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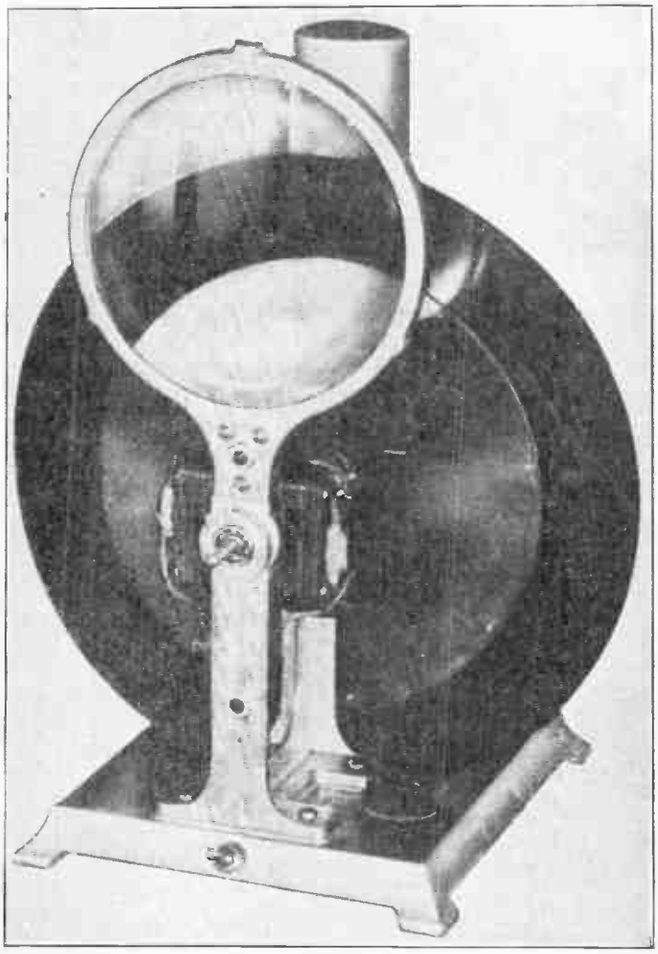

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See page 20.

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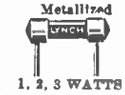

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A Four-Tube Portable Using Pentodes for R-F and Output

By Anthony C. Spear

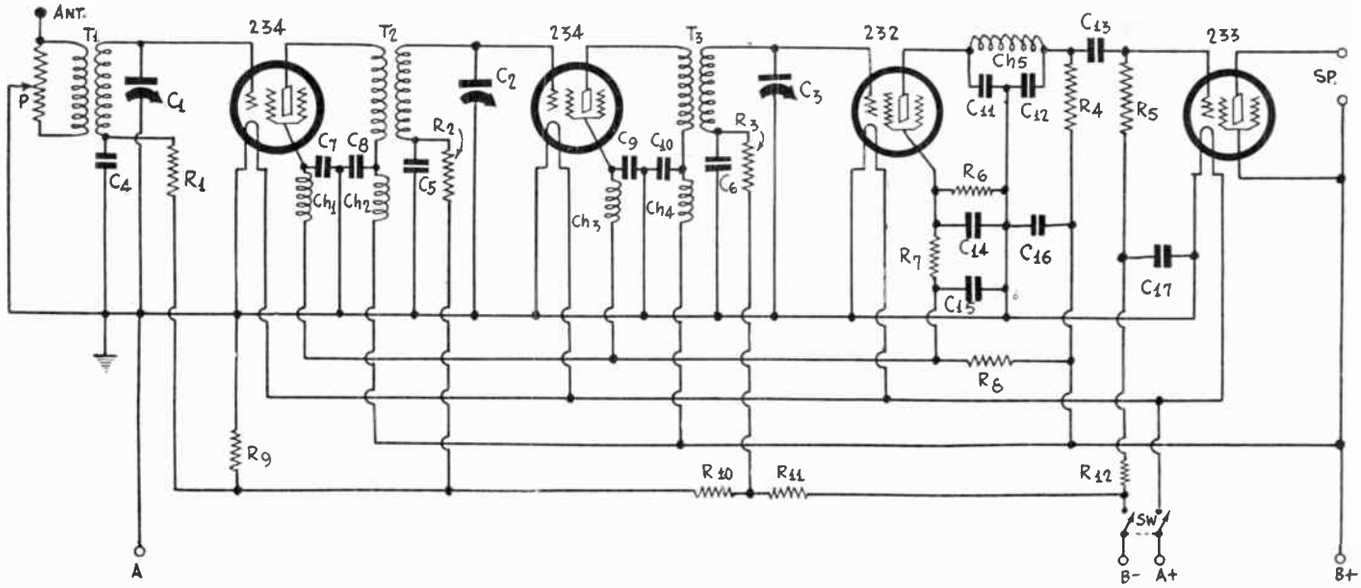

FIG. 1

The circuit of a four-tube portable receiver utilizing the two volt tubes, with two r-f pentodes, one screen grid detector and a power pentode.

THE call for portable receivers has been sent out from every part of the United States and Canada in anticipation of Summer outings and vacations. Set builders must get ready to meet the demand.

Any portable receiver must meet two major requirements, namely, lightness of weight and sensitivity. Selectivity is not a major requirement although it is a desirable one if it can be had without sacrificing either of the other two requirements.

The first requirement is met mainly by using small tubes, which require a very small and light filament supply. If we can use a

LIST OF PARTS

Coils

T1, T2, T3—Three r-f transformers as described.
Ch1, Ch2, Ch3, Ch4, Ch5—Five 800 turn duolateral chokes, of about 10 mh each.

Condensers

C1, C2, C3—One triple gang of 350 mmfd. condensers with trimmers built in.
C4, C5, C6, C7, C8, C9, C10—Seven 0.1 mfd. by-pass condensers.
C11, C12—Two 0.00025 mfd. condensers.
C13—One 0.1 or 0.01 mfd. condenser (use the larger for low notes).
C14, C15, C16, C17—Four 0.25 mfd. condensers, or larger.

Resistors

R1, R2, R3, R7, R12—Five 50,000 ohm resistors (R12 optional).
R4—One 0.25 megohm resistor.
R5—One 1 megohm resistor.
R6—One 15,000 ohm resistor.
R8—One 20,000 ohm resistor.
R9—One 100 ohm resistor.
R10—One 50 ohm resistor.
R11—One 300 ohm resistor.
One two-ohm limiting resistor.

Other Requirements

P—One 100,000 ohm potentiometer for volume control.
Sw—One double pole, single throw switch.
Seven binding posts.
Three grid clips.
Three UX sockets.
One UY socket.

Sensitivity and Light Weight

Resistance Coupling Used for Better Portability

(*Continued from preceding page*)

battery that weighs less than five pounds that will make a receiver more easily portable than if we have to use batteries that weigh 50 pounds. This is possible if we use the 2 volt tubes in the receiver for they take a very low current as well as a low filament voltage.

These tubes also draw a comparatively low plate current so that we can save weight not only in the filament battery but also in the plate battery. If we also arrange the circuit so that it does not require any grid batteries, we save a considerable weight on that

A Four-Tube Portable

In the present portable receiver we have four of the latest two-volt tubes. The radio frequency amplifier tubes are the new 234 r-f pentodes, the detector is the 232 screen grid tube, and the output tube is a 233 power pentode. This makes a set that is the equivalent of a five tube midget for alternating current in so far as sensitivity is concerned. The output, of course, will not be so great as if we used a 247 tube in the final stage but it is ample for the purpose for which the set is intended.

In order to get the most out of the set we must have the proper speaker. It is not practical to use a regular dynamic speaker for we have no way of getting the field excitation. We can't use the filament battery or the plate battery for this purpose without increasing the weight of these beyond the permissible limit. We must use a magnetic speaker, or an inductor dynamic, or a permanent magnet dynamic. Whatever type of speaker is used, it should be sensitive when used with the 233 power tube.

Getting Sensitivity

As a means of getting a high sensitivity we can use r-f transformers with heavy primaries. Such transformers are necessary for the pick-up will be small, assuming that we cannot use a first class antenna at every place the receiver is set up. There are coils available with 90 turn primaries and 127 turn secondaries, wound on one-inch tube and encased in light aluminum shields. They are used in automobile receivers where high sensitivity is essential and they are no less suitable for this portable receiver. These particular coils are wound for 350 mmfd. tuning condensers, and this size is recommended, for they are the smallest tuning condensers with which the broadcast band can be covered, and the smallest condensers result in the highest all-around sensitivity.

Using two r-f pentodes in the radio frequency amplifier in conjunction with these coils insures high sensitivity, because these tubes are much superior to the 232 tubes. In the detector, however, we must use a 232 because this is a better detector than the pentode. In the output stage there is no better tube available than the 233 power pentode.

Transformers Omitted

As a means of reducing weight no audio transformer is used in the circuit, but instead resistance coupling is employed between the detector and the power tube. The customary values of 0.25 megohm for R4, one megohm for R5, and 0.1 mfd. for C13 are used.

Filtering in the circuit is rather thorough, but this is done because of the high gain in the circuit. In each of the screen and plate circuits of the two r-f pentodes we have a filter consisting of one 0.1 mfd. by-pass condenser and one small r-f choke. These by-pass condensers are C7, C8, C9 and C10 and the chokes are Ch1, Ch2, Ch3 and Ch4. Each choke may be an 800-turn duolateral coil such as the coils used in intermediate frequency transformers. The other filter choke, Ch5, is also of the same type and size.

Due to the omission of the usual grid battery in using in place of it voltage drops in the common plate return circuit, it is necessary to filter the grid returns of the radio frequency tubes. Each filter consists of a 0.1 mfd. by-pass condenser and a 50,000 ohm resistance. These condensers are C4, C5 and C6 and the resistors are R1, R2 and R3. It will be noted that each of the condensers is a part of a tuned circuit and is in effect in series with the tuning condenser. If the value of each of these condensers is 0.1 the effect on the tuned circuit, even when the tuning condenser is set at maximum, is negligible.

Additional Filtering

There is also considerable filtering in the coupler between the detector and the audio amplifier. The choke Ch5 is designed to prevent r-f currents from entering the audio amplifier and condensers C11 and C12, each of which has a value of 0.00025 mfd., help in this respect. C14, C15, C16 and C17 serve to prevent back coupling through the B supply and each may have a value of 0.25 mfd.

The various resistors heretofore specified are for voltage division. R6, R7 and R8 divide the plate voltage so as to give each element the proper voltage and R9, R10 and R11 are for grid bias division. R12 is not strictly a voltage divider resistance but rather a filter. Its use is optional.

We wish a screen voltage of 15 volts on the detector tube, and this is to be the drop in R6. Now we are at liberty to choose any value of resistance that will give this drop but we must remember that the higher the current the more rapid is the drain on the B battery. This drain must be kept low. If we allow one milliampere, which is not excessive even in a portable set, the value of R6 should be 15,000 ohms. Now we want a voltage of 67.5 volts on the screens of the two 234 tubes, and this is the drop in R6 and R7 combined. Hence the drop in R7 alone should be 52.5 volts. The same current flows through R7 as through R6 because the detector screen current is very small. Hence we should make R7 52,500 ohms. However, since the nearest commercial value is 50,000 and there is a small current to the detector screen we are justified in making it 50,000 ohms.

When the plate voltage on the 234 is 135 volts and the screen voltage is 67.5 volts the screen current to each of the 234 tubes is one milliampere. Hence through R8 the current is 3 milliamperes. The drop in R8 is 67.5 volts, practically. Hence the value of R8 should be 22,500 ohms. Again we are justified in selecting the nearest commercial value, namely, 20,000 ohms.

Computing Grid Bias Resistors

Through the three grid bias resistances the total current supplied by the B battery flows, and before we can compute any of the resistance values we must estimate the current. The two 234 tubes require 7.6 milliamperes together, the detector takes about 0.2 milliampere, and the power tube 18 milliamperes. Hence the tubes take 25.8 milliamperes. To this we add the one milliampere bleeder current and get a total of 26.8 milliamperes. The drop in R9, R10 and R11 should be 13.5 volts as this gives the bias for the power tube. The drop in R10 and R9 should be 4.5 volts to bias the detector, and the drop in R9 should be 3 volts to bias the r-f pentodes. Hence R9 should be 112, R10 56, and R11, 336 ohms. The nearest commercial values of 100 ohms for R9, 50 ohms for R10, and 300 ohms for R11 will do very well. If R12 is used at all it should be about 50,000 ohms.

In view of the fact that there is a resistance across the B battery even when the tubes are not lit, it is necessary to open the plate circuit as well as the filament circuit when the set is not in use. Hence we have the single throw, double pole switch Sw in the leads shown.

The Power Supply

The filament supply in this circuit should be an air-cell, which has a voltage of 2 volts. It may also be a 2-volt storage cell of small dimensions. However, for portable sets, it is likely that the only type of filament supply that is available or practical is a 3 volt dry cell battery. If that is used it is necessary to put in a current limiting rheostat or simply a fixed resistance. The filament current will be 0.44 ampere and the drop in the limiting resistance should be one volt. Hence the limiting resistance should be 2.27 ohms. It is safe to use a two-ohm resistance. If a rheostat is employed it need not be of higher resistance than 6 ohms. It is safer to use a fixed resistance of 2 ohms than a rheostat that can be adjusted to just 2.27 ohms because if the rheostat is used there is always the temptation of putting the entire voltage across the filaments, or this may be done inadvertently.

One No. 6 dry cell will deliver 0.25 amperes for a considerable time but it is not advisable to draw a higher current. Therefore two dry cells of this size should be connected in parallel. Each cell will then deliver 0.22 ampere. Since the voltage required is 2 volts and one cell will only give 1.5 volts, it is also necessary to use two in series, and this gives 3 volts, requiring the limiting resistance to cut down the excess voltage. Hence we need four No. 6 dry cells connected in series parallel.

The plate voltage can be supplied by three medium size 45-volt B batteries connected in series.

The two ohm limiting resistance, or the rheostat, should be put in the negative lead to the filament battery.

A Universal Meter

Six Voltage and Five Current Ranges, A-C and D-C

By Clarence Wright

SERVICE men have need for a universal meter, that is, one that will measure both alternating and direct currents and voltages. Such a meter has innumerable applications to radio experimentation and servicing. This is particularly the case when there are many ranges. An instrument of this type can now be built for a relatively low price. In fact, if all the different combinations were to be provided by as many different meters the cost would be so high that the cost of the single combination seems insignificant.

A device of this type, designed by the Shallcross Manufacturing Company around the 301 Type Weston Universal meter, is diagrammed in Fig. 1 and the appearance of the completed unit is depicted in Fig. 2.

The universal instrument is of the dry rectifier type and it is so arranged that it will operate accurately on either direct or alternating current. To change from direct to alternating current it is only necessary to throw a switch.

FIG. 1.

This shows the assembled multi-range universal voltmeter and milliammeter.

By referring to Fig. 2 we note that as a voltmeter the instrument has six different ranges, 0-5, 0-10, 0-50, 0-250, 0-500, and 0-1,000 volts. These ranges apply to both alternating and direct voltages. We also note that as a milliammeter it has five different ranges, 0-1, 0-5, 0-100, and 0-500 milliamperes. All current ranges apply to both direct and alternating current. As a current meter the maximum voltage drop across the meter is 5 volts, and as a voltmeter the sensitivity is 1,000 ohms per volt.

About All You Need

It is seldom, indeed, that a service man or radio experimenter will need any other meters than those provided by this universal instrument.

On the diagram we note that there are two double throw, triple pole switches. One of them, the one on the right, converts the instrument from a milliammeter to a voltmeter, or vice versa. The other, on the left, converts the instrument from a d-c meter to an a-c meter, or vice versa.

There are several precautions against possible damage to the meter. One of these is a safety key, which should only be depressed for taking a reading if the other safety indications are correct. One of the other safeguards is a cautionary deflection. If this appears before the safety switch is depressed it is not safe to depress it, and the switches should be reset. The other safeguard is the one ampere fuse in the line. Under certain circumstances the fuse will blow in case the selector switches are not set properly, but the blow-out will occur before the safety switch is depressed. It is better to blow out fuses than to burn out the meter, but if care is exercised there is no reason why either should burn out.

Parts Needed

All the resistance values of the voltage multipliers and current shunts are clearly given on the diagram. It is essential that all of them be accurately adjusted to the indicated values. There is one resistance the value of which is not indicated but this comes with the meter.

The parts needed are:

Wire-wound resistors: 500,000, 250,000, 200,000, 100,000, 40,000, two 5,000, 1,000, 200, 50, 10 ohms; bakelite panel about 5.5 x 9 inches; one subpanel; 1 amp. fuse with holder; two three-pole, double-throw switches; single pole, double throw push button switch (safety key); two binding posts, one (—) and one (+); cabinet.

In Fig. 3 we have a view of the underside of the panel, in which the arrangement of the various parts is clearly shown. The resistors are distributed about the switches so as to make the wiring simple.

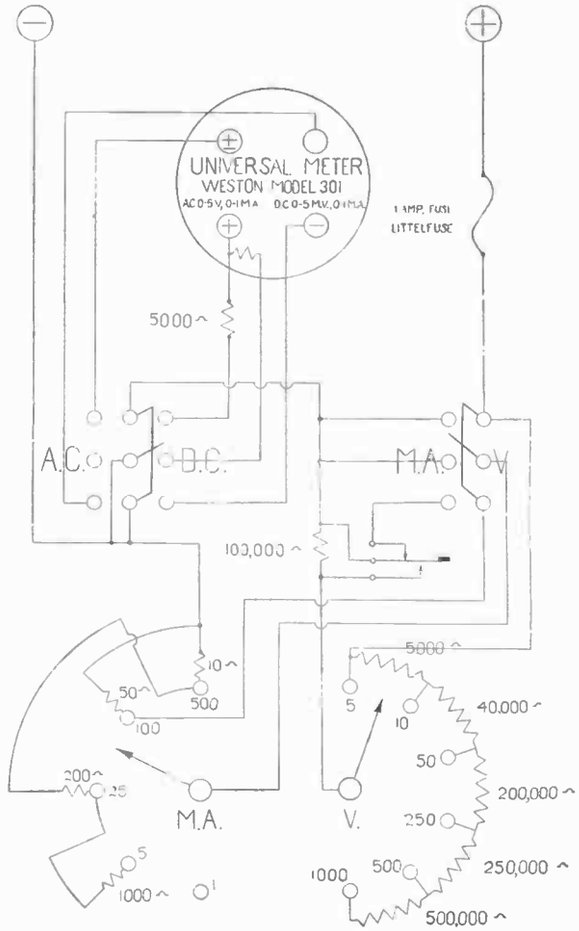

FIG. 2.
The circuit diagram of a multi-range universal voltmeter and milliammeter.

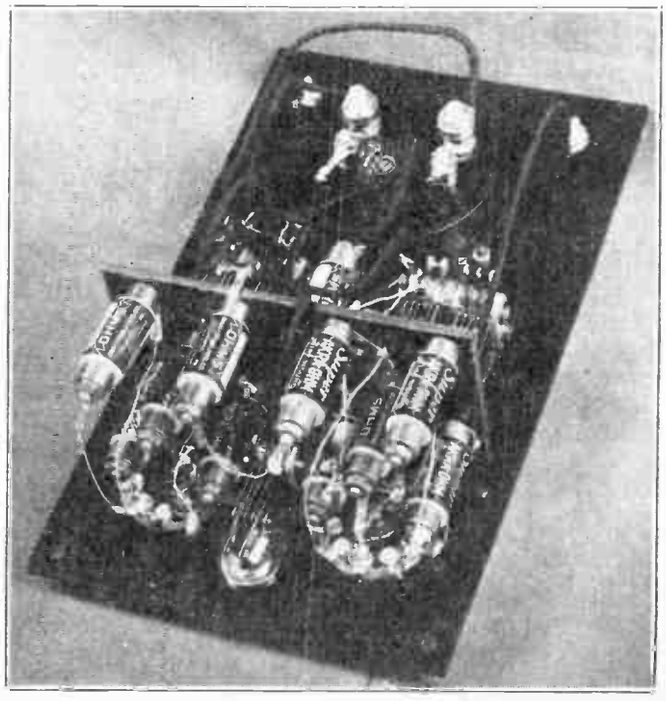

FIG. 3.
Inside view of the wired model.

