RADIO WORLD

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The First and Only National Radio Weekly

Eleventh Year *555th Issue*

PADDING Fully Analyzed

All-Wave Oscillator

Latest Majestic Receiver

SOCKET CONNECTIONS, ALL SET TUBES

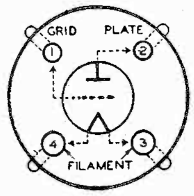

FIG. 1

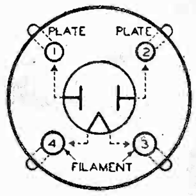

FIG. 2

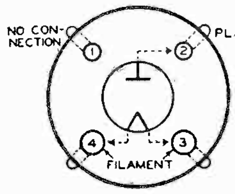

FIG. 3

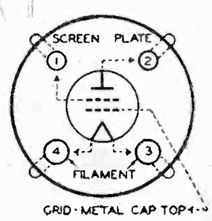

FIG. 4

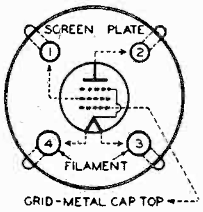

FIG. 4A

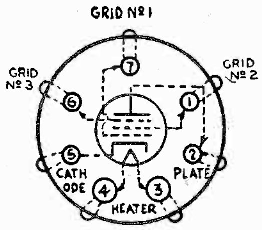

FIG. 5

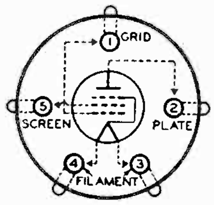

FIG. 6

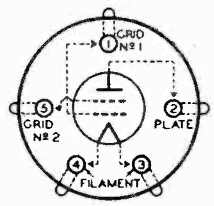

FIG. 7

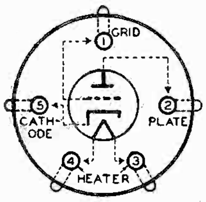

FIG. 8

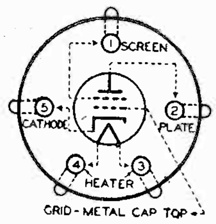

FIG. 9

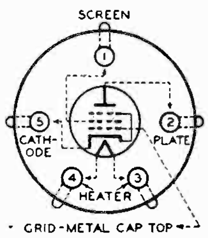

FIG. 9A

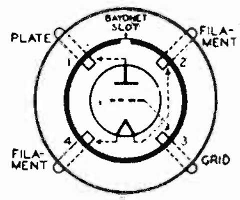

FIG. 10

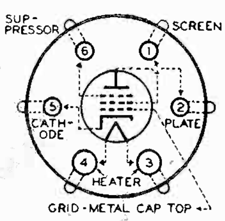

FIG. 11

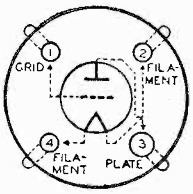

FIG. 12

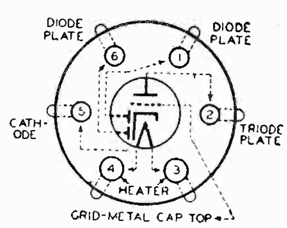

FIG. 13

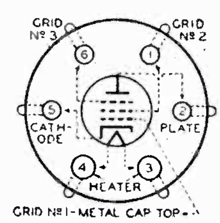

FIG. 14

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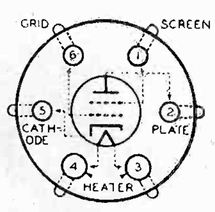

FIG. 15

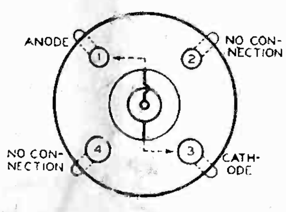

FIG. 17

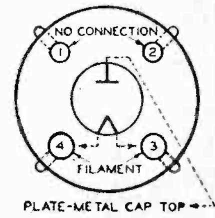

FIG. 16

See tube chart on pages 12 and 13.

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THE MAJESTIC 324

Model 320 Circuit Used, Twin Speakers

TECHNICAL DATA PERTAINING TO MODEL 320 CHASSIS

The Circuit

THE Model 320 Chassis is employed in the Model 324 Receivers. Fundamentally the 320 circuit is identical to the 300 circuit, except that it has delayed automatic volume control employing two type G-4 tubes in the second detector stage. This type of automatic volume control is even better than the duodiode type employed in other Majestic receivers.

The tubes required in the Model 320 chassis are as follows:

Radio Frequency Amplifier—1 Type G-58-S Multi-Mu Spray Shield Pentode Amplifier Tube.

Oscillator—1 Type G-56 Triode Tube.

First Detector—1 Type G-58-S Multi-Mu Spray Shield Pentode Amplifier Tube.

Intermediate Frequency Amplifier—1 Type G-58-S Multi-Mu Spray Shield Pentode Amplifier Tube.

Second Detector and A.V.C.—2 Type G-4 Duo-Diode Detector Tubes.

Synchro-Silent Tuner—1 Type G-57-S Spray Shield Pentode Amplifier Tube.

First Audio Frequency Amplifier—1 Type G-57-S Spray Shield Pentode Amplifier Tube.

Phase Rotating Stage—1 Type G-58-S Spray Shield Multi-Mu Pentode Amplifier Tube.

Pentode Power Amplifier—2 Type G-47-Pentode Tubes.

Rectifier—1 Type G-82 Mercury Vapor Rectifier Tube.

Method of Biasing

Initial bias on the R.F. and I.F. tubes is obtained from Resistor R-1. The initial bias on the first detector tube comes from Resistor R-2. Automatic volume control bias is applied to these three tubes from Resistor R-13. To secure proper filtering and stability, there are used Resistors R-7, R-8, R-9 and R-12. For this same purpose condensers C-5, C-7, C-9 and C-13 are used. The oscillator tube obtains its bias from Resistor R-10.

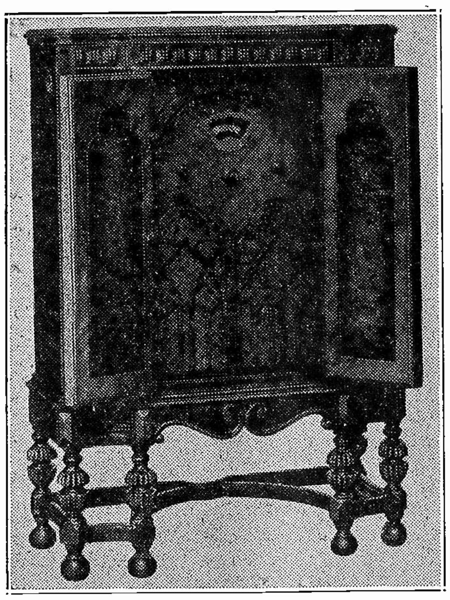
The fixed bias on the screen grid A.F. tube is obtained from resistor R-4 while the bias necessary for Synchro-Silent Tuning is obtained from R-15.

Bias for the phase rotating tube is obtained from R-20.

Bias for the output tubes comes from R-6.

Automatic Volume Control System

The Model 320 chassis is equipped with



Majestic Model 324, housed as illustrated, has twelve tubes.

delayed Automatic Volume Control which is even more satisfactory than the duodiode type employed in other Majestic receivers. It is obtained by a unique arrangement of two G-4 tubes in the second detector stage.

The manual level control is a simple audio frequency potentiometer, R-14, in the grid circuit of the screen grid audio stage. Automatic Volume Control effect is exerted on the R.F., First Detector and I.F. tubes, due to the voltage drop across R-13.

G-19-B and G-19-C Speakers

For dual speaker operation the G-19-B and G-19-C speakers are used simultaneously. Both of these speakers are of generous design, and can handle great amounts of power. The frequency response represents the very latest in dynamic speaker development.

Other Features

The Model 320 chassis is also equipped with Synchro-Silent Tuning, Reactance Resonance Indicator and Resistance-coupled push-pull output. These function just the same in the Model 320 chassis as they do in the 300.

Model 320 Chassis Parts List

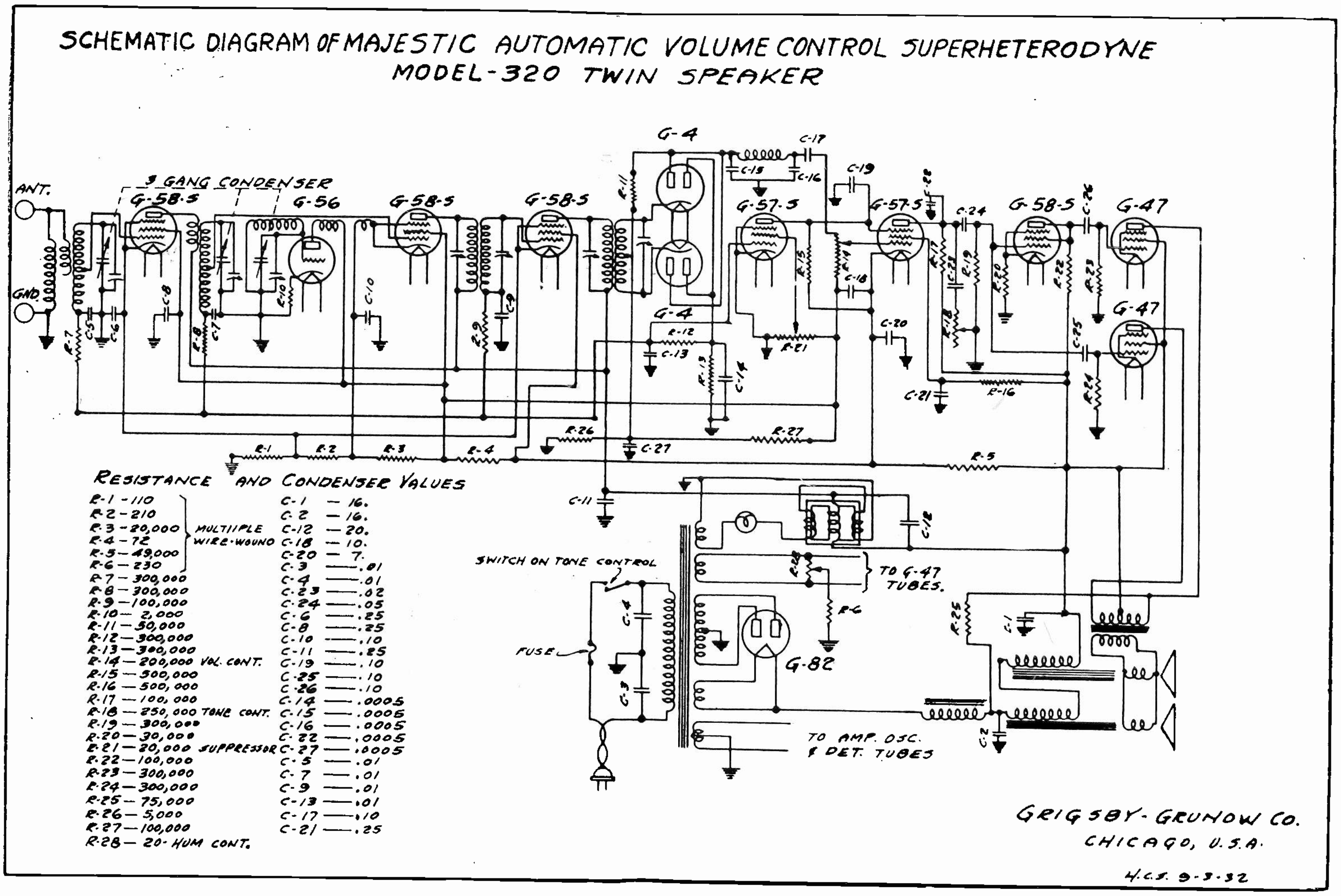
7276	Socket (6 prong)
8303	Socket (6 prong)
7435	Socket (5 prong)
7434	Socket (4 prong)
8304	Socket (5 prong)
5545	Antenna Terminal Board Assembly
1813	Binding Post for Ground
7284	Bypass Condenser Assembly
7285	Bypass Condenser Assembly
7364	Single 4-lug Terminal Board
5059	Resistor 100,000 ohms 1/5 watt
7253	Resistor 300,000 ohms 1/5 watt
5857	Resistor 5,000 ohms 1/3 watt
6242	Mica Condenser .0005 mfd.
6245	.01 mfd. condenser
5234	.10 mfd. condenser
7480	Power Choke Assembly
7455	1st I. F. Transformer Assembly Comp.
7210	Adjustable Cond. Assembly
7426	1st I. F. Trans. & Yoke Assembly
8309	2nd I. F. Trans. Complete
8310	2nd I. F. Trans. & Yoke Assembly
8313	Power Transformer Complete
7450	3-gang Condenser
7176	Condenser Mounting Bracket
7447	Dial and Drive Assembly
7236	Volume Control
7316	Tone Control and Line Switch
7237	Hum Control
7855	Multiple Wire Wound Resistor
7181	Oscillator Coil
7469	R. F. Coil Assembly
7495	Antenna Coil Assembly
8314	Internal Chassis Cable
7427	Suppressor Control
7306	Suppressor Cable
7489	Electrolytic Condenser 16 mfd.
7482	500,000 ohm Carbon Res.
8305	.25 mfd. condenser
7785	Reactance Dimmer Assembly
7784	20 mfd. Electrolytic Condenser
7402	10 mfd. Electrolytic Condenser

TECHNICAL DATA PERTAINING TO MODEL 300 CHASSIS

The Circuit

Chassis 300 is employed in the 303, 304 and 307 models. Fundamentally the Model 300 circuit is similar to the 200 circuit, except that it has push-pull Type G-47 output, and incorporates the new

(*Contnued on next page*)



The model 320 Majestic chassis, diagram above, is used in the model 324 receivers. Model 320 circuit is identical with model 300 circuit except that 324 has delayed a-v-c.

(*Continued from preceding page*)

Majestic Reactance Resonance Indicator. Another outstanding feature is the use of true resistance coupled push-pull amplification through a novel phase rotation circuit. The following features represent improvements in the Model 300 chassis over the Model 200 chassis:

1. Use of the new G-57 and G-58 series R.F. Pentodes.
2. Use of the new G-56 Oscillator.
3. Use of the new G-82 Full-Wave Mercury Vapor Rectifier.
4. Incorporation of Majestic Synchro-Silent Tuning.
5. Fixed tracking Oscillator Condenser.
6. Reactance Resonance Indicator.
7. Resistance coupled Push-Pull Amplification.

The following features which were in previous Majestic models have been retained:

1. Image rejection circuit.
2. Majestic Duo-Diode Automatic Volume Control.
3. Continuously adjustable tone control.
4. Screen grid A.F. Amplification.
5. Push-Pull Pentode Output.

The tubes required in the Model 300 chassis are as follows:

Radio Frequency Amplifier—1 Type G-58-S Multi-Mu Spray Shield Pentode Amplifier Tube.

Oscillator—1 Type G-56 Triode Tube.

First Detector—1 Type G-58-S Multi-Mu Spray Shield Pentode Amplifier Tube.

Intermediate Frequency Amplifier—1 Type G-58-S Multi-Mu Spray Shield Pentode Amplifier Tube.

Second Detector—1 Type G-4-S Spray Shield Duo-Diode Detector Tube.

First Audio Frequency Amplifier—1 Type G-57-S Spray Shield Pentode Amplifier Tube.

Pentode Power Amplifier—1 Type G-47 Pentode Tube.

Synchro-Silent Tuner—1 Type G-57-S Spray Shield Pentode Amplifier Tube.

Phase Rotating Stage—1 Type G-58-S Spray Shield Multi-Mu Pentode Amplifier Tube.

Rectifier—1 Type G-82 Mercury Vapor Rectifier Tube.

Method of Biasing

Initial bias on the R.F. and I.F. tubes is obtained from Resistor R-5. The initial bias on the First Detector tube comes from Resistor R-6. Automatic volume control bias is applied to these three tubes from Resistor R-9. To secure proper filtering and stability, there are used Resistors R-18, R-19, R-20 and R-10. For this same purpose condensers C-19, C-20, C-21 and C-16 are used. There is also provided an R.F. choke in the center tap lead of the Diode I.F. transformer. The oscillator tube obtains its bias from Resistor R-17.

The fixed bias on the screen grid A.F. tube is obtained from resistor R-7, while the bias necessary for Synchro-Silent Tuning is obtained from R-8.

Bias for the phase rotating tube is obtained from R-16.

Bias for the output tubes comes from R-1.

Automatic Volume Control System

This is the new proved Majestic Duo-diode Circuit, which was so successfully used in the 200 and 210 chassis. The manual level control is a simple audio frequency potentiometer, R-23, in the grid circuit of the screen grid audio stage. Automatic Volume Control effect is exerted on the R.F., First Detector, and I.F. tubes, due to the voltage drop across R-9.

Power Supply System

The Power Supply System in the Model 300 chassis consists of the power transformer, Type G-82 Mecury Vapor Rectifier, Filter Choke, and 2-16 microfarad electrolytic condensers; C-1 and C-2, and the field of the G-20-K or G-19-H and G-19-J speakers, depending on whether the chassis is used for single or dual speaker operation.

Automatic Synchro-Silent Tuning

When the dial of an ordinary automatic volume control set is tuned between stations, the sensitivity of the set is very high. In noisy locations, therefore, an automatic volume control set of the standard type might be open for considerable unfavorable reaction, because of the background of "hiss" and static heard when tuning between stations. For this reason many automatic volume control receivers in the past have had on them a push button or switch known as a "Speaker Mute." This device simply short circuits the voice coil of the dynamic speaker so that the signals are very much weakened. Instructions are given that this "Speaker Mute" should be operated whenever the set is tuned between stations. Obviously this remedies the difficulty, but is an undesirable operation, and likewise is very difficult to explain.

It is now easy to see how the new Majestic Synchro-Silent Tuning is quite unique and original. It was decided that since silencing of the radio set was desired between stations, the best place to accomplish this would be in the audio amplifier stage between the second detector and output. For this reason a new Type C-57-S tube is used for the first audio stage, because of its sharp grid voltage cut-off characteristic. By inserting a high negative bias in the suppressor grid circuit of this tube, the tube is "blocked out" and no signal will come through.

To obtain this, a type G-57-S is used as a Synchro tube. This Synchro Tube obtains its plate supply through Resistor R-8, which is in the suppressor grid circuit of the audio amplifier. The Synchro tube obtains its grid voltage from the Automatic Volume Control circuit. When there is no station tuned in, there is no Automatic Volume Control voltage, and hence the grid of the Synchro tube is approximately at zero bias. This causes its plate to draw current through Resistor R-8. The voltage drop across this Resistor biases the G-57-S audio amplifier tube so high that the audio amplifier is "blocked out," and hence no noise comes through.

When a station is tuned in, Automatic Volume Control voltage develops across Resistor R-9 and this Automatic Volume Control voltage is impressed in the form of a negative bias on the Synchro tube. The plate of the Synchro tube now draws little or no current, and hence the bias across the Resistor R-8 disappears, leaving nothing but the normal operating bias on the audio amplifier tube. In this condition the entire set is operative, just as though there were no Synchro tube in the circuit. In fact, it is possible to tune in a station, remove the Synchro tube and notice no difference. On the other hand, if this tube is removed when no station is tuned in, the customary interstation noises are heard. Because of the variation in antennae and noises in different locations, it is necessary to provide a control to govern the point at which the Synchro tube takes hold. A potentiometer, R-22, is therefore included in the screen circuit of the Synchro tube.

There are certain precautions necessary in setting the value of this potentiometer as follows:

INSTRUCTIONS

For Intalling and Operating Chassis Using Majestic Automatic Synchro-Silent Tuning.

1. Complete installation in the same manner as an ordinary broadcast receiver so far as antenna, ground, tubes, etc., are concerned.
2. Set Synchro-Silent Tuning Knob to position of no silencing. (All the way clockwise when facing Synchro-Silent Tuning Control.)
3. Tune receiver to a position off of the broadcasting station, preferably near the low frequency end of the dial.
4. Turn volume control full on. In this position a great deal of noise will be heard, depending upon the location.
5. Adjust Synchro-Silent Tuning Control by rotating counter-clockwise slowly until the noise just stops. It will be found that the noise drops out quite suddenly, and it is desirable that the control be set only to the position required to take out the noise and no further counter-clockwise than necessary.
6. The set is now ready for operation, and it will be found that stations come in with just as much volume as they would if the Synchro-Silent Tuning were not used, but when tuning between stations, the set is absolutely quiet. It may be found that in some particular locations the noise is greater at one end of the dial than at the other, so that if the Synchro-Silent Tuning Control is adjusted to take out noise at the low frequency end of the dial, some noise may come in at the high frequency end. In this case, it is perfectly permissible and advisable to readjust the Synchro-Silent Tuning Control at the high frequency end of the dial.
7. If at any time it is desired to get maximum distance without regard to noise between stations, simply turn the Automatic Synchro-Silent Tuning Control knob as far clockwise as possible.

Sensitivity

Because of the elimination of noise through Majestic Automatic Synchro-Silent Tuning, it has been possible to improve the Sensitivity of the 300 chassis to several times that heretofore used.

Majestic Push-Pull Resistance Coupling Circuit

This a feature which has never before appeared in a broadcast receiver. The advantages of resistance couplings are so well known that it is unnecessary to point out how good tone quality and well designed resistance coupling are synonymous. The advantages of push-pull are also well known, the chief among these being that it is possible to get greater power output with less distortion. Now, as mentioned above, for the first time we have both of these features in one chassis.

In push-pull amplification, it is necessary that the grids of the push-pull tubes be fed with voltages that are equal in magnitude, but exactly opposite in phase or polarity. When a transformer is used, this is accomplished simply by using the two extremes of the secondary winding to feed the push-pull grids, and if a center tap is provided, these voltages are bound to be equal, and opposite in value.

In the new Majestic circuit, phase rotation is accomplished by making use of the fact that a signal in passing through a vacuum tube is rotated in phase exactly 180° (complete reversal). Following the audio channel from the duodiode, we find that the audio voltage built up across Resistor R-9 is fed to the G-57-S audio tube through potentiometer R-23. The output of this audio amplifier follows two channels. The direct and conventional channel is through condensers C-18 and C-11 to the lower of the two G-47 push-pull output pentodes. The remaining channel is through condenser C-18, and the G-58-S phase rotating tube. The signal coming out of this tube built up across R-13 is reversed in polarity over that originally built up across R-11. This reversed signal is fed to the upper of the two G-47 output Pentodes. By suitable design, the G-58-S phase rotating tube and associated circuit is arranged so that no change in the magnitude of the signal takes place, the only change being a reversal of polarity or phase.

