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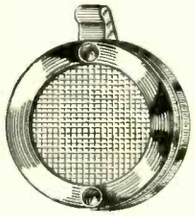

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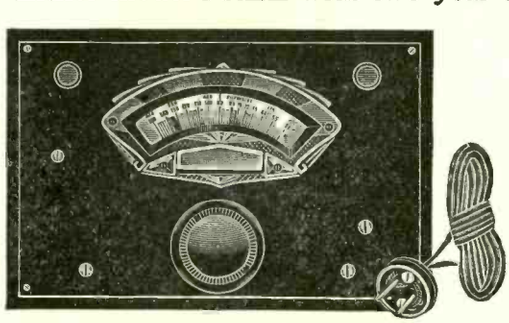

The test oscillator has a frequency-calibrated dial, 150 to 50 kc, with 1 kc separation between 50 and 80 kc and 2 kc separation between 80 and 150 kc. Intermediate frequencies are imprinted on the upper tier. Broadcast frequencies are obtainable on tenth harmonics (500 to 1,500 kc).

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THE a-c model is completely self-operated and requires a 56 tube. The battery model requires external 22.5-volt small B battery and 1.5-volt dry cell, besides a 230 tube. The use of 1.5 volts instead of 2 volts on the filament increases the plate impedance and the operating stability.

The battery model is modulated by a high-pitched note. Zero beats are not obtainable with the battery model.

Directions for Use

Remove the four screws and the slip cover, insert the 56 tube in its socket, restore the cover and screws, connect the a-c attachment plug to the wall socket, and the a-c test oscillator is ready for service.

For testing some particular set, follow the directions given by the designer or manufacturer. In the absence of such directions, use the following method.

Mentally affix a cipher to the registered frequencies on the lower tier (so 50 is read as 500, and 150 as 1,500), and set the dial for any desired broadcast frequency. Connect a wire from output post of test oscillator to antenna post of set. Leave aerial on for zero beats, off otherwise. At resonance the hum will be heard. Off resonance it will not be heard. For testing intermediate frequencies, connect the wire to plate of the first detector socket. The first detector tube may be left in place and bared wire pushed into the plate spring. The intermediates then are tuned for strongest hum response. If an output meter is used, tune for greatest needle deflection.

The battery model is connected to voltage sources as marked on oscillator outleads and is used the same way.

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PHOTO-CELL USES

And the Construction of an Electric Relay

By J. E. Anderson

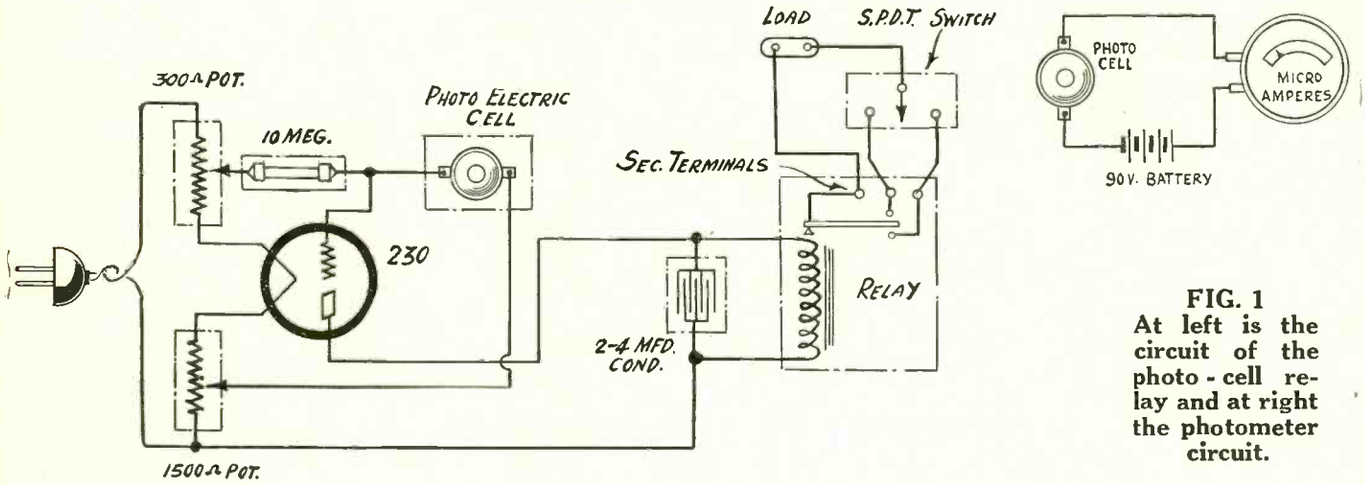


FIG. 1
At left is the circuit of the photo-cell relay and at right the photometer circuit.

IT IS no exaggeration to say that the photo-electric cell is the most versatile device ever invented. If we were to enumerate all its possible applications we would have an almost endless catalogue of mechanical operations. It is not correct to say that the cell itself performs all the operations but rather that it controls them.

The principle of the cell is simply that it responds to light values and that the response is directly proportional, within certain limitations, to the amount of light flux that enters the cell. It is usually said that it converts light into electricity. Possibly that is true, if any conversion is necessary. At any rate, it converts varying light values into correspondingly varying electric values.

The cell forms a part of an electric circuit in which there is a comparatively high electromotive force acting. The current that flows in the circuit depends not only on the value of the electromotive force, that is, the voltage, but also on the amount of light flux that enters the cell. We may, therefore, look upon the cell as a type of resistor the resistance of which depends on the amount of light flux that enters.

How It Works

Another way of looking at the cell is that it is a type of electron tube in which the rate of flow of electrons depends on the amount of light that enters the cell. Indeed, that is the correct way of regarding the cell, for the light releases electrons from the cathode and the electromotive force in the circuit drives the electrons around that circuit. That light takes the place of the heat in the ordinary electron tube. There is this difference, however, that the response to light is instantaneous, whereas that to changes in heat is comparatively very slow.

The voltage in the circuit is so high that all the electrons released by the light are attracted to the anode so that the current that flows is the saturation current. This varies with the amount of light and for that reason there is a variation in the current as the light intensity varies.

Applications

There are two general types of photo-electric cells, the high vacuum type and the low vacuum type. The high vacuum type of tube is more faithful to light intensity variations and for that reason it is used in precise measurements of light values. However, it is comparatively insensitive. The low vacuum tube is much more sensitive than the other and for that reason is used where a strict proportionality between light and electric current is not essential.

While the various applications of the photo-electric cell are numberless, the field has only been scratched in spots. Any experimenter with a modest outfit has the opportunity of discovering many other applications, some of them, undoubtedly, of high value. The cell is an ideal tool for the practical inventor.

Not only does it offer opportunities to the discoverer of new applications and the inventor of new devices based on such discoveries, but it also offers opportunities to the service man who can install photo-electric cell systems in applications already known. Let us discuss a few of the known applications which the enterprising service man may take advantage of when opportunity offers.

Illumination Control

Control of illumination by means of a cell seems to be one of the most logical and at the same time one of the most useful. This application is also very simple. As an illustration we might take street lighting. At a certain time in the evening the natural illumination has fallen to the extent that artificial illumination becomes necessary. If then the cell is adjusted so that it will turn on the electric switches when the natural illumination has reached a predetermined

(*Continued on next page*)

(*Continued from preceding page*)

low value, the lights will go on automatically when the illumination has been reached. Likewise, if relays have been adjusted properly, the cell will open the electrical switches when the natural illumination has reached the same value in the morning. It may even happen that during a storm the natural illumination will fall in the daytime. The cell will then be on guard and turn on and off the electric lights at the proper moments. For this application electric relays are essential, but they are simple and easily installed.

Another application of the cell is to the automatic opening of doors. The garage door seems to be the most favored door, for no driver, or passenger either, desires to get out to open the door, and certainly not if it's raining. He prefers to have the door opened for him, and that the photo-electric cell will do provided that it has been set in the proper circuit.

As a rule, this application requires that a photo-electric cell be placed so that the headlights on the car will actuate the cell, that the cell will trip a relay which in turn starts an electric motor, which does the actual opening. Details for such an arrangement are a matter for the installer to determine in each particular instance.

Drinking Fountains

Automatic public fountains have been arranged so as to operate with photo-electric cells. A beam of light is arranged so that when no one is drinking it falls on a photo-electric cell which keeps the water valve closed. The instant a person stoops down for a drink the head interrupts the beam of light, the cell operates, and the valve is opened. This application, of course, raises the question which is the more expensive, to let the water run all the time or to install the photo-electric system and have a light burning all the time. It is, of course, conceivable that this could be operated without a light burning if there is ample illumination about the fountain, for the cell could be arranged so that the head of the drinker could exclude sufficient illumination to actuate the cell. That would leave a comparison between the cost of the water flowing all the time and the cost of the automatic system. This system is mentioned merely because it has been used.

Automatic Counters

One of the most useful applications of the photo-electric cell is the counters. As an example, the cell has been used for counting the number of persons passing a certain street corner during the day, or during a whole week. Here, as in all other counters, a beam of light is arranged so that the person, or thing, to be counted interrupts a beam of light that normally falls into the cell. Each time the beam is interrupted a relay trips, and that in turn operates a mechanical counter. A device of this sort when applied to pedestrians would not be accurate because it would not give greater weight to a couple walking side by side than to a single individual.

A more accurate and perhaps more useful application of the counter is in factory production. When the units produced by the factory move along a conveyor, each unit interrupts a beam of light and each is registered on the mechanical counter through the operation of the cell. There are no mistakes no matter how fast the units may move past the cell. Where it is essential to count the units, the photo-electric cell device seems to be the ideal counter.

Color Sorters

A similar application of the cell is that of the color sorter. As an example of this we might take the sorting of cigars

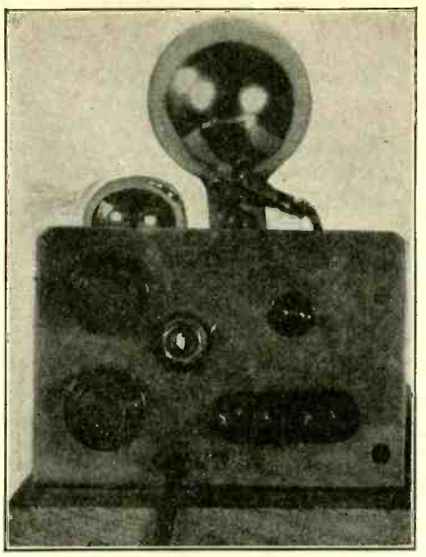


FIG. 2

according to their shade. This takes the form of "light sieves." As the cigars come along the production line they are assorted as to shade. Some are dark, some medium, and some light. The first cell along the line might be adjusted so that it will pass the medium and the light cigars and divert to another conveyor only the dark. The next cell might be so adjusted that it will pass the light and divert the medium. Thus two cells arranged in tandem along the conveyor will sort the cigars into three grades, based on shade. More cells could be used to sort the cigars into more groups.

Of course, this sorting is not confined to cigars, but could be applied to any products that are to be sorted according to shade or according to color.

In this application a beam of light is not interrupted by the units, in general, but a strong light is thrown on the unit and the reflected light is passed into the cell. A dark unit will reflect little light, a medium unit will reflect more, and a light unit still more. When the units are to be graded as to color, cells sensitive to certain colors can be used or color filters may be employed.

Airport Illumination

The photo-electric cell has been applied to the automatic illumination of airports at night. Before a night flier can land at a field that field must be illuminated. As the flier approaches a dark field he can drop a flare, the light from which will actuate a photo-electric cell, which in turn operates the switches controlling the illumination on the field. Thus no man is needed on the ground to watch for approaching night fliers.

Another application is to the indication of the amount of smoke in smoke stacks. When heavy smoke is emitted from the stacks the boilers are fired inefficiently, and in many instances, illegally. The stokers desire to know at all times just how much smoke is being emitted in order that they may know when to make corrections when necessary. By means of a photo-electric cell suitably arranged they can be apprised continually of the density of the smoke. A beam of light is passed across the smoke flow at some convenient point and at one side is a photo-electric cell in the circuit of which, at a place convenient to the stokers, is a sensitive microammeter. The reading of this meter indicates directly the density of the smoke because the light interrupted is directly proportional to the density. When the reading on the meter is very low, the smoke is dense, for then nearly all the light in the beam is prevented from reaching the cell. This is a highly practical application of the photo-cell because the cost of the installation of the system is negligible compared with the cost of the fuel saved by proper operation of the furnaces, and this does not take into account the enormous economic and sanitary advantages of freedom from tons of carbon-laden smoke.

Photometry

Photometry, the art of measuring light values, has been advanced immeasurably by the use of the photo-electric cell. Nearly all work of this nature is now done by means of such cells, usually those of the high vacuum type, and in the field of photometry comes the art of color matching. It was not until the development of the photo-cell that this art really entered the realm of precise science. Now colors can be matched precisely and scientifically. It is no longer necessary to depend on the peculiarities of different observers, no two of which have equal eyes.

Also, astronomical observations can be made, and the spectral energy distribution determined.

While this work can now be done with precision, not all those who can afford a photo-electric cell can do so, for it requires special training as well as special equipment. One application of the cell to photometry which might prove both useful and profitable is the photographic exposure meter. The cell measures the amount of light that enters the cell. Thus if it is pointed at the object to be photographed, the cell will indicate the illumination on that object, and it is that which counts in photography. It is easy to work out a relation between the reading of the microammeter in the photometer circuit and the exposure that will give the best negative in any particular case. The illumination is always the unknown quantity in photography.