Third Detector Appears

Mystery Circuit Clues Are Augmented

By Herman Bernard

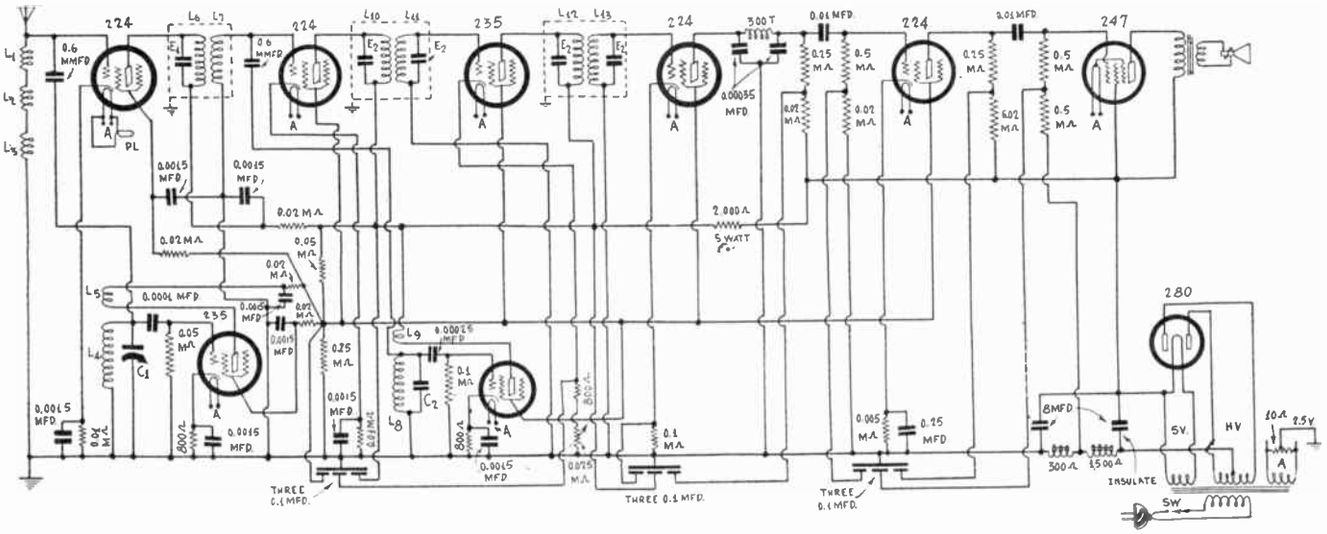

FIG. 1

Readers are entitled to use any esoteric processes at their command to penetrate the mystery purpose of this receiver. Enough clues are given this week to sink a toy battleship.

A MYSTERY circuit naturally arouses suspicion. Is the circuit mysterious also to the inventor. If there is an invention there is no mystery, for in a sense an invention is the solution of a mystery.

However, as between the non-inventor and the invention there may exist considerable mystery, and so the reader is advised that the circuit herewith may comprise a puzzle for him.

Last week the subject was broached and a simple diagram printed, with the threat that a more complicated one would follow. Some clues were given then, but the statement was made that the following week a circuit with more tubes in it would give a better insight into the mystery.

One thing is certain: the new method is included well enough in the diagram published this week, just as well as in the one printed last week, but now the clues are, if anything, more pertinent.

Get This Hot Frequency Tip!

The reader should direct his attention to the radio frequency portion of the circuit. Audio and rectifier are only "necessary evils." There are only virtues in the preceding portions.

The three coils in the antenna circuit—to repeat from last week—are not inductively related and it may be assumed that their natural periods are at different frequencies. The oscillator alone is subjected to variable tuning. The filtration is more intense in one part of the circuit than in the subsequent part, and one may assume with safety that different frequencies are handled in these different circuit sections, and the direction of difference is known by any one familiar with the comparative behavior of tube circuits in respect to frequencies.

The tube at upper left is a so-called first detector or modulator, the one below it is the variably tuned local oscillator, while the grid-leak-condenser circuit in the local oscillator is a frequency stabilizer, without connection with detection.

Obviously, the circuit is a superheterodyne. The modulator is not tuned, and this is an important clue, because under some frequency circumstances it is virtually imperative to tune the modulator, while under other frequency circumstances it is permissible not to tune it. If the modulator were tuned it would have to maintain a fixed frequency difference in respect to the tuned oscillator, and it is just possible that there is so great a diversity between oscillator and modulator frequencies that all frequencies are put into the modulator and the oscillator alone relied on for tuning. This tuning, of course, is incontestable. Given all frequencies of input to the modulator, the oscillator will combine with only one at a time to produce a transmitted output frequency from the modulator, and that is the intermediate frequency.

Take the 224 tube at upper left. This is a modulator or first detector, it was stated. But right next to it, with only a transformer between, is another 224 tube, and its bias is of the same value, in fact all voltages are substantially the same as in the first 224 tube. Therefore the second one also is a modulator, say, a second detector, and there must be little amplification. Therefore not for gain is the transfer made. If not for gain, then for what, in this selfish world?

Then we come to what is obviously an amplifier—a 235 tube—and again we strike a detector. Let us say it is the third detector. But hold on! There's another local oscillator, and it seems that it is tuned to a fixed frequency. Hence the situation developed by the first two tubes—the first detector and the variably tuned local oscillator—is duplicated by the second detector and the second local oscillator, which second oscillator is not variably tuned. There has been some frequency changing again.

Here we have a superheterodyne that must do things that other circuits, even other supers, fail to do.

In attempting to solve the problem, disregard the formal appearance of the diagram whereby it seems not to depart from the usual routine, but merely to do some extra frequency changing, with two mixers instead of one. Bear in mind the trend in radio receivers, the comparison of public interest to-day with what it was only a year or so ago, in regard to distances and frequencies desired to be received, and remember that always new thrills are being sought in radio. Then you may come upon the solution quite naturally, disclosing a method of appeasing the greater demands in a manner most convenient to the user. All other systems appease that demand less conveniently.

Not a Joke—Unless on Us

The circuit is not a joke—J. E. Anderson and I regard it with uncommon seriousness—and when readers are asked to send in their solutions, it is only for the purpose of stimulating their mental processes, of taxing their radio knowledge and ingenuity. Even in case of failure correctly to solve the riddle, a desire for deeper knowledge of radio is prompted, so that mysteries such as these will be easily penetrable. So please write a letter, giving your solution, and if modesty or misgivings require that your name be omitted from published letters, ask for such omission. Otherwise your name will be used.

Besides, it's lots of fun, from this end, at least. We wouldn't care so much about readers sending in their own riddle circuits for us to solve. Readers do much better with that work, because they are numerous, and editors are only a handful. The odds are too great, numerically. They may be even too great technically. The world is full of ignorance and we have our share.

In parting, may I suggest that it is well to consider a condenser and dial that afford 360 degree rotation, when studying the variably tuned oscillator.

Portable Public Address

Amplifier Designed for Automobile Use

By Broderick Evans

THERE are many uses for a small audio frequency amplifier, in radio reception, home talkies, phonograph reproduction, advertising, and public address systems. With the coming election, particularly, there is need for a small portable amplifier that can be carried in an automobile as an aid in political campaigning. Many service men have an opportunity of making extra money by this means if they are ready with a suitable amplifier.

We have in Fig. 1 the diagram of a four tube amplifier utilizing the automotive type tubes. The first is a 239, the second a 237, and the two in the output stage 238. This amplifier has a high gain and the output volume, assuming a good dynamic speaker, is ample for the purpose. While it is not sufficient to reach large outdoor assemblies, it is large enough for most indoor assemblies and for small outdoor gatherings, particularly such as would gather around a political speaker. Or, it is sufficient to reach everybody within a block, even through considerable street noise.

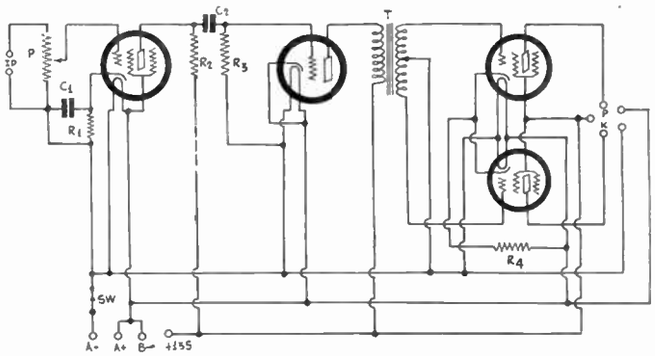

FIG. 1

A three-stage, four-tube audio frequency amplifier suitable for use in an automobile in connection with addressing small assemblies.

Controlling Volume

Obviously, it is necessary to have a good volume control on an amplifier of this type, for the required output is not the same under all circumstances, and the input will not be the same for all applications. Hence we have put in a 100,000 ohm potentiometer in the grid circuit of the first tube, by means of which we can vary the input signal voltage from zero up to the maximum available. In case the potentiometer resistance has a special taper, and this is recommended, the end with the slow change of resistance should be connected on the ground side of the circuit.

The coupling between the first and the second tubes is by resistance and capacity. A suitable value of the plate resistance R2 is 250,000 ohms, and a suitable value of the grid leak R3 is one megohm. The stopping condenser C2 may have any value from 0.01 mfd. up, but it is hardly necessary to go beyond one microfarad. Where voice and music only are to be amplified it is not necessary to go beyond 0.1 mfd.

It will be noticed that the screen of the first tube is connected to the positive end of the heater circuit. This makes the screen voltage something less than 6 volts. If the drop in R1 is 1.5 volts and the voltage of the storage battery is 6.3 volts, the screen voltage is 4.8 volts.

Reason for Low Screen Voltage

This low screen voltage is used in order to insure that at no time will the screen voltage be greater than the effective voltage on the plate of the tube, and thus to make certain there will be no wave form distortion in the first tube. The low screen voltage also helps to stabilize the amplifier. While the amplification will be less with the low screen voltage, no useful gain will accrue if the amplification is accompanied by wave form distortion, which is inevitable when the effective plate voltage is less than the screen voltage.

We have assumed that the drop in R1 is 1.5 volts, but it is not necessary to have just this bias. It may be less or greater, provided that it does not deviate much from this value. The plate current in the tube will not be more than 0.5 milliampere. Hence if we make the bias resistance 3,000 ohms, we will get a voltage of 1.5 volts on the grid. Any normal variation in the plate current will not affect the bias appreciably.

The condenser C1 across the bias resistance should not be smaller than one microfarad, and for ordinary voice and music it is not necessary to make it any higher.

Connection of Intermediate Tube

The intermediate amplifier is a 237, which operates well on a bias of 6.3 volts. This is obtained by connecting grid return to the negative end of the filament circuit and the cathode to the positive end. It is assumed that the applied plate voltage is 135 volts on this tube, as well as on all the others.

In the output stage we have two 238 power pentode tubes, on the screens and plates of which the voltage is 135 volts. The bias on these tubes is partly obtained from the storage battery and partly from the bias resistance R4. This should have a resistance of 600 ohms.

A dynamic speaker of the automobile type should be used, that is, one that requires a field voltage of 6 volts. This speaker may be obtained with a push-pull output transformer built in, and the connections to this speaker should be as indicated by the five terminals at the right of the power stage. These represent a UY socket. A push-pull input transformer T is needed.

Connection to Car

The circuit has been wired on the basis that the negative of the car battery is connected to the car chassis. About half of the cars have the positive grounded. In such cases the chassis of the set should be insulated from the chassis of the car. In view of the fact that no tuner is associated with the circuit there is no difficulty about the grounding, since it is always an easy matter to prevent a short circuit.

The amplifier may be assembled either on a metal or an insulator sub-panel, and for temporary work a wooden baseboard is just as good as any other.

When the amplifier is used in a car for addressing or entertaining assemblies, the input will be obtained either from a phonograph or a microphone. In either case the output of this device is impressed on the two input terminals marked IP in the drawing. In the pick-up unit there is a volume control which can be used in addition to the one built into the amplifier. As a rule, the output of a good pick-up unit is so great that both are desirable even if not absolutely necessary. The output of the microphone is usually less and can be handled well enough with the potentiometer.

It is assumed that the B supply employed is in good condition and for that reason no by-pass condensers are shown across the plate battery. If the battery is allowed to become exhausted to a considerable extent the internal resistance of it will give rise to distortion . Hence if this occurs after a period of use, a temporary cure is to put a large condenser, say 8 mfd., across the battery. This condenser will not make the battery last indefinitely, however, and as soon as the quality becomes poor, a new battery should be put in.

[*This circuit and its uses were suggested by H. H. Tipton, Brookfield, Ill.*—EDITOR.]

LIST OF PARTS

P—One 100,000 ohm potentiometer, preferably tapered at ground end.
R1—One 3,000 ohm resistance.
R2—One 250,000 ohm resistance.
R3—One one megohm grid leak.
R4—One 600 ohm resistance.
C1—One one microfarad by-pass condenser, or larger.
C2—One 0.01 mfd. condenser, or larger.
T—One push-pull input transformer.
Five UY sockets.
One 6-volt field dynamic speaker.
Six binding posts.
Three grid clips.

Automatic Volume Control Excell But Extra Amplifier

By E. Bun

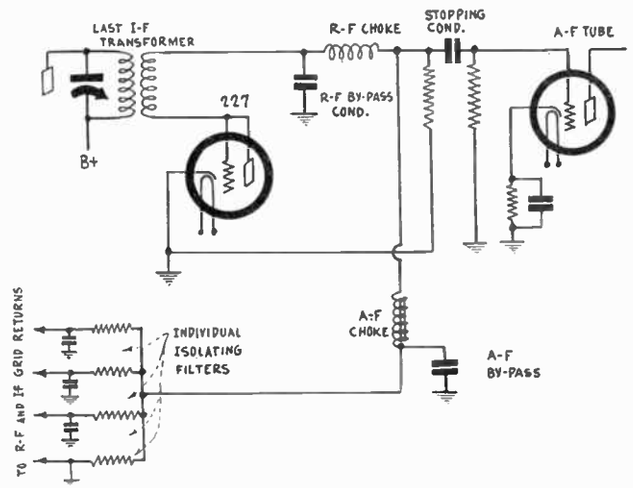

FIG. 1
A combined diode detector and automatic volume control circuit.

SINCE the highly sensitive superheterodyne circuit has come into more or less general use, the interest of the designer has been turned toward automatic and semi-automatic volume controls. The high gain in these receivers, combined with their ability to reach out right through local stations, has caused many more persons to listen to DX programs, and unless the volume control is continually adjusted simultaneously with the tuning dial, each local station as it is passed when tuning for distance blasts into the speaker with terrific force.

An automatic volume control, properly operating, should make possible the changing of the dial from the most distant station it is possible for the receiver to get with adequate volume, to the strongest local without touching the volume control, and without audible difference in volume. Once the control is adjusted for the intended volume level any station can be tuned in with the tuning dial at about the same volume.

Although the principle involved is basically the same in all cases, there are a great many methods of accomplishing the result, and there are two major schools of thought as to the correct placing of the volume leveller in the circuit.

Two Methods for A-V-C

Essentially, the operation of an automatic volume control is simple. The circuit is so arranged that when a strong signal is received the bias on the amplifier tubes is increased, and amplification accordingly is reduced. The stronger the signal, the greater the bias applied on the r-f tubes, and the less the amplification. Of course, as the bias increases and the amplification drops, the signal strength drops also, and a balance is reached. The point of this balance governs the control, and can either be fixed, or varied as the manual control of the output level.

Two methods offer themselves for the accomplishment of this purpose. Either a relay tube, operated by the signal and controlling the grids of the amplifier tube by its plate voltage variation, or, the radio frequency current itself may be rectified and passed through a resistor, the voltage drop thus generated being used as bias. In either case the bias will vary with the signal.

The latter method is extremely simple. It is merely necessary to connect a tube of the —27 variety as a rectifier, using resistance coupling to the audio system, and to utilize the drop across the coupling resistor as bias for the amplifier tubes. The bias must then be directly proportional to the signal, and further, no distortion will enter the circuit through such a detector, since, being purely a rectifier, the output wave form must be exactly the same as the modulation present in the carrier.

Loss Must Be Compensated

A tube so used, however, instead of representing gain in signal strength, shows a loss. The transformer secondary represents an impedance of about 2,500 ohms, the tube about the same, and the coupling resistor at least 10,000 ohms, all of which are in the audio circuit. The voltage at audio frequencies, of course, divides according to the impedance of the various portions of the circuit, and the voltage applied to the grid of the audio tube or tubes also represents the audio voltage drop across the same resistor.

This system, already stated to be simple in theory, and productive of distortionless reproduction, has two great drawbacks. One is the already mentioned loss encountered, which in a given instance was of the order of 30 db. The other is the fact that rather careful filtration of the three components of the signal is necessary for best results. The r-f component must be bypassed to ground, d-c. filtered clean of either audio or r-f, and fed back as bias, and the a-f portion directed to the grid of the tube. Even the traffic cop at Broadway and Seventh Avenue would have a tough time keeping all these in their proper paths.

Vacuum Tube Voltmeter Hookup

The loss has already been mentioned. This loss, unfortunately, affects the selectivity as well as the sensitivity. The diode detector utilizes actual power from the secondary of the last coil, or r-f transformer. Since the selectivity of a tuned circuit is dependent upon freedom from losses, the abstraction of power for the detector, instead of the use of the voltage only, without power, as in the detector of the usual type, seriously affects the selectivity, and when taken in addition to the fact that the stage loses instead of amplifying, it becomes evident that an additional r-f or i-f stage is necessary to make up for the loss in the detector. The addition of this stage adds considerable complication. With each increase in the number of amplifying stages there is more trouble from oscillation, more filtering required, more trouble in stabilizing, and so on.

When using the other system, with a separate tube, the additional tube is connected as a vacuum tube voltmeter, and so inserted in the circuit that the voltage drop developed across its plate circuit is between the grid returns of the amplifier tube and ground. A voltage divider totalling a 100-volt drop is placed between the negative end of the power pack and ground. A tap is taken off at a point about seventy-five volts negative with reference to ground, and this is connected to the cathode of the control tube through a hum filter, consisting of a resistor and bypass condenser to ground. A potentiometer is placed between the cathode and the negative end of the voltage divider, and the grid of the control tube is connected to the movable arm, also through a hum filter. As the arm of the potentiometer is moved towards the cathode, the bias on the control tube is reduced, more plate current flows in this tube, and more voltage is developed across the plate resistor due to this current. This places more bias on the amplifier tubes.

Introducing Automatic Feature

When the arm of the potentiometer is moved away from the cathode, more bias is placed on the grid of the control tube. As this bias increases, the plate current of the control tube drops, finally reaching zero at twenty volts or so bias. With no plate current flowing in the control tube, no voltage drop is developed across the plate resistor, and no bias is applied to the amplifier tubes.

In other words, with the potentiometer set to put a high bias on

Rider's Magazine, "Se

The first issue (February) of "Service," a monthly digest of radio and allied maintenance, published by John F. Rider Publications, shows a fundamentally sound basis of appeal to service men, for whom alone the magazine is printed.

The magazine, in its present form, is the outgrowth of a publication Mr. Rider has been mailing to subscribers, but because of the greater width of its scope may be regarded, in a sense, as a new magazine.

The issue consists principally of original matter intended to simplify and clarify the work of the service man in the radio and refrigeration fields, but also includes a digest of service articles printed in other radio publications and index.

Mr. Rider's association with service dates back quite a few years, and his works on the subject are familiar to virtually all service men. His contacts with manufacturers, which enable him to get first-hand information early, grew out of his origin of the service man's manual, and he has gathered together all his assets of important connections, besides a competent editorial staff, to make possible the monthly production of "Service" on a substantial scale.

The first issue of "Service," or its first appearance in its present "suit of clothes," shows a firm grasp of the editorial requirements, as well as of the technical necessities, and promises that the magazine will be of growing importance to its specialized class of readers. Some of the editorial tailoring

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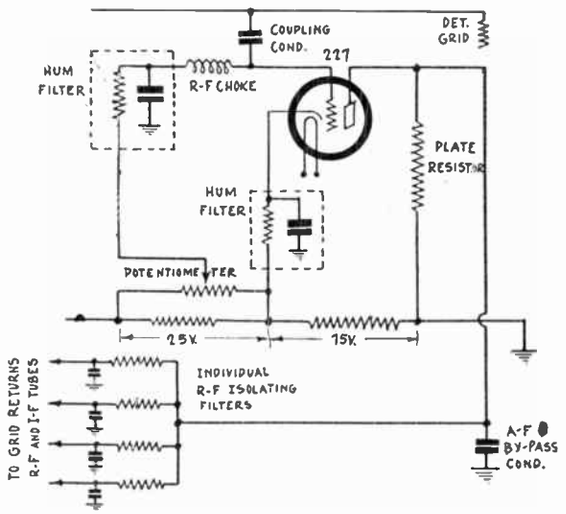


FIG. 2
In this circuit the 27 type tube is used only for automatic volume control.