In this way, we have two voltages fed to the two G-47 output tubes which are equal in magnitude, but opposite in polarity and true push-pull resistance coupled operation results.

Reactance Resonance Indicator

This is an entirely new feature in radio. By referring to the wiring diagram, it will be seen that the reactor used consists of three windings on three legs respectively, of the iron core. The windings on the two end legs are connected in series with the pilot light, while the winding on the center leg is connected in series with the plates of the R.F., First Detector, and I.F. tubes. An electrolytic condenser, C-5, is connected so as to shunt the center winding. Its purpose will be explained later.

The operation of the reactor is as follows:

When the set is turned on and the tubes are warmed up, but no station is tuned in, a relatively large plate current will flow through the center winding. This saturates the iron core so that the reactance of the two outer windings is quite low and considerable current therefore flows through the pilot light. When a station is tuned in, it operates the G-4-S Automatic Volume Control tube so that an automatic bias voltage is built up across Resistor R-9. This bias voltage is, in turn, impressed upon the control grids of the R.F., First Detector and I.F. tubes. When this bias is impressed on these amplifier tubes, the normal AVC action takes place; namely, their amplification is decreased. It also happens, however, that their plate current is decreased, due to the higher negative bias on their grids. This reduced plate current flowing through the center winding of the reactor relieves the saturation in the iron core so that reactance of the out windings increases and the current flowing through the pilot light is therefore reduced, causing the pilot light to dim when a station is tuned in.

It is, therefore, a simple and fascinating matter to adjust the dial until the pilot light is dimmest, with the perfect assuredness that exact resonance will be located.

The two outer windings are connected so that they buck each other so far as the center leg of the core is concerned. Hence, there will be induced no A.C. in the center winding, which is in the plate circuit of the amplifier tubes. Because of small unbalances which may occur, it has been found necessary that we place the electrolytic condenser, C-5, across the center winding so that there is no possible chance of any A. C. getting into the plate circuit of the amplifier tubes.

"On" and "Off" Line Switch

The "On" and "Off" line switch is attached to the tone control shaft. Turning the tone control completely to the left shuts the receiver off. The first fifteen degrees of rotation of the tone control to the right will turn the receiver on. The balance of the rotation to the right controls the tone, the treble position being at the extreme right, and the bass position at the extreme left, just before the switch is turned off.

Antenna and Ground Terminals

Terminals are provided on the Model 300 chassis for antenna and ground connections. They are located at the rear of the chassis, and are clearly marked. Normal antenna lengths should be approximately forty to sixty feet. If the receiver is operated in localities several hundred miles from broadcasting stations, a longer antenna is recommended. Where long distance reception is of primary importance, an antenna of approximately one hundred feet in length may be used.

G-20-K, G-19-H and G-19-J Speakers Employed in Majestic Models

For single speaker operation the large G-20-K speaker is used in connection with the 300 chassis. For dual speaker operation the G-19-H and G-19-J speakers are used simultaneously. Both of these speakers are of generous design, and handle great amounts of power. The frequency response represents the very latest in dynamic speaker development.

A THOUGHT FOR THE WEEK

GEORGE ENGLES, who knows entertainment values better than most men in the amusement and radio fields, is quite frank in stating that it is no longer safe or wise to rely on the stage for outstanding radio material. Mr. Engles, as head of the N. B. C. Artists Bureau, is in a position to know and, although progressive, he still is conservative enough to make folks stop and listen when he declares that radio must look to its own ingenuity and enterprise in creating new entertainment personalities, and dramatic, musical and comedy features for the air. Hence, Mr. Engles and his able associates are met by the necessity of striking out in new directions rather than straying along the beaten roads and doing the old things in the old way. Leave it to George Engles to be equal to the demands of a radio public that grows more captious every year.

REDUCING NOISE

Due to R-F Interference

"Philco Serviceman" prints the following article:

The reduction of interference noises or man-made static is an important factor in the sale of modern radio, particularly in the congested areas. Many people in these sections refuse to have a radio in their homes because of the electrical noises which are invariably present when the listener wants to hear a favorite program.

There are several known facts about radio noises which should be thoroughly understood by every radio dealer and serviceman before he tries to talk intelligently to a customer on the subject. Get these facts now:

1. Regardless of advertised claims, there is no method or device known to radio science which will eliminate natural static. Static is produced by electrical interference in the atmosphere, and is carried through the air in much the same way as radio from a broadcasting station. It can be reduced in some instances by means of a tone control.

2. Man-made static is produced by various kinds of electrical machines and motors, trolley lines and high tension power lines. It can be reduced in most cases and in many instances can be completely eliminated by filtering, shielding, and by proper erection of the aerial.

3. Man-made static which is picked up on the flat portion of the aerial cannot be eliminated any more than natural static except by moving the aerial farther away from the source of interference, or by suppressing the interference at its point of origin.

4. Man-made static cannot be eliminated by connecting any kind of a device to the power cord of a radio receiver. This type of interference is radiated from the particular power line in which the interfering noise originates. It is carried through the air and is picked up in the aerial and lead-in wires just the same as any other radio signal. A certain amount of this noise does come in on the power line to the radio set, and can be suppressed; every Philco radio is equipped with a line condenser built into the chassis for this purpose.

5. The only correct way to eliminate man-made static is to suppress it at its source. For example, radio noises produced by an automatic oil burner can be reduced by placing a suitable filter unit at the motor and automatic switch terminals, but the same filter would be worthless if placed at any other point in the power line.

6. Shielded lead-in wire, either with or without impedance changing devices to reduce losses, will not eliminate or even reduce man-made static which is picked up in the aerial. For this reason, a shielded lead-in is of little or no value in reducing noise in the average home installation. The only condition under which shielding has any effect in reducing noise is where the lead-in wire passes close to interference-carrying power lines, either inside or outside the building. A greater percentage of this noise is picked up in the lead-in wire than in the aerial wire; thus if the lead-in is shielded by means of a grounded metal covering, the interference will be reduced.

7. Ordinarily shielded lead-in produces a definite loss in signal strength for which compensation must be made in the form of a higher and longer aerial to afford greater pickup of signal.

8. A good outside aerial installation produces less interference noise in the receiver for a given volume of music than a faulty installation or an inside aerial. This is true of every radio from the cheapest to the most expensive. With a good aerial, the radio set can be operated at a lower volume control setting for a given volume in the speaker than it can with a poor aerial. This means that the receiver does not have to work so hard to bring in the signal. Hence the amount of interference noise which is picked up is reduced proportionately.

Summing up all of the above points, it is obvious that the noise of natural static cannot be eliminated, but that the performance of any radio set can be improved from a noise standpoint by the correct application of filter units and the use of a good aerial installation, in some cases with shielded lead-in wire. When so installed, even an inexpensive set will give performance equal to many larger sets carelessly installed, while the powerful and costly set will perform far better than anything the customer has ever known before.

It is unnecessary in all cases to go to an elaborate installation using shielded lead-in. As a matter of fact, such shielding is ordinarily required only in large apartment buildings or hotels. Radio reception for demonstration purposes could be improved in practically every dealer's store because in almost every case the store is located in a business district where radio noises are at their worst. By erecting the aerial high above these noises, and by shielding the lead-in wire, better reception will result. Philco has always advocated the use of shielded lead-in wire in such installations.

The important things to remember in your home installations are that the aerial picks up less noise when run at right angles to power and trolley lines than when it is parallel with such lines; that a carefully installed outside aerial installation always gives superior performance to a small installation; that electric power companies and street car companies are always willing to co-operate in correcting faulty power equipment which produces radio noises.

DX Corner

As readers have spoken most emphatically in favor of a DX department or column we shall make a beginning, but first shall remind all that the success of this column depends greatly upon all brother DXers, and if it is to be a place for the expression of ideas, experiences and helpful suggestions we must continually hear from great numbers. So before we proceed permit us to suggest that you now send along your letter dealing with any aspect of DX whatsoever while the matter is fresh in your mind.

To give a little information about the number of broadcasting stations in North America it might surprise many to learn that there are more than 790 stations. This list, besides containing the forty-eight states also includes Canada, Newfoundland, Costa Rica, Cuba, Haiti, Honduras, Dominican Republic, Salvador, Mexico, Puerto Rico, Hawaii and Alaska. From this one has plenty of material to dial for.

From Latrobe, Pa., J. S. Goral writes: "I have logged nine stations of 100 watts, eleven stations of 250 watts, one of 350 watts and a large list of stations covering all but 10 channels. This was done on a seven-tube second-hand midget. The ground is a hot water tank buried in the earth four feet deep."

Francis Granucci, 174 N. Whittlesey Ave., Wallingford, Conn., seeks information on Western Canada and Central American stations.

John Gillock, 80 Court St., Newark, N. J., who is quite a DXer, wants general information and comments from those with good records.

Wm. M. Eastwood, 124 N. Streeper St., Baltimore, Md., who operates a 7-tube super, table model, has a list of over 200 stations, including West Coast, Canadian, Mexico, Cuba and Hatian, practically all verified.

Nathaniel D. Wales, Jr., 8 Foxcroft Hall, Phillips Academy, Andover, Mass., writes that he has found a loop is very helpful for him in DXing and suggests articles along this line.

From Chicago, Ill., writes Ralp Bright, 5210 S. Honore Street: "I rarely buy RADIO WORLD, but would do so if you conduct a column for DX hounds. I am desirous of seeing listed seldom-heard stations."

Arthur L. Robb, 1338 Mulvane Ave., Topeka, Kansas, writes that he is not interested in personalities and a lot of mechanical detail but is strong for DXing.

Well so that's the way in general the letters go. Real sincere and honest-to-goodness opinions.

J. MURRAY BARRON.

RESISTANCE SCALE **0-1 MA E=400 V. IL=400,000 V.**

SCALE=0—20

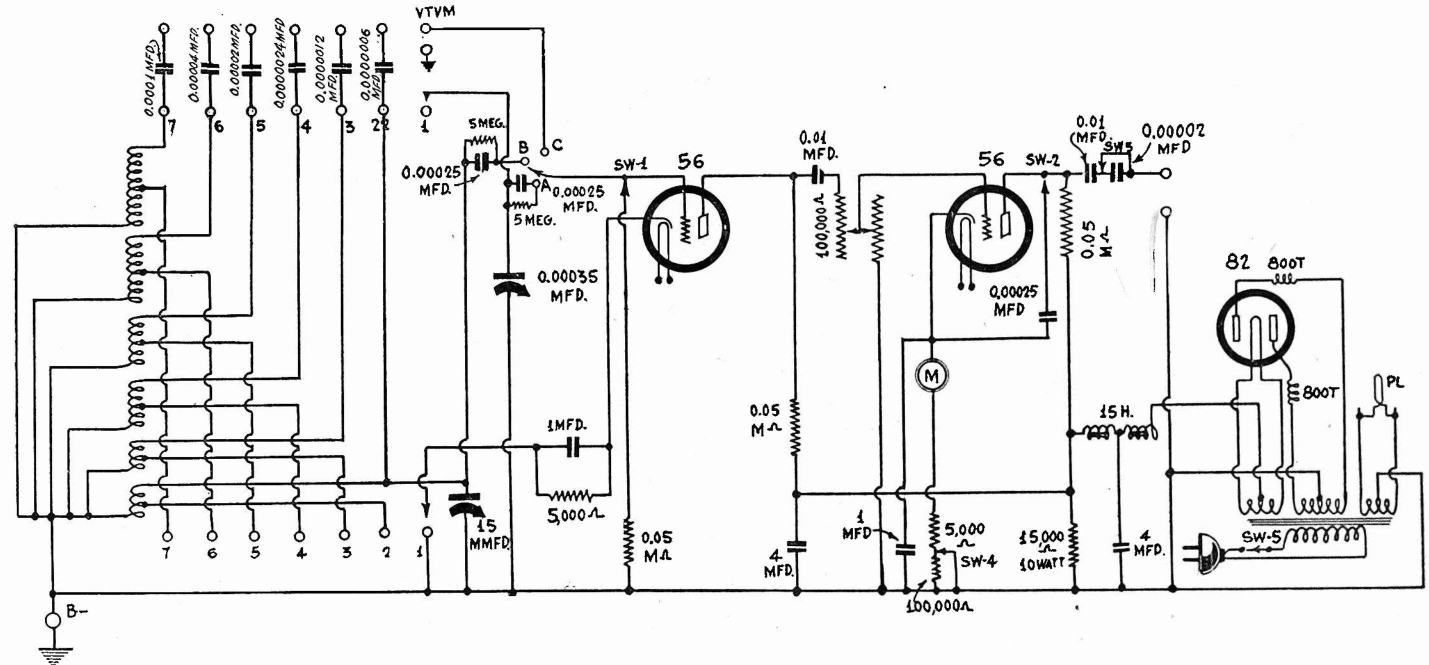
Scale Divisions	*Megohms Resistance*	*Scale Divisions*	*Megohms Resistance*
0	00	8	0.6
1	7.6	8.9	0.5
1.3	5.0	9	0.489
2	3.6	10	0.4
3	2.27	11	0.327
3.5	2.00	11.5	0.3
4	1.6	12	0.266
4.1	1.5	12.5	0.25
5	1.2	13	0.233
5.25	1.0	14	0.1713
6	0.934	14.75	0.15
6.66	0.8	15	0.1333
7	0.743	16	0.1
7.5	0.7		

Switch Type Modulated Oscillator

170 TO 60,000 KC

Useful Also as Converter and VTVM

By Herman Bernard



Three-tube modulated oscillator (with switch SW-1 for modulation removal), 170 to 60,000 kc, with converter and vacuum tube voltmeter built in.

Coil switch, 1, 2, 3, 4, 5, 6, 7, to switch cathode tap and grid terminal on coils. Grid switch A, B, C at A.
Grid switch, A, B, C, to pick up large and small condensers, and open grid circuit for VTVM without oscillation.
SW-1, open for modulation, closed for modulation removal.
SW-2, closed for earphone listening to squeals and i-c-w, also when calibrating.
SW-3, closed when listening with earphones at output, for squeals and i-c-w, also when calibrating.
SW-4, closed for amplification bias, open for detecting bias. Always closed when earphones are at output. Used one way or other for VTVM, depending on M. See text. SW-5, a-c line switch.
For ultra frequencies, coil switch at 2; A, B, C switch at B. For VTVM, coil switch at 1, A, B, C switch at C. For short-long wave converter, coil switch at 2, 3, 4, 5, 6 or 7, A, B, C switch at A, except for ultra frequencies, when at B; SW-1 closed, SW-2, SW-3, open, SW-4 open.

A MODULATED oscillator that puts the onus on the dial, because the frequency stability is better than the degree of accuracy with which the dial can be read, is quite the thing. Here is such a device. It uses the switch system—no plug-in coils—and it tunes in frequencies from 170 to 60,000 kc. The coils you can wind, the coil switch has to be the best that money can buy, while the rest of the circuit consists of apparatus a radio experimenter likely has around the house or shop.

The oscillator is a 56 tube, the circuit being Shiepe's adaptation of the Hartley. There is a stage of amplification, in which the grid load is a constant impedance control of the type diagrammed or one that produces the same effect, although circuited differently. The output is switched for radio frequencies or audio frequency.

Service It Affords

The service performed by this inexpensive device—in which the coil switch (1 to 7) costs almost as much as all the other parts put together—is as follows:

Modulated oscillation frequencies, 170 to 60,000, modulation consisting of a high-pitched squeal due to grid blocking.

Input and output terminals.

Vacuum tube voltmeter.

Calibration without the requisite of any auxiliary system, such as a detecting system.

Ultra frequency tuning by an electrically separate condenser mechanically linked to the main condenser.

Serves as short and long wave converter.

The oscillation frequencies arise from the tuning of the oscillator circuit by the main variable condenser, of 0.00035 mfd., in all instances but one, and in the exceptional instance, by the very small tuning condenser, while the coil switch picks up the proper inductances. The 56 is a tube that, as oscillator, has a readily blocking grid, especially if the oscillation is intense, as it would be if the coils in the tuned circuit were center-tapped. In use as a converter omit modulation by closing SW-1.

Grid leak values as low as 50,000 ohms had to be used in broadcast superheterodynes to stop blocking at frequencies higher than 1200 kc, but now we desire the blocking, and make sure to have it by selecting an inordinately high value of grid leak and a hundred times the value that blocked above 1200 kc.

Switching

The coils are wound on one tubing, and the grid and cathode connections have to be switched. Hence two decks, seven positions per deck, plus two index positions, shaft insulated, constitute the requirement. However, the grid itself has to be switched to one leak-condenser system or the other (because the small tuning condenser is permanently across the smallest coil), and also the VTVM position requires that there be no load on the grid circuit. So by using another deck, with seven more positions and the extra index, making the switch three decks, seven positions and index per deck, the three operations may be combined.

The input and output terminals need explanation, especially as few of the regular run of oscillators provide input. Suppose you desire to calibrate an oscillator you have built, not only in terms of frequency but in at least relative values of oscillation voltage. The amplification of the oscillator is of use, so connection to the grid circuit is necessary. The impedance values of the coupling device have to be different for the different bands, or at least for different groups of bands. Therefore a series condenser, one side to a binding post, other side to grid of a coil, will give us the different values.

The condensers noted are not unprocurable by any means. The smallest capacity is expressible also as 0.6 mmfd., and is a commercial product. The next highest capacity is two such units in parallel, the next is four of them in parallel, while the three remaining capacities are constituted of individual equalizing condensers of 20-100 mmfd., the smallest capacity at minimum setting, next capacity two turns of a screwdriver toward ca-

(Continued on next page)

(*Continued from preceding page*)
pacity increase (right-handed screw motion, i.e., clockwise), and the highest capacity at maximum of the equalizer.

Input Terminals

This distribution is not necessary on the elaborate basis shown, one capacity for each band of frequencies, but is advisable. If the coupling is too tight oscillation might stop at the higher frequencies of any one band. With the distribution as shown the detuning effect is very slight, so that wide frequency ratios prevail (maximum to minimum settings of tuning condenser). Otherwise the detuning would be of no consequence, even if of a considerable nature, as it is a permanent condition in respect to the calibration, and is not destructive of frequency stability at all, when input is used.

With the input terminals, and proper proportion of coupling capacities, it is practical to use the oscillator as the second element of a beat note system, thus enabling reception of interrupted continuous waves, with phones at the output, and of course permitting the calibration of the oscillator against standard frequencies by the low-growl beat note or by the zero beat. With an oscillator like this the zero beat method will work, provided that the original frequency generator emits a sharp wave. For instance, a tuned radio frequency set, with tubes oscillating, the present oscillator coupled thereto by means of the input terminals, might not provide zero beat at all frequencies, due to the lack of tracking in the t-r-f set. However, calibrating against supeheterodynes permits zero beat throughout, since the superheterodyne's oscillation frequency is the relative determinant.

Ordinarily you need, besides an oscillator and a standard of frequencies, some detecting system, i.e., another receiver, to make the beat audible and thus enable registration of zero beat, but here we dispense with the second receiver.

Two Points

The foregoing covers the theory, except as to the admission of two possible shortcomings, one being that the second smallest coil will occasion rather critical tuning because of the large capacity in relation to the small inductance, and the other that the ultra-frequency oscillator may stop oscillating before reaching 60,000 kc, although it was found entirely satisfactory up to 40,000 kc on all occasions. One remedy for oscillation stoppage is to increase the plate voltage, but if this is originally high (around 250 volts or even a little more) there should be no trouble about oscillation even on the smallest coil.

The small condenser, marked 15 mmfd., but which may be somewhat larger, should provide a frequency ratio of 2.4-to-1, and therefore, starting at 24,000 kc, should reach around 60,000 kc. What happens in respect to this particular circuit depends largely on the quality of the coil switch used (low capacity, low contact resistance, etc.) and the nature of the wiring, so that stray capacities are kept at a minimum and distributed inductances likewise. In some instances the tube itself may reduce or stop oscillation at the higher frequencies intended, using the smallest coil.

Positions of Switches

As for the mechanical operation:

The coil switch is turned to positions 7, 6, 5, 4 and 3 when the grid switch is at A, for use of the 0.00035 mfd. tuning capacity. The direction as given is from low to high frequencies.

Position 2 of the coil switch requires that the grid switch be at B, for then the small tuning condenser, permanently across the smallest coil, is picked up.

Position 1 of the coil switch does not pick up any coil, but only the grid itself, so that some unknown voltage may be put into a tube that is not now an oscillator at all, but the driver of a vacuum tube voltmeter, the second 56 tube being used as VTVM. The input voltage must be alternating or audio-modulated, because of the 0.01 mfd. stopping condenser between the two 56 tubes. That is, the input is no good for d-c.

The second 56 tube has a meter in its cathode circuit, and this may be any 0-1 to 0-5 milliammeter, provided however that the maximum current through this tube (at zero bias voltage) does not exceed the full-scale deflection current of the meter used.

Meter and Tube Adjusted

This particular circuit should be adjusted to the meter. Therefore the 100,000 ohms need not necessarily prevail, but this resistor selected on the basis to be outlined. For detection the tube is usually set at 0.2 ma, and 100,000 ohms will afford about that. However, the oscillator itself is a detector, due to grid leak and condenser, and this is true despite the negative bias applied to that tube. There is a switch to cut out the major part of the series biasing resistors in the second 56 circuit, when the tube is to be used as an amplifier. However, since the greatest current will flow at the zero bias, the circuit should be adjusted to the meter on that basis first, then two biasing resistors selected.

Readrite makes a small panel type 0-5 milliammeter that may be used as the indicating device. This instrument, No. 305, has a resistance of 2160 ohms, and may be used where the meter M is designated. Then the current through the tube is tested at zero bias (shorting the biasing resistors) and the lower value of biasing resistor selected so that about 0.5 ma flows, whereupon increase in voltage of input will cause the needle to advance to higher current readings, although the full scale never will be utilized, as 5 milliamperes never would flow. However, the compromise is based on the selection of an inexpensive meter, one costing around $1.25 net, whereas if a 0-1 milliammeter is used, which is preferable, the low value of biasing resistor is selected on the basis of 0.4 milliampere, and the additional biasing resistor inserted, value increased until the current flowing is 0.2 ma.

Which Bias to Select

The difference between the use of the two meters is that the amplification bias is used for VTVM calibration for the inexpensive meter, and the detecting bias is used for calibration when the 0-1 milliammeter is selected.

In any case, when it is desired to listen in (albeit only squeals or their absence, denoting zero beat, constitute the "program") the bias switch should be thrown for lowest current reading, which is the detecting bias. Only in the 0-1 ma case may readings be taken then.

