WHEN THEIR MINDS DON'T MEET—Susie's vision is of romance of the balcony scene variety, but Cholly, her suitor, is so much of a radio fan that his whole attention is on the program they're hearing.

RF ADDED TO REGENERATIVE SET
SELECTIVE THREE-CIRCUIT TUNER
A Statement by GORDON C. SLEEPER

The SLEEPER RADIO CORPORATION will shortly announce the new TYPE 54 MONOTROL.

In my opinion no set ever made so nearly meets the ideas of 28,000 radio dealers in the United States as to what they want to sell and what the public wants to buy.

The TYPE 54 MONOTROL establishes new standards of engineering and mechanical design. It is the supreme development of the GRIMES Inverse Duplex Circuit.

A Cabinet of inlaid African Mahogany with the finish of a Steinway. A panel of etched bronze to please the most discriminating eye.

The new Sleeper DUAL Condenser used in this set allows tuned radio frequency on one dial, and by its sharp-tuned efficiency, points the way to obsolescence of sets with two, three or more tuning dials.

The New Monotrol will operate on loop only, on ground only, or on aerial and ground. It uses either storage battery or dry cell tubes.

The set is the result of an entire year’s research by DAVID GRIMES, Chief Engineer of the SLEEPER RADIO CORPORATION, in collaboration with H. C. Doyle.

It incorporates features that are an absolute challenge to the Radio Industry.

The TYPE 54 MONOTROL is worth waiting for.

(Signed) GORDON C. SLEEPER, President

SLEEPER RADIO CORPORATION,
88 PARK PLACE, NEW YORK
"Better Than the Super-Heterodyne"

The Metaform System of Reception, designed by Walt S. Thompson, Jr., reduces the wavelength to below that used in the Super-Heterodyne and sometimes below the broadcast wave. Strong, undistorted signals result. "It can't be done," experts told Thompson, but he did it.

A Notable Advance In Reception

[Herewith Radio World presents a method of reception new to experimenters—the heterodyning of an incoming signal to a given wavelength, lower than that used in the Super-Heterodyne. In the Super-Heterodyne the wavelength is increased, by means of a local oscillator, and all signals finally detected at a fixed number of meters, say, 10,000. In the Metaform System, as the new method is called, the change in frequency is made in another direction, all signals being changed to a given wavelength, in the instant case, about 600 meters (500 kilocycles.) The changed wavelength in the Metaform is above the broadcast wavelengths, but by use of a different oscillator could be brought below the minimum of the broadcast range. "It can't be done," experts told Walt S. Thompson, Jr., brilliant expert who successfully designed and constructed the Metaform, which he declares has advantages over the Super-Heterodyne and the Neutrodyne. But Mr. Thompson did it and herewith presents the absorbing story.]

By Walt S. Thompson, Jr.

For some time past the writer has felt that there were certain advantages to be gained in the reception of radio signals by using a method differing from those in use today. Having given some thought as to just what changes could be made in the modern methods of reception and having decided upon a means for effecting these changes, there followed a period of development and experimentation after which a receiver was built incorporating the results of these experiments.

The purpose of this article is to describe these experiments, the receiver built and its operation and to discuss the theory underlying its operation as well as to name some of the advantages to be gained by its use. For the purpose of discussion, the writer is describing first, the method of reception and second, the manner in which the method is applied.

The receiving system used is illustrated by Fig. 1. The energy collective agency, such as an antenna, is connected to a tuner made up of the usual resonant circuits. The output of this tuner is fed to a frequency changer which changes the frequency of the incoming radio signal wave to some other frequency above 500 kilocycles per second. After leaving the frequency changer, the signal may go through a radio frequency amplifier to a detector, as shown by Fig. 1, or may go directly to a regenerative detector as shown by Fig. 2. After leaving the detector the signals are amplified at audio frequencies in either case.

Let us assume that we wish to change the frequency of the incoming signal to 500 kilocycles per second. The operator of such a set would first adjust the tuner to the signal being received and would then adjust the frequency changer so that the wave passed to the detector, or radio frequency amplifier, would have the desired frequency of 500 kilocycles. Thus we see that this method consists of a receiver of most any type and a frequency changer. The receiver proper is kept tuned to a given frequency at all times, in this case 500 kilocycles, and the incoming signals are all changed in frequency to that of the receiver. This method the writer has named the Metaform system of reception. "Metaform" means "to change the form of."

As the receiver proper can be of any type, the frequency changer alone will be discussed. This frequency changer uses the heterodyne or beat method for changing frequencies similar to that used in the Super-Heterodyne receiver. The frequency changer used in
most of the present-day Super-Heterodyne receivers is illustrated schematically by Fig. 3. In this figure the vacuum tube V is connected as a detector with the frequency changer unit used by the writer in his experiments with broadcasting frequencies was constructed as shown by Fig. 5, in which each piece of apparatus is lettered to conform to the following list of material used:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Material</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Hard amplifier tube</td>
<td>UV201A</td>
</tr>
<tr>
<td>H-I</td>
<td>Variable air condensers</td>
<td>.0005 mfd</td>
</tr>
<tr>
<td>R</td>
<td>Filament rheostat</td>
<td>20 ohms</td>
</tr>
<tr>
<td>L-1-10</td>
<td>Fixed coupler</td>
<td>L-10-40 turns</td>
</tr>
<tr>
<td>L-6-20</td>
<td>Fixed coupler</td>
<td>L-60-70 turns</td>
</tr>
</tbody>
</table>

The two fixed couplers were mounted about six inches apart and placed perpendicular to each other to eliminate inductive coupling between them. The condensers also were widely spaced and were gear-driven to get a fine vernier effect. A C battery voltage of about three volts for a B battery voltage of about 1.2 volts was used to keep the operating point on the correct part of the characteristic curve.

The receivers proper which were used in conjunction with the frequency changer were of various types. First a tuned transformer-coupled, radio-frequency amplifier

(Continued on next page)
Set in England that Gets WJZ

This is an American adaptation of the British Navy circuit, which gives remarkable results. There are three stages of radio-frequency amplification, detector and two stages of audio-frequency amplification. It is assembled and wired in a very compact manner, using a minimum of space, thus making very short leads possible. The six tube sockets, which are of the low-loss porcelain base type, are placed on shock-absorbing rubber cushions, as shown in the photograph. The radio-frequency transformers have a strip of brass placed on the outside and grounded to the negative A battery terminal. This circuit, used in England, has heard many of the United States broadcasting stations consistently, particularly WJZ, New York City. Local stuff comes in great without antenna, loop or ground. Although the radio-frequency tubes cannot be tuned, great volume is obtained over the entire broadcasting wave-length range. The whole is mounted on a baseboard with convenient binding post blocks for facilitating battery connections. Evidently this outfit is used as a portable set, as flexible leads are taken off from the filament posts on the sockets and run direct to a battery of proper voltage. The detector tube is the one at the upper left hand corner, to which is connected the grid condenser. No leak is used. An outfit like this, built so compactly, might well be inserted in a phonograph or small handbag for portable use.

Signals Converted to 600 Meters

(Concluded from preceding page)

such as the Neutrodyne receiver, was used; second, an untuned transformer-coupled, radio-frequency amplifier was tried and finally a regenerative detector with its tuner was coupled to the frequency changer. In all cases the two output terminals D in Fig. 5 were connected to the primary winding of the receiver input coupler as illustrated by Fig. 6.

When the frequency changer was being used with the Neutrodyne receiver, the terminals D in Fig 5 were connected to the antenna and ground binding posts of this receiver as in Fig. 6, the ground binding post first having been disconnected from the negative side of the A battery. The Neutrodyne was tuned to a frequency of about 500 kilocycles or 600 meters and left in that adjustment. The condenser I in Fig. 5 was then adjusted to bring the circuit E in tune with some broadcasting station, such as WEAF. The condenser H was next rotated until WEAF was heard in the loud speaker connected to the output of the Neutrodyne.

This adjustment of the condenser H brought the frequency of the oscillating tube V to such a value as to beat with the frequency of the incoming wave. In this case the incoming frequency was 610 kilocycles and the oscillator frequency was 1110 kilocycles, resulting in a difference frequency of 500 kilocycles, to which the Neutrodyne receiver was tuned. This was repeated for various broadcasting stations, changing the frequency of each to 500 kilocycles. As the next experi-
A Double Range Three-Circuit Tuner

By Brainard Foote

Good many suggestions have come forward recently for slightly altering the single circuit tuner so that it will not only be modified as radiator of "whistles," but so that it may be as selective as more complicated circuits. By far the most satisfactory of all of these schemes is the addition of another circuit, not tuned, however, but merely in the form of an extra coil for coupling the antenna to the grid circuit. Such devices involve the addition of an antenna coupling coil having about 15 turns, a secondary of about 50 turns and a movable tickler.

Good as these coils are in their selective tuning, there remains yet an improvement which makes them of even greater value. Operators of any circuit where the broadcast band is covered completely by a single condenser and a fixed coil have found that the adjustment for a weak low wave station is exceedingly difficult, broadcasters seeming to overlap and run into one another. This, however, is more the fault of the tuning device in use, for the assigned wave lengths are separated by as great a frequency difference on low as on high waves. In other words, the tuning range of the variable condenser ought to be more "spread out" to facilitate reception on waves below 360.

Any single circuit receiver may be converted to the coupled 3-circuit arrangement very handily and with scarcely any expense. The alteration will not mean a reduction in volume at all, but will open one's eyes in the way of sharpness. Did you ever try to get WHAS, Louisville, while WOR or WJY was on the air? With a single circuit this is a physical impossibility, for there is only 5 meters difference in wave length. Yet with the coupled circuit, it is possible to hear WHAS quite well and not be disturbed very greatly by WOR except on an unusually strong note or "blast" of jazz.

Similarly, have you ever attempted to tune in KGO, Oakland, Cal., on 312 meters? A single circuit will scarcely perform this seeming miracle with WLW or WSAI on 309 meters banging away. But with the coupled circuit, KGO comes through once in a while, even with no more than one tube. So it will pay any single circuit user to try the modification, for it costs practically nothing and a new radio world of reception awaits him.

The photos illustrate a coupled circuit receiver built especially for this purpose. Any single circuit owner may note what few changes are needed for his own receiver.

Deviation from the makes listed below is, of course, possible so long as the number of turns and capacities are kept the same. The type of coupler chosen was used because it is already prepared for use with only two taps. Any standard coupler may be employed with a similar tapping arrangement.

- 2 megohm grid leak and mounting.
- General Radio Type 268 vario-coupler.
- Tube socket.
- General Radio Type 247-M vernier condenser .00025 mfd.
- Federal "split-Rheo," 16 ohms.
- Radion panel 7 x 10 inches.
- 2 Radion dials, 3 inches diameter.
- 4 Fahnestock clips.
- 2 switch points.
- 2 stop points.
- Eby binding posts.
- 4 lengths bus-bar for connections.