A Photometer Circuit

The photometer circuit is extremely simple, as indicated in Fig. 1. It consists of the photo-electric cell, a battery of suitably high voltage, and a sensitive microammeter, all connected in series. For a given voltage in the circuit, the current indicated by the meter is directly proportional to the light flux that enters the cell, and, of course, to the sensitivity of that particular cell.

The sensitiveness of the cell to light variations can be tested in a thousand different ways. Suppose the cell is in a fixed position in a lighted room. The meter reads a certain value. Now if the curtains are pulled down, the reading becomes less. If the hand is placed in front of the cell opening, when the room is illuminated, the reading also becomes less. If the cell is placed in a darkened room and a light is moved in front of the cell window, the reading will go up or down according as the light is moved nearer or farther away from the cell.

Quantitative Tests

These tests are only qualitative. Rough quantitative tests can be made by setting the cell in a dark room except from the illumination from a movable light, such as a candle. A relation can then be found for the reading of the meter against various distances between the light and the cell. When doing this it should be remembered that the light that enters the cell is inversely proportional to the square of the distance between the light and the cell. That is, if the distance is doubled, the reading on the meter should be only one-fourth what it was before. This holds if the current in the cell is directly proportional to the light flux that enters the cell. If there is any stray light in the room, the law will not hold.

Many practical applications of the photo-electric tube requires the use of a

relay circuit. The simplest circuit of this type is one in which the current from the cell actuates the field magnet of the relay. The armature winding in that case is connected in place of the microammeter in Fig. 1. In order that this should work it is essential to use an extremely sensitive relay for the photo-electric current is extremely feeble. But suitable relays are available.

A somewhat more complicated circuit, but one that is extremely sensitive, is indicated to the left in Fig. 1. Here the photo-cell is coupled to the grid circuit of the vacuum tube amplifier by means of a high resistance, in this case 10 meg. As the photo-current flows through this resistance a voltage difference is set up across the resistance and if the current varies due to a variation in the light that falls on the cell, the signal voltage on the grid of the tube varies in the same manner. Of course, the plate current in the amplifier tube varies with the grid voltage. The winding of an electric relay is connected in the plate circuit of the tube, and a variation in the plate current will either close or open the relay according to the connections. The single-pole double-throw switch gives the option of opening or closing action by the relay.

We shall assume that a light signal is such that the plate current increases. The armature of the relay will then be pulled down. The right of the alternative circuits will then be closed. If the single pole, double throw switch is then left in the right position, the load circuit will be closed. The signal will then light a lamp or start a motor or start operation of the device in the load circuit.

If the single pole double throw switch is left in the left hand position the circuit is closed and the pulling down of the armature by the signal will open the circuit, thus terminating an operation.

The Choice

Thus the same signal will either start or terminate an operation, and the choice is made by throwing the single pole, double throw switch. It would also be possible to arrange the amplifier circuit so that the signal would decrease the plate current. This would reverse the functioning of the relay circuit.

The purpose of the 300-ohm potentiometer in the grid circuit is to provide a means for adjusting the operating bias on the amplifier tube. The potentiometer is used to bring about a "condition of balance" of the circuit, that is, to adjust the cell and the amplifier circuits so that the signal produces the desired effect on the relay. The 1,500-ohm potentiometer is also used for balance and in general it is preferable to make most of the adjustments by means of this instrument. The voltage between the sliders of the two potentiometers determine the voltage on the photo-electric cell.

It is better to operate the circuit with direct current, with the negative applied to upper terminal and the positive to the lower. When this is done the by-pass condenser across the relay winding should be omitted.

The circuit may also be operated with alternating current. This is possible because when the upper terminal is positive and the lower negative, no current can flow either in the amplifier plate circuit nor in the photo-electric cell. Thus the positive bias on the grid of the amplifier can cause no damage. It is, of course, necessary in the first place to connect the photo-cell so that current can flow in that when the plate of the amplifier is positive.

Voltage Division

The object of having two potentiometers is to divide the available voltage between the grid and the plate circuits. One is of 300 ohms, the other of 1,500 ohms. Thus if we neglect the resistance in the filament and all currents other than the filament current, the maximum grid voltage and the plate voltage will be proportional to these resistors. Thus if the line voltage is 120 volts, the grid voltage may be 20 volts and the plate voltage 100 volts. The grid voltage can be made less than 20 by means of the 300-ohm potentiometer. The voltage on the anode of the cell can also be made less than 100 volts by means of the 1,500-ohm potentiometer. The proper anode voltage for the cell used in the circuit is 90 volts.

The amplifier tube employed in the circuit is a 230. This tube will get the proper filament current when the line voltage is 110 volts.

The physical arrangement of the various parts entering into the circuit as given at left in Fig. 1 is shown in Fig. 2 herewith and in the illustration on the front cover. The device was built by Michael Blau, 177 Greenwich Street, New York City.

The two knobs at the left are for the two potentiometers. The twin binding post strip is for the load connection and the toggle switch immediately above it is the single pole, double throw switch. The jack in the center of the panel enables the operator to cut into the cell circuit for the purpose of using it as a photometer by plugging in a microammeter. This is not shown in the circuit diagram. The jack is of the closed type and is connected in series with the anode lead of the cell. A six-foot cord with plug is provided and this contains an on-off switch for the power.

The Review

Questions

1. Under what condition of anode voltage will a rectifier tube rectify?
2. Is a resistance-coupled audio amplifier, so circuited as to omit the stopping condensers, actually non-reactive? If not, why not?
3. What sort of a tube is the 1A6 and what are the typical operating conditions?
4. In a highly-sensitive superheterodyne receiver, is it necessary to use tube shields and for the intermediate level, and is the safeguard against feedback completed then? If not, what additional safeguards are necessary? Which circuit is the most critical in respect to feedback?
5. In a diode-biased amplifier tube, as in the case of the triode of the 55 biased by the signal of the diode, what is the point most likely to be overloaded first, and what is the remedy?
6. What is time delay and what effect has it on very weak signals?
7. Name the two new half-wave rectifiers for 6.3 and 12.6-volt heaters and state the rated characteristics.
8. Can ultra waves penetrate farther than the horizon? If so, why?
9. Are doubly-tuned intermediate-frequency transformers more selective than singly-tuned transformers? Does single or double tuning constitute the sole basis of selectivity difference?
10. Can a meter shunt resistor be determined from a magnet wire table? If not, what use is such a table in this connection?

Answers

1. The rectifier tube will rectify when the a-c input thereto is positive at the anode.
2. A resistance-coupled audio amplifier with circuit so arranged that stopping condensers are omitted is not truly non-reactive, but is called so because being close to nonreaction. The capacities of tube elements, wiring and other strays, because constituting capacity across high-resistance circuits, defeat complete non-reaction.
3. The 1A6 is a pentagrid converter tube for battery sets. That is, it is a combination modulator and oscillator, consisting of a triode oscillator and pentode modulator. Electron coupling is present in the common cathode circuit. The filament voltage is 2 volts, the filament current 0.06 ampere. At 180 plate volts the other voltages are: screen, 67.5; control grid bias for pentode, minus 3; oscillator bias through 50,000-ohm grid leak with 0.002 mfd. stopping condenser.
4. It is necessary to use tube shields for the intermediate stages in a sensitive superheterodyne. Besides, the intermediate coils should be shielded, and if the leads from coils to overhead grids are rather long, these should be shielded, too. All shields should be grounded, either to chassis or cathode. Plate and cathode circuits should be filtered. The most critical circuit in respect to feedback is the cathode, as all currents flow through it, and a high-inductance choke and high capacity bypass condenser may be used to advantage.
5. The point most likely to be overloaded first in a diode-biased triode is the triode, as the diode will work satisfactorily up to about 20 volts of rectification (d. c.), whereas the triode plate current will be reduced below the non-distorting point at a lower voltage than this. The remedy is to reduce the amount of antenna input (shorten aerial or use series antenna condenser), otherwise reduce the sensitivity ahead of the triode tube, which may include putting into the triode less than the full rectified voltage of the diode.
6. Time delay is the negative biasing of a rectifier anode so that the bias voltage has to be overcome by the positive cycle of a-c to start rectification. The effect is to wipe out very weak signals, since the a-c voltage put into the rectifier by such signals is less than that which creates the rectification conditions.
7. The two new half-wave rectifiers for 6.3-volt and 12.6-volt heaters are, in that order the 1v and the 12Z3. Both draw 0.3 ampere heater current. The 1v is good for 350 volts and 50 ma, the 12Z3 for 250 volts and 60 ma.
8. Yes, ultra waves can penetrate farther than the horizon due to refraction in the ionized layers of the stratosphere.
9. Doubly-tuned intermediate transformers are generally more selective than single-tuned ones, due more to the required looseness of coupling than to the mere fact that the two circuits are tuned instead of one. Thus double tuning is not the sole basis of the selectivity.
10. A meter shunt can not be determined from a magnet wire table because the resistance of the meter has to be determined or ascertained first. When the meter resistance and the desired highest current of the measurable circuit are known, the resistance required for the shunt can be computed, and the length of given size wires to attain such resistance can be obtained from the magnet wire table. Such a table was published last week.

THE NEXT NUMBER OF RADIO WORLD, DATED SEPTEMBER 30th, WILL BE INCREASED TO OUR REGULAR NUMBER OF PAGES.

NEW MOTOR FOR VISION

Peck's 1,440 R. P. M. Synchronous Device Enables Use of Talkie Film—New Principle

TO send and receive television images *with sound* synchronously from talking motion picture films, a motor that would run at 1,440 revolutions per minute is necessary. The reason is that there are 24 complete pictures per second in talking picture projection, and 24 times 60 (the number of seconds in a minute) equals 1,440.

When starting his experiments with television transmission of sound movies, William Hoyt Peck, president of Peck Television Corporation, with laboratories at 115 West 45th Street, New York City, sought to purchase a pair of synchronous 1,440 R.P.M. motors from several leading manufacturers.

He Tried But Discarded Gears

He was advised by General Electric that no such motors existed. Another company advised him that no such motors could be built. These and other concerns suggested using 1,800 R.P.M. synchronous motors with suitable gearing to reduce the speed the desired amount.

Peck then experimented with gearing, such as is used at present in motion picture work. Even the best gear trains were found to be impractical and unsatisfactory from various viewpoints. For example, even fiber gears introduced a certain amount of highly undesirable noise. In addition, the gears, no matter who well machined, caused vibrations which resulted in a flickering of the image, even when costly mechanical filters were applied.

The only solution was to obtain a 1,440 R.P.M. motor, a motor which the motion picture industry had been seeking since the inception of sound films, which the pick of America's engineers had said was impossible to construct.

It could not be done, they said, because even on a split phase motor it would be impossible to get a proper working ratio between the fixed poles and the rotating poles.

Evolved a New Theory

Mr. Peck, however, believed that they were on the wrong track in trying to adopt the conventional types of synchronous motors to the desired speed. It was, according to Mr. Peck's opinions, necessary to evolve a new theory of synchronous motor operation. He therefore worked out a theory and constructed a model employing an entirely new principle making use not only of the split phase, but of an induced phase shift.

The result was a motor which runs at 1,440 R.P.M. The "impossible" had been accomplished.

The new Peck motor is as efficient in power consumption as any other synchronous electric motor, although it is about 25% larger and heavier. Its cost to manufacture is the same as that of any other synchronous motor of equal power, when produced in similar quantities.

While the Peck motor revolutionizes television, making possible for the first time mechanical scanning of talking pictures without the need for delicate and elaborate means of synchronizing from the signal, it will doubtless have an even wider immediate application in talking picture photography and projection.

Solves a Sound Movie Problem

At present the motion picture industry is struggling along with the gear trains to get the required speed. And the speed, unless synchronous motors are used, varies alarmingly, necessitating manual or governor control.

The Peck 1,440 R.P.M. motor will solve one of the major problems of sound motion picture photography. The gear trains on synchronous motors made enough noise to be markedly noticeable on the recordings unless costly sound-proof booths were used to house the cameras. Governor and rheostat systems, while lacking the gear train noise, allowed the speed of the apparatus to vary to a more or less objectionable extent, for when a picture is not taken at absolutely uniform speed there will be distortion of sound accompaniment when projected, even if a perfect speed level is maintained at the projector, and vice versa.

When gearless synchronous motors are used, both of the problems (i. e., maintaining a constant speed and eliminating gear noise) are overcome. Pictures taken with cameras equipped with the 1,440 synchronous motors will be perfect when projected by machines using similar motors, or even by machines using other synchronous motors employing the proper gear ratio to bring the speed to 1,440 R.P.M.

Dozen Fewer Parts

But it is not deemed likely that the geared motor will be used at all for motion picture work after the Peck television motor reaches the market. The new motor, having no gears or mechanical filter, has some dozen fewer parts to wear, break or get out of order. In addition, it will be far cheaper, as finely machined gears and filter parts will not be used. The installation of such parts is always necessarily hand work, and the Peck motor can be produced entirely by machines operated by skilled workmen.

Television has had a great deal of assistance from the developments already made in motion picture work, and no one is more conversant with this fact than is Mr. Peck, for many years a leading figure in the motion picture field.