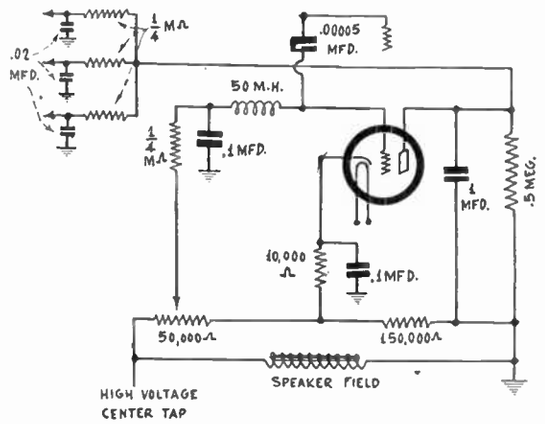


FIG. 3
In this automatic volume control voltage drop across the speaker field is utilized to actuate the automatic volume control tube.

the control tube, the bias on the amplifier tubes drops to or near zero, and the volume from the set is maximum. With the potentiometer set to zero bias on the control tube, there is a high bias on the amplifier tubes, and the volume on the set is very low or zero.

Thus far, the control tube as described has contained no automatic feature.

Position of R-F Choke

If a radio frequency choke is placed between the grid of the control tube and the hum filter, and the grid of the control tube is coupled by a small condenser to the grid of the detector (second detector if a super), any voltage developed by the incoming signal at the grid of the detector will also be developed at the grid of the control tube, in addition to, but opposing, the bias voltage reaching the grid of the control tube from the potentiometer. This signal voltage decreases the effective voltage biasing this grid, and allows more plate current to flow, just as if the potentiometer arm had been moved towards the cathode end. The resulting increase of plate current means a greater voltage drop across the plate resistor, and a higher bias on the amplifier tubes, reducing the amplification in the set.

The stronger the signal, reaching the grid, the less amplification will be developed in the amplifying tubes. In other words, the signal itself turns the volume control up or down in direct proportion to the signal strength.

Convenient Use of Speaker Field

In a receiver using the speaker field in the negative lead, the voltage drop across the field winding is very convenient for a voltage source for the automatic volume control tube. Fig. 3 gives a suggested circuit for such use, with values which have been found satisfactory.

With the potentiometer set at maximum volume (towards the cathode) the plate current of the tube will be about 0.1 milliampere, giving a bias voltage across the 0.5 mag. resistor of 50 volts. At the opposite setting the plate current will be immeasurably small, and the bias developed will be practically zero.

The usual resistor of a few hundred ohms in the cathode leads of the —35 or —51 amplifier tubes will secure the regular minimum bias of 3 volts for these tubes. A small milliammeter, 0-10 ma scale, in the plate circuit of one of the amplifier tubes will serve as a tuning meter. With the control at maximum, and no signal tuned in, this will read about 7. A strong local signal will cause it to drop to 1 or 2. Weaker signals will cause smaller drops.

There are many variations possible in this circuit, but if any hookup is carefully analyzed, it will be found that it reduces to the basic circuits, either Fig. 1 or Fig. 2.

The only trouble likely to be encountered by the home builder in adding the volume control is a tendency towards either motorboating or a lag in time between adjustment of the control knob and the change in volume. Either is correctible by experimenting with the size of the various filter and bypass condensers.

rvice," Fills Need

difficulties of putting on the "new suit of clothes" are apparent, but these will be ironed out in due course in proper tailoring fashion, as the mechanics of production work more smoothly.

One of the feature articles is "Servicing the Loftin-White Amplifier," and therein it is pointed out that this type of amplifier does not lend itself to testing with the usual equipment a service man has, and that the difficulty has led some manufacturers to discard this type of amplifier for more conventional coupling systems. The main data in the article concern actual information on servicing such an amplifier.

Under the group head of "General Data" briefly stated facts are collated on pentodes, interference, bias, image trouble in superheterodynes, and other troubles, with suggested solutions. Four full pages of the total of 16 are devoted to "General Data."

A diagram of the new RCA short-wave converter, with text, is printed, as well as other information on short waves. Refrigeration and public address are given a page each, three pages are devoted to "Abstracts," which are the excerpts from other magazines with editorial comment, while auto radio gets a page. The inside back cover is an engraving of tube socket connections.

The magazine fills a need and Mr. Rider is one of the best qualified men to guide its technical excellence to outstanding success.

A Television Super

Wide Band Width In Intermediate Channel

By C. K. G. Warren

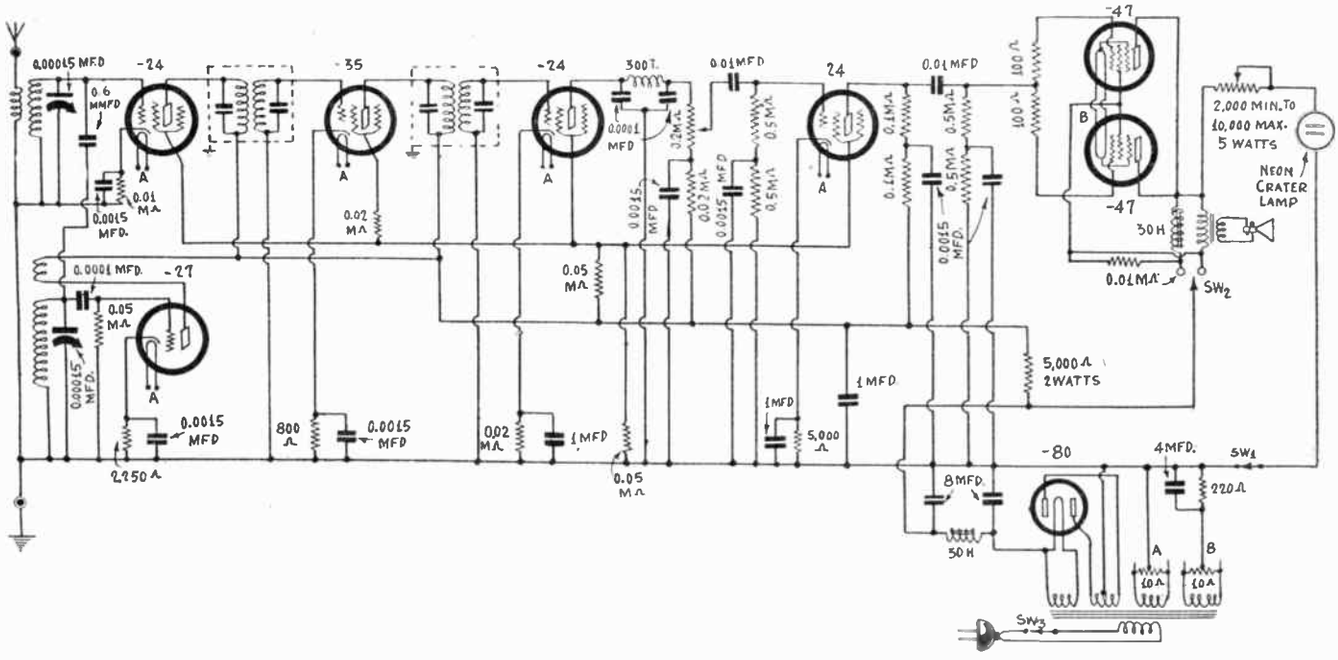


FIG. 1

A simple superheterodyne for tuning in television frequencies in the continental band. A high intermediate frequency is used.

ALTHOUGH in the beginning superheterodynes were sidetracked for television purposes, today there is a large number of such sets in use, and the performance is excellent. One serious requirement is to get away from the selectivity that a superheterodyne may readily produce, but this is no difficulty, especially if the intermediate frequency is high, when it is better that there should be two tuning controls, one for modulator, the other for oscillator.

A dash line is shown enclosing the intermediate frequency coils. Since the lowest television frequency is 1,600 kc., the intermediate frequency may be a little lower, say, 1,550 kc. or 1,570 kc., and the intermediate transformers made up at home. Using 1-inch diameter tubing, 50 turns of No. 28 enamel could be wound, and, with insulating fabric of slight thickness between, 50 turns put over the other for the companion winding. This affords a 1-to-1 transformer, tight coupling, since one winding is closely over the other, and broad tuning. When time comes to tune the intermediate coils, with equalizers, the plate condensers are not connected to the plates of the two tubes, but the grid condensers are adjusted. Then the grid connections of these two condensers are removed and the plate condensers connected to plates and tuned, whereupon th grid condenser restoration is made, and the circuit left thus. The result is a so-called flat-top tuning characteristic—enough band width for the television carriers intended to be tuned in.

Oddly Placed Volume Control

The circuit has, as said, separately tuned modulator and oscillators. It has also a separate tube for each of these, one stage of intermediate frequency amplification, and two stages of audio, the last stage consisting of two pentode tubes in parallel. The resultant impedance of the output is about the same as that of a single 245, so the output transformer for the speaker should be of the 245, not 247, type.

The volume control is in a rather odd place, but advisedly so, because the frequencies ahead of it are high, the control in any earlier position would alter the frequency, that is, would have a tuning effect, and this would be true even were it a cathode resistor. The d-c. voltage changes introduced by the control would alter the frequency. In fact, television sets have been tuned (t-r-f type) with a cathode resistor for bias adjustment, so that one station could be tuned in or out simply by moving the volume control.

Another factor is that the circuit should be stable, and once stabilized, which is not difficult with the present circuit, there would be no need of a check on r-f. oscillation, which additional purpose nearly all television volume controls serve. The better method is to get rid of the oscillation as a matter of circuit perfection. Then the temptation for hopping up the signal with regeneration, though not gone perhaps, is nevertheless unexecutable. There are limits to all receivers, and introducing intense regeneration does no good, because the resultant "picture" may be a pattern of zig-zag lines in reality, more cubistic than illuminating.

Two Little Resistors

The pentode grid circuit shows two 100-ohm resistors. I do not know from experience why they are there, but I was in a television receiver factory the other day and was told that they were killers of parasitic oscillation. I saw a receiver operated with them in and with them out, and on occasion the inclusion of the two resistors was consistent with improved results.

The output is so arranged that a 10,000 ohm resistor is in series with the maximum B voltage for application to the suppressor grid (or screen grid) of the pentode tube when television is to be put on to the lamp. This is an extreme precaution in the present circuit and its inclusion is merely optional.

The two plates of the output tubes are tied together, and so are one side of the primary of the output transformer and one side of a 30-henry choke. The other end of the choke goes to one side of the 10,000-ohm resistor, the other side of which goes to the common screens of the pentode. This common screen also is connected to the remaining terminal of the output transformer's primary. A single pole double-throw switch is used, with index to B plus maximum, to pick up either the end of the choke or the end of the primary. The choke is used for television, whereupon another switch is thrown to closed position (SW-1), and the primary is for sound, whereupon SW-1 is open. SW-1 will be seen in the lower right-hand corner of Fig. 1.

When the speaker is used the choke and the 100,000-ohm resistor are in series, and the combination in parallel with the primary. For television input to the neon lamp there is a similar parallel situation, unless the 10,000-ohm resistor is omitted.

Across the intermediates are 20-100 mmfd. equalizers.

The coils for the intermediate amplifier have been described. They must be shielded and the shield grounded. The modulator coil may consist of 30 turns of No. 18 wire for secondary, 12 turns of that wire for primary, wound adjoining the secondary, 1/16 inch away, while the oscillator has 20 turns of No. 8 enamel, for secondary, with 15 turns of No. 28 enamel or similar size wire for the tickler, wound next to it, 1/16 inch a separation. Diameters are 1 inch.

A Seven-Tube Superheterodyne Using 400 kc Intermediate; Fine Filtering Aids Suppression of Image Interference

By J. E. Anderson

EVER since we published the eight tube, 400 kc, automobile superheterodyne a short time ago we have had requests for an a-c operated receiver along the same line. If by "along the same line" is meant a superheterodyne with a 400 kc intermediate it is easy to meet these requests, but if it is meant to use the same type tubes, the same number, and the same kind of audio circuit, there are too many complications to meet the requests. There is the question of getting the proper power transformer, and also the question of getting rid of hum, which would be serious in an audio amplifier of the type used in the auto set. That is, it would be serious unless we built a special power supply with extremely good filtering.

Right now the seven tube midget superheterodyne is popular, and all the parts for it are available so that there will be no difficulty in assembling the necessary components. But this seven tube super would only have six amplifier and detector tubes, whereas the automobile set had eight. The seventh tube would be used for B supply. Fortunately, larger tubes are somewhat better amplifiers and the voltage that would be used in the a-c set would be higher so that there would be no essential difference in the sensitivities of the two receivers. Moreover, the maximum undistorted output of the 247 tube, which would be used, is greater than that of the two 238 tubes in push-pull.

Along the Same Line

Hence we present a seven tube, a-c operated, 400 kc, superheterodyne which conforms as nearly as practical to the circuit used in the eight tube automobile set.

All the parts of this circuit are now available, because the special parts peculiar to the 400 kc super are just as applicable to 2.5 volt tubes as to automobile tubes. They were designed, not for the automobile receiver, but for the 400 kc superheterodyne.

The circuit diagrammed in Fig 1 is nearly the same as the circuit in any midget superheterodyne. It is only necessary to make the appropriate substitutions of coils. However, one of the features of the automobile superheterodyne was the low screen voltage on the two detectors. This is a feature which we can carry over and in that manner move "along the same line" a little more closely. Unfortunately, we cannot do it in the same way, but we can do it in an equivalent way. The results will be the same, or even better.

We are accustomed to think of the superheterodyne as a receiver in which both the selectivity and the sensitivity are high. Of course, these characteristics are relative and we cannot avoid the fact that if we increase the sensitivity we generally decrease selectivity, and vice versa, unless we get gain by regeneration. The superheterodyne is subject to this condition as well as any other type of receiver. In the automobile set we had to use large primaries on the r-f coils because it was necessary to build up the sensitivity to offset the very low pick-up in a car. In a set designed for a-c operation, which will be used in one place once it has been installed, we can use much smaller primaries on the r-f coils because we can build up the signal by using a regular antenna. Using smaller primaries we not only decrease the amplification but we also increase the selectivity. This increase is needed due to the effect of the larger antenna. In the end we come out about equally well in either case.

Choice of Coils

Coils are available on one inch forms, encased in aluminum shields, that tune with 350 mmfd. condensers. The secondaries of these coils contain 127 turns, which makes the inductance just right to cover the broadcast band. If we want to emphasize selectivity, which we do when we intend to use a regular outside antenna, the primaries should contain about 25 turns. However, if we intend to use a fairly good indoor antenna we might double the number of primaries turns, and if we want to receive with only a short length of wire, we might go up to 75 turns, or even 90 turns. The choice should be based on the nature of the antenna. Of course, if we want to get distant stations regardless of selectivity, we can use a large primary even if the antenna is long. T1 and T2 are identical.

T3, the oscillator coil does not offer a wide choice. The number of turns on the tuned winding is fixed by several conditions, among which are the intermediate frequency of 400 kc, the capacity of the tuning condenser C3, and the band coverage. Since we have fixed all these conditions we have also fixed the coil as far as the tuned winding is concerned. The coil especially designed for the 400 kc broadcast superheterodyne has an inductance of 145 microhenries, and the coils available have been carefully adjusted to this inductance. The tickler is not important but it contains 25 turns and this number works out satisfactorily. The pick-up winding, which is connected in the cathode lead, contains 10 turns.

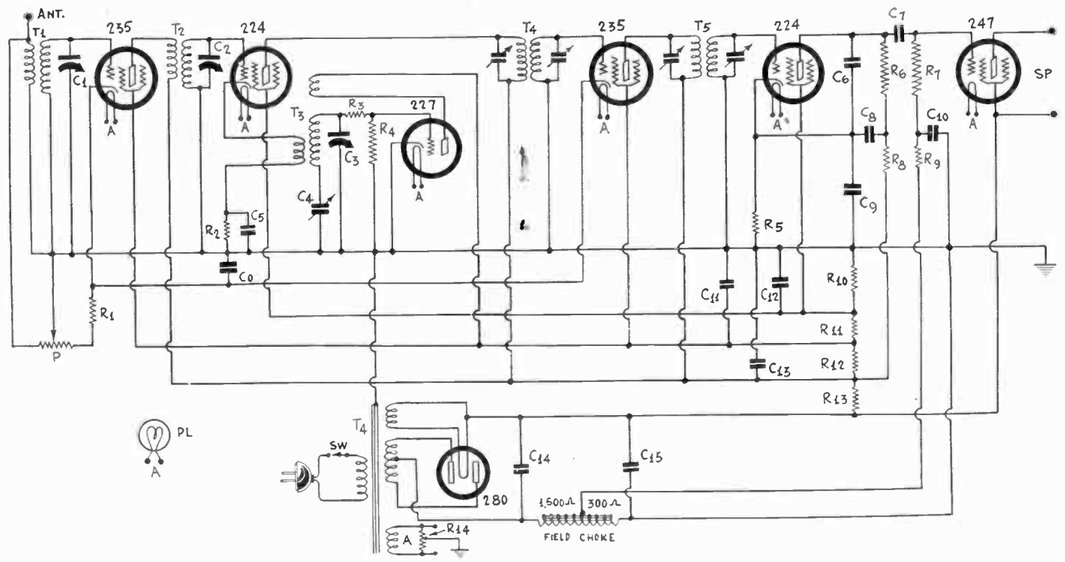


FIG. 1.
The circuit of a 400 kc., seven tube midget superheterodyne.

The Padding

The padding of the oscillator to track with the r-f tuners is a simple operation when the proper coils and condensers have been obtained. First, it is necessary to calibrate with r-f tuner with the oscillator coil shorted. The grid clip normally on the mixer tube is moved over to the cap of the detector, from which the clip has been removed. A low wave station, as near to 1,500 kc as practical, is first located and the trimmer condensers on C1 and C2 adjusted for strongest signal. This should be done so that the gang condenser dial reads about 5 if the signal is 1,500 kc, and slightly more if the signal is slightly lower. Next tune in a station of about 570 kc. The trimmers should not be touched. All that is necessary is to find where the station comes in on the r-f tuner. This done, restore the oscillator to working condition and also connect the grid clips as they are supposed to be.

Now set the gang condenser where the low wave station came in and adjust the trimmer on C3 until it comes in loudest. Don't touch the trimmers again, except as will be stated below. Now set the gang condenser on the point where the long wave station came in, and now adjust C4 until it comes in loudest. The circuit is now adjusted. It is well, however, to go back to the low wave station and test the accuracy of the trimming of the oscillator alone. This test will not be needed if C4 had approximately the right value before the adjustment was begun.

LIST OF PARTS

Coils

T1, T2—Two shielded r-f transformers wound for 350 mmfd. condensers.
T3—One special shielded oscillator coil wound 350 mmfd. condenser and 400 kc. intermediate frequency.
T4, T5—Two shielded, 400 kc. intermediate frequency transformers.
T6—One power transformer.

Condensers

C1, C2, C3—One gang of three 350 mmfd. tuning condensers.
C4—One 350-450 mmfd. trimmer condenser.
C6, C5, C9—Three 0.1 mfd. by-pass condensers in one case.
C6—One 0.00025 mfd. by-pass condenser.
C7—One 0.1 mfd. condenser.
C8, C10, C11, C12, C13—Five 0.25 mfd. by-pass condensers.
C14, C15—Two 8 mfd. electrolytic condensers.

Resistors

P—One 10,000 ohm potentiometer, with line switch attached.
R1—One 150 ohm bias resistor.
R2, R5—Two 30,000 ohm resistors.
R3—One 10,000 ohm resistor.
R4—One 100,000 ohm resistor.
R6—One 250,000 ohm resistor.
R7—One one megohm grid leak.
R9—One 100,000 ohm resistor.
R10—One 2,000 ohm resistor.
R11—One 7,000 ohm resistor.
R12—One 4,500 ohm resistor (2 watts or more)
R13—One 3,000 ohm resistor (2 watts or more).
R14—One 30 ohm centertapped resistor.

Other Requirements

Six UY sockets.
One UX socket.
One dynamic speaker with 300-1,500 ohm field.
Four grid clips.
One vernier dial with pilot light attached.
One midget, steel chassis.
Two binding posts, one ground and one antenna.

The tuning of the intermediate frequency selector, which in this case is done to 400 kc, perhaps presents the greatest difficulty, for accurate adjustment requires an auxiliary oscillator generating 400 kc. An oscillator can be connected up quickly and tuned to a frequency that will serve. For example, an oscillator may be made of the same kind of coils that are used in the intemediate tuner and its frequency can be adjusted to 400 kc by beating it against a broadcast station of 800 or 1,200 kc. As soon as the signal of 400 kc has been obtained, its output is coupled loosely to the grid circuit of the first detector or mixer. Then each tuned circuit in the i-f amplifier is adjusted for maximum signal strength.

Accurate tuning of the intermediate frequency selector is of utmost importance if the circuit is to be selective and sensitive. However, it is not absolutely essential that the intermediate frequency be exactly 400 kc. It is only necessary that it be approximately 400 kc., that all the i-f circuits be tuned to the same frequency, and that the oscillator be adjusted for this frequency. If no auxiliary oscillator is available the adjustment of the intermediate amplifiers may be done by first tuning in a station near 1,500 kc. with the trimmers alone until it is as loud as it can be made, and then the intermediate tuners can be adjusted for maximum signal strength. This yields a good intermediate frequency but not necessarily 400 kc. When the i-f has been adjusted in this manner the r-f and oscillator circuits may be adjusted as previously outlined.

