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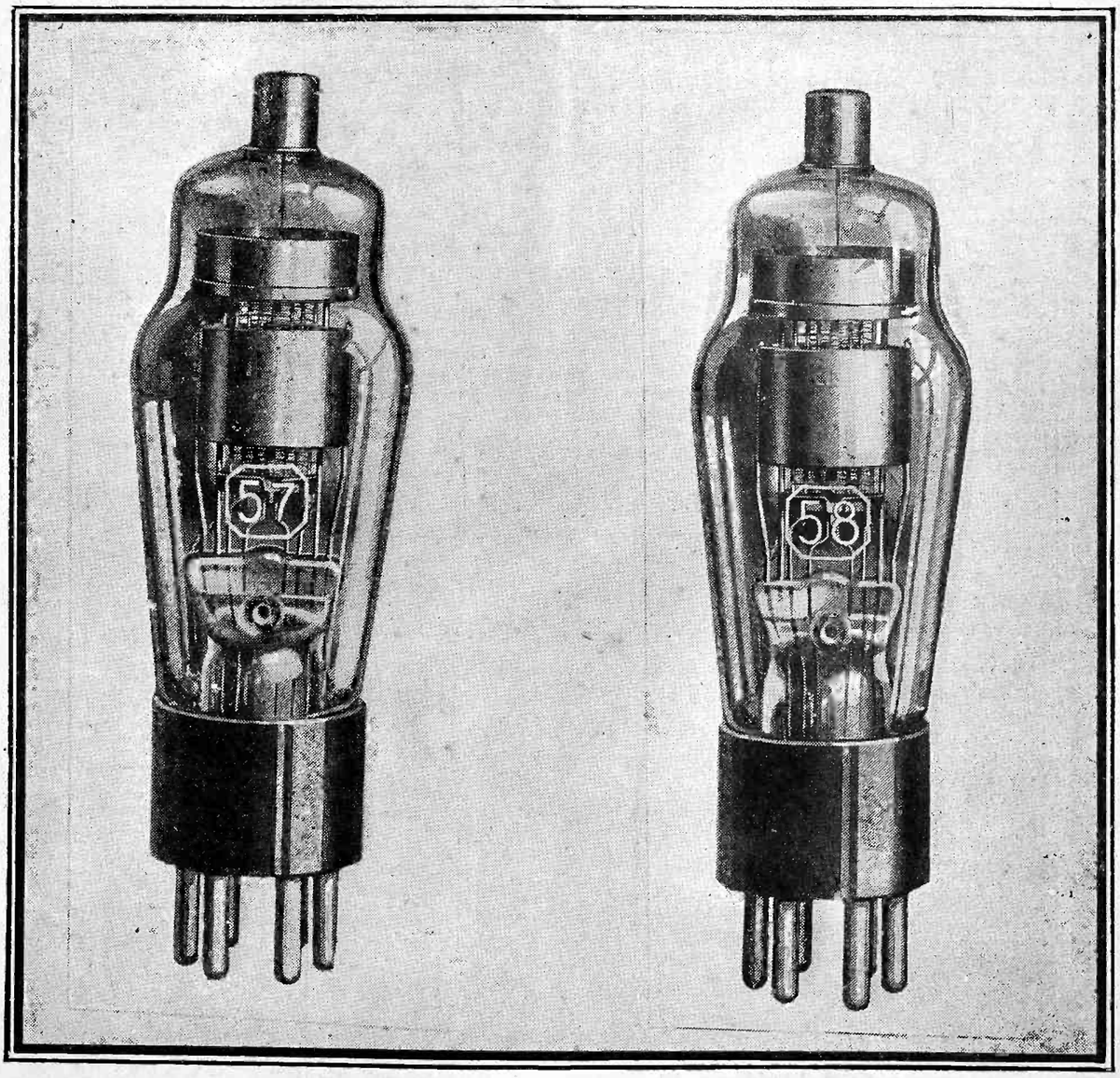

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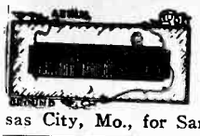

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Full Data on Five New Tubes

One General Purpose, Five Special Valves

FIVE new tubes are announced, two of them of an appearance utterly unfamiliar, two of them with six-pin bases, these two having grid caps besides and being six-element tubes.

The tubes are the 46, 56, 57, 58 and 82.

The 46 is designed particularly for service in Class B audio amplifier circuits of a-c operated receivers. A pair of these tubes in a Class B output stage is capable of supplying economically a reserve of power to meet requirements for an extended volume range. The 46 is constructed so that its two grids may be connected in the circuit to make the tube applicable either to the output or the driver stage of a Class B amplifier.

The 56 is a general purpose triode of the a-c heater type and is recommended for service as detector, amplifier or oscillator.

The 57 is a triple-grid amplifier detector which makes use of a suppressor and a radically new construction to obtain superior performance capabilities.