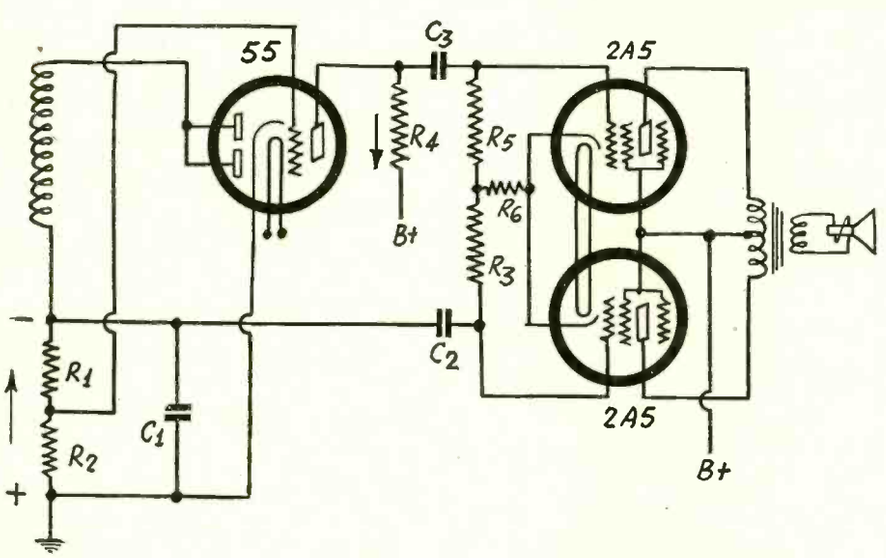
Television Paying Its Debt

He now feels that television is beginning to pay its debt to the movies. Not only will the new motor be of great use, but possibilities are already seen for the motion picture use of the new Peck reflector, described in the September 9th issue of RADIO WORLD.

Where it is now necessary to use a 200 to 300-watt light in a small motion picture projector, the Peck reflector produces approximately 300 times as much usable light as is had from an unreflected source. This means that a 40 or 60-watt bulb, used in conjunction with a Peck reflector, will provide a far brighter picture than will the bigger bulb without it.

"Television is making rapid strides," said Mr. Peck, "and the day when the mechanical scanner will emerge from the laboratory to provide a large, brilliant picture in homes and theaters may not be so far distant."

Phase Shift in 55 for Push-Pull Resistance



The 55 tube used for phase-shifting in a push-pull resistance-coupled audio amplifier.

One of the means of introducing resistance-coupled push-pull audio-frequency amplification is to use a tube as phase-shifter. Then the input to the tube will be very nearly 180 degrees out of phase with the output. Hence the push-pull tubes following may be fed, one from input, the other from output, of the phase-shifting system. The signal voltages have to be equalized.

This may be accomplished with a 55 tube as diagrammed. The diode is the rectifier and its load consists of two resistors, R1 and R2. Experimentally the two resistors may be the total resistance of a potentiometer, and the lead to the grid may be the arm. The rectified voltage is positive at ground, negative at the end in the input coil. Thus the negative may be directly coupled to the output tube, or, since there will be a stopping condenser and leak in the upper branch, these may be included in the lower branch, to equalize the effects, as there will be some phase shift in the stopping condensers, C2 and C3.

TUBE OPERATION 224A, 227, 235, 551, 226, 245, 46, 247, 210, 250.

224A

Type of tube—Cathode tetrode.
Socket—Five-contact.
Purpose—R-F amplifier and detector.
Overall height—5¼ inches.
Overall diameter—1 13/16 inches.
Filament voltage, a-c or d-c—2.5 volts.
Filament current—1.75 amperes.

Bias Detector

Load resistance—250,000 ohms.
Plate voltage, applied—180 volts.
Screen voltage—45 volts, or less.
Grid bias—4 volts.

Amplifier, Resistance Coupled

Load resistance—250,000 ohms.
Plate voltage, applied—250 volts.
Screen voltage—25 volts.
Grid bias—1 volt.
Plate current—0.5 milliampere.
Amplification factor—1,000.
Plate resistance—2,000,000 ohms.
Mutual conductance—500 micromhos.
Voltage gain—11 or more.

Amplifier, R-F

Plate voltage—180 volts.
Screen voltage—90 volts.
Grid bias—3 volts.
Plate current—4 milliamperes.
Grid bias resistance—300 ohms.
Amplification factor—400.
Plate resistance—400,000 ohms.
Mutual conductance—1,000 micromhos.

Amplifier, R-F

Plate voltage—250 volts.
Screen voltage—90 volts.
Grid bias—3 volts.
Plate current—4 milliamperes.
Amplification factor—615.
Plate resistance—600,000 ohms.
Mutual conductance—1,025 micromhos.
Grid-plate capacity—0.010 mmfd., max.
Grid-cathode capacity—5.0 mmfd.
Plate-cathode capacity—10 mmfd.
(A)

227

Type of tube—Cathode triode.
Socket—Five contact.
Purpose—Detector and amplifier.
Overall height—4 11/16 inches.
Overall diameter—1 13/16 inches.
Filament voltage, a-c or d-c—2.5 volts.
Filament current—1.75 amperes.
Grid-plate capacity—3.3 mmfd.
Grid-cathode capacity—3.5 mmfd.
Plate-cathode capacity—3 mmfd.
Amplification factor—9.

Bias Detector

Plate voltage—250 volts.
Grid bias—30 volts.

Amplifier, 135-Volt Plate

Plate voltage—135 volts.
Grid bias—9 volts.
Plate current—4.5 milliamperes.
Bias resistance—2,000 ohms.
Plate resistance—9,000 ohms.
Mutual conductance—1,000 micromhos.
Maximum undistorted output—80 milliwatts.
Optimum load resistance—13,000 ohms.

Amplifier, 180-Volt Plate

Plate voltage—180 volts.
Grid bias—13.5 volts.
Plate current—5 milliamperes.
Bias resistance—2,700 ohms.
Plate resistance—9,000 ohms.
Mutual conductance—1,000 micromhos.
Maximum undistorted output—165 milliwatts.
Optimum load resistance—18,700 ohms.

Amplifier, 250-Volt Plate

Plate voltage—250 volts.
Grid bias—21 volts.
Plate current— 5.2 milliamperes.
Grid bias resistance—4,000 ohms.
Plate resistance—9,250 ohms.
Mutual conductance—975 micromhos.
Maximum undistorted output—300 milliwatts.
Optimum load resistance—34,000 ohms.
(A)

235 and 551

Type of tube—Supercontrol tetrode.
Socket—Five contact.
Purpose—R-F amplifier and detector.
Overall height—5¼ inches.
Overall diameter—1 13/16 inches.
Filament voltage, a-c or d-c—2.5 volts.
Filament current—1.75 amperes.
Grid-plate capacity—0.010 mmfd., max.
Grid-cathode capacity—5 mmfd.
Plate-cathode capacity—10 mmfd.

First Detector

Plate voltage—250 volts.
Screen voltage—90 volts.
Grid bias—8 volts (about).

Amplifier, 180-Volt Plate

Plate voltage—180 volts.
Screen voltage—90 volts.
Grid bias—3 volts.
Plate current—6.3 milliamperes.
Grid bias resistance—350 ohms.
Amplification factor—255.
Plate resistance—250,000 ohms.
Mutual conductance—1,020 micromhos.

Amplifier, 250-Volt Plate

Plate voltage—250 volts.
Screen voltage—90 volts.
Grid bias—3 volts.
Plate current—6.5 milliamperes.
Bias resistance—350 ohms.
Amplification factor—370.
Plate resistance—350,000 ohms.
Mutual conductance—1,050 micromhos.
(A)

226

Type of tube—Filamentary triode.
Socket—Four contact.
Purpose—Amplifier.
Overall height—4 11/16 inches.
Overall diameter—1 13/16 inches.
Filament voltage, a-c—1.5 volts.
Filament current—1.05 amperes.
Grid-plate capacity—8.1 mmfd.
Grid-filament capacity—3.5 mmfd.
Plate-filament capacity—2.2 mmfd.
Amplification factor—8.3.

Amplifier, 90-Volt Plate

Plate voltage—90 volts.
Grid bias—7 volts.
Plate current—2.9 milliamperes.
Bias resistance—2,400 ohms.
Plate resistance—8,900 ohms.
Mutual conductance—935 micromhos.
Maximum undistorted output—30 milliwatts.
Optimum load resistance—9,800 ohms.

Amplifier, 135-Volt Plate

Plate voltage—135 volts.
Grid bias—10 volts.
Plate current—5.5 milliamperes.
Bias resistance—1,800 ohms.
Plate resistance—7,600 ohms.
Mutual conductance—1,100 micromhos.
Maximum undistorted output—80 milliwatts.
Optimum load resistance—8,800 ohms.

Amplifier, 180-Volt Plate

Plate voltage—180 volts.
Grid bias—14.5 volts.
Plate current—6.2 milliamperes.
Bias resistance—2,300 ohms.
Plate resistance—7,300 ohms.
Mutual conductance—1,150 micromhos.
Maximum undistorted output—180 milliwatts.
Optimum load resistance—10,500 ohms.
(A)

245

Type of tube—Filamentary triode.
Socket—Four contact.
Purpose—Power amplifier.
Overall height—5⅝ inches.
Overall diameter—2 3/16 inches.
Filament voltage—2.5 volts.
Filament current—1.5 amperes.
Amplification factor—3.5.

Amplifier, 180-Volt Plate

Plate voltage—180 volts.
Grid bias—34.5 volts.
Plate current—27 milliamperes.
Grid bias resistance—1,300 ohms.
Plate resistance—1,900 ohms.
Mutual conductance—1,850 micromhos.
Maximum undistorted output—780 milliwatts.
Optimum load resistance—3,500 ohms.

Amplifier, 275-Volt Plate

Plate voltage—275 volts.
Grid bias—56 volts.
Plate current—36 milliamperes.
Grid bias resistance—1,550 ohms.
Plate resistance—1,670 ohms.
Mutual conductance—2,100 micromhos.
Maximum undistorted output—2,000 milliwatts.
Optimum load resistance—4,600 ohms.
(A)

46

Type of tube—Filamentary double grid.
Socket—Five contact.
Purpose—Classes A and B power amplifier.
Overall height—5⅝ inches.
Overall diameter—2 3/16 inches.
Filament voltage, a-c—2.5 volts.
Filament current—1.5 amperes.

Class A Amplifier

Plate voltage—250 volts.
Grid bias—33 volts.
Plate current—22 milliamperes.
Bias resistance—1,500 ohms.
Amplification factor—5.6.
Plate resistance—2,400 ohms.
Mutual conductance—2,350 micromhos.
Maximum undistorted output—1,250 milliwatts.
Optimum load resistance—6,400 ohms.

Class B Amplifier

Average Characteristics for Two Tubes.

Plate voltage—300 volts.
Grid bias—Zero.
Plate current—8 to 70 milliamperes.
Maximum undistorted output—16 watts.
Optimum load resistance—5,000 ohms, minimum.
Plate voltage—400 volts.
Grid bias—Zero.
Plate current—12 to 75 milliamperes.
Maximum undistorted output—20 watts.
Optimum load resistance—5,500 ohms.
(A)

247

Type of tube—Filamentary pentode.
Socket—Five contact.
Purpose—Power amplifier.
Overall height—5⅝ inches.
Overall diameter—2 3/16 inches.
Filament voltage, a-c—2.5 volts.
Filament current—1.5 amperes.
Plate supply voltage—250 volts.
Screen voltage—250 volts.
Grid bias voltage—16.5 volts.
Plate current—31 milliamperes.
Screen current—6 milliamperes.
Grid bias resistance—400 to 450 ohms.
Amplification factor—150.
Plate resistance—60,000 ohms.
Mutual conductance—2,500 micromhos.
Maximum undistorted output—2,500 milliwatts.
Optimum load resistance—7,000 ohms.
(A)

210

Type of tube—Filamentary triode.
Socket—Four contact.
Purpose—Power amplifier.
Overall height—5⅝ inches.
Overall diameter—2 3/16 inches.
Filament voltage, a-c—7.5 volts.
Filament current—1.25 amperes.
Amplification factor—8.

Amplifier, 250-Volt Plate

Plate voltage—250 volts.
Grid bias—22 volts.
Plate current—10 milliamperes.
Grid bias resistance—2,200 ohms.
Plate resistance—6,000 ohms.
Mutual conductance—1,330 micromhos.
Maximum undistorted output—400 milliwatts.
Optimum load resistance—13,000 ohms.

Amplifier, 350-Volt Plate

Plate voltage—350 volts.
Grid bias—31 volts.
Plate current—16 milliamperes.
Bias resistance—1,950 ohms.
Plate resistance—5,150 ohms.
Mutual conductance—1,550 micromhos.
Maximum undistorted output—900 milliwatts.
Optimum load resistance—11,000 ohms.

Amplifier, 425-Volt Plate

Plate voltage—425 volts.
Grid bias—39 volts.
Plate current—18 milliamperes.
Grid bias resistance—2,050 ohms.
Plate resistance—5,000 ohms.
Mutual conductance—1,600 micromhos.
Maximum undistorted output—1,600 milliwatts.
Optimum load resistance—10,000 ohms.
(A)

250

Type of tube—Filamentary triode.
Socket—Four contact.
Purpose—Power amplifier.
Overall height—6¼ inches.
Overall diameter—2 11/16 inches.
Filament voltage, a-c—7.5 volts.
Filament current—1.25 amperes.
Amplification constant—3.8.

Amplifier, 250-Volt Plate

Plate voltage—250 volts.
Grid bias—45 volts.
Plate current—28 milliamperes.
Grid bias resistance—1,600 ohms.
Plate resistance—2,100 ohms.
Mutual conductance—1,800 micromhos.
Maximum undistorted output—1,000 milliwatts.
Optimum load resistance—4,300 ohms.

Amplifier, 350-Volt Plate

Plate voltage—350 volts.
Grid bias—63 volts.
Plate current—45 milliamperes.
Grid bias resistance—1,400 ohms.
Plate resistance—1,900 ohms.
Mutual conductance—2,000 micromhos.
Maximum undistorted output—2,400 milliwatts.
Optimum load resistance—4,100 ohms.

