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RADIO WORLD

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The First and Only National Radio Weekly

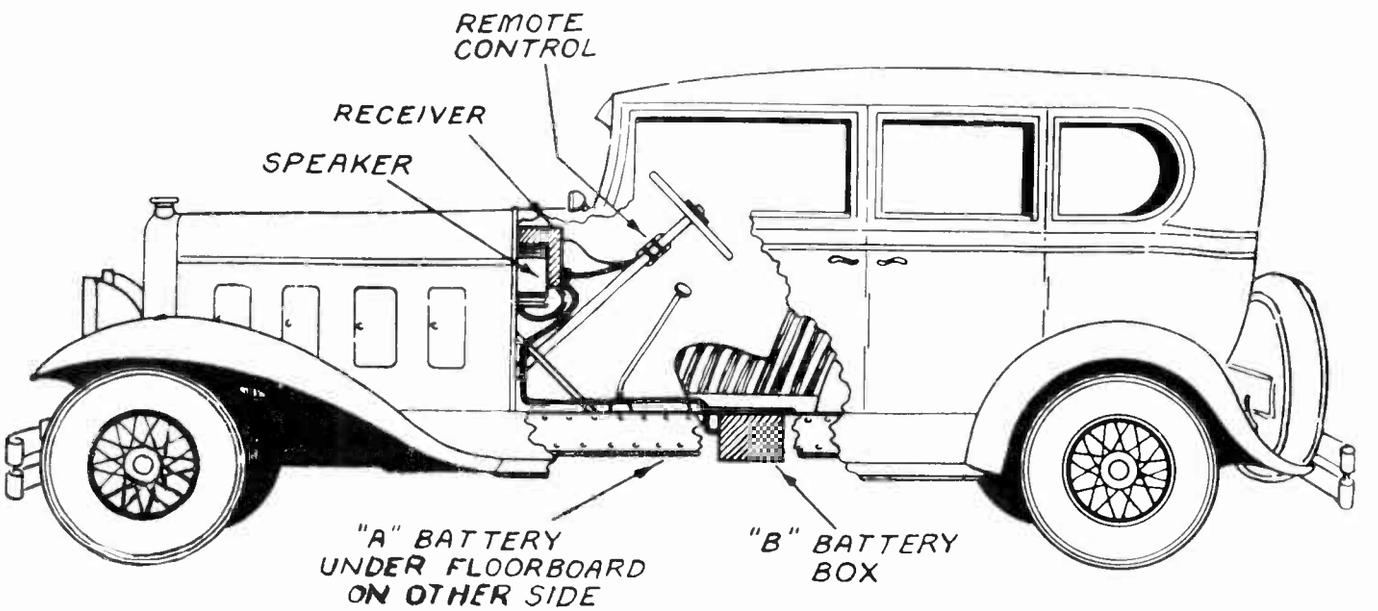
507th Consecutive Issue

TENTH YEAR

NEW R-F PENTODE TUBE

BIAS FROM UNTAPPED FIELD COIL

INSTALLING A SET IN A CAR



Behind the bulkhead, under the cowl, is a good place to put both auto set and speaker, with remote control on the steering post. See article on pages 6, 7 and 8.

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New Tube Announced

239 Is R-F Pentode of Automotive Series

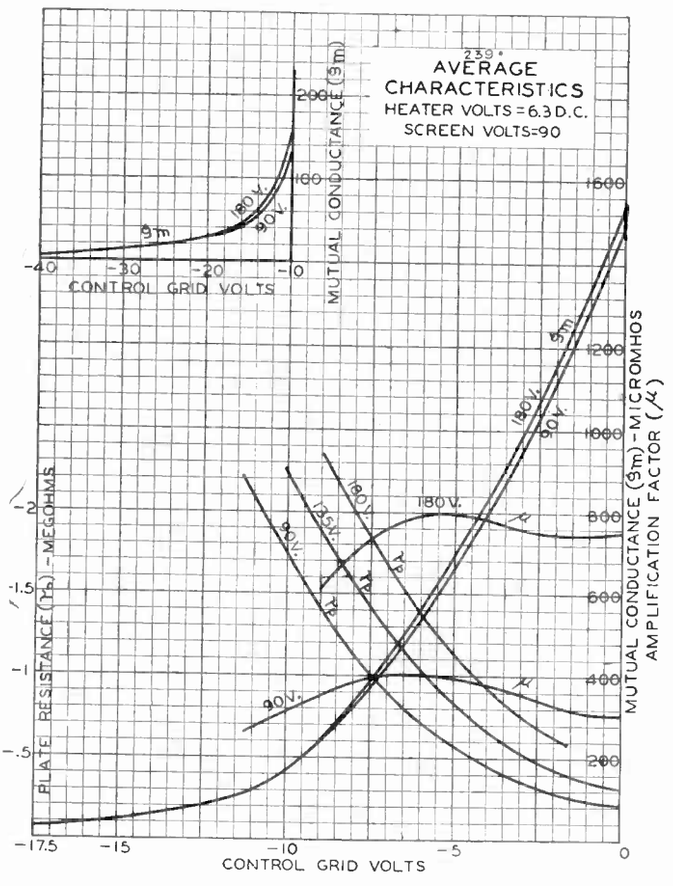

FIG. 1

Characteristic curves for the first standard pentode r-f amplifier tube to be placed on the American market, the 239. It is also a variable mu tube and even may be used as a first detector in superheterodynes.

THE first radio frequency pentode of standard type ever to come into the American market has just been announced. It is a variable mu tube of the automotive series, suitable also for operation from d-c electric lines. It is the 239.

This new tube incorporates a number of new design features which make it particularly suitable for use in future circuits.

The 239 is recommended for use as a radio frequency amplifier, intermediate frequency amplifier, and superheterodyne first detector. It is very effective in reducing cross modulation and modulation distortion over the usual range of received signals. Its design, like that of the 235, is such as to permit easy control of a large range

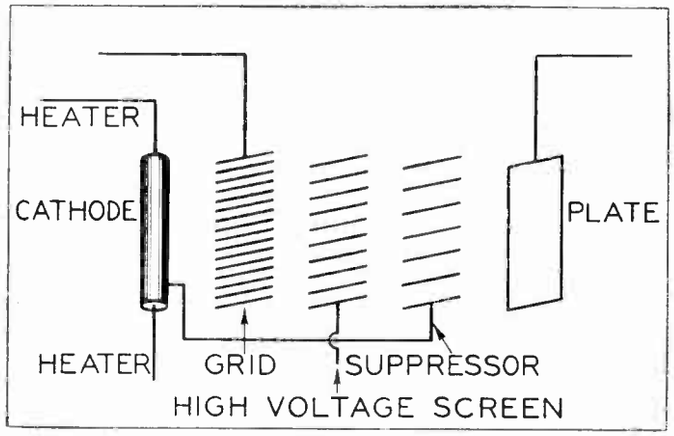

FIG. 2

Diagrammatic view of the element arrangement of the 239. The element marked "grid" is also known as the control grid.

of signal voltages without the use of special local-distance controls. This super-control characteristic makes the tube uniquely suitable for use in receivers designed for automatic volume control.

Why It is a Pentode

This new tube is a five electrode design, hence the name pentode. In addition to the usual cathode, control grid, screen, and plate elements, a fifth element, called the suppressor, is placed between the screen and the plate. This suppressor is connected within the tube to the cathode and effectively eliminates the secondary emission effects which otherwise limit the voltage swing permissible in screen grid tubes if operated with a low plate voltage, that is, at a plate voltage approximately equal to the screen voltage. The suppressor in this new radio-frequency pentode therefore makes possible the operation of this new type of tube with excellent results where the plate voltage available is limited, as for example in sets designed for operation on 110 volt d-c.

The use of the suppressor makes possible further advantages tending toward better set performance, since the fifth element permits of greater flexibility in obtaining a high mutual conductance and a high plate resistance, even though the tube may be operated at a low supply voltage.

Allows for Heater Voltage Variation

The 239 utilizes a coated cathode of the heater type designed for direct current operation. Owing to the special cathode construction, the heater voltage may vary during the charge and discharge cycles of the automobile storage battery without affecting seriously the performance or service of this tube.

No resistor in the heater circuit is required for operation from a six volt battery.

For operation in receivers designed for direct current power lines, the heaters of two or more of these tubes may be connected in series. Since the current rating of this tube is the same as the 236, 237, and 238, that is, 0.3 ampere, any heater combination of these tubes

(*Continued on next page*)

Pentode R-F in A-C Set

Series Heaters Enable Use of 20 Volt Transpower

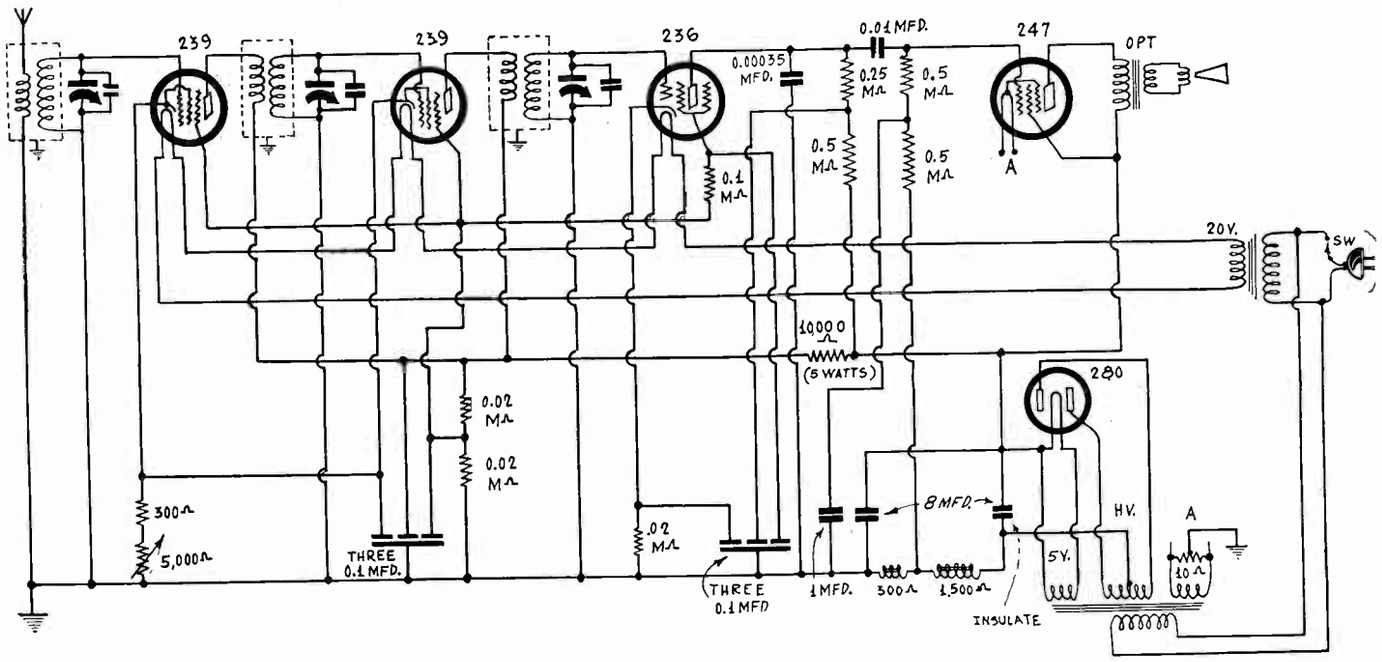

FIG. 1

Using the new pentode r-f tubes in an a-c operated circuit, one may develop greater gain, while the heater voltage is economically supplied from the secondary of a 20 volt transformer, the heaters of course being in series. Therefore the detector tube is also of the automotive series.

(*Continued from preceding page*)

in series is practical, provided that the current is adjusted to the proper value.

This new tube is not interchangeable with any other type of vacuum tube.

Set for A-C Operation

The enticing thing about the tube, of course, is the fact that it is a pentode, and that it therefore has an accelerator grid. This is important as lifting the amplification factor, it being 750 at most, a value that may be at least approximated in practice, because of the prevention of secondary emission.

When the cathode emits electrons some of them strike the plate and bound back and therefore constitute a retarding influence on the new crop of electrons that is about to bombard the plate. The accelerator speeds on the electrons, or, to put the same thing differently, the extra grid is a suppressor grid in that it suppresses the secondary emission.

The fact that the tube is a variable mu tube, while important, is secondary in point of interest, as we are familiar with variable mu tubes, but the pentode as an r-f amplifier of standard make is something new. An r-f pentode was put on the market nearly two years ago by a manufacturer then an independent, but the market was not ripe for it.

Although the tube is primarily intended for automotive use, or for d-c electric operation, it can be used in a-c sets as well, as Fig. 3 shows a diagram for this purpose.

Heaters in Series

About the most economical method of supplying the heater voltages, in the absence of a 6.3 volt winding, would be to get a 20 volt transformer, such as it used for loudspeaker dynamic rectifier supply, and which can be bought for less than $1. Then the heaters of the two 239 r-f tubes, as well as the heater of the 236 detector, are connected in series across the secondary, the voltage across each heater being 6.7 volts. This is all right, as when the automotive tubes were first announced it was said that up to 7.5 volts a-c could be put on the heaters, as they are not critical.

The circuit follows the design of standard midget five tube a-c sets and has the volume control as a voltage alterent in the cathode return of the two r-f tubes. The minimum bias requirement of 3 volts is afforded by the 300 ohm resistor, as the current will be 11.4 ma through it when the volume control is at zero, and 260 ohms would give that voltage.

The requirement that must be watched carefully is the plate voltage. This is not as high as for other tubes used in a-c sets. Therefore a resistor is used to drop the maxumum B voltage to 180 volts. If the d-c output of the rectifier on load is 275 volts, then about 180 volts will result if the series resistor is 8,300 ohms, though 10,000 ohms is more easily obtainable and may be used as shown. The rating of this resistor should be 5 watts or more. The half watt and one watt resistors will burn out.

Except for the extra filament transformer and the 10,000 ohm resistor the circuit is substantially the same as that on which the Blueprint No. 627 is based, and therefore it is quite practical to use that blueprint, and the same layout, adding the transformer where there is room underneath, at the middle of the chassis, and making the slight wiring and parts changes necessary.

Tentative Rating and Characteristics of the New 239 Valve

The preliminary rating and characteristics of the RCA-239 and the Cunningham C-239 are as follows, while the tubes of other manufacturers will have about the same characteristics:

Heater Voltage			**6.3 Volts D-C**
Heater Current			**0.3 Amperes**
Plate Voltage	**90***	**135**	**180 Volts Maximum**
Screen Voltage, Maximum	**90***	**90**	**90 Volts**
Grid Voltage, Variable	**–3***	**–3**	**–3 Volts Minimum**
Plate Current	**4.4**	**4.4**	**4.5 Milliamperes**
Screen Current	**1.3**	**1.2**	**1.2 Milliamperes**
Plate Resistance	**375000**	**540000**	**750000 Ohms**
Amplification Factor	**360**	**530**	**750**
Mutual Conductance	**960**	**980**	**1000 Micromhos**
Mutual Conductance at { –30 volts bias	**10**	**10**	**10 Micromhos**
{ –40 volts bias			**very small, but not zero**
Interelectrode Capacitances			
Effective Grid-Plate Capacitance			**0.007 uuf. Maximum**
Input Capacitance			**4 uuf.**
Output Capacitance			**10 uuf.**
Overall Dimensions			
Length			**4 3/16"—4 11/16"**
Diameter			**1 9/16"**
Cap			**0.346"—0.369"**
Bulb			**S-12**
Base			**Small 5 Prong**

***Recommended values for use in receivers designed for 110-volt d-c operation.**

Bias from D-C Dynamic

How to Use Untapped Field As If It Were Tapped

By Capt. Peter V. O'Rourke

THE use of the B supply choke in the negative leg of the rectifier, especially when the field coil of a dynamic speaker is used as the B choke, has become very popular. Standard midget receivers, as well as some large sets, use this method.

In most instances the field coil is tapped, so that it is necessary only to bring the grid return of the pentode or other output tube to the tap. Of course the field coil has to be tapped for the specific purpose intended. If a single output pentode (247) is used, then it is customary to have an 1,800 ohm field coil, with a tap at 300 ohms. Since all the B voltage used by the set flows through the field coil, and since the pentode bias is 16.5 volts, the coil is designed for a set drawing 55 milliamperes (16.5 divided by 300). This is a typical five tube midget, including rectifier, but since r-f tubes, if added, would account for only 5 ma each, or resistance coupled audio tubes for less than 1 ma each, two or three more tubes can be used without seriously upsetting the voltage requirements. Thus such a field coil is good for a five, six and a seven tube set.

When There Is No Tap

The placement of the choke in the negative return of the rectifier and the connection of the power tube's grid return to a tap thereon results in audio regeneration. Therefore considerable gain is obtainable from the pentode alone, and no other audio tube need be used, provided there are two stages of t-r-f and a tuned detector, with large primaries. Such a circuit is covered by Blueprint No. 627, an extremely sensitive five tube receiver.

In that circuit, as well as in other hookups, a resistor capacity filter is used, intercepting the grid return of the power tube, to prevent hum from backing into the tube.

Many persons, however, have so-called d-c dynamics, which means that the field is excited from the B supply of the receiver, but there is no tap on the field coil used as B choke. Nevertheless the owners of such dynamics would like to build circuits that call for a tapped dynamic field coil, and the method of utilizing the untapped field is shown in Fig. 1. Instead of the voltage being divided by the choke itself, two resistors are placed across the total voltage drop in the choke, and the grid return is made to the juncture of these two resistors. This method is just as good as the tapped coil method, except that it develops a little hum, so the resistor-capacity filter has to be of larger proportions, principally in regard to the condenser. So instead of 0.1 mfd. or 0.25 mfd. or some such capacity, 1 mfd. is used, as shown in the diagram.

Current Drawn

The two resistors should be of high resistance, so that little current will flow through them. In that way very inexpensive resistors may be used, like pigtail grid leaks, and there will be little reduction of the choking effect. If the resistors were relatively large, say only a few times greater than the resistance value of the choke itself, too much unchoked current would be passed along. Since the larger condenser (1 mfd.) gets rid of the little hum, no further attention need be paid to this consideration.

The total amount of B current flowing should be known. If it is not known it may be estimated. A five tube set, including rectifier (only fourtubes affect the B drain), if using a 247 output, draws 55 ma, as stated; a six tube set 60 ma, if the extra tube is r-f; a six tube set 56 ma, if the extra tube is resistance audio; a seven tube set 61 ma, if the two extra tubes are, one for r-f, the other for resistance a-f.

The resistance of the field coil always is known, since it is marked right on the speaker, so either by the current measurement method, or by the approximation given in the figures just stated, the voltage drop across the coil can be computed. It is the resistance in ohms multiplied by the current in amperes. All that is necessary is to express milliamperes in terms of amperes, that is, 55 ma would be 0.055 ampere.

Let us take the case of a field coil of 2,500 ohms resistance, at 55 ma. The drop across the field coil would be 137.5 volts. We desire to use only 16.5 volts. The ratio of 16.5 to 137.5 is approximately 1 to 8, therefore since the filament center of the pentode is grounded—and please note that B minus is *not* grounded—any connection to a point other than ground must be negative in respect to ground, since ground is the positive side of the voltage drop in the choke. Therefore we choose the two resistors, R1 and R2 accordingly, being careful to place the smaller value with one terminal to ground and the larger value with one terminal to B minus connection, shown at right in Fig. 1 above.

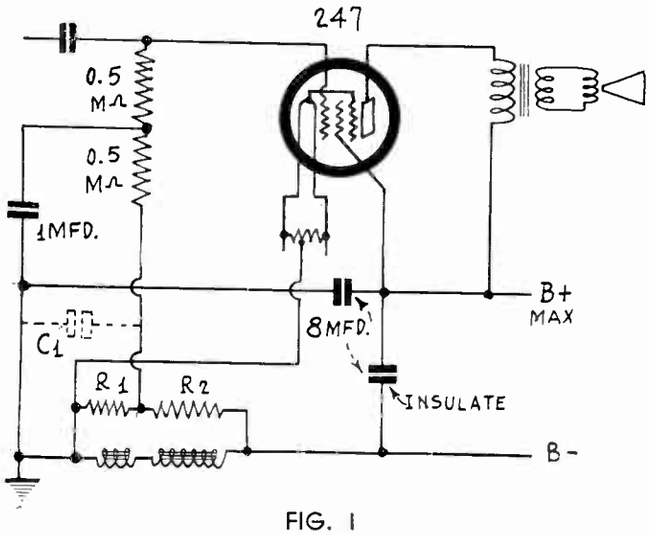

FIG. 1

How to use a d-c dynamic speaker in a circuit that calls for a tapped field coil, and provide bias for the output tube. R1 and R2 are two high vavle resistors apportioned according to the value of the voltage drop across an untapped field coil and the negative bias desired.

It is not always a simple matter to get precisely the correct proportion in commercial values of resistors. Suppose we select 100,000 ohms for R1. Then where are we to get a resistor of 800,000 ohms? However, by using higher values of resistors we can usually attain the desired proportion, or a good approximation thereof, and besides will be reducing still further the direct current, which is entirely bleeder, through the two resistors. Let us select 0.25 meg. (250,000 ohms) for the lower value R1. Then the higher value, R2, should be 2,000,000 ohms. These two values are easily obtained.

Bias Not Very Critical

If the choke coil has a resistance of of 1,250 ohms, then the voltage drop is one-half of 137.5, since the resistance is half, hence 68.75 volts, and the proportion is one-half, that is 1 to 4, instead of 1 to 8.

There is nothing very critical about the bias, and it may even be up to 20 volts. Around 20 volts bias is used in many commercial receivers.

When the two resistors are selected, add their values. In a previous instance the total was 2,250,000 ohms. The voltage drop was 137.5 volts. Therefore the current through the resistors (the voltage in volts divided by the resistance in ohms, or 137.5 divided by 2,250,000) was 0.00006 ampere, or 60 microamperes. This current is entirely too small to enable direct measurement of the bias voltage by using any meter you may have, except an electrostatic voltmeter or a vacuum tube voltmeter, across the smaller biasing resistor. Hence the bias test is made on the basis of measuring the applied plate voltage (B plus to ground or, accelerator grid to ground) and reading the plate current in the pentode, which for about 265 volts should be around 32 milliamperes.

It is well, however, to keep the total value of the two resistors around or over the megohm mark, to keep the bleeder current down.

While very little bleeder current flows through the biasing resistor, the signal current in the grid circuit flows through the biasing section (R1), hence if R1 is relatively large in respect to the grid leak itself or the resistor of the filter, or both (these two marked 0.5 meg. in diagram), then R1 is a series part of the audio coupling. For that reason R1 may be used also as part of an additional filter, by putting in another condenser, C1, this one from the low end of the other filter resistor to ground. It may be 1 mfd. also.

The condenser at top, leading to grid, is the stopping condenser, the other side of which goes to detector plate or to plate of an audio tube, if there are more than one stage of audio. The center tapped resistor across the pentode filament need not be used if the 2.5 volt winding of your power trans-

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Car Set Installation

Instrument Board Unmolested—Compactness Essential

By Edwin Stannard

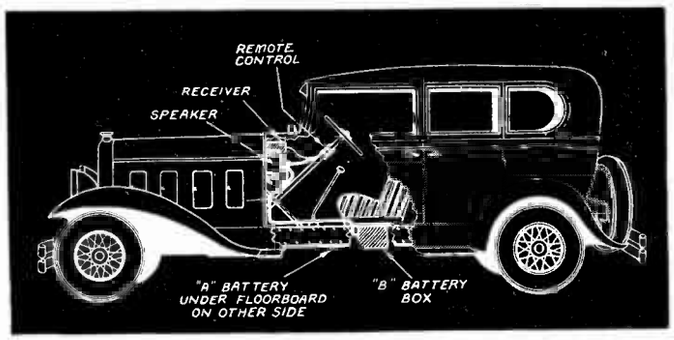

FIG. 1

A method of installing a radio set in an automobile without "cutting up the car" in any way. The set is mounted with four screws on the bulkhead under the cowl, the speaker is next to the set, while the remote control is on the steering post. A B battery box goes underneath the floorboard

MANY persons who have an automobile would like to have a radio receiver in it, but are deterred by the possibility that the instrument board will be cut up and possibly be ugly after the job is finished. While automobiles with radios built in do have instrument board access, this of course is done neatly and easily as part of the construction of the car. But when one has a radioless car, the problem of not doing any injury to the car has to be met.

The circuit has nothing to do with this problem. The consideration is purely mechanical. Therefore one has to decide where the set, the tuning control and the B batteries shall be. Of course, the storage A battery is on the car, and all one need to do is make connections thereto.

The first requirement is that the set itself be small, and as six tubes must be used for sensitivity, the mechanical problem is partly solved by compactness. A steel box shield 9 inches wide, 6 inches front to back, and 7¾ inches high was found, on the basis of measurements taken in many cars, to constitute an excellent size, so that the set could be fastened to the bulkhead under the cowl, and elevated sufficiently not to interfere with the feet of the assistant driver at the chief's right.

How About the Austin?

The box fits nicely in this manner even in the new and old Fords, in the Chevrolets, Pontiacs and other small cars, though no test was made on the Austin.

When the set is housed in so small a box shield the problem is essentially solved if remote control tuning is introduced. The attachment of the box to the bulkhead is easily done by using "self-starting" screws, four of which are required.

How high to elevate the set from the floorboard is a matter of choice. In virtually all cars there is a slant of the flooring behind the bulkhead, so any height should be measured from the highest floor point. However, between the back of the instrument board and the bulkhead there is room in all the standard cars, small ones included, for the box of specified size, so Fig. 1 shows the set mounted almost as high up as it will go. To the left of the set is the speaker, a dynamic with its field excited by the 6 volt storage battery. The drain is about half an ampere. The push-pull output transformer is built into the speaker and is matched for pentode output.

Now, there is scarcely a handier place to put the tuning, switching and volume controlling mechanisms than on the steering post. Fortunately, a remote control device is obtainable that has the dial, dial light, volume control and on-off key switch for the set built into it compactly, with a clamp for attachment to the steering post, and a fuse holder and fuse at the side. Fig. 2 shows the chassis shield, B battery box and the remote control.