The 58 is a triple-grid super-control amplifier similar in construction to the 57, but designed to operate effectively over a large range of signal voltages, either with manual or automatic volume control circuits.

The 82 is designed especially for supplying a-c receivers with d-c power of uniform voltage independent of variations in the direct current demand. This feature makes this tube uniquely suitable for use in receivers employing Class B power amplifiers.

The design of the 56, 57 and 58 is characterized by relatively low heater power consumption, small size, and excellent characteristics. Both the 57 and the 58 have the unique feature of having the suppressor lead brought out to its own terminal.

The following data were furnished by RCA Radiotron Company, Inc., and E. T. Cunningham, Inc.

46

CLASS B POWER AMPLIFIER

The 46 is a double grid power amplifier tube recommended especially for service in Class B amplifier circuits of suitable design. In such circuits an output stage is preceded by a power amplifier stage designated as the "driver." A pair of 46's in a Class B output stage is capable of supplying an exceptionally large amount of virtually undistorted power; while a single 46, operated in the driver stage as a Class A amplifier, will deliver sufficient power to drive the pair of 46's in the output stage.

The dual application of the 46 both to Class B and to Class A amplifier service is made possible by different connections of the two grids incorporated in the tube's structure. Each grid terminates in its respective base pin. For Class B operation, the two grids must be tied together. This connection causes the tube to have an amplification factor so high that negative grid bias is not required for its operation as a Class B amplifier. For Class A operation, the grid adjacent to the plate is tied to the plate in order that the tube will have a low amplification factor. In this case, negative grid bias is required for proper operation of the tube.

The 46 is not interchangeable with any other tube.

Class B Amplification Considerations

In Class B service the tube is operated so that the plate current is practically zero with no grid excitation. When a signal of sufficient magnitude is applied to the grid there will be no plate current flow over a substantial part of the negative half-cycle. In other words, plate current flows only during the least negative excursions of the signal voltage. A considerable amount of second and higher even-order harmonic distortion is thus introduced into the power output of a single tube. However, with two tubes in a balanced push-pull circuit, the even harmonics are eliminated from the power output. In such a circuit, therefore, two tubes may be employed as Class B amplifiers to supply virtually undistorted output.

In Class B service it is possible to drive the grids of the two amplifier tubes positive to a certain amount and still obtain reasonably undistorted output, provided that sufficient input power is available to supply the grid current required by the positive grids. This power is conveniently supplied by a Class A power amplifier feeding the grids of the output tubes through a push-pull transformer having the proper characteristics. Usually this transformer has a step-down ratio.

A High Mu Power Tube

By designing Class B amplifier tubes with a sufficiently high mu-factor, it is possible to operate them with zero grid bias, and so dispense with biasing resistors whose effect would be to produce considerable loss in sensitivity because of degenerative effects. Since provision for grid bias is unnecessary with

(*Continued on next page*)

New Valves Classified

46—Special purpose, power amplifier, particularly for Class B in a-c sets; very high mu as Class B; can be Class A at 5.6 mu; 2.5 volts a-c on filament, 1.75 amps; maximum undistorted power output as Class A, 1.25 watts; as Class B, continuous power output 20 watts; no grid bias for Class B; 33 volts negative as Class A. This is a double control grid tube. UY socket.

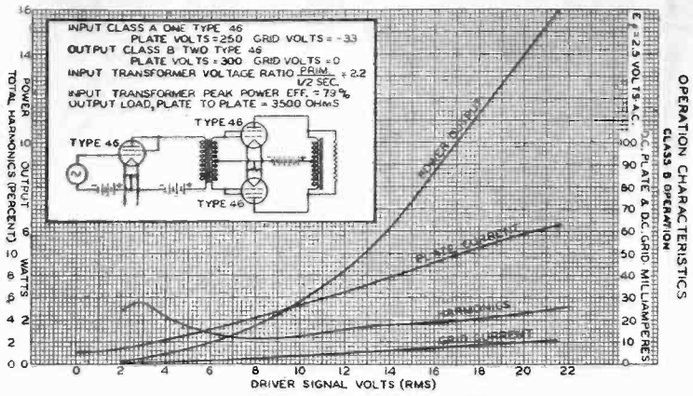
56—General purpose, three-element; detector, oscillator or amplifier; 2.5 volts a-c on heater, 1 ampere; UY socket. Substantially a relatively high mu —27 (mu 13.8). Excellent for resistance-coupled audio. Not vari-mu.

57—Special purpose, triple grid amplifier-detector; six-element; 2.5 volts a-c on heater, 1 ampere; very high mu (greater than 1,500); 6-pin base plus cap. The cap is the control grid; the suppressor grid is to a base pin; the other base pins are to plate, cathode, screen and two to heater. Sharp plate current cutoff (non-vari mu).

58—Special purpose amplifier; six element vari-mu, with choice of uses as 5-element tube by interconnections; 2.5 volts a-c on heater, 1 ampere; 6-pin base plus cap. Cap and pin connections may be as in the 57. Permits high impedance in screen circuit.