Fig. 1 gives the front panel view. Mahogany pane and dials were employed for the sake of appearance, with rheostat knobs to match for the rheostat and the switch lever, these replacing the knobs supplied with the instruments. Tuning is done with the left hand dial and regeneration is controlled by the right. The switch is moved to the right for Range No. 1, where wave lengths between about 360 and 650 meters may be reached. With the switch at the left, the second range is in use, and the condenser covers stations from 180 to 400 meters. The G. R. coupler has 80 turns on its outside winding, with one binding post for connection to the middle. Any other coupler may be similarly arranged by connecting the entire winding, or 80 turns of it, as the entire secondary coil, and providing a tap at the center. The variable condenser is the .00025 mfd. size, having 14 plates. Any variable from 11 to 15 plates will do, however. Note the type of vernier provided: a large gear with smaller gear and external knob. This is the form of vernier desirable—and do not attempt to use this circuit without a vernier of some kind, for it will be almost impossible to set the condenser just right with the large knob. The vernier must not be of the type including an extra plate or a small condenser on the end, for this upsets the dial settings of the large dial. Stations will then not come in at the same dial reading time after time and tuning will be very much confused. The vernier should be a friction or geared arrangement which moves the entire set of movable plates.

The bottom view, Fig. 2, illustrates the placing of (Concluded on next page)
Change Your Single Circuit to This

the coupling coil—just inside the grid end of the vario-coupler winding. The four clips on the hard rubber strip are, from left to right, “B” plus, “B” minus, “A” plus, “A” minus and some of the wiring may be followed from Fig. 3. The binding posts at the lower left are for the phones, while those at the right are for ground and aerial. Note that the ground is connected to the plus “A,” and it is to this point that the return lead from the antenna coupling coil comes.

The coupling coil is made by winding 15 turns of double covered wire about No. 22 in size, on a cylinder slightly smaller than the inside of the vario-coupler’s outer tubing. The turns are then held together, “bunched” you might term it, and placed inside the tubing. There they are allowed to spring apart till they fit inside the tubing snugly. Then two or three wraps of tape are placed on the coil to hold the turns together and it is replaced in the coupler, at the grid end. Be sure to get the coupling coil at the end which contains the half of the secondary coil which is in use no matter which way the double contact switch is thrown.

Fig. 3 gives the circuit diagram in conventional style, and this carries its own message. The circuit delivers a great deal of volume from local stations, and if you live within 15 miles of them you will find that you can work your loud speaker to some extent on just the single tube. A power tube such as the 216A or even the 201A gives very good volume. As far as DX is concerned, there is little difference between storage battery tubes and dry cell tubes, and the UV199 operates excellently. Except in the case of a soft detector tube, use a 45-volt “B” battery.

The antenna should not have too high a capacity, and a single wire 80 to 100 feet long operates very well. Its capacity may be kept low by elevating it ten or twelve feet above the roof and keeping the lead four or five feet out from the wall on the way down. This is done so that the “natural” period of the antenna circuit (which includes the coupling coil) may be lower than 200 meters. Otherwise its absorbing effect at its fundamental may interfere with regeneration on that wave length.

With the switch thrown to the right to include the entire secondary coil, the circuit will function much like the ordinary receiver, although it will tune considerably higher. For instance, on the set illustrated, 600 meters comes in at 85, KSD is heard at 66, KYW at 62½, WWJ at 58, WEAF at 51, WMAQ at 38½, WDAR at 23, WHN at 18½ and KDKA at 12. Move the switch over, and you’ll get WOR at 91½ instead of at 27½ on the upper range. Tune lower and WHN comes in at 67. Here’s what you should notice—on the upper range there are just 9 dial degrees between those stations.

If you want something simple and selective to the point of utmost gratification, try it. And withal, you’ll have a high class receiver in which the setting of the regeneration dial doesn’t have to be changed more than five degrees for the whole scale from 180 to 650 meters!

[Readers are advised to add Thompson’s Neutrad Unit to this circuit. Full constructional data and diagrams were published in Radio World, issue of May 3.—Technical Editor.]

14 New Stations in Class B Soon

Plans have been made for the erection of at least fourteen new class B broadcasting stations.
Valuable Tips on Choice of Tubes

Suit the Tube to the Circuit

Choose the tubes for which set is designed to operate best. If the type of tube is changed, make necessary changes in apparatus where desirable or essential, usually the transformer and neutralizer size, or do not expect equivalent results.

A tube designed only for audio amplification will not serve well as a radio amplifier, but a radio amplifying tube can be used for audio frequencies.

Dry cell operation, such as the UV199, is practical and very satisfactory in low stages. Large volume requires larger tubes, as 201A, Western Electric, UV202 or equal. Standard base tubes are preferable, as replacements can be obtained most anywhere, as wanted.

If possible, test each tube on an actual set in operation before purchase, or have a dealer make an instrument test for you, to show that plate current changes properly with change in grid potential applied.

By P. E. Edelman

The C battery is used to apply initial negative potential to grid and is not needed in detector connections, many radio amplification stages nor any low audio stages. It is only when the plate voltage is increased that a C battery becomes useful, and manufacturers give tables of C battery for different plate voltages. With 199 tubes, C batteries are not needed below 44 volts plate voltage, but up to 100 volts will be needed. The UV201A type tubes work well without C battery when 80 volts or less B battery is used, and up to possibly 100 volts. The IR drop across the rheostat included in the negative side of the filament circuit applies sufficient negative grid current. For some reflex stages, a negative C battery is not desirable, as stabilization depends on the audio variation current.

Do not connect a WD12 tube to a set using six-volt A battery unless you increase the rheostat to a value of 20 ohms maximum. Label the binding posts of your home-made set correctly so as not to get the B battery across the filament of the tubes, as thousands of tubes are burned out that way. Do not connect B battery until you have first connected A battery and lighted filaments without applying B battery.

In considering tables of tube characteristics, mutual conductance is an important guide to the performance of the tube as an amplifier. The amplifying factor is less important to consider in choosing an amplifier. For detection, a large change of plate current unilaterally with small change of grid current is wanted, whereas in amplifying a similar change of plate current corresponding to grid potential variation is wanted, without unilateral or rectifying effect. That is a reason why combination circuits using simultaneous detector and amplifying action are usually not so clear as when the functions are separated in different tubes.

**AMPLIFIER RATINGS**

(AVERAGE, MFG. FIGURES)

<table>
<thead>
<tr>
<th>Type Tube</th>
<th>Plate Volts</th>
<th>Amplification Factor</th>
<th>Mutual Conductance (Microhms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV199</td>
<td>60</td>
<td>6.2 to 6.3</td>
<td>315</td>
</tr>
<tr>
<td>DV199</td>
<td>60</td>
<td>6.2 to 6.3</td>
<td>300</td>
</tr>
<tr>
<td>UV199</td>
<td>80</td>
<td>6.2 to 6.3</td>
<td>300</td>
</tr>
<tr>
<td>DV199</td>
<td>100</td>
<td>6.2 to 6.3</td>
<td>300</td>
</tr>
<tr>
<td>W11</td>
<td>45</td>
<td>6.75 to 7.60</td>
<td>450</td>
</tr>
<tr>
<td>DV1</td>
<td>45</td>
<td>6.75 to 7.60</td>
<td>450</td>
</tr>
<tr>
<td>W11</td>
<td>70</td>
<td>6.75 to 7.60</td>
<td>450</td>
</tr>
<tr>
<td>W11</td>
<td>90</td>
<td>6.75 to 7.60</td>
<td>450</td>
</tr>
<tr>
<td>UV201A</td>
<td>90</td>
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<td>345</td>
</tr>
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<td>UV201A</td>
<td>120</td>
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<td>345</td>
</tr>
<tr>
<td>UV201A</td>
<td>160</td>
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<td>345</td>
</tr>
<tr>
<td>UV201A</td>
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</tr>
<tr>
<td>UV201A</td>
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<tr>
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<td>345</td>
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<tr>
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<td>400</td>
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</tr>
<tr>
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<td>6.5 to 6.6</td>
<td>345</td>
</tr>
<tr>
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<td>600</td>
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<tr>
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<td>700</td>
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<tr>
<td>UV201A</td>
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<tr>
<td>UV201A</td>
<td>900</td>
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</tr>
<tr>
<td>UV201A</td>
<td>1000</td>
<td>6.5 to 6.6</td>
<td>345</td>
</tr>
</tbody>
</table>

(*) Best all around amplifiers for radio, audio or reflex.

RECEIVING SET aboard a Pennsylvania R. R. train.

(PHOTOS BY FOTOGRAFMS) EXTENSIVE tests are being conducted by members of the American Radio Relay League, who are operating under Federal licenses in conjunction with the Pennsylvania Railroad. The object is to determine the availability of radio telegraphy for transmitting messages other than train dispatches should trouble develop over the usual wire lines. The tests proved highly successful, and radio was demonstrated as practical for the purpose. Above photo shows the cage antenna system on top of a railroad car. The photo at the right shows the experimental installation in the club car of the train. Constant communication was had with the transmitting station, regardless of the moving of location. Besides being available for the handling of train orders and passenger messages, the set is able to furnish entertainment for the entire train. This is especially desirable on long overland trips when the tiresome journey hours are held no joys for the jaded traveler.
Untuned RF in a Regenerative Set

By N. N. Bernstein
Technical Editor

The single circuit regenerative set, when operated by the novice, is very often allowed to oscillate. That is, the operator tunes in by means of the broadcasting station’s carrier wave, which can only be heard when the tube is so adjusted that a slight hiss and whistling noises are audible in the ear phones. When the circuit is in such a state, it is in effect a miniature transmitter of radio waves.

Radio users have often condemned the “squeal boxes” or single circuit sets, when, in the midst of a nice program, some neighbor with such a set starts to tune in by first finding the carrier wave. The wavelength of the energy transmitted by the interfering set is the wavelength its operator is tuning on, therefore, should Mr. A be listening in on WEAF on 492 meters, and Mr. B next door tunes in on WEAP’s carrier wave, Mr. A will hear all manner of squawks, howls, whistles, groans and scratchy noises until Mr. B gets off the wave.

There is a good method for stopping this interference, and at the same time improving the range and volume of the single circuit outfit. By the addition of one stage of radio-frequency amplification, which can be done at comparatively small cost, a muffler action is placed on the oscillations emitting from the detector tube and the energy is prevented from getting out to the antenna.