In case an r-f oscillator that covers the broadcast band is available the r-f tuner may be calibrated independently. Then the circuit should be tuned to some broadcast station, as indicated by the calibration just obtained and the known frequency of the station. Then the calibrated oscillator should be set so that its frequency is 400 kc. higher than the frequency of the station selected. The beat frequency is now 400 kc. and the i-f tuner can be tuned to it. This offers a method of getting a 400 kc. signal when a signal of known frequency and a calibrated oscillator are available.

The Oscillator

The oscillator circuit in this receiver differs in one detail from the oscillator in the automobile set. The series condenser C4 is put between ground and the coil instead of between the variable condenser and the top of the tuned circuit. The change has two advantages. First, it permits grounding one side of the series condenser and thus makes the adjustment of it easier. Second, it obviates the need for the grid stopping condenser. Any simplification of a circuit that can be effected without sacrificing efficiency is an improvement.

There is also a change in the plate circuit of the detector tube, and this also serves a two-fold purpose. A resistance R8 of 50,000 ohms is connected in the plate return lead and a condenser of 0.1 mfd., C8, is connected between the junction of R8 and R6 and the cathode of the tube. First, this serves to prevent feed-back of the carrier frequency, 400 kc, and thus prevent the squealing resulting from beating of harmonics of the i-f frequency with the oscillator. Second, it serves to suppress hum.

The combination R9 and C10 also serves to suppress hum.

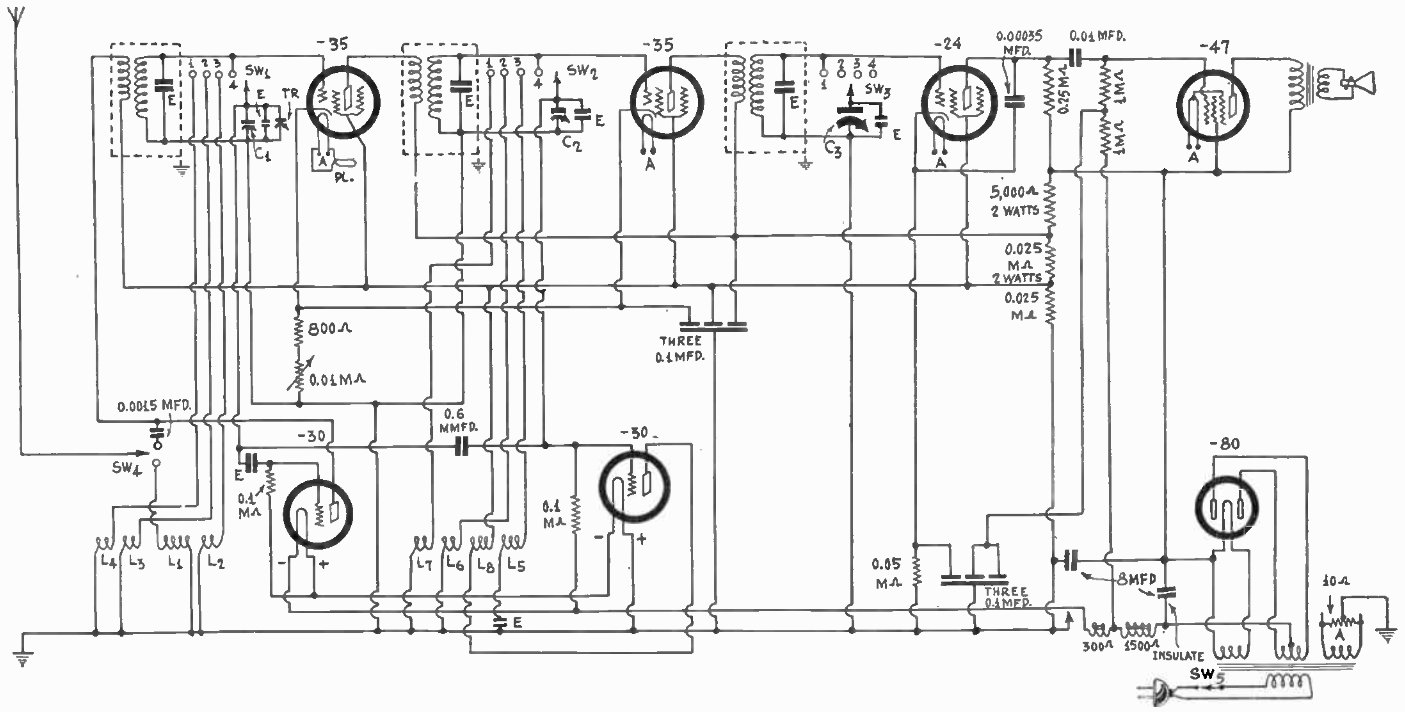
The volume control is a 10,000 ohm potentiometer P which varies simultaneously the bias on the two high frequency amplifiers and the input to the set. This should be tapered and the end of the resistance having the slow change of resistance should be connected to the antenna. The limiting resistance R1 should be of 150 ohms, since this gives a satisfactory minimum bias to the r-f and i-f amplifiers.

The screen voltage on the two detectors, that is, the drop in R10, should be about 20 volts. If we allow a bleeder current of 10 milliamperes we must use 2,000 ohms for R10 to get this voltage. The voltage on the screens of the other tubes and on the plate of the oscillator should be 90 volts. Therefore the drop in R11 should be 70 volts. Now the current flowing to the two detector screens is negligible in comparison with the bleeder current so that we can assume that 10 milliamperes flow in R11. Thus the value of this resistance should be 7,000 ohms.

The drop in R12 should be 90 volts if the plates of the tubes, excepting the last, should be 180 volts. The current in R12 will be 20 milliamperes so that the value of this resistance should be 4,500 ohms. The wattage in this resistance will be 1.8 watts and the resistance chosen should stand more than this. The drop in R13 is also about 90 volts, and the current through it will be about 30 milliamperes. Hence R13 should be 3,000 ohms. A three watt resistor will do.

Common Primary, Separate Seco For Wide Frequ

By Jack



The idea of separate windings for tuned circuits, but a common primary (or tickler) is represented at lower left of this diagram.

AMONG the various methods of avoiding the use of plug-in coils, the shorted-tap method, while it does work, is perhaps as far from perfection as any. The unused turns are shorted out.

The next lowest position in point of performance may be allotted to the tapped coil where the unused turns are dead-ended, although depending on whether more turns are used than unused, the two examples just cited may exchange their positions of dubious honor.

Next we come, in the ascending scale of electrical values, to the tapped coil used in such manner that the total coil is always in the circuit, but the tuning condenser stator is moved from the grid itself, which then includes the entire coil in the tuning, to taps farther down, whereby a smaller part of the winding is tuned. The situation then is that of the secondary (if it be a secondary) acting as an auto-transformer, wherein the tuned part is the primary and the entirety is the secondary.

Use of Separate Windings

The previous examples are of continuous windings with taps. A better result is obtained if separate windings are used, even if they are on the same form. Thus, a primary would be located in one position, a secondary on one side of it, all other secondaries on the other side.

It will be noticed that with the tapped coil method, where there must be a primary, too, or its equivalent, despite wide differences in frequencies the medium for coupling is not changed. There is no such change either relatively or absolutely. The distance between coils isn't changed. Of course there is an altered impedance of the primary to the different frequencies. This impedance change may be, and usually is, in the wrong direction, a great many turns of primary for a very high frequency. and no alteration of the physical separation between primary and secondary, i. e., coupling.

Now, the mutual impedance is important, and if it can be changed to respect the requirements of the different frequency bands, so much the better. And that change takes place automatically, if the primary is located as stated, one secondary on one side, the other secondaries in order on the other side. Let us take an example.

Winding Information

Assume a 1 inch diameter, 0.00035 mfd. tuning condensers. The broadcast band could be covered with 127 turns of No. 32 enamel wire. Leave some small space, say, 1/16 inch, and wind the primary, say, 15 turns of any convenient size of wire. Now when we put on the next secondary, on the other side of the primary. we can use any amount of physical separation we desire. Suppose we make it ⅛ inch. Then we may put on 27 turns of No. 28 enamel wire. The next winding may be put on right adjoining the former, and consist of 10 turns of No. 22 enamel wire, the last winding, again closely adjoining, of 4 turns of No. 18 enamel. We have done one extra thing. We have increased the size of the wire for the higher frequencies, in fact, the size of wire on each secondary is different, to wit, No. 32, No. 28, No. 22 and No. 18.

If oscillation is needed (and usually it is) one may obtain it more readily if the wire diameter is as large as specified for the last two or smallest windings.

Our total coil will be a little bit long—about 2 inch axial length

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Please enroll me as a member of Radio World's Short Wave Club. This does not commit me to any obligation whatever.

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Conversion Table, Kilocycles to Meters, or Meters to Kilocycles

kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc	kc or m	m or kc
10	29,982	1,010	296.9	2,010	149.2	3,010	99.61	4,010	74.77	5,010	59.84	6,010	49.89	7,010	42.77	8,010	37.43	9,010	33.28
20	14,991	1,020	293.9	2,020	148.4	3,020	99.28	4,020	74.58	5,020	59.73	6,020	49.80	7,020	42.71	8,020	37.38	9,020	33.24
30	9,994	1,030	291.1	2,030	147.7	3,030	98.95	4,030	74.40	5,030	59.61	6,030	49.72	7,030	42.65	8,030	37.34	9,030	33.20
40	7,496	1,040	288.3	2,040	147.0	3,040	98.62	4,040	74.21	5,040	59.49	6,040	49.64	7,040	42.59	8,040	37.29	9,040	33.17
50	5,996	1,050	285.5	2,050	146.3	3,050	98.30	4,050	74.03	5,050	59.37	6,050	49.56	7,050	42.53	8,050	37.24	9,050	33.13
60	4,997	1,060	282.8	2,060	145.5	3,060	97.98	4,060	73.85	5,060	59.25	6,060	49.48	7,060	42.47	8,060	37.20	9,060	33.09
70	4,283	1,070	280.2	2,070	144.8	3,070	97.66	4,070	73.67	5,070	59.13	6,070	49.39	7,070	42.41	8,070	37.15	9,070	33.06
80	3,748	1,080	277.6	2,080	144.1	3,080	97.34	4,080	73.49	5,080	59.02	6,080	49.31	7,080	42.35	8,080	37.11	9,080	33.02
90	3,331	1,090	275.1	2,090	143.5	3,090	97.03	4,090	73.31	5,090	58.90	6,090	49.23	7,090	42.29	8,090	37.06	9,090	32.98
100	2,998	1,100	272.6	2,100	142.8	3,100	96.72	4,100	73.13	5,100	58.79	6,100	49.15	7,100	42.23	8,100	37.01	9,100	32.95
110	2,726	1,110	270.1	2,110	142.1	3,110	96.41	4,110	72.95	5,110	58.67	6,110	49.07	7,110	42.17	8,110	36.97	9,110	32.91
120	2,499	1,120	267.7	2,120	141.4	3,120	96.10	4,120	72.77	5,120	58.56	6,120	48.99	7,120	42.11	8,120	36.92	9,120	32.88
130	2,306	1,130	265.3	2,130	140.8	3,130	95.79	4,130	72.60	5,130	58.44	6,130	48.91	7,130	42.05	8,130	36.88	9,130	32.84
140	2,142	1,140	263.0	2,140	140.1	3,140	95.48	4,140	72.42	5,140	58.33	6,140	48.83	7,140	41.99	8,140	36.83	9,140	32.80
150	1,999	1,150	260.7	2,150	139.5	3,150	95.18	4,150	72.25	5,150	58.22	6,150	48.75	7,150	41.93	8,150	36.79	9,150	32.77
160	1,874	1,160	258.5	2,160	138.8	3,160	94.88	4,160	72.07	5,160	58.10	6,160	48.67	7,160	41.87	8,160	36.74	9,160	32.73
170	1,764	1,170	256.3	2,170	138.1	3,170	94.58	4,170	71.90	5,170	57.99	6,170	48.59	7,170	41.82	8,170	36.70	9,170	32.70
180	1,666	1,180	254.1	2,180	137.5	3,180	94.28	4,180	71.73	5,180	57.88	6,180	48.51	7,180	41.76	8,180	36.65	9,180	32.66
190	1,578	1,190	252.0	2,190	136.9	3,190	93.99	4,190	71.56	5,190	57.77	6,190	48.44	7,190	41.70	8,190	36.61	9,190	32.62
200	1,499	1,200	249.9	2,200	136.3	3,200	93.69	4,200	71.39	5,200	57.66	6,200	48.36	7,200	41.64	8,200	36.56	9,200	32.59
210	1,428	1,210	247.8	2,210	135.7	3,210	93.40	4,210	71.22	5,210	57.55	6,210	48.28	7,210	41.58	8,210	36.52	9,210	32.55
220	1,363	1,220	245.8	2,220	135.1	3,220	93.11	4,220	71.05	5,220	57.44	6,220	48.20	7,220	41.53	8,220	36.47	9,220	32.52
230	1,304	1,230	243.8	2,230	134.4	3,230	92.82	4,230	70.88	5,230	57.33	6,230	48.13	7,230	41.47	8,230	36.43	9,230	32.48
240	1,249	1,240	241.8	2,240	133.8	3,240	92.54	4,240	70.71	5,240	57.22	6,240	48.05	7,240	41.41	8,240	36.39	9,240	32.45
250	1,199	1,250	239.9	2,250	133.3	3,250	92.25	4,250	70.55	5,250	57.11	6,250	47.97	7,250	41.35	8,250	36.34	9,250	32.41
260	1,153	1,260	238.0	2,260	132.7	3,260	91.97	4,260	70.38	5,260	57.00	6,260	47.89	7,260	41.30	8,260	36.30	9,260	32.38
270	1,110	1,270	236.1	2,270	132.1	3,270	91.69	4,270	70.22	5,270	56.89	6,270	47.82	7,270	41.24	8,270	36.25	9,270	32.34
280	1,071	1,280	234.2	2,280	131.5	3,280	91.41	4,280	70.05	5,280	56.78	6,280	47.74	7,280	41.18	8,280	36.21	9,280	32.31
290	1,034	1,290	232.4	2,290	130.9	3,290	91.13	4,290	69.89	5,290	56.68	6,290	47.67	7,290	41.13	8,290	36.17	9,290	32.27
300	999.4	1,300	230.6	2,300	130.4	3,300	90.86	4,300	69.73	5,300	56.57	6,300	47.59	7,300	41.07	8,300	36.12	9,300	32.24
310	967.2	1,310	228.9	2,310	129.8	3,310	90.58	4,310	69.56	5,310	56.46	6,310	47.52	7,310	41.02	8,310	36.08	9,310	32.20
320	936.9	1,320	227.1	2,320	129.2	3,320	90.31	4,320	69.40	5,320	56.36	6,320	47.44	7,320	40.96	8,320	36.04	9,320	32.17
330	908.6	1,330	225.4	2,330	128.7	3,330	90.04	4,330	69.24	5,330	56.25	6,330	47.36	7,330	40.90	8,330	35.99	9,330	32.14
340	881.8	1,340	223.7	2,340	128.1	3,340	89.77	4,340	69.08	5,340	56.15	6,340	47.29	7,340	40.85	8,340	35.95	9,340	32.10
350	856.6	1,350	222.1	2,350	127.6	3,350	89.50	4,350	68.92	5,350	56.04	6,350	47.22	7,350	40.79	8,350	35.91	9,350	32.07
360	832.8	1,360	220.4	2,360	127.0	3,360	89.23	4,360	68.77	5,360	55.94	6,360	47.14	7,360	40.74	8,360	35.86	9,360	32.03
370	810.3	1,370	218.8	2,370	126.5	3,370	88.97	4,370	68.61	5,370	55.83	6,370	47.07	7,370	40.68	8,370	35.82	9,370	32.00
380	789.0	1,380	217.3	2,380	126.0	3,380	88.70	4,380	68.45	5,380	55.73	6,380	46.99	7,380	40.63	8,380	35.78	9,380	31.96
390	768.8	1,390	215.7	2,390	125.4	3,390	88.44	4,390	68.30	5,390	55.63	6,390	46.92	7,390	40.57	8,390	35.74	9,390	31.93
400	749.6	1,400	214.2	2,400	124.9	3,400	88.18	4,400	68.14	5,400	55.52	6,400	46.85	7,400	40.52	8,400	35.69	9,400	31.90
410	731.3	1,410	212.6	2,410	124.4	3,410	87.92	4,410	67.99	5,410	55.42	6,410	46.77	7,410	40.46	8,410	35.65	9,410	31.86
420	713.9	1,420	211.1	2,420	123.9	3,420	87.67	4,420	67.83	5,420	55.32	6,420	46.70	7,420	40.41	8,420	35.61	9,420	31.83
430	697.3	1,430	209.7	2,430	123.4	3,430	87.41	4,430	67.68	5,430	55.22	6,430	46.63	7,430	40.35	8,430	35.57	9,430	31.79
440	681.4	1,440	208.2	2,440	122.9	3,440	87.16	4,440	67.53	5,440	55.11	6,440	46.56	7,440	40.30	8,440	35.52	9,440	31.76
450	666.3	1,450	206.8	2,450	122.4	3,450	86.90	4,450	67.38	5,450	55.01	6,450	46.48	7,450	40.24	8,450	35.48	9,450	31.73
460	651.8	1,460	205.4	2,460	121.9	3,460	86.65	4,460	67.22	5,460	54.91	6,460	46.41	7,460	40.19	8,460	35.44	9,460	31.69
470	637.9	1,470	204.0	2,470	121.4	3,470	86.40	4,470	67.07	5,470	54.81	6,470	46.34	7,470	40.14	8,470	35.40	9,470	31.66
480	624.6	1,480	202.6	2,480	120.9	3,480	86.16	4,480	66.92	5,480	54.71	6,480	46.27	7,480	40.08	8,480	35.36	9,480	31.63
490	611.9	1,490	201.2	2,490	120.4	3,490	85.91	4,490	66.78	5,490	54.61	6,490	46.20	7,490	40.03	8,490	35.31	9,490	31.59
500	599.6	1,500	199.9	2,500	119.9	3,500	85.66	4,500	66.63	5,500	54.51	6,500	46.13	7,500	39.98	8,500	35.27	9,500	31.56
510	587.9	1,510	198.6	2,510	119.5	3,510	85.42	4,310	66.48	5,510	54.41	6,510	46.06	7,510	39.92	8,510	35.23	9,510	31.53
520	576.6	1,520	197.2	2,520	119.0	3,520	85.18	4,520	66.33	5,520	54.32	6,520	45.98	7,520	39.87	8,520	35.19	9,520	31.49
530	565.7	1,530	196.0	2,530	118.5	3,530	84.94	4,530	66.19	5,530	54.22	6,530	45.91	7,530	39.82	8,530	35.15	9,530	31.46
540	555.2	1,540	194.7	2,540	118.0	3,540	84.70	4,540	66.04	5,540	54.12	6,540	45.84	7,540	39.76	8,540	35.11	9,540	31.43
550	545.1	1,550	193.4	2,550	117.6	3,550	84.46	4,550	65.89	5,550	54.02	6,550	45.77	7,550	39.71	8,550	35.07	9,550	31.39
560	535.4	1,560	192.2	2,560	117.1	3,560	84.22	4,560	65.75	5,560	53.92	6,560	45.70	7,560	39.66	8,560	35.03	9,560	31.36
570	526.0	1,570	191.0	2,570	116.7	3,570	83.98	4,570	65.61	5,570	53.83	6,570	45.63	7,570	39.61	8,570	34.98	9,570	31.33
580	516.9	1,580	189.8	2,580	116.2	3,580	83.75	4,580	65.46	5,580	53.73	6,580	45.57	7,580	39.55	8,580	34.94	9,580	31.30
590	508.2	1,590	188.6	2,590	115.8	3,590	83.52	4,590	65.32	5,590	53.64	6,590	45.50	7,590	39.50	8,590	34.90	9,590	31.26
600	499.7	1,600	187.4	2,600	115.3	3,600	83.28	4,600	65.18	5,600	53.54	6,600	45.43	7,600	39.45	8,600	34.86	9,600	31.23
610	491.5	1,610	186.2	2,610	114.9	3,610	83.05	4,610	65.04	5,610	53.44	6,610	45.36	7,610	39.40	8,610	34.82	9,610	31.20
620	483.6	1,620	185.1	2,620	114.4	3,620	82.82	4,620	64.90	5,620	53.35	6,620	45.29	7,620	39.35	8,620	34.78	9,620	31.17
630	475.9	1,630	183.9	2,630	114.0	3,630	82.60	4,630	64.76	5,630	53.25	6,630	45.22	7,630	39.29	8,630	34.74	9,630	31.13
640	468.5	1,640	182.8	2,640	113.6	3,640	82.37	4,640	64.62	5,640	53.16	6,640	45.15	7,640	39.24	8,640	34.70	9,640	31.10
650	461.3	1,650	181.7	2,650	113.1	3,650	82.14	4,650	64.48	5,650	53.07	6,650	45.09	7,650	39.19	8,650	34.66	9,650	31.07
660	454.3	1,660	180.6	2,660	112.7	3,660	81.92	4,660	64.34	5,660	52.97	6,660	45.02	7,660	39.14	8,660	34.62	9,660	31.04
670	447.5	1,670	179.5	2,670	112.3	3,670	81.70	4,670	64.20	5,670	52.88	6,670	44.95	7,670	39.09	8,670	34.58	9,670	31.01
680	440.9	1,680	178.5	2,680	111.9	3,680	81.47	4,680	64.06	5,680	52.79	6,680	44.88	7,680	39.04	8,680	34.54	9,680	30.97
690	434.5	1,690	177.4	2,690	111.5	3,690	81.25	4,690	63.93	5,690	52.69	6,690	44.82	7,690	38.99	8,690	34.50	9,690	30.94
700	428.3	1,700	176.4	2,700	111.0	3,700	81.03	4,700	63.79	5,700	52.60	6,700	44.75	7,700	38.94	8,700	34.46	9,700	30.91
710	422.3	1,710	175.3	2,710	110.6	3,710	80.81	4,710	63.66	5,710	52.51	6,710	44.68	7,710	38.89	8,710	34.42	9,710	30.88
720	416.4	1,720	174.3	2,720	110.2	3,720	80.60	4,720	63.52	5,720	52.42	6,720	44.62	7,720	38.84	8,720	34.38	9,720	30.85
730	410.7	1,730	173.3	2,730	109.8	3,730	80.38	4,730	63.39	5,730	52.32	6,730	44.55	7,730	38.79	8,730	34.34	9,730	30.81
740	405.2	1,740	172.3	2,740	109.4	3,740	80.17	4,740	63.25	5,740	52.23	6,740	44.48	7,740	38.74	8,740	34.30	9,740	30.78
750	399.8	1,750	171.3	2,750	109.0	3,750	79.95	4,750	63.12	5,750	52.14	6,750	44.42	7,750	38.69	8,750	34.27	9,750	30.75
760	394.5	1,760	170.4	2,760	108.6	3,760	79.74	4,760	62.99	5,760	52.05	6,760	44.35	7,760	38.64	8,760	34.23	9,760	30.72
770	389.4	1,770	169.4	2,770	108.2	3,770	79.53	4,770	62.86	5,770	51.96	6,770	44.29	7,770	38.59	8,770	34.19	9,770	30.69
780	384.4	1,780	168.4	2,780	107.8	3,780	79.32	4,780	62.72	5,780	51.87	6,780	44.22	7,780	38.54	8,780	34.15	9,780	30.66
790	379.5	1,790	167.5	2,790	107.5	3,790	79.11	4,790	62.59	5,790	51.78	6,790	44.16	7,790	38.49	8,790	34.11	9,790	30.63
800	374.8	1,800	166.6	2,800	107.1	3,800	78.90	4,800	62.46	5,800	51.69	6,800	44.09	7,800	38.44	8,800	34.07	9,800	30.59
810	370.2	1,810	165.6	2,810	106.7	3,810	78.69	4,810	62.33	5,810	51.60	6,810	44.03	7,810	38.39	8,810	34.03	9,810	30.56
820	365.6	1,820	164.7	2,820	106.3	3,820	78.49	4,820	62.20	5,820	51.52	6,820	43.96	7,820	38.34	8,820	33.99	9,820	30.53
830	361.2	1,830	163.8	2,830	105.9	3,830	78.28	4,830	62.07	5,830	51.43	6,830	43.90	7,830	38.29	8,830	33.95	9,830	30.50
840	356.9	1,840	162.9	2,840	105.6	3,840	78.08	4,840	61.95	5,840	51.34	6,840	43.83	7,840	38.24	8,840	33.92	9,840	30.47
850	352.7	1,850	162.1	2,850	105.2	3,850	77.88	4,850	61.82	5,850	51.25	6,850	43.77	7,850	38.19	8,850	33.88	9,850	30.44
860	348.6	1,860	161.2	2,860	104.8	3,860	77.67	4,860	61.69	5,860	51.16	6,860	43.71	7,860	38.14	8,860	33.84	9,860	30.41
870	344.6	1,870	160.3	2,870	104.5	3,870	77.47	4,870	61.56	5,870	51.08	6,870	43.64	7,870	38.10	8,870	33.80	9,870	30.38
880	340.7	1,880	159.5	2,880	104.1	3,880	77.27	4,880	61.44	5,880	50.99	6,880	43.58	7,880	38.05	8,880	33.76	9,880	30.35
890	336.9	1,890	158.6	2,890	103.7	3,890	77.07	4,890	61.31	5,890	50.90	6,890	43.52	7,890	38.00	8,890	33.73	9,890	30.32
900	333.1	1,900	157.8	2,900	103.4	3,900	76.88	4,900	61.19	5,900	50.82	6,900	43.45	7,900	37.95	8,900	33.69	9,900	30.28
910	329.5	1,910	157.0	2,910	103.0	3,910	76.68	4,910	61.06	5,910	50.73	6,910	43.39	7,910	37.90	8,910	33.65	9,910	30.25
920	325.9	1,920	156.2	2,920	102.7	3,920	76.48	4,920	60.94	5,920	50.65	6,920	43.33	7,920	37.86	8,920	33.61	9,920	30.22
930	322.4	1,930	155.3	2,930	102.3	3,930	76.29	4,930	60.82	5,930	50.56	6,930	43.26	7,930	37.81	8,930	33.57	9,930	30.19
940	319.0	1,940	154.5	2,940	102.0	3,940	76.10	4,940	60.69	5,940	50.47	6,940	43.20	7,940	37.76	8,940	33.54	9,940	30.16
950	315.6	1,950	153.8	2,950	101.6	3,950	75.90	4,950	60.57	5,950	50.39	6,950	43.14	7,950	37.71	8,950	33.50	9,950	30.13
960	312.3	1,960	153.0	2,960	101.3	3,960	75.71	4,960	60.45	5,960	50.31	6,960	43.08	7,960	37.67	8,960	33.46	9,960	30.10
970	309.1	1,970	152.2	2,970	100.9	3,970	75.52	4,970	60.33	5,970	50.22	6,970	43.02	7,970	37.62	8,970	33.42	9,970	30.07
980	303.9	1,980	151.4	2,980	100.6	3,980	75.33	4,980	60.20	5,980	50.14	6,980	42.95	7,980	37.57	8,980	33.39	9,980	30.04
990	302.8	1,990	150.7	2,990	100.3	3,990	75.14	4,990	60.08	5,990	50.05	6,990	42.89	7,990	37.52	8,990	33.35	9,990	30.01
1,000	299.8	2,000	149.9	3,000	99.94	4,000	74.96	5,000	59.96	6,000	49.97	7,000	42.83	8,000	37.48	9,000	33.31	10,000	29.98