82—Full-wave mercury-vapor rectifier; relatively constant voltage, due to low resistance of tube (normal drop 15 volts), but low resistance filter choke is imperative. D-C output 125 ma. continuous; maximum a-c per plate, 500 v rms.; filament 2.5 volts, 3 amps.

Class B Amplifier Among the New Tubes



Family of curves of the 46, with circuit for driver and output stage.

(*Continued from preceding page*)

such tubes, the entire voltage of the rectifier is available for plate supply.

Distinguishing features of this class of service are that very high output of good quality may be obtained with fairly small tubes operating at relatively low plate voltage; and that unusual overall economy of power consumption is possible because the plate current is very low when no signal is applied to the grid. To give these advantages, the Class B amplifier circuit requires the use of two tubes in a balanced output stage preceded by a driver stage capable of supplying considerable undistorted power and the use of a power supply capable of maintaining good voltage regulation regardless of the variation of average plate current with signal intensity. It should be noted that the distortion present in the high power output of Class B amplifiers is usually negligible but is always somewhat higher for the ordinary range of signals than that obtained with Class A amplifiers employing much larger tubes capable of operating at the same maximum power output.

Class B amplifiers, however, have the distinct advantage of providing, with relatively small tubes, a reserve of power-delivering ability to meet requirements for an extended volume range.

RATING AND CHARACTERISTICS OF THE 46

General

Filament Voltage	2.5 Volts A-C
Filament Current	1.75 Amperes
Maximum Overall Length	5⅝ Inches
Maximum Diameter	2 3/16 Inches
Bulb	S-17
Base	Medium 5-Pin

Class "B" Amplifier

Operating Conditions and Characteristics:

Filament Voltage	2.5 Volts A-C
Plate Voltage	300; 400 Max. Volts
Grid Voltage (both grids tied together)	0; 0 Volts
Plate Current	4; 6 Milliamperes
Peak Plate Current	150; 200 Milliamperes
Load Resistance per Tube	1,300; 1,450 Ohms
Max. Signal Voltage	40; 41 Volts RMS
Max. Continuous Power Output (2 tubes)*	16; 20 Watts
Max. Plate Dissipation (avg. per tube)	10; 10 Watts

Class "A" Amplifier

Operating Conditions and Characteristics:

Filament Voltage	2.5 Volts AC
Plate Voltage	250 Max. Volts
Grid Voltage (grid adjacent to plate tied to plate)	-33 Volts
Amplification Factor	5.6
Plate Resistance	2,380 Ohms
Mutual Conductance	2,350 Micromhos
Plate Current	22 Milliamperes
Load Resistance (Optimum for max. undistorted power output)**	6,400 Ohms
Max. Undistorted Power Output	1.25 Watts

*Power measured across indicated value of resistor in plate circuit of each tube, with indicated signal applied through 250 ohm resistance in the grid circuit.

**Approximately twice this value is recommended for load of driver for Class B stage.

Installation

The base of the 46 is of the medium 5-pin type. Its pins fit the standard five-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with the filament pin openings one vertically above the other.

The bulb of this tube may become very hot under certain conditions of operation. Sufficient ventilation, therefore, should be provided for free circulation of air around the tube to prevent overheating.

The filament is designed to operate at 2.5 volts. The transformer winding that supplies the filament circuit should be designed to operate the filament at this recommended value (as measured at the filament terminals) when rated voltage is applied to the primary of the power transformer operating under average load. The filament circuit wiring and the filament contacts of the socket should have adequate current capacity to accommodate the high current drain (1.75 amperes) of this tube. All connections should be well soldered.

The filament winding should be provided either with a mid-tap or with a mid-tapped resistor of approximately 20 ohms shunted across it. To this mid-tap, the grid and the plate return lead should be connected.

The filament wiring should, in so far as possible, be isolated from the input circuit of the driver stage in order to avoid the possibility of hum caused by electrostatic induction from this wiring.

A variable center-tapped resistor across the filament (or heater) supply for the driver stage is desirable for minimum hum adjustment. The use of a push-pull driver stage with either equipotential or filament type tubes will reduce hum resulting from the filament supply, but is usually unnecessary under normal conditions of operation.

Application

For Class B Audio Power Amplifier Service the 46 is particularly recommended because of its design. In this type of service the two grids in the tube are connected together and thus the signal voltage is applied to both simultaneously. No grid bias is necessary with this connection as the steady plate current at zero basis is only a few milliamperes. The design of the 46 permitting its operating as a Class B amplifier with zero bias is particularly important because it prevents the variation of bias with applied signal which would otherwise exist if any self-bias arrangement were employed.

