillators used for this purpose, such as "blocking" and "relaxation"; there are gas discharge tubes and high vacuum tube discharge circuits; impulse wave forms and saw-tooth wave forms; and amplifiers new and unique both as to characteristics and purpose. For the time being, take it for granted that our mosaic can be scanned, as described, and let the "how" wait.

While we are on the subject of the mosaic and its scanning, let me point out some interesting effects that television camera operators will be able to obtain, once they become familiar with the device and its operation. Let us say the camera is televising a scene in a room in which a group of three are talking at one side of the room and a couple are standing at the other side. At first, the image of the whole room will be covered as the electron beam scans the entire mosaic.

By decreasing the amount of swing (amplitude) of the beam, both vertically and horizontally, and shifting the centering current (thus scanning but an off-center part of the mosaic) the effect will be of moving the camera "in" for a close-up on the group of three, although *the camera itself is*

*not moved.* Shifting the position of this "reduced area" scanning pattern on the mosaic, the effect will be that of turning the camera around for a close-up of the couple; then, by increasing the amplitude of swing of the beam to include the entire mosaic, it will appear (to those with receivers) that the Iconoscope was moved away to again take in the entire room, yet the camera itself need not be shifted.

I am quite sure that, long before this, quite a number of discerning readers have said, in effect, "Wait a minute here, Thompson. If that electron beam scans the mosaic from a 30-degree angle, it is not going to scan a rectangular shape. The scanning pattern will be a keystone-shaped area (see Figure 9a) because of the greater distance from the deflecting point to the top of the mosaic." Which is absolutely right, and brings up the matter of "keystoning."

What is actually done to correct this is to so deflect the beam, by the scanning action, that, if it were scanning a plate at right angles to the axis of the electron gun, the result would be a trapezoidal pattern such as is shown by Figure 9b. The swing of the electron beam is made slightly shorter toward the top of the mosaic, gradually increasing in length as it moves down. Thus, the result, at the receiver, is exactly as it would be if both the axis of our optical lens and the axis of our electron gun were squarely perpendicular to the mosaic (see Figure 9c).

A block diagram of the more important units necessary to a commercial television transmitter is presented in Figure 10. Because of the feebleness of the initial currents from the Iconoscope it is practically essential that the unit termed "Iconoscope Pre-amplifier" be included in the camera.

This unit may consist of five stages of amplification, using the comparatively new type 1851 tubes, which will permit the signal voltage to be raised to a level of about one-half volt (peak to peak video signal). By doing this immediately following the Iconoscope, and before subsequent mixing, clipping and transmission operations, the signal will be well above any "noise" or hum introduced while in transmission lines or by control circuits. The difficulties to be overcome in developing such an amplifier can well be imagined when one considers that equal response is desired over a band width of 60 cycles to 5 megacycles.

The unit identified as "Shading Panel" may cause some lifting of eyebrows. An Iconoscope has the inherent characteristic of having appear in its output a variety of undesirable spurious signals along with the video currents. What is known as "dark spot signal" appears (if not corrected) in the received picture as shading over portions of the picture. This can be almost completely eliminated by the introduction of "shading" signals at the grid of the first tube in the Pre-amplifier. Because this "dark spot signal" varies for different operating conditions, and for different Iconoscopes,

it is useful to have available, from the shading panel, saw-tooth, sine and parabolic waves at both horizontal (13,230) and vertical (60) frequencies.

Following the Pre-amplifier in Figure 10, it will be seen that the signals now go into the "Video Mixing Amplifier." The formation of a complete set of television transmission signals, such as were shown in the first article, requires that the video signals be combined with suitable blanking (blackest black) voltages, and that synchronizing pulses be superimposed upon the blanking signals.

The mixing unit wherein this is done may very properly consist of seven tubes, the first two of which are straight amplifiers. Into the plate circuit of the second, however, a third tube (acting as an amplifier only) injects blanking signals supplied to it from the unit called "Blanking Circuits." The fourth and fifth tubes merely amplify the combination of video and blanking signals. An operation known as "clipping" is performed by the sixth tube. As used here, it is (for the benefit of advanced amateurs) a plate current cut-off type circuit, the linearity of which has been improved by degeneration, introduced by cathode loading.