Details on Three Cables

Two screws are tightened down and the clamping is completed.

The B battery problem still has to be solved. It is most practical to make a box of just the right size to contain three 45 volt B batteries. Then the B battery box can be screwed underneath the left-hand side of the floorboard, about parallel with the position of the A battery, which is commonly located on the right-hand side, under the floorboard.

The cabling is as follows:

(1)—A four lead shielded battery cable with no plug at either end, used for connecting to the A minus, A plus, B plus 67.5 and B plus 135 volts. B minus and A minus are interconnected direct between batteries.

(2)—A five lead speaker cable, with a five prong plug at one end, the free leads at the other end soldered by the builder to the five posts on the terminal strip of the speaker. The plug goes into the UY socket marked "SPK." The connections establish contact for the plates of the push-pull tubes, B plus 135 volts and the 6 volts of the storage battery (through the set) for field coil excitation.

(3)—A five lead remote control cable, marked VC on Blueprint No. 629, which connects to the A voltages and to two points (extremes) of the volume control potentiometer. One extreme is the aerial connection also, which may be made at the control on the steering post. The fifth connection is a "spare" and is used for interconnecting A plus battery cable and A plus of the tube sockets.

Circuit Shown in Fig. 3

A special auto aerial may be placed over the top, under the car chassis or under the running board.

As for the circuit, Fig. 3, this consists of two stages of tuned radio frequency amplification, using the new 239 variable mu pentode r-f tubes, 236 tuned detector (thus three screen grid tubes), 237 first audio and 238 (pentode) push-pull output. The r-f tubes may be 236 screen grid, if you have tubes already, otherwise use 239. The circuit was designed by J. E. Anderson and is covered by Blueprint No. 639, which is full scale and gives all constructional and dimensioned data, except coil winding. The coils may consist of 30 turn primaries (No. 32, enamel or silk) wound over 127 times (No. 32 enamel), on 1 inch diameter, encased in shields, or 300 turn r-f chokes may be used as primaries inside the secondaries. These shielded coils are T1, T2 and T3.

(*Continued on page* 8)

Speaker Plug Connections for A-C Sets

(*Continued from preceding page*)

former has a center tap. Probably the same 2.5 volt winding is used for pentode and all the heater tubes of the receiver. That is quite proper, as it merely gives the heaters a positive bias equal to the negative bias on the pentode, or 16.5 volts, which is well within the approved limits, as much as 50 volts having been common, when 245 tubes were in vogue.

The center tapped resistor should have a low value, total not exceeding 30 ohms, and may be as low as 10 ohms or so.

In the preceding part of the circuit (not shown), grid returns of r-f, detector and preliminary audio tubes would be made to ground, through biasing resistors in cathode legs, just the same as if the choke were in the positive leg.

The filter capacities of the B supply are shown as 8 mfd. each and are situated, one from B minus to B plus maximum, the other from ground to B plus maximum. Electrolytic condensers are commonly used.

Therefore the caps of these condensers are interconnected (anodes), but the cases have different potentials, 137.5 volts apart in one instance, as we have found. The condenser on the grounded side of course has its case grounded, but the condenser next to the rectifier has its case insulated. For this purpose two insulating washers are furnished, the metal chassis (if such is used) being sandwiched between the insulators, and a special removable lug provided so as to pick up the otherwise unconnected case. This lug goes to B minus.

In building a set it is customary to use a tube socket as a receptacle for the so-called speaker plug. For the untapped choke coil a four spring socket (UX) may be used, as there are only four leads from the speaker: plate of pentode, B plus maximum, B minus and ground. For the tapped coil there are five connections, plate of pentode, B plus, B minus, tap and ground. A good method is to use the heaters of the receptacle socket interchangeably for plate and B plus; plate of socket as ground; cathode of socket as B minus; grid of socket as tap. For the UX socket condition, filaments would be used as plate of pentode and B plus maximum, plate as ground and grid as B minus.

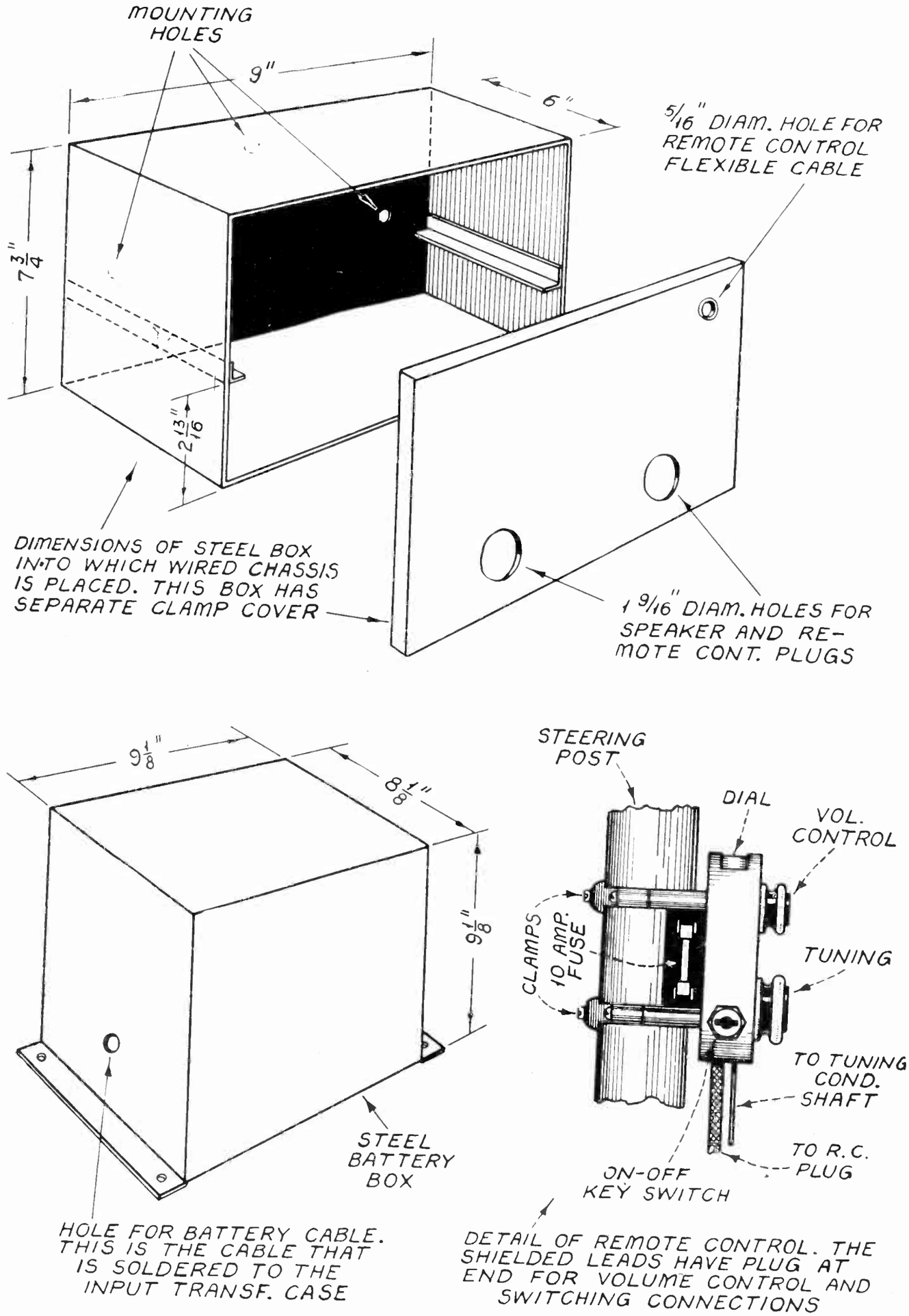

FIG. 2

Detail of the steel box shield into which the set chassis fits is shown at top. A clamp cover goes in front and passes two UY plugs (speaker and remote control cables) as well as the thin control cable for the tuning condenser shaft. The battery box and remote control are depicted at bottom.

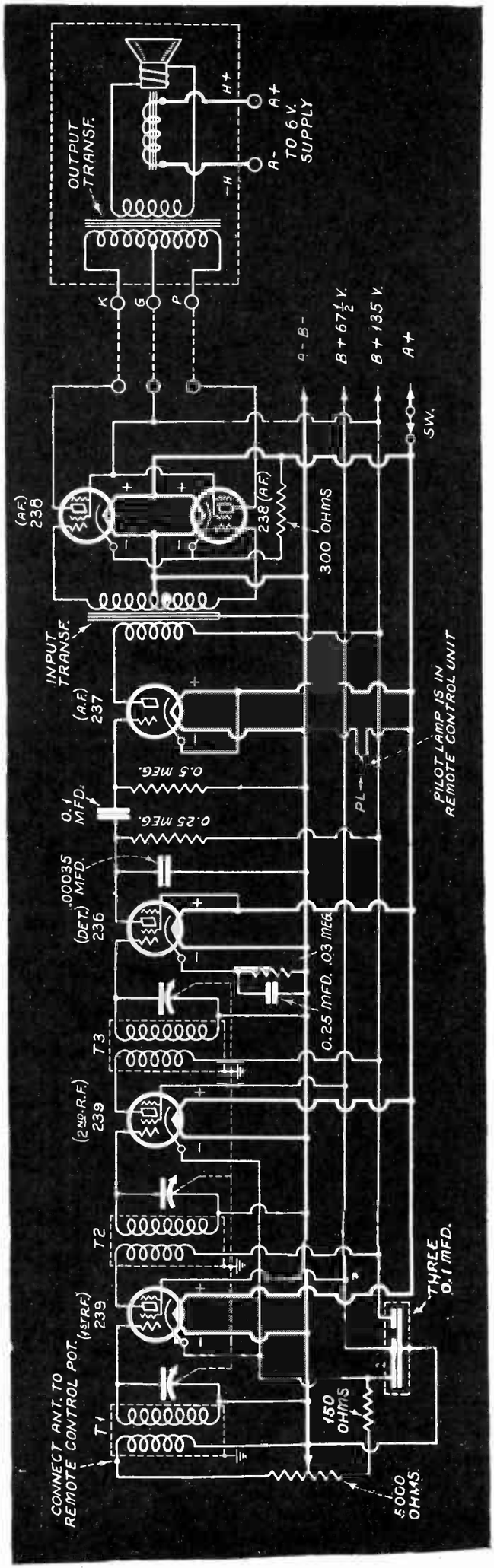

FIG. 3

The new variable mu pentode r-f tubes are used as amplifiers, while there are screen grid power detection and two stages of audio, the last push-pull pentode.

Aerial Problems in Auto Sets

(*Continued from page 6*)

Aerial facilities are at a premium in automobile installations. One desires as much pickup as possible, and it is not possible to get a great deal.

Undoubtedly the best solution is to string an aerial across the top, elevated 1 foot or more, and bring down the lead-in straight at the front. The car chassis will serve suitably as ground.

Some of course will object to this replacement of the aerial, because the appearance of the car is not improved, and the fact may be brought home by some skirted sharer of one's worldly possessions.

Lacking the aerial as described, one may use an upright wire at front, with lead-in taken from the top, giving the general appearance of an incompleted figure 4.

Loop Effect

The reason for stressing the lead-in position and the horizontal aerial is to avoid any loop effect. Suppose one had a horizontal aerial over the top, brought the lead-in down at rear, under the floorboard, to the front, then up to the set. This would be a U-shaped aerial, really a loop. Then you would have the same effects as obtained when you are using a regular loop. Directional effects would be strong and when you turned a corner either the station would be tuned out or the volume would decline considerably.

This condition is generally called "fading," although of course it is not fading, but is due exclusively to the directional effect of the actual loop aerial. Fading concerns the difference in phase or time of arrival between the ground wave and the sky wave, due to the reflection of the sky wave back to earth by the Kennelly-Heaviside layer.

Coil Suggestions

Large primaries should be used on automobile receivers, because the sensitivity of tuned radio frequency receivers is least at the higher wavelengths, and the short antennna also has least field strength at these waves.

Sometimes the primaries consist of radio frequency choke coils that fit inside the secondary form, and are honeycomb coils of about 300 turns. This opens the possibility also of tuning the primaries to some high wavelength, preferably just outside the broadcast band, which tends to compensate for the receiver's sensitivity characteristic that rises sharply with frequency.

The automobile set has been slow in gaining popularity, but since the improvement of receivers for this purpose, and the introduction of methods of installation that do not ruin the appearance or require cutting up the instrument board, interest has increased greatly.

It is estimated there are 50,000 auto sets in use, contituting a small percentage of the number of cars, but no doubt this will increase, especially now that receivers with 239 multi-mu pentode r-f amplifiers are possible. The sensitivity will be much greater than formerly, hence the results and enjoyment will be greater.

LIST OF PARTS

Coils

T1, T2, T3, one set of three-shielded automobile R-F transformers for 0.00035 mfd. tuning condenser.
One push-pull input transformer.

Condensers

One 3-gang 0.00035 mfd. tuning condenser, trimmers built-in.
One 0.00035 mfd. fixed condenser.
One 0.01 mfd. fixed condenser.
One 0.25 mfd. fixed condenser.
Three 0.1 mfd. fixed condenser in one shield case.

Resistors

Five resistors, viz: One 150 ohms, one 300 ohms, one .03 meg (30,000 ohms), one 0.25 meg. and one 0.5 meg.
[5,000 orm potentiometer is in remote control]

Miscellaneous Other Parts and Accessories

Eight UY sockets; six marked for tubes, two for plugs.
Five grid clips.
Dynamic speaker with 6 volt field and cable.
One special auto aerial to go over top, under auto chassis or running board.
One chassis, one chassis box with shelves, one box front and one battery box.
Special remote control unit, containing potentiometer, tuning dial, pilot bracket, lamp and switch.
One 4-wire shielded battery cable, 8 feet long.
Seven spark suppressers and one mfd. condenser.
One 5-prong plug for speaker.
Four 6/44 Parker screws.

The "Scotch" Converter

It Can Be Built for Less than $10

By Ralph C. Cross

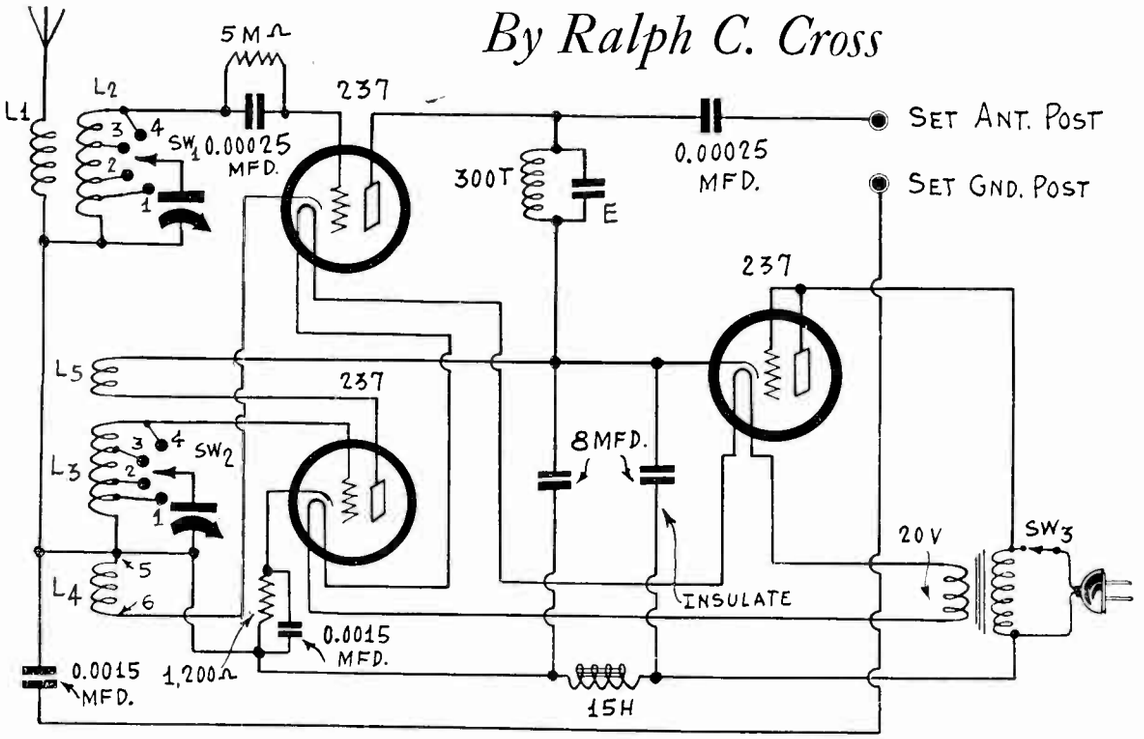

FIG. 1

THE 237 tube lends itself admirably to use in a short wave converter, since the general purpose tube is well adapted to modulation, serves well as B supply rectifier and moreover is a fine oscillator. In fact, for such a circuit there would be no advantage whatsoever in using screen grid tubes. Would a screen grid tube make a better oscillator, a better B supply rectifier, or a better modulator in view of the output coupling necessity? It would not. Therefore no advantage whatsoever would be served by using a screen grid tube in any one of these positions, and no purposes of economy prompted the selection of the tubes, despite my Scotch ancestry.

Their functioning is at par, and moreover the current drain is so very low that the outfit does not cost more than one-tenth of a cent an hour to run, anywhere in the United States. That is at the rate of 10c per kilowatt hour, and the rate is less than that nearly everywhere, and in some sections of the country is being lowered from recent levels. So you can listen on short waves from far and near, all night long, if you desire, and still run up your juice bill less than one cent!

Changes Made

The circuit is similar to one discussed before, but the changes introduced are as follows: the single output choke coil has an equalizing condenser across it, so that there may be some tuning in this circuit and there is no resistor in this circuit; there is no series condenser in the antenna circuit, but instead a larger capacity condenser is in series with the external ground; the grid continuation method is used in the coil system, instead of the shorting out turns for higher frequencies.

The circuit as previously presented, in the August 29th issue, has been very successful, and users report the reception of the most remote foreign countries and the smallest powered stations, all over the earth, and the shorting coil method was used. After 42 hours of laboratory testing and comparison it has been found that the present "edition" is a little more sensitive, due particularly to the tuning of the output, which also gets rid of direct reception of broadcast stations, to a large extent. The rest of the changes are of small but actual help, and the circuit as published now is recommended to be used, even though it is admitted that the improvement is not enormous.

Works on All Types of Sets

The circuit offers an excellent opportunity for the construction of a converter that will work on all types of sets, including superheterodynes, because the output coupling is such that it feeds well into the antenna systems used in supers, providing for good results on any intermediate frequency, thus including tuned radio frequency sets as among those with which the converter well may be used.

It should be noted that there is no essential difference between one type of set and another, so far as the signal is concerned, and that if the a converter will pick up a signal, even if there must be mixing in the converter, and again more mixing in the superheterodyne, the output of the converter still is subjected to whatever sensitivity the receiver has, and therefore results should be good. Poor coupling methods, particularly the use of screen grid output tubes, which do not present a suitable impedance to any type of antenna load found in sets, account for the failure of some converters to work well on some sets. Persons will report that a converter worked well on a set in a friend's home but in the owner's home (using a different set) the same converter did not work. The present design does not depend so much on the sensitivity of the receiver to solve the problem, but itself delivers a good voltage to the input of the set.

Independently Tuned Circuits

This fact arises from the use of two tuned circuits, the

(*Continued on next page*)

LIST OF PARTS

Coils

Two coils, one for modulator, one for oscillator; two windings on modulator coil, three windings on oscillator coil.
One 300 turn honeycomb coil.
One 20 volt transformer.
One 15 henry B supply choke coil.

Condensers

Two 0.00035 mfd. tuning condensers.
Three 0.00025 mfd. fixed condensers (one with grid clips).
Two 8 mfd. condensers, with mounting nut and lug for each.
One Hammarlund equalizer, 20-100 mmfd.
One 0.0015 mfd. fixed condenser.

Resistors

One 5 meg. grid leak.
One 1,200 ohm fixed resistor.

Miscellaneous Parts and Accessories

One a-c cable and male plug.
Three leads for external connection (ant., gnd., output).
One 10x8x3 inch cabinet.
One a-c toggle switch.
Hardware: two dozen 6/32 machine screws, two dozen nuts, two dozen screws; one machine screw 2 inches long; two threaded bushings.
Two flexible leads, tipped at both extremes.
Two dials.

High Sensitivity from

Independent Tuning, Plus Output Tun

(*Continued from preceding page*)

avoidance of use of an untuned stage in or ahead of modulator, and to the independence of the tuning. It is all right to put in a gang condenser when the intermediate frequency is fixed, as where a stage of i-f is built in (which is not done here) but any such system forecloses one from choice of an intermediate frequency. An i-f stage, of course, adds considerable gain, probably around 100, so even if a set is not very sensitive at the compulsory intermediate frequency, the i-f stage makes up for it. There are some very excellent converters of this built-in-stage type, and they are very good, particularly one of them (National's) but in the present instance the circuit is necessarily confined to greater simplicity of construction, and is offered as one that can be built of parts costing not in excess of $10. Any intermediate frequency may be used—from 30 kc to 1,600 kc.

Coil Method

The grid continuation method of coil switching simply consists of connecting the stator of a condenser to the moving arm of a switch and picking up the coil extreme, next first tap removed therefrom, next second tap removed therefrom, etc., and, depending on the capacity of the condenser, the number of taps will be chosen accordingly. So the diagram shows four taps, as some will use smaller capacity than 0.00035 mfd. for tuning, whereas if 0.00035 mfd. is used, only three taps are necessary.

Instead of regular switches, however, the condenser shifting to various taps is done as follows: two UY tube sockets are put on the cabinet top, their grid springs wired to the stators of the respective tuning condensers. Then the extreme and two (or three) taps are wired to the other springs. A flexible lead with tips that fit into socket springs is then used, one end going into the grid hole and staying there, while the other end is moved from one point to another, as desired, the only necessary precaution being that the progression (extreme, first tap, etc.) be in the sameorder for both tube sockets, to avoid confusion. Surely this is not the use of plug-in coils, but it is the use of plug-in leads, and of course it is a switching arrangement. Whatever definition may be attached to it, the system works very well, costs little, and helps to bring to the radio building public a converter for which the parts cost so very little that even in these times no one need be without the sheer fascination of listening to short waves.

Balance Struck

The two coils used are oscillator and modulator. The oscillator coil, at left in the picture diagram (Fig. 2), has one more winding than the modulator coil, which has two. The modulator coil also may be referred to as the antenna coil. The aerial is connected directly to primary, and the series condenser previously present is not used. The pickup is a little stronger this way, and so, of course, the danger of direct interference from broadcast stations would be heightened, but the tuning of the output cuts down the direct interference, while the input is kept high.

The series condenser in the ground lead prevents putting the B supply choke across the line, not that it would do any harm, as the choke has as high an impedance as the primary of the filament transformer, but there is that much less current used, so the economy is worth while, besides there is a little added coupling between modulator and oscillator by this method, provided there is an r-f drop between B minus of the converter and actual external ground, which there usually is.

The main coupling, of course, is afforded by the coil system. The cathode of the modulator, instead of returning direct to ground, returns through a winding on the oscillator coil (second from bottom in Fig. 2, left), and this winding is in close inductive relationship to the oscillator secondary, so the coupling is effectuated. The oscillator plate winding is at bottom in the pictorial diagram, and must be connected as shown (provided windings are in the same direction), to insure oscillation. However, if oscillation fails, or if you suspect its absence, simply reverse the connections to the plate winding.

Cabinet Size

The top panel size is 10x8 inches, and the converter may be built into a box cabinet that has the proper holes drilled. The sockets have to be accommodated, there being three for the converter tubes and two for the switching method, and provision must be made for the two 8 mfd. condensers. The inclusion of such high capacity in a modest converter is well considered, because it is a sure preventive of any hum trouble, when used with a B choke of even small inductance. The B choke coil is specified at 15 henries, but that does not mean it is large, for the total current through it may be only around 10 ma, while the 30 henry chokes readers are more familiar with are usually rated for 100 ma, or so. The inductance increases as the current decreases, so the 15 henry choke is a small affair, though wholly adequate.

The same precautions obtaining in receivers must be taken here regarding the insulation of the case of one of the electrolytics, but if a wooden cabinet is used, including top panel or any other insulating material, then of course the panel itself takes care of the requirement. Some lug or looped wire must be used to establish an easy connection to the case, which may be aluminum, hence not solderable by you.

Tuned Output

The same precautions obtaining in receivers must be taken to insure selection of the best intermediate frequency. If your set is sensitive at a high frequency, say, from 800 kc up, turn the setscrew of the equalizer to zero, for minimum capacity. If your set is more sensitive at lower frequencies, turn its dial to respond to some favorable frequency, where there is no broadcasting coming in directly, and then tune in a station on the converter, which already is connected to the set.

You can leave the modulator dial at the same position for this short wave station, and simply use a screwdriver to turn down the setscrew of the equalizer until the signal comes in loudest.

If you don't know just where sensitivity is best, as the power and distance of broadcast stations vary, and an open guess may away off, tune in a short wave station, leave the modulator dial as it is for this wave, and then keep changing the dial settings of your set and of the oscillator, first the set, then the oscillator to catch up with the changing inermediate frequency, and listen until the station is heard loudest. Of course some direct broadcasting—powerful locals—may be heard as you go over the set dial, but at least you can determine the region of the best sensitivity, and can then adjust the trimming condenser of the output coil to meet this situation.

Layout of Parts

If the equalizing condenser is connected with its thick brass lug to the plate and the thin copper lug to B plus voltage (referring to the Hammarlund 20-100 mmfd. equalizer), then a metal screwdriver may be used for adjustment without any body capacity effects.

The layout is such that at left and right rear are the two 8 mfd. electrolytic condensers, the three tubes are in a line between them, the sockets for coil switching are just forward of the electrolytics, and the two dials are at front, with a-c switch between them. An a-c cable with plug emerges from the rear. This goes to the convenience outlet or lamp socket. The only other connections to make are: remove the aerial from your set (a long aerial is advisable) and connect it instead to the antenna wire of the converter; connect the ground wire of the converter to the ground post of the set but leave the ground at the set; connect the remaining converter wire (output) to the vacated antenna post of the receiver. The connections can be made in three minutes by any one who has read these directions.