The direct current requirements of Class B circuits are subject to fluctuation under operating conditions. The power supply, therefore, should have as good regulation as possible to maintain proper operating voltages regardless of the current drain. The use of a mercury vapor rectifier in the power supply is recommended because it has a low and practically constant space charge voltage drop within its operating limitations. As a further means of obtaining good regulation, the filter chokes and transformer windings of the power supply should have as low resistance as possible. In designing the power supply for a Class B amplifier, it should be remembered that such an amplifier may frequently demand peak currents of 200 milliamperes or over.

The grid of the 46 is operated sufficiently positive to cause grid current to flow in its input circuit. This feature imposes a further requirement on the preceding amplifier stage. It must supply not only the necessary input voltage, but it must be capable of doing so under conditions where appreciable power is taken by the grid of the Class B amplifier tube.

A More Involved Design

Since the power necessary to swing the grid positive is partially dependent on the plate load of the Class B tube, and since the efficiency of power transfer from the preceding stage is dependent on transformer design, it is apparent that the design of a Class B audio power amplifier requires that more than ordinary attention be given to the effects produced by the component parts of the circuit. These effects may be produced in the first stage amplifier by the design factors of the power output stage. For this reason, the design of a Class B audio amplifier with its driver stage is somewhat more involved than for a Class A system, and must be checked for each change in the component parts.

A complete discussion of design features for Class B amplifiers would be rather extensive, but certain outstanding points may be mentioned. The inter-stage transformer is the link interconnecting the driver and the Class B stage. It is usually of the step-down type, that is, the primary input voltage is higher than the secondary voltage supplied to the grids of the power output tubes. Depending upon conditions, the ratio of the primary of the interstage transformer to one half its secondary may range between 1.5-to-1 and 5.5-to-1.

The transformer step-down ratio is dependent on the following factors: (1) Type of driver tube, (2) Type of powertube, (3) Load on power tube, (4) Permissible distortion and (5) Transformer efficiency (peak power).

The primary impedance of the interstage transformer is essentially the same as if the transformer were to be operated with no load, that is, into an open grid. Since power is transferred, the transformer should have reasonable power efficiency. It should be noted that the power output and distortion are often critically dependent upon the circuit constants which should therefore be made as near independent of frequency as possible. This applies particularly to the interstage coupling transformer

and to the loudspeaker. Since it is difficult to compensate for leakage reactance of the coupling transformer without excessive loss of h-f response, the leakage reactance of this transformer should be as low as posible. In the case of the Class B output circuit, the use of compensating networks is advised.

Needs Distortionless Driver

The type of driver tube chosen should be capable of handling sufficient power to operate the Class B amplifier stage. Allowance should be made for transformer efficiency. It is most important, if low distortion is desired, that the driver tube be worked substantially below its Class A undistorted output rating, since distortion produced by the driver stage and the power stage will be present in the output.

For Class A operation of the 46, the grid adjacent to the plate is connected to the plate. The grid next to the filament serves as the control grid. Operation of the tube is then similar to any Class A power amplifier triode. The operation of this tube connected as a Class A amplifier is not indicative of its performance in Class B circuits and should not be confused with the latter.

The intended application of the 46 as a Class A amplifier is for driving two 46's in a Class B amplifier circuit. The tube has been constructed for this dual service in order to reduce the number of tube types necessary in a receiver. The tabulated values for Class A operation of this type as given under "Rating and Characteristics" above, are for its operation as a power output tube.

56

DETECTOR, AMPLIFIER, OSCILLATOR

The 56 is a general purpose three-electrode tube of the indirectly heated cathode type recommended for use as a detector, amplifier or oscillator in A-C receivers employing the 57 and/or 58. The 56 is characterized by the small overall size, the relatively low heater power consumption, the high mutual conductance, and the comparatively high amplification factor. This tube is especially useful in resistance-coupled audio-frequency amplifiers.

The use of the 56 to replace any other tube is not recommended.

RATING AND CHARACTERISTICS OF THE 56

General

HEATER VOLTAGE	2.5 Volts A-C or D-C
HEATER CURRENT	1.0 Ampere
DIRECT INTERELECTRODE CAPACITIES	
Grid-Plate	3.2 uuf
Grid-Cathode	3.2 uuf
Plate-Cathode	2.2 uuf
MAXIMUM OVERALL LENGTH	4¼ inches
MAXIMUM DIAMETER	1 9/16 Inches
BULB	S-12
BASE	Small 5-Pin

Amplifier (Class A)

OPERATING CONDITIONS AND CHARACTERISTICS:	
HEATER VOLTAGE	2.5 Volts
PLATE VOLTAGE	250 Volts, Maximum
GRID VOLTAGE*	-13.5 Volts
AMPLIFICATION FACTOR	13.8
PLATE RESISTANCE	9500 Ohms
MUTUAL CONDUCTANCE	1450 Micromhos
PLATE CURRENT	5 Milliamperes

*If a grid coupling resistor is used, its maximum value should not exceed 1.0 megohm.