Amplifier, 450-Volt Plate

Plate voltage—450 volts.
Grid bias—84 volts.
Plate current—55 milliamperes.
Grid bias resistance—1,500 ohms.
Plate resistance—1,800 ohms.
Mutual conductance—2,100 micromhos.
Maximum undistorted output—4,600 milliwatts.
Optimum load resistance—4,350 ohms.
(A)

[Socket connections in September 9th issue.]

GAIN IM

By Stabilizing the I

By Roger

THE scheme of stabilization of an intermediate amplifier, as worked out in RADIO WORLD'S laboratories, is shown in Fig. 1 and is applied to a receiver circuit, Fig. 2. The theory was set forth last week, issue of September 16th.

It will be noted that the plate circuits are filtered with choke and condenser. The 1.3-mlh chokes are 400-turn honeycombs, the 25-mlh chokes are 1,300-turn honeycombs, both of the small types now popular. It is not requisite to shield these

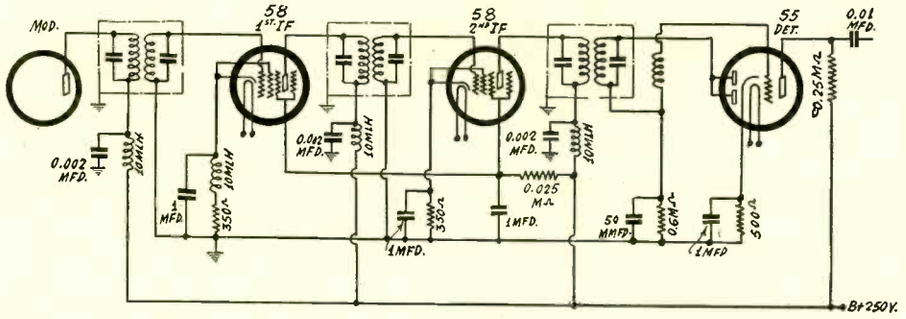


FIG. 1

A completely stabilized intermediate channel. The gain in the intermediate channel was increased very considerbly by use of this method of feedback cancellation.

chokes, but they should not be placed close to one another.

The 1 mfd. condensers should be used in the two cathode legs of the intermediate stages, and in the first stage besides the 1 mfd. there is a 25-mlh choke. It was strange to discover that so high a capacity as 1 mfd. was required, as affecting so high a frequency as 465 kc, for instance, and that a choke was needed in one particular cathode leg. But if the 1 mfd. condensers in these circuits were replaced with 0.5 mfd., or if 1 mfd. was retained and the sole cathode choke omitted, there was oscillation.

Gain Is Increased

When oscillation is prevented by suitable bypassing, the gain may be pressed to much higher levels than otherwise. Even the somewhat unusual gain of 200 per stage can be exceeded. The complete receiver illustrated was tried out in New York City, twelve miles from WOR's transmitter, and the diode load resistor voltage was 30 volts. Fancy that! And what to do with 70 volts!

The circuit has automatic volume control affecting the two intermediate tubes, and the manual control consists of a potentiometer that picks off all or any part of the a.v.c. action. In some localities this manual device will not give quite sufficient control, in which instance an auxiliary volume control may consist of a potentiometer of 25,000 ohms or thereabouts, connected one end to antenna, other to ground, the antenna primary connected one end to ground, other end to the arm of the potentiometer.

Fading Considered

However, for most uses the control as shown will be satisfactory, that is, if one does not live close to some broadcasting stations. The control, moreover, works in the right direction, in that with loud locals automatic volume control is introduced, perhaps to its fullest, and for weak distant stations the grids of the controlled tubes are grounded through the bypassed filter resistors, thus a.v.c. is omitted and amplification is at its maximum.

Of course, one may ask what about the prevention of fading where such prevention is most needed? The answer is that on very weak, faint signals, no a.v.c. is a cure for fading or even an approach to being a pardonably meager remedy. The a.v.c. action depends on the carrier amplitude, and a weak station has a very low amplitude. Moreover, there is a threshold voltage which must be achieved before a.v.c. has a recognizable effect on the ear, and weak signals do not achieve this threshold.

Special Tube Shields Considered

If a.v.c. is applied without possibility of regulation of its amount, then many distant stations may be lost, because the sensitivity has been reduced so much. A possible remedy would be to use less than the full diode-rectified voltage for a.v.c., but the less used, the smaller the effect of the a.v.c. It is just as well to have the amount of a.v.c. under control, for then one may, if he desires, use all or none, or in-between values.

The diagram does not tell the whole story. It is advisable to use shielded wire on the leads from plates to coils in r-f and i-f circuits, also shielded wire on overhead grid leads if they are more than an inch long, also shielded wire for the antenna lead from binding post to antenna primary, all shielding grounded, except that tube shields may be connected to cathode.

There is a special type of form-fitting shield with which is supplied a phospher bronze wafer blade, like a thin lug, so that the cathode may be slipped into a hole in the blade and the blade bent at a right angle to hug the tube base and point in the upward direction. Then the blade is passed under the shield. It is practical to solder the lug to this type of shield. An advantage of such a shield is that tube and shield are removed in one operation and no tube-shield base is required, so there is no danger of any set analyzer not having a plug of small enough diameter to pass the narrow-necked shield bases.

Fitting of Shields

Such a shield will fit over the 58 tubes and the 55. For the 58 it is a natural fit. For other circuits, with the 55's cathode positive, to avoid possibility of the shield (which is cathode-connected) being shorted to ground (which is B-minus connected) the shield is pushed up a bit toward the top, to clear the tube base bottom, and then the blade is soldered to the shield. In the present circuit it makes no difference, as cathode of 55 is grounded.

It is not a bad idea, either, to solder the two separate compartments of the shield together at one point on each side.

There are two stages of tuned radio frequency amplification, a tuned input to the modulator, and a tuned oscillator, besides three double-tuned intermediate transformers, effectively a total of nine tuned circuits. The oscillator does not count, as whatever selectivity seems to arise from its operation is due to the intermediate amplifier's selectivity.

Electronics O

of Utilization of Inertial

By HO

Chief- Engineer, Shortwav

A new branch of electricity, an offspring of the old family tree, which promises to become a very sturdy and self-sufficient industry, has been coming into being since 1915. Today it is here; its manifestations are all about us. Yet most people are hardly conscious of its present and future greatness. Its name is Electronics. Its secret is based on lack of inertia.

Inertia is a fundamental quality of matter. The public best knows it as a result of weight. If a tennis ball and a cannon ball were both hurtling towards a person at 30 miles an hour and he had to choose which one to stop, there would be no hesitation in making a choice. It would be the tennis ball, because the cannon ball with so much weight would have developed so much inertia it would be impossible to handle at that speed.

Efforts in the design of all modern machinery have been towards making the moving parts as light as possible so as to use less power in operation and reduce vibration. Again it is inertia due to weight-on-the-move that is the problem.

Of course one might reduce matter to a tiny dimension such as the atom! But what could one do with an atom? would be the layman's logical question. It would seem to have no place and be beyond control. Now, an atom is made up of protons

PROVED

ntermediate Channel

Beal Conant

the tuning capacity. For 0.00035 mfd. use 250 microhenries, for 0.00041 mfd. use 230 mmfd., and for the oscillator coil use 63/115 of the secondary inductance of the others. Numbers of turns of particular wire sizes for any diameters may be obtained from Edward M. Shiepe's book, "The Inductance Authority." For 1-inch diameter tubing, No. 32 enamel wire, the 250 value is attained by 127 turns and the 230 value by 115 turns. The primaries consist of 25 turns of any fine wire wound over the secondaries, and this in-

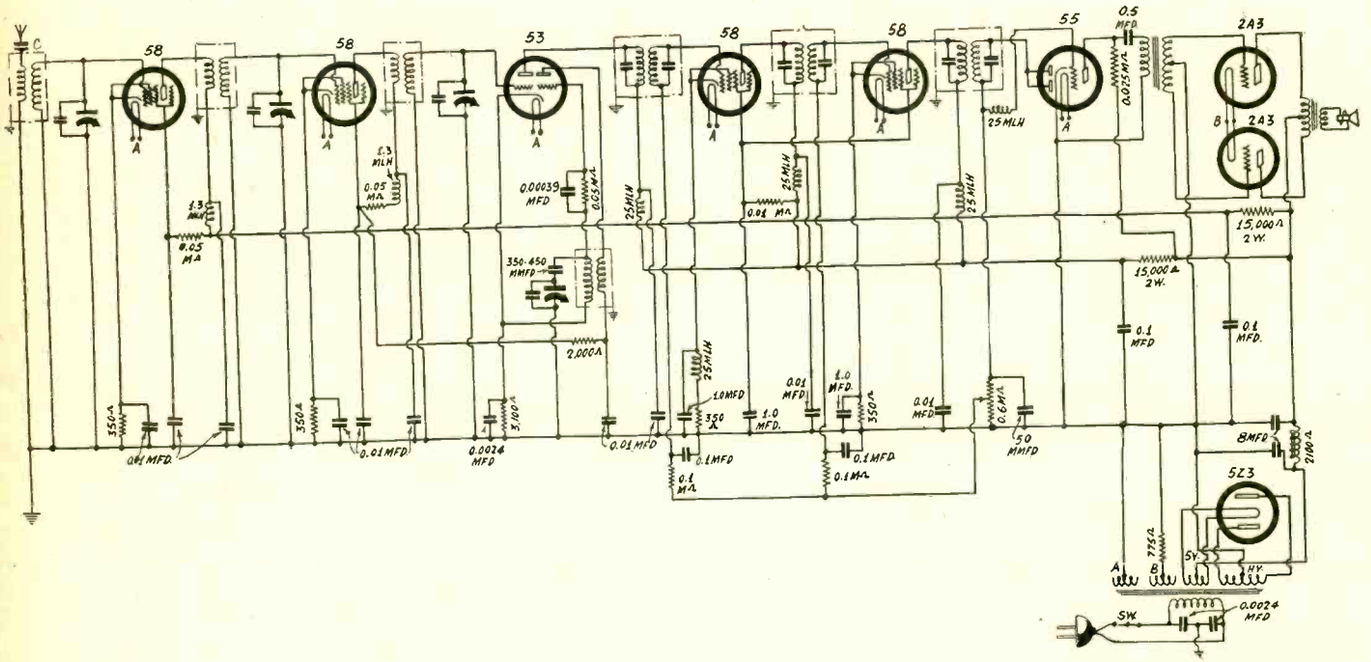


FIG. 2

The stabilization method introduced in a receiver. Automatic volume control is used in more or less degree by the operator through the manual control.

Two stages of t-r-f are advisable if one is to use a long aerial, for otherwise there would be heterodyne squeals. Such heterodynes are due to local stations getting by the tuner, to mix with the oscillation frequency and with the desired signal frequency. An easy verification of this cause of trouble may be made on any receiver by simply shortening the aerial considerably, or inserting a 50 mmfd. condenser in series with the aerial. Lo! the heterodyne squeals depart! Reason: the looser coupling between set and aerial has improved the selectivity ahead of the modulator.

No reference to the coils used appears in the diagram. The usual commercial types were tried with satisfaction, but Litz-wound r-f coils, when substituted, made the amplification almost uniform over the broadcast band. In both instances the intermediates were Litz-wound.

The secondary inductance depends on cludes the tickler of the oscillator as a primary.

The tickler should not be larger than required for oscillation.

These data do not apply to Litz wire, which has to be bank wound, to avoid an extraordinarily long coil, and it is assumed the constructor hasn't bank-winding facilities.

Output Tubes

While the circuit is shown with 2A3 output tubes (and will load these up very nicely), persons living in remote regions, far from any broadcasting stations, may prefer to use pentodes in push-pull. They do not require the greater power output of the 2A3's but they can use the much greater sensitivity of the 2A5's. Six-spring sockets would be needed for the power tubes then, the screens would be returned to the same B plus point as the plates, the cathodes would be joined and returned to ground through a 5-watt resistor of 200 to 250 ohms, and the center of the heater winding would go directly to ground, or a transformer might be used having a single 2.5-volt winding for all the tubes except the rectifier.

The speaker for the 2A5's would have an output impedance of 14,000 ohms, plate to plate, and for the 2A3's, 5,000 ohms, plate to plate. The voltage intended for the 2A3 plates is higher than that for the others, total of 365 compared to 275, and the difference may be compensated for either by a bleeder or by using the full voltage even on the 2A5's and increasing the biasing resistor until the steady combined plate-screen current per power tube does not exceed 40 ma.

pens Vast Vista

ss Action of Vacuum Tube

LLIS BAIRD
e and Television Laboratories

and a number of electrons. It is the electrons that give the name to the new art of Electronics.

These particles are so small that they may be said to have no appreciable inertia. Again the layman would say that any useful purpose for, and control of, these particles, smaller than the seemingly useless atom, would be impossible. But the commercial use of the vacuum tube in 1915 started off the electronic era in which these particles were to be successfully harnessed.

The vacuum tube is based on a controlled flow of electrons. The passing years have seen engineers investigate electronics after getting started by way of the vacuum tube. The result is the Electronic Art. Controlled flow of practically weightless and, therefore, practically inertialess electrons is now used in a thousand different ways, some of the commonest fields of use being communications systems, talking motion pictures, television, tele-photography, certain musical instruments, navigation and unlimited industrial applications.

A sturdy youngster indeed is Electronics. It lifts the whole field of electrical engineering into a new and vast era of research whose infinite possibilities promise to exceed the present human

Radio University

A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (52 issues) at $6, without any other premium.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

A d-c Super

I HAVE a call for a d-c operated superheterodyne that is to give top-notch performance in all the regular departments. The cost of the circuit is of not great importance.—W. H. C., Detroit, Mich.