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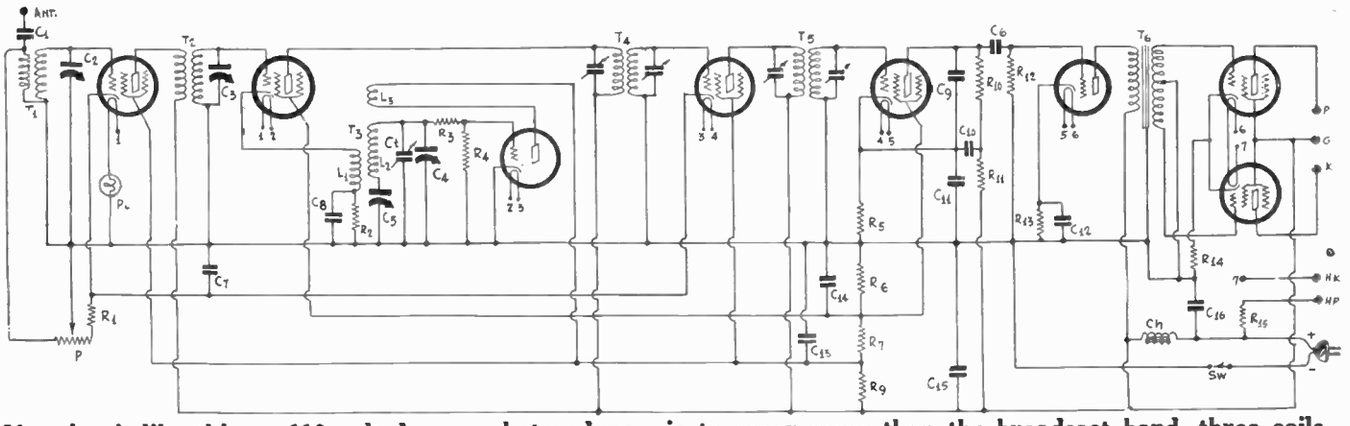
ndaries on One Form ency Coverage in Simple Circuit

Tully



If a circuit like this—a 110-volt d-c superheterodyne—is to cover more than the broadcast band, three coils are needed for each band.

of windings only—but it can be enclosed in a shield of the type used on tube bases, and we will meet all requirements. The number of turns is given in each on the basis of aluminum or zinc composition shielding, 2⅛" minimum diameter.

Tabulation

Assuming that the coils are machine-wound (although the looser texture of home winding will not make much difference) we can determine the axial distances readily from a table of turns per inch. Fortunately all the secondary wire used was enamelled, and so let's make the primary No. 28 enamel also. The result is as follows:

Winding	*Turns*	*Size*	*Turns per inch*	*Length*
Secondary No. 1	**127**	**32**	**115.6**	**1.1**
Primary	**15**	**28**	**74.1**	**0.2**
Secondary No. 2	**27**	**28**	**74.1**	**0.32**
Secondary No. 3	**10**	**22**	**37.7**	**.21**
Secondary No. 4	**4**	**18**	**23.9**	**.17**

The axial length of the windings (adding the column at right) is 2 inches plus, but the separations equal 5/16 inch, or total length 2 5/16 inches. These figures assume close winding all the way, although in some commercial practice the winding of the broadcast secondary (127 turns) is brought to and end with a few turns wound spirally over half an inch space or so. This method enables the winding to have the same total length, despite wire imperfections and winding eccentricities, since the coil always will begin at the same point and end at the same point, the largely spaced few turns in between, usually near the top, being adjusted to fit the circumstances. Even so the total length would be 1.6 inches for that one winding (127 turns).

Coupling Change

It can be seen, therefore, that when the first secondary is used it bears a definite relationship to the primary, when the second secondary is used, definition prevails, but the coupling is a little looser, whereas when the third secondary is used the coupling is made much looser, due to the primary now being separated from the utilized secondary by the length of the intermediate secondary plus the separation between two windings, or, about half an inch, whereas the third secondary is about three-quarters of an inch away. Thus without moving the primary or indeed anv coil, but simply by picking up the respective secondaries, the mutual impedance is varied, and this makes for improved results, particularly at the high frequencies.

With that view in mind the coils were put in a t-r-f receiver, an extra winding placed over the large secondary for plate connection to produce oscillation, and consisting of 25 turns of No. 40 silk covered wire.

Results Obtained

It was found that results on the broadcast band were as good as were to be expected, remembering there are only two tuned circuits, and that regeneration, while very effective, is more effective on weak signals than on strong ones. On the first short-wave band the results were excellent, on the second and third good and on the last fair. That shows how the system works.

And the surprise may come in the statement that there was reception on the smallest winding, even though the cards seemed to be against it. The requirement was that the tuning be confined to the lower two-thirds of the dial (highest capacity of tuning condenser avoided), as then the inductance-to-capacity ratio, low enough to be sure, was still not too low to produce some results.

The response from this system is about the same as that from the system using four separate coils, with separate primary and secondary (two windings on each of four forms), and of course here there were only two forms, and they did not take up much room.

Besides the coil system there is no novelty to the circuit, for it represents a more or less standard arrangement, even with its three stages of resistance coupling, which are stabilized by low leak values, by resistor-capacity filters in the necessary parts of the receiver circuit proper, and common plate return to one well-bypassed voltage point. [*Circuit and construction next week.*]

Patent Questions and Answers

IS THERE any way immediately to prevent the infringement of a patent which has not been adjudicated in court, by getting a preliminary injunction pending the outcome of a suit?—L. M., Chicago.

No. It is the common practice of the court not to grant a preliminary injunction except on an adjudicated patent and it often proves difficult to have an exception made of this rule. One exception to this, however, is the case of patents which have run for many years and their validity has been acquiesed in by the public as evidenced for instance, by the taking out of many licenses.

* * *

WHAT is a patent interference proceeding?—C. B., Cincinnati, O.

An interference is a proceeding between two or more claimants for a patent to the same invention to determine which of them is entitled to the patent. These proceedings are highly technical in character and their necessity arises through the simultaneous working of more than one inventor in the same field. Because every invention is a gradual evolution due to what has been invented before, and also to public need of a new article, it often happens that two or more inventors working independently bring out the same idea at the same time. This brings on the proceeding known as an "interference." Alexander Graham Bell was only a few hours ahead of Elisha Gray in recording his invention of the telephone and the question of the right to a monopoly on the patent was long in interference. Three inventors invented photographs in 1839, and two besides Edison claimed invention of the phonograph in 1877. There were two rival claimants for the typewriter as well as for the stereoscope. In more recent years long drawn-out contests had to be decided to determine the first inventor of patents for the gas engine between Daimler and Seldon. It was largely by the proceeding known as an interference together with its attendant litigation later that these competing rights were finally determined.

Send questions to Ray Belmont Whitman, Patent Editor.

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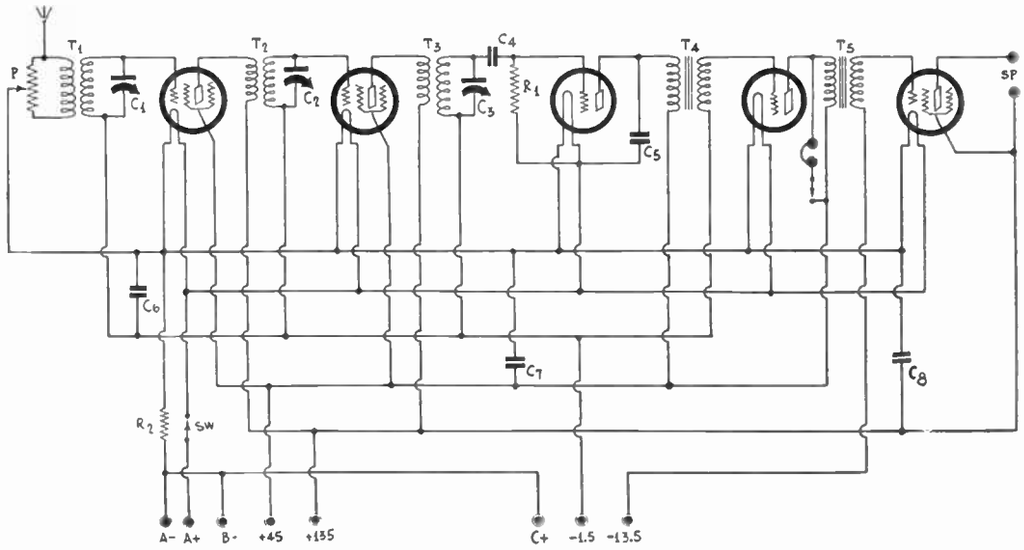


FIG. 995

This five-tube circuit, which utilizes the two-volt tubes, is suitable for a portable set or for home use where power economy is important. It requires at least four No. 6 dry cells for supplying the filament current. The cells should be connected in series parallel.

Five-Tube Battery Set

IF you have a diagram of a five-tube battery set utilizing the two-volt tubes will you kindly publish it? I prefer to use two stages of transformer audio as I have two excellent transformers. Please indicate voltages and the ballast resistance.—F. W. J., Binghamton, N. Y.

In Fig. 995 is a diagram of just the type you want. The voltages are indicated, except the filament voltage. If you use a three-volt battery and the first two tubes are 234, the detector and first audio 230, and the output tube a 233, then the ballast resistance R1 should be two ohms.

* * *

When to Listen

WHEN is the best time for me to listen to European short-wave stations? I have a very good combination of short-wave converter and t-r-f set but, although I can get South American stations, I have never been able to get any European stations. I suspect that I am not listening in when the stations are on the air. It may also be that I am not tuning in on the waves that carry a quarter the distance around the world. Can you give any suggestions that would be of help?—W. T. L., Chicago, Ill.

First you have to provide yourself with a station list giving stations, locations, frequencies, and times of operation. Radio World published such a list recently for the higher frequencies (February 27th issue). Then you have to pick out a time when a given European station is operating. It will probably be in the late afternoon or early evening at your place. Second, you should refer to the charts published last week (March 12th issue), from which you can tell whether there is much chance of getting the station. Your distance from European stations is about 5,000 miles, or 8,000 kilometers. You will note from the day chart that there is little chance of getting any stations lower than 10,000 kc, and not much chance above that frequency. The night chart is quite favorable in the range between 4,000 and 12,000 kc. There are so many variable factors that the best way to "fish" for the European station is to tune in when you know they are on the air and make the set as sensitive as you can.

* * *

Meaning of Attenuation

IN FIG. 4, page 7, March 12th issue, is a curve showing attenuation against kilocycles. I understand that the kilocycles mean above and below the resonance point, but I don't understand what the attenuation means. Will you kindly explain?—F. C. E., Denver, Colo.

Attenuation is given in decibels, as a rule, but in the drawing in question the unit of attenuation is not specified. Judging by the scale the attenuation is given as a ratio of two similar quantities. If that be the case, it requires a signal 400 times as strong to produce the same effect as at resonance when the interfering signal is only 10 kc. off resonance. At 5 kc. off resonance the interfering signal must be about six times as strong as the desired signal to which the circuit is tuned to produce the same effect. Ordinarily, when the curve is plotted as shown the quantity "microvolts per meter" is given in place of the attenuation.

* * *

Advantage of Many Frames

WHAT is the advantage of increasing the number of frames per second in television? Does it improve the detail of the picture, or is it simply necessary to increase the number of frames as the number of lines is increased?—W. H. C., Des Moines, Iowa.

The only advantage of using many frames per second is that it reduces the flickering. If the number of frames is less than 16 per second the flickering is strong, but if the number is 20 or more the flickering is not noticeable. However, the number of frames required for a given flickering depends on the intensity of the light. As the intensity increases the number of frames must be increased. Increasing the number of frames does not improve detail at all. Indeed, it has the opposite effect if the electrical circuits remain the same. Increasing the number of frames increases the required band coverage of the amplifier. Increasing the number of lines per frame improves the detail, provided that it is done correctly, both optically and electrically.

* * *

Impedance of Small Condenser

IF a condenser of 250 mmfd. in series with the antenna is all right for a frequency of 600 kc., what should it be at 60,000 kc.? On what is the determination based?—F. R. W.

If the circuits in the two cases are similar, the series condenser should in each case have the same impedance or reactance. At 600 kc. a 250 mmfd. condenser has a reactance of 1,060 ohms. This should also be the reactance of the condenser used at 60,000 kc. It turns out to be 2.5 mmfd. It will be observed that the ratio of the two frequencies is 100. All that is necessary, then, is to divide the first capacity, 250 mmfd., by 100, and we get 2.5 mmfd.

* * *

Meaning of Fidelity Curves

IN E. Bunting Moore's article on "The Super's Superiority" in the issue of March 12th, there are fidelity curves. Will you kindly explain these curves? Why are some decibels negative and some positive, and why is the t-r-f curve so high over 100?—R. B. N., Omaha, Neb.

The amplification at all frequencies is referred to that at 400 cycles per second. Therefore at 400 cycles the gain or loss is zero. The dotted line crosses the attenuation axis at this frequency. The superheterodyne curve clings to this line for some distance, deviating from it only below 100 and above 4,000 cycles. When either curve is below the zero line the amplification is less than it is at 400 cycles, and when the curve is above the amplification is greater. It will be noted that the t-r-f curve is about 11 db at 100 and —26 at 4,000 cycles. Thus there is a difference of 36 db between these two frequencies. That repre-

sents very poor quality, as the high audio frequencies are greatly suppressed. Below 100 cycles the amplification falls more rapidly so that at 30 cycles there is practically no amplification, which we judge by the course of the line where it stops. The superheterodyne curve is more satisfactory at both ends, but especially at the high frequencies. The decibels are computed with this formula db = 20 log (A/Ao), in which A is the amplification at any frequency and Ao that at 400 cycles. The logarithm is to the base 10. At 100 the attenuation is about 11 db. Thus 11 = 20 log (A/Ao). From this we get that the amplification is 3.54 times greater at 100 than at 400 cycles. At 4,000 cycles, at the upper end of the dotted line, the attenuation is 26 db below. Hence the amplification at 400 cycles is about 20 times greater than that at 4,000 cycles.