For detecting modulation, including beats, the plate bypass condenser of 0.00025 mfd. should be cut in, but of course when oscillation voltage alone is to be the output, this condenser must be cut out, for it sidetracks radio frequencies. Also, the stopping condensers in the output have to be switched, so full 0.01 mfd. is in use for listening purposes at the output, on account of the audio frequency, whereas for coupling of oscillation voltage output only a small stopping condenser is wanted, and 20 mmfd. will suffice. When the two condensers are in series the capacity is a trifle less than 20 mmfd., and when the small series condenser is cut out, then the capacity is 0.01 mfd. The two switches concerned may be united (double pole single throw) equal to a two-decked on-off switch, shaft insulated. However, many would use a double pole, double throw switch, with one position having no connections, as this would be done as diagrammed separately.

RF-Calibration

Now, as for calibration of the radio frequencies. Connection is made to the proper input binding post, preferably with one side of the input grounded, and connected to ground binding post. Whether one side of the input is grounded does not depend on the test oscillator but on the source.

Some idea of the frequency region is obtained from the statement of approximate extremes, given with the winding data. For the lowest band 170 to 500 kc will enable fundamental frequencies within all the popular ranges of intermediate frequencies, and then some. The broadcast band coverage is a little in excess of the strict limits, i.e., 500 to 1520 kc, as a frequency ratio a trifle in excess of 3-to-1 is effective here, with proper condenser. (The actual capacities were 0.000365 mfd. maximum, 28 mmfd. minimum.)

Approxiately 3-to-1 prevails, except for contraction in the bands covered by the two smallest coils tuned by this condenser.

Thus the other bands would be approximately 1,470 to 4,200 kc, 4,000 to 11,000 kc, 10,000 to 25,000 kc and 24,000 to 60,000 kc.

Zero Beat

In calibrating, to use the zero beat, pick up the whistle, tune to one side and the other of it, the frequency rising on both sides of zero beat until reaching inaudibility. Thus there are three theoretically inaudible settings, two removed from the standard frequency by an infinite number of frequencies above audibility, and the third the center position or zero beat, where there is no difference in frequency. Generally, however, at so-called zero beat an undulation may be perceived, something akin to very slow frequency motorboating. This is not zero beat exactly, but close enough to it, perhaps only a few cycles away, in some instances in calibrating this device, one part in several million.

There are precision dials, laboratory type, that are worth while using on such an oscillator, but use the best dial you can, and if it is of a receiving set type of dial, be sure it is one with a very large scale. A scale diameter of more than 4 inches is desirable, and one of more than 5 inches preferable.

The VTVM

As for calibrating the VTVM (second 56 tube), reread the directions for adjusting the meter, note the meter current when the particular operating bias applicable to VTVM service is to prevail, open the grid lead of the second 56, short out the two biasing resistors and connect C battery voltages, C+ to ground, minus values to grid. Insert C battery voltages, 1.5 to 15 volts in steps of 1.5 volts, and note the cathode current readings. Read 0 bias also. In case the detecting bias current is less than what can be established in this manner (true only if the operating point of self-bias was negative more than 15 volts) take a reading at 22.5, 18 and 16.5 volts, using a 22.5 volt C battery. What the actual bias voltage is by self-bias, either for amplification or detection (bias switch's two positions) may be determined after all points (1.5 volts apart) are registered on plotting paper. Use ten squares of tens or two-cycle logarithmic paper. The curve may be drawn through registered points and the general contour followed to make up for values not directly plotted, that is, values between the 1.5 volt graduations,

(*Contnued on next page*)

AN $8 ACCESSOR

Low Cost Despite Two Switches

By Adrian Brille

ON a panel 4.5 inches square, in a box 2.5 inches deep inside, it is possible to build the Accessor diagrammed herewith. One switch enables five different current readings, which are all that would be required, and another enables alteration of the grid bias on cathode type tubes, as a test of the tube condition.

Since the bias variation has to be different for different type tubes, for instance, small difference for 57 tubes, medium difference for '27 and 56 tubes, and large difference for variable mu and power tubes, a switch enables picking up voltages of 0, 1.5, 4, 4.5, 6 and 7.5 volts higher, from a small C battery built into the Accessor. There is only one a-c power tube of the indirectly heated type, among standard tubes, but all the 6.3-volt tubes are of heater construction, also the 30-volt tube (48).

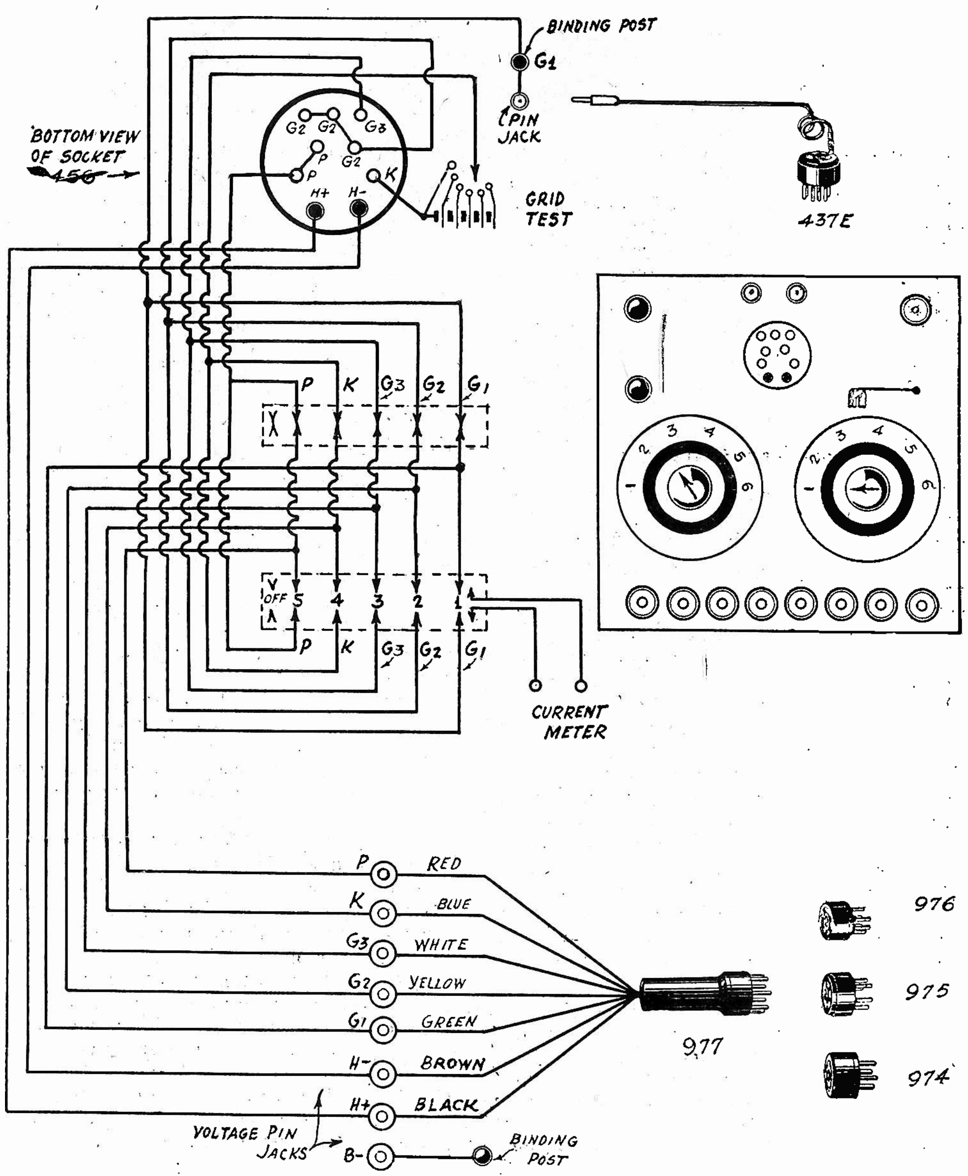
Not only may the currents be read by switching, but, by plugging, the voltages from one pin jack to another, and also of course resistance values. For resistance measurements the same transfers are made—tube taken from set, analyzer plug inserted in vacated set socket, and tube inserted in Accessor socket—but the receiver is not turned "on".

Resistance Measurements

The meter or meters for current and voltage measurements, also for resistance determinations, are not a part of this device, which merely renders the circuits accessible. Of course for resistance measurements the current switch is not used, but the measurements are made between the pin jacks.

The analyzer plug is of an inexpensive type, not the somewhat handier type that costs more, but simply a seven-pin speaker plug of the long type, with a 5-foot cable having seven leads. Thus where tubes transferred are of the type with control grid at top (cap of tube) there is no transfer by plugging, so a lead is run between the G1 binding post (either of the two at upper left) to the receiver, and at the receiver end should have a grid cap so that the free grid clip in the set may be connected thereto.

The socket on the Accessor is of the universal type that takes UX, UY, and six-pin tubes. The seven-pin tubes cannot be put into the universal socket, so an adapter is used that permits testing when a seven-pin tube is met. The seven-pin tube is finally released now by the licensed group of tube manufacturers as a whole, it being the 59 power tube, which, by various grid interconnections, may be a Class A amplifier (pentode or triode type), or a Class B output tube. With Class B two tubes must be used in the output in push-pull form.



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etc., and below 1.5 volts minimum. Then the only useful part of the curve is that between zero bias and the operating point, as the signal or other input to the VTVM has the effect of decreasing the bias. Therefore replot the curve from the operating point to zero bias. Positive bias values are of little help, so avoid them, as grid current flows, and the calibration does not hold very well. At least it is irregular. Since the self-bias operating point for VTVM service has been obtained, and as the equivalent bias voltages to produce various currents are known, the voltage designations, instead of being on the basis of the battery voltages, may well be on the basis of the differences. This isn't the actual amount of the a-c input voltages. Thus, suppose the operating point is 13 volts negative bias. Then the points registered as 1.5, 3, 4.5, 6, 7.5 volts, etc., are (13-1.5 or 11.5), (13—3 or 10), etc.

DIRECTIONS FOR WINDING COILS

Outside diameter of coil forms, 2 inches.
Length of coil forms, 8 inches.
Copper or aluminium shield box, 9 x 4 x 4".
One coil form and one shield required.

* * *

Largest winding (top) 2800 microhenries inductance, 310 turns of No. 30 enamel wire, winding space about 3.5 inches. Leave ¼ inch space before beginning next winding. Approximate range, 170 to 500 kc.

Second largest winding (second from top) inductance 280 microhenries, 60 turns of No. 28 enamel wire, winding space under 1 inch. Leave ¼ inch before beginning next winding. Approximate range, 500 to 1520 kc.

Third largest coil (third from top), inductance 35 microhenries, 17 turns No. 28 enamel wire, winding space about ½ inch. Leave ¼ inch space before beginning next winding. Approximate range, 1470 to 4200 kc.

Fourth largest inductance 4.5 microhenry, 6 turns of No. 18 enamel wire, winding space ¼ inch. Leave ½ inch space before beginning next winding. Approximate range, 4000 to 11000 kc.

Fifth largest winding inductance 0.7 microhenry, ¾ turn No. 14 wire. Leave ½ inch before beginning next winding. Approximate range, 10000 to 25000 kc.

Smallest coil ½ turn ⅛ inch O.D. copper tubing. Approximate range, 24000 to 60000 kc.

Center tap all windings.

The seven-pin tube adapter has seven holes on top and six pins at bottom. Since G1 is introduced independently at the Accessor, being the seventh cabled lead of the analyzer plug, it does not go through the universal socket, and there would be no connection despite the use of the adapter (437E). So on the adapter the control grid of the tube inserted in the adapter is communicated to the receiver through the analyzer plug by inserting a plug tip into the G1 pin jack. This would be the pin jack above the grid clip in the panel diagram. It is connected to the G1 binding post, as the diagram shows. The tip plug is one terminal of a lead eyeletted to the adapter, the control grid connection being established in the adapter between control grid and eyelet.

All the general run of tubes may be accommodated in the Accessor by using the circuit as shown, with adapter as specified. But unusual tubes, such as WD-11, WD-12, Kellogg overhead heaters, UV-199, etc., would require special adapters in addition to the one device specified, but these are obtainable by any who desire them. Every plug, adapter and part specified is a commercial product readily obtainable in the present market, except panel and box.

Receiver Adapters

At the receiver end, as has been stated, the seven-pin analyzer plug fits into seven-hole sockets, but into these only, and since most persons haven't yet even seen such a socket, it is obvious that most testing will be done for a long while on receivers having UX, UY and six-pin sockets. Therefore three adapters are used at the receiving end, to permit plug connections to the set. These adapters all have seven-hole tops, for the plug's seven-pin base must fit into them, and as they are for different type sockets they have different type bases, e.g., adapter 976 has a six-pin base, adapter 975 has a UY base and adapter 974 has a UX base.

All general the run of tubes may be accommodated at the receiver end by using the circuit as shown, with the specified plug and three adapters, while unusual tubes would require additional adapters, and such additional ones are readily obtainable in the present market.

Although economy was sought, two switches are used, the reason being that the current switch does not cost any more —in fact a little less—than would five separate closed-circuit switches to be opened by depressing a button. The button type that closes an open circuit by depression is the inexpensive one.

The voltage switch for the C battery also is inexpensive. So are the tip jacks and binding posts. Likewise the panel and box. You can drill if not cut the pauel yourself, and likewise may make the box.

Current Switch

The current switch has four decks, six different positions. At any one position a closed circuit is opened at the same time that an open circuit is closed. The socket connection in the Accessor is brought to one side of the closed switch that opens, the other side of this switch to the analyzer plug lead. No connection is made to the insulated circuit-opener of the closed switch. Then the open switch that closes is connected in parallel with the other switch. Hence when the plate lead is opened by the opening switch the meter is closed into this circuit, which otherwise would be discontinuous.

The mechanical arrangement of the switch is such that the opening circuit (always one side to tube element, other side to a cable lead) is at rear. Thus two lugs in one line, fourth and third rows as you look at the switch with knob toward you, would be connected to socket spring and cable lead of one particular circuit. In the same line, toward the knob, would be the two lugs (second and first tiers) for circuit-closing, and the one nearer a current lug, on second tier from knob, would be connected to the third tier lug, while the front lug of the closing switch would be connected to the rear lug.

Although these switch directions may sound confusing, there will be no confusion when you see the switch itself. If the switch has more positions than required, use only as many as you require.

The Sixth Connection

The current switch needs a sixth connection, although only G1, G2, G3, K and P currents are read, because all five leads must be closed for voltage readings. The switch, when at any one position, leaves the other current leads closed, therefore the sixth position, leaving all five current lines continuous.

P and K always have the same significance, plate and cathode. G1 is virtually always the control grid, G2 and G3 are other grids and may be high voltage or other circuits, depending on the connection of these grids. New types of tubes have these different grids and every service man and experimenter should familiarize himself with them. Sufficient data for such familiarization are published in the present issue, the socket connections and relative grid locations on the front cover, and the characteristics chart of all standard receiver tubes on pages 12 and 13.

G2 is often the screen grid, G3 an extra grid to a lower potential. Switch Nos. 1, 2 and 3 correspond to those grid numbers.

The parts required are few: panel, box, multiple switch, voltage switch, universal socket, two binding posts, eleven pin jacks, adapter 437E, analyzer plug 977, plug adapters 976, 975 and 974, a 7.5-volt C battery, and a grid lead, with bared terminal at one end and a grid cap at the other. The total cost (less panel and box) is less than $8.

The disposition of parts on the panel follows:

Upper left, G1 binding post; below it, B minus binding post; above socket, tip jacks for current meter; to right of socket, grid clip connecting G1 binding post to green cable lead; below it, tip jack for accommodation tip plug of adapter 437-E. left-hand switch, single pole, six-throw, for C battery; right-hand switch, multiple device already explained.

The eight tip jacks at bottom correspond to the eight shown in perpendicular alignment on the leads from the 977 analyzer plug.

The grid clip lead may have a light spring attached under the panel so the clip springs back to the panel level when not in use.

Should Have An Accessor

For want of a suitable setup for testing many home experimenters can not locate troubles that develop, and are prone to cast the blame entirely on others, which they should not do, because perhaps the cause of the trouble is something slight, which they themselves can remedy, if only they knew just what the cause of the trouble was. Therefore some kind of an Accessor should be in every one's possession, and various types have been discussed in these columns during the past several months, none of them expensive.

In fact, the expense is so little that many ask whether it is true that the Accessors do practically what the costly commercial analyzers do, and if so, how is is possible. They do not make all the tests that the more expensive models make, and those tests that are made are sometimes a little unhandy, but in general the Accessors give about the same service, the notable fact to recognize being that the commercial analyzers have the meters included, and the Accessors do not.

Besides, you have to build the Accessors yourself, and the labor charge cost of the factory-made analyzers is rather considerable, as not every Tom, Dick and Harry can put them together properly. The switching is exceedingly difficult to wire. In the Accessors, however, it is easy to wire switches, where included, and even one not very familiar with radio can make a success of the construction.

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THE 10 NEW TUBES

Their Uses and Purposes Expounded

By Percy Wall

TEN or more new tubes were introduced during the past year. Were these necessary, or was their only purpose to render existing receivers obsolete, as some cynics say? No, they were not absolutely necessary for we could have got along without them. As a matter of fact the introduction of new tubes could have stopped ten years ago. A new tube is no more necessary than a new model automobile. But that is not saying that they are not desirable. If a better tube can be produced, a tube that will do something that no existing tube can do, or one that will perform a certain function more economically, or one that will perform much better with just a little more power, then a new tube is desirable.

Some of the new tubes have had only momentary popularity, not because these tubes were not good but because better tubes came out to take their place. In some cases we suspect that the tube manufacturers made a mistake, judging by the short time it took them to turn out an improvement. But no tube ever came out that in some respect was not an improvement over a similar preceding tube, or that did not fill a definite want.

The Duplex Diode Triode

One of the outstanding tubes was the 55, a tube that can be used as a diode rectifier, automatic volume control rectifier, and audio frequency amplifier. This tube was not absolutely necessary for we could have used two tubes to perform these functions. But if a single tube can do better what it took two tubes to do before, there is a need for such a tube. That is why the 55 quickly became popular.

There is one feature about the 55 which imposes limitations on design, and that is the fact that the diode and amplifier have a common cathode, but this is never serious and to use two separate cathodes would have introduced complications in the manufacture of the tube.

The 55 tube, in conjunction with the 57, has also been applied to interchannel noise suppression control. Many other specialized uses can be found for it, notwithstanding the limitation imposed on it by the common cathode.

The 56 is the next of the new tubes. It differs from the 227 in that it takes only one ampere for filament current, can be used with higher plate voltages, and is more efficient. It is also smaller and therefore takes less room in the receiver, which reflects in greater economy in manufacture of receivers. This tube is a splendid detector, oscillator, and audio frequency amplifier.

R-F Pentodes

The two new pentodes, the 57 and the 58, are improvements over the tubes they replaced, the 224 and the 235. Each has an additional element, the suppressor grid, which can be used for various purposes in special circuits. Ordinarily, the extra element is connected to the cathode and this connection of the suppressor grid removes to a large extent one of the weaknesses of the screen grid tube, secondary emission. Whether or not the 57 and 58 are improvements over the tubes they displaced we have only to make the substitution and make the comparison. It is noteworthy that receiver manufacturers found when they did this that ordinary methods of control were not sufficient. It is also significant that as soon as these tubes were put into sets, many manufacturers dropped a tube from the circuit. But they did not sacrifice sensitivity.

The 46 is a unique tube. Most of us would say that as far as home reception is concerned the tube is entirely superfluous, for who wants a battery of loudspeaker pouring out 25 and 30 watts of sound power into the drawing room! Nevertheless, some manufacturers have put out receivers with a couple of 46s in the Class B connection, so all did not think the same way. It remains to be seen how the public will take these receivers. Right now there is keen interest, but the owner's neighbors have not put in their word yet.

Of course, the 46 is a versatile tube and can be used in the same way as a triode, like the 245, for example. But if we are to use in this manner we might as well use the 245. It is highly doubtful that the 46 will become popular, and, as a matter of fact, a new substitute for it has already been put on the market. We'll come to that.

The 48 and 89 Tubes

Most experimenters and manufacturers would undoubtedly say that the 238 tube of the automobile series of tubes was a mistake. Well, the manufacturers put out the 89, which seems to make the opinion unanimous. The 89 is a good tube. It does more than two 238 tubes in push-pull or in parallel, it can be used in three different connections, as triode, pentode, and as Class B amplifier. It is as a pentode that the tube has found most favor, both in automobile and d-c receivers.

But the 89 was not very old when the 48 came out. The 48 is similar to the 89 except that it takes a filament voltage of 30 volts instead of 6.3 volts. It does take the same current. Therefore the wattage requirement of the 48 power tube is nearly 5 times as great as that of the 89. The increased wattage happens to be wattage saved for a useful purpose.

There are two applications of the 48, namely, to d-c receivers and to receivers operated on 32 volt storage batteries. Therefore the new tube has been designed to meet the requirements of those who live in d-c supplied districts, usually in the large cities, and of those who live on the farms remote from power plants. May be the 48 and the 89 were not needed to save the radio industry but they were certainly needed to perform functions that no other tubes did well or economically.

The very latest of the new tubes is the 59, a heater type tube requiring a seven-contact socket which otherwise is very much like the 47. Due to the fact that the 47 was a filament type tube certain limitations were imposed in design. The 59 removes these. Incidentally, the 59 will put out a little more undistorted power than the 47, in so far as the power pentode does put out undistorted power. This tube is destined to become very popular, provided an improvement does not come out before engineers have had time to put it into sets. But that is not likely because the engineers usually have had time to do that before the tube is officially announced.

The 82 rectifier tube came out at the same time that the 55, 56, 57, 58, and the 46 came out. It was to be used particularly in circuits utilizing Class B amplification because it was capable of very good voltage regulation, a prime requirement in Class B operation. Up to this time there has been little sentiment in favor of it. This lack of interest may be due to the fact that it is necessary to use a couple of radio frequency choke coils in the anode leads in order to remove noise. It may also be due to the excellent service that the old 280 is giving.

From one point of view it seems that the 82 was a mistake. It requires 2.5 volts across the filament when most transformers were already made for 5 volts. Well, the manufacturers quickly announced the 83, which is practically the same as the 82 except that it takes 5 volts on the filament. The 83 is a sturdier tube. No doubt, each of these tubes has its place but neither has yet displaced the 280.