The circuit shown here seems to meet with the requirements. It has proved its worth in many instances but there may be many kinks that will have to be ironed out before it will perk just right.

* * *

Suggestions for Super

I AM ENGAGED in the design of a superheterodyne for my personal use and get a great kick out of working out my own ideas, but there is one point on which I wish you would enlighten me. Shall I press the gain as far as possible at the radio-frequency level and also at the intermediate-frequency level, using power output tubes after the detector, or shall I reduce the earlier gain and use more audio?—L. B. D.

For a superheterodyne the most important consideration at the radio-frequency level is selectivity. Amplification is not needed much, as plenty can be obtained at i-f and a-f levels. We would suggest that the r-f coils have equal primaries, that the antenna lead from binding post to coil be shielded and shield grounded, and that a very small series antenna condenser be used, 50 mmfd. or less. The coils might have 25-turn primaries wound over secondaries, 0.02" insulation between. The second detector should be able to handle the maximum signal voltage likely to be put into it by this system, and a diode would meet this requirement. However, no matter which hook-up is used for the succeeding triode, the input to the triode should be kept down to the point that does not overload it. So less than the full voltage developed across the diode-load resistor may have to be put into the triode. If the output tubes are pentodes (push-pull or single), they may be coupled to the detector, but if low-mu output tubes are used (45, 2A3, etc.) then a 56 driver stage should be included.

* * *

Measuring Small Resistances

IS IT POSSIBLE to measure small resistances with a meter that draws small current, or is it necessary to have very large current, say, 100 ma?—K. C. D.

It is entirely practical to measure low resistances with small current. Access to the terminals of the meter itself would be necessary, and this is usually easy. Suppose a regulation ohmmeter, with 0-1 milliammeter as the indicator, 1,500 ohms limiting resistor, battery 1.5 volts. The full-scale current through the meter would be 1 ma. This is equivalent to zero unknown resistance. However, perhaps the lowest resistance that could be read plainly would be 50 or 100 ohms, and the maximum 50,000 ohms. Now, suppose that across the meter were put a shunt resistance equal to the meter's internal resistance. Then the needle would indicate half-scale deflection. If the meter resistance is 27 ohms the shunt is 27 ohms. If the shunt is the unknown the low values of resistance would be read from a calibration, which can be computed, reading from 10 ohms or so up to, say, 1,000 ohms. If still lower resistance is to be read, the meter would be shunted for 10 ma whenever these low resistances are to be read and the unknown extra shunts could be determined as to resistance value from 0.1 ohm to 100 ohms.

* * *

Line Voltage Ohmmeter

IS IT PRACTICAL to use the line voltage in connection with ohmmeter work? I was thinking of a simple rectifier, the voltages to be supplied to the ohmmeter as needed.—K. E.

Yes, it is practical, but rather awkward, because to obtain the exact voltage required a resistance would have to be shifted, and this would be part of a series resistance network that should be constant. The resistance network could be made constant by changing the voltage in an almost perfect rectifier, but in ordinary practice this would mean a voltage-regulator tube. You can see that chokes, condensers, regulator and rectifier tubes and other requirements begin to complicate the situation somewhat. A battery would be preferable. Means of measuring 0.1 ohm to 2 meg. can be provided if only a 22.5-volt small battery were used.

* * *

Diode Analyzed

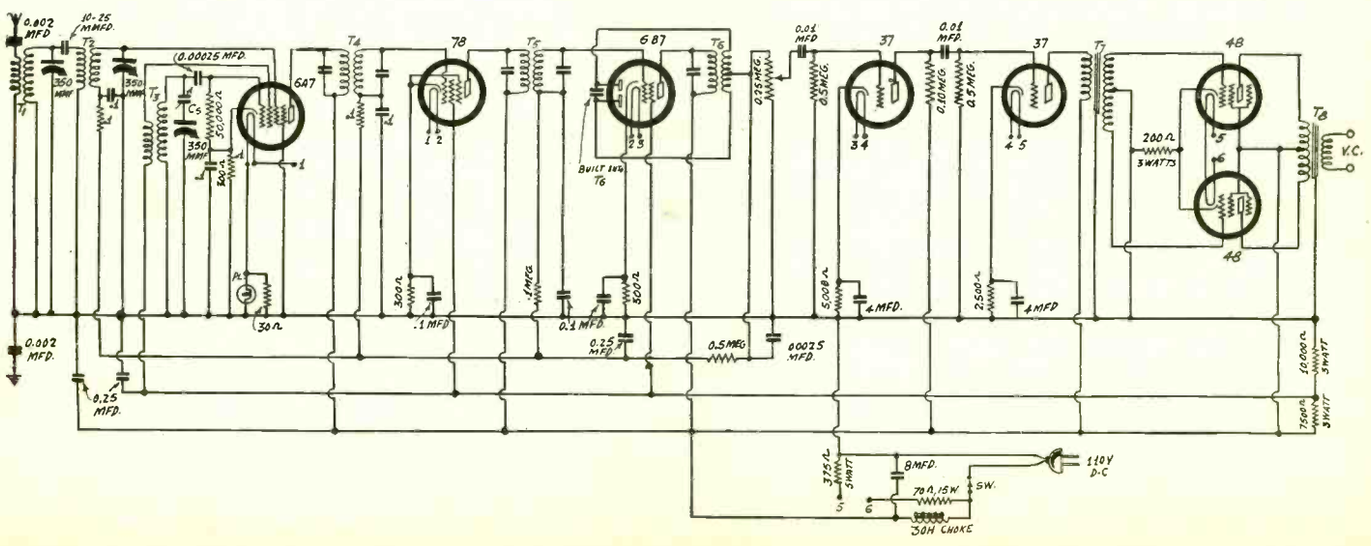
WILL YOU please explain to me the nature of the currents and voltages in a diode-biased triode? I have a 55 in my circuit but do not understand just what's what. On a 0-0.25 milliammeter, 1,200,000 ohms in series, I read the voltage from a meter in the diode circuit (using voltmeter as load). It registers higher voltage for higher carrier amplitudes, but the plate current in the triode tube decreases as the carrier increases.—K. D. A.

The input to the diode is alternating current of the frequency of the tuned circuit, which is normally equal to the intermediate frequency in superheterodynes or the carrier frequency in t-r-f sets. During the positive cycle of the alternation the anode is made positive and thus rectification takes place. The current flowing through the load resistor (voltmeter circuit) is rectified, which is direct current. The amplitude of the carrier determines largely what this voltage is. The other determinant is the modulation of the carrier. Some r-f or i-f would get through, hence a small condenser should be put across the load resistor (voltmeter). This will increase the voltage because it offers a low impedance to the r-f or i-f, but a high impedance to the audio frequencies. It holds up the voltage much as does the condenser next to rectifier in a B supply, and filters for the same reason. Therefore the carrier has not been eliminated in all aspects, only the a.c. of the carrier, the rectified component being left. This d.c. is pulsating and the pulsations are of the frequency of modulation, an audio frequency. It is plain, therefore, that there is no a.c. in the load circuit but pulsating d.c. The two are not quite the same thing. When the direct current flows in the diode circuit it is positive at the cathode, from the viewpoint of the signal or pulsation or rectified current, and negative at the other end. Suppose cathode is grounded. Then the other end of the resistor is negative in respect to ground, and is negative by the amount of the rectified carrier and its modulation. Hence the higher the carrier amplitude, the more negative the bias on the tube, and the more negative the bias the lower the plate current.

* * *

I-F Line-up Difficult

IN LINING UP the intermediate channel of a superheterodyne, is it possible to



This superheterodyne has been designed for use on d-c lines. It is highly sensitive.

do this by ear, or should an output meter or other similar indicating device be used in conjunction with a modulated oscillator that has steady modulation?—H. R.

It is possible to do this by ear, but it can not be done as well by ear as it can by the meter method. In fact. accurately lining up the intermediate channel of a superheterodyne, even with a meter, is a difficult and trying operation. First, a weak input should be provided, for instance, test oscillator loosely coupled to the i-f circuit. If this can not be done handily, at least attenuate at the volume control so that the meter indication will be low at approximate resonance. Then each stage has to be adjusted carefully. The trouble comes here, because a very slight displacement will cause a serious frequency change, and the intensity, due to slight mistuning, may be reduced 50 per cent. or more. The mechanical aspects of the work are trying, because there has to be stiff tension on the springs of the condensers in the i-f coils, which makes minute changes in capacity difficult. Besides, some of the circuits (plates particularly), are sensitive to body capacity, so that even with a long, insulated driver this effect might be troublesome. That means that the screw has to be adjusted bit by bit and the needle watched for maximum deflection. Often one will go beyond the desired point and must return and start over again. When the intermediate channel is properly lined up it is quite likely that many squeals previously heard will be absent, due to the improved selectivity. Since the intermediates will not hold the absolute settings forever, the careful readjustment should be made every few months. To do a job like this properly should require at least an hour. Even when done in the best possible manner, precise resonance throughout the channel might be considered a rare and lucky accident rather than a repeatable achievement. This severe fact has not been stressed before in print, so far as we know, but every engineer is familiar with it.

* * *

Magnetic Field

WHEN CURRENT is passed through a short piece of wire is there any electromagnetism, even if the wire is not coiled? —O. H. D.

Yes, whenever current is passed through a wire there is a field, and if the current is alternating the electro-magnetic field builds up and collapses at the frequency of the current passed through the system.

* * *

Suppression of Lows

WHY is it that the bass notes are suppressed in many radio receivers equipped with pentode power tubes? Is it not a fact that a vacuum tube is non-reactive device insofar as audio frequencies are concerned?—W.E.P., New York, N.Y.

Yes, it is a fact that a tube is a non-reactive device at audio frequencies. Therefore it would seem that the suppression of the lows is due to limitation of the grid swing. The lows require a very much wider grid swing than the higher frequencies. That this is the answer is confirmed by the fact that when a tube is operated in a Class B circuit with high negative bias the lows come out very well. Indeed, that is one of the first things noticed. In some instances this may be accentuated by the suppression of the highs, for the bias may be so high that these frequencies are not amplified at all.

* * *

Padding or Tracking

WHICH is considered to give the better results in a superheterodyne receiver, padding of the oscillator or using a tracking condenser? Please give reasons for your answer.—R.E.N.

Theoretically, the use of a tracking condenser should give superior results because with it there should be exact tracking all the way. Practically, either method may give better results, depending on adjustments. For good results with padding it is necessary that the coils and the adjusting condensers be properly designed. For good results with a tracking condenser it is necessary that the condenser shall have been designed correctly. By this time the condenser makers have had a great deal of experience in making proper tracking condensers.

* * *

Sidebands Proved

RECENTLY I READ about a report that two scientists had proved the actual existence of sidebands, that is, that they are more than mathematical conceptions. Moreover, it was stated that they could be produced without the presence of distortion. What is your opinion about the question?—W.H.C.

While we have read about the experiment in question, we are not entitled to an opinion because we have not studied the paper in question. We wonder, however, if it is possible to prove that they exist. The mathematical treatment requires distortion for their production as independent realities. The question then arises: Was all distortion eliminated in the experiment which proved that they can be produced without distortion? There can be no question that they are real in a radio circuit. There is distortion in the circuit. Freedom from distortion requires strict proportionality between force and displacement. Is there anything in nature that obeys this law? Displacements in air, such as sound waves, are not proportional to the pressure; and we understand that the experiment in question dealt with sound. We doubt the finality of the proof.

* * *

Tunable Hum

WHAT CAUSES tunable hum and what can be done to remove it? I have noticed that it is more intense on the higher radio frequencies than on the lower. Filtering of the power supply does not seem to help.—E.M.S.

When the hum is tunable it gets into the circuit by way of modulation. When it occurs stronger on the higher frequencies it is reasonable to suspect oscillation or very strong regeneration. The oscillation may possibly be a parasitic one. Filtering at these high frequencies by means of electrolytic condenser does not do a great deal of good because the effective capacities are not nearly as high as the rated capacities. The electrolytics should be assisted by non-inductive paper condensers. Frequently the hum is due to an unbalance of the filament or heater circuit. In short-wave receivers the hum has been removed in many instances by means of small by-pass condensers across the heater circuit or between the ground center of the circuit and the two sides. This might prove helpful in your case.

* * *

Diode Biased Amplifier

WOULD YOU recommend the use of diode bias for the first audio amplifier in preference to fixed bias? Is there greater distortion when the bias is obtained from the signal as is done in diode biased circuits?—C.W.O.

As far as distortion is concerned it does not make a great deal of difference. When diode bias is used the bias can never be excessive; neither can it be less than it should be, for it is always proportional to the signal carrier. When fixed bias is used there may be distortion as a result of excess signal over bias. But there may be distortion when diode bias is used, too, for the detector-amplifier tube is quite limited in its voltage handling ability. The diode biased circuit has the advantage that it is much simpler and requires fewer parts.