Fig. 1 shows the complete wiring diagram of a regenerative set with the addition of one stage of untuned radio-frequency amplification. The parts needed for the added stage are:

- One tube
- One rheostat
- One 45-volt B battery
- One socket
- One 50-turn honeycomb coil or 35 turns No. 22 wire on a 3” tube
- One 400 ohm potentiometer

These parts may be mounted on a baseboard or in a small cabinet 6” x 6”. The only adjustment necessary on the RF stage is the potentiometer, which can be set where best results are obtained and left there for most stations.

In wiring the set, the antenna is connected to one side of the coil and to the grid of the first tube. No grid condenser or leak is used here. The ground is connected to the other side of the coil and to the center or switch arm of the potentiometer. The end binding posts of the potentiometer are connected directly across the filament leads going to the first tube. This does not short-circuit the battery, as the resistance of the potentiometer is so high as to allow only a trifling amount of current to pass. The rheostat is connected into the negative A battery lead. The variable condenser which is already in the original set is connected as follows: One end of the primary of the coupler, which is connected to the grid condenser and leak, is wired to the rotor plates of the variable condenser and to the plate of the first tube. The stator plates of the condenser are connected to the positive A battery lead. The other end of the primary is connected to the 45-volt positive tap of the added B battery. The minus of this new B battery is connected to the plus of the original 22½-volt battery. The secondary of the coupler, or tickler, is connected to the detector tube plate at one end and to the ear-phone binding post at the other. The remaining ear-phone binding post is wired to the 22½-volt tap on the 22½-volt B battery. A small fixed condenser of 0.001 mfd. may be connected across the phone posts for improving the tone of the music received.

Aerial for Portable

A good way of making antenna and ground connections when in the country or woods with a portable set is to drop a few feet of bare wire into the river or lake for the aerial. A sort of counterpoise for this is a large spike or piece of iron pipe connected to another piece of wire driven into the soil five or ten yards from the bank. With sets that use a loop this method brings fairly good results. The set should be set on a dry box so as to be well insulated from the ground.
Completing Super-Heterodyne

By J. E. Anderson

PART IV.

THERE is a quite simple method of adjusting the transformers, which may be used in case a wave meter is not available. This, however, requires that the set be in actual operation and that a signal is coming in. The method is entirely satisfactory and is always available, and it has the advantage that no extra testing equipment is necessary, except possibly, for convenience, three variable air condensers. Have them in parallel with the condensers C, C, and C. Set them all at zero. Now tune in the circuit until a signal is heard. There will be two distinct points on the C dial which will give the same signal. The distance between these points is a measure of the frequency to which the three transformers E, E, and E are tuned. If the capacities of the auxiliary condensers across the secondary windings to protect them from crowding the transformers. If the other types of construction be used, the length may be from 0.015 inch. In that case either the baseboard or the panel must be about twice as wide. Before purchasing the cabinet, baseboard, and panel, lay out all the parts on a piece of paper and decide on the proper sizes for the panel nad baseboard, and which type of assembly is the most suitable. Arrange the panel layout as nearly symmetrical as possible without sacrificing good electrical layout. Similarly arrange the baseboard, taking into consideration the panel layout already decided. The three tubes which support the tuning coils should be mounted with their axes mutually at right angles as near to their respective condensers as is practicable. The three intermediate frequency transformers should also be mounted with their axes mutually at right angles. Similarly, the audio frequency transformers should be mounted with their axes very close together. This, however, is not essential because the magnetic flux outside the iron cores is negligible. It may want to make the cabinet moderately long and arrange the parts in two rows, one back of the other. Any of these methods may be made to suit the individual taste. The last method will be shown in detail below.

No matter in what way it is decided to assemble the receiver, sufficient room must be allowed for the various parts. Do not crowd the apparatus. Allow from four to six inches for each of the three high frequency stages, at least four inches for each of the three intermediate frequency stages, and somewhat less than that for the two audio frequency transformers. This refers particularly to the transformers. If the circuit is built in a long cabinet, 36 inches is the minimum length that may be used without crowding the transformers. If the other types of construction be used, the length may be from 18 to 24 inches.

The grid terminals which were left on zero. The transformers are not to be left, but are merely used as an aid in tuning, gradually reducing their capacities until one is on zero. Remove a few turns from the coil across which this condenser is connected, and tune again. The settings of the other two condensers will now be nearly zero. Continue this process of removing turns from the first coil until two of the condensers are on zero while one is still above zero. Now remove equal number of turns from both condensers, and the two until the second condenser is also on zero. The transformers are then in tune with the same frequency, and the auxiliary condensers may be removed. Any differences in the setting of the capacities of the three condensers may be neglected, so the coils may still be considered in tune with the same frequency after the condensers have been removed.

The smaller grid return leads will not be necessary for the receiver, as the shield may be placed between the common post on the sub-panel and the ground bus bar. The shield may also be placed between the circuit from the rest of the receiver. One shield must be placed back of the panel to eliminate body capacity. Another shield should separate the oscillator from the rest of the receiver. One shield may also be placed between the radio frequency part of the circuit and the intermediate frequency part. The shielding material is sheet copper, brass, or aluminum about 1/16 of an inch thick. But if the proper tools for working this material are not available then copper or tin foil may be employed. The thicker the foil the better will be the shielding.

The leads must be cut holes in the metal big enough so that mounting screws and condensers shafts do not touch it anywhere. Where wires which type of assembly fail to make large holes so that the wires may be kept away from the metal. The best shielding material is sheet copper, brass, or aluminum about 1/16 of an inch thick. But the proper tools for working this material are not available then copper or tin foil may be employed. A one inch should be regarded as the minimum distance allowable, and this should be measured from the nearest.

(Continued on next page)

U.S. Airs Broadcasting News for Business Men

THE Federal Government has taken advantage of radio as a means of disseminating information calculated to be of interest to business men, exporters, producers and farmers throughout the United States. Today, 20 broadcasting stations are carrying items on domestic and foreign commerce, 131 stations broadcast weather reports every day, and 85 transmit market reports at least once daily, in practical territory.

The broadcasting of the weather and market reports is well known to most farmers who own radio receivers, or who listen in on the broadcast of the Foreign Trade Division of the Commerce Department to keep commercial men informed as it will give the finished receiver a much better appearance, and it will remove all batteries and battery leads to the rear.

A suitable arrangement of the binding posts on the sub-panel is as follows: Look at the rear of the cabinet, the right hand end of the sub-panel, then in turn, the common, or negative post, the positive A the 60 volt B. The distance between them may be from one to one and a half inch.

The receiver must be carefully shielded. One shield must be placed back of the panel to eliminate body capacity. Another shield should separate the oscillator from the rest of the receiver. One shield may also be placed between the radio frequency part of the circuit and the intermediate frequency part.

KGO wires under Bay Tap studio in San Francisco

The Pacific Coast broadcasting resources of KGO, the Pacific Coast station of the General Electric Company at Oakland, Cal., have been greatly increased by the introduction of a new Broadcasting studio at the Hotel St. Francis. Ground wires under San Francisco Bay connect the San Francisco studio with the control room and power for working the broadcasting apparatus is at longer need to be provided for San Francisco artists to travel to Oakland to fill a radio engagement with KGO.
Tuning Directions for “Super-Het”

(Continued from preceding page)

point of the windings. This may not be
pointed out in all cases, but if it is not
observed, the losses in the metallic shields
be mounted as far from the shields as
possible. One inch should be regarded as
the minimum distance allowable, and this
should be measured from the nearest
may be excessive, thereby cutting down
sensitivity and selectivity.

After a satisfactory layout for the
panel and baseboard has been decided
upon, proceed with the drilling of the
panel. First lay it out carefully on a
piece of strong paper the exact size of the
panel. Measure the apparatus that
are to be mounted on the panel and transfer
the dimensions to the paper. When
this has been done check carefully and
clamp the paper to the panel. Mark the
panel with a sharp instrument where a
hole is to be drilled. Remove the paper
template and check again to make sure
that all marks are at the correct places.

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clamp the paper to the panel. Mark the
panel with a sharp instrument where a
hole is to be drilled. Remove the paper
template and check again to make sure
that all marks are at the correct places.

Accuracy is essential. Now deepen the
marks with a center punch and drill.

In drilling use a drill which allows con-
siderable clearance for rotating parts, and
hold the drill at right angles to the panel.

Mount condensers, jacks, rheostats etc.
onto the panel. Attach the panel to the
baseboard and arrange the parts that go
on the baseboard in the most suitable
manner, mounting shields where they are
to go.

When the wiring has been finished go
over it carefully to make sure that it has been
done correctly. Connect the fila-
ment battery and insert the tubes in the
socket. See that they all light and that
the three rheostats function properly. If
they do not, find out where the open
circuit is and mend it.

Now connect the plate battery. First
connect the positive and then tap the
negative terminal post with the nega-
tive lead from the
battery. The tubes should not become
red hot. If they do not, it is safe to
make the negative connection perma-
nent. If they do, it is necessary to
ascertain whether the plate potential
reaches the various plate binding posts on
the tube sockets. This may be done by
merely touching them with the finger,
provided contact is also made on
the other side of the
battery. If the high
potential does not reach all sockets there is an
open circuit which must be attended to.

If you have a buzzer these tests may
be made without using the batteries. The
buzzer may also be used for testing the other
parts of the circuit—testing the con-
densers to see whether they are open or
not. By tuning the grid circuit of a
receiver to the frequency of the
buzzer, the buzzer may be heard. This is
done in exactly the same way as a neutrodyne
receiver is neutralized.

It is connected between the
grid of the muffler tube and tap
of coil
. One point will also be found on the
dial of this, where the sig-
als are a maximum. This condition is found
due to the variation in
the metallic shields
that are employed for the purpose.

Should the signals from the local sta-
tions become too strong for comfortable
reception on either the headset or the
loud speaker, the volume may be reduced
by detuning condenser
, and by turning
down the amplifiers, especially those of
the intermediate frequency transformers.

Cables may be used to prevent oscil-
lations anywhere in the circuit due to
stray feed-back, notwithstanding careful
shielding and placing of coils, special ad-
justments must be made. Chief of these
is the neutralizing condenser
, which
may be used to prevent oscillations in
the muffer tube. This is done in exactly
the same way as a neutrodyne receiver is
neutralized. It is connected between the
grid of the muffer tube and tap of coil
. This adjustment is made as
nearly as possible, but not nearly as strong.

This energy reaches the grid of the modulator through the
connections between the muffer tube and the leads to
that tube. It is this capacity that must be
neutralized. This is done by adjusting
the condenser
, until the signal
is reduced to a minimum. When this has
been done to complete the adjustment, and clamp it so
that it will not move.

The first tube may now be lighted, and
the signals permitted to pass through in
the usual way. No oscillations should now
occur in that tube. But if there is still
a tendency to oscillate for certain settings of the
condensers, the filaments may be
turned down a little, which should stop it.

An additional simple way of tuning the
intermediate frequency transformers to the
same frequencies to use such
such as that which is shown in Fig. 10.
This circuit consists of two identical
oscillators in which two of the trans-
formers are tested and are adjusted
through the
oscillations.