Coil Data

If you want to wind very small coils for this outfit, using 1⅛ inch diameter tubing, No. 28 enamel wire, you may put on, for the modulator coil's primary (antenna winding), 10 turns, for the secondary, 33 turns, tapped at the 22nd and 26th turns. The oscillator coil would consist of 25 turns secondary, tapped at the 13th and 18th turns. The taps are counted from the grid end. The plate winding consists of 20 turns, spaced close to the pickup winding of 10 turns that is between the plate and the grid windings. These data are for 0.00035 mfd.

NEW BOOKS

"SERVICING SUPERHETERODYNES," by John F. Rider. Published by Radio Treatise Co., 1440 Broadway, New York, N. Y. Price $1.00.

This book contains information of immediate and everyday value to the service man. What with the large number of superheterodyne receivers being sold daily and the meagre amount of service information available concerning superheterodynes, this book should be welcome.

The book is type set and bound in a flexible cover. The folio size is 5x7 inches.

a Low-Cost Converter

ing, Afford Device That Works Well

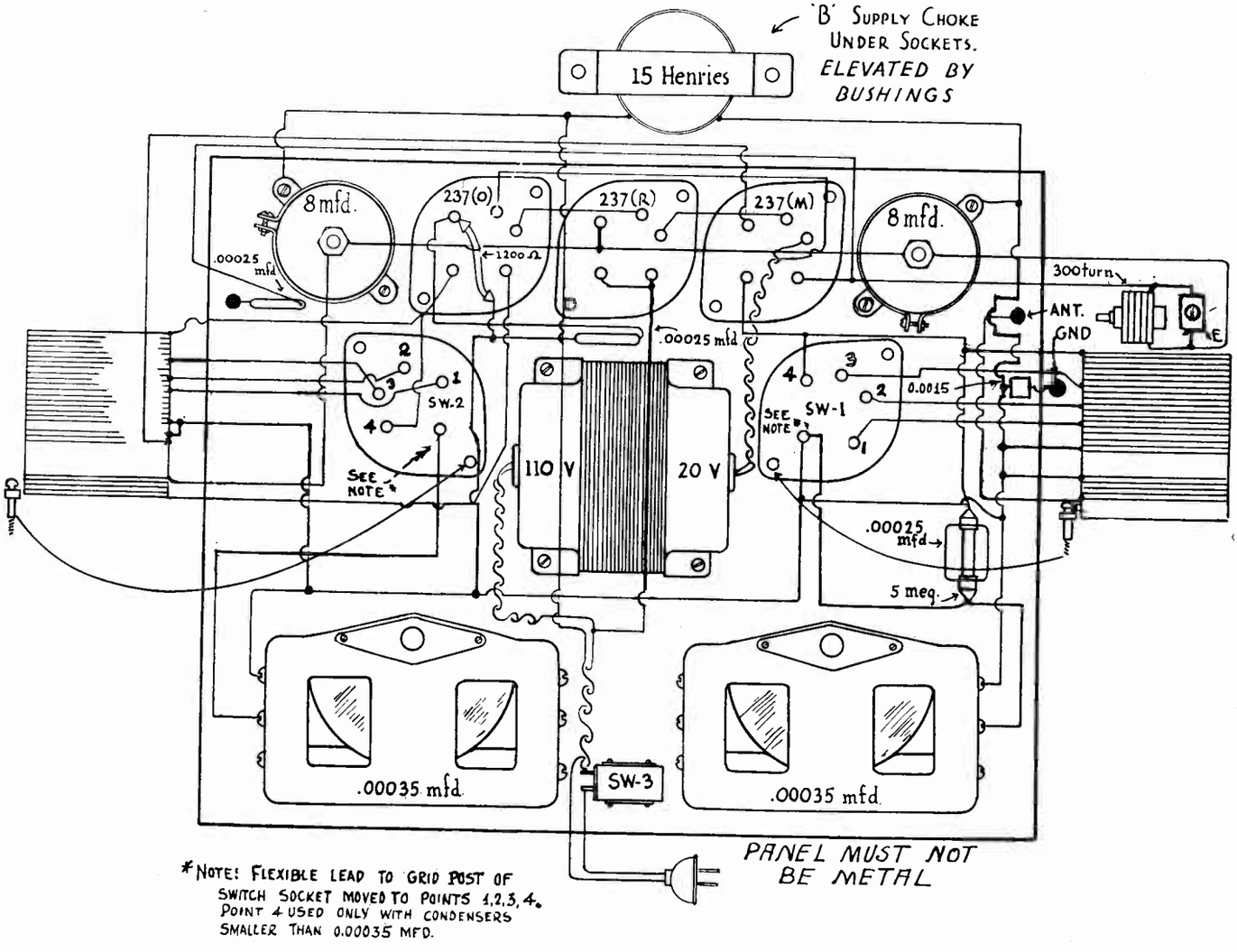

FIG. 2

Pictorial diagram of the converter.

Raymond F. Brown, 101 Prospect Street, Gloucester, Mass.
A. Davies, South Slocum, B. C., Canada.
R. S. Gillam, Mart, Texas.
Elwood S. Fauls, 325 Carpenter St., Oneida, N. Y.
L. E. Parris, 515 Martin St., Greensboro, N. C.
Edward McQuade, 9 Lincoln St., Marlboro, Mass.
Tom Edwards, 420 Lantz Ave., Detroit, Mich.
Y. Ewart, 5775 Victoria Drive, Victoria, B. C., Canada.
Sr. Jose Garza Lopez, Calle Gral Tren No. 834, Monterey, N. L., Mex.
C. B. Johnston, R. D. No. 1, Verona Rd., Verona, Pa.
Kenneth Wood, Jr., Box 26, Leslie, Ga.
C. C. Stalder, Route No. 19, Orlando, Fla.
Vincent F. Edick, Mgr., Radio Service Co., 906 Jefferson Ave., Utica, N. Y.
Kenneth Sargent, 3717-74th St., Jackson Heights, N. Y.
Howard R. Taylor, 2925 Scarborough Rd., Cleveland, Ohio.
Sam. Adams, Bennington, Nebr.
Harold Sopanek, Hays Hall, Moscow, Idaho.
P. R. Swan, 2801 Ohio Ave., Topeka, Kans.
O. B. Sparks, No. 6 So. 80th St., Birmingham, Ala.
S. J. Welch, Ellicottville, N. Y.
Robin Matthew, 5 St. Michaels Pl., Charleston, So. Car.
L. E. Parris, 515 Martin St., Greensboro, No. Car.
Robert E. J. Tate, 25 Kingsbury St., Roxbury, Mass.
Franklin O. Miller, 934 Allen St., Allentown, Pa.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

Charles E. Smith, 24 Upland St., Lyman, S. C.
James Dunlop, Rt. 2, Box 85, Placerville, Calif.
Allen H. Schooley, 282 Littleton St., West Lafayette, Ind.
W. R. Newcomb (for short wave parts and accesories), 156 Enfield Cres., Norwood, Winnipeg, Man., Canada.
John J. Clifford, 4924 Broad St., Pittsburgh, Pa.
Bradley Overton, Box 765, Bartow, Fla.
K. R. Zumhagen, 3609 No. 17th St., Milwaukee, Wis.
John E. Adams, P. O. Box 2197, Atlanta, Ga.
Daniel Johnston, R. F. D. No. 4, Vilonia, Ark.
H. F. Williams, 109 Dresden St., Houston, Texas.
Cadet Wm, A. Rank, Jr., N. M. M. I., Box 378, Roswell, New Mex.
Lewis M. Scott, 1015 1st Ave., Columbus, Ga.
W. E. Bishop, Bishop Radio Service, 706 Florida St., Amarillo, Texas.
T. W. Mermel, 1900 D St., N. W., Washington, D. C.
Reginald McCullough, La Grange, Mo.
Adolph Lohner, 820 Holland Ave., Wilkinsburgh, Pa.
Louis Bittay, 25 Brookline Ave., New Brunswick, N. J.
F. Smarde, 4226 Ogden Ave., Chicago, Ill.
Hubert F. Lange, R. F. D., No. 1, Fredonia, Pa.
Frank Q. Norman, 2604 Wentworth Rd., Hanilton P. O., Baltimore, Md.
Geo. A. Ashland, Douglas Steam Laundry, Douglas, Wyo.
N. Leonard Wilson, 831 Lincoln Ave., Cincinnati, Ohio.

List Prices of Tubes

The following table gives the prevailing price lists of the various tubes:

Tube	Price	Tube	Price	Tube	Price
227	@ $1.00	551*	@ $2.20	240	@ $3.00
201A	@ .75	224	@ 1.00	WD-11	@ 3.00
245	@ 1.10	171A	@ .90	WX-12	@ 3.00
280	@ 1.00	112A	@ 1.50	200A	@ 4.00
230	@ 1.60	232	@ 2.30	222	@ 4.50
231	@ 1.60	199	@ 2.50	BH	@ 4.50
226	@ .80	100	@ 2.75	281	@ 5.00
237	@ 1.75	233	@ 2.75	250	@ 6.00
247	@ 1.55	236	@ 2.75	210	@ 7.00
235	@ 1.60	238	@ 2.75	BA	@ 7.50
		120	@ 3.00	Kino	@ 7.50

*This tube comparable to the 235.

Diode Detector in

Provision for Automatic Volume Control Includ

By Herman

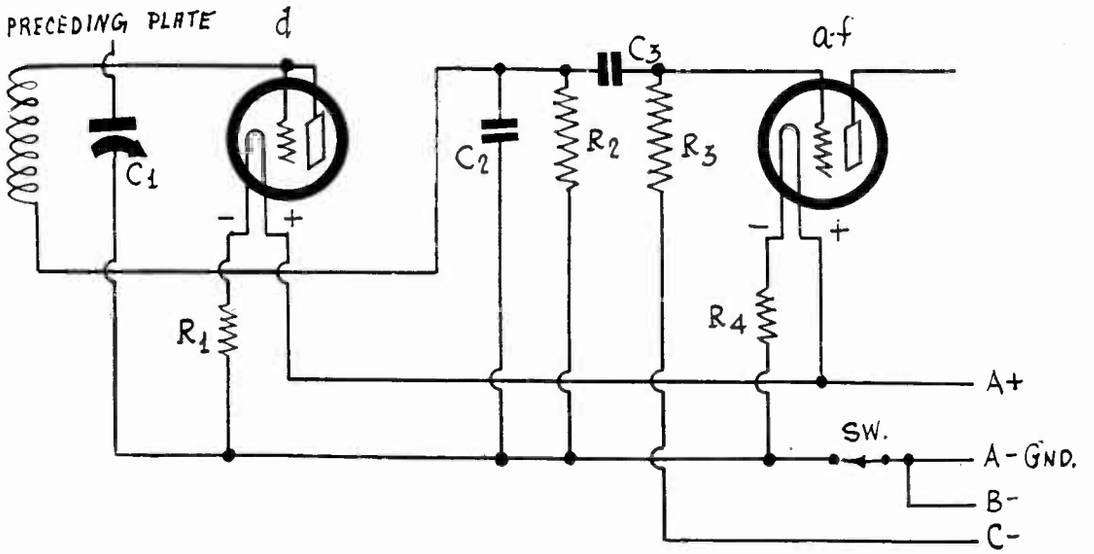

FIG. 1

The diode detector in a battery operated circuit, using filament type tubes. The tuning condenser is not put directly across the secondary that feeds the detector, but effectively across the primary.

THE diode as a detector is applicable to battery operated receivers, as well as to sets that are a-c operated, the single exception being that the filament type diode can not be used for feeding a push-pull resistance coupled stage, as can heater tubes. This is due to the grounding of the cathode circuit (filament) in battery type tubes.

Since the advent of the automotive series, which are classed as battery type tubes, although the heaters may be fed by a-c, it is no longer possible to distinguish tubes simply as battery operated or a-c, for some are both, but the present article deals with filament type tubes. The automotive series tubes may be treated as in the a-c class for the present purpose, and readers therefore are referred to the equivalent use of a-c tubes as diodes, pages 6 and 7 of the November 21st issue.

Fig. 1 shows the use of a battery type tube as a diode detector. A diode is simply a two element tube. But no such tubes are marketed to-day in this country, so a diode is constituted of a triode (three element tube) by joining grid and plate elements. A general purpose tube is used, e. g., 201A, 199, 237.

Coil's Return Connections

In any rectifier the plate or anode is negative, and here the equivalent is the joined grid and plate elements. The radio frequency coil's secondary feeding the detector therefore may be included directly in the circuit, but instead of grounding the secondary directly, the secondary must be connected with its low potential end to a resistor (R2), and thus gets to ground. However, we desire to remove the radio frequency from the resistor, retaining a high impedance to audio frequencies while presenting a low one to radio frequencies. The fixed condenser C2 accomplishes this sufficiently. However, if the coil shown were tuned with a condenser, the C1 and C2 would be in series, and would upset gang tuning, hence the preceding plate circuit is tuned.

The values are as follows: C1, your tuning condenser; R1 and R4, the filament resistors in your set; C2, 0.00035 to 0.001 mfd.; C3, 0.01 mfd.; R2, 50,000 ohms; R3, from 0.5 meg. up, using as large a value here as is consistent with absence of motorboating.

There is no danger of motorboating, if only one stage of resistance audio is used, as there can be no feedback to the detector, because the detector is not an amplifier.

Stated broadly, therefore, the diode may be classed as not as sensitive a detector as the tubes normally used, but it will stand a greater load, it being virtually impossible to overload it with any radio signal obtainable from the run of receivers, even from the nearest local.

Aspect of Sensitivity

However, since the tube does not amplify, it is removed from the chain that aids in producing r-f squealing when the amplification is lifted. So if you have two stages of t-r-f ahead of the diode, and if with some other type detector there was squealing and general instability until primaries were cut down, with the diode the large primaries may be restored, for the amplification at r-f is confined to the r-f tubes alone. In other cases the detector adds to r-f gain by feedback.

So it is advisable not to regard a detector or any other tube in any circuit as something quite unto itself, but as a link in a chain, or, preferably to regard the chain as a unit, and design circuits according to that theory. Practice requires such procedure, anyway, whatever the mental attitude or the code of approach.

Thus with greater sensitivity easily developed by increasing the number of primary turns, the net effect may be as great a sensitivity as you had before, with better quality. The object of the diode detector is entirely one of quality, but of course it is desired to achieve this end with minimum sacrifice, particularly on the sensitivity score.

Fig. 1 shows the diode circuit, but it is suggested that two stages of resistance coupling be used.

It is assumed in the foregoing that shielded coils are used in r-f systems and that batteries are bypassed, as necessary aids to stability.

Case of Transformer Coupling

If instead of resistance coupling you desire to use transformer coupling, this may be done simply by making the primary replace R2 and the secondary replace R3, omitting the stopping condenser, C3.

The diode may be the second detector of a superheterodyne or it may be the detector of a t-r-f set.

It was pointed out, in connection with a-c sets discussed in the November 21st issue, that automatic volume control can be achieved, without the use of an extra tube, by making the diode detector serve as the control tube as well. The way to do this is to connect the grid return of the controlled tube or tubes to a point on the diode load resistor, which is negative in respect to ground. This is shown in Fig. 2. It is usual and preferable to filter the return circuit, so C1 and R1 are used for that purpose. They are 0.1 mfd .and 0.25 meg. respectively.

It will be noticed that the filament resistor R2 is in the negative leg of the r-f amplifier, which may be any type tube, including screen grid, but is shown as a general purpose tube for convenience. Thus when there is no signal there is still current flowing through R1, and the potential difference between its terminals constitutes a negative bias on the tube.

Bias Necessary When There's No Signal

This is important, because there must be always some provision for negative bias when there is no signal, that is, the bias can not depend exclusively on the control, for then there would be zero bias when tuning from one station to another, or when "fihsing" for astation, or when an SOS puts all stations off the air, or when the aerial is disconnected. Especially uneconomical would zero bias be for battery operated systems, due to the heavy B current drain, not to mention the

Battery Operated Sets

ed—Push-Pull Resistance Possibilities Discussed

Bernard

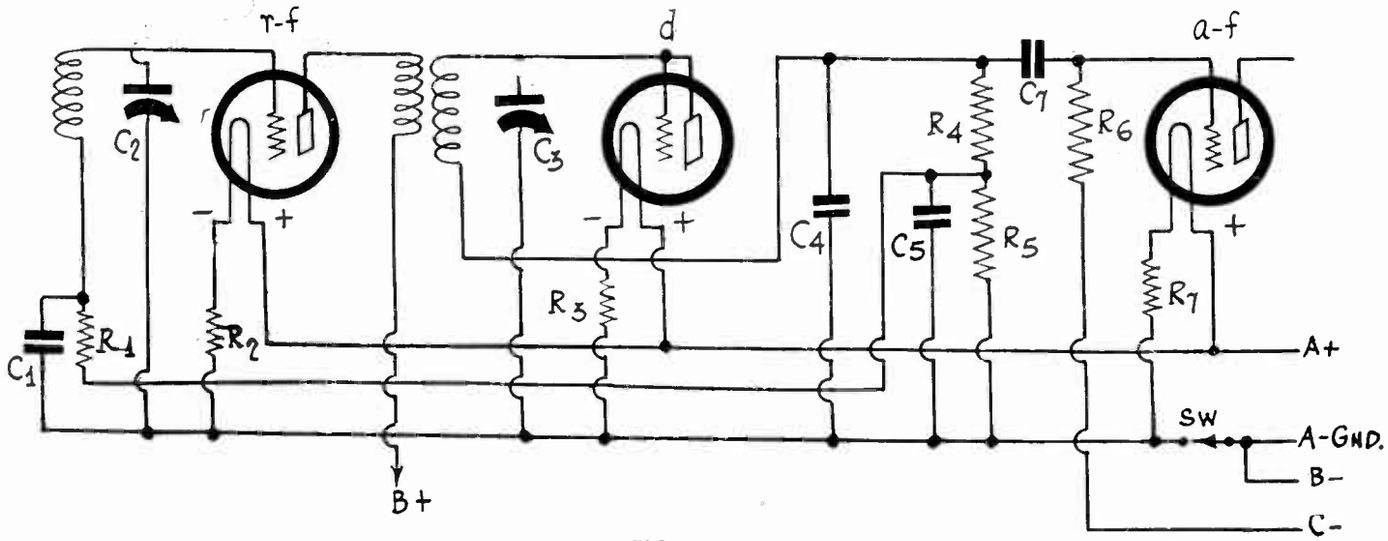

FIG. 2

Here the diode serves as detector and also as an automatic volume control tube. There must be regulation bias, or not very much less than the recommended value, when there is no signal, and this is provided by the grid return, through capitalizing the voltage drop in the filament resistor R2. R5 may be considered as the control element. The modulation is removed by C5, which is 1 m.f.d. C2 stator goes to grid, C3 stator to preceding plate.

reduction in tube life no matter what type tube is used or how powered.

The negative bias is retained, due to R2, even though the grid return is through a high resistance, because at no signal there is no current through this resistance (R5).

The second that there is a signal there is current through the rectifier (d) and while it is direct current, on account of the rectification that has taken place, there is still the signal in it, that is, the current is pulsating direct current. To avoid possibility of negative audio feedback, hence damping, it is necessary that the modulation component be removed from the control section.

Modulation Removed from R5

The current flows through the untuned secondary feeding the detector, which secondary handles therefore both d-c and a-c, and from the subsequent circuit the a-c is sufficiently removed by C4. Now the current, pulsating d-c, flows through R4. There is another resistor, this one R5, in series, and across it is C5, a large capacity, one that will remove the modulation. It is 1 mfd.

Now, the current at the plate or anode of the detector is negative, hence it is negative even in respect to ground, for, as to this rectified current alone, grounded B minus is positive. So when the controlled tubes have their grid returns detoured to the juncture of the two series resistors, R4 and R5, the grids are negative in respect to what they would be were the returns made directly to ground. If the returns were made to ground the bias would be negative by the voltage drop in R2, whereas the control makes the return more negative than the drop in R2 provides, but only when there is a signal, and the greater the amplitude of the carrier at the detector point, the greater the drop in R5 and the greater the bias.

The automatic volume control system is applicable to tuned radio frequency sets as well as to superheterodynes, in fact, Fig. 2 contemplates a t-r-f set.

Fixing the Steady Bias

If the tubes ahead of the diode are of the general purpose type, or are 222's, there is little danger of crossmodulation, but if the 236 is used there is a little danger that the bias increase due to the signal will introduce crossmodulation. The 222 and the general purpose tubes do not have detecting characteristics at negative bias increase within the values contemplated by this article, but the 236 has. The 236 is the screen grid tube of the 2 volt series. However, even that would have to be subjected to a three-fold rise in bias before attaining serious detection, and such a large increase is not to be expected from t-r-f sets, except six circuit tuners or the like, few of which exist in battery models.

Another precaution is that, depending on the type of tube used, and the voltage of the supply to the filament, the steady bias should not be much more than that recommended in the characteristics chart. Such a chart, covering all receiver and some transmitter tubes, total, 34 tubes, was printed in full in last week's issue, dated December 5th. What voltages to apply, bias and otherwise, was given in that chart. The only tube not included was the new 239, the variable mu pentode r-f amplifier of the automotive series, data on which will be found elsewhere in this issue. The 239 was not ready for the market when the characteristics chart was prepared.

Bias Solution

The solution where the bias is too high to start with—that is, the steady bias alone is beyond the recommended limit—would be to make the drop in the negative leg of the filament less. You could halve it, for instance, by putting half the value of R2 in the negative leg and half in the positive leg, or establish any other proportion the circumstances required. The drop in R2 always can be made what you want it to be, or what it should be, as to steady value, provided the departure is on the side of too high starting bias. If the bias is too low by a small amount, even by one-third, you may leave it thus and depend on the signal for the rest.

The value for Fig. 2 are: C1, 0.1 mfd.; R1, 0.25 meg.; R2, R3, R7, your filament resistors; C2, C3, your tuning condensers; C4, 0.00035 mfd. to 0.001 mfd.; R4, 50,000 ohms; R5, 50,000 ohms; R6, 0.5 meg. or larger value, as high as consistent with absence of motorboating, although no motorboating can arise in a single stage of resistance coupling following a diode, as there can be no feedback; C5, 1 mfd.; C7, 0.01 mfd.

Diode Arouses Interest

Considerable attention has been attracted to diodes since the publication in these columns, pages 6 and 7 of the November 14th issue, of an article, "Diode Rectification for Push-Pull and Other Circuits." The use of automatic volume control in the diode, issue of November 21st, continued the same general discussion, while the present article constitutes an exposition of the diode applied to battery operated sets. It can be seen, aside from automatic volume control, the change is easily made, and many no doubt will desire to experiment with the results. For primary tuning, ordinary r-f transformers may be reversed. Also, other radio magazines are taking up the subject, and articles along the same lines as published herewith and previously in these columns will be found weeks or months later in other periodicals.

Bringing Out the Low Nc

High Current Voltage Divider and Choke

By Charles

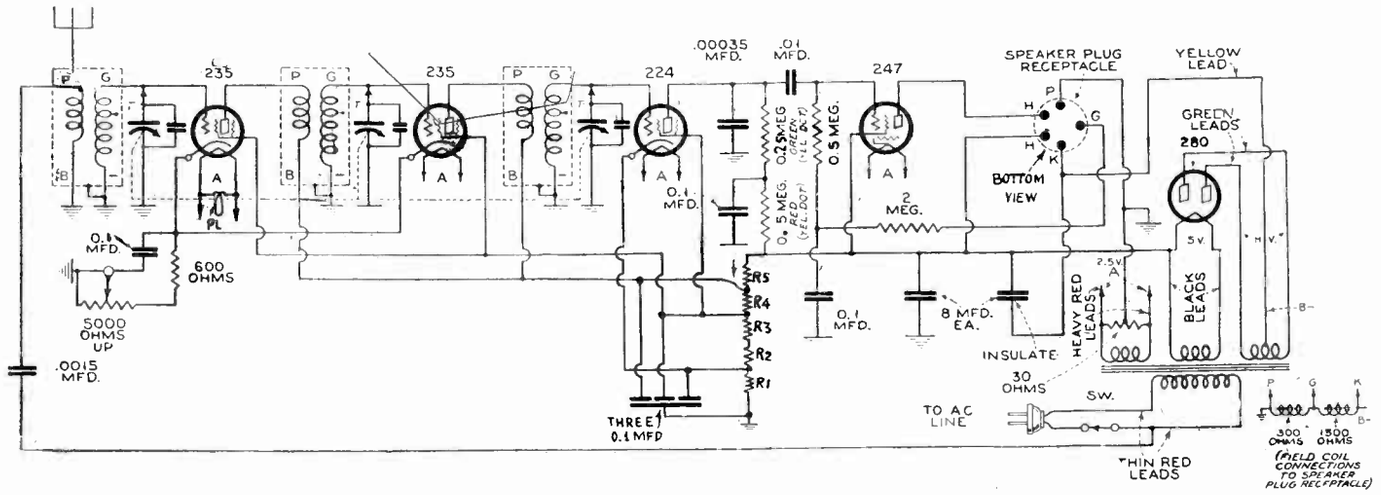

FIG. 1

A high current voltage divider is used in this circuit, intended for midget receiver, while the negative bias for the pentode nevertheless is obtained from the voltage drop in the dynamic field coil, an unusual combination. By this method grid leak values of the order of 2 meg. are practical in the pentode circuit without motorboating. Tonal response was excellent, with full rendition of low notes.

NEARLY all of the circuits for midget set construction, including factory-made receivers, call for grid leak type of resistors for voltage division. Some sets have the B supply choke coil, which is the dynamic speaker's field coil, in the negative leg, to enable pentode bias attainment from a choke, others have the choke in the positive leg and get the bias from an independent resistor, from 247 filament center to grounded B minus. However, an advantage of having the choke in the negative leg is that audio regeneration results.

The other type of voltage divider is known as the high current type, and its function, besides affording voltage distribution, is to permit a sufficiently large bleeder current to steady the actual voltages despite the changes introduced by the signal. As the signal amplitude increases, more plate current is drawn, so voltage drops in series resistors increase, where voltages otherwise governed will increase, and this introduces an unsteadiness. It is not a harmful one and there is no serious objection to these changes, nor is it true that the high current voltage divider completely eliminates them. Yet the high current type does tend to reduce the relative effect of the voltage changes.