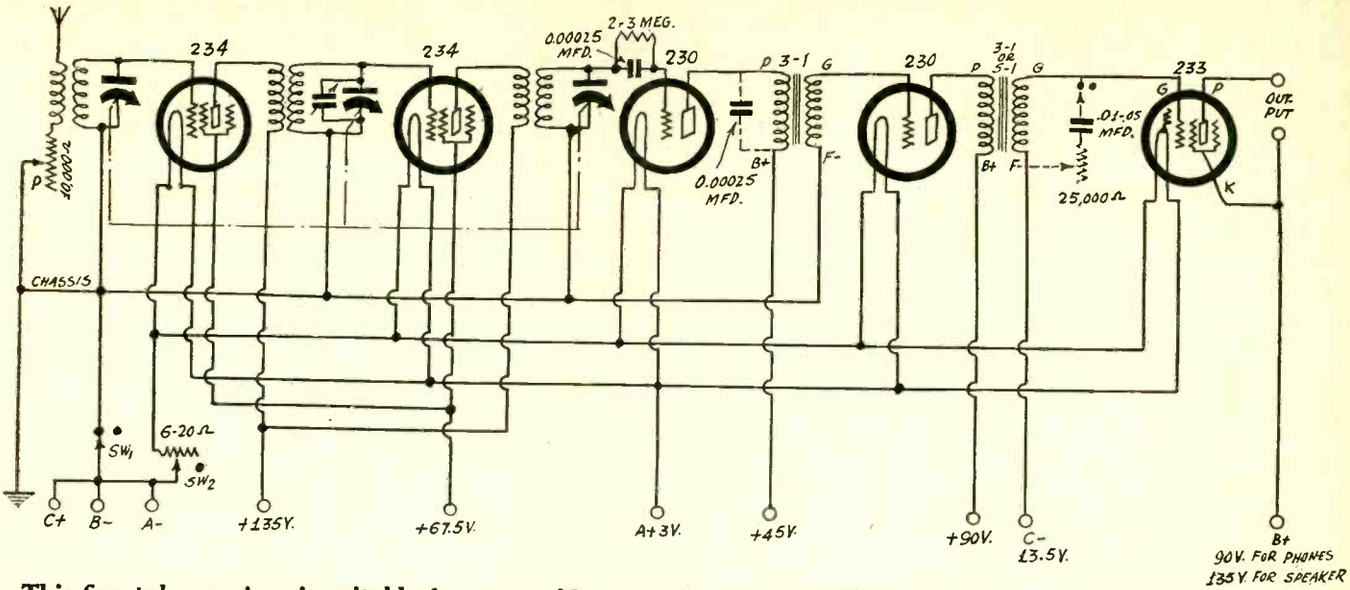
* * *

Glowing of Phototubes

I HAVE BEEN working with phototubes and during tests I have noticed that the tube glows at times. Is this detrimental to the tube and what causes it?—E.R.

The so-called soft, or gaseous, tubes glow when the anode voltage is excessive. The voltage at which the tube begins to glow depends not only on the voltage but also on the light flux that is entering the cell at the time. The stronger the light the sooner the glow begins. The glow is

(*Continued on next page*)



This five-tube receiver is suitable for a portable set and was originally built for use on small fishing boats.

(*Continued on next page*)

detrimental to both the tube and the work that is being done and for that reason it should be avoided. The operating characteristics accompanying the tube specify the high voltage that should be used on the anode and also the highest current that should be allowed to flow. These should never be exceeded.

* * *

Portable Set Circuit

PLEASE show a sensitive circuit of five tubes that can be built in a portable set. The 2-volt tubes are preferred because it is important that the filament circuit should be economical. It may be either a t-r-f or a super.—F. R. M., Pittsburgh, Pa.

A circuit of this kind is shown on this page. It employs two 234's, two 230's, and one 233 in a t-r-f circuit with a grid leak detector and audio frequency amplification. This is an old stand-by that usually gives good results for little money.

* * *

Detection by Tubes

SOME TUBES have been designed for detection and others for amplification, but I have found that tubes designed for amplification only often make better detectors than those designed for detectors. How is this?—E.A.L.

All tubes detect, some well, others fairly well, and still others excellently. It may be that a detector tube, that is, one that detects excellently, does it too well in certain circuits. Then better results will be obtained with a tube that detects only moderately well, that is, with a tube that is called an amplifier. This is quite common in very sensitive circuits. The better detector a tube is the more quickly it becomes overloaded, and then it may become paralyzed. A less sensitive tube then saves the day.

* * *

Small Speakers

FOR a time radio loudspeakers were very large and it was said that they had to be so in order to bring out good quality. But now most of the speakers used are very small. It seems that they bring out just as good quality. What is the answer? —B.W.A.

The answer is that the small speakers do not bring out as good quality. They cannot handle the low notes as well as the larger speakers. But if the small speaker is well baffled and the circuit has been designed with the object of using a small speaker, it does all right. This, of course, is aided by the fact that the ear is not very critical. It does not make a great deal of difference whether the speaker brings out the oompah, oompah of the bass horn or not.

A Funny Thing

IN A SUPERHETERODYNE I built I experienced a funny thing. The intermediate frequency is 492 kc, the i-f and r-f coils are Litz-wound. Everything is all right until I get up to past 570 kc, when suddenly the set starts violent oscillation. The tuning meter is in the plate leg of a diode -biased 55, so the needle runs to zero on oscillation. I tried to ascertain what is oscillating. Can you assist?—P. O. B.

The intermediate channel is oscillating, and the reason is that the r-f channel becomes tuned to almost the intermediate frequency and thus some extra stages equivalent i-f are introduced, resulting in oscillation. The higher gain at the low frequencies with Litz coils accounts for this in part. However, your set probably tunes too low, say, 520 kc or so, or only 32 kc away from the intermediate frequency. If you reach 540 kc at 95 or so on the dial, as seems likely, take off secondary turns until 540 kc comes in at 99 or 98, and trouble will be diminished. Also why not increase the intermediate frequency a bit?

A THOUGHT FOR THE WEEK

"The Sellout," a new comedy depicting scenes in the field of radio, and now running at the Cort Theatre, New York City, is about as kind to our radio friends as "The Crooner," a novel of last year, was to the same folk. The author, Albert G. Miller, who writes scripts for those sponsor accounts, doesn't think very highly of some raido folk; in fact, he loathes them, and so indicates his state of mind in a play that doesn't quite list you where you live. "The Sellout" might be a faithful picture of certain radio angles, but we sincerely hope not. Radio can't be quite as bad as Mr. Miller makes it.

DISTORTION PREVENTION

Automatic volume control reduces sensitivity quite some, and even selectivity, but does even out the response considerably and thus prevents distortion arising from overloaded detector and audio. The circuit should be adjusted so that the loudest local will not blast. Then the automatic volume control action takes care of the rest.

WYNN CHAIN'S OPENING TO BE ON SEPT. 25TH

The Amalgamated Broadcasting System announced that the formal opening of its Atlantic Seaboard network had been fixed for Monday evening, September 25th. The announcement was made in behalf of President Ed Wynn by Ota Gygi, vice president.

Mr. Gygi promised that assurances given to an expectant public during the last four months, of innovations and improvements over existing broadcasting practices, will be fulfilled from the outset.

"All of us from President Wynn down," Mr. Gygi explained, "expected our chief to be with us on our opening night. He is busy completing a feature picture in Hollywood. The recent strike in the studios there delayed his work to such an extent that when it was seen that he would be unable to return here before October he gave the word to go ahead. This removes the last cause of any hesitancy, and we are glad to see our plans fulfilled. I may say further that Ed Wynn has been with us in all our councils by long distance telephone these last 60 days when our policies were being shaped into practice.

Final Rehearsals Held

"All of us know that the 15,000,000 radio listeners-in embraced in our Atlantic Seaboard network territory will feel that their patience, in view of the character of what we have achieved, has been justified."

Final rehearsals in the 30-story Amalgamated building at 501 Madison Avenue, New York City, enlisted the full personnel, several hundred artists, in its seven studios. More than a score of program features have been broadcast in complete form experimentally, and over several components of the new network for the last three weeks. Other programs likewise received final auditions before their acceptance by sponsors, of whom there will be more than 30 before the end of the month, Amalgamated officials said.

The inaugural feature at 8 p.m. the opening night will be transmitted by WBNX, New York, 1,350 kc.; WTNJ, Trenton, 1,280 kc.; WPEN, Philadelphia, 1,500 kc.; WDEL, Wilmington, 1,200 kc.; WCBM, Baltimore, 1,370 kc.; WOL, Washington, 1,310 kc.

The metropolitan outlet for the seaboard network represents a consolidation of the WCDA-WMSG-WBNX hookup, assuming for the present the latter's call letters.

The Amalgamated's central network, next to be put in operation, represents a supplementary coverage for the city's tributary area, each and all of whose components will be occasionally piped on the seaboard chain before its formal separate set-up. It includes these stations: WCNW, Brooklyn, N. Y.; WFAS, White Plains, N. Y.; WCAM, Camden, N. J.; WCAP, Asbury Park, N. J., and WJBI, Red Bank, N. J. The central station of this hookup is the former WMIL, Brooklyn.

Will Present Some "Finds"

"Good taste" in radio entertainment, the watchword of the Ed Wynn "new deal" air policy, is claimed by Amalgamated's officials in more than 30 major features, embracing all the scope of audible entertainment from soloist to symphony orchestra.

The production department was quoted by Mr. Gygi as being ready to present also a number of "finds" whose work will be heard by the public for the first time. Outstanding stars of the stage and screen who will make their radio premieres under Amalgamated's auspices include McIntyre & Heath, Gus Edwards in "School Days of the Air," Beverly Bayne and Pedro de Cordoba, Rita Gould, Rosamond Johnson, Katherine Tiff Jones and their negro choir under Johnson's direction, in a series of features titled "Big Meetin' Time," and a score of soloists with European and American backgrounds, who have been heard hitherto only on the classic concert and opera stage.

They Say

CLAYTON IRWIN, general manager, Radio Shows and Associates: "Radio is showmanship. This largely has been lost sight of by the variety of persons who have had their hands in program building. A haphazard conglomeration of lines, music and blurbs no longer satisfies a listening audience and when air channels are filled with such mediocre offerings it is natural that the public will shut off their sets. The answer is better programs, with a sufficient number of reheasals to insure a finished production in every sense of the word. The fact that a radio production exists for but a short interval often has proved a mental hazard to clean-cut thinking about entertainment as applied to radio. And without entertainment there is no audience. With network facilities costing what they do today, it is sound economics to build a program that will insure the highest percentage of listeners. To do this we believe that each program must be individually produced by its own production unit."

KRLD AND KRLA ADDED TO CHAIN

L. H. Armer, president of Southwest Broadcasting Company, announced that A. L. Chilton of Dallas, Tex., has been appointed manager of the Southwest Network and also managing director of stations controlled by Southwest Broadcasting Company of Fort Worth. Mr. Chilton takes active management of sales and station management of the network and the five stations owned by Southwest Broadcasting Company. He has been identified with broadcasting in the Southwest for many years and is manager of KRLD, Dallas, Texas, as well as president of the Arkansas Broadcasting Company, owner of KRLA, Little Rock, Arkansas.

Both of the above stations will be included as affiliated stations of the Southwest Broadcasting Company. All stations of the network are now connected by wire and cover Texas, Oklahoma and Arkansas. The twelve stations included in the group are KRLD and WRR, Dallas; KTAT, Fort Worth; KTSA, San Antonio; WACO, Waco; KNOW, Austin; KTRH, and KXYZ, Houston; KFDM, Beaumont; KGKO, Wichita Falls; KOMA, Oklahoma City; and KRLA, Little Rock.

Key stations will be in both Fort Worth and Dallas and special programs can be originated from other stations of the network. General offices of the network will be in Fort Worth, while the commercial offices will be located in the Kirby Building, Dallas, Texas.

In Fort Worth new studios and offices are now being constructed in the Texas Hotel, which are nearly ready for occupancy.

AMATEURS GIVE AID AS STORM SWEEPS COAST

Storm and flood, hurricane and disaster, along the entire Atlantic coast line during late August and early Setember found radio amateurs re-establishing disrupted communication links with stricken areas in Maryland, Delaware, Virginia and Florida and Texas.

On Wednesday and Thursday, August 23rd and 24th, came the climax to the worst flood and rainstorm ever experienced in the memory of the oldest resident of the Delmarve Peninsula and nearby inland towns, of which Salisbury, Md., and Laurel, Del., were hardest hit. Power lines, telegraph and telephone lines were down throughout most of this area; no trains or busses were running nor was private automobile transportation possible.

In downtown Delmarva a group of amateurs held a hurried conference and decided to move W3CQS, the amateur station of Ed Thompson, from his home to the small section of the city where power was available. The station was set up in a booth in the dining room of Thompson's Grill, while outside other amateurs braved the fifty-mile gale in the attempt to erect an antenna.

First Contact at 3 A.M.

At three o'clock in the morning the first contact was made with station W9CVW, of Louisville, Ky., the operators working with inches of water over the floor. Emergency pleas of relief, thousands of words of press, personal massages and official traffic flowed from the transmitter until 5 p.m. the next day, when regular telegraphic communication was resumed.

In Laurel, the gasoline station of E. L. Hudson, section communications manager of the American Radio Relay League, at which his station W3BAK is located, was the second communications outlet for the inundated area. Hudson not only handled emergency traffic for his own region but assisted emergency stations in Virginia to establish contact with the outer world, delivering many eastern shore messages directly when land telephone service had been restored.

In the Tidewater section of Virginia an eighty-mile wind accompanied by a terrific storm cost the lives of 15 persons and did $10,000,000 damage. Not a vestige of electric power was available in the Norfolk area, and the only station able to work was W1ZZAR, operated by Lyman Rundlett on the U. S. Coast and Geodetic Survey ship Oceanographer, tied up at the Naval base, which had its own power.

Sent News Dispatches

Meanwhile, a group of operators at Norfolk News endeavored to get a small battery-operated portable station in operation, but before this had been completed power service was resumed, and in a short while a number of stations were actively on the air handling all necessary communications without difficulty.

The bulk of the traffic handled by the fifty or more amateur stations cooperating in this work was press information, written by special correspondents and local newspapers and transmitted to the outer world as the only information available concerning the emergencies. Steamship companies made use of amateur nets to assure themselves of the safety of their vessels.