Since the transformers have been
made as nearly alike as possible, and since
the two oscillators are used for
modulation by the oscillators will be
very nearly the same, and they will be
very nearly the same as the frequencies
from which the transformers are
efficient when used as such. Ordinarily
the difference will be low enough so that
the beat current formed by the modulation of
the
will be audible in the
antenna.

This difference is due to the variation in
the distributed capacities of the circuit
and the coils, to the deviation of the con-
densers
from their rated value, and to
small variations in the inductances of the
coils.

The variable condenser
, shown be-
(Concluded on page 26)
It Is the Patriotic Duty of All Citizens to Have a Radio

By hearing candidates a better appraisal of their character can be made than by just reading what they say. It is possible for only a minor percentage of the voters ever to see the candidates. Our physical vastness has its commanding advantages, but some disadvantages, too, of which this circumstance is one. Swinging around the circuit does not bring a candidate's compass at more than two points of any given diameter. But with the radio circuit that's different! Though you may not see him, you will hear him, and a voice has sometimes altered the destiny of nations. While destiny may tread her even course no matter who is elected, nobody will hear him, and a voice has sometimes altered the destiny of nations. With even the slightest interest in our government would want to miss hearing the candidates on the great political issues of the day. The public interest in the event was newly affirmed by the close attention given to the candidates on the radio circuit. The attention given to the candidates on the radio circuit is one. Swinging around the circuit does not bring.

The right of way of radio to the homes and the hearts of all our people is emphasized by an injunction that this circumscription is one. Swinging around the circuit does not bring the most important task that they have franchised to themselves. All of our people is emphasized by an injunction that this circumscription is one. Swinging around the circuit does not bring.

It will finish in even greater splendor, with laurels newly won and more certainly implanted. The right of way of radio to the homes and the hearts of all our people is emphasized by an injunction that now becomes obvious: It is the patriotic duty of all our citizens to have a radio.

Why the Multi-Tubes?

Why more than three tubes in a set? The question is asked repeatedly. The answer gets little publicity.

A 3-tube set generally means one detector tube and two tubes for audio-frequency amplification, enabling loud speaker operation. Unless regeneration is used, the volume may not be sufficient. If regeneration is used it will probably cause much annoyance to neighbors who have sets, due to radiation resulting from unskilful operation. Therefore a fourth tube is used, serving as a blocking wall against radiation, and usually making the set more selective. That tube is for radio-frequency amplification. Two stages of RF are most popular. Hence we find 5-tube sets in big demand, such as the Neutrodyn. Those who care to spend more money for greater distance-getting buy or make a Super-Heterodyne.

In reflex circuits the crystal is popular as a detector (substituted for a tube) and brings down the cost of the set.

His Super-Heterodyne Employes 8, 9, 11 and Even 14 Tubes

(Wide World)

THIS GIANT RADIO SET was designed and built by F. R. Greene (above), of New York City. It is a Super-Heterodyne operating on either 8, 9, 11 or 14 tubes, arranged as follows: Eight tubes in the Super-Heterodyne, two tubes in an additional audio-frequency amplifier, one step of power amplification and three additional steps of radio-frequency amplification. It uses 25 volts of B battery and two 6-volt A batteries—one of 100 amperes hours, and the other 150 amperes hours. The cabinet is 41 inches high, 3 feet 6 inches long and 16 inches deep. The set requires no ground or aerial, and cannot be operated on less than eight tubes. Distant stations are brought in like locals on the loud speaker. There are 19 dials and switches to operate all told. Mr. Greene would like to hire a few extra pairs of arms for use while tuning in DX.
In reference to the simplified Super-Heterodyne by Mr. White in Radio World for May 17. 1—What are the secondaries of the 30 K.C. transformers connected to? 2—In this circuit, which tube is the detector? 3—Can I use two UV201A tubes, one UV200, one Navy type and two C301A's and in what order should they be placed?—Dr. W. J. Blackford, Mosley Clinic, Newburyport, Mass. 1—The secondaries of the intermediate frequency transformers are connected to the center tap of a 400-cdm potentiometer, as shown in Mr. White's diagram. 2—the fourth tube from the left is the detector tube. In all circuits, the detector is always the one having a full condenser connected to the grid of the tube. 3—You are correct in this! The grid leak can usually be disconnected with a UV200 and the tube should be in the last socket. The grid leak gives a fuller effect in this case is obtained by merely turning the tickler coils or rotors on the couplers, in which case they should give me some general information for making a suitable loop for this set? 6—I am unfamiliar with the symbol shown connected across the filament leads of the second tube in the diagram. 2—What is this potentiometer? 5—Can you tell me which stations I could receive with the symbol shown connected across the filament leads of the second tube in the diagram? 3—Can I use two UV201A, UV200, C301A, and the Navy tube in this circuit, and enable the set to be built for portable use. The first secondary is C, the secondaries being 180-degrees apart.

Join RADIO WORLD'S University Club
And Get Full Question and Answer Service for the Coming 52 Weeks.

RADIO WORLD, 1493 Broadway, New York City:
Enclosed find $6.00 for RADIO WORLD for one year (52 Nos.) and also consider this as an application to join RADIO WORLD'S University Club, which gives me free information in your Radio University Department for the coming year.

Name ...........................................................
Street ..........................................................
City and State .............................................
CARUSO, TENOR (first name Antonio, however, who was discovered in the shipping department of the General Electric Co. at Schenectady, N. Y., by his namesake. Tony has made his first public appearance before the microphone at WGY, Friday, evening of June 12."

"The Sheik" at the Layman."
A Novelty Is Instituted to Stimulate Deeper Interest in Broadcasts

The "scenery" will be "painted" by the announcer, semi-oral fashion. The "curtain" falls at 10:30, though not necessarily to enable commuters to catch their trains.

The novelty was inaugurated Tuesday, June 17, with "A Night With the Conquistadores." In announcing the series, Stuart R. Jackson, chief of the Information Bureau, said:

"Throughout the past year there has been a marked tendency among both radio listeners and the radio press to demand something new and better in broadcasting. From time to time Broadcast Central has presented a more radical change has been considered essential if public interest in broad-casting is to be maintained, particularly during the summer season."

The ensuing program of this feature follows:

Thursday, June 19, "A Night Out of the Past."
Friday, June 20, "Sport."
Sunday, June 22, "A Night at the Opera."

[Readers of Radio World who listen in on these broadcasts and who have an interest in their opinion of these programs, should address Program Editor, Radio World, 1483 Broadway, New York City.]

**Note:** This text is a continuation of the previous pages and appears on page 18.
PRETTY MAE SCHNITZER hit upon this novel idea of providing a small loud speaker. A single headphone was used in place of the double set and one of those small metal horns used for portable phonographs was fastened to the phone cap. Under good conditions sufficient volume can be had to supply dance music, but if the terpsichorean couples demand a regular loud speaker, why blame Mae? The small horn, although unable to amplify the earphone signal with great volume, nevertheless suffices for ordinary purposes such as the camping tent or on a canoe. It wouldn't be a bad idea to have two of these small horns, one for each phone.

ONE of the most urgent needs on the waterfront in New York was a loud speaker that would reproduce music faithfully, yet would be able to compete with the fog-horn competition from ships plying the harbor. This has been accomplished, says Paul De Kidschichsky, a New York inventor, commenting on his efforts. The photo shows a demonstration on the roof of a building in lower Manhattan. The result was tried out on auditors who stood on the sidewalk.

SUMMER fashion hint for the girl radio fan—Miss Helen Dickinson, of New York City, suggests that all girl radio fans wear some kind of a radio insignia this summer. She has started the idea full blast by wearing this miniature loose coupler on her ring. It is a real loose coupler and it works. The wire with which it is wound is extremely fine and can tune from 200 to 600 meters. The base and coil ends are fashioned of genuine ivory, and the whole mounted on a gold ring.
Tests in New York City

RADIO played an important part in an Army Lawn Fete at Governors Island, New York. Through special loud speakers on the rooftop the various events were announced. Between features the auditors heard music picked up by receivers and amplified. This is the first time the stunt has been done in Army circles in this particular way.

SUCCESSFUL tests were made for transmitting and receiving messages and voice with a set located in solid steel U. S. war tanks.

Navy's Best Sea Aerial

ABOARD Uncle Sam's newest light crusier, the Trenton, are the Navy's best receiving and transmitting antennas. Several antennas of the cage type, of different sizes, are strung from end to end of the craft from the top masts. All those knobs on the guy wires are circuit-breakers or insulators, to prevent the steel guys from picking up the energy from the antennas and radiating the signal on another frequency. This also prevents undue absorption of transmitted energy by the surrounding objects.

RADIO livens up the lunch hour period for the construction gang on the world's largest suspension bridge, now being built over the Hudson River between Bear Mountain, the popular summer resort, and Anthony's Nose.
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"A Double Range Three-Circuit Tuner," by Brainard Foot (Illustrated).  Page 6

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"Completing the Super Heterodyne," by J. Anderson.  The final instalment of a four-part article.  Page 10

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NEXT WEEK WILL BE PUBLISHED AN EYE-OPENING ARTICLE BY B. J. BORGART, DESCRIBING HOW TO BUILD A 1-TUBE SUPER-HETERODYNE. TWO OF THOSE FOUR TUBES ARE FOR THE ANTENNA CIRCUIT. WHAT DETERMINES ITS LOCATION? HOW IS IT DONE? HOW GOOD IS THE SELECTIVITY AND DISTANCE? MR. BORGART EXPLAINS FULLY AND DWELLS ON THE NOVEL METHOD BY WHICH HE ACCOMPLISHED THIS FASCINATING FEAT. THE ARTICLE IS ILLUSTRATED WITH FIVE DIAGRAMS AND GIVES COMPLETE TECHNICAL DETAILS, INCLUDING MINUTE ASSEMBLY DATA. CONSTRUCTION IS SIMPLE.

Another feature in next week's issue will be "The Improved Ultra Reflex." Radio World's unique circuit brings into play the selecting property of one stage of RF and one of AF reflected in the second tube, and a straight second stage of AF, crystal detector by use of which the undesired lines are eliminated.

P. E. EDMELAN, IN THE SAME ISSUE, WILL CONTRIBUTE AN AUTHORATIVE ARTICLE ON "THE SHORTEST AERIALS FOR VARYING PURPOSES, INCLUDING THE UTMOST DISTANCE RECEPTION." THE ARTICLE WILL BE ILLUSTRATED WITH 18 DIAGRAMS.

Programs

Monday, June 23 (concluded from page 15)

WWJ, Detroit, 517m (568k), E. S. T.-10:25 A. M., weather forecast. 11:15 A. M., Arlington time. 12 noon, Detroit News orchestra. 3:30 P. M., baseball scores. 3:45 P. M., weather forecast. 8 P. M., Ambassador Cocoanut Grove orchestra.