Combination of Uses

Constructors, used to wire wound voltage dividers that stand considerable current, may prefer to use them. Those who adhere to the grid leak type need have no qualms, however, for the only resistor that carries considerable current is the one that drops the maximum B voltage to the B plus plate voltage for the radio frequency tubes. This is marked R5 in Fig. 1, and it is usually recommended that the rating be 5 watts. Now, this is not a husky resistor, yet 5 watts would be ample for the purpose (more than twice the actual wattage). Resistors don't begin to look husky until they get into the 25 watt class.

The other resistors, even in Fig. 1, may be of the 1 watt type, the familiar 2-inch pigtail resistors of the grid leak style.

Fig. 1 shows what is intended to be a combination of uses. While the voltage division may be on the basis of 1 watt resistors, except for R5, for none of them carries more than 10 ma, while R5 will not carry more than 20 ma, if the resistance values of R4, R3, R2 and R1 are lowered, the device becomes a high current voltage divider. The total then need not much exceed 6,000 ohms.

The current through the various sections will differ, and in some instances there will be only a net current, due to the flow of a certain amount in one direction and another amount in the opposite direction. If a voltage divider of around 6,000 to 10,000 ohms total is used, that has sliders on it, the sliders may be moved until the desired voltages are obtained, and a voltmeter will measure them. For instance, across the total voltage divided there would be around 230 volts, whereas the joint of R5 and R4 would be 180 volts, and that of R3 and R4 around 50 volts or more, that of R1 and R2 around 5 volts. The screen voltage as stated (50) is lower than the standard value, which is 90 volts, but any voltage between 50 and 90 may be used, as this variant is a check on oscillation.

Speaker Leads

The diagram is partly pictorial, and therefore an explanation of the choke and bias is necessary. Taking the pentode output, this is connected to the primary of an impedance-matched transformer built into the dynamic speaker, and the connections are made to the heater springs of a UY socket used as speaker plug receptacle. The speaker has five leads emerging in a cable with UY plug at end, and the plate and maximum B plus connections are as stated. Then there are the three leads emerging from the field coil—two extremes and bias tap. The receptacle socket has its plate spring for ground connection, grid spring for the tap (G) on the field coil and cathode for B minus, as detailed at lower right of Fig. 1. So the field coil is actually connected between B minus and ground, and the grid return of the pentode is to the tap (G), not to ground. Center of the 2.5 voilt filament is grounded.

There is a voltage difference of more than 100 volts between cans of the electrolytic condensers, hence the identified can must be insulated from a metal chassis.

The B current for the pentode, flowing to plate and to suppressor grid, has to get back to B minus, and finds that path wholly outide of the voltage divider. That is, he current flows from B plus maximum to plate and suppressor grid, through the tube to the filament and through the filament to its grounded center and then through the field coil to B minus. The 38 ma or so in the power tube therefore do not go through the volage divider, but the 12 to 15 ma or so for the radio frequency and detector tubes do flow through at least part of the divider. Although the currents through various sections of the divider will be different, if the average is, say, around 20 ma, the variations are more than halved, except in the pentode, but that tube's variations are controlled largely by those in the preceding tubes.

Divider Values

In designing a voltage divider, it is usual to ascribe first a certain amount of bleeder current. Suppose it was 20 ma. This would be the value of current without any augmentation by tube drain. Then the bleeder is added to the tube drain, say 15 ma for the radio frequency tubes, whereupon the resistance value of R5 might be (275 minus 180) divided by 0.035, or about 2,700 ohms. This is R5. The plate current that is thus diverted by the tubes

tes in Midget Receivers

Bias Combined—Grid Leak Value High

J. Barrington

never returns through the divider, but reaches B minus through the cathode circuit of the tubes. This is true also of the screen currents of the r-f tubes. However, the bias of the detector is obtained from the voltage divider, so its plate and screen currents flow through R1. Current that has never passed through R5 therefore passes through R1. The detector plate voltage is the maximum (275 volts nominally, but 230 actually, due to the divider's bleeder current pulling down the voltage.

The value of R5 and R1 will not change materially, whatever the values R2, R3 and R4, within reasonable limits for these three, so a rather wide choice remains for these three.

By using a voltmeter of 1,000 ohms per volt it is easier of course to work out the problem experimentally, and obtain the resistance values. Also, no computation errors will creep in. The experimental method was used in obtaining the resistance values for the chain as follows: R5, 1,200 ohms; R4, 3,000 ohms; R3, 2,000 ohms; R2, 1,000 ohms; R1, 200 ohms.

High Value Pentode Leak

The method of obtaining the bias from the field coil, while apportioning the other voltages from the voltage divider, made possible the use of a high value of resistor in the resistor-capacity filter of the pentode stage.

The condenser used in this filter is marked 0.1 mfd., but may be larger, say, up to 0.5 mfd. for this circuit, and yet the effect of a large grid leak remains. The 0.5 meg. resistor in the upper part of the grid circuit is in series with the 2 meg. grid leak except as to the reduction effect of the condenser from 2 meg. to ground. This reduction is extremely low for the low frequencies, in fact, may be neglected, and yet the condenser is effective as preventing hum from backing into the pentode tube. Just why this should be so does not seem quite clear, for the circuit (2 meg. with 0.1 mfd. across) is a low pass filter, the condenser being effective therefore only on the high frequencies. Still the hum is of a low frequency, particularly 120 cycles, the second harmonic of the line frequency. Only a phase displacement, therefore, can account for the phenomenon.

A Previous Experiment

Such a displacement renders the effect of small capacities quite considerable, as was brought out quite obviously in another circuit, where three resistance coupled audio stages were used, a resistor of 10,000 ohms between cathodes of the two preliminary 224 tubes, and a common 10,000 ohm resistor going to grounded B minus. A small capacity across the first 10,000 ohms had a strong tuning effect. As low as 0.0005 mfd. cut off the high notes abundantly. Of course that was in the opposite direction, for it was a low pass filter in theory that proved a real low pass filter in fact. The hum cutter is a low pass filter in theory that is a low pass filter in fact, except as to the hum. Since the result is hum elimination, possibly we had better not look a gift horse in the mouth, but accept the favor gracefully and without inquisitive comment.

The 2 meg. resistor therefore is, to all audio intent and purpose, in series with the 0.5 meg., so we have 2.5 meg. in the grid circuit, a respectable value of resistor. This makes the low note response much stronger. Since such methods may be used it seems idle to mention high audio frequency accentuation of the pentode tube, for the lows can be brought out much more strongly by devices such as the one mentioned.

Raising Leak Values

It is sound advice to all who build sets, using resistance audio, whether a-c operated or not, to use as high a value of grid leak in the output stage as is practical. The limitation is motorboating. Once that appears, reduce the leak value only so much as necessary to get rid of the motorboating. Moreover, the grid leaks in any other audio stages have a similar effect, and the raising may be done in any audio grid circuit, for the audio channel is a unit, and it is without profit to theorize on the independence of the tube circuits. The audio channel is best regarded as a single impedance.

The detector tube must be included as an audio tube, since it handles audio frequencies. Its radio frequency output is sidetracked purposely, usually by a bypass condenser, except in regenerative sets, and even then the radio frequency is sidetracked finally, that is, after the tickler coil.

The circuit, Fig. 1, is markedly similar to that in Blueprint No. 627, and those desiring to follow Fig. 1 may use the blueprint for the layout and nearly all of the wiring.

R-F Coil Taps

The taps T on the radio frequency coils represent points picked up by a rotary selector switch, for coverage down to 80 meters. The coils used were in small aluminum cans (2.5 inches diameter), with screw bases, and the taps were represented by the ground symbol lugs protruding at bottom.

The ground connection was made in the coins to the can itself, except for the B lug representing ground of the antenna winding itself.

A short switch was tried, and the condenser stators connected to it, but running these leads from condenser to switch, back to coil, required such lengths of wire that the coupling was too strong, and there was oscillation on the broadcast band as well as on the short wave band. However, when a special switch was used, with sections so placed that they came right close to the condenser and coil leads, there was no trouble on broadcasts.

The coils consisted of 100 turns secondaries, No. 31 enamel wire, tapped at the 24th turn from the grid end. Therefore the coils evidently contemplate the shorting out of the 76 turns, and if you have only the shorting type of switch, this method has to be used. However, if you desire to follow Fig. 1 literally, and adhere to these coil data, then what is the ground end of the winding, soldered to a rivet in the shield, will have to go to the grid, and the other end of the secondary will be soldered to the rivet. Then instead of shorting out 76 turns, these turns are left in circuit as a continuation to grid, while the condenser stator is moved from the extreme of the winding to the tap 76 turns removed from the grid end.

The primaries for these coils consist of 25 turns of No. 42 silk wire wound over the secondary, with three layers of insulating fabric in between. The actual wire sizes stated need not be used, but any size somewhere near the specifications.

Detector Screen Voltage

As sliders on a voltage divider were used, it was easy to experiment with different values of screen and plate bias voltages for the detector tube. A much lower screen voltage was used, whereupon the bias had to be lowered, and the rectified voltage output of the detector (using a vacuum tube output meter) was excellent. It merely showed that low screen voltages are quite all right, but bias must be accordingly. However, since one screen voltage for all is handier, and the results were good, with 5 volts negative grid bias, the circuit is shown with a single screen voltage for the r-f and detector tubes.

It will interest many to know that the tonal values were excellent indeed from this receiver, so excellent that some radio engineers specializing in acoustics actually enjoyed the reproduction of an orchestra broadcasting from a local station, and admitted that the quality was good. The set was in a typical midget cabinet, except oblong, rather than of the Gothic arch type. The speaker was 7-inch diameter Rola, series F. The Magnavox and Utah speakers of the same specifications may be used interchangeably. These specifications are: 1,800 ohm field coil, tapped at 300 ohms; output transformer built in, matched for the impedance of a single pentode tube. The cone diameter must be 7 inches for such a cabinet, but may be 10.5 or 12 inches for a console installation.

Kit Enables Short Wave Sets to Reproduce Television

Short Wave Club members can now very inexpensively add television to their present equipment and enjoy the thrill of seeing as well as hearing their favorite programs. The See-All Televisor, manufactured by the Television Manufacturing Company of America, Inc., New York, can be purchased in kit form at a reasonable cost for use with a present short wave set.

The feature of this new scanner kit is the low price coupled with excellent engineering and workmanship. Actual demonstrations of the See-All kit prove the manufacturer's claim that it produces a brilliantly clear picture.

One of the reasons for this is that the holes in the special scanning disc are square, not round, thus providing greater illumination.

Another feature of the See-All scanning disc is that a double spiral of holes is provided, which greatly simplifies the framing of the picture.

Upon receipt of the call signal the See-All tunes is instantly in perfect synchronization with the broadcasting station. The kit comes with detailed simple instructions and blue prints for quick assembly. With over thirty important radio stations now broadcasting television, this new form of radio entertainment should be very gratifying to the club members.

THE SECRET OF SUCCESS IN BR

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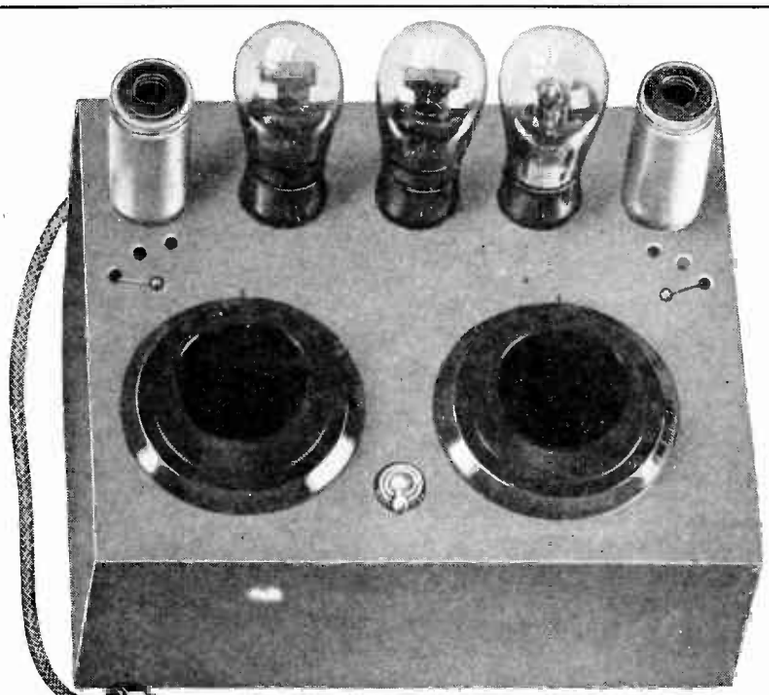
The Programs of Strange Lands

15 TO 200 METER CONVERTER



HERE at last you have it—a highly sensitive short-wave converter, 15 to 200 meters, that works on *any* set and that has its own A, B and C supply built in and that does not use plug-in coils for band shifting

Two separate tuning condensers and two dials are used, so there *can not be any possibility of sensitivity loss* due to mistuning, as where ganging prevails. Also, any intermediate frequency may be used.

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Two coils are used, one for oscillator, the other for modulator, and two tube sockets are near these coils, and underneath the top panel, not for tubes but so that you can move the grid connecting wire of the two condensers to any one of four points for wave shifting. Simple, effective, inexpensive, infallible!

Three 237 tubes are used. These are of the automotive series and are most economical, the total consumption, A and B power being less than 10 watts, hence costing no more than one-tenth of a cent per hour to operate!

This converter works on superheterodynes as well as on tuned radio frequency sets, because IF ANY CONVERTER IS A GOOD ONE IT IS BOUND TO WORK ON ANY TYPE OF SET.

There are 16 mfd. of filter capacity and a 15 henry B choke, in the B supply, as well as a husky line transformer.

Do not suppose just because the price of parts is low that this converter does not perform efficiently, for it is a knockout! What sensitivity! What power! What results! Send for complete parts to-day. A clear diagram is furnished with each kit. Order Cat. R-CNV.....

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(SEE TUBES ADVERTISED AT BOTTOM OF OPPOSITE PAGE)

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FOR short wave superheterodyne work 1,600 kc. is the popular intermediate frequency, because you can tune to below 9 meters without interlocking of modulator and oscillator circuits, due to the high intermediate frequency. Our 1,600 kc. shielded transformers have large diameter wire, loose coupling for selectivity and stability, and Hammarlund's new superheterodyne condensers built in, accessible to a screwdriver. Both plate and grid circuits are tuned. Shield is 2⅛ inch diameter, 2⅞ inches high. For variable mu tubes. Order Cat. FF-1600 @ $1.65

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This set enables band shifting from the front panel without any further effort than turning a single knob. It is equipped also with on-and-off switch and volume control (one unit) and a rotary band selector switch of the anti-capacity and non-shorting, insulated type.

You know from your experience with short waves that you need plenty of audio amplification, and here you have it—two stages of screen grid audio and 247 pentode output! The audio amplifier is of the highest quality and is *perfectly suitable for television.*

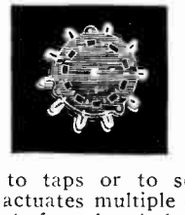
The radio frequency end affords the simplest possible method of tuning in a wide band of frequencies, so that the radio circuits are all tuned to the same frequency, and no padding or other difficulties present themselves. The circuit is tuned radio frequency.

The cabinet into which the chassis fits is one of exquisite beauty, being a two-tone walnut effect, with decorative grille for a 7 inch dynamic speaker. All parts are of the highest class, including Rola full dynamic speaker (7 inch cone). Build this set and know real short wave reception. All parts and diagram are supplied at this price, exception tubes. Order Cat. R-S.....

$24.25

(Tubes used: three 235, one 224, one 247 and one 280. See tube prices at bottom of opposite page.)

SHORT WAVE SWITCHES



SWITCHES of special precision, positive contact, non-shorting, are needed for short waves. These rotary selector switches are suitable for moving the stator connections of tuning condensers to taps or to separate coils. Single knob actuates multiple circuits. Knob can't slip on shaft and switch can't slip on panel.

Single circuit, 4 taps and index. Cat. 4-1-SW @ **$1.05**

Two circuits, 4 taps and index for each. Cat. 4-2-SW @ **$1.87**

Three circuits, 4 taps and index for each (fewer taps may be used). Cat. 4-3-SW @ **$2.28**

These switches may be used for any purpose where single, double or triple circuits are to be worked, up to four different positions, and are suitable for all wave switching because the shafts are totally insulated. These are anti-capacity switches of the precision type.

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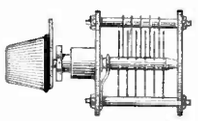

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Oscillator coil for switching bands without plugging in, to cover 15 to 200 meters with 55 mmfd. Cat. M-55-C (coil only) $2.15

TAPPED COILS FOR BAND SHIFTING

TAPPED coils are proving very popular, as they make for economy of room and also afford good results. The Roland coils are obtained in two types, one for broadcast coverage, 200 to 600 meters, with tap for going down to 80 meters, so television, airplane talks, amateur and other interesting transmission may be heard, and the other for coverage from 200 to 15 meters only. (No broadcast band.) These coils are wound on 1⅛ inch diameter and are attached at the factory to aluminum screw bases, with lugs protruding at bottom. An aluminum cover (not illustrated) screws over the base.

The primary is wound over the secondary, with insulating fabric between, and the inductance is kept exactly equal for all coils by keeping the axial length of the winding identical, as well as the number of turns. Therefore at top (what looks like a separate winding) a space is "spun," as well as at bottom, to insure such identical inductance.

For 80-600 meters, for use with 0.00035 mfd. three gang, order Cat. M-35-C (three coils, three shields at this price) @ $2.45

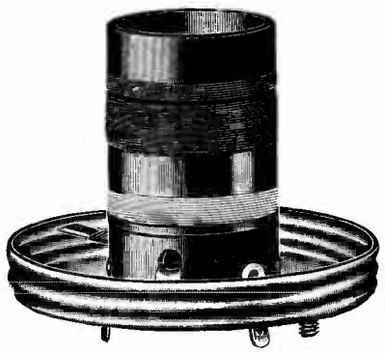
For 0.00046 mfd. order Cat. M-46-C MSSC @ $2.45

For 0.0005 mfd. order Cat. M-05-C @ $2.45

The short wave coils, 15 to 200 meters, are listed herewith:

For 0.00035 mfd., two shielded coils, one with two windings for antenna coupler, other with three windings for sensitized detector. Order Cat. OSW-35-L @ $1.95

For 0.00015 mfd. two shielded coils. Cat. SW-015-L @ $2.05



PRECISION PARTS AND ACCESSORIES

WE carry a complete line of Rola dynamic speakers, all sizes, all purposes, as well as the exclusive Farrand inductor speaker for push-pull pentode output that requires no output transformer.

The Rola speakers are very popular in midget sets, both of the broadcast and short-wave type, as well as for all-wave coverage, and are used also to great advantage in automobiles.

The Rola speakers for home receivers are obtainable with field coils that may be used also as the B supply choke coil, and which field coil has a tap, so that bias for a pentode may be obtained from the field coil itself. This method introduces audio rgeneration, which improves tone and sensitivity. The tapped coils have a total resistance of 1,800 ohms and the tap is at 300 ohms from the ground end. The grid return of the power stage is connected to the tap. This is the method used in all our a-c circuits.

Rola dynamic speaker, 1,800 ohm field coil, tapped at 300 ohms. Output transformer matched to single pentode is built in. Diameter of cone is 7 inches. Cat. RO-18 @ $4.50

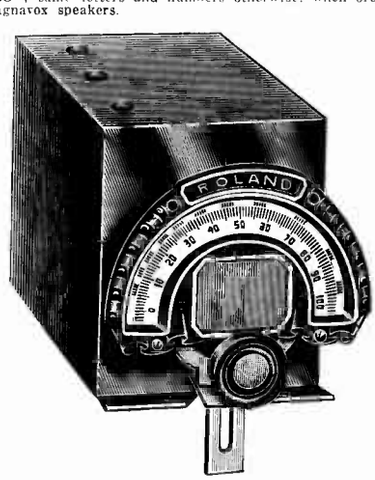
Same as above, except that cone diameter is 10.5 inches. Cat. RO-18-10 @ $5.85

Same as above, except that cone diameter is 12 inches. Cat. RO-18-12 @ $7.25

Rola dynamic 6 inch cone for automobile sets, 6 volt field to be connected to car's storage battery. Speaker fits on bulkhead under the instrument board. Shielded cable is supplied with each speaker. Cat. RO-AU @ $4.95

Notes Send for our Blueprint No. 629, six tube auto set. See bottom of this page.

Magnavox speakers can be supplied, if desired, at same prices, same specifications. Use code "MA" instead of "RO", same letters and numbers otherwise, when ordering Magnavox speakers.

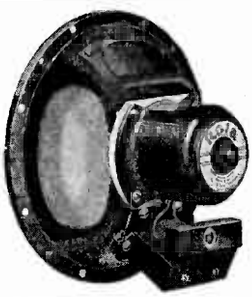


MATCHED COMBINATION TUNING UNIT, to cover from 80 to 600 meters, using a coil system including a single tap on each secondary, and serving as the tuning adjunct in superheterodynes with an intermediate frequency of 175 kc. The tap need not be used if only the broadcast band is desired. The oscillator circuit is accurately padded for that in intermediate frequency. The matched tuning unit includes a three gang, brass-plate, steel-frame condenser, with stator shields built in, the entirely shielded again, with extra partitions built inside to serve as rotor shields. Low vibration factor to avoid grunting nuisance of some types of superheterodyne condenser construction. Three trimmers are built in. The three shielded coils, of the same general appearance as the one illustrated at upper right-hand position on this page, are supplied. The oscillator coil is already padded. Order Cat. CMTU @ $6.65

Set of three shielded coils, padded for 0.00035 mfd., for use with 175 kc. intermediate amplifier. Tap is included. Cat. SUC-35 @ $3.10

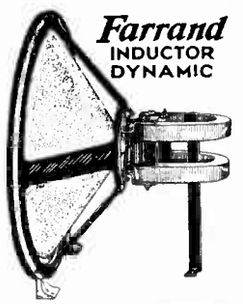
Same as above (set of coils) except for 0.00046 mfd. Cat. SUC-46 @ $3.10

Same as above, except for 0.0005 mfd. Cat. SUC-5 @ $3.10



FARRAND inductor dynamic, for pentode push-pull requiring no output transformer. Simply connect the two tipped leads to the plates of the pentodes and connect the untipped (yellow) lead to the maximum B plus voltage. By this method no plate current flows through the winding, only signal current so there is no danger of burnout or premature saturation, and the tone quality is superb.

This speaker has one of the best audio curves of any ever produced, but it is not quite so sensitive as other type dynamic speakers, and therefore should be used on high powered sets. It is suggested therefore that it be used on a-c sets having no fewer than six tubes or battery sets having fewer than seven tubes. It is strongly recommended, however, that the speaker be used on all high powered sets using push-pull pentode output. These pentode speakers are not generally obtainable. We're privileged to have a source of supply that enables us to fill the needs of those most discriminating as to tonal values. Order Cat. FAR-PENT @ $8.75



800 TURN HONEYCOMB coil, total diameter 1¼ inches; will tune to 175 kc. with 0.0001 mfd. (or 20-100 mmfd. equalizer). Cat. HC-800 @ .....$ .50

200 TURN HONEYCOMB coil, same style, tunes to 450 kc. with 0.0001 mfd. Also may be used without condenser as antenna input coil, screen and plate choking, or two used inductively coupled for evening the amplification of t-r-f sets, in untuned stage feeding detector. Cat. HC-300 (each) @ .....$ .43

50 TURN HONEYCOMB coil, ¼ millihenry, for all short wave purposes. Cat. HC-50 @ .....$ .25

1 WATT PIGTAIL RESISTORS, all resistance values. Mention Cat. PGTR and state resistance in ohms thereafter. Price .....$ .15

5 WATT 2,000 OHM resistor to drop maximum B to B plus 180 volts for plates of r-f tubes in any t-r-f set. Cat. 5-W-2 @ .....$ .45

POTENTIOMETERS: 400 ohms at 27c; 5,000 ohms @ 35c; 25,000 ohms @ $1.25; 50,000 ohms @ $1.25; 100,000 ohms @ $1.25; 500,000 ohms @ $1.25.

POTENTIOMETER with a-c switch attached, 10,000 ohms, for variable mu grid bias as volume control. Cat. POT-5-SW @ $1.55

WALNUT FINISH ROLAND (illustrated upper left) CABINET for midget sets, cut for 7-inch cone. Cat. MDCB @ $4.90

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickled frame. Shielded. Cat. DJA-35 @ $1.95

Eveready-Raytheon 4-Pillar Tubes

227	@$0.60	245	@$0.60	240	@$1.80	236	@$1.65
224	@ .60	250	@ 3.60	112A	@ .90	237	@ 1.05
235	@ .96	U-99	@ 1.50	222	@ 2.70	238	@ 1.65
247	@ .93	V-99	@ 1.68	230	@ .96	239	@ 2.05
226	@ .48	120	@ 1.80	231	@ .96	280	@ .60
171A	@ .54	201A	@ .45	232	@ 1.30	281	@ 3.00
210	@ 4.20	200A	@ 2.40	233	@ 1.65	Neon	@ 4.50

DYNATRON OSCILLATOR, a-c operated; plug-in coils; 15 to 550 meters; built-in filament transformer; requires 90 volts B supply extra, which may be batteris. National vernier dial. Compleecly wired, with tube. Cat. DN-OS @ $11.00

KELFORD 30 henry choke; stands up to 100 ma; in black shield case. Cat. KEL-30 @ $1.75

KELFORD 15 henry B supply choke; 60 ma; unshielded. Cat. KEL-15 @ .....$ .95

2.5 VOLT center tapped fil. trans., 8 amperes (will stand up to five heater tubes, when voltage is 2.25 v). Cat. FLT @ $1.62

HAMMARLUND 0.0002 mfd. variable condenser, junior midline; rotation is within 2-inch diameter; for short waves. Cat. H-20 @ $1.35

HAMMARLUND 60 mmfd. manual trimming condenser. Cat. H-60 @ .....$ .79

HAMMARLUND 20-100 MMFD. EQUALIZERS: adjusting screw works in a threaded brass stud, so excess force cannot damage the unit. Cat. 3-EQ-100 (price is for three) .....$ .60

CHASSIS for midget, fits in Roland cabinet; chassis is 13½ inches wide, 7½ inches front to back; flaps front and back 3 inches high; drilled for socket and speaker plug and for volume control and switch at front. Cat. 5-TCH @ $1.75

CHASSIS for 6 tube midget. Cat. 6-TCH @ $1.75

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Cat. DJA-35 @ $1.95

THREE 0.1 MFD. condensers in one shield case; black lead is common; three red leads go interchangeably to destination; mounting screw built in. Cat. 31 @ ...$ .57

MIDGET POWER TRANSFORMER, for five-tube set, to handle three heater tubes, one 247 and one 280. Cat. MPT-5 @ $3.15

MIDGET POWER TRANSFORMER for six-tube set, to handle four heater tubes, one 247 and one 280. Cat. MPT-6 @ $3.55

8 MFD. WET ELECTROLIC condenser, for inverted mounting; washer and extra lug provides insulation from chassis for circuits with B choke in negative leg. Cat. LCT-8 @ .....$ .85

BLUEPRINTS

Blueprint No. 627, five tube a-c midget, broadcast band. Uses two 235, one 224, one 247, one 280. There is no 5 tube midget to compare with it. 80 meter tap coverage optional. Order Cat. BP-627 @ .....$ .25

Blueprint No. 628, six tube a-c short wave set, no plug-in coils; 15 to 200 meters. Order Cat. BP-628 @ ..$ .25

Blueprint No. 629, six-tube auto set. Order Cat. BP-629 @ .....$ .25

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Annual subscriptions are accepted at $6 for 52 numbers, with the privilege of obtaining answers to radio questions for the period of the subscription, but not if any other premium is obtained with the subscription.