The 85 is a tube similar to the 55 except that it has been designed for 6.3 volts and 0.3 ampere. Therefore it is useful both in d-c and automobile sets. As an automatic volume control in an automobile set it fills a definite need.

Tube List Prices

Type	List Price	Type	List Price	Type	Price List
11	$3.00	'32	2.35	57	1.65
12	3.00	'33	2.80	58	1.65
112-A	1.55	'34	2.80	59	2.50
'20	3.00	'35	1.65	'80	1.05
'71-A	.95	'36	2.80	'81	5.20
UV-'99	2.75	'37	1.80	82	1.30
UX-'99	2.55	'38	2.80	83	1.55
'100-A	4.00	'39	2.80	'74	4.90
'01-A	.80	'40	3.00	'76	6.70
'10	7.25	'45	1.15	'41	10.40
'22	3.15	46	1.55	'68	7.50
'24-A	1.65	47	1.60	'64	2.10
'26	.85	48	2.80	'52	28.00
'27	1.05	'50	6.20	'65	15.00
'30	1.65	55	1.60	'66	10.50
'31	1.65	56	1.30		

SEE CHARACTERISTICS CHART OF RECEIVING TUBES ON FOLLOWING TWO PAGES, AND SOCKET CONNECTIONS ON FRONT COVER

DETECTORS AND AMPLIFIERS

TYPE	PURPOSE	BASE	SOCKET CONNECTIONS	DIMENSIONS MAX. OVERALL: LENGTH	DIMENSIONS MAX. OVERALL: DIAM.	CATHODE TYPE	RATING: FILAMENT (OR HEATER) VOLTS	RATING: FILAMENT (OR HEATER) AMPERES	RATING: FILAMENT (OR HEATER) SUPPLY	RATING: PLATE MAX. VOLTS	RATING: SCREEN MAX. VOLTS	PLATE SUPPLY VOLTS	NEGATIVE GRID BIAS VOLTS: D C ON FIL.	NEGATIVE GRID BIAS VOLTS: A C ON FIL.	SCREEN VOLTS	PLATE CURRENT MILLI-AMP.	SCREEN CURRENT MILLI-AMP.	A C PLATE RESISTANCE OHMS	MUTUAL CONDUCTANCE MICRO-MHOS	VOLTAGE AMPLIFICATION FACTOR	OHMS LOAD FOR STATED POWER OUTPUT	POWER OUTPUT MILLI-WATTS
UX-200-A	DETECTOR	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	5.0	0.25	D C	45	—	45	Grid Return to (—) Filament		—	1.5	—	30000	666	20	—	—
UX-201-A	DETECTOR, * AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	5.0	0.25	D C	135	—	90 135	4.5 9.0	—	—	2.5 3.0	—	11000 10000	725 800	8.0 8.0	—	—
WD-11 WX-12	DETECTOR, * AMPLIFIER	WD 4-PIN MEDIUM 4-PIN	FIG. 12 FIG. 1	4 1/8" 4 11/16"	1 3/16" 1 7/16"	FILAMENT	1.1	0.25	D C	135	—	90 135	4.5 10.5	—	—	2.5 3.0	—	15500 15000	425 440	6.6 6.6	—	—
UX-112-A	DETECTOR, * AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	5.0	0.25	D C	180	—	90 135	4.5 9.0	—	—	5.2 6.2	—	5600 5300	1500 1600	8.5 8.5	—	—
UX-222	RADIO FREQ. AMPLIFIER	MEDIUM 4-PIN	FIG. 4	5 1/32"	1 13/16"	FILAMENT	3.3	0.132	D C	135	67.5	135 135	1.5 1.5	—	45 67.5	1.5 3.3	*	850000 600000	350 480	300 290	—	—
UY-224-A	RADIO FREQ. AMPLIFIER	MEDIUM 5-PIN	FIG. 9	5 1/32"	1 13/16"	HEATER	2.5	1.75	A C or D C	275	90	180 250	3.0 3.0	3.0 3.0	90 90	4.0 4.0	*	400000 600000	1000 1025	400 615	—	—
UY-224-A	BIASED DETECTOR	MEDIUM 5-PIN	FIG. 9	5 1/32"	1 13/16"	HEATER	2.5	1.75	A C or D C	275	90	275‡	5 approx.	5 approx.	20 to 45	Plate current to be adjusted to 0.1 milliampere with no signal.						
UX-226	AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	1.5	1.05	A C or D C	180	—	90 135 180	6.0 9.0 13.5	7.0 10.0 14.5	—	2.9 5.5 6.2	—	8900 7600 7300	935 1100 1150	8.3 8.3 8.3	—	—
UY-227	AMPLIFIER	MEDIUM 5-PIN	FIG. 8	4 11/16"	1 13/16"	HEATER	2.5	1.75	A C or D C	275	—	90 135 180 250	6.0 9.0 13.5 21.0	6.0 9.0 13.5 21.0	—	2.7 4.5 5.0 5.2	—	11000 9000 9000 9250	820 1000 1000 975	9.0 9.0 9.0 9.0	—	—
UY-227	BIASED * DETECTOR	MEDIUM 5-PIN	FIG. 8	4 11/16"	1 13/16"	HEATER	2.5	1.75	A C or D C	275	—	250§	30.0 approx.	30.0 approx.	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-230	DETECTOR, * AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 1/4"	1 9/16"	FILAMENT	2.0	0.06	D C	180	—	90 135 180	4.5 9.0 13.5	—	—	2.5 3.0 3.1	—	11000 10300 10300	850 900 900	9.3 9.3 9.3	—	—
RCA-232	RADIO FREQ. AMPLIFIER	MEDIUM 4-PIN	FIG. 4	5 1/32"	1 13/16"	FILAMENT	2.0	0.06	D C	180	67.5	135 180	3.0 3.0	—	67.5 67.5	1.7 1.7	0.4 max.	950000 1200000	640 650	610 780	—	—
RCA-232	BIASED DETECTOR	MEDIUM 4-PIN	FIG. 4	5 1/32"	1 13/16"	FILAMENT	2.0	0.06	D C	180	67.5	174✱	6 approx.	—	67.5	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-234	SUPER-CONTROL R-F AMPLIFIER	MEDIUM 4-PIN	FIG. 4 A	5 1/32"	1 13/16"	FILAMENT	2.0	0.06	D C	180	67.5	67.5 135 180	3.0 min.	—	67.5 67.5 67.5	2.7 2.8 2.8	1.1 1.0 1.0	400000 600000 1000000	560 600 620	224 360 620	—	—
RCA-235	SUPER-CONTROL R-F AMPLIFIER	MEDIUM 5-PIN	FIG. 9	5 1/32"	1 13/16"	HEATER	2.5	1.75	A C or D C	275	90	180 250	1.5 3.0	1.5 3.0	75 90	5.8 6.5	2.5 2.5	350000 350000	1100 1050	385 370	—	—
RCA-236	RADIO FREQ. AMPLIFIER	SMALL 5-PIN	FIG. 9	4 17/32"	1 9/16"	HEATER	6.3	0.3	D C	180	90	135 180	1.5 3.0	—	67.5 90	3.0 3.1	1.7 max.	300000 350000	1050 1050	315 370	—	—
RCA-236	BIASED DETECTOR	SMALL 5-PIN	FIG. 9	4 17/32"	1 9/16"	HEATER	6.3	0.3	D C	180	67.5	135‡	6.0 approx.	—	67.5	Plate current to be adjusted to 0.1 milliampere with no signal.						
RCA-237	AMPLIFIER	SMALL 5-PIN	FIG. 8	4 1/4"	1 9/16"	HEATER	6.3	0.3	D C	180	—	90 135 180	6.0 9.0 13.5	—	—	2.6 4.3 4.7	—	11500 10000 10000	780 900 900	9.0 9.0 9.0	—	—
RCA-237	BIASED * DETECTOR	SMALL 5-PIN	FIG. 8	4 1/4"	1 9/16"	HEATER	6.3	0.3	D C	180	—	90 135	10.0 15.5	—	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-239	SUPER-CONTROL R-F AMPLIFIER	SMALL 5-PIN	FIG. 9 A	4 17/32"	1 9/16"	HEATER	6.3	0.3	D C	180	90	90 135 180	3.0 3.0 3.0	—	90 90 90	4.4 4.4 4.5	1.3 1.2 1.2	375000 540000 750000	960 980 1000	360 530 750	—	—
UX-240	VOLTAGE AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	5.0	0.25	D C	180	—	135† 180†	1.5 3.0	—	—	0.2 0.2	—	150000 150000	200 200	30 30	—	—
RCA-55	DUPLEX-DIODE TRIODE □	SMALL 6-PIN	FIG. 13	4 17/32"	1 9/16"	HEATER	2.5	1.0	A C or D C	250	—	250	20	20	—	8.0	—	7500	1100	8.3	20000	200
RCA-56	AMPLIFIER	SMALL 5-PIN	FIG. 8	4 1/4"	1 9/16"	HEATER	2.5	1.0	A C or D C	250	—	250	13.5	13.5	—	5.0	—	9500	1450	13.8	—	—
RCA-56	BIASED * DETECTOR	SMALL 5-PIN	FIG. 8	4 1/4"	1 9/16"	HEATER	2.5	1.0	A C or D C	250	—	250§	20 approx.	20 approx.	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-57	RADIO FREQ. AMPLIFIER	SMALL 6-PIN	FIG. 11	4 27/32"	1 9/16"	HEATER	2.5	1.0	A C or D C	250	100	250	3.0	3.0	100	2.0	1.0 max.	exceeds 1.5 meg.	1225	exceeds 1500	—	—
RCA-57	BIASED DETECTOR	SMALL 6-PIN	FIG. 11	4 27/32"	1 9/16"	HEATER	2.5	1.0	A C or D C	250	100	275‡	6.0 approx.	6.0 approx.	100	Plate current to be adjusted to 0.1 milliampere with no signal.						
RCA-58	SUPER-CONTROL R-F AMPLIFIER	SMALL 6-PIN	FIG. 11	4 27/32"	1 9/16"	HEATER	2.5	1.0	A C or D C	250	100	250	3.0	3.0	100	8.2	3.0 max.	800000	1600	1280	—	—
RCA-85	DUPLEX-DIODE TRIODE □	SMALL 6-PIN	FIG. 13	4 17/32"	1 9/16"	HEATER	6.3	0.3	D C	250	—	135 180 250	10.5 13.5 20.0	—	—	3.7 6.0 8.0	—	11000 8500 7500	750 975 1100	8.3	25000 20000 20000	75 160 350
UV-199 UX-199	DETECTOR, * AMPLIFIER	SMALL 4-NUB SMALL 4-PIN	FIG. 10 FIG. 1	3 1/2" [illegible]	1 1/16" [illegible]	FILAMENT	3.3	0.063	D C	90	—	90	4.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

POWER AMPLIFIERS

RCA-210	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	5 5/8"	2 3/16"	FILAMENT	7.5	1.25	A C or D C	425	—	250 350 425	18.0 27.0 35.0	22.0 31.0 39.0	—	10.0 16.0 18.0	—	6000 5150 5000	1330 1550 1600	8.0 8.0 8.0	13000 11000 10200	400 900 1600
UX-112-A	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	5.0	0.25	D C	180	—	135 180	9.0 13.5	—	—	6.2 7.6	—	5300 5000	1600 1700	8.5 8.5	8700 10800	115 260
UX-120	POWER AMPLIFIER	SMALL 4-PIN	FIG. 1	4 1/8"	1 3/16"	FILAMENT	3.3	0.132	D C	135	—	90 135	16.5 22.5	—	—	3.0 6.5	—	8000 6300	415 525	3.3 3.3	9600 6500	45 110
RCA-231	POWER AMPLIFIER	SMALL 4-PIN	FIG. 1	4 1/4"	1 9/16"	FILAMENT	2.0	0.130	D C	180	—	135 180	22.5 30.0	—	—	8.0 12.3	—	4100 3600	925 1050	3.8 3.8	7000 5700	185 375
RCA-233	POWER AMPLIFIER	MEDIUM 5-PIN	FIG. 6	4 11/16"	1 13/16"	FILAMENT	2.0	0.26	D C	135	135	135	13.5	—	135	14.5	3.0	50000	1450	70	7000	700
RCA-238	POWER AMPLIFIER	SMALL 5-PIN	FIG. 9 A	4 17/32"	1 9/16"	HEATER	6.3	0.3	D C	135	135	135	13.5	—	135	9.0	2.5	102000	975	100	13500	525
UX-245	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	5 5/8"	2 3/16"	FILAMENT	2.5	1.5	A C or D C	275	—	180 250	33.0 48.5	34.5 50.0	—	27.0 34.0	—	1900 1750	1850 2000	3.5 3.5	3500 3900	780 1600
RCA-46	POWER AMPLIFIER CLASS A ◘	MEDIUM 5-PIN	FIG. 7	5 5/8"	2 3/16"	FILAMENT	2.5	1.75	A C or D C	250	—	250	31.5	33.0	—	22.0	—	2380	2350	5.6	6400	1250
RCA-46	POWER AMPLIFIER CLASS B ●	MEDIUM 5-PIN	FIG. 7	5 5/8"	2 3/16"	FILAMENT	2.5	1.75	A C or D C	400	—	300 400	0 0	0 0	Power output values are for two tubes operating at indicated load per tube.						1300 1450	16000 20000
RCA-247	POWER AMPLIFIER	MEDIUM 5-PIN	FIG. 6	5 5/8"	2 3/16"	FILAMENT	2.5	1.75	A C or D C	250	250	250	15.0	16.5	250	31.0	6.0	60000	2500	150	7000	2500
RCA-48	POWER AMPLIFIER TETRODE	MEDIUM 6-PIN	FIG. 15	5 3/8"	2 1/16"	HEATER	30	0.4	D C	125	100	95 125	-20.0 -22.5	—	95 100	47.0 50.0	9.0 9.0	10000 10000	2800 2800	28 28	2000 2000	1600 2500
UX-250	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	6 1/4"	2 11/16"	FILAMENT	7.5	1.25	A C or D C	450	—	350 400 450	59.0 66.0 80.0	63.0 70.0 84.0	—	45.0 55.0 55.0	—	1900 1800 1800	2000 2100 2100	3.8 3.8 3.8	4100 3670 4350	2400 3400 4600
RCA-59	POWER AMPLIFIER TRIODE ¶	MEDIUM 7-PIN	FIG. 5	5 5/8"	2 1/16"	HEATER	2.5	2.0	A C or D C	250	—	250	28.0	28.0	—	26.0	—	2400	2600	6.0	5000,	1250
RCA-59	POWER AMPLIFIER PENTODE ⊖	MEDIUM 7-PIN	FIG. 5	5 5/8"	2 1/16"	HEATER	2.5	2.0	A C or D C	250	250	250	18.0	18.0	250	35.0	9.0	40000	2500	100	6000	3000
RCA-59	POWER AMPLIFIER CLASS B Ψ	MEDIUM 7-PIN	FIG. 5	5 5/8"	2 1/16"	HEATER	2.5	2.0	A C or D C	400	—	300 400	0 0	0 0	Power output values are for two tubes operating at indicated load per tube.						6000 6000	16000 20000
UX-171-A	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	4 11/16"	1 13/16"	FILAMENT	5.0	0.25	A C or D C	180	—	90 135 180	16.5 27.0 40.5	19.0 29.5 43.0	—	12.0 17.5 20.0	—	2250 1960 1850	1330 1520 1620	3.0 3.0 3.0	3200 3500 5350	125 370 700
RCA-89	POWER AMPLIFIER TRIODE ¶	SMALL 6-PIN	FIG. 14	4 17/32"	1 9/16"	HEATER	6.3	0.4	D C	180	—	160	20.0	—	—	17.0	—	3000	1570	4.7	7000	300
RCA-89	POWER AMPLIFIER PENTODE ⊖	SMALL 6-PIN	FIG. 14	4 17/32"	1 9/16"	HEATER	6.3	0.4	D C	180	180	163 180	17.0 18.0	—	163 180	17.0 20.0	2.5 3.0	79000 82500	1575 1635	125 135	9000 8000	1250 1500
RCA-89	POWER AMPLIFIER CLASS B Ψ	SMALL 6-PIN	FIG. 14	4 17/32"	1 9/16"	HEATER	6.3	0.4	D C	180	—	180	0	—	Power output values are for two tubes operating at indicated load per tube. For other characteristics, refer to Technical Bulletin.						3400 2350	2500 3500

● Two grids tied together. ◘ Grid next to plate tied to plate.
⊖ Grid #1 is control grid. Grid #2 is screen. Grid #3 tied to cathode.
¶ Grid #1 is control grid. Grids #2 and #3 tied to plate.
Ψ Grids #1 and #2 connected together. Grid #3 tied to plate.

RECTIFIERS

UX-280	FULL-WAVE RECTIFIER	MEDIUM 4-PIN	FIG. 2	5 5/8"	2 3/16"	FILAMENT	5.0	2.0	A C	A-C Voltage per Plate (Volts RMS) ... 350 400 550 D-C Output Current (Maximum MA.) ... 125 110 135 For d-c output voltage, refer to curves in Manual. The 550 volt rating is permissible only with filter circuits having an input choke of at least 20 henries.
UX-281	HALF-WAVE RECTIFIER	MEDIUM 4-PIN	FIG. 3	6 1/4"	2 7/16"	FILAMENT	7.5	1.25	A C	A-C Plate Voltage (Maximum Volts RMS)......700 D-C Output Current (Maximum MA.)......... 85 For d-c output voltage delivered to filter of typical rectifier circuit refer to curves in Manual.
RCA-82	FULL-WAVE MERCURY-VAPOR RECTIFIER	MEDIUM 4-PIN	FIG. 2	4 11/16"	1 13/16"	FILAMENT	2.5	3.0	A C	Maximum A-C Voltage per Plate......500 Volts, RMS Maximum D-C Output Current, Continuous....125 Milliamperes Maximum Peak Inverse Voltage....1400 Volts Maximum Peak Plate Current...... 400 Milliamperes Approximate Tube Voltage Drop.............15 Volts
RCA-83	FULL-WAVE MERCURY-VAPOR RECTIFIER	MEDIUM 4-PIN	FIG. 2	5 3/8"	2 1/16"	FILAMENT	5.0	3.0	A C	Maximum A-C Voltage Per Plate......500 Volts, RMS Maximum D-C Output Current, Continuous....250 Milliamperes Maximum Peak Inverse Voltage....1400 Volts Maximum Peak Plate Current......800 Milliamperes Approximate Tube Voltage Drop.............15 Volts
RCA-866	HALF-WAVE MERCURY-VAPOR RECTIFIER	MEDIUM 4-PIN	FIG. 16	6 5/8"	2 7/16"	FILAMENT	2.5	5.0	A C	Maximum Peak Inverse Voltage.........7500 Volts Maximum Peak Plate Current.......... 0.6 Ampere For additional information refer to Technical Bulletin. Approximate Tube Voltage Drop.............15 Volts

REGULATORS

UX-874	VOLTAGE REGULATOR	MEDIUM 4-PIN	FIG. 17	5 5/8"	2 3/16"	Designed to keep output voltage of B-Eliminators constant when different values of "B" current are supplied.	Operating Voltage.......... 90 Volts D C Starting Voltage.......... 125 Volts D C Operating Current..........10-50 Milliamperes
UV-876	CURRENT REGULATOR (BALLAST TUBE)	MOGUL	—	8"	2 1/16"	Designed to insure constant input to power operated radio receivers despite fluctuations in line voltage.	Operating Current.......... 1.7 Amperes Voltage Range..........40-60 Volts
UV-886	CURRENT REGULATOR (BALLAST TUBE)	MOGUL	—	8"	2 1/16"	Designed to insure constant input to power operated radio receivers despite fluctuations in line voltage.	Operating Current.......... 2.05 Amperes Voltage Range..........40-60 Volts