WCAE, Pittsburgh, 462m (650k), E. S. D. S. T.-11 A. M., Adrian garden dance program. 3:30 P. M., Mount Royal Orchestra. 4:30 P. M., dinner concert from William Penn Hotel. 4:45 P. M., Mount Royal orchestra.

WCAW, Oakland, 312m (960k), E. S. D. S. T.-4:50 P. M., baseball scores; weather forecast; market report. 7 P. M., Melrose concert. 8 P. M., "School Days," a one-act play.

KWJ, Detroit, 517m (568k), E. S. T.-10:25 A. M., weather forecast. 12 noon, Detroit News orchestra. 3:30 P. M., baseball scores. 3:45 P. M., weather forecast. 8 P. M., Ambassador Cocoanut Grove orchestra.

WCAE, Pittsburgh, 462m (650k), E. S. D. S. T.-4:30 P. M., baseball scores; weather forecast; market report. 7 P. M., melrose concert.

KWG, Portland, Ore., 492m (615k), E. S. T.-11:30 A. M., weather forecast. 3:30 P. M., talk by Jean- nce in Central time. 5:30 P. M., baseball scores; weather forecast; market report. 7 P. M., music by George Olson's metropolitan orchestra.

KGO, Oakland, Cal., 312m (960k), E. S. T.-4 P. M., short musical program; address, "Creative Ex- pressions in Music," by Paul Kramer. 5 P. M., music by Consolidated Concert Orchestra of the Hotel St. Francis. 6:45 P. M., baseball scores; 7 P. M., Central time. 9 P. M., "School Days," a one -act play.

WHAS, Louisville, Ky., 400m (750k), C. S. T.- 4 P. M., selections by Alamo Theatre orchestra; when they so designate their desire for music, they play radio. 8 P. M., baseball scores. 9 P. M., program by Walnut Theatre orchestra; latest news bulletins. 9:30 P. M., baseball scores; weather forecast; market report. 11 P. M., baseball scores. 12 noon, Detroit News orchestra, 3:30 P. M., baseball scores. 3:45 P. M., weather forecast. 8 P. M., Ambassador Cocoanut Grove orchestra.

KFI, Los Angeles, 640m (44k), E. S. T.-10 P. M., L. A. Church Federation service. 4:30 P. M. C. M. Central time. 6:45 P. M., baseball scores. 7 P. M., Central time. 9:45 P. M., baseball scores. 10 P. M., baseball scores. 11 P. M., baseball scores.

WOA, Omaha, Neb., 525m (376k), C. S. T.-5 A. M.5:15 A. M., children's story hour by Arion Trio; course in agriculture, Spanish, music, economics, and literature. 6:45 P. M., baseball scores. 9 P. M., weather forecast. 11 P. M., baseball scores; weather forecast; market report. 12 noon, Detroit News orchestra. 3:30 P. M., baseball scores. 3:45 P. M., weather forecast. 8 P. M., Ambassador Cocoanut Grove orchestra.

KPO, San Francisco, 423m (116k), P. T.-2:30 P. M., organ recital by Theodore J. Irwin. 4:45 P. M., baseball scores; weather forecast. 11 P. M., baseball scores. 11 P. M., base- ball scores; weather forecast; market report.

Tuesday, June 24

WOAW, Miami, Fla., 575m (294k), C. S. T.-5 A. M.5:15 A. M., children's story hour by Arion Trio; course in agriculture, Spanish, music, economics, and literature. 6:45 P. M., baseball scores. 9 P. M., weather forecast. 11 P. M., baseball scores; weather forecast; market report. 12 noon, Detroit News orchestra. 3:30 P. M., baseball scores. 3:45 P. M., weather forecast. 8 P. M., Ambassador Cocoanut Grove orchestra.

KPO, San Francisco, 423m (116k), P. T.-2:30 P. M., organ recital by Theodore J. Irwin. 4:45 P. M., baseball scores; weather forecast. 11 P. M., baseball scores. 11 P. M., base- ball scores; weather forecast; market report.

WFN, Harrison, 480m (44k), E. S. T.-2 P. M., "School Days," a one-act play.

WFAA, Dallas, Tex., 475m (276k), C. S. T.-12:30 P. M., recital by the Sympoation Jack-rabbits orchestra.

Who Is America's Most Popular Radio Entertainer?

Everybody is interested in this query: Who is America's most popular radio entertainer? You have your favorite. Who do you know your choice, whether a comedian, an opera singer, a jazz band, or a story-teller.

RADIO WORLD wants to be able to tell the world the name of the entertainer who stands highest in the regard of listeners.

Use the accompanying blank and mail to Broadcasting Manager, RADIO WORLD. Cut off. Fill out. Mail today.

BROADCASTING MANAGER, RADIO WORLD

1483 Broadway, New York City.

Dear Sir: My favorite entertainer is ______ Station ______ Name ______ Street Address ______ City and State ______

Yearly subscribers for RADIO WORLD may, when sending in their $6.00 for a yearly subscription, vote the entire fifty-two issues in advance for their favorite entertainer, whether a comedian, an opera singer, a jazz band, or a story-teller.

RADIO WORLD will be published a tally showing H. M. Snodgrass, of WOS, Jefferson City, Mo., leading. Another tally will be made and published in an early issue.
Coolidge and Dawes, as Radio Fans, Hear Selves Nominated—Elaborate Installation at Cleveland

CLEVELAND.

The broadcasting of the Republican Convention that nominated Calvin Coolidge for President and Charles G. Dawes, of Illinois, for Vice-President, was a complete success.

It was the first time a Presidential convention was broadcast. Fifteen stations put the convention on the air and millions heard the speeches and votes.

Elaborate preparations had been made for the broadcasting.

In addition to sending the speeches broadcast by radio, the American Telephone and Telegraph Company is furnishing a running commentary on the convention, delivered by Graham McNamee, one of the best known of its announcers. Mr. McNamee was stationed in a glass sound-proof booth erected on the right side of the stage directly under the proscenium arch.

There is an elaborate installation which carries the waves to these fifteen broadcasting stations: WRC and WCAP, Washington; WEAF and WJZ, New York; WNAC, Boston; WGY, Schenectady; WGR, Buffalo; KDKA, Pittsburgh; WJAX and WTAM, Cleveland; WLW, Cincinnati; WLS and WGM, Chicago; KSD, St. Louis, and WDAF, Kansas City.

Both President Coolidge and Brig.-Gen. Dawes heard themselves nominated. The President was at the White House, where special amplifiers made every sound plainly audible. Dawes was at the home of his sister, Mrs. Alice Beach, at Marietta, O., the town where he was born.

The rank and file of radio listeners all had the same privilege and opportunity as these two. They heard the result and were thrilled at the enjoyment of listening in on such an important and interesting occasion. They heard the votes cast. Coolidge was nominated on the first ballot—Coolidge, 1,065; La Follette, 34; Hiram Johnson, 10.

Dawes won on the third ballot—Dawes, 682; Hoover, 234; William S. Kenyon, 75.

The whole nation responded nobly to the fascinating opportunity to listen in. The broadcasting constituted one of the momentous events in radio history, not only because of the imposing array of personalities connected with it, but because (Concluded on page 23)

ON THE INSIDE—The big room in the Auditorium, Cleveland, constituting the "broadcasting department," was abustle during the entire convention. The work of these men enabled broadcast listeners to "attend" the convention via the ether. Special attention was paid to modulation. The experts worked day and night at their tasks, which were crowned with success, for which the radio fans were thankful.
The Weekly Rebus

Can you decipher this Rebus? Send your answer to Rebus Editor, Radio World, 1493 Broadway, New York City, and mention Rebus No. 6. The names and addresses of those sending in the correct answer will be published, so be sure to write your full name and address very plainly.

The Rebus No. 6 picture is a system of aerial wires suspended in the air—some wires being positive, and some negative, one to another; with no apparent means of conveying the necessary electrical energy. To learn how the current travels from one part of the wave that passes its immediate vicinity, is the reason why some form of collector or detector is necessary. Such is the case, and that is the reason why some form of collector or antenna is used with all radio receiving sets.

Before telling you how the detector works, we first must explain the action of the crystal rectifier, or rectifier, and a pair of ordinary ear phones. Thus we see that the original wave has been changed or rectified to go only in one direction. The received wave is of a very high frequency. The alternating current is changed or rectified to go only in one direction, and out of the ear phones.

In a future article the action of a vacuum tube receiver will be explained.

What Makes it Possible for You to Receive Broadcasts

It is still a big mystery to many as to how it is possible to transmit electrical energy and messages from one place to another, with no apparent means of conveying the necessary electrical energy. To learn how the current travels from one part of the wave that passes its immediate vicinity, is the reason why some form of collector or detector is necessary. Such is the case, and that is the reason why some form of collector or antenna is used with all radio receiving sets.

Before telling you how the detector works, we first must explain the action of the crystal rectifier, or rectifier, and a pair of ordinary ear phones. Thus we see that the original wave has been changed or rectified to go only in one direction. The received wave is of a very high frequency. The alternating current is changed or rectified to go only in one direction, and out of the ear phones.

In a future article the action of a vacuum tube receiver will be explained.

The Radio Primer

Information and Instruction for the Beginner

What's Wrong Here?

Study this Wrong Diagram. Send in what you think is the correct solution. Address Wrong Diagram Editor, Radio World, 1493 Broadway, New York City. Specify Wrong Diagram No. 7. The names and addresses of those sending in correct answers will be published. The following names were among those who sent in correct answers:

WRONG DIAGRAM NO. 3

C. W. Pomroy, 7664 Pershing Ave., St. Louis, Mo.

Wrong Diagram No. 7

A. M. Smith, E. Second Street, Peru, Ind.

Join the A. B. C.

The American Broadcast Club, formed under the auspices of Radio World, has for its object the promotion of the welfare of the broadcast listeners of the United States, Canada, and Mexico.

Membership is open to all interested in radio in any way, whether as broadcast listener, dealer, manufacturer, wholesaler or jobber.

A novel feature of the A. B. C. is that membership entails no duties or obligations whatever. All you have to do is enroll. That will signify your interest in radio and make you one of the thousands unselfishly united in a common interest.

NEW MEMBERS

Charles H. Peterson, dealer, 176 Hopkins Ave., Jersey City, N. J.

Don Bunner, Box 178, Pleasantville, N. Y.


B. J. Killeen, 34 Indiana St., Wheeling, W. Va.

J. W. Fields, 215 West 13th St., New York City.

A. T. Kline, Box 178, Pleasantville, N. Y.

Robert V. Ayers, Box 174, Sparksville, Cal.

Don Bunner, Mentone, Ind.