Choice of a Circuit

HAVING 28x14 inches room in a console I intend to build a receiver and was wondering whether four stages of tuned radio frequency, detector, two stages of audio and rectifier would be better than an eight tube superheterodyne. Also, I desire to receive television and would like to know if transformer coupled audio will be satisfactory, as it is of the best and most expensive kind. If I build a super, is it all right to put a coil in the screen of the modulator to couple to the oscillator, or what do you suggest? Should I use the 235 or the 551 tubes for radio frequency?—H. G. D.

You will get high sensitivity from a tuned radio frequency set of the type that you describe, but the selectivity will not be comparable to that the super will afford. Moreover, four stages of t-r-f can not readily be stabilized, and you are almost certain to have oscillation trouble. We advise you to build a super instead. As for television, using audio transformers of the best type, it is practical to get a good picture, even though resistance coupling is more usually recommended. It is true that a better quality of amplification is obtainable from resistance coupling, but some of the resistance audio circuits in television receivers are not as good in that respect as the best audio transformers. The reason is inappropriate choice of constants. Evidently you have the transformers and there is no reason why you should not use them. Be sure, however, not to connect them with primaries as plate loads on screen grid tubes. Use a 227 as negative bias detector and another as first audio tube, with push pull output. It is all right to couple as you suggest, but take care not to make the coupling tight. The 235 tubes cost less and are very satisfactory.

* * *

Hum on Converter at 25 Cycles

ABOUT four months ago I bought a short wave converter, but it so happened it was for 50-60 cycles, while the frequency here (London, Alberta, Canada) is 25 cycles. As you may surmise, there was very considerable hum. I put in a 25 cycle transformer, but this did not cure the trouble. Then I suspected the filtration, and I believe that the choke coil in the B supply is not large enough, and that I need more than the two 8 mfd. electrolytic condensers, to get rid of hum.—C. H.

The 25 cycle transformer certainly was necessary, for while a transformer of a given frequency rating may be used at higher frequencies, it can not well be used at lower frequencies, because the impedance is too low at the lower frequencies. Likewise the filtration for 25 cycles has to be better. It is doubtful whether you need any more choking, even though the inductance of a choke intended for 60 cycles is less at 25 cycles. The common practice in receivers is to add more capacity next to the rectifier, so we suggest that you connect an 8 mfd. condenser in parallel with the present one next to the rectifier, and we believe this will be satisfactory. If, however, you desire also to add more inductance, simply put another choke in series with the one now there, arranging the condensers so there will be the two 8 mfd. in parallel (totaling 16 mfd.) from the B plus output of rectifier to ground, and the 8 mfd. single at the end of the newly constituted choke system. In other words, do not put capacity at the joint of the two chokes.

* * *

Phonograph Amplifier

A SPECIAL amplifier, for use with phonograph only, is desired. I have on hand one Polo power transformer, 100 ma rating, 700 volts d-c, 5 v and 2.5 volts, also an Amertran output transformer, primary 14,000 ohms for pentode tube, secondary, 15 ohms, to work into my dynamic speaker, also one Audak pickup of specially low impedance with special Ferranti matching transformer, matched primary for the pickup and secondary for the input to a 227 tube. What I want is no hum. I have read "New Audio Circuit," by Bernard, on page 4, Fig. 1, October 10th issue, also "Public Address System," by Brunn, September 5th, page 12. How about providing a push-pull output from 227 first audio? And is the Bernard (new audio) amplifier as quiet as Brunn's public address system? I have had hum trouble with pentodes. The amplifier is to be used in a living room, 30 x 40 feet.—L. T. G.

The public address system would be rather too much for the living room, as it is intended primarily for small halls and auditoriums. The Bernard audio amplifier, using audio regeneration, has been worked out entirely along the lines of resistance coupling and therefore does not fit into your parts supply. You will get all the volume you need, and more, from two stages of audio, the last stage in push-pull. The power transformer will fit nicely into the requirements if you use 247s in push pull. The first audio tube may be a 227, with 90 volts applied to the plate through the primary of the push-pull input transformer, whereupon the bias should be 6 volts negative, through a potential drop in a cathode resistor, and the plate current will be 2.7 milliamperes. This current is low enough not to reduce substantially the inductance of the primary of the push-pull transformer. The maximum undistorted power output of the first stage will be 30 milliwatts and the ohms load required is 14,000. The biasing resistor should have a condenser of 8 mfd. across it. The push-pull stage is standard, but be certain not to put a condenser across the common resistor from filament center to ground biasing the push-pull tubes. Connect a resistor of 0.25 meg. from the joint of the secondary winding of the push-pull input transformer to ground, and put a 1 mfd. condenser across this resistor. Thereby you will have a resistor capacity filter that will stop hum from backing into the output tubes. The hum should be very low, particularly as push-pull gets rid of second harmonics, and the principal hum component is the second harmonic of the line frequency, that is, 120 cycles. The filtration need be no more than the usual B supply choke coil with 8 mfd. next to the rectifier and 8 mfd. at the other end of the choke. However, if your speaker field has a tap to permit pentode bias, then you may put the choke in the negative leg of the rectifier, connect the push-pull grid return through the 0.25 meg. resistor to the tap in the field coil, instead of to ground, but have the 1 mfd. bypass condenser go from the joint to ground nevertheless. The pentodes do not produce hum any more than do the 245's, only they amplify more. That is, the mu of the 245 (single) is 3.5, whereas that of the pentode is 90, so the pentode enables a gain of almost 26 times that of the 245. Your hum trouble may have been due in part to inclusion of a bypass condenser across the biasing resistor of the push-pull tubes, for such a condenser upsets the dynamic symmetry of the push-pull circuit, to the extent that any overtaxing of tube by signal is not to be compensated. In a proper push-pull circuit there is no signal current in the biasing resistor, so the use of a bypass condenser could never work anything but injury.

* * *

Coils for 628-B

PLEASE give coil data for 0.00035 mfd. condenser, for use in the circuit covered by your Blueprint No. 628-B (short wave six tube receiver of the midget type).—B. A. J.

The impedance coil for broadcasts may consist of 127 turns of No. 34 wire or thereabouts, on 1 inch diameter tubing. For a series condenser of 100 mfd. in the oscillator circuit, for broadcast waves, the first secondary may have 47 turns, the secondary 20 turns, and the third secondary 9 turns, the fourth 4 turns on 1 inch diameter. Use 28 enamel wire. The plate winding is between the first and second largest secondaries and consists of 22 turns. The blueprint clears up the relative positions. While 628-B is a set primary for 15-200 meters, the data given cover the broadcast band as well, since this is easily done.

* * *

Speaker Impedance

I WONDER if you could tell me if the impedance of the Farrand inductor speaker, model G, is satisfactory for pentode push-pull output, and if not, what shall I do about obtaining a suitable output transformer?—J. M.

If you have the Farrand Model G with the center tap coming out as a free lead (as distinguished from the two tipped leads), then you do not need any output transformer. Simply connect the tipped leads to the plates of the output tubes, and the plain lead (yellow) to B plus maximum voltage. The impedance is satisfactory for such a circuit. However, the Farrand is not as sensitive as the other types of dynamics, therefore there will be less volume of sound, not due to impedance trouble, but to the constructional features of the speaker. The tone will be most excellent, as the Farrand inductor in that respect is one of the best speakers ever made. The Farrand company sold out to a set manufacturer that now uses the inductor dynamic in his own sets, and the speakers are not generally obtainable by experimenters for that reason. If you have a Farrand with single output (no yellow third lead) it would be handier to use it with an audio choke coil in the plate circuit of a single output tube, a 2 mfd. condenser connected one side to plate, other side to one of the speaker leads, the other speaker lead going to the center tap of the power tube filament winding (usually ground).

Detector Short Wave Adapter

AS a reader of your magazine I have become interested in short waves. I am particularly interested in a set that could be plugged into the detector of a broadcast receiver. Do you know of a good short wave device of this kind or can you give diagrams for its construction? Do you believe that such an arrangement is practical and that the results would be equal to those of a regular short wave set?—E. G. S.

An adapter such as you describe is not very reliable. It works on some sets, not on others, and at best does not do nearly as well as a good short wave set. The resort to plugging into the detector brings in too many uncertainties, such as type of detector is used, distribution of d-c voltages and nature of the plate load. As such a device must be regenerative, the trouble too often is that regeneration fails, as conditions are not right to produce it, and thereupon next to nothing is heard. We published some information on building such devices about a year ago, but pointed out the absence of general application, along the lines now laid down. We do not encourage the building or use of these detector socket adapters, as short wave converters can do ever so much more, and short wave sets outclass both. A good converter was described in last week's issue, dated December 5th, and another one is published this week.

* * *

Short Wave Set

WILL you please tell me where to get a blueprint of the circuit shown on page 8 of the September 5th issue, a short wave midget?—H. L. N.

That was a five tube a-c tuned radio frequency set. There is no blueprint on it. However, Blueprint No. 628-B is available, for 15 to 200 meter coverage (optional 200-550 meters easily exercised), using six tubes in an a-c superheterodyne circuit.

* * *

From a Battery User

I HAVE built a compact resistance coupled circuit, one 222 r-f tube, one 240 detector, one 222 first audio and one 112 second audio, but have been unable to overcome slow motorboating, except at the expense of greatly reduced volume. You have shown methods of overcoming audio regeneration but I have not seen where you ever applied this to battery operated sets. Also, in regard to the diode detector, November 7th issue, you apply this to a-c sets, but not to battery sets. I would like to include this detector. Please take care of this in an early issue, as we battery users are many.—J. C. W.

The slow motorboating may be killed off by using a lower value of grid leak in either first or second audio circuits. Also a resistor-capacity filter will tend to isolate the last audio grid circuit from the variations that cause the trouble. Disconnect the power tube grid leak from its grid return, insert an 0.25 meg. resistor between this point and C minus, and connect a 1 mfd. from the resistors' juncture to ground. Overcoming regeneration in battery operated sets is more difficult than in a-c sets, because batteries are used for biasing, hence there are no biasing resistors in the plate-grid circuits. The set you built is not one of extreme sensitivity, and as the diode is best applicable to sensitive sets, because adding no gain of its own, you would not get enough volume of sound, unless you increased the primaries of the transformers considerably. You may retain the detector tube and circuit as you have them and by getting rid of the slow motorboating you will have good performance. Also, you may try a condenser of 8 mfd. from B plus maximum to ground, to lessen motorboating, although when motorboating is very slow of course a capacity of 8 mfd. would not be of much help. Data on battery tubes as diodes are published elsewhere in this issue.

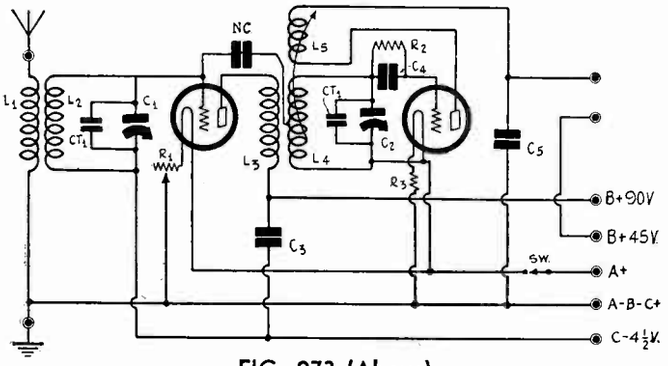
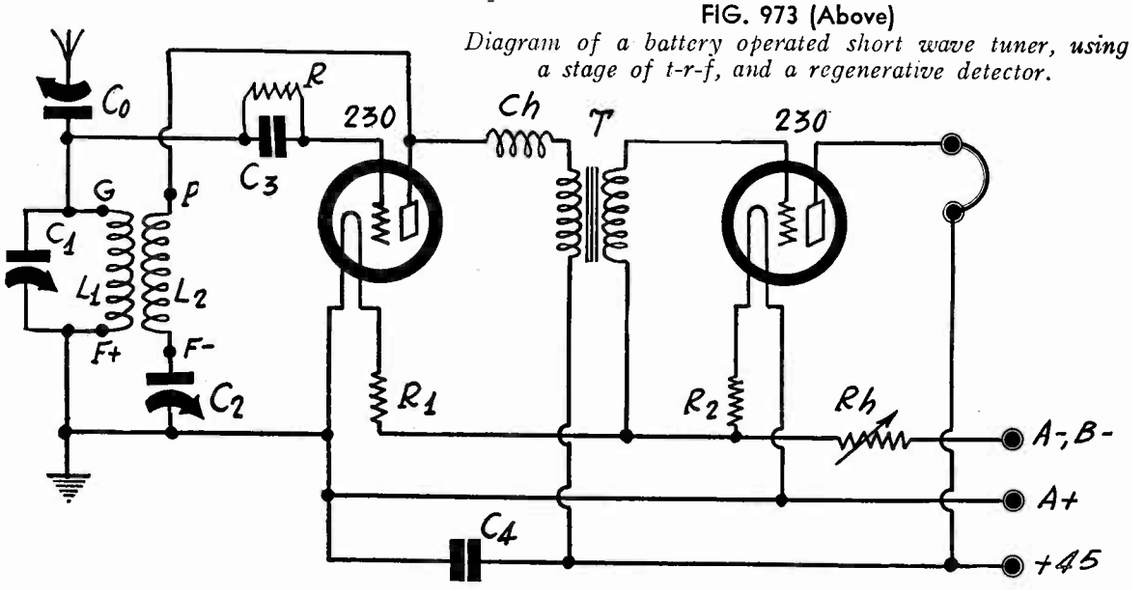


FIG. 973 (Above)

Diagram of a battery operated short wave tuner, using a stage of t-r-f, and a regenerative detector.

FIG. 974

A regenerative detector and one stage of audio. This circuit was popular several years ago for broadcasting listening, on earbhones, and short wave listening, but present conditions require greater selectivity, as obtained from the circuit shown in Fig. 973. Besides, the t-r-f stage (Fig. 973) provides about as much gain as does an audio stage.



Two Circuits Compared

WILL you kindly illustrate and compare these two circuits: each has two tubes and each is for short waves, but one has one stage of audio and the other has a stage of t-r-f and a detector. These circuits are for battery operation and to cover only one band (200 to 60 meters).—N. I. P.

Please see Figs. 973 and 974. Fig. 973 represents the stage of t-r-f and detector, while Fig. 974 shows the detector and one step. We prefer Fig. 973, because of the increased selectivity. The short waves are badly congested and high selectivity is needed in that region much as in the broadcast band. As most short wave listeners want some foreign reception, and about their only opportunity of getting it is through high selectivity and good sensitivity, we recommend the two tuned circuits. Using a tickler coil, of course plug-in coils or switching would not be very practical, however you desire to cover only about a 3-to-1 frequency ratio, and this can be done with 0.00035 mfd. tuning condensers. L1 and L2 are the antenna coupler. L1 is 10 turns, spect ⅛ inch, L2 is 50 turns, No. 28 enamel wire on 1-inch diameter. L3, L4, L5 are the three circuit coil. L3 has 6 turns, L4 has 50 turns, tapped at the 10th turn from the ground end. No. 28 enamel wire, 1 inch diameter. L5 is on a shaft. Secure the shaft to the front panel to actuate the coil, which clears the other form by ½ inch. The diameter is ½ inch dowel, and the number of turns is 16 of No. 32 wire on each side of where the shaft is fastened. Provide an end stop for the tickler and reverse tickler connections if regeneration fails. NC is an equalizing condenser of 15 mmfd. maximum, adjusted with a neutralizing rod to stop oscillation in the r-f tube. CT also are equalizers and may be of higher capacity. C1 and C2 are 0.00035 mfd., C3 is 1 mfd., C4 is 0.00025 mfd. with clips, C5 is 0.0001, 0.00025 or 0.00035 mfd. For 201A tubes, R1 is 20 ohms, but should also have a 4-ohm resistor in series with it (not shown), while R2 is 50,000 ohms and R3 is 4 ohms. These directions assume a 6-volt storage battery. The other circuit, Fig. 974, is adaptable to plug-in coils and the condensers and coils may be smaller.

* * *

Diode in T-R-F Set

HAVING just finished reading Herman Bernard's article in the November 21st issue on the use of the diode as a combination detector and automatic volume control tube, while this applied to an a-c superheterodyne, could it not also be applied to a tuned radio frequency set? Would not a dual impedance transformer work as a coupler between a first audio tube (227) and a push-pull pentode output?—F. G. L.

The system of course can be applied to tuned radio frequency just as to superheterodyne sets. In fact, the circuit is identical in this respect. The dual impedance can be used, working out of a 227.

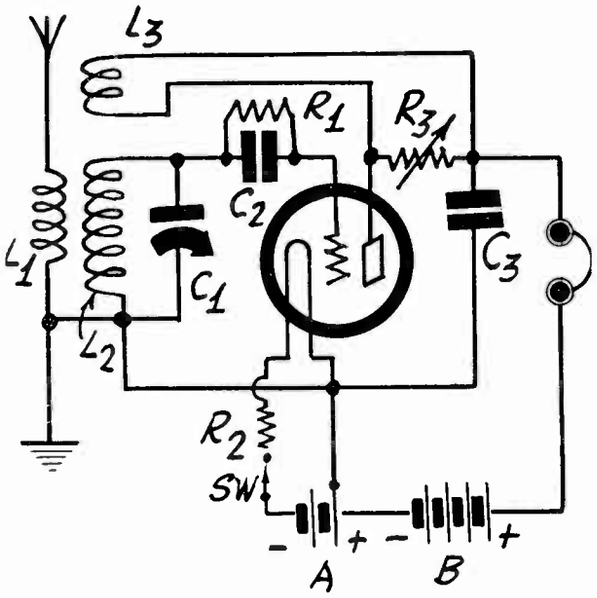


FIG. 975

Regeneration controlled by an adjustable resistor in parallel with the feedback coil L3

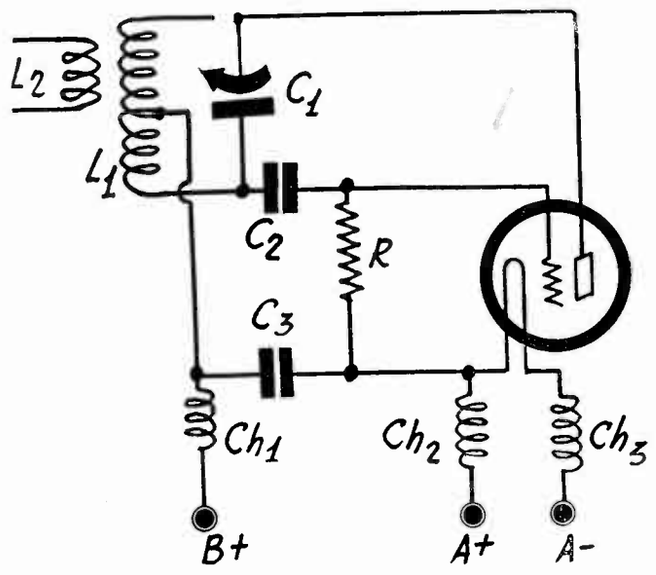


FIG. 976

A circuit for producing high frequency oscillations. The line from coil to rotor, at top, should be closed.

(*Continued from preceding page*)

KINDLY show how to control regeneration with a high resistance and state whether you regard this method as satisfactory, as it has been recommended to me, but I am in doubt. Apply it to a one tube set, please, for battery operation.—N. B.

The method shown in Fig. 975, whereby an adjustable resistor is across the tickler coil, L3, works well. It is also all right to use a resistor in series with the tickler, but in that case the resistor should be of much higher value. In the diagram a 5,000 ohm resistor will work, or values up to 25,000 ohms may not prove over-critical, but for series connection a resistor of 100,000 ohms or more is recommended. The grid leak, R1, may be 5 meg., the grid condenser 0.00025 mfd., the coil a three circuit tuner for the condenser you use, the tickler fixed at a feedback value at zero resistance of the control.

* * *

No Pep on Low Waves

THE 233 Diamond, built from specifications in the July 4th issue, works splendidly from 550 to 800 kc, but not much is brought in above that in frequency, as there is next to no response on the low waves. Will you please let me know how I can build up the volume and sensitivity on the lower waves? Is there a blueprint for this circuit?—Q. C. S.

Use a smaller value of radio frequency choke in the detector plate lead of this battery operated all-wave set that has tapped t-r-f coils for switching. A 300 turn coil in some instances may prove too large. You can test temporarily by shorting out this coil, then replacing it with one of 50 turns or so. The honeycomb type will suffice. When tuning in short waves you should disconnect the long aerial used for broadcasts, in working this receiver, and use a short aerial on the moulding or under the carpet, say, 20 feet long. Then broadcasts will not come in on any short wave taps. Be sure you have the receiver wired correctly as to taps. The tuning condenser stators are moved from one tap to another. Reverse the connections to the secondary of the detector t-r-f coil, connecting to grid the terminal now going to ground, and to ground the terminal now going to grid. This also has the effect of reversing tickler connections, as it seems you are not getting regeneration, and reverse feedback is more effective as a damper on the higher frequencies. There is no blueprint for this circuit.

* * *

Has Own Power Pack

REGARDING Blueprint No. 627, for a five tube broadcast t-r-f set, a-c operation, I do not desire to use the circuit as shown, because I have a power pack and also a magnetic, instead of a dynamic speaker. Could you give me a print of such a circuit to fit my needs, up to and including the detector?—G. W. T.

We do not have the blueprint you request.

* * *

Coil and Pick-up Data

I WOULD like to build a five tube midget such as you described in RADIO WORLD. Would you please tell me the number of turns for a variable condenser of 0.00035 mfd. capacity? If I connect a phonograph pickup in the grid of the 224 detector, would the volume be great enough to fill the house?—J. W.

The coils may consist of 25 turn primaries wound over 127 turn secondaries, the diameter being 1 inch, the separation around 1/16 inch, due to insulating fabric between primary and secondary, the wire being No. 32 or thereabouts. You can not well connect a pickup as stated, because the detector is biased for detection, and you would desire amplification bias, and besides, without special precautions, the secondary of the coil feeding the detector would short the pickup. Instead, put the pickup in the grid circuit of the pentode. The amplification is about 90, and this is deemed sufficient by many for home phonograph use. Try it and decide for yourself. If you want still more volume, put the pickup in series with the detector biasing resistor, with one side of pickup to cathode, and arrange to short out the biasing resistor when the phonograph is to be played. The bypass condenser then would be across the biasing resistor only.

* * *

Seeks Condensers

PLEASE advise where 0.000325 mfd. condensers may be obtained, as used in the Monitor Receiver.—H. A. L.

From Roland Radio Co., 35 Hooper Street, Brooklyn, N. Y.

* * *

High Frequency Oscillator

FOR an oscillator in the ultra frequencies I desire a simple one tube circuit. Will you please state what make or type of standard tube to use. I have some No. 22 enamel wire on hand and could wind my own coils.—U. S. W.

It depends on how "ultra" the frequencies are to be. If decidedly ultra, then standard tubes can not be used, only special valves, and we know of only one company that makes them in this country, and the price is very high for amateur experimenting. If you mean frequencies somewhat lower — say wavelengths around 5 meters—then Fig. 976 may be used. The coil, L1, may consist of one turn of No. 14 copper wire, held on a base, diameter about 4 inches, for the grid, and one turn of the same for the plate, the coupling adjustable. The pickup coil should be several inches, say six, at least, from the other coils, and in that case may consist of two or three turns of No. 14 wire. The r-f choke coils, Ch 1, 2 and 3, consist of 6 turns of No. 18 wire on a 1 inch diameter. No. 18 wire is used, as the filament current passes through two of the chokes. C1 is the smallest capacity variable condenser you can get. So, 50 mfd. would be very large for this work, R is 20,000 ohms, C2 and C3 are 0.0001 mfd. The tube may be 230, 201A or 199.

* * *

Modification Desired

I AM very much interested in Blueprint 627, especially regenerated audio, and any later improvements will be very much appreciated. Could another stage of r-f be added to 627 without any complications, to make the set more selective, or would a stage of band pass filter be still better to increase selectivity? Could regeneration be added to detector stage of this 627 circuit to increase selectivity, without complications? For our experiments with the 627, with its regenerated audio circuit, we must use a separate power pack, so we must know the voltage values of all the separate leads from the power pack to this set. Using separate power pack would remove the speaker 20 feet from the set. On account of the resistance coupling in the set, how much voltage and mils should a power pack deliver for the 6 tube set, if another r-f tube were added, and possibly another 247 pentode? Is the two stage audio of the Monitor Receiver described in November 14th regenerated resistance audio? Can automatic volume control be added to these t-r-f sets? If so, how? Have you a back number that

tells how to add automatic volume control to t-r-f sets, and could it be added to these that have regenerated audio?—W. B. M.