Station Sparks

By Alice Remsen

MYSELF, YOU AND THEM

What a hurry I'm in this week! Everything is popping right and left. Loads of new programs being readied, the telephone ringing all day with calls for auditions; am getting ready right now to take a train for Cleveland to appear on the Ford program; there for just one day; back right to New York after the show. . . . But isn't it great news that business is really and truly making big strides ahead, for the advertising game is the first to feel the uptrend. . . . Alice Joy is singing with Vincent Lopez on his silk commercial program over WJZ Sunday nights. . . . Station WINS, New York, is earning the undying gratitude of all baseball fans in the Metropolitan area; WINS is broadcasting a play-by-play description of the big games every once in a while; very exciting, too. . . . Did you hear Johnny Green's first Sunday program over WABC? This twenty-four-year old composer proved himself a real arranger and conductor and I predict a great future for him, with an orchestra of his own before very long; Gertrude Neisen sang "Savage Serenade" in the middle of the program; she did a great job; the song is just suited to her exotic style. . . . And is James Melton getting slim, well rather—he looks as he did when I first met him in 1927—when he joined The Revelers and opened on the Palm-Olive Hour. . . .

* * *

Art Jarrett, the handsome radio crooner, married Eleanor Holm, the beautiful swimming star; a great match, so far as appearance goes; let's wish them jolly good luck! . . . Don Carney is rehearsing the old Main Street sketches again for sponsored presentation over WOR. . . . "Senator" Ed Ford, the famous vaudeville monologist and after-dinner speaker, will make his debut soon for a sponsor with Harry Tighe, in a radio series written by the redoubtable Senator himself. . . . The Don Hall Trio may now be heard on Sunday evenings at 6:30 p. m., EDST, over WJZ, with the Phantom Strings; a lovely program; be sure not to miss it. . . . Ann Lester is singing now with the Meyer Davis Orchestra at the St. Regis, New York; her charming voice is heard four times weekly over the NBC networks. . . . It's good news from WABC —that Alexander Woollcott is back with his interesting program, The Town Crier; always enjoy listening to his amusing anecdotes and bits of theatrical gossip; each Wednesday and Friday, 10:30 p. m. . . .

* * *

Peter Dixon Back—and Busy

Peter Dixon is back in town after a holiday with the family in and around the Thousand Islands; Peter is a busy lad these days; he has several commercial contracts for radio material; besides that, he is planning some shows of his own; more power to you Peter! . . . Morris Hamilton, that genial producer of programs at NBC, is on his vacation; the place is West Harwich, Cape Cod—and how I envy him those bracing salt sea breezes! . . . There will be a wedding on October 15th at the Park Central Hotel; Roslyn Schafler, of the Harms Music concern, will become the bride of Yuriel Benjamin, of the Meyer Davis office. . . . Several new songs have made their appearance at the Shapiro-Bernstein office, where little Molly Klinger is still smilingly greeting artists; some new ones are: "If I Had Somebody to Love," by Peter de Rose and Billy Hill, a sweet love ballad; "Empty Days," by Jacues Krakeur 2nd, a sophisticated torch song of great beauty, and the sensation of blase New York; "The Last Round-Up," by Billy Hill, a cowboy song, classical in its sheer simplicity; the latter number will be featured in the new edition of the "Ziegfeld Follies." . . . Kate Smith's new schedule has been changed; the portly singer will now be heard on Mondays at 9:00 p. m., Tuesdays at 8:45, and Wednesdays at 9:15. This new sustaining series—her first in two years—adds forty-five more stations to Kate's network, giving her sixty-five outlets in all; her manager, Ted Collins, will announce the broadcasts as usual, and Nat Brusiloff will continue as musical director. . . . The Columbia Public Affairs Institute, the weekly series of discussions on current thought by men and women prominent in national and international affairs, has been resumed for the season; each Saturday evening, from 10:00 to 10:30 p. m., EDST, over WABC and the Columbia network. . . . Erno Rapee has gone Columbia; he will make his debut over WABC with the new Coast-to-Coast Bath Club Review, on October 1st; with Rapee's Orchestra will be Jane Froman and Nino Martini. . . . Met up with Billie Dauscha, the Melody Maid of Manhattan, and she tells me she has signed up with the Ed Wynn chain. Jolly good luck, Billie! Hope you get plenty of programs! . . . Cantor will not be on the air for a while; Jimmy Durante and Ruth Etting have taken over the Chase & Sanborn program; this should be a grand combination; Ruth is a great singer of her own particular type, and Schnozzle—well, I think he's funny, with or without his nose. . . .

* * *

Phil Baker with Armour

The Armour Company has signed for another fifty-two weeks of air-time through the N. W. Ayer Agency; Phil Baker has thirteen weeks of that time already contracted and will probably wind up with the rest of it, as Phil has given great satisfaction to his sponsors and the radio public. . . . Leo Reisman is all set with two good accounts in October—the Phillip Morris program and the None-Such mincemeat; the Ben David office fixed it up; Reisman has thirteen-week contracts with both sponsors and has renewal options; the Morris contract calls for three fifteen-minute periods a week beginning October 6th; the mincemeat one-half hour weekly; both on NBC; the David office also announces a renewal of seventeen weeks for Al Goodman on the Gulf Oil program, three times weekly. . . . Adele Starr, contralto crooner, heard in New York on several one or two shot spots two years ago, is now being built-up out of KYW, Chicago. . . . August time sales on both big chains show an increase over July, which is good news. . . . Tito Guizar, the Mexican tenor, will be heard after October 1st, each Sunday afternoon on WABC, sponsored by Brillo; his musical background will be rather unique—a harp trio. . . . The Beechnut Packing Company is well represented in the Middle West with three fifteen minute spots; Monday, Wednesday and Saturday over WLW, Cincinnati. . . . Radio artists are becoming publicity conscious and advertising themselves in trade papers; looks like the good old days of vaudeville competition; Rubinoff, Mary McCoy, Meyer Davis, Al Goodman, Leon Belasco, Mildred Bailey, Jane Froman, Isham Jones, Howard Lanin, James Melton, Lee Wiley, Ramona, Ruby Norton, Milton Berle, Lennie Hayton and Don Ross are a few who are paying out good money for that publicity; there is no doubt that it pays dividends. . . .

Songs That Sell

There is no truth in the rumor that Harry Link will leave the Keit-Engel organization; in fact, Harry is more enthusiastic than ever about his affiliation with this upstanding music firm. . . . "Lazy Bones" is still leading song sales and "Valley of the Moon" is holding its own in a remarkable manner; Archie Fletcher is one of the wisest business men in the music business; when he exploits a song it stays that way for a long, long time. . . . Guy Lombardo has taken over the Ted Lewis Chicago spot, The Dells, with Lewis touring the Middle-West in vaudeville. . . . King's Beer has graduated from a local WABC spot to a ten-station chain, which includes Albany, Syracuse, Buffalo, Hartford, Providence, Boston, Bangor and Washington. . . . And I think it's about time for me to graduate to the Grand Central Station and the train for Cleveland; so toodle-oo, pip-pip! I'm off!

MARCONI OFF FOR VISIT HERE

Information that Guglielmo Marconi, noted radio scientist, will visit the United States early next month and be the guest at a celebration in his honor at the Century of Progress in Chicago was received by General James G. Harbord, chairman of the board of the Radio Corporation of America.

General Harboard's information came in a radiogram from David Sarnoff, president of the Radio Corporation of America, who was in Europe, stating that Marconi had accepted an invitation to visit America and the World's Fair. Mr. Sarnoff had issued the invitation on behalf of Rufus Dawes, president of a Century of Progress, Dr. Joseph Castruccio, Italian Consul at Chicago, and the Radio Corporation of America.

Marchese and Marchesa Marconi plan to sail for New York on the Conti di Savoia. Arrangements are now being made at the Century of Progress for the celebration on October 2d of "Marconi Day," at which the inventor will be honored for his contributions to science and the development of radio. Dinners will be held in his honor in Chicago and New York. Marchese and Marchesa Marconi will be the guests of the Radio Corporation of America during their stay in this country.

It is anticipated that the inventor's visit will arouse much interest in radio and technical circles because of his recent experiments with ultra-short radio waves. Press dispatches from Rome during the summer have described Marconi's experiments with ultra short, or micro waves between his yacht "Elettra" and an experimental station on the shore, the reports indicating that the inventor had communicated successfully on a sixty centimeter wavelength a distance of one hundred and sixty miles. Ultra-short waves which have many properties of light waves, have not yet been adapted to practical long range radio use, and while experiments have been in progress on both sides of the Atlantic, unusual interest has been attracted to Marconi's tests because it was through his research of a similar nature that short radio waves were first found to be practical for day by day radio service.

Marchese Marconi has not visited the United States since 1927, when he attended the International Radio Conference at Washington.

WIP Sues Music Group; Monopoly is Charged

The Pennsylvania Broadcasting Company, which operates WIP, Philadelphia, announced that it had entered suit in the Federal court against Gene Buck, Louis Bernstein, E. C. Mills and Jerome Kern, as individual defendants, on a charge against the American Society of Authors, Composers and Publishers. The suit was said to be based on the charge that the Society is operating in restraint of trade. An injunction is asked on the charge that the Society, its officers and agents fix prices, and "monopolize and control for the benefit of its members the public performance of all forms of musical entertainment."

Inquiry at the A.S.C.A.P.S. offices in the Paramount Building on Times Square brought the information that neither the Society nor its officers had been served in the action mentioned in the news columns of the daily papers, although it was not denied that such action probably was being contemplated. It also was indicated that WIP had brought a similar action six years ago but that the suit had never reached a judge and jury.

New Manual Is Guide for the Serviceman

By SYDNEY BASS,
Advertising Manager, Try-Mo Radio Corp.

A new "Handy Servicemen's Guide" is ready for release by the Try-Mo Radio Company, Inc., 85 Cortlandt St., N. Y. City, which is one of the most practical, inexpensive servicemen's guides sold today.

Thumbing through the 128 pages we find a horde of informative ideas for quick radio servicing and how to discern the origin in most popular radio sets.

The book is 3x6 inches, making it a handy portable directory.

Here are some of the more important items in the Manual: Shortwave and long-wave hookups, t-r-f tuner hookups, amplifier hookups, tube characteristics, resistance color code charts, Continental and Morse codes, volume control data, trouble shooting, schematic symbols, etc.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

Louis Mascia, 2526 Valentine Ave., Bronx, New York City.
Sam Kurlandsky, 561 Broadway, South Haven, Mich.
Lester Levy, 1201 Shakespeare Ave., Bronx, New York City.
Jackson Brothers Service, 208 Woodlawn Ave., Jersey City, N. J.
A. N. Lump, 4413 N. 7th St., Philadelphia, Pa.
Barta Brothers, Radio, Electrical Supplies and Service, Red Cloud, Nebr.
J. K. Watkins, 307 East Bertsch St., Lansford, Pa.
Ted Wnukowski, 2948 Keeley St., Chicago, Ill.
S. R. High, Sellersville, Pa.
Eustaquio Ferrer, Box 335, Guayamo, Puerto Rico.
G. Kenneth Smiley, R. D. No. 2, Carlisle, Penna.
Wm. F. Littlefield, Marina Station, P. O. Box 42, Mayaguez, Porto Rico.
C. S. Holderman, 2610 Aberdeen Ave., Hoquiam, Wash.
A. H. Edgerly, Kensington, Conn.
Clarence Kay, P. O. Box 132, Hornell, N. Y.
R. W. Partridge, "Galloway's," 940-42 Granville St., Vancouver, B.C., Canada.
Milton O. Warren, R.F.D. No. 5, Trenton, N. J.
H. D. Smith, 323 East Lake Drive, Station E, Atlanta, Ga.
John W. Cook, Junior College, El Centro, Calif.

TRADIOGRAMS

By J. Murray Barron

The latest release from the laboratory of the Universal Microphone Co., Inglewood, Cal., is the Universal Recording Feed Screw Device which moves any recording cutting head across the face of the disc, and thereby grooves the record at the same time of making the recording. It is claimed that this method of making the groove at the actual time of the recording has proven superior to the use of pre-grooved records. It will be marketed through the regular trade channels and will be found practicable for transcription studios, home recording and agencies which make an air check of broadcasts.

* * *

Now that we are over the Summer vacation period and getting ready for the Fall and Winter, those interested in radio as a business proposition, especially servicemen, should bear in mind that a real knowledge of the industry is quite essential if one is to be proficient. No matter how much information one has picked up through practical work, even if one now earns his living at it, to get one's share of the big openings that radio holds out in the next few years one must have a technical training. To those interested seriously along these lines, the R. C. A. Institutes, Inc., 75 Varick Street, New York City, will send an illustrated catalog and full information either about the resident school courses or the extension home study courses

* * *

Some readers of radio magazines who are interested in the industry from many angles, whether it be news or circuits for constructional work, may not be interested in selling kits, or receivers, as they may be purely experimenters. However, there are many, especially in the smaller communities, who though they may not read many radio publications, are interested in selling. To those it would be a great favor if their attention is called to the fact that many worthwhile radio receivers and kits may be had for representation, and that in some instances actual inquiries may be had to call upon in their communities.

* * *

James I. Benjamin, long associated with the radio industry, and more recently as treasurer and general manager of the Pilot Radio and Tube Corporation, at Lawrence, Mass., has been elected president and treasurer of the newly-formed Federal Instrument Corporation, 325-341 Classon Avenue, Brooklyn, N. Y., who will manufacture a complete line of radio parts, catering to the set manufacturers. They are now in production on variable air condensers in one, two, three and four gang types.

* * *

To the fans and DX hounds, and those in Europe and foreign countries, who are keenly interested in short wave, long and ultra-long waves, from 15-2,400 meters, an announcement of real interest comes from the Fanning Radio Labs., 377 Eighty-seventh Street, Brooklyn, N. Y., that a new 7-tube model of this type has been released. A new illustrated booklet describing this and a complete line of 1934 radio receivers to cover various combinations of wavelengths, with five models of broadcast receivers, is now ready for free distribution.