E. F. Jones, 215 East 13th St., New York City.

Leo Burnes, 193 Montague St., Brooklyn, N. Y.

F. A. Siravatka, 2218 Austin Blvd., Cicero, Ill.

R. W. Fields, 215 West 13th St., New York City.

Leo Burnes, 193 Montague St., Brooklyn, N. Y.

F. A. Siravatka, 2218 Austin Blvd., Cicero, Ill.

C. T. Dunton, 225 East 13th St., New York City.

L. J. M. Smith, E. Second Street, Peru, Ind.

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L. J. M. Smith, E. Second Street, Peru, Ind.
How Frequency Standards Were Fixed

ABOUT 570 radio broadcasting stations are now operating in the United States and the number of such stations constantly increasing through the improvements in receiving and transmitting equipment, what is to prevent the programs from getting hopelessly mixed up? The Department of Commerce has assigned definite wave lengths to the various stations, but then there remains the problem of setting up a practical standard of wave length and holding the transmitter to it.

In the old spark telegraph days "wave length" was a convenient unit, but in these modern times of accurate design "frequency" has been found better. Wave length and frequency are connected by a simple rule: Speed of light divided by wave length equals frequency. Wave length is given in meters; the speed of light is approximately 300,000,000 meters per second, and so for a 400-meter broadcasting station the frequency of the alternating current generated by the oscillator tubes is 750,000 cycles per second.

Currents Are Grouped

This current is called the "carrier," and on it are superimposed "currents." The voice current is really made up of a great many currents having frequencies ranging from 100 cycles to 5,000 cycles, and when it is transmitted or modulated on the carrier the result is a group of currents covering the range from 745,000 to 755,000 cycles.

The Department of Commerce has assigned to stations carrier frequencies 10,000 cycles apart. Since each station uses substantially this full range, it has been necessary to develop some accurate and reliable standard with which to check the frequency of the transmitting circuit. Otherwise, the programs of two stations might overlap, or the carriers of the two stations might "heterodyne" in receiving sets and cause a constant and annoying whistle.

Started at Middle

In their search for such a standard, engineers of the Western Electric Company determined to go back to the most nearly constant thing known, the rotation of the earth upon its axis. But this has a frequency of 1 cycle per 24 hours. How could one be used to check up electrical currents having frequencies around 1,000,000 cycles per second?

To solve the problem, says the "New York Times," the engineers decided to start at the middle and work out. If they could produce an alternating current of say, 100 cycles per second, they could make it drive a clock, and by comparing the clock's performance with the Arlington time signals they could determine accurately this frequency. Then by electrical means they could compare it with successively higher frequencies up to the desired amount.

The apparatus devised by the engineers to produce electric currents of known and constant frequencies depends for its action upon the old familiar tuning fork. An alternating current of any desired frequency can be produced from a direct current by means of any device which will vary the direct current in a regular and periodic manner. Because of the regularity of its action, a tuning fork was selected for the controlling device.

The tuning fork used has a frequency of 100 cycles per second, and is kept in motion electrically. A high-impedance telephone receiver is clamped close to each prong of the fork, but without touching it, so that the motion of the prong will affect the magnetism through the receiver coils. Thus the fork can sing into the electrical system. A pair of electromagnets are fastened near the top of the fork, without touching it, in such a way that each prong, in its vibration will pass through the "lines of force" between the poles of one of the electromagnets.

Fork is Vibrated

The fork is made to vibrate by tapping one of the prongs. The vibration of the prongs sets up an alternating current in the receiver, whose frequency is exactly equal to the frequency of the vibrations of the fork. This current, amplified by a two-stage vacuum tube amplifier, is then passed through the windings of the driving electromagnets.

The current is so timed by the amplified circuit that each time the prongs of the fork pass between the poles of the electromagnets they are given a slight magnetic "pull," and so kept in motion. It is apparent, then, that the tuning fork can be kept in motion as long as desired by the magnetic effect of the alternating current whose frequency is determined by the rate of the fork's own vibration. Since none of the apparatus touches the fork changes in its rate will only be caused by changes in temperature or variations in the characteristics of the electric circuit, it is comparatively easy to keep such changes so small that their effect upon the fork will be negligible.

Closes a Circuit

To compare the frequency of the fork with that of the earth's rotation, it is necessary to count the number of cycles of the fork per day. Procedures are in operation which use this frequency as a synchronous motor designed to rotate once to every five vibrations of the fork.

The motor in turn, through a reduction gear and a commutator, closes a circuit once a second, thus driving an electric clock. If the fork makes exactly 100 vibrations every second, this clock will keep correct time. To check its accuracy, the fork-driven clock is compared directly with a high-class laboratory electric clock and with time signals received from Arlington by radio.

The Two Differ

Records of comparisons made over long and short periods of time show that the tuning fork and the laboratory clock differ from each other in rate by about six parts in 1,000,000, and that, compared to the time signals sent out by Arlington, the electric clock is the more accurate. The modern mechanical clock has been developed during several centuries, and one will feel an added respect for American research technique, which has in less than two years developed an electronic time standard to exceed the accuracy of all but the finest chronometers and astronomical clocks.

Frequency standards have a very interesting and important property—that of absolute portability, by means of wire by radio. Currents obtained from harmonics of the tuning fork of the Bell System Laboratories in New York have been transmitted to a number of points throughout North America for checking the calibration of such secondary standards as were more frequently used in the adjustment of communication apparatus. During the installation of the Havana-Key West cable the calibrations of oscillators in Cuba were frequently checked directly against the frequency of the fork in New York.

A TIP ON WIRING A SET

In wiring a set, keep all leads as short as possible, especially grid and plate leads, which should not be parallel.
MR. D. X. HOUND

Radio World's Own Artist Creates An Enjoyable Character

By HAL SINCLAIR

The Radio Trade

Sale of New R. C. A. Sets Is Put at $2,000,000 a Month

RADIO CORPORATION OF AMERICA's report for 1923 showed enormous increase in operations over the three years to be as follows:

1923 1922 1921
Gross Income $ 436,394,789.58 $ 248,630,856.76 $ 148,164,442.52
Gen. Oper. etc. 21,831,093.93 12,126,464.71 7,762,331.48
Other Income 176,041.11 270,187.72 28,166.65
Net Income for Year $ 413,529,666.52 $ 234,275,814.92 $ 145,674,685.69

The rapid increase from three local to 600 stations scattered across the country changed the demand from one class of equipment to altogether another class. Conditions like these usually happen in the first three years of any new industry. A large sales force is in charge of distributing the new line of sets that was developed for this market. These sets are being manufactured on a large scale, but were not adaptable to the changed conditions in broadcasting.

An effort was made to dispose of a large portion of these sets in the South American market without success and they were returned. The climax came early last summer when this material was dumped on the market at which we understood to have been a loss of more than a million dollars. By this time the tube production began to rise so that the last four months of the year was very profitable. All this time the sets that were being offered were not up-to-date and the company's engineers were concentrating on a new line of sets ranging in price from $35 to $425. These sets were offered to the public on April 1, 1924.

April of this year will be the first month to show the sales of new sets which we learn amounts to about $100,000 a day or approximately $2,000,000 a month. This with the tube sales running close to 1,000,000 tubes should bring April sales up to $5,000,000 or about three times that of April, 1923, and more than the gross of the whole company's operation in 1921.

These are big figures, how about profits? It has been said by many that R. C. A. is run by the large electrical concerns who get all the profits and the R. C. A. take all the risk and loss if any. This is not true as the report shows a net profit of $4,737,773.76 on a gross of $26,394,789.58 or 20 per cent on the business handled. True, R. C. A. had to take the loss on sets that became unsaleable. This was due to the manner in which this great business grew. No manufacturer could keep pace with it.

Third Annual Show in New York Nov. 3

THE Third Annual National Radio Show will be held this year in Grand Central Palace during the week of November 3-4. Attendees will be able to see Roxie and his gang at an actual broadcast from the show. R. C. A. (S. L. Rothafel) has consented to take charge of the entertainment program of the show.

Entries are now being accepted for the Continental Electrification Corp. contest which offers $1,500 to the person who can come closest to the actual broadcast. The winning entry will be announced at the show.

Business Opportunities

Radio and Electrical Rates 6c a line: Minimum 3 lines

BUSINESS OPPORTUNITIES

ESTABLISHED IMPORTERS of electrical products with $30,000 investment; unusual opportunity. Box 1, Radio World.

RADIO PHONOGRAPH SHOP, established seven years; low inventory; excellent location; owner has other interests. Box 2, Radio World.

RESEARCH AND DESIGN engineer desires capital connection to start production. C. E. H., 1061 Liberty Ave, Richmond Hill, N. Y.

RADIO OPPORTUNITY, fully equipped factory making high grade receiving sets; owner has other interests; will sell at $8,000; free and clear. Box 3, Radio World.
Coolidge's Message to Smith

A MESSAGE from President Coolidge to Governor Smith of New York, was handled in a practical manner on the occasion of the 300th anniversary of the founding of Albany. The message was to the Naval Communications Service by messenger from the White House at 9:35 A. M., relayed by radio to the airship Shenandoah over New York City, and held by Governor Smith until the airship was over Albany, at 10:30 A. M. when it was repeated through a loud speaker, and reached the ears of the Governor in person.

The Federal Telephone and Telegraph Company broadcasting station WGR, at the Hotel Statler, Buffalo, New York, was in constant contact with the Shenandoah over a radius of fifty miles, maintaining perfect two way conversation. The Shenandoah officers commented on the clearness of WGR station, saying that no repeat was necessary.

Radion Employes Chip In

THE many radio fans who work on Radion panels, dials and other parts in the factories and offices of the American Hard Rubber Company at Akron, O., Butler, N. J., College Point, N. Y., and New York City, have collected $900 which has been turned over to S. L. Rothafel of the Capitol Theatre for use as part of the "Roxie" Fund to equip veteran hospitals everywhere with radio sets.

The success of the Fund seems fully assured since the widespread interest has been developed due to the stirring efforts of "Roxie and his gang" in boosting for it so persistently and consistently over the air every Sunday evening. This will mean that there will be one headset for every veteran in every hospital in the United States and is substantial evidence of the appreciation which the radio listening public has for not only the veteran but for the generous entertainment provided by the owners of the Capitol Theatre enjoyed all over the country.

Coolidge Hears

Self Nominated

WASHINGTON.

PRESIDENT COOLIDGE "listened in" practically all the time the convention was in session. On the day he was nominated he did not go to his executive office during the afternoon because of the keen desire of himself and Mrs. Coolidge to hear the speeches and votes. The only person with them was Henry Long, who was Coolidge's private secretary when Coolidge was Governor of Massachusetts. It was not noticeable that the President became excited when worked up in his office that if he wanted to hear the nominating speech he had better hurry. He methodically put some papers on his desk in his study where the radio had been tuned and was giving out the proceedings.