* * *

Coupling High Frequency Circuits

WHICH is better, a resistance or a choke coupler, in a short-wave receiver? I have in mind particularly the coupling between the antenna and the first tube, but I also want to try untuned coupling between tubes. What resistance and inductances are needed? Will an 85 mh coil do?—G. B. W.

Neither resistance nor inductive coupling is much good. You have to tune to get much results. The loss in an untuned coupler is quite high because the tube capacity has a low impedance and that is in parallel with the resistance or the choke. A choke of 85 millihenries is likely to have a considerable distributed capacity, and when this is added to the capacity of the tube, the capacity across the tube is quite high. The resonant frequency of the circuit thus formed is very likely to be well below the frequencies you want to receive, and then you have the same situation as if you detuned the tuner. Tune by all means even if you have to eliminate a tube. That is, if you have only one tuned circuit connect the antenna to that and not to the grid of an untuned stage ahead. Of course, you must make the coupling between the antenna and the tuned circuit loose.

* * *

Coils for Wide Frequency Coverage

FROM TIME TO TIME I have seen reference in your columns to the determination of the number of turns for wide-frequency coverage by a proportion. It is stated that the frequency is approximately proportional to the number of turns. Another similar situation is that the frequency ratio of a given condenser is stated, and the data given for the lowest frequency coil, the next coil to be reduced in number of turns by that ratio, and soon, because of the approximate relationship between frequency and number of turns. But this does not check experimentally.—H. D., Fargo, N. D.

The statement made is, as you repeat, that the results are approximate. If the shape factor of the coils remained the same, the result would be much closer. As it is, the error is on the side of greater overlap than needed, hence in the right direction. To state the situation somewhat differently regarding the shape factor, or proportion of diameter to axial length, the inductance increases fast during the early part of winding a coil, much more slowly toward the end, allowing for a large coil. Thus for a broadcast secondary, on 1 inch diameter, 0.00035 mfd. tuning, 127 turns of No. 32 enamel wire could be used, and on a 3-to-1 frequency basis, usually applicable to 0.00035 mfd., for the frequencies other than the very high ones, 43 turns would be used for the tap (if the coil is to be tapped), which is erroneous, since 30 turns is much more nearly correct. However, in this one instance the shape factor has been changed radically, while for the remaining coils, or taps, the proportion of number of turns would be more nearly right. Thus, for separate coils, secondaries would be 127, 30, 11 and 5, the smaller reduction of the higher frequency coils being due to the reduced frequency ratio, on account of the relatively greater effect of the minimum capacity.

* * *

Choice of Sensitivity or Hum

IN THE CONSTRUCTION of a superheterodyne I have had some trouble with hum and sensitivity, in that the greatest sensitivity develops the most hum, and I dislike to reduce the sensitivity, while of course desiring to get rid of the hum, which while not terrible, is still objectionable. All the screens have the same voltage, the second detector is a screen grid tube, power detection type, and the plate load is a resistor. What should be the negative bias for the second detector?—K. W. D., Albany, N. Y.

You will find by experiment that a correct combination of resistor and bypass condenser in the second detector circuit will afford good sensitivity at low hum. Since you have the same screen voltage on all tubes, this assumes r-f and intermediate tubes, as well as detector, hence 75 to 90 volts, the detector screen voltage is higher than the effective plate voltage. When the screen voltage is high on the detector the bias should be high, and normally recommended values (5, 6, 7.5 volts, etc.) for negative bias may be ignored, and abnormal bias used, say, 10 volts. It is not practical to measure this bias with usual equipment, therefore measure the value of the biasing resistor in ohms, and multiply it by the current through it in amperes. If the biasing resistor is 100,000 ohms and the current through the resistor is 0.1 milliampere, the biasing voltage is 100,000x0.0001, or 10 volts. Do not hesitate to try this high bias. Usually a bypass condenser of 0.0015 mfd., 0.0002 mfd., or thereabouts, will be satisfactory. Larger values will occasion greater sensitivity, but the hum increase may be disproportionately greater. Put a resistor-capacity filter (say 0.02 meg. and 0.1 mfd.) in the grid circuit of all audio tubes. The resistor goes in series with the present grid load, the capacity from the joint to ground.

* * *

Remedies for Hum

HUM IS a considerable nuisance in some of the circuits I build, and not enough is printed about its elimination. Will you please let me know what remedies to apply?—K. A. Q., San Antonio, Tex.

It is always a good plan to determine whether the hum arises at radio frequencies (by modulation) or by the audio route, which includes the detector. Earphones in the detector plate will help, because the relative intensity of the hum may be compared aurally with the loudspeaker result. This is just a guide, and if r-f is the origin, extra filtration of the plate and screen leads to these tubes will reduce hum considerably. Nearly always the trouble is in the audio channel, particularly as to audio frequencies in the last tube's grid circuit (due to bias from insufficient filtered sources and to speaker connections) and in the detector plate circuit. So put a resistor-capacity filter in the grid circuits of the audio channel, as recommended to K. W. D. of Albany, N. Y., as well as in the detector plate circuit. Besides, reverse the connections to the output transformer, as the wrong connection causes a hum increase of about 20 per cent. This recommendation is strongly made, because many present-day speakers have output transformers built in, with no special identity to the high and low connections, or if there is any identity, it may not be correct, because the leads were brought out at the factory the wrong way. Also, separate as far as practical the leads that emerge from the speaker, at a point of emergence, to reduce capacity coupling that may exist between a field coil used as B choke and the plate connection of the output tube.

* * *

Back and Forth Scanning

HOW CAN the scanning at the transmitter be done when the receiver is to be equipped with a cathode ray scanner where the light beam moves back and forth? Is it necessary to scan the same way at the transmitter as at the receiver? Please give examples of back and forth scanning.—H. J. G., Oakland, Calif.

One case where the back and forth method of scanning is possible is in transmitting from a film. If the scanning spot falls on a vibrating mirror and the reflecting beam is made to pass through the film and then to the photo-electric cell, while the film moves with uniform velocity, the order of picture element transmission will be the same as the order of assembly by the cathode ray scanner. Again, if the scanning spot stands still and the film vibrates transversely as it moves forward uniformly, the same order will be obtained.

A THOUGHT FOR THE WEEK

DEAR LITTLE LINDY, the lost baby of Hopewell and who has taken his place in the hearts of all the world, furnished the most human note that ever was struck over the air. Waiting millions have drunk in every word that has been broadcast about him. The stations and program sponsors have let business and self-interest go by the board in an effort to aid the stricken parents. The whole civilized world stands aghast at the crime but, like the parents, has felt from the first that the chief concern of civilization is that the Lindy baby be returned safe and sound to the protecting bosom of the sorrowing mother.

RADIO WORLD

Title Reg. U. S. Pat. Off.

The First and Only National Radio Weekly

Tenth Year

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

NBC's Secrecy

NO legal objection can be made to the refusal of the National Broadcasting Company to impart information on its experimental television transmissions on the ultra frequencies from its station atop the world's highest building—the Empire State. It must be admitted that the expenses are being paid by the NBC and the experiments are being conducted for its own purpose, so that from all the expensive endeavors there may emerge a service, comprising transmission and reception, that will bestow a real benefit on the public and produce a profit.

Perhaps NBC is motivated by a fear that if it gives out information about its transmissions that competitors will derive benefit therefrom, and the object of producing television receivers from which a profit can be made will be impeded. But if some attention is paid to the situation as it exists in broadcasting proper, it will be found that the money lies at the sending and not at the receiving end. During the past year, when profits were virtually unknown to any broadcast receiver manufacturers, the NBC turned in a good-looking profit.

The more receivers, the greater the audience, the better the service the transmitter can render, the more and better programs it can present, with aesthetic profit to listeners and financial profit to itself. It is taken for granted that the Federal Radio Commission will finally permit sponsored programs on the vision channels, and when that act is done one will be able to say that the Commission has decreed television is out of the "experimental" class at last.

There are teeming thousands of persons interested in the experimental and constructional side of radio who offer no commercial menace, and yet, of course, NBC could not distinguish between them and the potential competitors. The secrecy is maintained fairly successfully, although so long as outsiders can build sets to tune in the frequencies, and erect scanning apparatus to see the pictures, it is a case of secrecy exercised upon those who offer no present problem. The commercially minded person eager to ascertain what's going on can have a suitable receiver and televisor in action in one week and keep tabs on NBC transmissions very nicely. Secrecy is virtually ineffective in this instance on those on whom, it is assumed, the mask is intended to rest.

NBC really should give out the details, declare its schedule, tell some of the bare facts that are ascertainable anyway, but that get bruited about in garbled or incomplete form because there is no source of accurate information. The army of experimenters might be able to contribute something of value, as General Electric Company found when it made its early tests on super-power, and got reports from listeners who were amateur experimenters. What harm would result from NBC stating how many lines, how many frames, what frequency, what approximate schedule? Maybe RCA, one of the NBC owners, when it gets around to commercializing the television machines, will find that these very experimenters will be least resistant to buying the machines.

A wider, broader viewpoint would be better. Secrecy is legal, but is it politic? Such secrecy in television is exclusive with N.B.C.

A Case for the Court

SO far the decisions have not been disastrous to the RCA in the suits against it by Government agencies, but no doubt the victories were empty, since it costs a great deal of money even to wage the winning fight. The consolation is that it would have cost more to lose.

Now RCA and associates are defending a suit that seeks dissolution of at least certain patent agreements and licenses. After conciliatory conferences had been held spasmodically, with anything but a flare-up from RCA, more defendants were added to the list, and the complaint extended as to the grievances stated. Thereupon a flare-up did indeed result, and now we have RCA virtually charging the Federal Government with hounding it. And particularly it is stated that the very concessions sought by the Attorney General, and ready to be granted, are the subject of attack.

Perhaps the essence of the dispute is over what should be done about past acts, rather than only future ones. If certain acts were committed that the Attorney General thinks were illegal, he may feel that whatever better conditions may prevail from now on do not alter what happened. He may want the court to settle it, rather than himself to achieve the result he desires and leave the case unprosecuted. Evidently RCA understood he wasn't going to act as he has acted—go after still more companies and make the blasts hotter—and with chagrin turns against what it considers an act of bad faith. All the more it becomes apparent it is indeed a case for the courts.

SUNDRY SUGGESTIONS FOR WEEK COMMENCING MARCH 20, 1932

Eastern Standard Time is used in this list of suggestions.

Sun.: March 20—Footlight Echoes.WOR 10:30 p.m.
Mon.: March 21—Evening in Paris.....WABC 9:30 p. m.
Mon.: March 21—Poet of the Organ.....WEAF 11:30 p. m.
Tues.: March 22—Kaltenborn Edits the News.....WABC 7:30 p. m.
Tues.: March 22—Billy Jones and Ernie Hare.....WJZ 7:45 p. m.
Wed.: March 23—Willard Robison.WOR 9:00 p. m.
Wed.: March 23—Eno Crime Club.....WABC 9:30 p. m.
Thurs.: March 24—Golden Blossoms.....WJZ 8:30 p. m.
Thurs.: March 24—Mills Brothers.....WABC 9:00 p. m.
Fri.: March 25—Jessica Dragonette.....WEAF 8:00 p. m.
Fri.: March 25—Street Singer....WABC 9:00 p. m.
Sat.: March 26—Little Symphony.....WOR 8:00 p. m.
Sat.: March 26—Scrappy Lambert & Billy Hillpot .....WABC 9:30 p. m.

(If you care to know something of your favorite radio artists, write Miss Alice Remsen, care of RADIO WORLD, *145 W. 45th Street, New York, N. Y.)*

BAILEY CHIEF ENGINEER OF DUBILIER

William Mason Bailey, formerly with the Wireless Specialty Apparatus Company of Boston, is now chief engineer of the Dubilier Condenser Corporation, New York City.

JAIL THREAT TO AMATEURS WHO FALSIFY CALLS

Washington

The esprit de corps which so materially aided amateur radio enthusiasts to secure their present rights and privileges apparently is breaking down in some localities, observed Director W. D. Terrell, of the Commerce Department's Radio Division, as he looked over a large number of complaints from indignant amateur radio operators charging that other amateurs are "bootlegging" their call letters to avoid detection for violations of the Radio Act while getting their sets adjusted.

Director Terrell pointed out that it was the willingness of amateur radio fans to work together that made it possible for them to secure their present status. During recent months, as the number of licensed amateurs increased, the old spirit of comradeship and cooperation seems to be disintegrating, he said.

Secret Sleuth Societies

It has been reported to Director Terrell that certain amateurs, in an effort to protect themselves, are forming secret societies to assist in running down offending stations, as the more experienced amateurs realize that constant violations may result in restrictions being placed upon all amateurs that will materially reduce the scope of operations now allowed.

The "bootlegging" of call letters to cover up digressions from the portions of the Radio Act having to do with the amateur is a serious thing, Director Terrell points out.

The offending amateur uses the call letters of another amateur while getting his set adjusted, so that any infraction of the regulations occurring during these adjustments will, to all appearances, be charged against an innocent operator whose station is in no way responsible for the violation.

Increased Vigilance

L. C. Quaintance, who handles many of the complaints of this nature, states that the "bootlegging" station discards the borrowed letters as soon as it has established communication with other amateurs and has learned to his satisfaction that his transmitter is adjusted for proper legal operations.

The Radio Division is planning to increase its vigilance materially to prevent further "bootlegging" of amateur call letters. Mr. Quaintance warns amateurs that the use of call letters other than those assigned to the station results in the classification of that station as an unlicensed one, the operation of which is a felony and punishable by a fine of $5,000 or a sentence of five years in prison, or both.

47 Per Cent Gain in Export Trade

Washington

The United States continues to hold the world lead in radio export trade. Even with import barriers erected by foreign countries, and despite utter prohibition of import of radio by two countries, the United States during the first ten months of 1931 showed an increase of 47 per cent. in value of these exports.

The total for the first ten months of 1931 was $11,737,424, according to the Department of Commerce. During the same period, preceding year, the figure was $7,965,618.

STATION SPARKS

By Alice Remsen

Romance

FOR THE SWEETHEART PROGRAM

(WEAF, Mondays, 5:30 p. m.; WJZ, Wednesdays, 11:45 a. m.)

You came by candle-light
Down the broad stair.
I kissed your hand so white
And touched your hair.
You wore a trailing dress
Of silk and lace,
A tiny beauty patch
On your sweet face.

It was deplorable
My roguish eye
Caught your adorable
Blush, and your sigh.
We led the minuet
In graceful dance;
Your eyes were dusky pools
Full of romance.

But you were not for me,
Dainty coquette;
Tho I most foolishly
Dream of you yet,
As you came by candle-light
Down the broad stair,
And I kissed your hand so white,
Then touched your hair.

—A. R.

* * *

The Romantic Tenor Voice heard on the "Sweetheart" program is that of John Fogarty, one of those handsome Irish tenors that cause palpitating hearts among the romantically inclined lady listeners. John has an exceptionally sweet voice, a very tender personality and a fascinating smile. He is not a crooner, for which Erin be thanked. He is a true Irish minstrel. Tune in; you'll like him.

* * *

Dear Gene Brown, of WBAL, Baltimore: Thanks for your kind words about the page. Send me some news of your nice station, please.

* * *

La Belle Baker and the Author, Mann Holiner, have been sequestered up at Montreal with Jack Denny and his orchestra and are rehearsing the Ever-ready blade radio program, and getting ready to go on the air Sunday, March 13th, at 9:00 p. m., E. S. T. via WABC and the Columbia network. Mann Holiner wrote a dandy theme song and several sketches specially for this program. Miss Baker has some new songs, presented in her own inimitable way, and of course, Jack Denny, always full of pep, is peppier than ever. Don't miss this outstanding program.

* * *

Congratulations to Frank J. Novak, Jr., for his splendid work as the one-man band on "Candle Light Reflections," heard over WOR Tuesday evenings at 7:00 p. m. A decidedly different presentation.

* * *

Listened to the First Dupont Program, "Today and Yesterday" and found it to be quite interesting. It was easy to realize that Don Stauffer, director of the greatly lamented "March of Time" program, is serving in the same capacity for the Dupont program, because he used the same technique in the introduction and during the rest of the program. Gladys Brittain, well-known soprano, was featured with a male quartet and Don Voorhees orchestra. The today and yesterday idea was carried out in the musical selections, and in the dramatic sketch. While the whole production was very reminiscent of the "March of Time," it was not so well done. Let us hope that the latter program returns to the air in the near future.

* * *

Ernie Golden Did a Good Job with the Sylvanians last Sunday evening over WABC at 7:45 p. m. Ernie and his orchestra have been radio favorites from the ear-phone period up to the present day—from the time when he used to announce "This is Ernie speaking—for the next numbah! . . . etc.," when he and his musicians were playing at the McAlpin Grill in New York and were pioneers of radio during its first few years. Ernie recently returned from the Pacific Coast, where he had been making pictures, and we are glad to have him back again.

* * *

Lanny Ross, One of My Favorite Singers, is deserting N.B.C. for the Columbia air waves. He will be heard with the Maxwell House Orchestra over WABC and the network, every Monday, Wednesday and Friday evening from 7:15 to 7:30. A repeat program will be routed to twenty-two additional stations from 11:15 to 11:30 p. m. Lanny will be featured. On each broadcast he will be heard in three numbers, while the orchestra, in addition to the singer's accompaniment, will play two selections. Again it is significant that Lanny Ross is not a freak crooner, but a sweet singer with a soft, appealing tenor voice.

* * *

Plenty of New Programs These Days. Another one is the Zenith one-man minstrel show, starring Irving Kaufman, one of the most versatile of entertainers. Every Tuesday and Thursday, 10:45 p.m. WABC.

* * *

Sidelights

JOHN WHITE, the N.B.C. Lonesome Cowboy, was once a sports writer on a Washington, D. C. paper . . . MILTON J. CROSS has announced the A. & P. Gypsy program for three years . . . KELVIN KEECH'S middle name is Kirkwood, and he's Scotch . . . ERNIE HARE once understudied Al Jolson . . . HARRY RESER is a direct descendant of Davy Crockett . . . JESSICA DRAGONETTE likes to tell fortunes by cards . . . FRANK LUTHER wanted to be a baseball pitcher when he was a kid . . . THE PICKENS SISTERS hail from Georgia, but they studied singing in Paris . . . ABE LYMAN owns a canary named "Lenny"; he brought it from the West Coast . . . BEN BERNIE says that "Prosperity is just around the crooner" . . . CARL GLASSMAN, N.B.C. drummer, has tuned kettledrums for Walter Damrosch for twenty-five years . . . FRAZIER HUNT has been a sugar planter in Mexico, a country editor in Illinois, a newspaper reporter in Chicago and New York and was one of the World War's noted correspondents . . . JOHN CHARLES THOMAS prefers radio to concert . . . CYRIL PITTS was brought up on a dairy farm . . . HERMAN LARSON owned one, so they both know all about cows . . . MORTON DOWNEY telephones his wife nightly while he is on tour . . . EDWARD DAVIES has a family of five bulldogs . . . ALFRED J. McCOSKER was recently presented with the key to the city of Long Branch, N. J. . . . GEORGE SHACKLEY has recovered from his siege of La Grippe.

* * *

ANSWERS TO CORRESPONDENTS

MRS. A. T. WILLIAMSON, Indian Gap, Texas—The Mills Brothers Quartet consists of young colored boys; yes, they are fine. I'll run their biogaphy for you soon. Little Jack Little may be heard at 9:00 a. m., E.S.T., every morning except Sunday over WABC. In your section you may get him through KTSA, San Antonio, and KTRH, Houston.

C. H. ANNIS, Tacoma, Wash.—The part of Uncle Hank in "Friendship Town" is played by Ed. Whitney. Jeff is played by Don Carney. You're right; real American speech is seldom heard over the air, it is usually exaggerated, as is the genuine English accent. I shall make good use of your information about Bing Crosby in an early issue. Thanks.

R. C., Rochester, N. Y.—The "Evening in Paris" program may be heard over the following stations: WABC, N. Y., WFBL, Syracuse, WHEC, Rochester, WKBW, Buffalo, WEAN, Providence, WNAC, Boston, WCAU, Philadelphia, W3XAU, short wave, WJAS, Pittsburgh, WMAL, Washington WCAO, Baltimore, WADC, Akron, WHK, Cleveland, WKRC, Cincinnati, WBT, Charlotte, N. C., WXYZ, Detroit, WSPD, Toledo, WOWO, Fort Wayne, WGN, Chicago, WMT, Waterloo, Ia., KMOX, St. Louis, and KMBC, Kansas City. Glad you like the program!