Another step of r-f amplification could be added, but it is not necessary to do so, as the set, as shown in Blueprint No. 627, has the r-f gain developed almost to the squealing point, and added t-r-f, while increasing selectivity, would not increase sensitivity, as primary turns would have to be removed in the plate circuits to avoid squealing. The blueprint itself contains all improvements to date. You can, if you desire, add regeneration to the detector, for improved sensitivity and selectivity, but that adds another control and besides introduces the usual critical tuning accompanying regeneration, which is generally not wanted in a broadcast set nowadays. It is better to build the set completely as shown, rather than to use only the tuner portion with an extra power pack, as the total parts, including cabinet cost something less than $20, and a power pack alone, such as you have in mind, costs about as much. However, the voltage values are: for r-f plates, around 200 volts; for screens, around 90 volts; for detector bias, around 5 volts; for pentode bias, around 16.5 volts, and for volume control (235 tube adjustable bias) from about 1.5 volts to about 15 volts. If, in using a separate power pack, the field is independent, and thus not in the negative leg of the rectifier, the whole circuit is changed, and we have no prints to accommodate your needs. For a six tube set the total current drain (where the extra tube is for r-f) would be about 60 ma, the voltage rating being unchanged, that is, around 350 volts a-c on either side of B minus, or, after the filtration, 275 volts d-c. If another 247 pentode is added besides, add 40 ma, voltages the same. However, the power transformer must have a wattage rating to meet the need (100 ma, 350 v a-c either side of B minus, 700 v a-c total, of course). The Monitor Receiver's two stage system has audio regeneration. Automatic volume control can be added to t-r-f sets as well as to supers, but is found almost exclusively in supers, because so soon as these extra refinements are introduced, cost goes up, and it becomes cheaper to build a superheterodyne. The automatic volume control is introduced in the same way as in supers, by bringing the grid returns of the controlled r-f tubes to the volume control. The easiest way to do this is by using a diode detector. The method was described in the November 21st issue, pages 6 and 7. Automatic volume control can be added to sets having regenerated audio, as there is no real relationship between the audio channel and the control.

* * *

Mixer Coil

WHAT are the coil data for a mixing coil on 1.75-inch diameter tubing, using, say No. 28 enamel wire, for short-wave work, from 200 meters down, using two separate variable condensers of 0.00015 mfd.?—E. S.

The data are shown on the diagram, Fig. 977. The space between the plate coil and the oscillator grid winding is 1⅛ inches. All windings are in the same direction. The tapped coil method is used. There may be a switch to slide the stator of each tuning condenser from one extreme to next tap and so on. This is the grid continuation method and avoids dead end effects and short circuited turns.

* * *

Experiences With Compact Set

SOMETIME ago I made one of your sets, published in RADIO WORLD, known as the H. B. Compact. It has been a very satisfactory receiver indeed, and recently I made another one in which I made some little changes as follows: I inserted an output transformer (S-M 221) and use a Western Electric speaker. I also put in an r-f choke in the plate outlet from the detector tube, which seems to have made an improvement, although I do not know the proper value of the by-pass condenser. I am using a 0.0005 mfd. The r-f choke is General Radio Co. m-h, Type 379. However, what I wanted you to straighten me out on was this: The third tube or first autdio stage, is a screen grid tube, 222. I find that the only tube that will work in this position is one particular make. I have tried other makes and they all produce a sort of motorboat growl, and that is the best I can get out of them, although the one tube works nicely. Why is this, when the other tubes are supposed to be of a higher quality, and the particular one I use does not test very high, I don't know. The next point is that I cannot make the set work with the three volt C battery attached. If I connect the two ends of the intended three volt C leads together it works very nicely, but attach them to a battery and the set will not work at all satisfactorily. In fact, it will scarcely give any results. In view of the fact that the set gives such satisfactory results otherwise, I would be very much interested to have you explain the reason of the above mentioned peculiarities.—H. E. G.

The radio frequency choke coil is all right as located, but to make the filtration complete you should use two condensers. The fixed capacity, 0.0005 mfd. that you have may be from plate to ground, but at the other end of the r-f choke put another condenser of equal or somewhat smaller capacity, from choke to ground. The motorboating or growl is due to the higher amplification of the other tubes that you use. In other words, the one that works best has a lower mu than the others. You can retain higher mu tubes in the circuit if you will put a large capacity across the B battery,

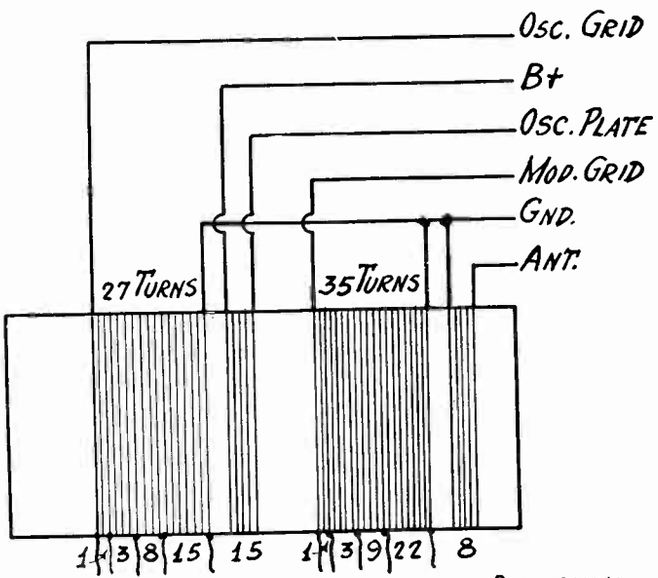


FIG. 977

Oscillator and modulator coils on 1.75 inch diameter tubing for 15-200 meter coverage, using 0.00015 mfd.

from maximum B plus to B minus. How large this condenser will have to be will depend on the frequency of motorboating, but less than 8 mfd. will have small effect. Absence of results when the C voltage is applied is due to incorrect bias for detection, but if you will connect a potentiometer across the C battery, with the grid return to the slider, you will find a detecting point. The potentiometer should have a switch attached, so as not to remain across the C battery when the set is not being operated, otherwise the battery life will be extremely short.

* * *

B. P. Filter for Super

WILL it be necessary for me to use a band pass filter ahead of the modulator of a superheterodyne I intend to build? I have a three gang condenser.—S. F. F.

No, that isn't necessary. You may use 235 r-f, 224 negative bias modulator and 235 oscillator, if for broadcast band and a-c. The oscillator then may be a dynatron.

A THOUGHT FOR THE WEEK

GERALDINE FARRAR, singer of many a delightful aria or simple song, in opera and on the concert stage, has forsaken the field of personal appearance before audiences. She is going to devote her time and talent to radio. Thus the world's newest and greatest unit of the amusement world is to have for its very own the lovely voice and fine artistry of a woman who has devoted her whole glamorous professional career to the best there is in music. Her friends are legion in all the countries in which she has given always the best she had to offer in musical culture and lovely womanhood.

RADIO WORLD

The First and Only National Radio Weekly
Tenth Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.
Roland Burke Hennessy, editor, Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor.

This Christmas

CHRISTMAS this year will find radio and radioists admittedly not in the best circumstances ever, and yet those who may be confronted with serious problems are none the less actuated by a desire to do all by the Christmas spirit that should be done. If anything, a little lull affecting the exuberance usually attending this season has the effect of making Christmas seem more serious, so that the gifts that will be made will be invested with an even greater measure of sincerity.

It has been notable that what provokes mirth has been most welcome, even if less effective than on more auspicious times. Magazines of silly humor recently started have developed large circulation. Comedy sketches and songs win unexpectedly big response. More persons read the newspaper comics. Jokes are most welcome. Even old ones will do, rather than the void of fun. The whole world probably needs humor as much now as it needs anything, for the tonic has its psychological effect, and we are told that much that faces us now is due to psychology.

Radio is playing its part in not only sending forth what are intended to be words and songs of good cheer, but is itself giving a striking lift to the acting profession that otherwise would be in a more serious plight. The microphone gives work to many artists, and pays quite a number of them enormously. Some gifted few are able, with vaudeville engagements and night club contracts, to make as much as $10,000 to $15,000 a week over a period of months, where radio alone contributes around $5,000 to $6,000 a week to the income. So something more tangible than psychology is helping along a few.

It must not be forgotten, too, that many others in different callings are earning more than at any previous time in their lives, including persons associated with the manufacture and sale of inexpensive novelties, where there is small competition, or low-priced social commodities, where there is considerable competition, but the consumption is large.

Radio manufacturers have almost completely withdrawn from participation in sponsored broadcasting, and their answer is that they will return to the microphone so soon as business improves, in itself an admission that profit is at a low ebb in radio. However, those associated with the trade in any way will take heart in the fact that, with strictest economy, it has been possible to carry on without loss, or at a small setback, and that the public has showed, during the depression, that it keeps right on being radio-minded, and is buying in the radio field as strongly as the purse warrants. Manufacturers reduced their own costs, and the prices of their products, to meet the state of the public pocketbook, which was sane beyond praise. As it is there is considerable selling, though at little or no profit.

So the public should become aware that radio sets, parts and accessories are very low priced right now, and if the present low levels will not continue much longer, that is merely saying the return of profitable business is at hand. Prices are too low in nearly all lines. The man who produces the product does not have enough margin to permit him to do enough spending in fields that will eventually bring profitable business to you and me. There should be a wider margin all around.

With prices lower than they've ever been in radio, even though with some persons' pocketbooks very scantily attended, there will no doubt be considerable volume of Christmas gift shopping in the radio field. The economic status may change from time to time, but the human heart, if anything, grows more generous in an emergency, and it would be the sheerest affront to good nature for any one even to suggest a moratorium on Christmas giving. Those who are not riding high are at least not so low in spirit or purpose as to forego Christmas giving, and may many a deserving heart be warmed by a thoughtful radio gift.

Continued in Our Next

A NEW method of advertising was instituted during the True Story Hour. Previously there had been a thrilling story enacted and completed before the microphone, supposedly an experience from real life, but at all hazards something that held the attention.

Then a prize contest was started, wherein manuscripts of stories told in plain words, were solicited—"just as you would speak"—and cash awards of high amounts were offered. Naturally, adding the expense of the contest to that of putting on the program on a chain required large returns. These must come from newsstand sales of the magazine, from increased advertising due to larger circulation, or other standard sources of revenue for a publishing company.

The use of the air to reveal the type of stories printed in the magazine on behalf of which broadcasts were made was not only entirely proper, but constituted a contribution to radio, for the publishers of the magazine know the art of story presentation to a nicety.

After rendering such a good service to the radio listeners, and probably to themselves, the publishers suddenly changed front. The period of broadcasting was devoted to two stories. One was enacted and completed. The other was enacted up to a certain exasperating point, and the listener was recommended to the newsstands for copies of the magazine containing the next instalment. There was to be no appeasal of curiosity over the air. One had to buy the magazine to find out what happened to whom.

As if from sheer malice of circumstances the story selected for the first of these experiments at incompletion did not strike one as raising enough interest to warrant buying the magazine for the solution of the mystery of whether an unhappily married divorcee shot her husband's latest girl friend, but the shock felt at the abuse of the air as a mere come-on lure for magazine sale, instead of as a genuine builder of good will, was none the less keen. It is to be wondered that a chain, or any station, would encourage sending into persons' homes programs that referred listeners somewhere else for the completion of the story. One would expect that the National Broadcasting System (WEAF) would not stand for it, and probably won't after the public has made its feelings well known. Also a word might be said by the associated stations against the practice: KSD, WBEN, WCAE, WCSH, WENR, WGY, WLIT, WOC, WRC, WSAI, WTAM and WWJ, even those owned by the N.B.C! The publishers themselves will be the first to stop the practice if the public tells them so.

Listen in, if you can, to Mary and Bob on the True Story Hour, Monday, 10:00 to 10:45 P. M. Eastern Standard Time, and if the same method is repeated again, write to the station you heard, and give your frank opinion of the practice, one way or the other.

KALEIDOSCOPE

Radio Station WELL, Battle Creek, Michigan, is ideal for reminding listeners to keep healthy. This admonishing station's symbol prophesies a renewed fad—longevity.

* * *

Is there no way to preserve proper ether conditions for long distance reception? Radio set owners feel aggrieved when frustrated in capturing far-off programs. The ether is not an actor, nevertheless is temperamental.

* * *

So much more comes out of the modulator than goes into the microphone that all radio singers become convinced they have powerful voices.—A. B.

* * *

RAY PERKINS ON NEW PROGRAM

Ray Perkins, jester, has retired as master of ceremonies of the Three Bakers hour on Sunday evening. A new contract calls for Perkins to broadcast for Jergens Hand Lotion at 6:30 p. m. on Tuesday and Saturday over WJZ and a chain instead of over WEAF on Wednesday and Friday at the same hour. As "The Prince of Pineapple," Perkins also broadcasts at 10 a. m. on Thursday and Friday.

IMPORTANT NOTICE TO CANADIAN SUBSCRIBERS — RADIO WORLD will accept new subscriptions at the present rates of $6 a year (52 issues); $3 for six months; $1.50 for three months; (net, without premium). Present Canadian subscribers may renew at these rates beyond expiration dates of their current subscriptions. Orders and remittance should be mailed not later than December 30, 1931. Subscription Dept., Radio World, 145 W. 45th St., New York, N. Y.

Station Sparks

By Alice Remsen

The Song Thrush

(For Morton Downey, WABC, Daily Except Sunday, 7:45 P.M.)

Oh, hear the golden-throated thrush singing on the breeze!
And harken to its liquid notes trembling through the trees!
The tall trees, the green trees, the verdant trees of spring,
The slender trees that listen to the thrush's caroling.

The thrush is not a lovely bird, feathers bright and gay,
But oh, the lovely song it sings on a day in May,
A May day, a gay day, a day so green and lush,
A perfect day to listen to the singing of a thrush.

And in the early morning light, sounding clear and strong,
A solitary lowly thrush sings a faultless song;
And then again at eventide cascading o'er the dale,
The thrush is only rivaled by the graceful nightingale.

Oh, hear the golden-throated thrush singing on the breeze!
And harken to its liquid notes trembling through the trees!
The tall trees, the green trees, the verdant trees of spring,
The tall trees, the green trees, the verdant trees of spring,

—A. R.

* * *

Golden-Throated Morton Downey, the "Song Thrush" of the Camel program, is due back on the air this week, after a vacation which took him out to the Coast. The Roundtowners Quartet substituted for him on the program during his absence. Morton needed the rest. He has returned all ready for a strenuous season and his countless fans will welcome his reappearance, for the program did not seem the same without him.

* * *

That Sinister Character of Radio, "The Shadow," will return to the air in the early days of 1932, after an absence of six months. The identity of this mysterious person has never been discovered, even by the people working in the same studio, for he always wears a black gown, a hood and mask and in order to escape detection, he uses the freight elevator direct to the twenty-first floor of the Columbia building whenever he is due for a broadcast.

* * *

Have You Ever Caught the "Hunter and Hampton" daily broadcast over WAAT, Jersey City? The nuttiest program on the air, with no prepared continuity. Hampton's laugh is most infectious and he possesses a very quaint sense of humor.

* * *

Another Good Feature on WAAT is the Sunday "Stardust" program, featuring J. C. Ingram, New Jersey's most popular radio editor, interviewing radio stars. I heard him interview Raymond Knight of N. B. C., recently, and he did a very good job. I had the pleasure of appearing on his program two years ago. It was a very enjoyable experience. Among other artists brought to WAAT by J. C. Ingram at various times were Singin' Sam, Ray Perkins, The Two Troupers, Vaughn de Leath and the Street Singer.

* * *

Apologies Are Due to Howard Greene; in a recent issue I told you what lovely photographs Mr. Greene made for radio stars and then left the final "e' off his name and also put him "West" instead of "East." The right address is 24 East 58th St. Sorry for the mistake!

* * *

George Olsen and His Music is the latest program to be featured daily by WABC. This will be the most extensive night schedule ever allotted a remote ensemble. The orchestra will be heard over a nationwide network every evening except Sunday at 11:45 p. m. Eastern Standard Time.

* * *

Joe Garrick, the Distinguished Star of talking pictures and musical comedy, was the guest artist on Footlight Echoes over WOR on November 29th. He sang three songs and proved to have an exceptionally beautiful high baritone voice, with perfect diction and fine dramatic restraint. By a strange coincidence we had as guest in the studio that evening the delightful little English dancer, Esme Gordon, who was born in the same town of Brighton, England, in the same year as Mr. Garrick. She also commenced her stage career the same year as he did, and in the same show, at the Queen's Theatre in London, with Lee White and Clay Smith's revue, "Come In."

Mr. Garrick is well known in this country for his good work in pictures, particularly in "The Sky Hawk," "Song of My Heart," "The Lottery Bride" and "Bad Company." Of course, like all moving picture stars, he has a beautiful home in California, and loves that state. He is married to a lovely brunette named Harriet, an American girl, who accompanies him everywhere. He is blond, of medium height, and has a charming smile. Likes sports of all kinds, particularly golfing, riding and swimming. Likes everything American but still wears English clothes and smokes Navy Cut cigarettes.

* * *

SIDELIGHTS

EMERY DEUTSCH was the first to introduce gypsy music on the air... JACQUES RENARD was born in Kiev, Russia...BING CROSBY studied to be a lawyer...KATHRYN PARSONS may be a girl of yesterday on the air, but she is modern enough to personally make any and all repairs necessary upon her automobile...VINCENT LOPEZ once was a stenographer for the president of a milk company. His salary was eight dollars a week . . . JOE WHITE not only sings, but his broadcasts over the National Broad- also directs the string trio heard during his broadcasts over the N. B. C. . . . J. MAXWELL, N. B. C. tenor, was born in Maxwellton, Scotland...RAYMOND KNIGHT, N. B. C. humorist, stands six feet one and a half inches in height, and, like all humorists, he has a lugubrious look . . . RUSS COLUMBO is an athlete. plays handball, rides horseback, shoots accurate goals in basket-ball and swings a wicket tennis racket...HARVEY FIRESTONE, JR., son of the rubber manufacturer, has a perfect radio speaking voice...PAUL DUMONT has shaved off that tricky little mustache...IRVING KAUFMAN is heard five times weekly over WABC—three times for Kolynos as "Salty Sam' and twice as "Charlie and Oscar"... FRANK PARKER has replaced tenor Leo O'Rourke in the Cavaliers Quartet.

* * *

Biographical Brevities

About M. H. Aylesworth

Many people have asked me to tell them a few facts about the career of M. H. Aylesworth. Well, in the first place, everybody knows that he is president of the National Broadcasting Company. His full name is Merlin Hall Aylesworth. He was born in Cedar Rapids, Iowa, a son of the Rev. Barton O. Aylesworth. When he was one year old he was taken to Colorado and spent his childhood and youth in the Rocky Mountain region, which probably helped to develop his wide perspective, for early in life he displayed the great executive ability that was later to place him at the helm of the world's largest radio organization.

Fellow students at the University of Denver, Colorado Agricultural College, University of Colorado, University of Wisconsin and Columbia University, knew him as an organizer of glee clubs—his singing voice was considered good—and also as manager of athletic societies, director of debating societies, and a good student.

Upon completing his education—he holds an L.L.D. degree from the University of Denver—Mr. Aylesworth took up the practice of law in Fort Collins, Col., one of his first accounts being the collection of bad debts for the county medical society.

Later he went into politics and served as Republican chairman for Larimer County for some time. He abandoned his law practice in 1914 to become chairman of the Colorado Public Utilities Commission, a post he held until 1918. At that time he became head of the Utah Power and Light Company, with headquarters in Salt Lake City, where he remained until the National Electric Light Association lifted him into New York in 1919 to reorganize that organization.

In 1909 Mr. Aylesworth married Miss Blanche Parrett and the couple have two children, a son, Barton Jerome, and a daughter, Dorothy.

Mr. Aylesworth has been chief executive of the National Broadcasting Association since its inception, November 15th, 1926, coming to radio from the National Electric Light Association, where he held the position of Managing Director. Since he took the reins the N .B. C. has forged to the front ranks in the entire world of broadcasting, according to various foreign experts who have visited America in recent months.

A few months ago Mr. Aylesworth visited Europe to make an exhaustive study of broadcasting conditions there and to consider the possibility of an international exchange of programs.

He is a member of the Christian Church and belongs to several clubs and organizations, including Sigma, Chi (Wisconsin), the Lotus, and Engineers Clubs of New York, and the Pelham (N. Y.) Country Club.

Until a short time ago Mr. Aylesworth was an ardent tennis player and still swings his racquet upon occasion, but his chief outdoor interest at present is golf. His only other hobbies are his family, public service and radio—the latter two, he thinks, are synonymous.

He is a kindly gentleman, not given much to chatter; rather silent than otherwise; has a very observant eye; is unassuming and possessing the blessed faculty of minding his own business.

SELF-SERVICE

One of the problems confronting service men is that next year is leap year and the tube replacement business is bound to be bad. This is because tube manufacturers have told the public to retube their sets at least once a year, and the public forgets the "at least" and goes to it once a year, if then. So with a shorter year ahead, the tube replacement market will fall off by 1/365, and as an offset, service men have decided to be more insistent on installation of new aerials. The P. M. business therefore will shift from unbranded tubes to polyglot aerials.

* * *

Prices of parts are lower now than ever before, and money is scarcer, so service men are considering improving their economic status by going into other lines of business. A committee of the Profitless Service Men's Contamination has been appointed to discover if there is any other business besides radio, since once a fellow is in radio he gets quite the opposite idea.

* * *

It is expected that the Japanese and Chinese markets will prove good outlets for manufacturers as soon as the military clashes become more serious. The advice about tube replacements being in order once a year does not apply to armies in the field, as various accidents attendant upon warfare makes more frequent replacement necessary. Not only tubes but portable transmitters and receivers can be sold to both armies, the only difficulty being in getting the credit department to O.K. the shipment. The demands may become "Sight Draft Bill of Lading."

* * *

Remote control tuning is being featured by the Piffle Encouragement Company, Inc., for adaptation to homes not equipped with radio. The device fits nicely onto a neighbor's set, and permits the non-radio household to tune in and hear what programs it desires, leaving the real owner of the set to suffer in noise, instead of the usual silence.

* * *

Short wave adapters and converters are becoming more numerous, and one of them that works has been manufactured by the National Company. This created such a furor that the company was accused of unethical conduct. The Worse Business Bureau has been notified. One of the newest adapters plugs into the detector socket and brings in police calls, if that is possible, without any other disturbance of the set or the user.

* * *

Four-tube superheterodynes are promised for the coming market, but why only four tubes, when you can also get next to nothing on only three, has not yet been disclosed.

EVERYTHING ON THESE TWO PAGES IS ONLY A JOKE, BUT REMEMBER! ONLY THESE TWO PAGES!

INTERRUPTED CONTINUOUS WAVES EVERY DAY ——— EVERYWHERE

GOL. 2 Cu. Ft. No., Minus 2
Whole No. ½
December 12th, 1931
(Entered as seventh rate matter while playing Office Boy despite Act 1, Scene 2, of the farce "Congress," at the Radio Playhouse, New York, N. Y.)

RADIO WHIRL
Nth YEAR

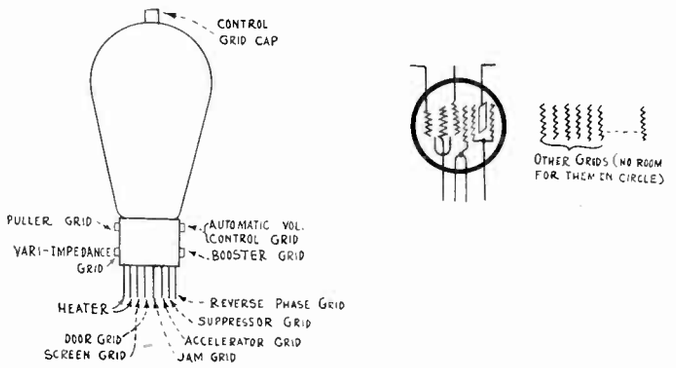
Two Lively Pages, Published once in a lifetime by Anybody Who Has the Nerve, from publication office in editor's hat. Coatrack No. 2, Aisle 4, Suite 1214, at 145 West 45th Street, New York, N. Y., next door to the Lyceum Theatre.

Infinite Element Tube

Nth Screen in Vari-mu Valve—Price Reduced 40% Before Tube's Release

By Daniel Dopester

A pictorial view of the new nth-ode is shown at left, the various grids being illustrated as numerously as possible, with functions stated. At right is a schematic diagram of the tube, showing nearly all the grids, but it was impossible to get even half of them in the circle.



BUSINESS being slow in tube factories, they have a lot of surplus grids around the plant, so a new tube has been brought out. It is called an nth-ode, not for poetic reasons, but because it has n-elements. It is the forerunner of the plus-infinity tube, which is now being perfected in the laboratories, and which will have n plus 1 elements.

The present new tube is the first nth-ode to be put on the world market, and requires special circuit design, as well as a socket that looks like a circular collander. Physical or mechanical limitations prevent the actual use of all the electrodes, because while engineers can dream up infinite purposes and variations, nature provides tangible and practical means of utilizing only some of them; that is, empitically one can not even approximate infinity, but let it go at that.

New Tube Has Low Number

The new tube, known as the 2946896342987, can not be used as replacement for any other tube, but is a very special purpose valve. Besides the familiar heater, control grid, cathode and plate there are other grids that serve new and startling purposes.

The result is a stable tube that has a working mu factor of 10,000. One of the reasons why this high mu is attained is that the nth grid, which can not be used for want of practical means of attaining the value n, automatically brings the tube in resonance with a tuned circuit. Hence only one condenser is needed for tuning, and one coil, using the n minus 1 tube, 2946896342986. The nth-ode will be pulled by its resonating grid into the same frequency as the tuned tube. This is known as the puller grid. It makes a very effective display in radio stores.

Another remarkable feature of the nth-ode is that it has an automatic volume control grid, thus dispensing with another tube..

This grid is so placed, between the vari-impedance grid and the puller grid, that any rise in amplitude shows up as a corresponding decline in amplitude, and affects the vari-impedance grid in such manner that the output is held constant despite the input fluctuations.