Eyes Dimmed, Coolidge's Father Listens In

PLYMOUTH, VT.

IN the simple living room where Calvin Coolidge took the oath of office as President Coolidge sat before a radio receiving set and heard his son nominated at Cleveland.

As the cheers which greeted the President's name carried him through the air, the old man's eyes watered, but his nerves were steady and he calmly took out his watch and timed each long round of applause.

Two or three friends also had head sets, and as Chairman Mondell was heard, "the President remarked to them that his voice sounded "just like Cal's"."

When Dr. Marion Leroy Burton in his speech of nomination mentioned some episode of the President's life in Plymouth the father exclaimed, "I wonder how he knew that."

Convention Broadcasting

Profes Big Success

(Coordinated from page 19)

of the scientific accomplishment. Radio was brought still closer to the hearts of the people.

Broadcasting of Convention Aids Radio Business

FIFTEEN of the country's most powerful stations scattered from Boston to Kansas City broadcast the opening session of the National Educational Convention to an audience of approximately 25,000,000 persons, according to estimates. Two New York stations, WJZ, on top of Aeolian Hall, and WEAF, 195 Broadway, were "on the air" with the proceedings from Cleveland at 11:30 a.m.

The key speaker was Representative Burton and selections by Sousa's band were features. WEAF worked on the 492 meter wavelength with WJZ on 455 meters. Other stations in the region were silent, so that no interference resulted.

The radio stations were all connected with the microphones in Cleveland by telephone lines furnished by the American Telephone and Telegraph Company. The convention announcer was Graham McNamee, WEAF's staff, and his voice served all stations simultaneously.

Radio stores throughout New York reported increased business in radio and the demonstration rooms of many of the larger stores were crowded with enthusiastic listening-in on Cleveland.

"ROLLS ROYCE"

Radio Tubes

Like their name, significant of purity, durability and powerful, firing in distance with a maximum of volume and clearness. Bring your order to the nearest jobber, and start the new season equipped with the best.

Type 200—5 volts, 1 amperes

$2.50

Type 199—2-4 volts, .06 amperes

Amplifier and Detector

$1.50

Type 192—3-4 volts, .06 amperes

Amplifier and Detector

$1.50

All Types

$1.50

S-P-E-R-D-Y-N-E

The Circuit Featured by RADIO WORLD

The most satisfactory radio circuit yet developed. Any locality, all conditions. Equal in all respects to five tube Neutrodynes, but more simple to tune and no critical adjustments.

With or Without Ground—Maximum Volume—Perfect Reproduction

Our engineers have developed the coils for this circuit to its highest perfection. Coils for Superdyne (complete with diagram) $6.50

(Note—These Coils have been developed by and are distributed solely by us, and should not be confused with inferior coils.)

Kits consisting of two Flewelling Condensers and complete set of parts $19.50

Complete parts assembled on engraved Radion Panel, and base panel with necessary bus bar ready to wire (diagram and plan furnished) at $65.00

Contrary to usual practice, all parts included in this kit are the very best quality on the market, and workmanship first class.

RESULTS GUARANTEED

Vacation Supplies of the highest quality on short notice Flewelling Condensers in Stock. Mail orders solicited.

WALLACE RADIO COMPANY, Inc.

135 LIBERTY STREET, NEW YORK
Texas Has Greatest Number of Broadcast Stations

The question of the "survival of the fittest" in broadcasting is again before the public, and the Government, for that matter, as radio broadcasting stations are almost as numerons as a year ago, and still increasing. Today there are 584 in operation, whereas the peak was only 591. Practically all wave lengths have been exhausted, necessitating a division of time. Texas is leading with 42 radio broadcasting stations; Pennsylvania is second, with 41; California, which used to be first, has 39; and Ohio is third, with 36. New York and Illinois are tied with 29 each; Missouri has 28, Washington 24 and Iowa 23. Nevada, New Hampshire and Porto Rico bring up the rear with one each, but every state is supplied with one or more stations.

Record Your Radio Stations On RADEX Log Cards to Match Your Set
- Mahogany Finials or Oak Cabinet
- Index Dividers, marks, cards
- A Useful Accessory to Any Set

Send a dime for your copy today!
New Patents Granted

Radio Telegraph System Radiotelegraphy Signaling System


This invention relates to radio telegraphy signaling systems and particularly to a signaling system for use in connection with high power radio transmission stations.

An object of the invention is to provide an efficient and effective signaling system for high power radio transmission stations.

Another object of the invention is to provide a uniwave signaling system for high power stations.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full those forms of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification.

In said drawings I have shown several transmission systems embodying my invention, but it is to be understood that I do not limit myself to such forms, since the invention, as set forth in the claims, may be embodied in a plurality of other forms.

The system of my invention is particularly applicable to a continuous wave transmitting system and in the present embodiment I have shown it in connection with a continuous wave arc generator 3 of the Poulsen type, but it is to be understood that it may be employed with other constant frequency generators of radio frequency current. One side of the arc is grounded and the other side is connected to the antenna 4, through one winding of the transformer 5 and the inductance or main loading coil 6. When the system of this invention is used in connection with an arc radio generator in a uniwave signaling system, a non-radiating oscillatory circuit 7 containing the other winding of the transformer 5, an inductance coil 8, a capacity 9 and a variable resistor 12 is connected across the arc, but this non-radiating circuit may be omitted when an alternator or other constant frequency generator of radio frequency current is used.

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LARGE COIL ANTENNA

Here is a proven idea. Owing to the large coil this type aerial gives better results than the old outdoor aerial especially for reception of weak signals. Any number of low wire staves contained are not obtained by outside aerials.

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The Popular Neodytrum!

This receiver is rapidly becoming the "Old Reliable." A five-tube tuned radio-frequency set that any inexperienced facl can operate.

SEE RADIO WORLD for March 8, 15, and 22 and get all the details which will enable you to build this reliable and powerful five-tube neodytrum outfit. The three copies for 5c, or send five if you send $5.00 for yearly subscription now.

RADIO WORLD, 149 Broadway, N. Y. C.
Completing Super-Heterodine

(Concluded from page 11)

between the condensers C3 is used to tune one of the oscillators to the frequency of the other. It may be thrown either to one side or the other according to requirements. Its value should not be greater than that given by a five-plate tuning condenser. If the beat frequency is increased when this condenser is connected across one of the coils, throw it over to the other side, when the beat frequency should decrease. In order to increase the capacity in this condenser until the beat disappears at the lower end of the musical scale. If it disappears suddenly at a frequency which is above 100 cycles per second, it means that the two oscillators are coupled too closely. Here is where condenser C3 enters. This is a by-pass condenser across the "B" battery and the telephones which decreases the coupling between the two oscillators. Its value should not be less than 1 microfarad. As this condenser is connected into the circuit the sound in the telephones will become much feeble, but the beats may be heard much lower. If they still disappear suddenly above 100 cycles per second, increase still further the value of C3. It may be increased to a point where the beat ceases to be heard as a tone and where the individual beats may be perceived. It is not necessary, however, to use a condenser so large that the beat tone may be heard much below 100 cycles per second.

Before making any adjustments on any of the transformers, insert the third transformer in place of the transformer which tunes to the lowest frequency, that is, the one of the two in the circuit which does not require condenser C3 in parallel. Then tune for zero beat again. This will determine which of the three tunes to the highest frequency. Let us use this as a standard in the test circuit and adjust the other two to meet it. The adjustment is done by removing turns from the two having lower frequencies until the beat tone is about 100 cycles or less. Each turn will increase the frequency about 40 cycles; that is, each turn will decrease the frequency of the beat tone by about 10 cycles.

When these adjustments are being made, condenser C3 should not be connected across either of the transformers, or at the grid circuits of either oscillator. Hence, in adjusting, it is necessary to make a change and then move the hands away, and to make no other changes than those required. Make all leads as short and direct as possible, and make them rigid so that no changes will be introduced. (This should also be observed in connecting the transformers into the intermediate frequency amplifier.) If it is decided to use this method in testing the coils, the apparatus which ultimately will go into the receiver may be used for setting up the test circuit.

TELEDYNE

The most satisfactory radio circuit yet developed.
M-V Teledyne Kit consisting of:
1 tuning inductance mounted on .0025
1 variable unit comprising the R. F. Plate coil and detector grid coil and regeneration coil.

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Mississippi Valley Radio Co.
203 Pine St., St. Louis, Mo.

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back and your money will be refunded.

S & H Battery Supply Co.
41 Neville St., Brooklyn, N. Y.
RADIO WORLD'S University
(Concluded from page 125)
RADIO World for May 17 integrates with other sets while it is in operation. The outfit is the one described by Mr. Caldwell, "2,000 miles on one tube."—C. Layman, 666 Bergen Ave., 19th New York, N. J.

The set you refer to is a one-tube reflex, and when operating does not interfere with other sets.

1. In the Superdyne circuit, as described in Radio World for May 17, 24 and 31, is it advisable to ground the negative filament lead (negative filament) to the ground?—Is the grid leak to be shunted across the grid condenser so that it runs to the negative filament lead from the grid?—Carl H. Lambback, 808 Patton Ave., Des Moines, Ia.

2. In many cases the set works better when the negative filament lead is grounded. It seems that the ground, if that connection improves the working any. Some tubes have been found to work a bit better with the grid leak across the condenser in this circuit, and some when the leak is connected to the negative filament lead.

When the vari-coupler in the Superdyne is assembled, what should the distance be from the first turn of wire to the rotor to the first turn of wire on the stator?—Ernest V. Olander, 1532 Milton St., S. E., Grand Rapids, Mich.

The bottom turn on the rotor is placed approximately on a level with the top turn on the stator. Some experimenters place it a little lower which may give more negative feedback.

Will you kindly republish the improved Grimm Reflex circuit which appeared in Radio World some time ago with the following changes: Using an outdoor antenna with vari-coupler and a variable condenser for frequency amplification. This is to be connected to a double circuit jack, allowing a loop to be plugged in, thereby cutting out the outdoor antenna and using the loop with the same condenser for tuning the loop. Also show jacks after detector and first audio stage. Please show how to connect a C battery in this circuit.—Paul Anderson, Blackfoot, Idaho.

Fig. 18 shows the circuit you want. The fixed condensers C are all 0.002 mfd. The correct voltage for the B battery is about 100. The 400-ohm potentiometer has been connected to the stator plates of the variable condenser and the switch arm to the negative filament lead. The remaining end is left free. A C battery is not advisable in reflex circuits.

I have built the Transcontinental Reflex as described in Radio World, issue of May 3, and find that I cannot get very much volume. Can you give a diagram showing where these two capacitors should be placed?—J. Fuchs, 251 Twelfth Ave., Long Island City, N. Y.