Detector

OPERATING CONDITIONS AS BIASED DETECTOR	
HEATER VOLTAGE	2.5 Volts
PLATE VOLTAGE	250 Volts Maximum
GRID VOLTAGE*	-20 Volts Approx.
PLATE CURRENT	(Adjusted to 0.2 ma. with no a-c input signal)
OPERATING CONDITIONS AS GRID LEAK DETECTOR	
HEATER VOLTAGE	2.5 Volts
PLATE VOLTAGE	45 Volts
GRID CONDENSER CAPACITY	0.00025 uf
GRID LEAK RESISTANCE	1 to 5 Megohms

Oscillator

OPERATING CONDITIONS AS OSCILLATOR	
HEATER VOLTAGE	2.5 Volts
PLATE VOLTAGE	90 Volts, Maximum
GRID VOLTAGE	0 Volts

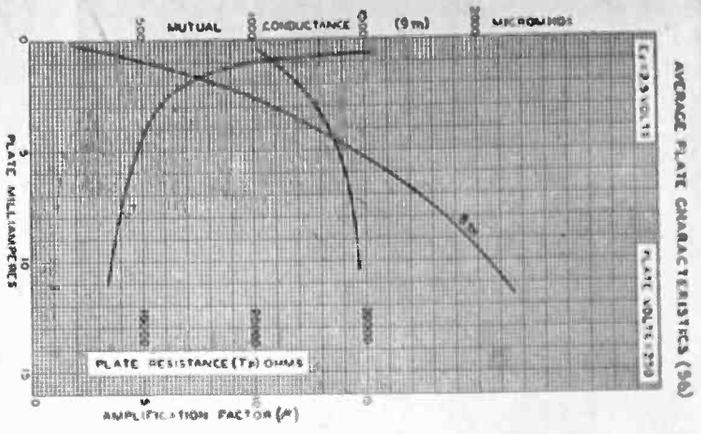
Installation

The base of the 56 is of the small 5-pin type. Its pins fit the standard five-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with its heater pin openings one vertically above the other.

The heater is designed to operate at 2.5 volts. The transformer winding supplying the heater circuit should be designed to operate the heater at this recommended value (as measured at the heater terminals) when rated voltage is applied to the primary of the power transformer operating under average load. A transformer having primary taps is recommended so that adjustment may be made to give 2.5 volts to the heater for the particular line voltage at each installation.

The heater circuit wiring and the heater contacts of the socket should have adequate current carrying capacity in order to minimize circuit drop and contact resistance.

The cathode should be preferably connected directly either to the mid-tap on the heater supply winding or to the mid-tap of a 50 ohm (approximate) resistor shunted across the winding. If this practice is not followed, the heater may be biased negative with respect to the cathode by not more than 45 volts. When the cathode is not connected directly to the heater in a-c receivers, attention should be given to keeping the impedance of the circuit between heater and cathode as low as possible. Unless this is done, hum may arise because of heater to cathode leakage.



*If a grid coupling resistor is used, its maximum value should not exceed 1.0 megohm.

Application

As an amplifier, the 56 is applicable either to radio-frequency or audio-frequency circuits. Recommended operating conditions for service using transformer coupling are given under "Rating and Characteristics" above. For circuits utilizing resistance coupling, typical operating conditions are as follows:

HEATER VOLTAGE	2.5 Volts
PLATE SUPPLY VOLTAGE	250 Volts
GRID VOLTAGE	-9 Volts Approx.
PLATE LOAD	50,000-100,000 Ohms
PLATE CURRENT	1-2 Milliamperes

A grid coupling resistor in excess of 1.0 megohm should not be used.

As a detector, the 56 may be used as a biased detector or as a grid-leak detector. Operating conditions for each type of service are given under "Rating and Characteristics." In general, grid-leak detection is the more sensitive, but grid-bias detection permits the handling of greater volume with high quality. For biased detector service, the grid bias may conveniently be obtained from the voltage drop in a resistor between cathode and ground. The value of this self-biasing resistor is not critical, 100,000 to 150,000 ohms being suitable. The higher value will permit the application of a larger input signal.

The 56 may be employed as a two-electrode detector preferably by connecting the plate to the cathode for the one electrode and using the grid for the other. With this arrangement, a-c input voltages as high as 40 volts RMS may be applied between grid and cathode.

As an oscillator, the 56 may be operated with a plate voltage of approximately 90 volts and zero grid bias. A lower value of plate voltage may be found desirable in some applications.