Clipping removes transients and spurious peaks caused by both the Iconoscope return trace and the shading signals. It is necessary also, first, so that the top of the blanking period pulse will be perfectly flat; second, that the height of the blanking period pedestal be set at a definite level, as it is this height which ultimately determines "blackest black"; third, it prevents high peaks of the video signal from extending up above the black level where they might interfere with the synchronizing operation.

Having now so arranged our continuous stream of signal that we have a flat-topped pedestal inserted 13,230 times per second, between which there are periods of video signal, we can now, in the plate circuit of the sixth tube, superimpose synchronizing signals upon the pedestals (see Figure 5, first article). Our seventh tube (used as amplifier only) is connected with its plate in parallel with that of tube six, its grid being fed with properly-timed synchronizing pulses from the unit termed "Synchronizing Pulse Circuits" in Figure 10. The output of the mixing unit is then amplified in a Video Line Amplifier properly designed to pass our 60-cycle to 5-megacycle video band width.

It is far beyond the scope of these articles to go into the circuits of the Synchronizing and Blanking Impulse Generator. It is an awsome array of tubes and the necessary coupling and control adjuncts, which includes all three units in my block diagram labelled "Blanking Circuits," "Synchronizing Pulse Circuits" and "Timing Unit." An illustration of such a panel, as used in one of RCA's transmitters, is shown. Sixty-two may be seen, of which about one-fourth are for timing and three-fourths for blanking and sync impulse generation. One begins to understand why the investment in a commercial television transmitter runs into box-car figures.

The timing part of a transmitter is interesting in many ways. There is, of course, an oscillator (6A8) which starts everything going, this being tunable and adjusted for 13,230 cycles. A lead from this oscillator can be taken out at this point for horizontal timing. The tetrode section of the 6A8, acting as a frequency doubler, then raises the frequency to 26,460; the next tube is a 6F8 multi-vibrator, synchronized with the frequency which is one-seventh of 26,460, or 3,780. Again, the frequency is divided by seven, reducing it to 540; the next two stages each divide by three, bringing it down to 180 and, finally, 60. Here a tap is taken off to provide our field (vertical) frequency; another lead takes part of the 60 pulse-per-second output into a unique arrangement whereby the whole array is locked into synchronization with the 60-cycle city power lines.

One may wonder why all this seemingly unnecessary doubling and dividing. It is a condition imposed by 441-line interlacing that the horizontal frequency of 13,230 p.p.s. contain no *even* harmonic of the field frequency of 60 p.p.s. The field frequency is obtained by dividing the second harmonic of 13.230 (26.460) in steps of 7, 7, 3 and 3. These four numbers. multiplied, equal 441, the lines per frame.

The amplified video current, complete with blanking and synchronizing pulses, may now be used to modulate an r.f. output created by any of the usual combinations of r.f. exciter, power amplifiers and output stage. So much for pick-up, amplification and transmission; having high-spotted some of the more interesting phases of these operations, we can now, in future issues, get into receiver essentials and design.

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***Television—Volumes I and II***
Publ. by RCA Institute Technical Press

[Next month the author continues this revealing, interesting television course by laying the groundwork for a discussion of the television receiver.—Ed.]