Suggest you go over the wiring carefully and try to shorten all the leads as much as possible. If necessary, move some of the parts so as to enable you to do this. A diagram of the Transcontinental Reflex showing position of all elements was published in Radio World for June 7 in the University Department.

In Radio World, issue of February 23, you described how to convert a double vacuum pentode receiver into a 2-tube reflex. I made this change and am pleased with the way it now works. But the volume seems limited, an unimproved UF201 tube with 90 volts on the plate. My transformers are 5-80 and 3-20. If I can get to do more volume—John Russo, 68 Germantown St., Newark, N. J.

The set you refer to is not much for volume. The best way to obtain great volume with that outfit is to add one stage of straight audio frequency amplification. Also suggest that you use UF201A tubes throughout.

Referring to the write-up in Radio World, issue of May 24, on page 22, please advise me where I can obtain a sketch of the 5-tube reflex, tuned radio frequency circuit mentioned in the last paragraph.—C. H. Dawson, 565 Maryland St., Gary, Ind.

Write to Acme Apparatus Company, Cambridge, Mass.

H O O K - U P S F O R E V E R Y B O D Y — H e n r y ' s M U L T I - T U B E C R Y S T A L A M P ; D I L E T T A N T , S C H O L A R , O R M A S T E R. P r e s s C o m m o n l y P r i n t , 1 4 9 0 B r a d f o r d , N . Y . - C .

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FREE! Descriptive Catalogue on request.

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4248 No. Western Ave.
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This Remarkable Set has Created a Sensation Among Radio Enthusiasts, Beautiful Walnut Cabinet with Special Howard-Neutroformers, Tube Sockets and Rheostats.

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CRAM'S RADIO MAP IN TWO COLORS—The best map of its kind on the market. Mailed for 35c. The Columbia Print, 1493 Broadway, N. Y. C.
Hints on Panel Drilling that Will Save You Trouble

As a sort of warning to prospective builders, the following should be of value. Before you think of drilling your panel, test your instruments out on a test board, using the apparatus you intend incorporating in the finished product. To do this is to save time, money and temper, because, if the set does not work properly after being carefully wired up on the test board, with short lengths of wire, it will not work on the panel. When wiring the test board, use heavy bell wire, or anode, and, make your connections straight and short. Then you can play around with it, and if it does not do the correct results you can determine just what is the trouble beforehand. Sometimes the wrong transformer will show itself, or any of a hundred other little things, or some particular arrangement of the component parts will produce some greatly desired effect, which arrangement can be carried out on the panel and the best results will be gained. Once you place the material on the panel, changing is a bad job, and nine cases out of ten, the apparatus will be damaged in some way.

Furthermore, as often said, always use the best materials and parts. You may save a few meager pennies on a condenser, but you will pay dollars in time and patience when the set is in use. The old motto of "Look after the pennies and the dollars will take care of themselves" does not apply to the purchasing of radio materials. There is a bargain, and there is a most expensive. To be the best, a part does not have to be most expensive, but it must be the best.

China to Have Station That Will Hear U. S.

WASHINGTON

In cooperation with the Radio Corporation of America and with the approval of the Chinese Government the Federal Telegraph Company will soon begin construction of a high-powered radio station, which, when completed, will be able to receive and transmit messages directly between the United States and the more important cities of China. The station is also expected to reach European cities directly.

Crosley Official is Radio Church Soloist

When you tune to the broadcast service every Sunday morning from the Presbyterian Church of the Covenant, radiated by Crosley WLW you hear the beautiful contralto voice of Louise Koetter who is an official of the Crosley Radio Corporation, Cincinnati.

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Experiments in Radio Movies Being Conducted

British radio-movie specialists are also experimenting in the transmission of moving pictures by radio, as is C. Francis Jenkins, of Washington, D. C. Broadcast listeners in and around London have "heard" moving pictures by radio, according to a report from Consular Officials in England, but few fans, if any, have seen them, because they are not possessed of the proper receiving apparatus. All the listeners heard was a high-pitched intermittent whistle.

Recently a wireless device capable of transmitting moving pictures which can be received on television sets, similarly to music and speeches, was tested by the inventor, J. L. Baird, operating from a town in England on the south coast.

The transmission apparatus is said to be simple, the object to be transmitted being placed in a beam of light before a rotating perforated disc. The rays of light then pass through a second rotating disc, and are received on a selenium cell. They are then translated into an electrical current, equivalent to a musical note such as is prevalent in radio transmission.

Receiving sets will be equipped with another rotating disc equipped with a ring of electric lights arranged in positions corresponding to the holes in the disc of the transmitter. As the disc revolves rapidly, the lamps are lighted by the incoming signals. Earlier experiments in television, transmitted a sharp image, the dispatch states. To insure the dual operation of both the transmitting and receiving discs exactly at the same speed, a wireless wave is sent out by the transmitting motor which regulates the speed of the receiving motor.

By Carl H. Butman

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BCL in and around London actually have received broadcast moving pictures on their sets. Consular officials report to Washington—many hear only the "Whistle"
The “Goode” Two-o-One

Le Ton d'argent

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EVANSVILLE
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The Goode Tube Corporation
EVANSVILLE, INDIANA

The Funoflex Circuit

Funoflex Editor:
I WAS operating a set using the Funo- flex Circuit last night and I found it so selective that I can't tune in all the pieces in an orchestra at one time. Can you tell me how to broaden it a bit?

Anxious

Funoflex Editor:
I see you are making a display of the set King George wears. Do I have to wear earphones to listen in or will an ordinary town suffice?

Jack

Plan, $0.60. Place crystal detector inside of panel, adjust cut for. A. A. Stoll, 358 Bryant St., No. Tonawanda, N. Y.

Best 2-TUBE HOOKUP ever developed. Equal to 5 tubes! Latest invention! Not yet on market! Hookup and instructions, $1.00 cash. B. Radio Central, 323 B Street, S. E., Washington, D. C.

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GUARANTEED NEW GENUINE RADIO- TIONS. ALL TYPES SENT POSTAGE PRE- PAID. GENERAL SALES SERVICE, ONSET, MASS.

HAUNTINGLY WEIRD music similar to steel guitar played upon ordinary handkey. No knowledge of music necessary. Mastered in three hours. Simple instructions, $1.00. Grady McPherson, Bellevue, Tenn.

CRAM’S RADIO MAP IN TWO COLORS—Best map on the market. $0.50. The Columbia Print, 1495 Broadway, N. Y. C.

BARGAIN—Freed-Eisenman neutrodynes, factory built. Coast to coast on loud speaker. As good as new. $30.00. Letter J. Toole, 786 So. Gilpin St., Denver, Colo.

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HEAR THE CONVENTION
GUARANTEED SETS FROM $25.00 UP TO $275.00
STANDARD PARTS AT LOWEST PRICES.
MAIL ORDERS OUR SPECIALTY. WRITE FOR PRICES
WHOLESALE RADIO SERVICE
5 Church Street
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PLANT, $0.60. Place crystal detector inside of panel, adjust cut for. A. A. Stoll, 358 Bryant St., No. Tonawanda, N. Y.

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Broadcast Problems Now Solved, Says Expert

WASHINGTON.

Dr. J. M. Dillinger, head of the Bureau of Standards' radio research, in a special interview, declared: "Relatively speaking, and from the technical development viewpoint, the problems of broadcasting and of broadcast reception are solved, and other things are being developed. The real work of broadcasting development was done three to ten years ago. Of course there is great commercial and technical progress being made in this line, but the processes of fundamental development work are being directed to such things as trans-oceanic radio-telephone service, radio aids to navigation on the seas and in the air, directed radio transmission, radio distant control, conquering of atmospherics, and reduction of interference."

The extremely practical importance of scientific work on standards is illustrated by Dr. Dillinger saying that much has been done to solve this great problem. Instead of the common attitude of wondering whenever a code message or other noise disturbs reception, an attitude of wonder and praise over the relative absence of interference would be more appropriate, he feels. There are each night several hundred radio messages simultaneously going through the ether from as many stations. Yet each reaches its hearers. There would be much conflict and pandemonium if each of these stations was not kept on, or very near, the assigned wavelength. This close adjustment of the station frequencies requires very accurate standards of frequency and constant vigilance to keep the stations and the measuring instruments in harmony with established standards.

ORGAN RECITALS BI-WEEKLY AT STATION WGY

At WGY, Schenectady, every Tuesday at 10:15 p.m. for a period of about one hour, Stephen E. Boisclair will give a program of organ music ranging from Bach to Handel. Thursday night he will offer a program of dinner music. Mr. Boisclair will play on the organ of Proctor's Harmonius Bleecker Hall, Albany, N. Y.

SHRINERS' PARADE BROADCAST KANSAS CITY.

Radio fans listening to WDAF heard the first of the three official Shriners parades, staged during the national convention of the order, this week. A sensitive microphone was placed next to a street over which the parade passed, where it picked up the continuous stream of music from the bands.

There is a Brand-New CRAM'S RADIO MAP

Just issued with all the very latest broadcasting stations and information.

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Biltmore Reflex

Three thousand miles on the loud speaker, without outdoor antennas, or even a loop! This is what the Biltmore Reflex Receiver is capable of. But ground, and a few feet of concealed wire are all that is required. It is undoubtedly the most sensitive receiver made. Actually, the results usually surpass those obtained on the eight-tube super-heterodyne.

The quality of the tone is pure, clear and full. Reproduction is perfect, due in large measure to the Erla fixed detector which is employed.

In appearance, the receiver is unsurpassed—beautiful Radion Mahogany panel, heavy hand rubbed mahogany, heavily nickel plated metal parts. All connections are made to the rear of cabinet.

The most efficient circuit is used, four tubes, yet equivalent to eight. The apparatus is made of the very best — Radion Mahogany panel, bakelite reflex vario-coupler, molded bakelite sockets and dials, Frost jacks, Erla rectified, Dubilier Micadons, Acme Radio Frequency Transformers, and Acme Audio Frequency transformers. We can obtain no better apparatus.

Extremely selective, it is, nevertheless, easy to tune. You have but to snap the switch to listen to the world. A child can operate it without previous experience.

It is but slightly affected by static. Ideal for summer reception.

It may be operated entirely on dry cells.

And—the price. But $100. Anyone can afford this wonderful receiver. Should you operate it, see it, and hear it, you would have no other.

And—we assure you of and guarantee you complete satisfaction.

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The first and still the leader

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The Acme Audio Frequency Transformer, type A-2, was the first transformer on the market for amateur and experimental use. It led then and it leads now.

From the very first we have stood back of them and made good. An Acme guarantee means something.

The Acme organization has grown tremendously but the management is the same, which means that the methods and principles which caused the growth are still reflected in the product.

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. 126, Cambridge, Mass.

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