57

TRIPLE-GRID AMPLIFIER DETECTOR

The 57 is a triple-grid amplifier-detector tube recommended especially for service as a biased detector in A-C receivers employing the 56 and/or 58. In such service this tube is capable of delivering a large audio-frequency output voltage of good quality at relatively small input voltages. Other applications of the 57 include its use as a low signal input screen grid amplifier tube and as an automatic volume control tube. The 57 is characterized by the small overall size, the dome-top bulb, the internal shield in the dome, the rigidity of construction, and the fifth electrode or "suppressor" with its own base pin terminal. Equally significant among its electrical features

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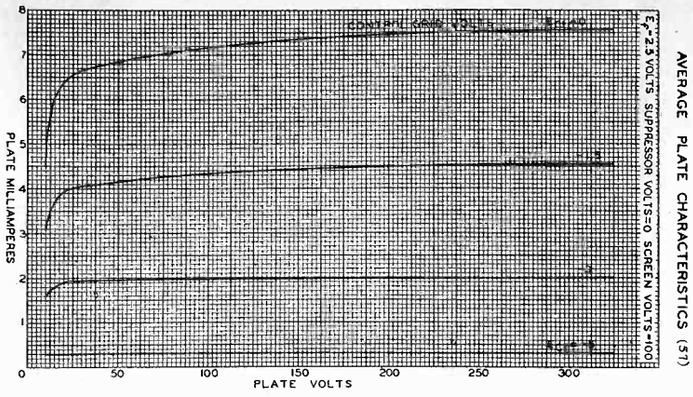

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are its relatively low heater power consumption, its sharp plate current "cut-off" with respect to grid voltage, and its adaptability of electrode combinations to unusual circuit applications.

This tube is not interchangeable with any other tube.

Design Structure Considerations

The suppressor grid employed in the design of this tube is placed between the screen and the plate and has its own base pin connection. The suppressor may or may not be connected to the cathode terminal depending upon receiver design requirements.

When these two terminals are connected directly together, the suppressor is effective in eliminating the secondary emission effects which limit the voltage swing permissible in the usual screen grid tube at low plate voltage, that is, at a plate voltage approximately equal to the screen voltage. The suppressor, therefore, makes possible the efficient operation of this type at a relatively low plate voltage, that is, at a plate voltage approximately equal to the screen voltage.

When the suppressor is not connected directly to the cathode it may be utilized in a number of ways for obtaining modified tube characteristics and for application of the tube to special circuits.

The internal shield is a distinctive feature in the design of this tube. It is placed in the bulb dome above the electrode assembly and is connected within the tube directly to the cathode.

The dome top bulb makes possible close proximity of the external and internal shields. The close spacing of the two shields makes available a low effective grid-plate capacitance. The form of the external shield-can may be somewhat modified depending upon the receiver design requirements for minimum grid-plate and output capacitance.

RATING AND CHARACTERISTICS OF THE 57

General

HEATER VOLTAGE ..... 2.5 Volts A-C or D-C
HEATER CURRENT ..... 1.0 Ampere
DIRECT INTERELECTRODE CAPACITANCES
Effective Grid-Plate ..0.010 uuf Maximum (With shield can)
Input ..... 5.2 uuf
Output ..... 6.8 uuf
OVERALL LENGTH ..... 4 19/32 to 4 27/32 Inches
MAXIMUM DIAMETER ..... 1 9/16 Inches
BULB ..... ST-12 (Dome Shape)
CAP ..... Small Metal
BASE ..... Small 6-Pin

Amplifier (Class A)

OPERATING CONDITIONS AND CHARACTERISTICS:
HEATER VOLTAGE ..... 2.5 Volts
PLATE VOLTAGE ..... 250 Volts Maximum
SCREEN VOLTAGE ..... 100 Volts Maximum
GRID VOLTAGE ..... -3 Volts
AMPLIFICATION FACTOR ..... Greater than 1500
PLATE RESISTANCE ..... Greater than 1.5 Megohms
MUTUAL CONDUCTANCE ..... 1225 Micromhos
GRID VOLTAGE FOR CATHODE CURRENT CUT-OFF ..... 7 Volts Approx.
PLATE CURRENT ..... 2.0 Milliamperes.
SCREEN CURRENT ..... 1.0 Milliampere Max.

Detector

OPERATING CONDITIONS AS BIASED DETECTOR:
HEATER VOLTAGE ..... 2.5 Volts
PLATE VOLTAGE ..... 250 Volts Maximum
SCREEN VOLTAGE ..... 100 Volts Maximum
GRID VOLTAGE ..... -6 Volts Approx.
PLATE LOAD—250,000 ohms or 500 henry choke shunted by a .25 megohm resistor. For resistance load, plate supply voltage will be voltage at plate plus voltage drop in load caused by specified plate current.
PLATE CURRENT—Adjusted to approximately 0.1 milliampere with no a-c input signal.

Installation

The base of the 57 is of the small 6-pin type. Its pins require the use of a standard six-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with its heater pin openings one vertically above the other.

The heater is designed to operate at 2.5 volts. The transformer winding supplying the heater circuit should be designed to operate the heater at this recommended value for full load operating conditions under average line voltages. A transformer having primary taps is recommended so that adjustment may be made to give 2.5 volts to the heater for the particular line voltage at each installation.

The cathode should preferably be connected directly to the mid-tap of the heater winding. This practice follows the recommendation that no bias be applied between heater and cathode, and that the resistance between them be kept as low as possible in order to prevent hum in the circuit. When this practice is not followed, the heater may be biased negative with respect to the cathode by not more than 45 volts. If the use of a large resistor is necessary between heater and cathode in some circuit designs, it should be by-passed by a condenser of at lest 4 microfarads or objectionable hum may develop.