DETECTORS AND AMPLIFIERS

TYPE	PURPOSE	BASE	SOCKET CONNECTIONS	DIMENSIONS MAX. OVERALL: LENGTH	DIMENSIONS MAX. OVERALL: DIAM.	CATHODE TYPE	RATING: FILAMENT (OR HEATER) VOLTS	RATING: FILAMENT (OR HEATER) AMPERES	RATING: FILAMENT (OR HEATER) SUPPLY	RATING: PLATE MAX. VOLTS	RATING: SCREEN MAX. VOLTS	PLATE SUPPLY VOLTS	NEGATIVE GRID BIAS VOLTS: D C ON FIL.	NEGATIVE GRID BIAS VOLTS: A C ON FIL.	SCREEN VOLTS	PLATE CURRENT MILLI-AMP.	SCREEN CURRENT MILLI-AMP.	A C PLATE RESISTANCE OHMS	MUTUAL CONDUCTANCE MICRO-MHOS	VOLTAGE AMPLIFICATION FACTOR	OHMS LOAD FOR STATED POWER OUTPUT	POWER OUTPUT MILLI-WATTS
UX -200-A	DETECTOR	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	5.0	0.25	D C	45	—	45	Grid Return to (—) Filament		—	1.5	—	30000	666	20	—	—
UX -201-A	DETECTOR, * AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	5.0	0.25	D C	135	—	90 135	4.5 9.0	—	—	2.5 3.0	—	11000 10000	725 800	8.0 8.0	—	—
WD - 11 WX - 12	DETECTOR, * AMPLIFIER	WD 4-PIN MEDIUM 4-PIN	FIG. 12 FIG. 1	$4\frac{1}{8}''$ $4\frac{11}{16}''$	$1\frac{3}{16}''$ $1\frac{7}{16}''$	FILAMENT	1.1	0.25	D C	135	—	90 135	4.5 10.5	—	—	2.5 3.0	—	15500 15000	425 440	6.6 6.6	—	—
UX -112-A	DETECTOR, * AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	5.0	0.25	D C	180	—	90 135	4.5 9.0	—	—	5.2 6.2	—	5600 5300	1500 1600	8.5 8.5	—	—
UX -222	RADIO FREQ. AMPLIFIER	MEDIUM 4-PIN	FIG. 4	$5\frac{1}{32}''$	$1\frac{13}{16}''$	FILAMENT	3.3	0.132	D C	135	67.5	135 135	1.5 1.5	—	45 67.5	1.5 3.3	*	850000 600000	350 480	300 290	—	—
UY -224-A	RADIO FREQ. AMPLIFIER	MEDIUM 5-PIN	FIG. 9	$5\frac{1}{32}''$	$1\frac{13}{16}''$	HEATER	2.5	1.75	A C or D C	275	90	180 250	3.0 3.0	3.0 3.0	90 90	4.0 4.0	*	400000 600000	1000 1025	400 615	—	—
UY -224-A	BIASED DETECTOR	MEDIUM 5-PIN	FIG. 9	$5\frac{1}{32}''$	$1\frac{13}{16}''$	HEATER	2.5	1.75	A C or D C	275	90	275‡	5 approx.	5 approx.	20 to 45	Plate current to be adjusted to 0.1 milliampere with no signal.						
UX -226	AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	1.5	1.05	A C or D C	180	—	90 135 180	6.0 9.0 13.5	7.0 10.0 14.5	—	2.9 5.5 6.2	—	8900 7600 7300	935 1100 1150	8.3 8.3 8.3	—	—
UY -227	AMPLIFIER	MEDIUM 5-PIN	FIG. 8	$4\frac{11}{16}''$	$1\frac{13}{16}''$	HEATER	2.5	1.75	A C or D C	275	—	90 135 180 250	6.0 9.0 13.5 21.0	6.0 9.0 13.5 21.0	—	2.7 4.5 5.0 5.2	—	11000 9000 9000 9250	820 1000 1000 975	9.0 9.0 9.0 9.0	—	—
UY -227	BIASED * DETECTOR	MEDIUM 5-PIN	FIG. 8	$4\frac{11}{16}''$	$1\frac{13}{16}''$	HEATER	2.5	1.75	A C or D C	275	—	250§	30.0 approx.	30.0 approx.	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-230	DETECTOR, * AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{1}{4}''$	$1\frac{9}{16}''$	FILAMENT	2.0	0.06	D C	180	—	90 135 180	4.5 9.0 13.5	—	—	2.5 3.0 3.1	—	11000 10300 10300	850 900 900	9.3 9.3 9.3	—	—
RCA-232	RADIO FREQ. AMPLIFIER	MEDIUM 4-PIN	FIG. 4	$5\frac{1}{32}''$	$1\frac{13}{16}''$	FILAMENT	2.0	0.06	D C	180	67.5	135 180	3.0 3.0	—	67.5 67.5	1.7 1.7	0.4 max.	950000 1200000	640 650	610 780	—	—
RCA-232	BIASED DETECTOR	MEDIUM 4-PIN	FIG. 4	$5\frac{1}{32}''$	$1\frac{13}{16}''$	FILAMENT	2.0	0.06	D C	180	67.5	174*	6 approx.	—	67.5	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-234	SUPER-CONTROL R-F AMPLIFIER	MEDIUM 4-PIN	FIG. 4 A	$5\frac{1}{32}''$	$1\frac{13}{16}''$	FILAMENT	2.0	0.06	D C	180	67.5	67.5 135 180	3.0 min.	—	67.5 67.5 67.5	2.7 2.8 2.8	1.1 1.0 1.0	400000 600000 1000000	560 600 620	224 360 620	—	—
RCA-235	SUPER-CONTROL R-F AMPLIFIER	MEDIUM 5-PIN	FIG. 9	$5\frac{1}{32}''$	$1\frac{13}{16}''$	HEATER	2.5	1.75	A C or D C	275	90	180 250	1.5 3.0	1.5 3.0	75 90	5.8 6.5	2.5 2.5	350000 350000	1100 1050	385 370	—	—
RCA-236	RADIO FREQ. AMPLIFIER	SMALL 5-PIN	FIG. 9	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	180	90	135 180	1.5 3.0	—	67.5 90	3.0 3.1	1.7 max.	300000 350000	1050 1050	315 370	—	—
RCA-236	BIASED DETECTOR	SMALL 5-PIN	FIG. 9	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	180	67.5	135‡	6.0 approx.	—	67.5	Plate current to be adjusted to 0.1 milliampere with no signal.						
RCA-237	AMPLIFIER	SMALL 5-PIN	FIG. 8	$4\frac{1}{4}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	180	—	90 135 180	6.0 9.0 13.5	—	—	2.6 4.3 4.7	—	11500 10000 10000	780 900 900	9.0 9.0 9.0	—	—
RCA-237	BIASED * DETECTOR	SMALL 5-PIN	FIG. 8	$4\frac{1}{4}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	180	—	90 135	10.0 15.5	—	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA-239	SUPER-CONTROL R-F AMPLIFIER	SMALL 5-PIN	FIG. 9 A	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	180	90	90 135 180	3.0 3.0 3.0	—	90 90 90	4.4 4.4 4.5	1.3 1.2 1.2	375000 540000 750000	960 980 1000	360 530 750	—	—
UX -240	VOLTAGE AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	5.0	0.25	D C	180	—	135† 180†	1.5 3.0	—	—	0.2 0.2	—	150000 150000	200 200	30 30	—	—
RCA- 55	DUPLEX-DIODE TRIODE □	SMALL 6-PIN	FIG. 13	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	2.5	1.0	A C or D C	250	—	250	20	20	—	8.0	—	7500	1100	8.3	20000	200
RCA- 56	AMPLIFIER	SMALL 5-PIN	FIG. 8	$4\frac{1}{4}''$	$1\frac{9}{16}''$	HEATER	2.5	1.0	A C or D C	250	—	250	13.5	13.5	—	5.0	—	9500	1450	13.8	—	—
RCA- 56	BIASED * DETECTOR	SMALL 5-PIN	FIG. 8	$4\frac{1}{4}''$	$1\frac{9}{16}''$	HEATER	2.5	1.0	A C or D C	250	—	250§	20 approx.	20 approx.	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
RCA- 57	RADIO FREQ. AMPLIFIER	SMALL 6-PIN	FIG. 11	$4\frac{27}{32}''$	$1\frac{9}{16}''$	HEATER	2.5	1.0	A C or D C	250	100	250	3.0	3.0	100	2.0	1.0 max.	exceeds 1.5 meg.	1225	exceeds 1500	—	—
RCA- 57	BIASED DETECTOR	SMALL 6-PIN	FIG. 11	$4\frac{27}{32}''$	$1\frac{9}{16}''$	HEATER	2.5	1.0	A C or D C	250	100	275‡	6.0 approx.	6.0 approx.	100	Plate current to be adjusted to 0.1 milliampere with no signal.						
RCA- 58	SUPER-CONTROL R-F AMPLIFIER	SMALL 6-PIN	FIG. 11	$4\frac{27}{32}''$	$1\frac{9}{16}''$	HEATER	2.5	1.0	A C or D C	250	100	250	3.0	3.0	100	8.2	3.0 max.	800000	1600	1280	—	—
RCA- 85	DUPLEX-DIODE TRIODE □	SMALL 6-PIN	FIG. 13	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	250	—	135 180 250	10.5 13.5 20.0	—	—	3.7 6.0 8.0	—	11000 8500 7500	750 975 1100	8.3	25000 20000 20000	75 160 350
UV -199 [illegible]	DETECTOR, * AMPLIFIER	SMALL 4-NUB [illegible]	FIG. 10 [illegible]	$3\frac{1}{2}''$ [illegible]	$1\frac{1}{16}''$ [illegible]	FILAMENT	3.3	0.063	D C	90	[illegible]	[illegible]	4.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

POWER AMPLIFIERS

RCA-210	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$5\frac{5}{8}''$	$2\frac{3}{16}''$	FILAMENT	7.5	1.25	A C or D C	425	—	250 350 425	18.0 27.0 35.0	22.0 31.0 39.0	—	10.0 16.0 18.0	—	6000 5150 5000	1330 1550 1600	8.0 8.0 8.0	13000 11000 10200	400 900 1600
UX-112-A	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	5.0	0.25	D C	180	—	135 180	9.0 13.5	—	—	6.2 7.6	—	5300 5000	1600 1700	8.5 8.5	8700 10800	115 260
UX-120	POWER AMPLIFIER	SMALL 4-PIN	FIG. 1	$4\frac{1}{8}''$	$1\frac{3}{16}''$	FILAMENT	3.3	0.132	D C	135	—	90 135	16.5 22.5	—	—	3.0 6.5	—	8000 6300	415 525	3.3 3.3	9600 6500	45 110
RCA-231	POWER AMPLIFIER	SMALL 4-PIN	FIG. 1	$4\frac{1}{4}''$	$1\frac{9}{16}''$	FILAMENT	2.0	0.130	D C	180	—	135 180	22.5 30.0	—	—	8.0 12.3	—	4100 3600	925 1050	3.8 3.8	7000 5700	185 375
RCA-233	POWER AMPLIFIER	MEDIUM 5-PIN	FIG. 6	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	2.0	0.26	D C	135	135	135	13.5	—	135	14.5	3.0	50000	1450	70	7000	700
RCA-238	POWER AMPLIFIER	SMALL 5-PIN	FIG. 9 A	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.3	D C	135	135	135	13.5	—	135	9.0	2.5	102000	975	100	13500	525
UX-245	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$5\frac{5}{8}''$	$2\frac{3}{16}''$	FILAMENT	2.5	1.5	A C or D C	275	—	180 250	33.0 48.5	34.5 50.0	—	27.0 34.0	—	1900 1750	1850 2000	3.5 3.5	3500 3900	780 1600
RCA-46	POWER AMPLIFIER CLASS A ◘	MEDIUM 5-PIN	FIG. 7	$5\frac{5}{8}''$	$2\frac{3}{16}''$	FILAMENT	2.5	1.75	A C or D C	250	—	250	31.5	33.0	—	22.0	—	2380	2350	5.6	6400	1250
RCA-46	POWER AMPLIFIER CLASS B ●	MEDIUM 5-PIN	FIG. 7	$5\frac{5}{8}''$	$2\frac{3}{16}''$	FILAMENT	2.5	1.75	A C or D C	400	—	300 400	0 0	0 0	Power output values are for two tubes operating at indicated load per tube.						1300 1450	16000 20000
RCA-247	POWER AMPLIFIER	MEDIUM 5-PIN	FIG. 6	$5\frac{5}{8}''$	$2\frac{3}{16}''$	FILAMENT	2.5	1.75	A C or D C	250	250	250	15.0	16.5	250	31.0	6.0	60000	2500	150	7000	2500
RCA-48	POWER AMPLIFIER TETRODE	MEDIUM 6-PIN	FIG. 15	$5\frac{3}{8}''$	$2\frac{1}{16}''$	HEATER	30	0.4	D C	125	100	95 125	-20.0 -22.5	—	95 100	47.0 50.0	9.0 9.0	10000 10000	2800 2800	28 28	2000 2000	1600 2500
UX-250	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$6\frac{1}{4}''$	$2\frac{11}{16}''$	FILAMENT	7.5	1.25	A C or D C	450	—	350 400 450	59.0 66.0 80.0	63.0 70.0 84.0	—	45.0 55.0 55.0	—	1900 1800 1800	2000 2100 2100	3.8 3.8 3.8	4100 3670 4350	2400 3400 4600
RCA-59	POWER AMPLIFIER TRIODE ¶	MEDIUM 7-PIN	FIG. 5	$5\frac{5}{8}''$	$2\frac{1}{16}''$	HEATER	2.5	2.0	A C or D C	250	—	250	28.0	28.0	—	26.0	—	2400	2600	6.0	5000	1250
RCA-59	POWER AMPLIFIER PENTODE ⊕	MEDIUM 7-PIN	FIG. 5	$5\frac{5}{8}''$	$2\frac{1}{16}''$	HEATER	2.5	2.0	A C or D C	250	250	250	18.0	18.0	250	35.0	9.0	40000	2500	100	6000	3000
RCA-59	POWER AMPLIFIER CLASS B ⊛	MEDIUM 7-PIN	FIG. 5	$5\frac{5}{8}''$	$2\frac{1}{16}''$	HEATER	2.5	2.0	A C or D C	400	—	300 400	0 0	0 0	Power output values are for two tubes operating at indicated load per tube.						6000 6000	16000 20000
UX-171-A	POWER AMPLIFIER	MEDIUM 4-PIN	FIG. 1	$4\frac{11}{16}''$	$1\frac{13}{16}''$	FILAMENT	5.0	0.25	A C or D C	180	—	90 135 180	16.5 27.0 40.5	19.0 29.5 43.0	—	12.0 17.5 20.0	—	2250 1960 1850	1330 1520 1620	3.0 3.0 3.0	3200 3500 5350	125 370 700
RCA-89	POWER AMPLIFIER TRIODE ¶	SMALL 6-PIN	FIG. 14	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.4	D C	180	—	160	20.0	—	—	17.0	—	3000	1570	4.7	7000	300
RCA-89	POWER AMPLIFIER PENTODE ⊕	SMALL 6-PIN	FIG. 14	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.4	D C	180	180	163 180	17.0 18.0	—	163 180	17.0 20.0	2.5 3.0	79000 82500	1575 1635	125 135	9000 8000	1250 1500
RCA-89	POWER AMPLIFIER CLASS B ⊛	SMALL 6-PIN	FIG. 14	$4\frac{17}{32}''$	$1\frac{9}{16}''$	HEATER	6.3	0.4	D C	180	—	180	0	—	Power output values are for two tubes operating at indicated load per tube. For other characteristics, refer to Technical Bulletin.						3400 2350	2500 3500

●Two grids tied together. ◘Grid next to plate tied to plate.
⊕Grid #1 is control grid. Grid #2 is screen. Grid #3 tied to cathode.
¶Grid #1 is control grid. Grids #2 and #3 tied to plate.
⊛Grids #1 and #2 connected together. Grid #3 tied to plate.

RECTIFIERS

UX-280	FULL-WAVE RECTIFIER	MEDIUM 4-PIN	FIG. 2	$5\frac{5}{8}''$	$2\frac{3}{16}''$	FILAMENT	5.0	2.0	A C	A-C Voltage per Plate (Volts RMS) .... 350 400 550; D-C Output Current (Maximum MA.) .. 125 110 135. For d-c output voltage, refer to curves in Manual. The 550 volt rating is permissible only with filter circuits having an input choke of at least 20 henries.
UX-281	HALF-WAVE RECTIFIER	MEDIUM 4-PIN	FIG. 3	$6\frac{1}{4}''$	$2\frac{7}{16}''$	FILAMENT	7.5	1.25	A C	A-C Plate Voltage (Maximum Volts RMS)......700; D-C Output Current (Maximum MA.)......... 85. For d-c output voltage delivered to filter of typical rectifier circuit refer to curves in Manual.
RCA-82	FULL-WAVE MERCURY-VAPOR RECTIFIER	MEDIUM 4-PIN	FIG. 2	$4\frac{1}{16}''$	$1\frac{13}{16}''$	FILAMENT	2.5	3.0	A C	Maximum A-C Voltage per Plate.....................500 Volts, RMS; Maximum D-C Output Current, Continuous....125 Milliamperes; Maximum Peak Inverse Voltage....1400 Volts; Maximum Peak Plate Current...... 400 Milliamperes; Approximate Tube Voltage Drop.............................15 Volts
RCA-83	FULL-WAVE MERCURY-VAPOR RECTIFIER	MEDIUM 4-PIN	FIG. 2	$5\frac{3}{8}''$	$2\frac{1}{16}''$	FILAMENT	5.0	3.0	A C	Maximum A-C Voltage Per Plate......................500 Volts, RMS; Maximum D-C Output Current, Continuous....250 Milliamperes; Maximum Peak Inverse Voltage....1400 Volts; Maximum Peak Plate Current........800 Milliamperes; Approximate Tube Voltage Drop.............................15 Volts
RCA-866	HALF-WAVE MERCURY-VAPOR RECTIFIER	MEDIUM 4-PIN	FIG. 16	$6\frac{5}{8}''$	$2\frac{7}{16}''$	FILAMENT	2.5	5.0	A C	Maximum Peak Inverse Voltage.....................7500 Volts; Maximum Peak Plate Current......................0.6 Ampere; Approximate Tube Voltage Drop.............................15 Volts. For additional information refer to Technical Bulletin.

REGULATORS

UX-874	VOLTAGE REGULATOR	MEDIUM 4-PIN	FIG. 17	$5\frac{5}{8}''$	$2\frac{3}{16}''$	Designed to keep output voltage of B-Eliminators constant when different values of "B" current are supplied.	Operating Voltage.......................... 90 Volts D C Starting Voltage.......................... 125 Volts D C Operating Current..........................10-50 Milliamperes
UV-876	CURRENT REGULATOR (BALLAST TUBE)	MOGUL	—	8"	$2\frac{1}{16}''$	Designed to insure constant input to power operated radio receivers despite fluctuations in line voltage.	Operating Current.......................... 1.7 Amperes Voltage Range..........................40-60 Volts
UV-886	CURRENT REGULATOR (BALLAST TUBE)	MOGUL	—	8"	$2\frac{1}{16}''$	Designed to insure constant input to power operated radio receivers despite fluctuations in line voltage.	Operating Current.......................... 2.05 Amperes Voltage Range..........................40-60 Volts

PADDING

By J. E. Anderson

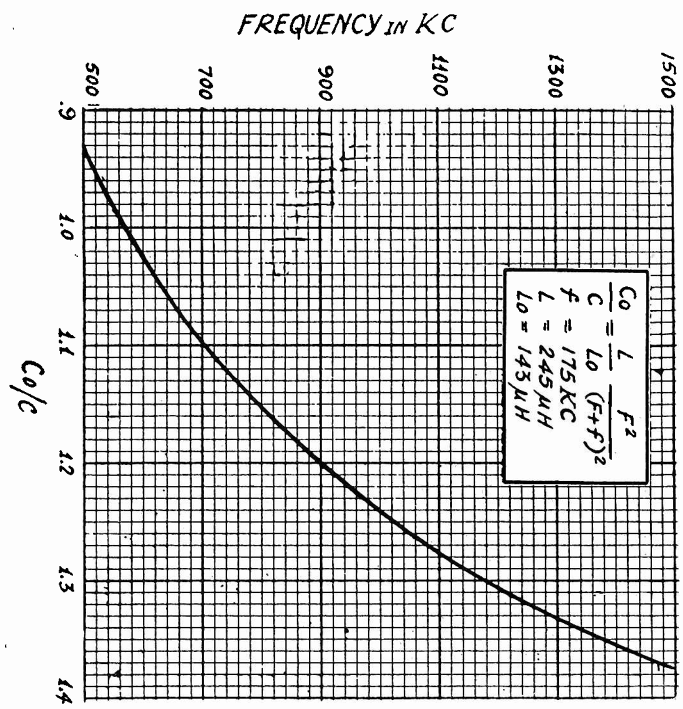


FIG. 1
This curve shows the relation that must exist between the oscillator and radio frequency tuner capacities for tracking. The curve represents a special case of the formula given.

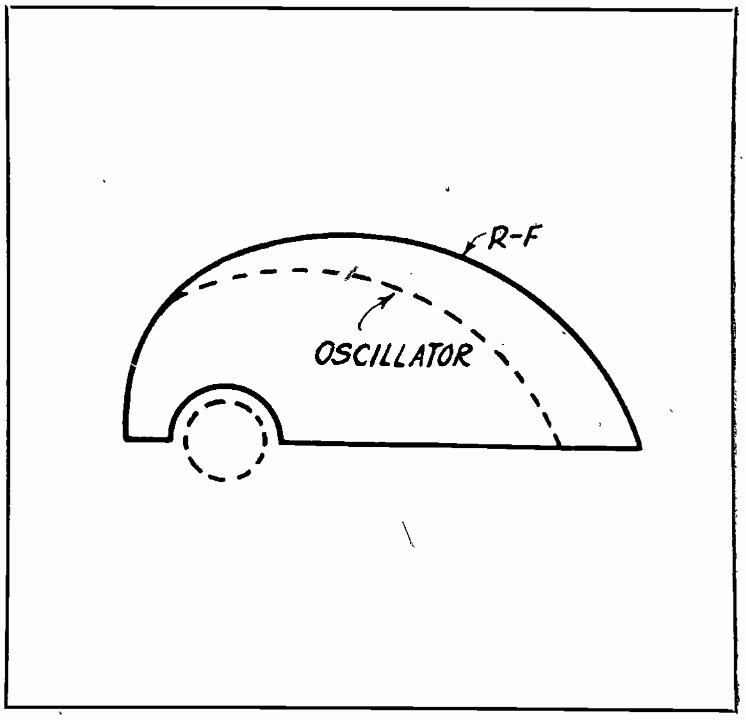


FIG. 2
This illustrates how the plates of a tracking condenser are shaped to produce tracking. The oscillator condenser plates are smaller as shown by the dotted line.

[Herewith is the first of a new series of articles by J. E. Anderson, technical editor, on the superheterodyne. Mr. Anderson is a recognized authority on this circuit, and besides a resourceful mathematician and practitioner. The discussion of padding introduces considerations never before published. Read these superheterodyne articles weekly in these columns and become fully acquainted with the outstanding circuit.—EDITOR.]

WHEN unified tuning came into vogue in tuned radio frequency receivers attempts were made to apply the same principle to superheterodynes. At first little success attended the efforts because the oscillator, the most critical part of the tuner, required a different rate of chance of the tuning condenser in order to maintain the constant difference frequency between the radio frequency tuner and the oscillator circuit. Various mechanical contrivances were used in isolated cases with good results but these were not adapted to large scale production. These contrivances consisted of mechanical couplers with specially cut cams or gears which made the oscillator condenser turn at the proper rate as the radio frequency condensers were turned.

Manufacturers of variable condensers realized that the proper rate of change of the oscillator capacity in respect to the rate of change of the radio frequency condensers could be effected by cutting the plates of the condensers differently. The so-called tracking condenser followed and is now used in some superheterodynes with unified tuning control.

Design of Plates

By properly designing the plates of the condensers correct tracking can be effected for any intermediate frequency and for any tuning range. The design may be done so as to require the same inductance in the oscillator circuit as the inductance in any of the radio frequency circuits, or it may be done so as to require different inductances. In one particular tracking condenser the plates are so cut as to require an inductance of 245 microhenries for the radio frequency circuits and an inductance of 143 microhenries for the oscillator, the coverage being the 550-1500 kc band and the intermediate frequency being 175 kc. It is easily shown that this particular combination requires a larger minimum capacity in the oscillator circuit than in the radio frequency circuits. This required difference can be introduced by means of the trimmer condensers mounted on the main condensers.

Let us examine what the relative values of capacity in the radio frequency and oscillator circuits should be in order that the difference between the natural frequencies should remain a constant regardless of the setting of the main condenser. Let Lo and Co be the inductance and capacity, respectively, in the oscillator circuit and let L and C be the corresponding values in the radio frequency circuit. Let F be the signal frequency and f the intermediate frequency.