* * *

Biographical Brevities

A FEW FACTS ABOUT MERLE JOHNSTON

Many radio artists are built up by astute publicity agents, others achieve fame through sheer talent and ability. In the first case, the rise is rapid but the old law of compensation steps in and the way is greased for an equally swift ride to oblivion. The highway over which inherent talent must traverse seems to be particularly arduous, with the traveler usually laying his own bricks.

Merle Johnston is in the latter class. He is full of inherent talent, but he puts preparation before talent in relative importance and argues that talent would never be any good unless the person possessing it is educated in its use. He, personally, furnishes a good example of logic in his argument. It was not until his senior year at Clarkson, where he was studying electrical engineering, that fate started him on the path that ended in his becoming one of the foremost exponents of the saxophone in the United States.

He had the good fortune (he so views it now) of arousing the displeasure of his degree professor. The latter had viewed Johnston's playing his way through college on a slide trombone as an indication that he would never be a successful engineer and so informed Johnston's fiancee. This interference in his personal life, which resulted in the girl breaking the engagement, started a feud between the two men. This ended in the professor refusing to recommend Johnston for employment as an engineer, although he had been given his degree upon graduation.

Music was the only alternative. He soon found, however, that despite the fact that he had amassed a bank roll in his college playing, he was still only an amateur musician. New York turned him down without any equivocation. Then began a long period of studying under a brother in Kansas City, Mo. His first real break was an opportunity to substitute for a professional saxophonist in an audition given to one of the local orchestras in a booking office. The professional could not be found at the moment, but turned up in time to fill the engagement and Johnston went back to practising and studying. Finally he got a two-weeks engagement with an orchestra in Okahoma City; this was followed by one in Omaha that lasted a year.

When he came to New York at the

(*Continued on next page*)

SOME SECRETS OF NBC VISION PENETRATED

Great secrecy is being maintained by the National Broadcasting Company regarding its television equipment at and transmissions from the Empire State Building, New York City. Requests for information of actual frequency used and approximate schedule are ignored, but experimenters have picked up some information by the not so simple process of building the proper receiver and tuning in, and besides, there has been a great deal of gossip about the NBC intentions.

While television is the main interest of the outside experimenters, the station also sends still pictures, or facsimiles, and some confusion arose until this fact was verified experimentally.

120 Lines Used

The sight channel is W2XF, licensed at 5,000 watts, and the license entitles the use of the 43,000-46,000, 48,500-50,300 and 60,000-80,000 kc bands, or, as more frequently expressed these days in megacycles, 43-46, 48.5 to 50.3 and 60 to 80 mgc. As the station may be anywhere in this band, "fishing" is necessary. The station has been found on 44.74 mgc, or 6.28 meters. Sound is sent on W2XK, 61 mgc, 4.915 meters. Television has been seen with good regularity daily, excepting Sundays and holidays, 5 to 6 p.m. and 7.45 to 10 p.m., E.S.T. Movie film is sent frequently, and evidently a film sound track is used, although on some occasions the sound transmission is a relaying of WEAF or WJZ regular programs.

The transmitted picture uses 120 lines and while the number of frames per second may be changed from time to time, stroboscopic measurements, as well as measurements of the tone and motor frequencies, indicate 24 pictures per second, which is the general practice in the movie industry, especially sound track movies. The motor revolutions afford a method of checking up, and a speed of 1,440 revolutions per minute was tried, and results obtained, although shifting had to be done from time to time, indicating changes made at the transmitter in the number of pictures per second. A disc is used by experimenters in trying to pry open the NBC secrets.

Expect Rush to 120 Lines

It is the general belief of those active in the television industry that the 120-line basis will become general, at least for a while, the reason being that more picture detail is reproduced, hence with adequate illumination at the receiving end a larger picture can be shown. Or, if the picture size is not enlarged at the receiving end, the full benefit of the extra detail is derived. Present scanning, 60 lines, affords good projection up to 5x6 inches, but if the 120-line scanning is used for no greater than 5x6 pictures the improved detail becomes so impressive as to engage public interest, if not admiration.

As exclusively announced in last week's issue of Radio World, W1XG, operated by the Shortwave and Television Corporation, Boston, is about to use 24-120 scanning, on 45 mgc, 6.663 meters.

A Western executive of NBC, after having seen a demonstration of its ultra-frequency television, proclaimed it remarkably good, and said he expected his station soon would be sending out pictures, but no such encomiums have been heaped upon NBC by its official spokesmen. Instead, television was described as being still in the laboratory, and the inference made that no appeal to the public to buy television sets would be made until NBC is quartered in Radio City, the great amusement and educational development under construction in what is now midtown New York.

Who Owns NBC?

The NBC is owned by the Radio Corporation of America, the General Electric Company and the Westinghouse Electric & Manufacturing Company, and it is expected that RCA will be the first merchandising company when the television receivers are offered to the public.

Others, now manufacturing television equipment, judging from the unanimous reports of those interviewed, have made no money and have not been able to develop an encouraging market for their radio products. Before the depression there was some activity in the sale of stock in television corporations, but even the sale of stock is at a standstill.

Several regular set manufacturers have television receivers they say they are ready to put on the market as soon as RCA acts, but these devices are of the conventional lens-disc type, where the disc is interposed between a neon crater lamp and a screen. This type of disc is costly and difficult to manufacture.

Cathode Ray Tube Used

The RCA-Westinghouse-General Electric system uses no disc at all, but a cathode ray oscillograph tube for scanning at the receiving end, introducing multiple frequencies and various voltages for operation. The receiver is said to be most carefully shielded and to consist of 25 tubes, for both sight and sound results, including the cathode ray tube, to manufacture which no inexpensive method has been found yet. It is said that the complete outfit would list for about $500.

An outside engineer who said he had inspected the plant atop the Empire State Building was asked what NBC had there and replied:

"They have nothing special, just a transmitter and a regular scanning system. The thing that counts most is what's to be at the receiving end, and I believe the biggest problem is the sight receiver."

Anti-Lottery Bill Makes Headway

Washington

The bill introduced in and passed by the House of Representatives, amending the substantive radio law to the sole extent of forbidding the broadcasting of information about contests in which the prize awards depend partly or wholly on chance, is the subject of Senate committee hearings, with every expectation of acceptance.

Representatives of organized labor are expected to present a united front in favor of the bill, which was introduced after the American Newspaper Publishers Association called attention to the postal laws forbidding lotteries in printed advertisements whereby the mails are used, but broadcasting was free to indulge lottery exploiters.

The bill has nothing to do with the present vogue of sponsors of radio programs in offering to send souvenirs or tokens free to all who write in for them, or with the practice of requiring wrappers or labels be taken from commercial products and sent in, with or without original composition on them, to get "gifts" or become eligible for awards where some competition in merit applies.

The bill's only substantive law change is in connection with lotteries, although there are some amendments affecting procedure before the Commission.

HIGHER POWER DENIED TO WFI; OTHER RULINGS

Washington

The penalty of being located in a city that already has good broadcasting service was felt by WFI, Philadelphia, when the Court of Appeals of the District of Columbia denied the station's appeal from a ruling of the Federal Radio Commission refusing power increase to 1,000 watts. The present power is 500 watts. The court agreed that Philadelphia is getting good radio service now, even though the State and zone are under-quota according to the Commission's own method of rating.

The power of WQAM, WIBO and WNOX, out-of-town stations, would have to be curtailed as an interference precaution if WFI got its 1,000-watt grant, and the court ruled against this. WFI operates on 560 kc, one channel from the last at the low frequency end.

No More Time for WOW

The court also decided in favor of the Commission, dismissing the appeal of WOW, Omaha, Neb., owned by the World Life Insurance Association, from a ruling that operating time could not be increased. The station has six-sevenths time on 590 kc, one-seventh being allotted to WCAJ, Nebraska Wesleyan University, Lincoln, Neb.

WOW was admitted to be rendering good service, its report shows large expenditures on improvements, so that expenses exceed income, but the court could not find that the action of the Commission was arbitrary or capricious.

The Isle of Dreams Broadcasting Co., Miami, Fla., was granted a construction permit for relay broadcasting, 12 hours daily operation, 2,500 watts, 6,040 kc. The Commission took the action.

New Cincinnati Permit Denied

Application of the Pillar of Fire, a New Jersey corporation that already has two part-time stations, for a construction permit for a new station in Cincinnati, O., 1,420 kc, 100 watts, unlimited time, should be denied, Elmer W. Pratt, examiner, recommended to the Commission. The corporation's other stations present educational programs and are well conducted, he reported, but Cincinnati at present has good educational service by radio.

Biographical Brevities

(*Continued from preceding page*)

end of that contract he had eight years of piano study, three of trumpet and three of trombone, in addition to his regular studies of the saxophone. His first Saturday afternoon in the metropolis was spent in hourly visits to the office of Wheeler Wadsworth, booking agent for Paul Whiteman. Just before the office closed Wadsworth told him that Whiteman needed a man at Palm Gardens. "If you are good," Wadsworth told him, "you'll get other dates." He kept his word. On the following Monday, Johnston was given eighteen engagements and has never been "on the street" since. He has been in radio on N.B.C., and Columbia networks for several years and at the present time is one of the leading orchestra conductors at WOR, New York, and with the N.B.C.

HARASSED BY GOVERNMENT, RCA DECLARES

Following the naming of four additional defendants in the United States Government suit against Radio Corporation of America and associates for dissolution under the anti-trust acts, the RCA issued a statement in effect implying to the Department of Justice, the prosecuting agency, unfairness and bad faith. Previously the practices complained of in the bill filed against the defendants had been the subject of conferences, RCA and associates offered certain concessions, and it was believed that some satisfactory arrangement would ensue. Then the supplemental compaint was filed and RCA and associates hit back.

The four new defendants in the case are the International General Electric Company, the Westinghouse Electric International Company, RCA Communications, Inc., and the National Broadcasting Company. The charges were amplified to include attempts to restrain foreign, as well as domestic, trade.

Patent Pool Basis of Petition

NBC is jointly owned by RCA, General Electric Company and the Westinghouse Electric & Manufacturing Company.

Besides the four additions the defendants are RCA, General Electric Company, Westinghouse Electric and Manufacturing Company, American Telephone and Telegraph Company and General Motors Corporation.

The corporations are charged with being a combination in restraint of trade in the manufacture and sale of radio apparatus and radio communication itself, by virtue of a patent pool and licensing and cross-licensing agreements.

The Department of Justice's statement regarding the amendment of the petition to include four more defendants and elaborate the charges, issued in Washington, follows:

"Negotiations have been conducted for some time between the defendants and Government and between the defendants themselves, with respect to the possibility of creating an open patent pool which would obviate the trial of some of the important issues of the case.

"The filing of the amended bill does not mean that these negotiations have been broken off, but the Government has been going on with its preparations for trial pending the outcome of these negotiations, with the purpose of having the case heard this Spring and the filing of the amended bill is in line with these preparations."

Says Contracts Created Trade

The RCA statement was issued the day after the amended petition was filed and set forth that the patent pool was necessary so that patents held by scattered interests could be brought under one ownership or control, so that licensed manufacturers could go safely ahead making sets.

"The cross-licensing contracts made legally possible the manufacture of radio apparatus," the statement set forth. "They did not restrain trade—they created it."

The contracts were submitted to the Attorney General in office twelve years ago, at the time of execution, it was stated, and to succeeding Attorneys General, and were investigated four years by the Federal Trade Commission "and the complaint was dismissed." From the time of the organization of RCA—in 1919—to date, the statement recounts, a great radio manufacturing industry has resulted, as well as broadcasting to more than 50,000,000 listeners, and the establishment of communication among forty countries, with lowered communication rates attending extension of service, to the benefit of business and home.

Now, the statement points out, there are 100,000 stockholders in RCA alone, and it becomes extremely difficult to modify contracts and other arrangements, whereas "it would not have been so difficult to have modified the fundamental arrangements when they were made."

For the first time RCA makes public announcement, in the statement, of the progress of negotiations with the Attorney General, including its withdrawal from General Motors Radio Corporation, modified contractual relations with the United Fruit Company, amendment of traffic agreements as to message service, and "favorable consideration to the creation of an open patent pool," which open pool was suggested by the Department.

Can't Understand New Move

An implication of bad faith on the part of the Department of Justice is contained in the RCA statement as follows:

"The amended and supplemental petition just filed by the Department makes issue of and seeks an injunction against some of the very arrangements altered to meet the Government's views. As to two of the corporations, parties defendant to the original complaint, the arrangements to which the Government made objections are being changed to meet the Government's views. Also other features have been changed to meet the Department's views, but despite this they are still the subject of attack in the new petition which the Department has just filed.

"In view of all these circumstances we are unable to understand the action of the Department in persisting in doing unnecessary things and making unnecessary charges particularly in times of great business depression and even when there is and long has been great competition—more than adequate from every point of view—in the radio industry. The Department's demand for additional competition came when there were so many competitors in the field that over production and cut-throat competition threatened the entire industry. This is even more true today, when surveys show that there now exist in the country radio plants with a capacity of approximately 25,000,000 radio sets per year while the market is estimated at approximately 3,000,000 sets per year, when prices for merchandise are lowest in the history of the industry and when few, if any, companies engaged in the manufacture and sale of radio devices are able to earn a profit on their business.

"The Radio Corporation of America and its associated companies, defendants in this case, together are doing less than 20% of the total business in radio receiving sets and less than 40% of the total business in radio tubes. It could hardly be contended that a monopoly is thereby threatened or that trade is thereby restrained."

$105,000 Copyright Suit Against NBC

Suit for $105,000 was begun in New York City against the National Broadcasting Company by the Society of European Stage Authors and Composers, on the ground that twenty-one stations in a chain hook-up broadcast excerpts from Franz Lehar's "Paganini" on June 14th last, in violation of copyright. Lehar is a Hungarian and is the composer of "The Merry Widow."

The plaintiff states that it is the exclusive owner of the American rights to "Paganini," which was composed in Hungary seven years ago. It is stated the program originated at WEAF, New York, and was carried by WTAM, Cleveland, WRC, Washington, D. C., of the N. B. C., as well as eighteen member stations, so damages are sought on the basis of $5,000 per station.

PALEY GROUP CONTROLS CBS IN STOCK SALE

An investment group, headed by William S. Paley, president of the Columbia Broadcasting System, has bought the 50 per cent. interest in the System that had been owned by Paramount-Publix Corporation, a movie concern. The transaction involved the payment of $1,164,000 in money to the movie company, although $5,200,000 was the valuation of the amount of the half interest. The difference, or $4,036,000, represented the value of Paramount-Publix stock that the System had owned and which Paramount Publix bought back under the contract.

Paley in Control

Thus Mr. Paley and his associates gain control of the company, a move that Mr. Paley favored as in the best interests of improving the service rendered by the chain. Unity of control, said Mr. Paley, was advisable because of the necessity for mobility of action and quick responsiveness to public taste.

Financial Participants

The participants in the new financial arrangement, besides Mr. Paley, were Brown Brothers, Harriman & Co., the Lehman Corporation, Field Glore & Co., and Herbert Bayard Swope. Mr. Swope was executive editor of the New York "World," up to some years before that paper's merger with the "Telegram." He was subsequently on the list of National Broadcasting Company directors.

Way Found to Enjoy Broadcasts on 'Plane

What is believed to be the first airplane in the United States equipped with an installation for the entertainment of passengers, with programs on the regular broadcast band, left the Dallas shops of American Airways, Inc., recently.

Up until this time the rapid flight of the plane, which increased or decreased the volume of local stations, the interference of the 425 horsepower engines, and the two-way radio telephones from the ship to the ground stations have prevented satisfactory reception on broadcast wave sets, although short wave sets have been employed with some success.

The development of an automatic control by which the volume remains stationary despite the speed of the plane, and the shielding of the magneto and other electrical devices to prevent interference, as well as the solving of numerous other technical problems by American Airways' radio department, has resulted in excellent reception. The set is a 9-tube automobile type and is located in the front cockpit, with the controls in the passenger cabin and plugs at each seat where head phones are connected. It has a day range of 500 miles and a night range of 1,500 miles and does not interfere with the radio telephones.

Airline officials declare that better reception is possible from the air than in the home because the absence of high-tension wires eliminates static.

It is planned to install similar equipment in all ships of the system as they are put into the shops for regular overhaul.

BIGGEST YEAR SEEN AHEAD AS PROGRAM PEAK

This will be the greatest radio audience year of all time, in the opinion of J. M. Spangler. manager of the Tube Division of National Carbon Company, Inc.

"Events of international interest and importance," says Mr. Spangler, "are due to come thick and fast this year. Our people are rapidly becoming more internationally minded, and what is happening at Geneva, at Basle, in Berlin and in London is engaging more and more attention from the American people. Some time ago we had only an occasional trans-Atlantic broadcast; now we have as many as four or five in a day.

"The campaigns for Hoover and Smith were followed by a vast audience but in my judgment they are going to appear small compared to the millions who will listen in this year. Then follows, of course, the election and its results to be broadcast.

Olympic Games Cited

"The Olympic Games will produce a vast audience not only in this country, but abroad. Football net season will continue to grow in popularity. In fact, the broadcasting companies are reaching out for every sport possible; they know the listener-interest.

"The public is keenly alive to such stunts as the volcanic eruption broadcast which startled the world oyl a short while ago; there doubtless will be increased enterprise in handling such phenomena.

"Then too there is every possibility that radio will go down to the bottom of the sea along with the engineers who will try to raise the Lusitania.

"The American Congress faces one of the most important sessions in its history. More and more commentators are being heard from the nation's capital and listeners are increasing.

Educational Aspects

"Grand opera is now on the air and thousands who have never been in the Metropolitan Opera House and never expect to get there are listening and will listen. Educational programs are developing and, while few of us realize the extent of the development, the schools and colleges are using radio to marked advantage. Children's programs are increasing in popularity and dramatizations are becoming more effective."

Air Excels Mail Response, Is Claim

The following was printed in "News Service," publicity sheet of the Westinghouse radio stations, WBZ-WBZA, KDKA and KYW-KFKX:

Impressive results showing the manner in which a response was obtained from radio broadcasting compared with direct mail advertising are graphically illustrated by the Independent Wall Paper Company, barn dance program sent out by Westinghouse Station KDKA at 10 o'clock Saturday evening.

More than 1,060 letters and other pieces of mail were received in one week, the result of a single program. The financial amount involved was only one-fourth as much as required by direct mail.

Literature Wanted

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

Edward J. Frank, 900 Ave. C., Bayonne, N. J.
A. Kucher, 982 Eastern Parkway, Brooklyn, N. Y.
Arthur L. Lang, 417 Main St., Watertown, Wisc.
Russell R. Quaintance, 720 Gibbard Ave., Columbus, Ohio.
F. E. Distel, 11 Otis Place, Buffalo, N. Y.
Ralph Ford, 1210 Broad St., Bristol, Tenn.
Lewis Rozhon, 221 George St., North Judson, Indiana.
John Siff, 6554 N. Natoma Ave., Chicago, Ill.
I. Horowitz, 555 Dahill Road, Brooklyn, N. Y.
H. S. Foote, American Legion Hospital, Battle Creek, Mich.
E. C. Phillips, 224 So. 15th St., Richmond, Indiana.
Albert C. Storm, 1216 Second St., Portsmouth, Ohio.
Edward Koller, 10308 Mt. Auburn Ave., Cleveland, Ohio.
Frank Mandel, 242 Fourth Street, Passaic, N. J.
John Hajnik, 3472 W. 62nd St., Cleveland, Ohio.
Harry Penn, 11 West 33rd Street, Bayonne, N. J.
K. W. Martin, Ivanhoe, Va.
Joseph Donwrat, 13½ Ward St., So. Boston, Mass.
Republic Radio Corp., 421 Beaubion St., Detroit, Mich.
Michael Pinchuk, Box 363, Syosset, L. I., N. Y.
Wm. C. Clark, 1457 Rhode Island Ave., N. W., Washington, D. C.
Huber Radio Service. 117 Newburgh Ave., Buffalo, N. Y.
T. J. Saari, 111 E. 80th St., New York, N. Y.
D. F. Estes, 1122 Gar Ave., Fort Smith, Ark.
Botes Stationery Co., Framingham, Mass.