In fact, the tube is so remarkable that even when there is no input there is a large output. This violates the law of conservation of energy, but the engineers who designed this tube are scofflaws. An amendment to the Radio Law of 1927 is to be sought to make the use of this tube legal for amateur and experimental use, especially as the functioning of the tube is more completely experimental than anything hitherto developed in radio, which is saying a lot.

Blueprints of circuits using this tube will have to be built by underpinning and construction companies, in layers. They really will not be prints, but models. The tiers will have the set-back construction required by the building zone laws of most large cities.

The heater voltage is 2.5 volts, a-c or d-c, and the heater current is 0.05 ampere. Thus power conservation is practiced in these times when the electric companies need all the business they can get.

The plate voltage is 200 volts and the amplification bias is 9.99 volts negative. Only the bias, not the results, are negative, the engineers report on the basis of the Schick test. The tube can not be used as a detector, so it has a non-detecting characteristic and can not detect the difference in functions of its multi grids.

It will be noted that the grids are numerous, but there is only one plate. After the n-plus-1-ode is brought out there will be, it is expected, an n-plus-20 ode, in which nineteen extra plates will be used, as there is a surplus of plates around factories, too.

Price Fixed and Reduced

The list of the nth-ode was given a pre-release price of $3.50, but the price was reduced 40 per cent. before the tube was brought out, and it is expected that as soon as quantity production begins the list price will be reduced below the cost of manufacture, the tube makers figuring that by selling an enormous quantity of tubes they can finally make income meet expenses.

The usual trade discounts will be allowed, and dealers ordering 100 tubes will get five tubes free, the discount applying to the free tubes as well, so that the manufacturer will have to pay the jobbers and retailers for taking the five extra tubes. This is a move to accelerate business.

A counting machine is sold to dealers by the tube manufacturers at cost, less express charges, so that customers can tell the number of grids without having to get out pencil, paper and a book of Napier's logarithms.

NEW "MIKE" IS SNOOPER

A sensitive microphone that has an opening front and back, like a double V evening dress, has been developed by engineers of the Impulse Registration Corporation. Also, the microphone can be focused on certain spots.

One of the outstanding advantages of this microphone is that, as to sound, it behaves as a searchlight does to light, except that the focusing is inverse, that is, sharper, the greater the distance.

The principal use to which the microphone will be put will be at large gatherings, like football, baseball, horse show, opera and other events, so that during periods of lull in the main event the microphone can be focused on the confidential conversation of celebrities, and the world will thus obtain their side comment on persons and events.

For instance, what does Mrs. Abernathy Dowager think of Mrs. Swell Mansion? The focusing microphone may pick up Mrs. Dowager's derogatory comments on Mrs. Mansion's table linen or evening dress (the latter was made from the former), or any other comment.

Hoover Idea Is Rejected

Washington.

A permit to use radio frequency transmission, from a small modulated oscillator, for pointless to pointless service, was issued by the Federal Radio Commission to the N. G. Hunter Corporation, which seeks to develop mine areas in the Southwest.

The corporation has a radio adaptation of the divining rod, and by radio means not only can tell whether there is water underneath, but even if there is something stronger, besides being able to disclose the presence of mineral ores and oils.

The Commission gave long and due consideration to the application, nevertheless granted the request. It is said that President Hoover, who, it will be remembered, is after all a mining engineer, was greatly interested in the application, to the extent of expressing doubt as to the practicability of the device.

The Commission overruled the President with no less compunction than it did Examiner Pratt in another case.

It was said at the Commission's office that the Commission has a mind of its own. A search was started instantly.

SECOND SIGHT AIDS BOARD

Washington.

The Federal Radio Commission has decided to require all stations to file daily reports, with full tabulated matter, stating what percentage of the programs is devoted to lotteries, fortune telling and other quack undertakings. It is understood the Commission has no direct power to rid the air of these, as a matter of censorial activity, so it is believed the statute has been construed to mean the Commission should give all possible assistance to wandering gypsies, Nabobs, second-sighters and miscellaneous other easy-money grabbers, provided not listed in the phone book.

One reason put forth for the attitude toward the necromancing ilk is that the Commission is at a loss to solve some of its most serious problems, and that one of the members got a big lift from a fortune teller, who solved two problems very nicely. This has engendered a deep respect for fortune tellers, although the prophesied dark man coming with a bundle turned out to be a colored letter carrier arriving with a bag of complaint mail.

ZVX Ousted but Increases Power

Washington.

After a hearing before Examiner Ellis Pratt, the Federal Radio Commission ordered ZVX off the air, thus reversing the examiner's recommendation.

The ground was that the station did not carry any advertising programs, and therefore was not emitting blurbs of or so-called "credits" of a fulminating and goading nature. This was held to constitute failure to comply with the legal requirement of serving public interest, convenience and necessity."

The station, as soon as it received the illustrated post card announcing it had been ousted, increased its power to 50,000 watts.

Worthless Accuracy

Statistics compiled by the Department of Commerce show that there are not as many sets in use as there should be, and that only 15,000,000 families have receivers. The total was arrived at by the simple process of counting noses during the 1930 census, and therefore is not as reliable as the estimates given out by the Department on other subjects. Statistics lose their significance when they represent actual values.

LATE NEWS

A German by the name of Heinrich Hertz, pronounced Hairtz, with a decided roll of the r, has been monkeying around with some apparatus that he calls electrical, and it has been possible, for him, says he, to generate what he calls radio waves, and receive them at a short distance, say, across a room. The waves are of different frequencies, some of them very high. Hertz, who is a professor at a university there, gave a demonstration before domestic and imported scientific celebrities. After he had sent and received he was congratulated by the German scientists, all of them his own students, but the foreign scientists said: "After having seen the thing done, we come to the conclusion that the pretended performance is impossible." Hertz then refrained from passing pretzels among the foreigners.

* * *

J. C. Maxwell, a British mathematician, has doped out some formulas that he says proves that radio waves are continuous and of the nature of light waves, differing only in frequency. His word for them is undulating. This is contrary to the accepted theory, as real scientists believe that Mr. Maxwell pulled a boner in some of his computations, but they can't say just where, because Maxwell's formulas are so complicated, and his sign language so original, that others cannot make head or tail of them. In fact, Maxwell, at a public meeting, could not read his own mathematical notes. The oil in the kerosene lamp had given out.

* * *

Michael Faraday has been doing some experimenting in a London garret, making most progress by ignoring the advice of a learned scientist for whom he had been working, and with whom he had travelled in Italy as sort of secretary. While on the great scientist's payroll the enterprising valet had to be polite. He drew the line, however, at polishing his master's shoes, as he said, that did not come within the civil service requirements of an assistant scientist. While protesting against shoe shining, and thus arousing the displeasure of his master's wife, Faraday disclosed confidentially that he had discovered a means of transferring current without wires, using what he calls electromagnetic induction. As the inductive school of reasoning is not in the ascendancy in England, Faraday has had trouble with his landlord about rent payments, and the theory of electromagnetic induction did not impress the unpaid landlord at all. Faraday said if he does not get a better break at home he'll go to America, as he has a season pass for the New York Aquarium.

LATER NEWS

Guglielmo Marconi, an Italian as his name indicates, but who was educated in England, has succeeded in flashing the letter S across the Atlantic, explaining that the letter S stands for Science, and that the letter Z, being zig-zag, could not make the grade, due to the straight path of the wave. His demonstration is regarded as a boyish prank of no useful significance.

* * *

Oliver Lodge has a new idea. He says that as different radio frequencies can be generated some means must be used for receiving different frequencies. So he has two coils and changes the relationship of one to the other to accomplish what he calls tuning. As Lodge's dues in the Learned Scientific Society are paid up to date his demonstration and explanation have been given official approval, and he is on the road to knighthood.

* * *

John Ambrose Fleming, being dissatisfied with devices called rectifiers, and wanting something more sensitive and more stable to afford the advantage of listening to radio transmissions, which are said to be utterly practical, has taken a piece of glass, removed the air with an air-remover, leaving inside two elements, one called the negative anode or plate, the other the cathode or positive. This device he calls a rectifier because it eliminates radio frequency and leaves something you can hear. Now that he is hearing things he may soon be expected to be seeing things. This business of seeing will be called television.

* * *

An American named Lee De Forest has produced what he calls an audion, and which not only can be used as a detector, as was the case with Fleming's device, but can be used to magnify signals. This magnification takes place because the signal put into the audio comes out larger. Besides, he can make the tube generate radio frequencies, which is regarded as important. This generation is all due to oscillation. The time between one generation and another is known as a cycle instead of as three score and ten.

LATEST NEWS

What is called a radio broadcasting station and is known by letters only, instead of by name, has sent out Harding election returns by radio. The results were spoken into a disc called a microphone and the pulses amplified and sent out from one of De Forest's oscillating tubes.

The station, or sending plant, is known as KDKA, and is owned and operated by the Westinghouse Electric and Manufacturing Co. People who owned receivers and earphones could hear the result. In this way Harding became aware of his election before the results were counted.

* * *

John McCormack and Geraldine Farrar were heard before the microphone of WEAF, New York City, on New Year's Night. They sang well, as usual, and their voices came in excellently on broadcast receivers. Such sets as were equipped with audio frequency amplifier and loudspeaker brought in the fine music with volume enough to fill an empty room.

* * *

The Television Thrilling Corp. has erected a station to send television around the world and is making receivers that get Mars and Hades.

(*More of these serious discussions, alas, on next page*)

Station Gaps

By Bernice Warbler

GOOD COOKING

(Agnes Catsaunt, QWMZ household adviser, recipe hound; Sunday and holidays, 2 p.m.)

HOW telling is a pie that's aptly baked,
Compared to stomaches that so sorely ached;
What joy ecstatic swells the human breast,
When mother's matchless pies have gone to rest.
And, oh, the lusty purpose of the hatch
Down which we crowd thrice daily quite a batch
Of what we miscall food, and oh, the look
Of joy on greeting one who *is* a cook!
So swell with pride instead of stomach pain
To greet the gorgeous oven-baked refrain,
The sizzling roast, the cake or custard pie
That thrills the spirit where the innards lie!

—B. W.

Oscar Impresario has been shifted from playing the breakfast music in the Pink Room of the Dewrop-Astoria, to playing the luncheon music in the Heliotrope Room. As only the Pink Room music is being broadcast, this leaves the maestro off the air temporarily. He is being congratulated by enemies on account of his advancement.

* * *

"Nobody's Business," a playlet in one-half act, recently was put on by the Nationwide Broadcasting Company. In it played Helen Tipsy, the wide-eyed girl of the Frozen North, who made such a hit twenty-seven years ago on the Pantages circuit, playing five a day as a middle aged lady. Helen has a voice that possesses the finest cracks imaginable, and the playlet was halted when half over only because of trouble in the control room. The studio director was in that room at the time.

* * *

Historical episodes from the early American era are to be presented beginning Friday by the Country Service Company. The first episode will deal with the Neanderthal ascension of the present Rocky Mountains. The part of the dinosaur will be taken by Herman Stuffem, former taxi driver.

* * *

Cissie Simplelocks, juvenile of the Down Home Air Opera Company, who sang "Manon" with great success, is a lover of Easter lilies. She married the first man who sent her a bunch, but later found out that the messenger had misdelivered the nosey spray. She is now his leading woman, and how she drives him. Her French is regarded as the most perfect specimen ever to be bred in an American high school. When she sings "Connais tu le Pays" what for the fine French and the adherence to tune, she perfects an artful doubling, also making it sound like "Coming Through the Rye," tune, words and all.

* * *

Several brand new numbers are about to go on the air and some have very attractive tunes and words. One of them is "Tea for Two," sponsored by the Great Pacific and Mediterranean Tea Company, with special dispensation from Providence and the copyright owners. Another is "A Kiss in the Dark," which has been open to some criticism from the Censurious Society, due to the frequent matrimonial consequences of dark kissing.

* * *

A most delicious luncheon was served the other evening at a radio star party by Uncle Donald Wan, who delights the hearts of the kiddies and is better known to them than their own daddies, what with the times driving daddies out nights to forget their troubles. When daddies return home from the office for supper they find it hard to get a greeting from their young sons and daughters, because Uncle Donald engrosses the children's attention. Uncle Donald really does not ride to and from the studio in an airplane but uses an automobile. He has a Lincoln. He gave his wife the Packard that needed new rubber.

PERSONALITIES

EDITH ACRIMONY has blimp hair. After washing, it goes up and stays up and on occasion circumnavigates the world. . . . ROSS TURNOVER learned to croon before crooning was known, as his mother was a crooner before him. Only they called it crowning at that time and Ross became an orphan at an early age. . . . Sugar sandwich biscuits are manufactured by the father of JASMINE DRAGONELLA. The charming daughter gives large quantities of these biscuits to the poor, who call her Marie Antoinette.

COLLIDE-OSCOPE

Short waves, being very low waves as used in radio, have encircled the globe. Amateurs listen regularly to stations all over the world, receiving code. It is expected that voice soon will be used, as amateurs who know enough code to pass the examination sometimes get rusty on code, but can follow the English language all right, even as spoken in foreign lands.

* * *

Alternating current tubes are announced, so that now it will be possible to operate sets without batteries or battery eliminators.

Optician Discovers New Facts About Ultras

RECENTLY there has been considerable interest in the ultra frequencies, those that enjoy the effects of light waves, and are obstructed by buildings and other objects, and follow the earth's curvature, travelling as far as sight, or to the horizon, as you prefer.

Dr. Spinwell Truthless, noted optician, optometrist and eyeglass doctor, who has made a special tudy of the possibilities of the ultra frequencies improving the attendance in his at his glassware store, said:

"After painstaking efforts, and the use of a high-powered microscope, I have found that not only is the behavior of the ultra frequencies likethat of light, but also that these waves, are, in a sense, true light, and the only reason we listen to the transmissions instead of seeing them is lack of sufficiently penetrating vision. I have developed a new lens that so improves the sight that the ultra-waves, like small boys, should be seen and not heard. I call it the Small Boy Lens and recommend it to radio engineers in particular, as judging by what I have observed, they do not see any too well."

Others have found interesting facts concerning the ultra frequencies. Jean Secondfiddle, the French-Canadian, assistant director of the Flop Laboratories, has invented an escutcheon that goes on any broadcast set and is used as an adapter for ultra frequencies. Thus, by putting this escutcheon on the broadcast set, and walking to or from the set, body capacity is made to change the frequency. It is the Theremin principle applied to an oscillating escutcheon.

See Things On Trip To Europe

Just back from a trip to Europe, made on behalf of his firm, all expenses paid, Ignatz Forsooth, consulting engineer of the Short and Long Selling Company, reports that Europe is making great advances in television.

He said that he attended a show in Berlin and that, to the best of his information and belief, it was possible actually to see the pictures. The neon lamp was used by some, the Kerr cell by others, mechanical scanning by most, a cathode tube by Von Ardenne, while all the men wore evening clothes, and the women had on slippers and fine dresses.

Speaking of the comparative quality of the television in Berlin, Mr. Forsooth said that the steins are a little shorter now, due to the reparations situation, but that the contents were just as enjoyable as during his visit two years previous, in fact, more so, since then he was strictly on his own, while this time the firm was paying all.

One of the scanning discs, that develops greatest speed, or was it the motor, was known as Sparkling Mozelle, and if anyone had ever seen a finer picture, it must have been a miracle, he said.

Besides, wherever he went, he received nothing but information on television, excepting of course a few concerns that had some worthwhile developments, and as to these there was only guarded information.

"Nothing to say," revealed these manufacturers, and Mr. Forsooth sailed for home, all expenses paid.

Here, There and Nowhere

Bargain prices prevail on midget sets, and on large console sets, as well as consolettes. It is always the same set, in one or another picked-up cabinet, and there is a bonus (P.M., for pin money) to every store salesman who palms off one of these in preference to a standard receiver on which the profit is greater.

* * *

The standard color designation code for resistors has caused considerable comment, as by having a little book in his pocket a service man can not mistake the value required for a replacement resistor. This takes much of the fun out of the work, since the tubes stay East and the set plays.

* * *

After patient years of experimental improvement, the Hammarlund Manufacturing Company has brought out an all-wave superheterodyne. When a demonstration was given recently, a European station was tuned in loudly and clearly, and one of the prospects ordered a set without discount and paid for it in advance, thus setting a precedent that unnerved even Lewis Winner, the chin of the Hammarlun unit.

* * *

The ability of radio waves to travel long distances has been established, as persons who listened to recent broadcasts at a distance of 1,000 miles or more were asked to report by mail to stations, and forty-six letters were received by six stations. This proves the wide range and extensive interest. It is expected that within ten years hundreds of radio sets will be in use.

* * *

Television isn't here commercially yet, so when Secretary Stimson takes a walk, or does anything equally vital, there is no camera to record the tremendous episode. For this he should be thankful, for his coat collar always rides far too high on his neck to make television safe for tailored democracy.

* * *

If that man who has not written to the station complaining of overdose of advertising talks will please communicate with the Secretary of Incredibility, he will not be suitably rewarded.

* * *

Over in China they have plenty of radio reception to keep their minds off the consequences of League of Nations assistance.

* * *

Another sort of Gandhi, more full attired, and bewhiskered besides, is Dino Grandi, Italian Premier, recent visitor here, who was said to speak English fluently, Hoover needing no interpreter. Then Grandi broadcast in English and we needed one.

AIR TO LINK 5 CONTINENTS IN MARCONI HONOR

Five continents will be linked in a radio roll call around the world arranged by the National Broadcasting Company to celebrate Marconi Day, December 12, thirtieth anniversary of the first successful attempt to span the Atlantic by wireless.

M. H. Aylesworth, president of N..C., characterized the celebration as the biggest international broadcast ever undertaken. Australia, Japan, Brazil, England, Argentina, France, Germany, Italy, Poland, elgium, Holland, the Philippines, Hawaii, Canada, Hungary and the United States will participate in the program, hooked in a single network, the largest ever set up.

Marconi to Speak

Guglielmo Marconi will speak over the world-wide span on this anniversary of the most important day of his life—a day on which was born a device that has saved thousands of lives, and now unites the world in a net of instantaneous communications.

On December 12, 1901, Marconi sat in Cabot Tower in St. John's, Newfoundland, and heard three faint clicks, the telegraphic code for the letter S, which had been originated a fraction of a second before by contacts of a key in Marconi's specially constructed station at Poldhu, South Cornwall, England.

Those three clicks, in a longer combination (. . . — — — . . .) form the SOS. They have brought rescuers to passeners and crews of innumerable ships in all the seen seas. That symbol still halts broadcasting everywhere withi nits reach, so the the commerce and entertainment of the world may not interfere with the urgency of saving endangered lives.

Other Scientists to Be Heard

The anniversary program will go on the air sometime during the afternoon of December 12. The exact hour has not been set, as a multitude of technical details must be arranged in order to tie together so many far-flun stations in a smoothly working unit. N.B.C. engineers and technical experts have been working for weeks in cooperation with officials of the various countries to perfect the network so it may unction without a flaw.

Scientists and other personages of the cooperating nations will speak briefly during the program in honor of Marconi, and music will be heard from many points around the world.

International Resistance Elects New Officers

The directors of the International Resistance Company have announced their reorganization plans necessitated by the death of their president, Francis R. Ehle, in a recent airplane crash.

Ernest Searing, former vice-president and director of the company, succeeds Mr. Ehle as president. William G. Porter has been elected vice-president and a director. Ruth N. Shires, formerly secretary of the company, has been elected secretary and treasurer.

45,000 Record for N. B. C. Missives

The daily incoming correspondence from radio listeners struck a new high at the National Broadcasting Company recently when more than 35,000 letters and telegrams were delivered to the company's headquarters in New York.

In addition some 10,000 letters, not included in this total, were opened and read at N.B.C. branch offices in Chicago and San Francisco.

The grand total for the day represents more pieces of mail than were received in a month when the N.B.C. was first organized five years ago, and better than half the total amount received during the entire year of 1923, the first year of chain broadcasting through station WEAF.

Many fans in New York delivered or sent their communications by hand, and the day's communications included nearly a thousand telegrams, as well as special delivery and air mail letters.

WHY WILKINS CAME TO TOP

W2XAF, Schenectady, N. Y., demonstrated that it is possible for short wave radio signals to bring a submerged submarine to the surface. This unusual demonstration recently was reported to the engineers of WGY's short wave station by Ray Meyers, radio officer of Sir Hubert Wilkins' submarine, Nautilus.

According to Mr. Meyers, W2XAF was the only short wave station he could receive dependably while in the Arctic. The Nautilus, at its Arctic base, was made ready for under water and ice exploration by dismantling the transmitter antenna. With this antenna out of commission it was impossible for the submarine commander to communicate with the outside world, but it was possible, through the receiver, to get the signals of W2XAF during the time the Schenectady transmitter was on the air.

The Nautilus had been under for a long time. No word had been received back in the United States and as the silence continued, anxiety was felt for the safety of the crew. When ships at sea and land stations failed to get response, the news of this failure was carried by the newspapers. This news item was included in news service read over WGY and carried by W2XAF. Mr. Meyers heard the story which reported that the entire world was concerned over the silence. When Sir Hubert learned that relief expeditions were actually being planned to locate him he decided to come to the surface. The transmitter antenna was replaced an dthe news of the craft's safety was sent out.

Grosswendt Named Pacent Plant Manager

The appointment of Carl Grosswendt as production manager of the Pacent Electric Co., Inc., is announced by Louis G. Pacent, president of the firm. Mr. Grosswendt assumed his new duties at the Pacent plant at 91 Seventh Avenue, New York.

Trained as a mechanical engineer, Mr. Grosswendth has specialized in scientific factory management in both Europe and the United States. His radio experience dates back to 1921, when he established a radio parts factory in Berlin. He has been connected with several large American radio firms.

WORK IS BEGUN FOR N. Y. OPERA BROADCASTING

Metropolitan Opera on the air came nearer recently when National Broadcasting Company engineers began drafting plans for microphone locations and a control and observation booth in one of the upper tiers, to be submitted to Edward Ziegler, assistant general manager for the Metropolitan Opera Company, New York.

Installation and construction work will commence as soon as the plans are approved by the opera company, and within two weeks it is expected that actual acoustical tests will be under way.

As soon as possible thereafter portions of regular performances of the nation's leading opera company will be made available to listeners throughout the United States.

With the realization that a great part of the country cannot hear opera because it is available only in the largest cities, the National Broadcasting Company is bringing opera directly from the stage of the Metropolitan to the homes of music lovers.

Deems Taylor to Be Narrator

Although it will be several weeks before the necessary arrangements for broadcasting can be completed, the servces of Deems Taylor, music critic, whose own compositions have been heard from the Metropolitan stage, have already been obtained as narrator for the series of operatic programs which will follow Assistant General Manager Ziegler's approval of the N.B.C. plans.

According to these plans, no temporary or portable equipment will go into the opera house. Control booth, wires and microphones will be permanent, but inconspicuous. Tehcnical facilities will be of the finest, but there will be nothing, save the control and obseration booth in an out-of-the-way spot, to indicate to operagoers that the performance is being broadcast to a far larger audience.

In the construction of this booth and the installation of equipment every effort will be made to share boxholders inconvenience or annoyance. The booth, from which the operating engineer and the production man coordinate the visual and auditory control of the broadcast, will be constructed outside the building and carried in section by section, in order that building operations will not conflict with scheduled performances.

Announcer in Chamber

In addition to the control room, this structure will also contain a special soundproof chamber, with a full view of the stage, from which Taylor and the announcer can speak to the radio audience without disturbing those seated in the vicinity.

Erection of the booth will be further complicated by the necessity for constructing it of fire-proof as well as soundproof material. Ordinary soundproofing employs wood, but in order to eliminate every possible fire hazard in the opera house the booth will be built of steel. his, the engineers point out, will make the equally necessary sound-proofing more difficult, thereby delaying the time when actual broadcasts may begin.

Once completed, the entire control room structure will be painted old rose to harmonize with the color scheme at the Metropolitan. Plans for the installation of the microphones have not been completed.

ULTRA WAVES' RANGE PUT AT FIFTY MILES

Tests made by the Shortware and Television Corporation in Boston lead the corporation to state that the projection of signals from great heights on ultra short waves brings about good television results.

Marshall P. Wilder, member of the research staff of the organization, analyzes the experiments conducted by WIXZ which contributed much new data on ultra-frequency television.

"The 100-watt transmitter of WIXZ is the first to be modulated with television and voice and broadcasts regularly on 6.7 to 6.97 meters," he reports. "The character of these waves makes them almost ideal for television purposes.

"Absence of fading, negligible (if not entirely eliminated) background noises, 'plenty of room to move around in' for the emission of wide bands for spreading good pictures, are among the favorable aspects.

Range About 50 Miles

"The main drawback, short range, is more than offset by the quality of received signals—and it must be borne in mind that few listeners in the eastern metropolitan districts regularly receive broadcasting from stations farther away than fifty miles. The quality of locals is undisputed and will be preferred to a distant station which have a hissing sound, perhaps a slight amount of crosstalk, or even a small amount of fading, no matter how good the program.

"Transmission on 43,000 to 45,000 kilocycles has approximately the same range, with no dead spots, provided the antenna is high enough at the station, at least 750 feet above the surrounding country, to attain this coverage.

"New York has a group of buildings suitable for such purpose and there are tall structures in other cities adaptable for television stations. With one-kilowatt power the high-up transmitter will be most effective. Shadows cast by large buildings do not seem to be such an obstacle; at least, I have not noticed any interference when receiving signals from the low powered station in and about Boston, although the present antenna is not advantageously placed. WIXG's antenna is a full wave current fed outfit with tuned transmission line.

Used Super-egenerator

"Voice reception was carried on through the use of a small super-regenerative receiver placed inside an automobile, with an aerial three feet long. Signals were strong with no fading over an irregular course from Boston to Newton Center, a distance of seven miles. At no time has the ignition system of the car been an annoyance. This form of interference, as well as that created by X-ray machines, power lines, etc., is negative. From Newton Center to Wellesley the signals sometimes droped, fading behind hills and in valleys; sometimes a foot advance brought them in at full strength. This is understandable because according to the accepted formula our signals should be effective at only eight miles based on the fact that our antenna is only about 50 feet above ground.