Obtaining Screen Voltage

The screen voltage may be obtained from a potentiometer or bleeder circuit across the B-supply source. Due to the screen current characteristics of the 57, the use of a resistor in series with the high voltage supply may be employed for obtaining the screen voltage provided the cathode-resistor method of bias control is used. This method, however, is not recommended if the high voltage B-supply exceeds 250 volts.

Shielding of all the components of each stage is required in circuits employing the 57 as a radio-frequency ampilfier in order to prevent inter-stage coupling and to obtain stable operation of the 57 in circuits designed to give maximum gain per stage. Unless complete stage shielding is used, the amplification possibilities of this tube cannot be realized. When a shield-can is used with the 57, it should provide sufficient ventilation to prevent overheating of the tube.

The use of radio-frequency filters in all leads which enter the stage shields is advised to reduce coupling in external parts of the circuit. The suppressor grid in this tube effectively eliminates the necessity for keeping the d-c resistance of the screen circuit low and thus permits the use of resistance-capacity filters in all leads except those carrying heater current. However, it is necessary to keep the impedance of the circuit from screen to ground as low as possible by the use of a high quality by-pass condenser.

Careful Shielding Necessary

Complete shielding of detector circuits employing the 57 is generally necessary, since considerable voltage at carrier frequency is usually present in the plate circuit even though the latter is by-passed with a low impedance capacitor. Two-section filters in the plate circuit are frequently necessary to prevent radio-frequency feed-back to the input of the detector.

In receivers employing a built-in loudspeaker, acoustic shielding may be necessary to prevent microphonic feed-back when a strong radio-frequency carrier voltage is present on the tube elements. It should be noted also that condenser plates may cause an audio howl due to mechanical feed-back from the speaker.

Application

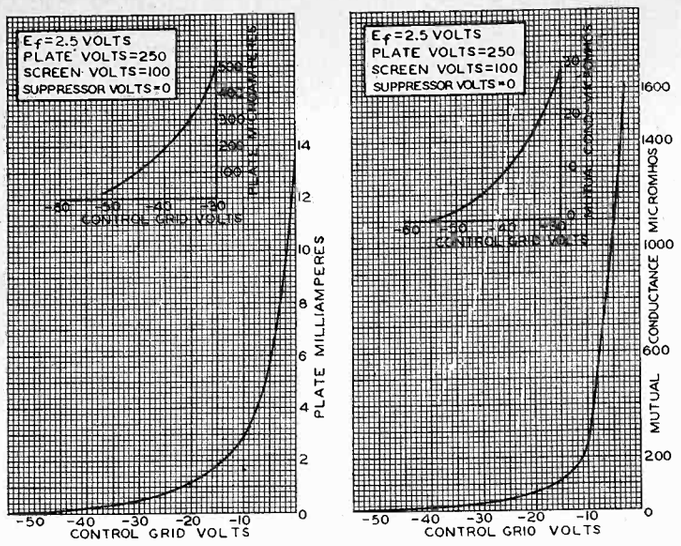
As a biased detector, the 57 is particularly recommended because of its ability to deliver a large audio-frequency output voltage of good quality with a fairly small radio-frequency signal input, if a satisfactory coupling resistance or impedance is used.

Resistance coupling usually provides the best fidelity but higher output and sensitivity may be obtained by the use of a very high impedance choke (500 henries) shunted by a resistance of approximately 0.25 megohm. If the choke is properly designed for the specific application, the quality of the output may be made nearly as good as is possible with resistor coupling. For design purposes, the impedance of the 57 to the audio-frequency range in nearly all cases may be considered to be practically infinite, that is, several megohms. Therefore, the output of the detector will depend almost entirely on the load impedance at the frequency or range of frequencies considered. In this connection the low output capacity of the 57 may be of advantage in certain cases.

The detector bias may be obtained from a bleeder circuit, from a resistor in the cathode circuit, or from a partial self-biasing circuit. The cathode-resistor method permits of higher output at low percentage modulation since the input signal may be increased almost in inverse proportion to the modulation without resulting in objectionable distortion.

Automatic Volume Control

As an automatic volume control rectifier of the biased type, the 57 may be used to supply the control grid bias for the radio—and intermediate-frequency stages in automatic volume control circuits. Resistance loading in the plate circuit is the



The 58 tube characteristic curves, Eg-Ip at left, Eg-Gm at right.

only possible form for this service. Fixed bias obtained from a bleeder circuit is recommended for this type of service as greatest sensitivity of control is obtained thereby. The same tube may be used with fair sensitivity under certain conditions for the dual function of supplying the input voltage to the audio amplifier and the d-c bias voltage for automatic volume control purposes. However, these functions can be accomplished more satisfactorily through the use of two tubes each operated under optimum voltage and load conditions.