—30—

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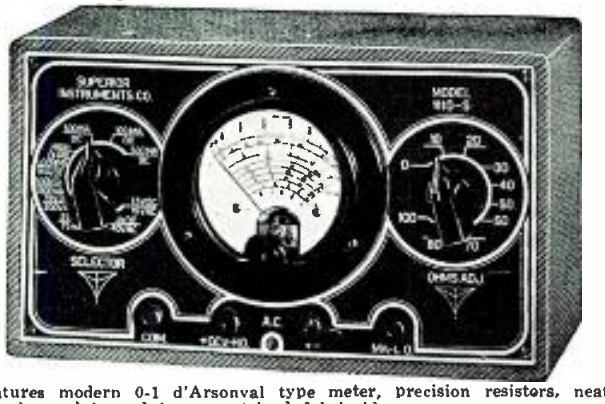

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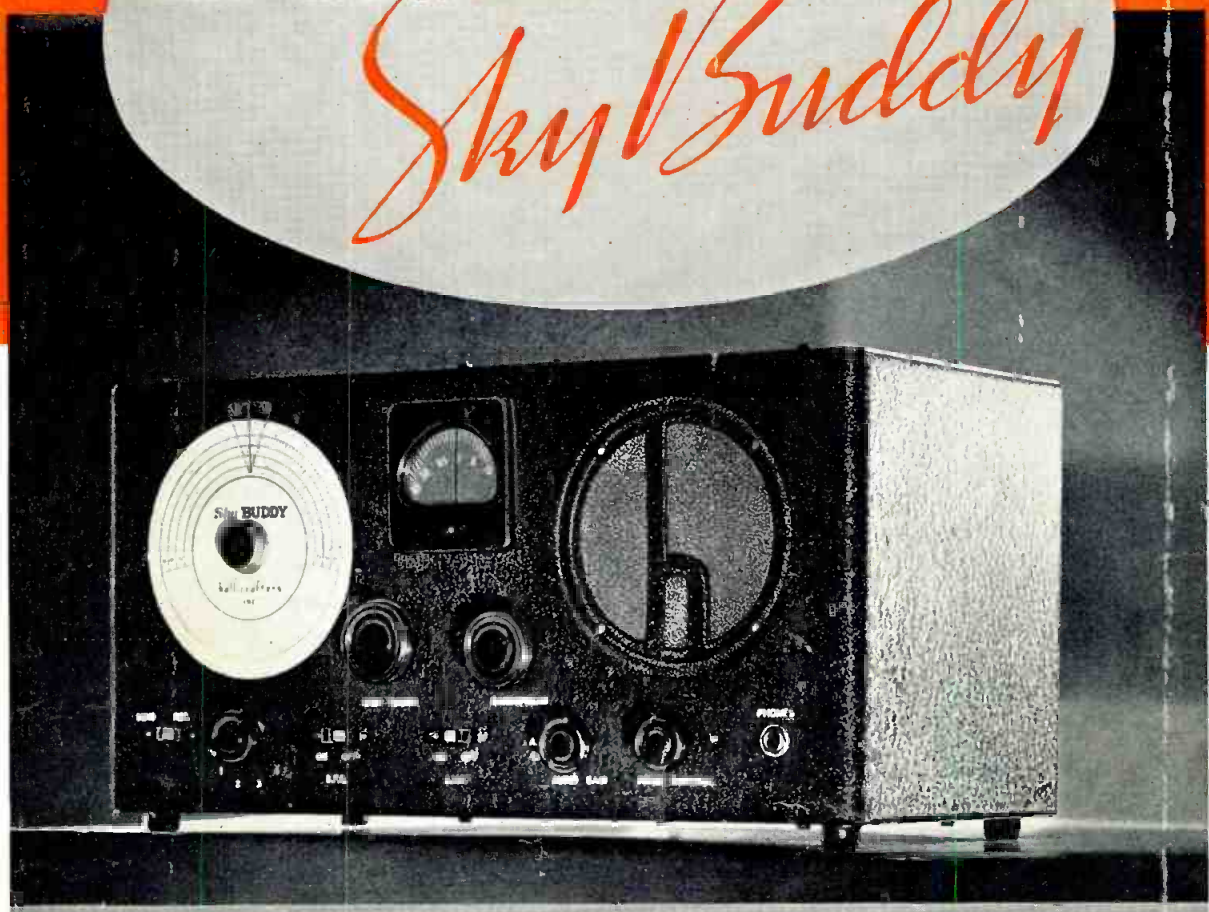


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