High Intermediate Frequency

If we apply the formula that connects frequency, inductance, and capacity in a tuned circuit we have $F+f=1/2\pi(LoCo)^{1/2}$ for the oscillator and $F=1/2\pi(LC)^{1/2}$ for the radio frequency circuit. If we square both sides of both equations and then divide the first by the second we obtain $(F+f)^2/F^2=LC/LoCo$, or $Co/C=LF^2/Lo(F+f)^2$, as the ratio that must exist between the capacities in the two circuits. It is clear that if the two inductances are equal the ratio of the capacities should be equal to the ratio of the squares of the two frequencies involved. If f is small compared with F for all values of F within the range of the tuner, then the ratio of the two capacities is nearly equal to unity and there is no difficulty in making the circuits track, for it can be done with identical condensers.

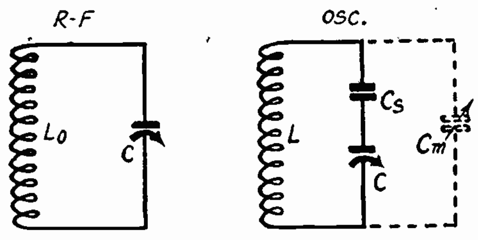
In most practical cases, especially in broadcast reception, the intermediate frequency f is not negligible compared with F at any setting of the condenser. Therefore the condensers must be different.

The formula above which states the condition required for tracking does not demand that L/Lo should have any particular value. But commercial condensers available are so made that L/Lo should be 245/143, or about 1.712. The reason for this may possibly be that it makes the mechanical design and construction of the condenser easier.

If we put this ratio into the formula for Co/C and compute the value of Co/C for an intermediate frequency of 175 kc from 500 to 1500 kc we obtain the data plotted in Fig. 1. It will be seen that the capacity ratio varies from 0.93 when F equals 500 kc to 1.375 when F equals 1500 kc. Nearly throughout the entire tuning range the capacity in the oscillator is greater than that in the radio frequency circuit, for the ratio is unity at 565 kc. For all higher frequencies the ratio is greater than unity.

This is an unexpected fact because it is obvious that the capacity of the variable condenser is smaller than the corresponding capacity in the radio frequency circuit, the oscillator condenser plates being cut smaller. The apparent discrepancy is due to the fact that the minimum capacity in the oscillator circuit is greater than the minimum in the radio frequency circuit.

We can easily compute what the two minimum capacities are. Let us assume that the radio frequency circuit tunes to 1500 kc when the capacity is minimum. The inductance in the circuit is 245 microhenries, for that is the value we have used and the value required by the particular condenser under discussion. If the inductance is 245 microhenries and



CASE I

FIG. 3
A simple case of tracking by the padding method. Cs and Cm are neglected in determining the inductance L at a high frequency.

the frequency is 1500 kc, the capacity in the circuit is 46 mmfd, which is the minimum value of C. At this frequency the ratio Co/C is 1.375 and therefore Co is 63.2 mmfd.

At 565 kc both capacities are 324 mmfd. At 550 kc the radio frequency capacity is 342 mmfd. and the oscillator capacity is 337 mmfd.

When a tracking condenser is used we are limited to the particular intermediate frequency for which the condenser was designed, although no serious harm results if a slight variation is made, provided that the change is compensated for by the adjustable minimum capacity and the inductance of either the radio frequency circuit or the oscillator circuit.

Tracking by Padding

It is also possible to achieve close tracking by using identical condensers in the radio frequency and oscillator circuits by padding the oscillator circuit. Padding consists of selecting a particular value of inductance, of adjusting the minimum capacity, and of putting a fixed condenser in series with the variable oscillator condenser. This is the method most frequently used and it is not limited to any particular intermediate frequency. It is not possible to effect exact tracking throughout the tuning range by this method but it is possible to adjust the circuit so that the oscillator is not detuned by more than one per cent. in a circuit covering the broadcast range. The actual amount of detuning in a case where the padding has been done properly does not depend a great deal on the intermediate frequency but on the frequency ratio covered by the radio frequency tuner.

When the padding method of tracking is used there will in general be three points at which the tracking will be exact. At all other points the oscillator will be off tune by amounts depending on the frequencies at which the tracking is exact and on the difference between the nearest of these frequencies and the frequency in question. By proper selection of oscillator inductance in relation to the inductance in the radio frequency circuit, by proper selection of the minimum capacity in the oscillator in reference to the minimum in the radio frequency circuit, and by proper selection of the capacity of the series condenser, it is possible to place the points of exact tracking so that the detuning is as much in one direction as in the other and so that the maximum deviation in either direction does not amount to more than about one per cent. of the intermediate frequency. This holds for cases where the ratio of the highest to the lowest frequency in the tuning range is 1500/550, the ratio obtaining in the broadcast band. It is the ratio that determines the amount of detuning, not the actual frequencies involved.

Typical Cases

Three cases of tracking will be considered. In the first we shall select two points at which we wish the tracking to be exact, and let the third fall where it will. In the next two cases we shall select the three points at which the tracking is to be exact, and these two cases will differ only in the assumed position of the adjustable minimum condenser. In the second case we shall assume that the trimmer condenser is connected across the variable condenser only, and in the third case we shall assume that the trimmer is connected across the variable and the series padding condenser. Of these cases the second is the most important because it is used in nearly all sets employing this method of tracking.

In Fig. 3 we have the conditions of Case I. Lo is the inductance of the radio frequency circuit, C is the capacity of the variable condenser in either the radio frequency circuit or in the oscillator. L is the inductance in the oscillator circuit, Cs is the series padding condenser in the oscillator, and Cm is the minimum capacity in the oscillator circuit. Cm is not the total minimum, but the excess capacity required in the oscillator as compared with the minimum in the radio frequency circuit. We do not know whether Cm is positive or negative, but if it should turn out to be negative in some application it would simply mean that the compensator condenser should be opened up more in the oscillator than in the radio frequency circuit.

In Case I we at first assume that Cm is zero but only for the purpose of determining the value of L and Cs. After these values have been obtained Cm can be found experimentally.

Suppose the intermediate frequency is f and also suppose that we wish the circuit to track exactly at Fo and at F_2, Fo being a frequency near the low frequency end of the tuner and F_2 a frequency near the high frequency end.

An Approximation

At the high frequency end the series condenser has so little effect that we may disregard it. Therefore we may assume that the capacities in the two circuits are equal. Hence the two inductances are proportional to the squares of the two frequencies. That is $L/Lo=[F_2/(F_2+f)]^2$. From this we get the value of L in terms of the frequency ratio and the inductance Lo in the radio frequency circuit, that is,

$$L=Lo[F_2/(F_2+f)]^2 \quad \ldots\ldots\ldots\ldots (1)$$

At the low frequency end we cannot neglect Cs for it is a major factor in determining the oscillator frequency. If Ko is the capacity in the oscillator circuit at the frequency Fo, and Co is the corresponding value of C, we have $(Fo+f)^2=1/4\pi^2KoL$ and $Fo^2=1/4\pi^2CoLo$. Dividing the first by the second we obtain $[(Fo+f)/Fo]^2=CoLo/KoL$. If we substitute the value of L from equation (1) and solve for Ko we obtain

$$Ko=Co(Fo/F_2)^2[(F_2+f)/(Fo+f)]^2 \quad \ldots (2)$$

When two condensers Cs and Co are connected in series the resulting capacity is $CsCo/(Cs+Co)$, and this is equal to Ko. Therefore if we set $Ko=CsCo/(Cs+Co)$ and solve for Cs we obtain

$$Cs=KoCo/(Co-Ko) \quad \ldots\ldots\ldots\ldots (3)$$

By means of equations (1), (2), and (3) we can determine the values of L and Cs in terms of the intermediate frequency f, the two frequencies Fo and F_2 at which we wish exact tracking, and the capacity Co, and thus Case I is solved.

Application of Case I

In order to find the numerical value of Cs we must also know the numerical value of Co. This is found from Fo and Lo by the usual frequency formula, which we may write $Co=1/4\pi^2LoFo^2$. Therefore our starting point is Lo, the value of which we must know before we make any computations.

Let us start with Lo=246 microhenries, a value ordinarily used with 350 mmfd. tuning condensers. Also let us select the value F_2=1,450 kc at which we want exact tracking and let the intermediate frequency f be 175 kc. Then from equation (1) we get L=196 microhenries. To proceed we must find Co from the frequency formula, and to apply it we must first decide what the second frequency at which we wish exact tracking is to be. Let us select 600 kc. Then we have Co=286 mmfd. Now we can find Ko from (2) and it turns out to be Ko=215 mmfd. Now we can apply equation (3) for determining Cs. We get Cs=866 mmfd.

Therefore if Lo=246, F_2=1450, Fo=600, and f=175, L=196 microhenries and Cs 866 mmfd., which is the solution of this particular case.

But if we should compute back using these values and determine the oscillator frequency for different settings of the tuning condenser we would not get good tracking except at the low frequency end. At the upper frequency end the oscillator frequency would be entirely too high. We can no longer disregard Cm. We could get an expression giving the value of the required Cm but it is complex and will not be reproduced. We do not have to know its value for the required adjustment can always be done experimentally, as it is always done. All that is necessary is to tune in a signal near the zero end of the scale and adjust Cm until the signal is loudest. The setting does not necessarily have to be that of 1,450 kc but it should be near it. While we make this adjustment we should also adjust the compensator condensers on the radio frequency circuit or circuits. After the adjustment has been made at the high frequency end Cs should be adjusted at the other end, not necessarily at 600 kc but near it.

Experimental Adjustment

We do not have to know the exact value of Cs but we should know that the adjustable condenser for Cc is capable of adjustment to the value obtained by the formula.

Case I is simple but it does not yield the optimum adjustment for the third frequency at which tracking is exact, for it was not tied down to any particular value. If we choose Fo and F_2 properly the tracking will be just as good as if we had obtained L and Cs by the more exact Case II which we shall discuss later. Experience must tell what two frequencies should be chosen. The two values chosen in the example are near the optimum values, but if we had chosen F_2=1500 and Fo=550 the tracking would not have been so good.

These two frequencies, 1500 kc and 550 kc, are usually taken when this simple method is used. They result in a value of L that is too large and a value of Cs that is too small. The resulting tracking is good at the high frequency end of the tuner, but very poor at the low frequency end. As an illustration of what

(Contnued on next page)

(Continued from preceding page)

happens we reproduce Fig. 4. The abscissas represent radio frequencies and the ordinates kilocycles off 400 kc. That is, the curve represents the tracking in a broadcast superheterodyne in which the intermediate is 400 kc. The zero line represents perfect tracking, but there are only three points at which this occurs, at 580 kc, 1290 kc, and at 1420 kc. In this case the intentional points were Fo=580 kc and F_2=1420 kc. The 1290 kc point just happened.

It will be noticed that the detuning amounts to nearly 3 kc at 550 kc, the oscillator frequency being too high by that amount. At 810 kc the detuning amounts to 8.4 kc, the oscillator frequency being low by that amount. At the upper frequencies the curve is near the zero line and therefore the tracking there is satisfactory, but as a whole, the curve is not good. Yet the maximum detuning is only about 8 kc out of 400, or two per cent. The defects would hardly be noticeable on a receiver unless both the radio frequency and the intermediate frequency tuners were very selective.

If the intermediate frequency tuner were adjusted to about 396 kc in the case represented in Fig. 4 the tracking would be greatly improved because then approximately as much of the curve would be above the zero line as below it. Still the tracking would be poor at the low end.

Since the shape of the curve depends on L and Cs and as L is not adjustable, about the only way to improve the tracking in case it is off as indicated in Fig. 4 is to retune the intermediate frequency tuner. In case the inductance L is too small and therefore Cs too large, the curve is similar and we can get a close idea of its shape by turning Fig. 4 upside down.

Virtually nothing can be done to change the total deviation from the zero line, except contracting the range of the tuner. The best we can do for a given tuning range is to adjust so that as much of the curve is below the zero line as is above it. This is largely a matter of choosing the frequencies at which the tracking is to be exact, or, as has been suggested, retuning the intermediate tuner. Of these the first is preferable, as the second is only a remedy for a bad case.

The curve in Fig. 4 is typical of all curves obtained when using the padding method. It will be noticed that within the region plotted it is of the nature of a third order equation. Therefore we can expect three points at which it crosses the zero line, or three points at which the intermediate frequency generated has the desired value and to which the intermediate tuner is adjusted. We must place the curve as nearly symmetrically as possible about the zero line.

Note a dot on the curve at approximately 1060 kc. This is the point at which the curve changes direction of slope. If the curve were truly a third order curve this would be a point of symmetry and therefore this point should fall on the zero line. If we could make this a condition for determining the values of L and Cs we could work out simple formulas, but unfortunately we cannot impose this condition and get satisfactory results, because the curve is not truly symmetrical. By numerous trials it has been found that the point of inflection should fall slightly below the zero line for best all around tracking. But this properly belongs to Case II.

The oscillator is the heart of every superheterodyne. When that stops, the receiver stops functioning, even if everything else remains in perfect order. If the oscillator is weak the set is feeble. If the oscillator is too strong most of the tubes are overloaded and no clear signals can be obtained from the set. Therefore much attention should be given to the oscillator in designing any superheterodyne.

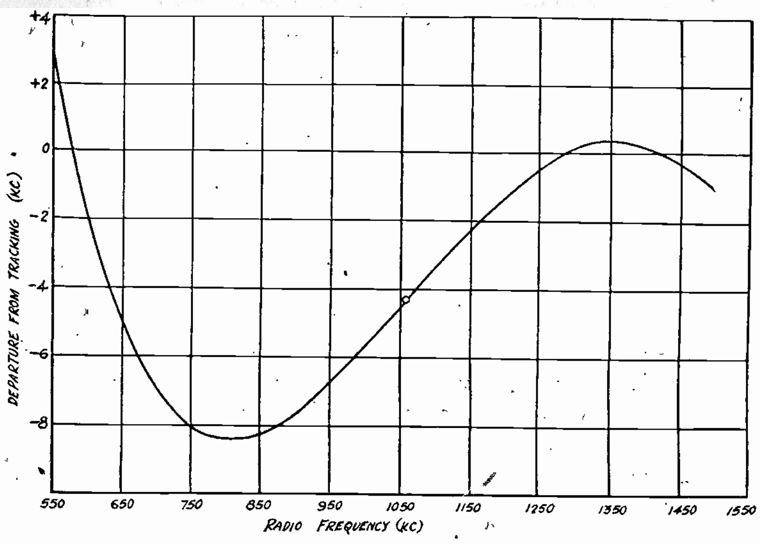


FIG. 4

A typical tracking curve obtained by the padding method as exemplified in Case I. The tracking indicates excessive oscillator inductance.

Many different oscillator circuits have been devised but only a few types are in wide use. There are, of course, many variations of each type, but they are only slight modifications made necessary by the peculiar demands of a particular circuit.

The essential feature of an oscillator is that there be a resonant circuit associated with an amplifier tube. This resonant circuit may be either on the plate or the grid sides of the tube. There must also be feedback. That is, the circuit must be arranged so that energy is returned from the plate to the grid, and this return must be in the proper phase. We must, therefore, have a transformer for coupling the grid and the plate circuits together. Either of the windings may be tuned, that is, either may be made a part of the resonant circuit. In some cases the tuning condenser is put across both windings.

Tuned Grid Circuit

In Fig. 1 we have what is called the tuned grid oscillator. The winding GK is tuned by condenser C and the resonant circuit thus formed is on the grid side of the tube. The feedback, or tickler, winding is PB, which is connected between the plate and the high voltage supply. The other parts, that is, C1, R, and C2, are accessories. C1 serves to stabilize the oscillation, to prevent excessive amplitude of the generated oscillation, and in conjunction with R it serves to maintain a negative voltage on the grid. If the grid were given a suitable bias by any one of the well-known methods, C1 and R could be dispensed with. But they could be retained even when bias is used. C2 merely serves to keep the generated high frequency current from straying into the B supply. While this oscillator is shown with a heater type tube, it can also be used with a filament type tube by merely treating the negative end of the filament as the cathode.

The values of the various components depend on the frequency that is to be generated. They will not be given at this time.

In Fig. 2 we have essentially the same oscillator except that the resonant circuit has been placed on the plate side. The tickler winding PB is tuned rather than the grid winding. In this case condenser C2 serves an additional purpose. In order to ground the rotor of the tuning condenser C and thus to permit ganging it with other condensers, the rotor is connected to B minus, which is usually the chassis and ground. But the coil must be connected to the positive side of the B supply. Therefore C2 not only serves as a by-pass condenser to prevent straying of high frequency current but it also serves to complete the resonant circuit. This condenser is made so large that it does not change the tuning characteristics of the variable condenser C by an appreciable amount. However, if it is large enough to serve as a by-pass it is large enough for the purpose of completing the tuned circuit.

This oscillator also is applicable to filament type tubes as well as heater type by treating the negative end of the filament as the cathode.

Modified Hartley

In Fig. 3 we have an oscillator in which both the grid and the plate windings are included in the resonant circuit. It is a modified Hartley oscillator and it is one of the simplest. This particular circuit can only be used with heater type tubes because the cathode cannot be grounded, and in a filament type tube the cathode, that is, the filament, is grounded. The Hartley oscillator for filament type tubes is not suitable for modern receivers, which becomes evident on studying the two circuits in Figs. 4 and 5, both of which are classed as Hartley oscillators.

In Fig. 6 is a type of oscillator that has come into wide use in commercial receivers in which the same tube must be used for both first detector and oscillator. It is clear that it is of the tuned plate type as illustrated in Fig. 2. But the grid coil is not put in the grid circuit in the usual way but in the cathode lead. Thus the grid coil is really in both the plate and grid circuits. Note particularly how the grid winding is connected. The grid end of the coil is grounded and the K end, which is often marked with the ground symbol on commercial coils, is connected to the cathode. At first thought it might seem that this is wrong, but on reflection it becomes evident that the proper phase is maintained, for G is connected toward the grid in respect to the cathode. The only thing that has been changed is the position of the ground connection, but moving that does not change the phase relations.

While the circuit in Fig. 6 is a complete oscillator as it stands, it does not appear in just that way in superheterodynes. A resonant circuit, tuned to the signal frequency is usually connected in the lead at the point marked X. This is done so that the rotor of the tuning condenser may be grounded. There is also a difference in the plate circuit. At the point marked Y a resonant circuit tuned to the intermediate frequency is inserted. There are several different ways of doing this. Sometimes there is a third winding, which takes on the function of tickler, and this is used so as to leave the resonant circuit containing C from undesirable connections.

Typical Oscillators

Since the oscillator in Fig. 6 is assuming greater importance in modern receivers, we reproduce two typical circuits taken from commercial superheterodynes. In Fig. 7 the radio frequency resonant circuit has been inserted in the grid lead as suggested in connection with Fig. 6 and the intermediate resonant circuit has been inserted in the plate lead. The oscillator circuit is connected exactly as in Fig. 6. Apparently a tracking condenser is used for there is no series padding condenser, but that does not alter the type of the oscillator.

In Fig. 8 we have an oscillator of the type shown in Fig. 6 but having three windings. The intermediate frequency tuned circuit is put in series with the plate lead and also in series with the third winding on the oscillator coil, which acts as tickler. The padding method of tracking is used, the series condenser Cs being connected so that one side of it is grounded, and Cm being connected across the variable condenser only. Except for the necessity of using a third winding, the oscillator in Fig. 8 is preferable to that in Fig. 7.

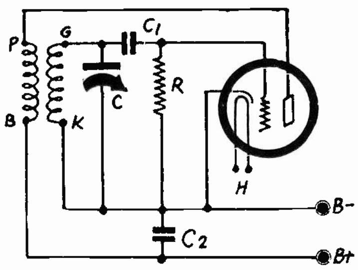
Any one of the oscillators in Figs. 1 to 8, inclusive, can be set up alone, calibrated, and then used for lining up superheterodynes. With suitable coils the frequency coverage can be made as desired. That can be constructed with plug-in coils or tapped coils, according to which method seems the more desirable.

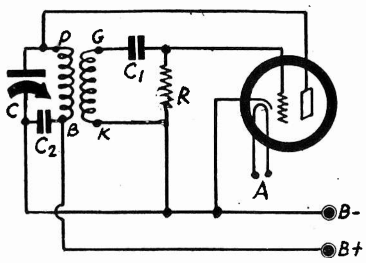
If the oscillator used for lining up the radio frequency amplifier does not cover the intermediate frequencies, an oscillator such as that shown in Fig. 9 can be constructed. The two resonant circuits in this case are those of an intermediate frequency transformer of the same kind as those used in the intermediate amplifier that is to be used. The transformer is connected in exactly the same way as if it were to be used for coupling two tubes, except that the lead that ordinarily goes to the plate of the tube ahead is connected to the plate of the same tube.

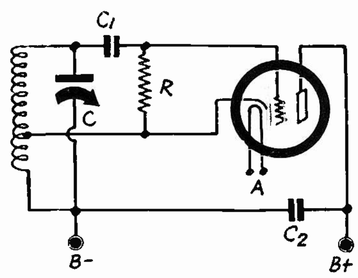
Calibrating Oscillator

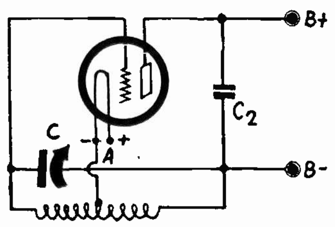
This oscillator must be calibrated before it can be used, and this is easily done against a calibrated broadcast oscillator or against a broadcast signal. Suppose, for example, that the intermediate frequency oscillator is to be adjusted to 175 kc. If it is started it will generate a frequency about 175 kc and there will be present in this oscillation all the harmonics. The first harmonic that falls in the broadcast band is the fourth, which is 700 kc. It could be calibrated against any signal of this frequency. The 5th harmonic is 875 kc. While this is in the broadcast band there is no broadcast channel on this frequency. The 6th harmonic is 1,050 kc, the 8th, 1,400 kc. Therefore there are several possibilities of calibrating it against a frequency that is available with a good receiver.

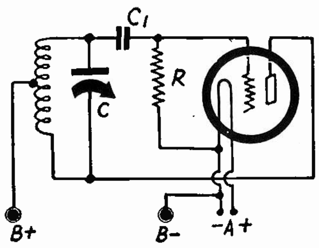
None of the oscillators given is modulated. But any of them can be used for lining up an intermediate amplifier even without modulation, for there is always a certain amount of noise present which will be maximum when the circuits are in tune. If it is not possible to go by the noise, a milliammeter in the plate circuit of the second detector could be used as indicator, for the deflection would be maximum at exact resonance. In case a modulation is essential, poorly filtered plate voltage could be used, or an alternating voltage of a few volts could be impressed in series with the B supply. For example, the secondary of a filament transformer might be put in series with the plate return lead, with the primary, of course, in the alternating current line.