Results on Meters

"Yet there is evidence that these high frequencies sometimes cover great distances. A Hoyt Taylor, of the Naval Research Laboratories, told me that he had maintained 24-hour service from Washington to Panama using only 7 meters for six months. That was two years ago. Conditions are different and hazily comprehended. Dr. Taylor described successful communications on waves of 4.5 meters between Washington and California in onl ytwo out of two this cannot be done now, for reasons only hundred trials. The border for reflected waves is reached at about 8.5 meters.

"At Arlington, Mass., ten miles from WIXG, reception is excellent on the hills."

"Goldbergs'" Party Gay Despite All

The second anniversary of "The Goldbergs" was celebrated recently. It was a happy occasion in the career of Gertrude Berg, author and principal actress of the National Broadcasting Company series.

"The Goldbergs" held open house in a studio at 711 Fifth Avenue, New York, home of the N. B. C., throughout the late afternoon and early evening.

For "Jake Goldberg," whose character in the sketch as that of the wife of Mollie Goldberg (played by Mrs. Berg), shook hands with the real life husband, Mr. Berg. The fictional husband of Mollie Goldberg and the real husband of Gertrude Berg chatted pleasantly together as they nibbled cakes and sipped coffee, and there never was greater serenity and less awkwardness or discomfort. They agreed they had, in their respective spheres, one professional, the other domestic, the finest helpmate in the world. Mrs. Berg beamed domestically on the one and professionally on the other—you can imagine which—and decided that they both meant a great deal to her.

HOW CELEBRITIES WRITE NAMES

Three weeks after N.B.C. placed a guest register in its Fifth Avenue studios the first page was filled with signatures famous in the fields of adenture and music.

By coincidence, the first half of the opening page included such famous names as A. Whitten Brown, first to fly the Atlantic with John Alcock; Capt. Eddie Rickenbacker, war ace; Colonel Charles A. Lindbergh, and Roy Chapman Andrews, exploring scientist.

Below them were registered famous singers and composers, including Geraldine Farrar, Mary Garden, John Philip Sousa, Henry Hadley and Rudolf Friml.

The smallest signature was that of the bandmaster, who wrote in a thin hand. "John Phil. Sousa." Lindbergh signed himself "C. A. Lindbergh" in simple style, with a slight tilt to the right. Explorer Andrews stretched his name in a sweep almost across the page. The boldest signature was written by Miss Garden, beginning with a giant capital "M."

Miss Farrar signed with sharp, cryptic capital letters tapering off into almost illegible endings. Friml had a dashing flourish with lines that whipped across his name in the 1890 style.

The book is kept in the office of J. de Jara Almonte, night executive, who is host to all notables participating in or attending broadcasts.

CHINESE KEPT POSTED BY AIR ON MANCHURIA

Chinese are kept posted by radio about developments in Manchuria, Henry K. Chang, Consul General in New York, said in a recent broadcast over WOR, Newark, N. J. He also spoke, in substance, as follows:

The Chinese Signal Corps has acquired modern vacuum tube transmitters and receivers. The men are well trained in military communication practice both for point-to-point service and mobile operation in the field. These portable stations can be erected in a few minutes and put the troops in touch with headquarters at distances upward to a thousand miles. Power is supplied either by hand-driven or engine-driven generators.

Trained in Three Languages

The Chinese Signal Corps men are put through a long period of training in government schools, both in engineering and telegraphy, being able to maintain and repair equipment and many being able to copy messages in English, Russian and Japanese.

Broadcasting stations in China are located at Shankhai, Peking, Mukden, Canton, Hangchow, Harbin, Nanking, and Tientsin, operating on wavelengths between 30 0and 500 meters.

There are also more than twenty modern short-wave stations, some of which are used for broadcasting and others for telegraph purposes.

These are located at Shanghai, Nanking, Chungking, Wuhu, Ichang, Hankow, Tientsin, Pieping, Swatow, Canton, Taian and other points. Some of this equipment has been supplied by the RCA and some by the International Telegraph and Telephone Company.

Hear Japanese Stations

The listener in China today finds a thrill in every turn of the dial, at one setting finding something coming out of Russia, at another from Japan, and again from the zone of hostilities. Some of the Japanese stations heard in China are JEZB, Tokyo, or 20 meters; JFAV, on 39.50 meters, and JHBB on 37.50 meters. Moscow is heard regularly on short waves.

An English program is broadcast daily (two p. m., Eastern Standard Time) from the 20 kilowatt short-wave station at Shanghai, XEL, on a wavelength of 37.64 meters.

Asking Too Much, or Who Could Comply?

"I don't like the person who plays Clem in your sketch 'Jimmy and Dad.' Why don't you fire him and get somebody else?" So wrote a listener to Pat Barnes whose one-man radio comic strips are heard daily over an NBC-WJZ network. Pat replied he couldn't discharge Clem without discharging himself, for Pat takes all the parts in his sketches.

Eight Tube Super

Further discussion of the eight tube superhetereodyne treated in an instalment last week will be published next week, December 19th.

Another article will deal with voltage dividers.

CONTROL KEEPS ULTRA WAVE ON ITS FREQUENCY

What constitutes the first practical employment of ultra-short radio waves, which for many years have remained one of the curiosities of radiotelegraph experimental work, has been accomplished with the establishment of the new inter-island radio telephone system of Hawaii.

The development is regarded as an important milestone of radio, as it taps an altogether new reservoir of wavelengths for commercial utilization. Such an ultra-short wave communications system lends itself to duplication in other archipelagos, and particularly in those of the tropical regions for this and similar short distance communication in reliable, continuous communication, although the efficiency of frequencies now employed for long range communication remains unchallenged.

Attempts Begun 20 Years Ago

Attempts to establish inter-island telephone service for Hawaii were begun by the Mutual Telephone Company in 1912, when a survey disclosed that the channels between the islands were too deep to make the use of cables for voice communication practicable. The successful system eventually was established through the cooperation of Radio Corporation of America engineers with the Mutual Company, which called upon R.C.A. Communications, Inc., for assistance following extensive research and experimental work by R.C.A. in the ultra-short wave field.

At the time R.C.A. engineers were brought into consultation, in 1928, experiments had been conducted in Hawaii over a period of years on various frequency bands open for use by the telephone company. However, the spectrum of intermediate and the so-called "normal band" of short waves had been abandoned because of the selective fading and strong atmospherics experienced. It was quickly found that transmission on the ultra-short waves would convey telephone conversation with reliability over the required distances, but many problems remained for solution before a practical system could be developed.

Behave Like Light Waves

Ultra-short waves have many of the properties of light waves, which do not tend to follow the curvature of the earth. In the Hawaiian system they are transmitted from point to point on the same plane, without there being mountains or other intervening obstacles. This condition was met by locating the Hawaiian stations on top of the mountains and in a direct air line with stations on the mountain peaks of other islands. Mathematically exact surveys were conducted so as to permit a perfect alignment of sending and receiving antennae at the different stations.

Although ultra-short waves provided, in this instance, the solution of transmission through the ether without static or interference, the apparatus which generated the waves was extremely critical of adjustment. A transmitter on so short a wavelength is subject to "frequency drift" or shifting of wavelength, from very slight causes. Even so small a factor as a change in atmospheric temperature would throw it off the appointed wave. This had to be overcome, else the constant attention of trained engineers would be required to keep the stations "in tune" and even then interruptions to the service would be inevitable.

New Control Introduced

The usual engineering method of maintaining a transmitter on its assigned wave is by means of electric crystal control. But this necessitates much associated apparatus and, in the case of ultra-short waves, so much additional equipment as to place the cost of operation beyond all reasonable limits. R.C.A. engineers solved this difficulty with a new development known as the Long Line Frequency Control.

This is an electrical circuit, with no tubes and no moving parts, connected to the five meter transmitting circuit. The action of the Long line Frequency control is to correct automatically and entirely by electrical means any tendency of the transmitter to stray from its proper wavelength.

Through its employment, the apparatus is lifted out of the category of critical, laboratory equipment and made practical for commercial use. The Long Line Frequency Control makes possible installations which need only periodic attention and otherwise maintain telephone communication between islands as dependably as though they were connected by wires. Equipment for the new system was supplied by R.C.A.-Victor Company.

Band from 5 Meters Down

The possibilities of ultra-short waves have for some years been a subject of speculation and investigation among radio engineers. Pioneering research in this field had been done by Marconi, both in his independent efforts and in cooperation with the Italian Government. R.C.A. began experiments several years ago.

The ultra-short wave band is generally listed in present day parlance as that part of the radio spectrum which extends from five meetrs downward. There appears to be little or no difference in the essential properties of these frequencies except that they present more problems in control as the wavelength shortens. Research among other frequencies in the realm of ultra-short waves has been and is being conducted at the R.C.A. Communications laboratories at Riverhead and Rocky Point, Long Island. It is believed that the principles of the Long Line Frequency Control will prove of great value in the taming of even the shorter of the ultra-short waves.

The Long Line Frequency Control is so named because the electrical circuit which constitutes this device comprises lines having a length many times the length of the wave on which the transmitter operates.

The Hawaiian radio-telephone system was due largely to the efforts of J. A. Balch, president of the Mutual Telephone Company, who pushed forward continuous experimental work on the islands. Of its operation, Mr. Balch reported that on the day the new system was opened for commercial traffic a total of 213 calls was handled without a single instance of a call having to be cancelled on account of unsuccessful transmission.

Immune from Static

During the first week of commercial service the islands were visited by a severe static storm, described by Mr. Balch as one of the worst in his experience, with lightning flashing almost continually for the better part of two days and nights.

"No difficulty was experienced, however, in the operation of our ultra-frequency telephone circuits," said Mr. Balch, "and it was a weird experience to be watching the lightning flashing and at the same time talking to Hilo without difficulty, or without any particular annoyance being experienced from the very faint indications of static on the circuit."

The system links the islands of Hawaii, Kauai, Oahu and Maui. A radiotelephone service in which the Mutual Telephone Company is interested between Hawaii and the North American mainland will be opened probably before this Christmas. For the mainland service, transmitting and receiving stations in Hawaii will be owned and operated by the R.C.A. Communications, Inc. In trans-ocean work the transmitting and receiving stations in California will be owned and operated by the American Telephone and Telephone Company. Connection to the Hawaiian land telephone land telephone network as well as to the new, inter-island redio-telephone service, will be made through the Mutual Telephone Company.

WAVES OF FIVE METERS OR LESS FOR MESSAGES

Forum

Thank You; We Feel Better Now

I SHALL not attempt to praise your (or should I say "our") publication, as words are inadequate to express the pleasure I feel when I arrive home and find the latest edition waiting for me.

Five hundred and six consecutive issues and getting better all the time, if that be possible. Keep up the good work and believe me to be one of your best boosters.

WILLIAM WOOD,
743 Willibrord Ave.,
Verdun, P. Q., Canada.

SUNDRY SUGGESTIONS FOR WEEK COMMENCING DECEMBER 13

Sun., Dec. 13: N. Y. Philharmonic Orchestra; WABC—3:00 p. m.

Sun., Dec. 13: Footlight Echoes; WOR—10:30 p. m.

Mon., Dec. 14: Merrie-Men—Male Quartet; WJZ—12:00 noon.

Mon., Dec. 14: Carl Fenton & Bing Crosby; WABC—7:15 p. m.

Tues., Dec. 15: Marion Harriss; WEAF—11:30 p. m.

Wed., Dec. 16: Sherlock Holmes; WJZ—9:00 p. m.

Thurs., Dec. 17: Weaver of Dreams; WOR—10:15 p. m.

Fri., Dec. 18: March of Time; WABC—8:30 p. m.

Sat., Dec. 19; Arthur Pryor and Revelers; WEAF—9:00 p. m.

(If you would like to know something of your favorite radio artists and announcers, drop a card to the conductor of Station Sparks. Address her: Miss Alice Remsen, care RADIO WORLD, 145 W 45th St., New York.)

Stations in United States and Canada, Corrected to Press Time

CANADA

Station	kc
CFAC	690
CFBO	890
CFCA	1120
CFCF	1030
CFCH	930
CFCL	960
CFCN	985
CFCO	1210
CFCT	630
CFCY	580
CFIC	1120
CFLC	915
CFNB	1210
CFQC	910
CFRB	690
CFRC	930
CHCK	960
CHCS	630
CHGS	1120
CHLS	730
CHMA	580
CHML	880
CHNS	910
CHRC	645
CHWC	960
CHWK	665
CHYC	730
CJBR	960
CJCA	930
CJCB	880
CJCJ	690
CJGC	910
CJGX	630
CJOC	1120
CJOR	1210
CJRM	665
CJRW	665
CKAC	730
CKCD	730
CKCI	645
CKCK	960
CKCL	960
CKCO	890
CKCR	645
CKCV	880
CKFC	730
CKGW	840
CKIC	1010
CKLC	840
CKMC	1210
CKMO	730
CKNC	960
CKOC	630
CKOV	1200
CKPC	880
CKPR	890
CKUA	580
CKWX	730
CKX	540
CKY	780
CNRA	630
CNRD	840
CNRH	910
CNRL	910
CNRM	730
CNRO	600
CNRQ	880
CNRR	960
CNRS	910
CNRT	1120
CNRV	1030
CNRW	780
CNRX	690
CPRY	840

UNITED STATES

Station	kc
WAAB	1410
WAAF	920
WAAM	1250
WAAT	940
WAAW	660
WABC	860
WABI	1200
WABZ	1200
WACO	1240
WADC	1320
WAGM	1420
WAIU	640
WALR	1210
WAPI	1140
WASH	1270
WAWZ	1350
WBAA	1400
WBAK	1430
WBAL	1060
WBAP	800
WBAX	1210
WBBC	1400
WBBL	1210
WBBM	770
WBBR	1300
WBBZ	1200
WBCM	1410
WBEN	900
WBEO	1310
WBGF	1370
WBHS	1200
WBIG	1440
WBIS	1230
WBMS	1450
WBNX	1350
WBOQ	860
WBOW	1310
WBRC	930
WBRE	1310
WBSO	920
WBT	1080
WBTM	1370
WBZ	990
WBZA	990
WCAC	600
WCAD	1220
WCAE	1220
WCAH	1430
WCAJ	590
WCAL	1250
WCAM	1280
WCAO	600
WCAP	1280
WCAT	1200
WCAU	1170
WCAX	1200
WCAZ	1070
WCBA	1440
WCBD	1080
WCBS	1210
WCCO	810
WCDA	1350
WCFL	970
WCGU	1400
WCHI	1490
WCKY	1490
WCLO	1200
WCLS	1310
WCMA	1400
WCOA	1340
WCOC	880
WCOD	1200
WCOH	1210
WCRW	1210
WCSC	1360
WCSH	940
WDAE	1220
WDAF	610
WDAG	1410
WDAH	1310
WDAY	940
WDBJ	930
WDBO	1120
WDEL	1120
WDEV	1420
WDGY	1180
WDIX	1500
WDOD	1280
WDRC	1330
WDSU	1250
WDZ	1070
WEAF	660
WEAI	1270
WEAN	780
WEAO	570
WEBC	1290
WEBQ	1210
WEBR	1310
WEDC	1210
WEDH	1420
WEEI	590
WEEU	830
WEHC	1350
WEHS	1420
WELK	1370
WELL	1420
WFNR	870
WEPS	1200
WEVD	1300
WFW	760
WEXL	1310
WFAA	800
WFDV	1310
WFAN	610
WFBC	1200
WFBE	1200
WFBG	1310
WFBL	1360
WFBM	1230
WFBR	1270
WFDF	1310
WFDV	1370
WFDW	1420
WHEC	1430
WFI	560
WFIW	940
WFLA	620
WFOX	1400
WGAL	1310
WGAR	1450
WGBB	1210
WGBC	1430
WGBF	630
WGBI	880
WGBS	1180
WGCM	1210
WGCP	1250
WGES	1360
WGH	1310
WGL	1370
WGN	720
WGR	550
WGST	890
WGY	790
WHA	940
WHAD	1120
WHAM	1150
WHAP	1300
WHAS	820
WHAT	1310
WHAZ	1300
WHB	860
WHBC	1200
WHBD	1370
WHBF	1210
WHBL	1410
WHBQ	1370
WHBU	1210
WHBY	1200
WHDF	1370
WHDH	830
WHEC	1440
WHFC	1420
WHIS	1410
WHK	1390
WHN	1010
WHO	1000
WHOM	1450
WHP	1430
WIAS	1420
WIBA	1280
WIBG	930
WIBM	1370
WIBO	560
WIBR	1420
WIBU	1210
WIBW	580
WIBX	1200
WICC	600
WIL	1200
WILL	890
WILM	1420
WIOD	1300
WIP	610
WIS	1010
WISN	1120
WJAC	1310
WJAG	1060
WJAK	1310
WJAR	890
WJAS	1290
WJAX	900
WJAY	610
WJAZ	1490
WJBC	1200
WJBI	1210
WJBK	1370
WJBL	1200
WJBO	1420
WJBT	770
WJBU	1210
WJBW	1200
WJBY	1210
WJDX	1270
WJJD	1130
WJKS	1360
WJMS	1420
WJR	750
WJSV	1460
WJW	1210
WJTL	1370
WJZ	760
WKAQ	890
WKAR	1040
WKAV	1310
WKBB	1310
WKBC	1310
WKBF	1400
WKBH	1380
WKBI	1420
WKBN	570
WKBO	1450
WKBS	1310
WKBV	1500
WKBW	1480
WKBZ	1500
WKJC	1200
WKRC	550
WKY	900
WKZO	590
WLAC	1470
WLAP	1010
WLB	1250
WLBC	1310
WLBF	1420
WLBG	1200
WLBL	900
WLBW	1260
WLBX	1500
WLBZ	620
WLCI	1210
WLEY	1370
WLIT	560
WLOE	1500
WLS	870
WLTH	1400
WLVA	1370
WLW	700
WLWL	1100
WMAC	570
WMAK	1040
WMAL	630
WMAQ	670
WMAZ	1180
WMBA	1500
WMBC	1420
WMBD	1440
WMBG	1210
WMBH	1420
WMBI	1080
WMBO	1310
WMBQ	1500
WMBR	1370
WMC	780
WMCA	570
WMIL	1500
WMMN	890
WMPC	1500
WMRJ	1210
WMSG	1350
WMT	600
WNAC	1230
WNAD	1010
WNAX	570
WNBF	1500
WNBH	1310
WNBO	1200
WNBR	1430
WNBW	1200
WNBX	1200
WNBZ	1290
WNJ	1450
WNOX	560
WNYC	570
WOAI	1190
WOAX	1280
WOBU	580
WOC	1000
WOCL	1210
WODA	1250
WODX	1410
WOI	640
WOKO	1430
WOL	1310
WOMT	1210
WOOD	1270
WOPI	1500
WOQ	1300
WOR	710
WORC	1200
WOS	630
WOV	1130
WOW	590
WOWO	1160
WPAD	1420
WPAP	1010
WPAW	1210
WPCC	560
WPCH	810
WPEN	1500
WPG	1100
WPOE	1370
WPOR	780
WRAM	1370
WPSC	1230
WPTF	680
WQAM	560
WQAN	880
WQAO	1010
WQBC	1360
WQDM	1370
WQDX	1210
WRAK	1370
WPRO	1210
WRAW	1310
WRAX	1020
WRBJ	1370
WRBL	1200
WRBQ	1210
WRBX	1410
WRC	950
WRDO	1370
WRDW	1500
WREC	600
WREN	1220
WRHM	1250
WRJN	1370
WRNY	1010
WROL	1010
WRR	1280
WRUF	830
WRVA	1110
WSAI	1330
WSAJ	1310
WSAN	1440
WSAR	1450
WSAZ	580
WSB	740
WSBC	1210
WSBT	1230
WSEN	1210
WSFA	1410
WSIX	1210
WSJS	1310
WSM	650
WSMB	1320
WSMK	1380
WSOC	1210
WSPA	1420
WSPD	1340
WSUI	880
WSUN	620
WSVS	1370
WSYB	1500
WSYR	570
WTAD	1440
WTAG	580
WTAM	1070
WTAQ	1330
WTAR	780
WTAW	1120
WTAX	1210
WTBO	1420
WTEL	1310
WTFI	1450
WTIC	1060
WTJS	1310
WTMJ	620
WTNT	1470
WTOC	1260
WTSL	1310
WWAE	1200
WWJ	920
WWL	850
WWNC	570
WWRL	1500
WWSW	1500
WWVA	1160
WXYZ	1240
KABC	1420
KBPS	1420
KBTM	1200
KCRC	1370
KCRJ	1310
KDB	1500
KDFN	1210
KDKA	980
KDLR	1210
KDYL	1290
KECA	1430
KELW	780
KEX	1180
KFAB	770
KFAC	1300
KFHB	1280
KFBI	1050
KFBK	1310
KFBL	1370
KFDM	560
KFDY	550
KFEL	920
KFEQ	680
KFGQ	1310
KFH	1300
KFI	640
KFIO	1120
KFIZ	1420
KFJB	1200
KFJF	1480
KFJI	1370
KFJM	1370
KFJR	1300
KFJY	1310
KFJZ	1370
KFKA	880
WFKU	1220
KFKX	1020
KFLV	1410
KFLX	1370
KFMX	1250
KFNF	890
KFOR	1210
KFOX	1250
KFPL	1310
KFPM	1310
KFPW	1340
KFPY	1340
KFQD	1230
KFQU	1420
KFQW	1420
KFRC	610
KFRU	630
KFSD	600
KFSG	1120
KFUL	1290
KFUO	550
KFUP	1310
KFVD	1000
KFVS	1210
KFWB	950
KFWF	1200
KFWI	930
KFXD	1420
KFXF	920
KFXJ	1310
KFXM	1210
KFXR	1310
KFXY	1420
KFYO	1420
KFYR	550
KGA	1470
KGAR	1370
KGB	1330
KGBU	900
KGBX	1310
KGBZ	930
KGCA	1270
KGCR	1210
KGCU	1240
KGCX	1310
KGDA	1370
KGDE	1200
KGDM	1100
KGDY	1200
KGEF	1300
KGEK	1200
KGER	1360
KGEW	1200
KGEZ	1310
KGFF	1420
KGFG	1370
KGFI	1500
KGFJ	1200
KGFK	1500
KGFL	1370
KGFW	1310
KGFX	580
KGGC	1420
KGGF	1010
KGGM	1230
KGHF	1320
KGHI	1200
KGHL	950
KGIR	1360
KGIW	1420
KGIX	1420
KGIZ	1500
KGJF	890
KGKB	1500
KGKL	1370
KGKO	570
KGKX	1420
KGKY	1500
KGMB	1320
KGNF	1430
KGNO	1210
KGO	790
KGRS	1410
KGU	940
KGVO	1420
KGW	620
KGY	1200
KHJ	900
KHQ	590
KICK	1420
KID	1320
KIDO	1350
KIT	1310
KJBS	1070
KJR	970
KLCN	1290
KLO	1400
KLPM	1240
KLRA	1390
KLS	1440
KLX	880
KLZ	560
KMA	930
KMAC	1370
KMBC	950
KMCS	1120
KMED	1310
KMJ	1210
KLMB	1200
KMMJ	740
KMO	860
KMOX	1090
KMPC	710
KMTR	570
KNX	1050
KOA	830
KOAC	550
KOB	1180
KOCW	1400
KOH	1380
KOIL	1260
KOIN	940
KOL	1270
KOMO	920
KONO	1370
KOOS	1370
KORE	1420
KOY	1390
KPCB	650
KPJM	1500
KPO	680
KPOF	880
KPPC	1210
KPQ	1500
KPRC	920
KQV	1380
KQW	1010
KRE	1370
KRGV	1260
KRLD	1040
KRMD	1310
KROW	930
KRSC	1120
KSAC	580
KSCJ	1330
KSD	550
KSEI	900
KSL	1130
KSMR	1200
KSO	1380
KSOO	1110
KSTP	1460
KTAB	560
KTAR	620
KTAT	1240
KTBR	1300
KTBS	1450
KTFI	1320
KTHS	1040
KTLC	1310
KTM	780
KTRH	1120
KTSA	1290
KTSL	1310
KTSM	1310
KTW	1220
KUJ	1370
KUOA	1390
KUSD	890
KUT	1500
KVI	760
KVL	1370
KVOA	1260
KVOO	1140
KVOR	1270
KVOS	1200
KWCR	1310
KWEA	1210
KWG	1200
KWJJ	1060
KWK	1350
KWKC	1370
KWKH	850
KWLC	1270
KWSC	1220
KWWG	1260
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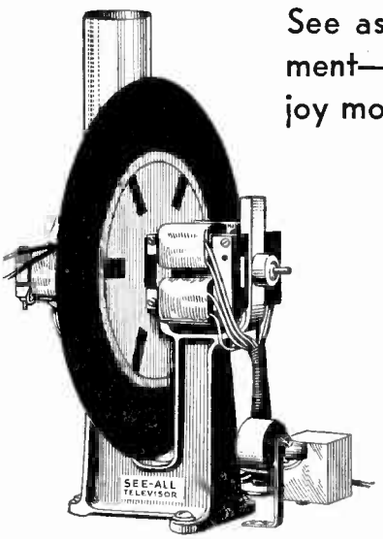

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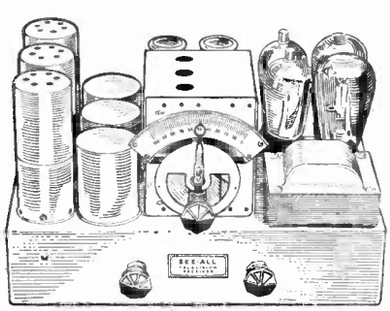

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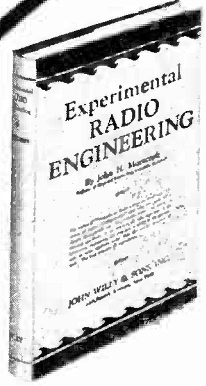

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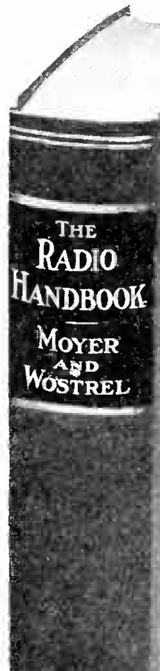

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