An interesting idea and plan is now under way whereby resident agents will be able to show models and give some demonstrations to those radio-minded who may live far away from the large centers. In connection with this idea is the one that fans or others who may want to act as demonstrators for broadcast and short-wave receivers may be appointed to specific territory. The idea is not entirely under way, but will very shortly be if there is a real call for same. Further information may be had by addressing Trade Editor.

* * *

Some interesting things are promised for the Radio Recovery Number of RADIO WORLD dated October 14th and on sale October 10th. Make sure you do not miss this number.

* * *

An unusual announcement comes from Coast-to-Coast Radio Corporation, 121-125 West Seventeenth St., New York City, of a new line of universally-powered amplifiers capable of operating from either 110-volt power lines or from a 6-volt storage battery source, or both. With a combination of this kind it is possible to use a permanent installation for portable work, if such is required, thus opening up a wide field for the experimenters and others. A technical circular with information in detail and schematic circuit and list of parts will be mailed free of charge by addressing Amplifier Manufacturing Division, Coast-to-Coast Radio Corp., 123 West Seventeenth St., New York City.

10 Per Cent Set Tax is Opposed in Ohio

The Radio Manufacturers' Association, Inc., and Ohio radio interests have opposed a proposal before the special session of the Ohio State Legislature to levy a new ten per cent. "luxury" sales tax on receiving sets. With the assistance of Charles T. Naddy, Columbus radio jobber, and other Ohio distributors and dealers, a vigorous fight against the proposed tax, suggested to apply generally in Ohio, has been waged. The latest reports indicate that the proposed tax will be defeated. A few years ago the RMA brought a test suit against a similar tax law in South Carolina and obtained a Federal Circuit Court decision that radio receiving sets are instrumentalities of interstate commerce and therefore cannot be taxed by any state. This United States court decision was transmitted by RMA to the Ohio legislative committee and used most effectively.

Committee will Study Police Radio Technique

A special committee to study engineering developments in connection with police radio has been organized by Chairman Virgil M. Graham of Radio Manufacturers' Association's Standards Committee. Special study will be made of problems in connection with police radio. The committee consists of L. F. Jones of Camden, New Jersey; E. L. Nelson of New York; T. J. Scofield of Jackson, Mich.; W. E. Poor of New York, L. F. Curtis of Springfield, Mass., and David Grimes of New York. Mr. C. G. Joliffe, Chief Engineer of the Federal Radio Commission, has accepted appointment as guest member of the committee.

NEW TUBES DEFERRED

Issue of new tube models has been deferred, in compliance with requests from tube jobbers and set manufacturers, for an indefinite period.

RTC's Big October SPECIALS

Every month we list on this page a few STAR ★ items which are not listed in our catalog. These are all specials of which the quantities on hand are not sufficient to catalog them. *Once sold out, no more can be had.* ORDER NOW—TODAY.

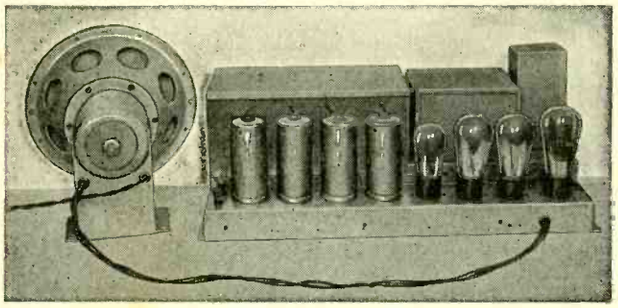
No One in Radio Undersells Us!

STOP SHOPPING—the lowest prices are right on this page. *No one undersells us.* We meet any price on any new merchandise. Order direct from this page and save money. 100% satisfaction on every transaction. Take advantage today of these special offers.

★"PEERLESS" 7-TUBE SCREEN-GRID T.R.F. RADIO RECEIVER

Complete with Full Dynamic Speaker

ONLY 100 LEFT AT THIS PRICE



Back View

The selectivity and sensitivity of this 7-tube receiver due to its **three tuned stages** are just as sharp as those of an expensive 11-tube Superheterodyne receiver. The construction of this receiver is best described as "standard." Its circuit is none other than the "good old standby" TRF type which is the most reliable. It incorporates two stages of tuned R.F. amplification using type '24 Screen-grid tubes; the power detector is a '24; a single stage of A.F. voltage amplification utilizing the type '27 tube, feeds a 247 super-power pentode, the full wave rectifier is an '80. All provisions are made for supplying field power for the 9 inch genuine Magnavox, fully shielded full dynamic speaker. Both cone and spider of this excellent reproducer are made of Burtex to improve the high note response (brilliance) without impairing the low note production.

Tuning is extremely simple, the tuned circuits being controlled by a single central knob; a vernier drum-type illuminated tuning dial is employed. The second knob controls the on-off switch and the third, the one on the right, volume control. Coils, tuning-condenser-gang, filter condenser bank, output choke and by-pass condenser bank are all individually shielded. The chassis itself is made of non-magnetic aluminum.

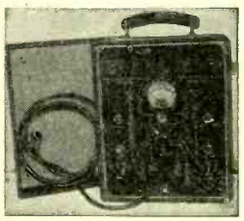
The use of three tuned circuits, employing screen-grid tubes and high gain R.F. transformers, together with careful wiring, and by-passing, result in high sensitivity. Tone quality, too, is extraordinarily fine. Despite the maze of new tubes recently thrown upon the market, it is generally conceded that for average home use a single 247 pentode supplies **adequate power with the least distortion.**

Why build a set when a complete receiver, wired and ready to use, and complete with speaker, can be bought at this phenomenally low price? Here is an excellent opportunity for wide-awake service men to "clean up." Remember that the supply is limited. Hence, "first come, first served." Overall size 21" x 8" x 8½" (set only). Ship. wt. 45 lbs.

List Price $75.00
NO. SP-2000 Peerless 7-Tube TRF Receiver
YOUR PRICE with speaker but less tubes $10.83
LIMITED SUPPLY—ORDER TODAY—TOMORROW MAY BE TOO LATE

BUILD THE "NEW DEPENDABLE" TUBE TESTER

Sold Either Wired or in Kit Form



Here indeed is your opportunity to build one of the finest tube checkers ever designed—an instrument which is MODERN in every sense of the word. Will test all the latest type tubes, including those with 7 AND 8 PRONGS—DIRECTLY—without the use of a single adapter!

The "NEW DEPENDABLE," despite its high degree of accuracy, is extremely simple to operate. Both plates of the 80—82—83 and other rectifier tubes are readily tested without the use of a "second plate" button.

The instrument employs a high-grade, D'ARSONVAL TYPE, MOVING-COIL METER, insuring thereby extreme accuracy. This instrument will check more than 120 different tubes and even those which have not as yet been placed on the market. The tube tester is amply guarded against tube "shorts," which condition is indicated by the flashing of a small pilot light. All component parts are mounted on a beautifully etched panel and the entire instrument placed in a sturdily constructed, leatherette-covered, carrying case. For operation on 105-125 volts, 50/60 cycles, A.C. This instrument is available either in kit form or completely wired and tested, ready to use. Shipping weight 9 lbs.

NO. 303 "New Dependable" Tube Tester, completely wired and tested.
YOUR PRICE..... $18.75

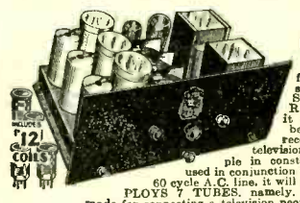
NO. 303A "New Dependable" Tube Tester in kit form.
YOUR PRICE..... $14.75

EXTRA SPECIAL

Baird Universal Short Wave and Television Receiver

Seven Tubes—15 to 500 Meters

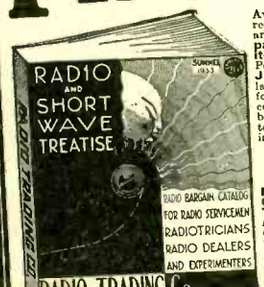
Only 20 at This Price



This is the same receiver which a short time back sold for $80. It is a receiver which is "Universal" in the strictest sense of the word. Not only will it intercept SHORT-WAVE and TELEVISION SIGNALS but REGULAR BROADCASTS AS WELL. In other words it will receive practically everything which is on the air below 550 meters. This receiver has obtained world wide recognition as the most advanced type of short wave and television receiver for home use yet devised. Amazingly simple in construction, marvelously proficient in performance. When used in connection with a Baird Televisor or any other televisor operating on a 60 cycle A.C. line, it will produce clear cut images of definite detail. The set EMPLOYS 7 TUBES, namely, 3-24's; 2-27's; 1-45 and 1 B.H. rectifier. Provisions are made for connecting a television neon tube and for switching from loudspeaker to televisor. A complete complement of 12 plug-in coils is furnished with the set. These coils cover a range of from 15-200 meters. Three additional coils to cover the broadcast range of from 200-550 meters can be furnished at an additional cost of $1.00 per coil. Provisions are also made for earphone reception as well as for a phonograph pick-up connection. Only high grade parts such as Hammarlund condensers, etc., are used. The chassis is completely wired and assembled ready to use and is CONTAINED IN A HANDSOME MAHOGANY CABINET. The supply of these sets is very limited, being only twenty in all. Act fast if you desire to take advantage of this offer. Shipping weight, 65 lbs.

LIST PRICE $80.00
No. 35 Baird Universal Short Wave and Television Receiver
YOUR PRICE..... ONLY $22.50

FREE RADIO AND SHORT WAVE TREATISE



Over 100 New Hook-Ups, Etc. 1000 Illustrations.

Avail yourself now of the opportunity to receive the FREE 1933 Edition of our Radio and Short Wave Treatise—**116 solid pages of useful information, radio items, diagrams and illustrations.** Positively the greatest book in print—**NOT JUST ANOTHER CATALOG.** Contains a large editorial section with valuable information not found anywhere else. Special consideration has been given to the radio beginner in this issue. Among the new technical information listed are the following:

HERE IS A PARTIAL LIST OF CONTENTS

Fundamental Principles of Radio—Ohm's Law—Discussion of New Tubes—Constructing a "Triple-Twin" Amplifier—All about Superheterodynes—Eliminating Man-Made Static—Constructing a Two-Tube Short-Wave "Globe-Trotter" Receiver—$3.00 Prize Suggestions—Radio Kinks, etc., etc.

WRITE TODAY. Enclose 4 cents for postage. Treatise sent by return mail.

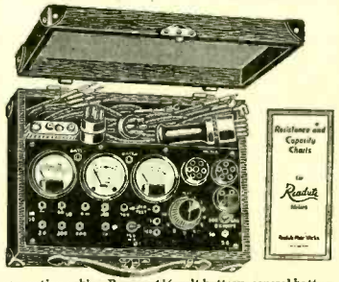
NEW READRITE MODEL 710 ANALYZER

TESTS LATEST TYPE 6 AND 7 PRONG TUBES

NINE METER SCALES AVAILABLE

This new Readrite precision instrument embodies features which have always been desired in any instrument built for service work: (1) low cost; (2) simplicity of design; (3) accuracy of measurements; (4) ruggedness of the complete unit. It is needless to add that the kit is capable of testing anything from old battery models to the latest screen-grid, pentode, and multi-mu receivers.

The "Model 710" is an extremely compact device. The outside dimensions of the carrying case are only 10¾ by 7¼ by 3¼ inches. The analyzer contains a D.C. voltmeter, an A.C. voltmeter and a milliammeter. The D.C. voltmeter has four ranges: 0 to 10; 0 to 60; 0 to 300 and 0 to 600 volts. The A.C. voltmeter has three ranges: 0 to 10; 0 to 140; and 0 to 700 volts. The milliammeter has two ranges; one for 15 mill. reading and the other for 150 mill. **This variety of ranges makes it possible to test every conceivable radio circuit;** high voltage secondaries of power transformers, current drain of all radio tubes, including the high power 250 and 210 tubes, etc.



CONVENIENT SELECTOR SWITCH—The instrument is equipped with a ten position bi-polar selector switch; by means of which readings may be obtained of "G" volts, "C" volts reversed, "K" volts, "K" volts reversed, plate voltage, screen-grid voltage, etc. A 4½-volt battery is supplied with the analyzer, to provide "C" bias, for grid tests, continuity tests, etc.

TESTS PENTODES—"MULTI-MUS" '57's and '58's—'80 RECTIFIERS, Etc.—There are four sockets on the panel of the analyzer to take care of the four, five, six and seven Prong Tubes. There is a "grid-test" push-button. Pin jacks are available for the individual use of all meters, externally, in every range. There is a screen-grid pin jack, and there are two pin jacks for connecting the external battery. Both plates of the '80-type rectifier may be tested by use of a special adapter furnished. Charts are provided for measuring resistances and capacities. The Analyzer is furnished complete with test leads, connecting cables, Burgess 4½-volt battery, several battery leads, UY to UX adapter, '80 rectifier adapter and resistance and capacity charts. Shipping weight, 8 lbs.

Model 710 Analyzer. List Price, $25,
YOUR PRICE **$14.73**

WE ARE A WHOLESALE HOUSE AND CAN NOT ACCEPT ORDERS FOR LESS THAN $3.00.
If C.O.D. shipment is desired, please remit 20% remittance, which must accompany all orders.
If full cash accompanies order, deduct 2% discount. Send money order—certified check—U. S. stamps.

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Should you wish goods shipped by parcel post, be sure to include sufficient extra remittance for same. Any excess will be refunded.

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