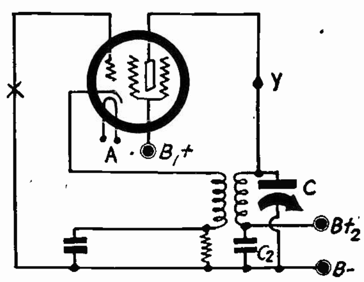


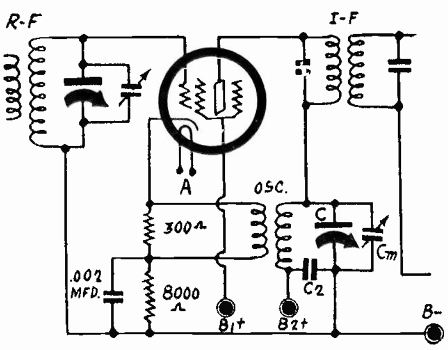


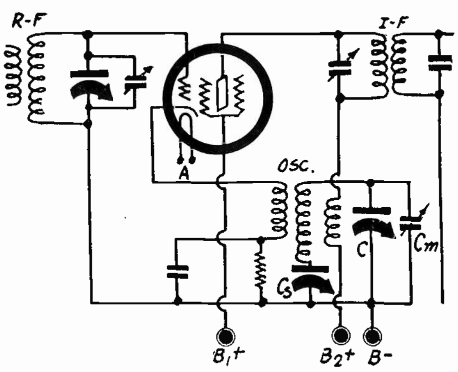


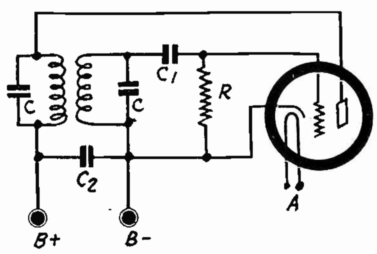












Top row, left to right: Fig. 1, a tuned grid oscillator circuit. This type is used in a large number of superheterodynes; Fig. 2, a tuned plate oscillator which is sometimes used in superheterodynes; Fig. 3, a simple modified Hartley oscillator that may be used when the oscillator is a heater type tube.

Middle row, left to right: Fig. 4, the original Hartley oscillator for filament tubes, not practical for modern receivers; Fig. 5, another version of the Hartley circuit for filament type tubes, not practical in modern receivers; Fig. 6, modification of the tuned plate oscillator, coming into wide use in circuits in which the same tube is used for oscillator and detector.

Bottom row, left to right, Fig. 7, how the circuit in Fig. 6 is used in one commercial receiver; Fig. 8, another application of the circuit in Fig. 6 to a commercial receiver, a tickler winding used; Fig. 9, oscillator with both plate and grid windings tuned. An intermediate transformer forms the basis of the circuit and it is suitable for lining up intermediate amplifiers.

SIX PRIZE CIRCUITS

Laboratory Developed, Tested in Commercial Production, These Hookups Excel

By Edwin Stannard

Roland Radio Company

IN the low-priced field certain circuits have been found to be outstanding, after considerable experimental and developmental work, and although the diagrammatic differences as between any one of these and an ordinary receiver might seem small, the performance difference is large. Therefore six circuits are shown in their improved and so-called perfected form, although it is admitted that nothing in this life is perfect.

The most modest of these is the four-tube a-c receiver, which has only three tubes effective in the receiver proper, but the rectifier tube is counted as one of the set tubes, as seems necessary to avoid confusion or awkwardness. Three tubes! It doesn't seem possible that speaker performance can be obtained on so few tubes, does it? And yet the circuit is really worth while. It has plenty of pep, good tone, and freedom from hum. It is one of the better grade four-tube circuits. While cheaper kits for worse circuits are obtainable, this receiver, No. 594-T, gives good output and good quality.

New Output Tube Used

The circuit uses the new 59 output tube as a pentode Class A amplifier, this tube being like the '47 that it replaces, but in some respects superior. First of all, it is a heater type tube, not a filament type, and that means hum is considerably less. It is the first heater type power tube for a-c operation, among the standard tubes, and perhaps marks the beginning of a trend toward indirectly heated power tubes, for the much lower hum level attainable with the same filter.

The negative bias for the new tube has to be a little higher than that for the '47, the values being 18 and 16.5 volts respectively, for 250 volts applied in the plate circuit.

A seven-pin base on the tube requires that the seven-hole socket be connected as shown on the diagram of No. 594-T, which results in pentode Class A operation.

Special coils are used in this receiver because of the necessity for developing every possible gain in a set that has so few stages. These coils have a primary not tightly coupled inductively to the secondary, but depend in part on an extra few turns for completing the coupling, so that the coupling is both inductive and capacitative. It would be, anyway, if primary were wound over the secondary, but the inductive coupling is purposely reduced, the capacitative coupling increased by this method. Better tracking prevails. It is a device for eliminating the necessity of a manual trimmer.

Circuit Requirements

The radio frequency amplifier is a 58, the detector a 57, the input to both stages being tuned, a two-gang condenser used. The actual capacity of each section is 0.000365 mfd., and the secondary inductance is 245 microhenries. With this inductance the capacity might be 0.00035 mfd., to just as good a purpose, but 0.00035 mfd. is merely a commercial value, and most condensers of that rated capacity do not have just that capacity, and the definitive statement of value is given merely in the interest of accuracy.

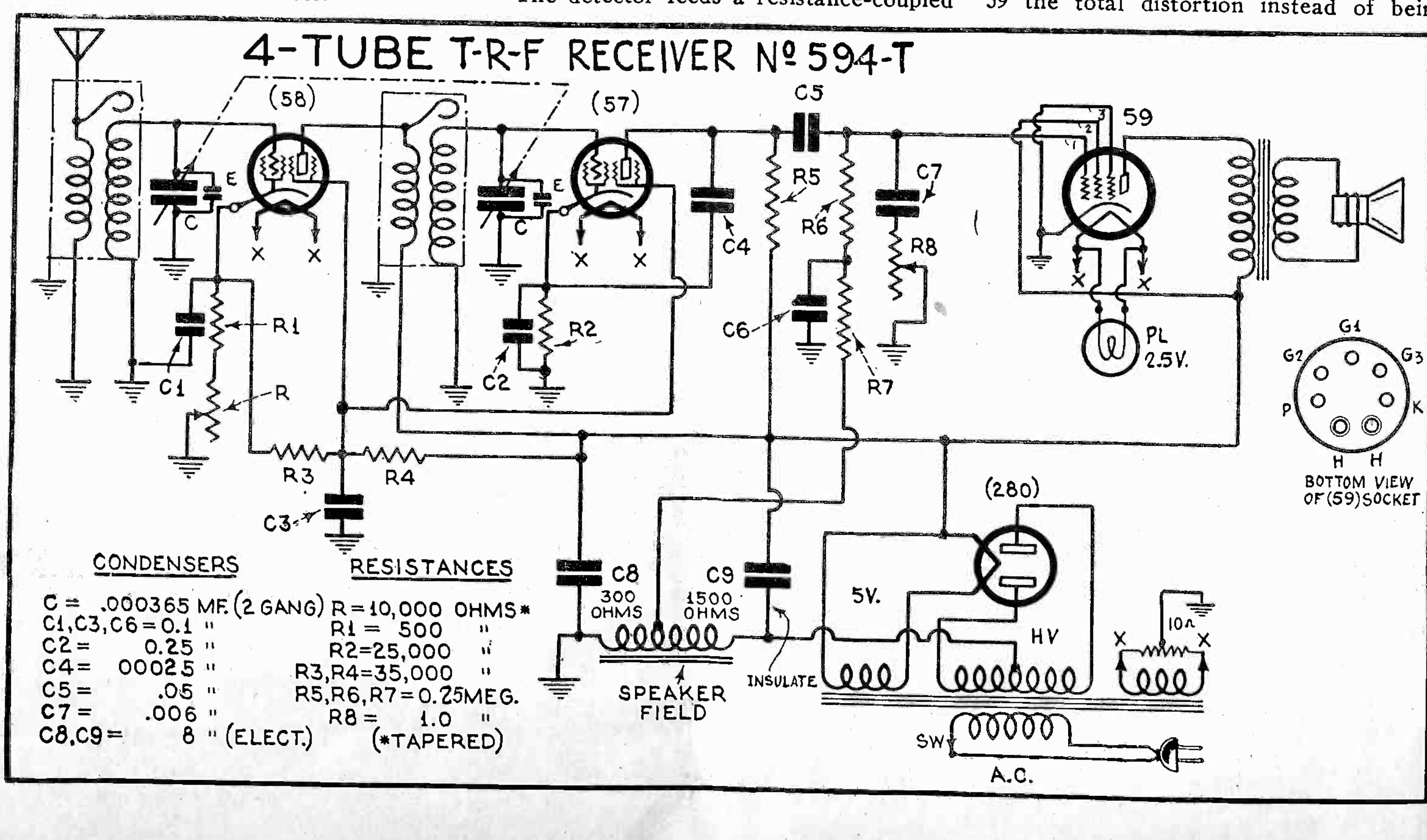
The detector feeds a resistance-coupled stage of audio for input to the power tube circuit.

The total d-c resistance in the power tube circuit is 0.5 meg., as the value must not be in excess of that, otherwise the power tube would lose bias, and perhaps be injured due to too heavy a plate current passage, on such occasions when grid current flows. The tube manufacturers are agreed on the theory of this protection, although they differ as to the maximum amount of resistance permissible. However, in the present circuit, first due to the confinement of the radio frequency amplifier to a single stage, and second to the bias obtained from the power supply, the total value of 0.5 is well supported by experimental findings.

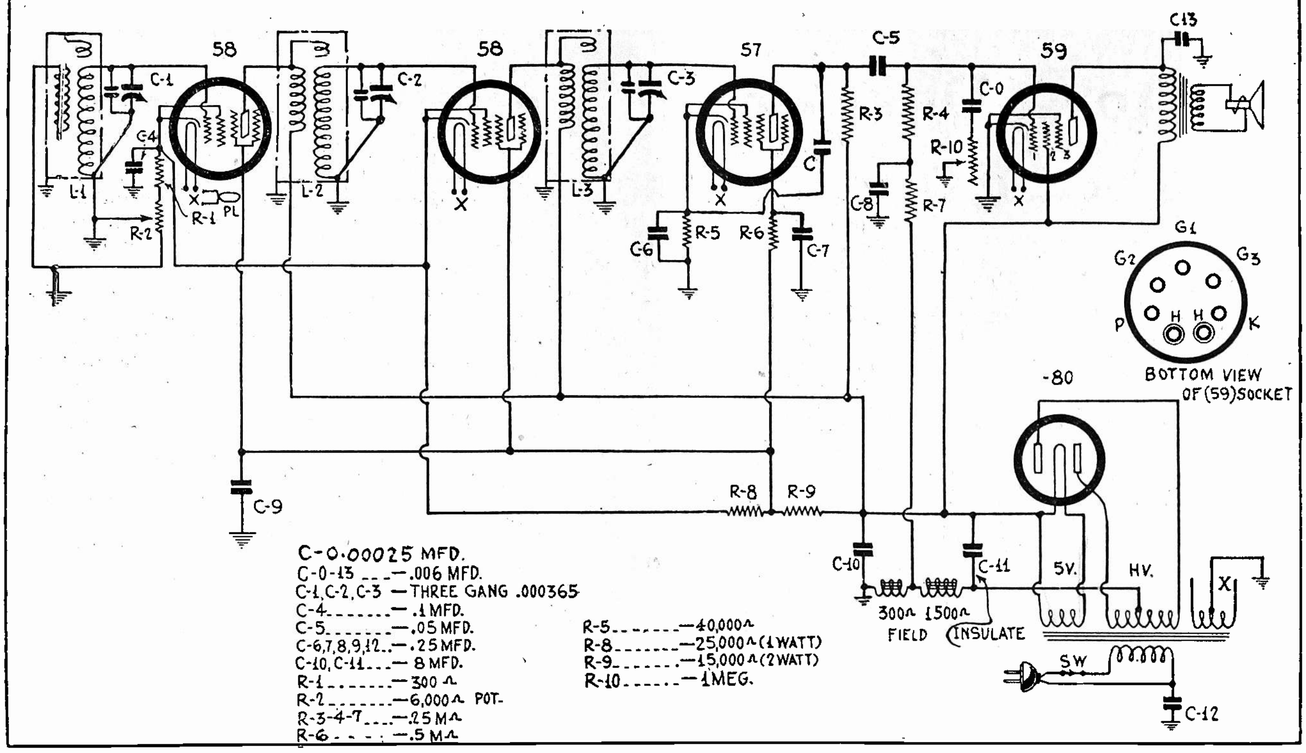
The newness of the 59 tube requires that the data for connecting the seven springs of the socket be given, and these data will be found imprinted on the diagram. Note the numbers ascribed to the three grids: No. 1, control grid; No. 2, screen grid; No. 3, suppressor grid. The control grid stands alone, as does the screen grid. but the suppressor grid is tied to cathode.

The Load Conditions

The amplification factor of this tube is 100, and in general about the same load may be used as for the '47, if one desires to impress into service a speaker one has. However, there is a difference. The '47 load requirement (output transformer) is 7,000 ohms, whereas the 59 load requirement is 6,000 ohms. At the same load, 7,000 ohms, the same output is obtained with either tube, but with the 59 the total distortion instead of being



FIVE-TUBE T-R-F RECEIVER No. 595-TS



7 per cent. is 8.4 per cent. The way to keep the distortion in the 59 to as low a figure as in the other instance, and at the same time to increase the power output as well, is to use a 6,000 ohm load. The result is 7 per cent. total distortion (as with the '47) but a power output at that distortion level of 3 watts, compared to 2.5 watts for the '47.

In the circuit diagrammed, and as commercially produced, the load is 6,000 ohms.

The values of the capacities and the resistors used are given under the classified tabulations in the diagram.

The receiver is equipped not only with a volume control but with a tone control as well, the tone control useful in producing the type of rendition most agreeable to the listener, including the reduction of interference in the high audio frequency region, such as caused by static.

B Current Analysis

The total B current is 60 milliamperes, as may be computed from the resistance value of the biasing section of the B choke (speaker field) and the requirement of 18 volts negative bias. The current in amperes is equal to the voltage in volts divided by the resistance in ohms.

This is more current than usually drawn in four-tube sets of this general pattern, but the extra bleeder current helps just a little in its steadying effect, and also a single tap type of speaker is rendered serviceable for four, five and even six-tube sets. This singleness of design is a commercial factor, but an entirely supportable one.

The total B current in the power tube is 44 milliamperes, of which 9 milliamperes are screen current and 35 milliamperes are plate current.

The extraordinary features of the receiver are the special coils used in the tuner, the inclusion of the newest power tube, and one that is the best pentode for a-c use, especially in view of the great hum reduction, and the inclusion of the most sensitive tubes generally obtainable.

The designation No. 594-T to identify this circuit is according to a code, and since this code is followed in the other circuits, it should be disclosed. The first two digits represent the type of power tube used, the third digit represents the total number of tubes, while the letter T is used for identifying a t-r-f design and the letter S a superheterodyne design.

Therefore a five-tube tuned radio frequency receiver with 59 output tube would carry the code No. 595-T.

Five-Tube T-R-F Set

A three-gang condenser is used in this set, with three coils and two stages of t-r-f, with 58 tubes as r-f amplifiers and the 57 as detector. The output again is the new 59.

Hence with such a circuit it is to be expected that sensitivity and selectivity will be higher, particularly sensitivity, as that is a sheer gain. The selectivity improvement is relative, in that it depends on the amount of amplification or input level. Since there is a volume control that affects both levels, the selectivity is very much higher when, as often is the case in practice, the total sound level is kept at less than maximum, e. g., no higher than the maximum output level of a four-tube model.

If an output meter is put across the four-tube set when room volume is enjoyed, whatever the volume control setting, and then when the five-tube model is used, output meter to read as it did on the four-tube set, the selectivity increase is very considerable. If the five-tube set is worked at maximum overall sensitivity, then the improvement in selectivity is not so great, because the amplification has been increased so much.

Effect on Bias

The five-tube model will reach to greater distances, of course, and also enable operation on a shorter aerial and in remote regions, with speaker volume from stations hundreds of miles away. The tracking problem is simplified to an extent by use of the special coils that give a nearer approach to constant impedance in the coupling than does the general run of coils.

Save for the extra tuned radio frequency amplifier and some minor alterations required to meet scientifically, the circumstances arising from new requirements, the five-tube model is simply the four-tube model with that extra hop and selectivity.

The speaker field again is a coil of 1800 ohms, tapped at 300 ohms, yet the current will be higher than formerly. It will be 67 milliamperes. The resultant bias on the output tube would be 19.1 volts. About this two things may be said: the small difference in bias is of no consequence, and besides when the maximum quantity of sound is put out, as would be true in when tuning in as many as half a dozen local stations in some cities, the extra bias on such a peppy and sensitive set helps a little, in that the signal swings the effective bias to less than the direct current (so-called "static" value) and the actual operating point will be under 18 volts anyway.

Signal Voltage

For the same reason the fixed bias value is scarcely ever the actual operating point of any power tube at room volume, and while this fact is of course taken into account when the steady bias value is recommended, it is also in point to register the fact that the bias may be exceeded a little in receivers of high sensitivity, because of the considerable signal voltage delivered to the power tube grid load, which voltage bucks the bias voltage.

This receiver also has volume control and tone control, and besides has a fixed condenser across the primary of the output transformer to prevent r-f back-coupling, especially on account of the r-f pickup in leads running to the speaker.

The specialties are constant impedance r-f coils, cathode type pentode output tube, great reduction in hum on account of that tube, sensitivity of better than 10 microvolts per meter over the tuning range, and approaching 5 m. p. m. at the high frequency end.

Of course the tuned radio frequency receiver is the simplest to build, and as kits are obtainable for circuits like those under discussion, it is only fair to make the statement about simplicity. With a superheterodyne one would have some trouble perhaps in lining it up properly, and in general getting from it that greatly increased selectivity of which it is capable, using the same number of tubes. The sensitivity need not be expected to exceed very much that of the five-tube t-r-f set, but certainly the selectivity goes up like a balloon in a working chimney.

The Five-Tube Super

You can see from a glance at the five-

(Continued on next page)

(*Continued from preceding page*)

tube superheterodyne circuit, No. 595-S, that there is much more to the super not only as to parts but as to adjustments. Indeed, on the t-r-f set about the only adjustment to be made is the setting of the equalizing condensers across the tuning sections of the gang—preferably for a frequency around 1400 or 1300 kc—but in the superheterodyne we must:

(1) Set the equalizing condenser across the input to the 57 oscillator-modulator tube.

(2) Set the padding condenser, PC.

(3) Set the equalizing condenser across the oscillator tuning condenser.

(4) Set the equalizers across primary and secondary of two intermediate coils, for the predetermined intermediate frequency.

Since there are four adjustments in the i-f channel and three in other places, we have seven adjustments to make in critical positions, as compared to two in the four-tube t-r-f set and three in the five-tube t-r-f set. These facts should be borne in mind. Also we require an oscillator, preferably a modulated one. This is a requirement, not an option. You can not hope to get to first base in playing the superheterodyne construction game unless you have an oscillator. It should be one enabling the accurate setting of the i-f transformers to the prescribed intermediate frequency, also it should enable a checkup on modulator (signal frequency) tunings of the antenna coil and oscillation frequency tuning of the oscillator coil.

In the interest of keeping down the number of tubes and separate units the functions of oscillator and modulator are combined in the first 57 tube, while the first i-f transformer and the oscillator coil are in a single shield, identified by "OSC.-I.F." on the diagram.

Intermediate Frequency

The intermediate frequency used is 175 kc. Therefore when the modulator input tuning is to the signal frequencies, the oscillator tuning must be to frequencies that differ from them by 175 kc. For various reasons the higher frequency always is used for oscillator, if the modulator input tunes from 1520 to 530 kc the oscillator must be tuned from 1695 to 705 kc. Since a two-gang condenser is used (one section shown to left of first 57 tube and other section just above that tube) the difference in frequencies must prevail at any and all settings. It is practical to adjust for the exact difference at two extremes and yet have no setting represent a difference greater than 4,000 cycles, which is close padding indeed.

Padding

It is not the present purpose to expound anew the full details of padding, but rather to disclose the effective circuits that have been laboratory-developed. Padding was discussed fully in the April 16th, 1932, issue. However, bare details of padding will be given.

The inductances are properly chosen, in conjunction with the tuning condensers and the adjustable padding condenser, so that the refinements are developed along capacity lines alone. There are three adjustments: the series padding condenser and the two parallel equalizing condensers (E).

It is assumed that the intermediate channel is accurately lined up at 175 kc, not only the first task but one of the most important contributions. Next the equalizing condenser across the oscillator is set at near minimum, that is, almost wide open. The equalizing condenser across the modulator is about half way in.

Low Frequency First

A frequency of 550 kc is used for the low frequency setting, introduced while antenna is connected, and with test oscillator coupled by means of a few turns of wire around the aerial lead-in. We do not know just where this will come in, tuning the signal frequency, but can find out by removing the grid clips from the first and second detectors, and connecting the clip that is intended for the first detector instead to the second detector cap, using a wire with grid clip cap at one end and grid clip at the other. We have a circuit consisting of a simple detector tube and an audio amplifier.

Since the test oscillator is modulated we can hear the modulation, or, if we have an output meter, we can tune for maximum deflection instead of just using the ear for determination of volume. Once we establish the dial setting we write it down and then tune the test oscillator and the receiver to near the other extreme, 1500 kc, and see what dial setting prevails. This we record also.

Now we turn back to the 550 kc setting, re-establish the circuit according to the diagram, introduce 550 kc of modulated test oscillation (or a station of that frequency) and adjust the padding condenser for loudest response or, if we have the meter, maximum deflection.

Then we are finished with the low frequency setting.