New Incorporations

S. Wolfson, Inc., Jersey City, N. J., radio and electrical equipment—Atty., Aaron A. Melniker, Jersey City, N. J.
Syracuse Refrigerator Co., Syracuse, N. Y., radios, etc.—Atty., C. H. Searl, Syracuse, N. Y.
Shapiro-Hoffman Co., electrical products, Queens, N. Y. City, electrical products—Atty., M. Berwitz, 299 Broadway, New York, N. Y.
Lisgar Mfg. Corp., Brooklyn, N. Y., electrical appliances— Atty., K. K. Klein, 10 East 40th St., New York, N. Y.
Radio Personalities, New York City, theatrical business—Atty., W. Klein, 236 West 44th St., New York, N. Y.
Nu-Lite Electric Co., Newark, N. J., electrical appliances, machinery—Atty., Emanuel Millman, Newark, N. J.
Tru-Lite Electric Lamp Co., Newark, N. J., manufacture electric lamps, machinery—Atty., Emanuel Millman, Newark, N. J.
Holloway Bentz Electrical Corp., New York City —Attys., Finkelstein & Jacobs, 521 Fifth Ave., New York, N. Y.
Throop Electric Co., Brooklyn, N. Y.—Atty., E. F. Kirk, 50 Court St., Brooklyn, N. Y.
United Television and Communications Co., Inc., Wilmington, Del., untilities, stocks—Attys., Colonial Charter Co., Wilmington, Del.
Radio Fan, advertising, New York, N. Y.—Atty., M. Casper, 20 Pine St., New York, N. Y.
Best Radio and Television Corp., Brooklyn, N. Y.—Atty., A. R. Daldin, 5011 Church Ave., Brooklyn, N. Y.
Gurney Distributors, New York, N. Y., refrigerators—Atty., A. J. Rosenblum, 551 Fifth Ave., New York, N. Y.
Tupper Lake Electrical Corp., Tupper Lake, N. Y., batteries—Atty., R. Hastings, Tupper Lake, N. Y.
Tricold Refrigerator Corp., Buffalo, N. Y.—Attys., Kimbal & Smith, Buffalo, N. Y.
The Sonolux Laboratories, Newark, N. J., manufacture electrical supplies—Attys., Kessler & Kessler, Newark, N. J.
Seibel Refrigeration, Ltd., New York City—Atty., T. Siskind, 233 Broadway, New York, N. Y.
DeLuxe Elextric Refrigerator Corp., Brooklyn, N. Y.—Atty., A. Oboler, 50 Court St., Brooklyn, N. Y.
Star Electric Co., Inc., Paterson, N. J.—Atty., Masso M. Surnamer, Paterson, N. J.
Edco Trading Corp., New York, N. Y., radios—Atty., S. I. Hoffberg, 1440 Broadway, New York, N. Y.
H. D. McRae, Rochester, N. Y., refrigerators—Atty., W. M. Nicoll, Schenectady, N. Y.

NAME CHANGES

Capitol Broadcasting Corporation to Pan-American Broadcasting System, Inc., Wilmington, Del.

Tenth Anniversary Number Next Week! Get Your Copy!

'FIVE-EDITION' DAILY NEWS ON KDKA SCHEDULE

Pittsburgh

Another public service for the audience of KDKA—the broadcasting of a complete news service—has been inaugurated in conjunction with "The Pittsburgh Press."

The latest happenings the world over are sent out five times daily during the week and twice on Sunday. The weekday schedule is 8:45 and 9:47 a. m.; 12:33, 6:10 and 11:15 p. m., E. S. T.

Lloyd C. Thomas, general commercial manager of Westinghouse radio stations, and Edward T. Leech, editor of "The Pittsburgh Press," both spoke from KDKA in officially opening the broadcasts.

Leech stressed the similarity between the radio and the newspaper enterprises, the one providing entertainment and education by the spoken word while the other accomplishes the same mission by the written word. He said:

"After all, it doesn't seem particularly necessary to dedicate a service bringing into co-operation the facilities of a great radio station and a big newspaper. For the two have so much in common that they have always necessarily worked along much the same lines."

Peck Television Co. Formed in Canada

As a result of demonstrations held in the St. Moritz Hotel, New York City, the Peck Television Company of Canada, Ltd., a closed corporation to market Peck Television receivers, has been formed, with offices at 320 Rue St. Joseph, Quebec. William Hoyt Peck's radically new reflecting lens system is used at the transmitting end.

A group of prominent Canadian business men headed by A. H. Carpenter, financier, and Emil Fontaine, sales manager of C. Robitaille, radio distributors in the Province, organized the company to manufacture and sell big-image television sets.

The set projects a foot-square image twelve inches from the scanning wheel, utilizing all the light provided by the crater tube. The fact that such a wide angle is obtained makes it unnecessary to use oversized cabinets or mirrors. This, in turn, makes it possible to house both the television receiver and an ordinary sound receiver in the same cabinet.

Crystal Sets in Sweden Replaced by "Supertubes"

Washington

The old-fashioned "cat whiskers" are flying out of the Swedish homes as the new "supertubes" set is demonstrating its technical superiority in picking up continental and world programs, according to a report to the Department of Commerce from Consul C. T. Steger, Malmo.

For a time public interest was so aroused that the supply could not keep up with the demand, it is said.

Good Swedish models are appearing on the market, although many of the more costly machines are imported from the United States.

Quick-Action Classified Advertisements

7c a Word — $1.00 Minimum
Cash With Order

HERE IT IS AT LAST! Electro-Static Aerial Eliminator. Send for yours today. $1.00 postpaid, fully guaranteed. Agents wanted. Radio Products Manufacturing Co., 6138 Woodlawn Ave., Chicago, Ill.

SHORT WAVE CONVERTER BLUEPRINTS. Four (4) A.C. and Battery models, including a three tube A.C. self-powered converter for TRF and Superhet sets, 25c (coin). Super Engineering Lab., 1313 40th St., Brooklyn, N. Y.

"THE CHEVROLET SIX CAR AND TRUCK" (Construction—Operation—Repair) by Victor W. Pagé, author of "Modern Gasoline Automobile," "Ford Model A Car and AA Truck," etc., etc. 450 pages, price $2.00. Radio World, 145 W. 45th St., N. Y. City.

BLUEPRINT NO. 627—Five-tube tuned radio frequency, A-C operated; covers 200 to 550 meters (broadcast band), with optional additional coverage from 80 to 204 meters, for police calls, television, airplane, amateurs, etc. Variable mu and pentode tubes. Order BP-627 @ 25c. Radio World, 145 West 45th Street, New York City.

BARGAINS in first-class, highest grade merchandise. Phono-link pick-up with vol. control and adapter, $3.32; .00025 mfd. Dubilier grid condenser with clips, 18¢. P. Cohen, Room 1214, at 143 West 45th Street, New York City.

THE FORD MODEL—"A" Car and Model "AA" Truck — Construction, Operation and Repair — Revised New Edition. Ford Car authority, Victor W. Page. 703 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

Large Temple Dynamic

Dynamic speaker, AC 110 Volts, 50 to 60 cycles, housed in table cabinet made of walnut, with carved grille. Output transformer and dry rectifier built in, also a hum eliminating adjuster and a variable impedance matcher. Plugged AC cable and tipped speaker cords are attached to dynamic. Outside cabinet dimensions: Height 14", width 11, depth 7½". Speaker diameter 9". Price, $11.50 net.

Guaranty Radio Goods Company
Dept. A, 143 W. 45th St., N. Y. C.

Your Choice of NINE Meters!

To do your radio work properly you need meters. Here is your opportunity to get them at no extra cost. See the list of nine meters below. Heretofore we have offered the choice of any one of these meters free with an 8-weeks' subscription for RADIO WORLD, at $1, the regular price for such subscription. Now we extend this offer. For the first time you are permitted to obtain any one or more or all of these meters free, by sending in $1 for 8-weeks' subscription, entitling you to one meter; $2 for 15 weeks, entitling you to two meters; $3 for 26 weeks, entitling you to 3 meters; $6 for 52 weeks, entitling you to six meters. Return coupon with remittance, and check off desired meters in squares below.

RADIO WORLD, 145 West 45th Street, New York, N. Y.
(Just East of Broadway)

Enclosed please find $.....for .....weeks subscription for RADIO WORLD and please send as free premium the meters checked off below.

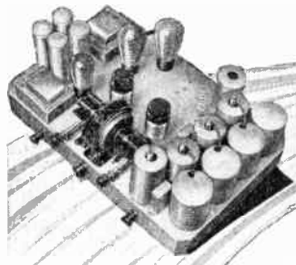
☐ I am a subscriber. Extend my subscription. (Check off if true.)

☐ 0-6 Voltmeter D.C. .....No. 326
☐ 0-50 Voltmeter D.C. .....No. 337
☐ 6-Volt Charge Tester D.C. .....No. 23
☐ 0-10 Amperes D.C. .....No. 338
☐ 0-25 Milliamperes D.C. .....No. 325
☐ 0-50 Milliamperes D.C. .....No. 350
☐ 0-100 Milliamperes D.C. .....No. 390
☐ 0-300 Milliamperes D.C. .....No. 399
☐ 0-400 Milliamperes D.C. .....No. 394

NAME .....

ADDRESS .....

CITY..... STATE.....



The 15 TO 550 METER COMET SUPER-HETERODYNE

YOU will search far to find the equal of the new Hammarlund COMET *Custom-Built* All-wave Superheterodyne.

A superbly efficient short-wave receiver, especially designed to cover also the regular broadcast waves up to 550 meters.

A.C. operated, using eight newest type tubes with Pentode output. Super-sensitive, super-selective, and has remarkably fine tone. Exclusive easy tuning features.

The ideal receiver for the home—office—laboratory—newspaper—police—airport—steamship.

Investigate also the COMET "PRO," the new Hammarlund custom-built 14 to 200 meter super-heterodyne for professional operators.

Write Dept. RW-319 for Details.

CUSTOM BUILT by HAMMARLUND

HAMMARLUND-ROBERTS, INC.
424 West 33rd Street, New York

245

Tubes at 30¢ Each

Four for $1.00

Sold on basis of remittance with order. We will pay the postage.

RELIABLE RADIO CO.
143 West 45th Street New York, N. Y.

SUBSCRIBE NOW!

RADIO WORLD, 145 West 45th St., New York City. Enclosed please find my remittance for subscription for RADIO WORLD, one copy each week for specified period.

☐ $10.00 for two years, 104 issues.
☐ $6 for one year, 52 issues.
☐ $3 for six months, 26 issues.
☐ $1.50 for three months, 13 issues.
$1.00 extra per year for foreign postage.
☐ This is a renewal of an existing mail subscription (Check off if true)

Your name .....

Address .....

City .....

"SWOOPE'S LESSONS IN PRACTICAL ELECTRICITY," 17th Edition, Revised by Erich Hausmann. E.E., Sc.D. Requires no previous technical knowledge; fully explains every question about the entire subject of electricity. New chapters on vacuum tubes, telegraphy, telephony and radio signalling. 709 pages, 542 illustrations, 5¼ x 8, Cloth, $2.50. Radio World, 145 W. 45th St., New York, N. Y.

"HANDBOOK OF REFRIGERATING ENGINEERING," by Woolrich—Of great use to everybody dealing in refrigerators. $4. Book Dept., Radio World, 145 W. 45th St., N. Y. City.

Two for the price of One

Get a FREE one-year subscription for any ONE of these magazines:

☐ RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW (monthly, 12 issues)
☐ Q.S.T. (monthly, 12 issues; official amateur organ).
☐ POPULAR MECHANICS AND SCIENCE AND INVENTION (combined) (monthly, 12 issues).
☐ POPULAR SCIENCE MONTHLY
☐ RADIO INDEX (monthly, 12 issues), stations, programs, etc.
☐ RADIO (monthly, 12 issues; exclusively trade magazine).
☐ MODERN RADIO (monthly).
☐ EVERYDAY SCIENCE AND MECHANICS (monthly).
☐ RADIO LOG AND LORE. Monthly. Full station lists, cross indexed, etc.
☐ AMERICAN BOY—YOUTH'S COMPANION (monthly, 12 issues; popular magazine).
☐ BOYS' LIFE (monthly, 12 issues; popular magazine)

Select any one of these magazines and get it FREE for an entire year by sending in a year's subscription for RADIO WORLD at the regular price, $6.00. Cash in now on this opportunity to get RADIO WORLD WEEKLY, 52 weeks at the standard price for such subscription, plus a full year's subscription for any ONE of the other enumerated magazines FREE! Put a cross in the square next to the magazine of your choice, in the above list, fill out the coupon below, and mail $6 check, money order or stamps to RADIO WORLD 145 West 45th Street, New York, N. Y. (Add $2.00, making $8.00 in all, for extra foreign or Canadian postage for both publications).

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DOUBLE VALUE!

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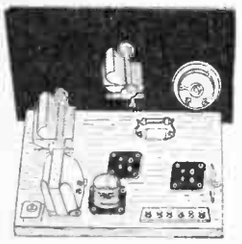
RADIO WORLD, 145 West 45th Street, New York. (Just East of Broadway)

Battery Set 15 to 200 Meters



A SHORT-WAVE receiver, using two 230 (2-volt) tubes, requiring 3 volts filament battery source and 90 volts of B battery. The circuit is detector and one transformer coupled audio stage. This "detector and one step" has been standard for ten years. With this circuit reception the world over has been enjoyed and the elated users number into the teeming thousands. Ranges 15 to 200 meters, using five plug-in coils. Old-timers know this circuit well. Persons who have had no experience with short-waves will find this a most appropriate circuit for a thrilling beginning. The circuit can be wired in 1½ hours.

PARTS REQUIRED: 5 plug-in coils, $1.50; Hammarlund 0.00014 mfd. tuning cond., $1.20; Hammarlund 0.0002 tuning cond., $1.35; three UX sockets, 30c; audio trans., 70c; 50,000 ohm leak, 10c; 300 turn honeycomb, 30c; 0.00025 mfd., clips, 15c; 6.5 ohm limiting resistor for filament circuit, 15c; 20-ohm rheostat, 40c; 20-100 mmfd. equalizer, 20c; battery switch, 20c; 6 bind. posts, 30c; bind. post strip, 10c; vernier dial, 50c; two knobs, 10c; 7 x 10 bakelite panel, $1.25; 7 x 10 baseboard, 25c.

Complete parts, with blueprint, less tubes, (Cat. SW-DAF), @ $9.10
Two 230 tubes @ total of.....$1.92

Precision Parts

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

300 TURN HONEYCOMB coil, same style, tunes to 400 kc. with 0.0001 mfd. Also may be used without condenser as antenna input coil, screen and plate choking, or two used inductively coupled for evening the amplification of t-r-f sets, in untuned stage feeding detector. Cat. HC-300 (each) @.....$ .30

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

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

5 WATT 2,250 OHM resistor to drop maximum B to B plus 180 volts for plates of r-f tubes in any t-r-f set. Cat. 5-W-2 @.....$ .45

POTENTIOMETERS: 400 ohms at 27c; 5,000 ohms @ 95c; 25,000 ohms @ $1.25; 50,000 ohms @ $1.25; 100,000 ohms @ $1.25; 500,000 ohms @ $1.25.

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

WALNUT FINISH, EITHER DORSET OR STANTON CABINET for midget sets, cut for 7-inch cone. Cat. MDCB @.....$4.90

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

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

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

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

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

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

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

CHASSIS for midget, fits in Roland cabinet; chassis is 13½ inches wide, 7¼ inches front to back; flaps front and back 3 inches high; drilled for sockets and speaker plug and for volume control and switch at front. Cat. 5-TCH @.....$1.75

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

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

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

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

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

8 MFD. WET ELECTROLYTIC condenser, for inverted mounting; washer and extra lug provides insulation from chassis for circuits with B choke in negative leg. Cat. LCT-8 @.....$ .62

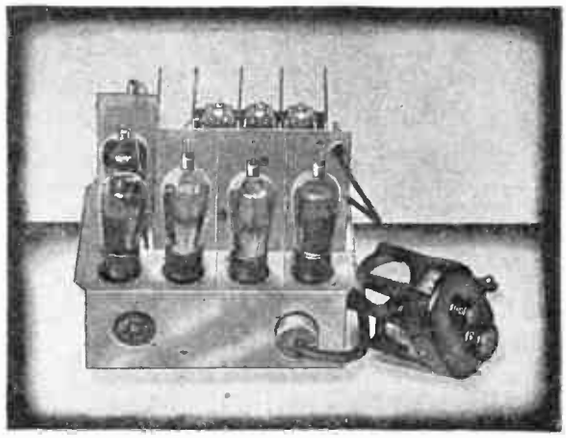
TELEVISION KIT, 80-100 meters, using two stages 235-r-f, 224 power detector, 224 first a-f, 247 output, 280 rectifier. R-f coils have right-angle honeycomb chokes with 4-turn pickup windings. Designed by Edwin Stannard. Dorset cabinet and Rola speaker included. 110 v., 50-60 c. Order Cat. TK @.....$18.95

GUARANTY RADIO GOODS CO.

Anderson's Auto Set, No. 631

In an automobile set what you need and must have is **SENSITIVITY.** You read about high-powered home receivers having a sensitivity of 10 microvolts per meter. Here is an 8-tube auto set, chassis 7 x 11½ x 2¾ inches, that has just such sensitivity. It brings in DX through 50,000 watt locals 10 kc. removed. Did you ever hear of that before in an auto set? Volume is high, without distortion. Push pull pentode output. This circuit was designed and engineered by J. E. Anderson and is by far the best auto set we've ever heard. Variable mu, pentode r-f tubes.

Complete kit of parts, including remote tuning control, running board aerial, speaker, battery box, everything but tubes which are: two 236, two 237, two 238 and two 239 (automotive 6-volt series). Order Cat. JE-631 @.....$50.00
Set of tubes for car receiver (Cat. 630-TUK), @.....$11.80



BROADCAST COILS WITH 80-METER TAP

The Roland 80-550 meter coils have a side lug (shown at left) and four identified lugs at bottom. The side lug is for grid return. The ground symbol lug is the 80-meter tap. P and B go to antenna and ground or plate and B plus. For oscillation B goes to plate and P to B plus.

TAPPED coils are proving very popular, as they make for economy of room and also afford good results. The Roland coils are obtainable for broadcast coverage, 200 to 550 meters, with tap for going down to 80 meters, so television, airplane talks, amateur and other interesting transmission may be heard. An insulated three-deck two-tap long switch is needed for front panel band shifting. See illustration at right. These coils are wound on 1⅛ inch diameter and are attached at the factory to aluminum screw bases, with four identified lugs protruding at bottom and a fifth lug at side. An aluminum cover (not illustrated) screws over the base.

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

For 80-550 meters, for use with 0.00035 mfd. three gang, order Cat. M-35-C (three coils, three shields at this price) @.....$2.45

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

175 kc tuning unit: 3-gang condenser, trimmers, r-f and modulator coil, and special oscillator coil with 700-1000 mmfd. padding condenser and 0.6 mmfd. grid-to-grid coupling condenser. Padding directions supplied, (Cat. 175-TU) @ $6.03

EVEREADY-RAYTHEON TUBES

240	@	$1.80	236	@	$1.65
112A	@	.90	237	@	1.05
222	@	2.70	238	@	1.65
230	@	.96	239	@	2.05
231	@	.96	280	@	.60
232	@	1.30	281	@	3.00
233	@	1.65	Neon	@	4.50
234	@	1.65	245	@	.66
227	@	.60	250	@	3.60
224	@	.96	U-99	@	1.50
235	@	.96	V-99	@	1.68
247	@	.93	120	@	1.80
226	@	.48	201A	@	.45
171A	@	.54	202A	@	2.40
		210 @ 4.20			

ROLA DYNAMIC SPEAKERS

Series F, Rola dynamic speakers for single pentode output, with 1,800 ohm field coil tapped at 300 ohms. Field coil may be used as B supply choke, with 300 ohm section for 247 bias, if field is put in negative rectifier leg. Output transformer built in. 7" cone. Cat. RO-18 @.....$4.50

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

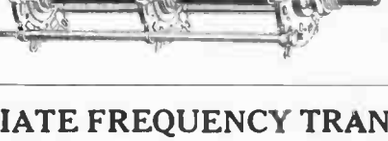
Same as above, except that cone diameter is 12 inches. Cat. RO-18-12 @.....$6.95

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

LONG SWITCHES

Three decks, four different positions on each deck. Cat. LSW-4-3 @ $2.95

Three decks, two different positions on each deck (used in 627 circuit). Cat LSW-2-3 @ $2.65



SUPER CONDENSERS

Fine padding condenser, 700-1,000 mmfd. to be used when i-f is 175 kc. Cat. PC-710 @..$ .50

Coupling condenser, oscillator grid to modulator grid, 0.6 mmfd., no pickup winding needed. Cat. C-6T @ .....$ .18

INTERMEDIATE FREQUENCY TRANSFORMERS

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

Doubly tuned fixed-frequency transformer, 1 to 1 ratio, 175 kilocycles. Band pass filter characteristic. Hammarlund 20-100 mfd. equalizers across primary and secondary accessible. Aluminum shield (must be grounded) 2¼ inches diameter, 2½ inches high, removable bottom. For variable mu tubes. Order Cat. FF-175 @.....$1.50

Same as directly above, for 400 kc. Order Cat. FF-400 @.....$1.50

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