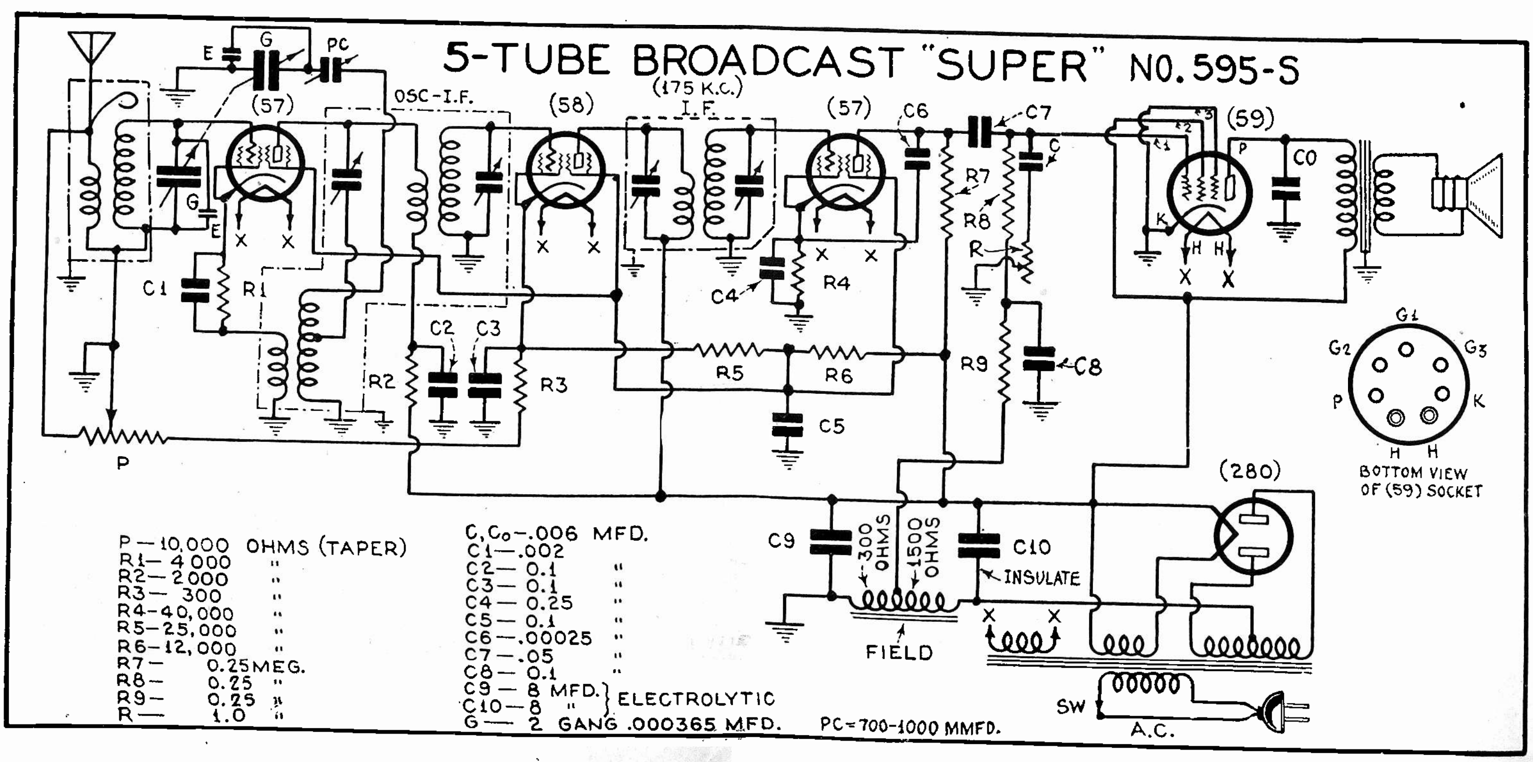
Now we turn to the high frequency end. No longer may we touch the padding condenser, as its effectiveness is on the low frequency end, whereas at the present end it is of scant effect, since it is a large capacity in series with a very small one. The inductance has been chosen so that the high frequency setting will be practically correct when the low frequency setting is absolutely correct, the only remaining consideration being the equalizing condenser across the oscillator. Like as not that may not have to be molested, but if the dial reads farther from zero for 1500 kc input than it did under the controlling determination of the dial setting for this frequency, then the equalizer on the set oscillator should be turned down just a trifle at a time, with an insulated screwdriver, until the response is greatest at the same setting as previously prevailed for **1500 kc.**

If instead of reading farther from zero than required, the dial reads closer to zero, the equalizing capacity has to be decreased, and if the equalizer was not all the way out in the first place you have the reduced-capacity method to resort to in the usual way. If the equalizer at as low a capacity setting as possible does not provide the remedy, remove the equalizer from the condenser frame. Resort to removal of the oscillator equalizer is the cure for many a troublesome padding problem.

The rest of the circuit is a standard intermediate channel, second detector and single stage of resistance audio, where the first audio amplifier is the 59 output tube. The previous discussion of the t-r-f systems covered the essential points as to these.

The seven-tube superheterodyne differs from the five-tube model in that there is a stage of t-r-f ahead of the combined modulator-oscillator 57, and two 59 tubes are in parallel at the output. The load for the parallel 59 output should be 3,000 ohms. The power output is about doubled, compared to that of the single 59. Because of the higher total current, and the desirability of not much increased voltage drop across the field coil, the field in this instance consists of 1,000 ohms, tapped at 175 ohms, so that the sections between tap and extreme are 175 ohms and 825 ohms respectively.

(*Concluded next week*)



STATION SPARKS
By Alice Remsen

The Old Salt

FOR "CAPE DIAMOND LIGHT"

(WJZ, Wednesday, 8:00 p. m.)

I cannot sleep for thinkin' o' the sea,
An' great tall ships that sail across the main.
I lie awake an' think of how 'twould be
If I were on a clipper once again;—
A-standin' on the ratlines stowin' sail,
While all around the water hissed an' curled,
With fingers frozen by the icy gale,
A-hurryin' to get the main sail furled.

An' then I think as how I'd like to be
A-sailin' slow beneath the magic stars,
Upon a warm an' glassy tropic sea,
With not a breath o' wind to sway the spars.
But here I am at home, all snug an' set,
The wife is sleepin' soundly by my side—
Outside my window, trees are drippin' wet—
An' my old ship has gone out with the tide.

—A. R.

* * *

AND IF YOU LISTEN IN TO Captain Jack Diamond's tales, on the Cape Diamond Light program, you will be filled with a nostalgic longing for a chance to go down to the sea in ships. This is the old Harbor Lights program under another name, written by the same man.

* * *

The Radio Rialto

In the mail this morning I received a wonderful letter from The Voice of Experience . . . This man is a remarkable person—physically handicapped, the recipient of knock-down blows throughout his life, yet he rose above it all and is now the helpful friend of thousands . . . enclosed in his letter were several brochures which he offers for free distribution and I can heartily endorse them; in fact, I wish all my readers would send to The Voice of Experience, Station WOR, Newark, N. J., for the brochure titled "Don't Be a Quitter"; it is his own life story, an inspiring document, and if you are anywhere near a radio at noon each day, tune in to WOR and listen to this man; I'm sure you will not regret it. . . .

And now for the old rialto—raining again, but what's the odds—put on your galoshes and trot along with me . . . we take the B. M. T. from Astoria, overtown, and get off at 49th St.; now we're right in the midst of the famous Tin Pan Alley . . . there's Tommy Weir, the Irish tenor,, bearing down upon us; he tells us that he's moved from New Jersey over to Staten Island . . . this lad has itchy feet —he's always moving . . . his new home is two blocks from the ocean and a long drive from the ferry . . . it takes twenty minutes in good weather to get over from New York by ferry, but Tommy says the Staten Islanders like it; they walk round and round the deck, getting good exercise and fresh air . . . that's not so bad, an ocean voyage thrown in for good measure twice a day; lots of people pay out good money for that. . . .

Con Conrad has closed the doors of his music publishing venture and will devote the rest of his time to the management of Russ Columbo and the discovery of new talent; Jack McCoy goes along with him as press man; and little Molly Klinger, who pounded the piano for him, has gone over to the old firm of Shapiro-Bernstein; Molly's a capable little girl and can really demonstrate a song; she has a sunny disposition and a million friends. . . .

Well, goodness gracious, look who's here; if it isn't Gene Austin in person. . . . He greets us with a smile and tells us he is playing in vaudeville, in town only for a few days, is married again and is very happy. He looks it; has got thinner and more good looking than ever. . . . What a heart-breaker this lad used to be, and how his phonograph records used to sell, long before radio and crooners were ever thought of; we chat for a minute and then pop along . . . Here's Helen Leighton, who put over the Pebeco Playboys, and the idea which is pulling plenty of mail—that of requesting the audience to send in titles of songs and selections used during program; it's a nifty idea and Helen deserves a whole lot of credit for thinking of it. She is a charming and clever little lady with whom I was associated at one time, and shall be again, I hope . . . Come along now, you're lagging behind, what! . . . You're . . . All right; let's turn in athungry. Lindy's and combine business with pleasure, or is it a pleasure to eat! . . . Here's a vacant booth, let's slide in. . . . Right across the room from us is—yes, it's Wee Willie Robyn; you've heard him over the air. Used to be with Major Bowe's Family; just recently at the Roxy and now, rumor has it, that he will be with Paul Ash on a new program soon. . . . With Wee Willie are Jack Coombs and Irving Bibo, both good musical lads. . . . Let's pay attention to the menu; I'd like a nice large glass of orange juice; the Voice of Experience says that we should drink two quarts of orange juice a day, so I'm starting right now with mine. . . . There's John Quinlan, the New Zealand tenor, who sings on the Littman program, and sings well; this program, by the way, is worth hearing; it is on WOR every weekday morning at 11:45. It is written by Yolande Langworthy, who was the creator of those famous Arabesque series, formerly heard over WABC. . . .

Supposing we take ourselves over to that Station . . . into a cab, 485 Madison Avenue. . . . Up to the 22nd floor. . . . There is much talk around WABC about the insurance policy taken out by Walter P. Chrysler to cover the 90 minute Plymouth radio business conference; it is for $500,000 and is the largest policy ever applied to such a brief period except in the case of money shipments in big city financial districts. Radio insurance is an entirely new development and opens a new field in the surety business. . . . That tall gal over there is Irene Beasley; she is opening in vaudeville again, somewhere in Long Island, next week. . . . We also hear that Kate Smith did put on a show at the National Vaudeville Artists place at Saranac for her sick fellow troupers. Good for Kate! . . . Whispering Jack Smith and the Humming Birds are now to be heard over WABC, with Arnold Johnson's orchestra, each Monday and Wednesday from 8:00 to 8:15 p. m. . . . Sponsored by the Musterole Company of Cleveland. . . . We meet the Three X Sisters darting down a corridor; they stop long enough to show us a letter they received from none other than Angus M. Fraser, pipe major of the Lovatt Pipe Band, expressing disbelief that the sisters' recent vocal imitation of a bagpipe was an imitation . . . he declared they must have used a real bagpipe; but the sisters assured me it was really an imitation and invited me to witness a repeat of the same program. . . . A good piece of news comes our way; Dale Wimbrow, the freckle-faced master of negro dialect, may now be heard on the Chipso program, with the Mills Brothers and Don Redman's orchestra, every Monday and Thursday at 9:15 p. m. . . . Thought I could not be mistaken in that voice of yours, Dale! Glad to see you back again, big boy. . . . Because the Ted Weems orchestra is playing an engagement in New Orleans, the first three weeks of the new Canada Dry series will be broadcast from that Southern city, necessitating the migration of Jack Benny, his wife, and Andrea Marsh, from New York to New Orleans. This program may be heard on Thursdays at 8:15 p. m. and Sundays at 10:00 p. m. . . . By the way: Sid Silvers will act in the capacity of "annoyer" for Jack Benny, a position he formerly occupied with Phil Baker. . . .

What say we migrate over to NBC. . . . It's stopped raining and the sun is shining, so we'll walk over to Fifth Avenue and down to 711. . . . First person we meet is Billy Jones, who informs us that he and Ernie now have a girl friend on their Best Foods program, Annette Henshaw, a cute little blues singer, with a style all her own. . . . The NBC pageboys are all of a dither, because May Singhi Breen has organized a ukulele club for them; I admire May for her devoted stand in championing the much maligned ukulele; she is still trying to win recognition for the uke as a legitimate musical instrument, but the Musicians Union can't see it. . . . There's the good-looking Lanny Ross, one of my favorite ether warblers; Lanny has just celebrated his first anniversary with the Maxwell House program; he informs us that young Audrey Marsh is now playing the part of his sweetheart, Mary Lou, on the Showboat program. . . . Morris Musselman, who writes the Johnny Hart stories for the Stanco program, hopped a plane for Hollywood, in order to obtain authentic atmosphere for the new series; he is out there now, which reminds us, that we had better hop a subway and get home before Octavia throws a fit; it's roast beef and Yorkshire pudding tonight and you're invited, so come along.

* * *

Biographical Brevities

ABOUT TOMMY McLAUGHLIN

(On WABC 9:15 p. m., Tuesdays)

Tommy McLaughlin is the most recently acquired baritone of the Columbia Broadcasting System. . . . What's more to the point, he's Irish, through and through. . . . His mother was born in Donegal, his father in Belfast; Tommy himself was born on our own West Coast. . . . He attended parochial schools in Los Angeles. . . . Played football for Loyola College and starred in their entertainments. . . . When he was eleven, his voice cracked; he was a soprano, but ended up as a baritone, and he's been one ever since. . . . For two years on Station KFI, Los Angeles, Tommy was billed as "The World's Youngest Baritone.". . .

His first professional appearance was at the Pacific Coast Radio Show, where, a chubby youngster, aged fifteen, he startled critics by singing "The Toreador" in a great big voice. . . . The family moved to Detroit in 1926 and he enrolled in the University there. . . . The college presented a show staged and directed by

(*Contmued on next page*)

STATION SPARKS

By Alice Remsen

(Continued from preceding page)

John Harwood and Max Scheck, who were responsible for many Broadway productions, Tommy shone in the show and thereafter renewed his radio connections. . . . He sang and announced at Stations WMBC and WJR. . . . A serious illness then interrupted his work, and after a great struggle to regain his health, he came to New York to search for a suitable teacher; he found one in William Whitney, who urged Tommy to take a course at the New England Conservatory, Tommy did so, and while a student there gave many concerts, singing for President Coolidge and President Hoover; he also made a tour of New England colleges, giving concerts. . . . After having completed his course, he sang with Vincent Lopez and accompanied him on tour. Returning, he joined Major Bowe at the Capitol Theatre. . . . A short time ago he received an audition at Columbia, made good, and is now featured with "Threads of Happiness" program, conducted by Andre Kostelanetz, each Tuesday night. . . .

He is stocky, grey-eyed, and has an infectious grin . . . Loves classic music . . . His favorite book is "The Story of San Michele.". . . Would rather eat potatoes and gravy than anything else. . . . His favorite colors are black, brown and grey. . . . Is inclined to be sentimental, but lives that down with a pungent wit and keen observation. . . . Won't sing without a ring on his little finger. . . . Is a bachelor. . . . Raves about football and is an incurable fight fan. . . . He'll sum himself up for you as "just a crazy Irishman who likes to sing". . . but take it from me, he's anything but crazy—and I don't blame him for liking to sing, because he sure can. . . . Listen in to him; you'll like him.

* * *

(If you would care to know anything about your favorite radio artists, drop a card to the conductor of this page. Address her: Alice Remsen, care Radio World, 145 W. 45th St., New York City.)

Literature Wanted

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

Dave Edman, 1915 E. 21st St., Des Moines, Iowa
The Radio Clinic, Robert W. Jacksen, 4837 Worth St., Dallas, Texas.
John Herockett, Box No. 206, Orofino, Idaho.
Charles Donnelly, 287 Barrow Street, Jersey City, N. J.
Don Boone, 1725 B Street, Pullman, Wash.
Harry Snyder, 94 Osborn St., Brooklyn, N. Y.
Philip H. Robinson, Shelburne, N. S., Canada.
Charles S. Sutton, 409-12th St., Toledo, Ohio.
Ralph E. Waite, 49 Race Street, Cincinnati, Ohio.
John A. McCurdy, 189 Main St., Matawan, N. J.
R. L. Moore Radio Service, 87 Osborne St., Auburn, N. Y.
Harold Ellison, 271 Lee St., S. W., Atlanta, Ga.
M. H. Goucher, Fort Fairfield, Maine.
R. F. Kinney, 118 E. 13th St., Oklahoma City, Okla.
Howard K. Dunlap, 934 N. Havenhurst Drive, Los Angeles, Calif.
John O. Cowell, 218 Mason St., Calumet City, Ill.
John G. Schmidt, 1008 W. Edgeware Rd., Los Angeles, Calif.
P. A. Pringle, 457 S. Maple Ave., Glen Mead, N. J.
Art A. Johnson, 320 S. Church St., Rockford, Ill.

SHORT-WAVE CLUB

Rudolph Gowin, Warner Hotel, 3301 Cottage Grove, Chicago, Ill.

Air King Granted License by RCA

Air King Products Co., Inc., of 35 Hooper Street, Brooklyn, N. Y., has been granted a license to manufacture receivers, power amplifiers, home talking movies and television receivers by Radio Corporation of America.

The Air King name is well-known throughout the industry, and within the past year has become familiar in foreign countries due to the special export products manufactured by the corporation. The Air King organization has been built up by J. P. Lieberman, president and treasurer, from a modest beginning, in 1918, to a large factory that is not an "assembling" organization but that makes practically all the products that it uses in its receivers and amplifiers.

The Air King corporation occupies two adjoining buildings in Brooklyn, total floor space exceeding 60,000 feet and is equipped to turn out 300 receivers a day. Production can be speeded up beyond this quantity on short notice due to the stamping presses and die equipment recently installed for all chassis and other stampings.

Supertone Products Corporation and Roland Radio Company are affiliates of Aid King and market their own brands, including a-c, battery-operated and d-c t-r-f sets and superheterodynes, as well as short-wave receivers and kits. Mr. Lieberman is president and treasurer of Roland and is assisted by Edwin Stannard.

Mr. Lieberman reports business of all three companies has been good during the summer, and that a decided upturn has been felt in orders to be filled for the early Fall season.

New Incorporations

Ansley Radio Corp., New York City—Atty., H. Coleman, 220 Broadway, New York City.
Buffalo Electrical Equipment Corp., Wilmington, Del., patents—Attys., Colonial Charter Co., Dover, Del.
Erb Electrical Supply Co., New York City—Atty., S. Hut, 130 W. 42nd St., New York City.
Howard Electric Instruments Corp., New York City, wireless telegraph and telephone—Attys., Hyman & Hyman, 103 East 125th St., New York City.
Gruenberg Electric Co., New York City—Atty., I. H. Taylor, 11 West 42nd Street, New York City.

ASSIGNMENTS
In Queens County

A. H. Grebe & Co., Inc., radios, 7072 Van Wyck Blvd., Richmond Hill, N. Y., has assigned to Harold E. Foote, 484 Broome St., New York City.

CORPORATION REPORTS

Brunswick-Balke-Collender Company and Subsidiaries—Nine months ended Sept. 30: Net loss after depreciation, inventory, adjustments and other charges, $848,146. Quarter ended Sept. 30: Net loss after above charges, $265,226, against $275,900 loss in preceding quarter. Comparison with 1931 figures unavailable.

Crosley Radio Corporation—Six months ended Sept. 30: Net loss after taxes, depreciation and other charges, $300,700, against $60,952 loss in corresponding period last year. Quarter ended Sept. 30: Net loss after above charges, $223,002, against $77,698 loss in preceding quarter and let profit of $84,005, equal to 15 cents a share on 540,800 no par common shares, in third quarter of 1931.

BANKRUPTCY PROCEEDINGS

Silver-Marshall, Inc.—On October 8 the firm of Silver-Marshall, Inc., organized soon after radio broadcasting became popular, was adjudged an involuntary bankrupt by the Chicago Courts, listing liabilities at $200,000. The firm has been in financial straits for a number of months past, but has already paid off a substantial amount of claims of creditors. A receiver has been installed, but an accounting of assets has not yet been filed with the court.

National Radio Advertising, Inc., 120 West 42nd St., by National Electrical Transcription Corp., for $3,177; Marcelline O'Meara, $50; Edna Epstein, $35. The Irving Trust Co. was appointed receiver last July in an equity action.

TRADIOGRAMS

By J. Murray Barron

Following along the line of most new inventions the photoelectric cell is now attracting the man in the street. A demonstration in the downtown radio section of N. Y. City, at Harrison Radio Co., 142 Liberty Street, proved of great interest as it registered the customers entering the establishment by ringing a bell. The bell was in the circuit of the cell upon which centered the beam of light. The circuit was simple, but the interest was large and opened up to the experimenter thoughts of even greater possibilities.

* * *

Emicon, Inc., 2 West 46th St., N. Y. City, is in production on the newest musical instrument, "Emicon, the instrument of the mortals," as it is called. There is some illustrated literature for free distribution.

* * *

National Union Radio Corp., 400 Madison Ave., N. Y. City, manufacturer of the National tube line, has issued for free distribution through dealers handling their line a very atractive and handy radio log and guide, illustrated with radio stars' photographs.

* * *

Radio fans and experimenters are always to be found in large numbers at Thor's Bargain Basement, 167 Greenwich St., N. Y. City. The two circuits Thor is specializing in are very popular with the DX fans. Alan Mannion is always ready to help a fellow out of a radio jam. This sort of service should be studied by others who so often think the transaction is ended with the ringing of the cash register.

* * *

R. H. G. Mathews & Associates, 325 W. Huron St., Chicago, Ill., radio engineering production and design, announces the affiliation of H. J. Kayner as an associate. Mr. Kayner was formerly connected with Brunswick and Bremer-Tully.

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A most unusual combination radio-phonograph-piano made under patents of John Hammond, Jr., for Radio City, N. Y. City, was demonstrated privately before a selected audience. Marvelous piano tones filled the theatre with tremendous volume. Heretofore the ordinary piano had been limited to large concert halls. The new instrument, with new and different tones, will be permanently installed in Radio City. It is manufactured in Germany. It may be used with earphones when practicing, so as not to disturb others.

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From time to time inquiries are made as to where parts for old battery sets may be had. The same applies to the earlier model electric receivers and many power packs and A and B eliminators. For those around the Metropolitan section the surest place to locate parts along these lines is what is known as "The Alley," in other words, Washington Street, between Cortlandt and Dey Streets, N. Y. City. Here may be found tradeins and all sorts of receivers and radio merchandise of every description. Many of the establishments test for you, while others sell "as is."

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Radio Corporation of America has made a revised proposal to the Attorney General of the United States whereby the so-called anti-trust suit would be settled. Prior to this new proposal RCA licensed a number of smaller set manufacturers, on a new liberal policy, provided only the applicants were financially responsible.