As a radio-frequency amplifier, the 57 may be used satisfactorily in applications where the r-f signal applied to the grid is relatively low, that is, of the order of a few volts. In such cases either screen or control grid voltage (or both) may be varied to control the receiver volume. When larger signals are involved, a super-control amplifier tube should be employed to prevent the occurrence of excessive cross-modulation and modulation distortion.

The plate circuit load should be as high as is practicable. A tuned impedance load will be satisfactory for intermediate-frequency amplifiers operating at a fixed frequency. The gain per stage can be made as high as 200 or more with ordinary care in design. For other applications requiring uniform sensitivity over a wide band of radio frequencies, coupling devices to meet the specific requirements will be necessary.

As a frequency converter or a superheterodyne first detector, the 57 may be employed but a tube having super-control characteristics is to be preferred, especially if signals of large magnitude are to be received, and if supplementary volume control is to be obtained in this stage.

As a dynatron oscillator, the 57 is not recommended.

58

TRIPLE-GRID SUPER-CONTROL AMPLIFIER

The 58 is a triple-grid super-control amplifier tube recommended especially for service in the radio-frequency and intermediate-frequency stages of A-C receivers employing the 56 and/or 57. The 58 is characterized by the small overall size, the dome-top bulb, the internal shield in the dome, the rigidity of construction, and the fifth electrode or "suppressor" with its own base pin terminal. Equally significant among its electrical features are the relatively low heater power consumption, the extended mutual conductance operating range, and the adaptability of electrode combinations to various circuit applications. The ability of this tube to handle the usual signal voltages without cross-modulation and modulation-distortion makes it uniquely adaptable to the r-f and i-f stages of receivers employing automatic volume control.

The 58 is not interchangeable with any other tube.

The suppressor grid employed in the design of this tube is placed between the screen and the plate and has its own base pin connection. The suppressor may or may not be connected directly to the cathode terminal depending upon receiver design requirements.

When these two terminals are connected directly together, the suppressor is effective in eliminating the secondary emission effects which limit the voltage swing permissible in the usual screen grid tube at low plate voltage, that is, at a plate voltage approximately equal to the screen voltage. The suppressor in the 58, therefore, makes possible the efficient operation of this type at a relatively low plate voltage, that is at a plate voltage approximately equal to the screen voltage.

When the suppressor is not connected directly to the cathode, its utility may be extended. The suppressor, in suitable circuits, provides a means for obtaining the desirable conditions of reduced selectivity for local reception. This operational characteristic makes possible improved loud speaker response when the receiver is tuned to powerful nearby stations.

Shield In Bulb Over Electrodes

The internal shield is a distinctive feature in the design of this tube. It is placed in the bulb dome above the electrode assembly and is connected within the tube directly to the cathode.

The dome top bulb makes possible close proximity of the external and internal shields. The close spacing of the two shields makes available a low effective grid-plate capacitance. The form of the external shield-can may be somewhat modified depending upon the receiver design requirements for minimum grid-plate capacitance.

RATING AND CHARACTERISTICS OF THE 58

General

HEATER VOLTAGE	2.5 Volts A-C or D-C
HEATER CURRENT	1.0 Ampere
DIRECT INTERELECTRODE CAPACITANCES	
effective Grid-Plate	.010 uuf Maximum (with shield-can)
Input	5.2 uuf
Output	6.8 uuf
OVERALL LENGTH	4 19/32 to 4 27/32 Inches
MAXIMUM DIAMETER	1 9/16 Inches
BULB	ST-12 (Dome Shape)
CAP	Small Metal
BASE	Small 6-Pin

Amplifier (Class A)

OPERATING CONDITIONS AND CHARACTERISTICS:	
HEATER VOLTAGE	2.5 Volts
PLATE VOLTAGE	250 Volts Maximum
SCREEN VOLTAGE	100 Volts Maximum
GRID VOLTAGE	-3 Volts Minimum
AMPLIFICATION FACTOR	1280
PLATE RESISTANCE	800,000 Ohms
MUTUAL CONDUCTANCE	1600 Micromhos
MUTUAL CONDUCTANCE	
(At -40 Volts Bias	10 Micromhos
(At -50 Volts Bias	2 Micromhos
PLATE CURRENT	8.2 Milliamperes
SCREEN CURRENT	3.0 Milliamperes Max.

First Detector in Superheterodyne Circuit

OPERATING CONDITIONS with VARIABLE GRID BIAS	
HEATER VOLTAGE	2.5 Volts
PLATE VOLTAGE	250 Volts Maximum
SCREEN VOLTAGE	100 Volts Maximum
GRID VOLTAGE (with 9-Volt Oscillator Peak Swing)	—10 Volts Minimum

Note: With an oscillator peak swing of 1 volt less than the grid bias, these values are not critical and may be chosen to meet receiver design requirements.

Installation

The base of the 58 is of the small 6-pin type. Its pins require the use of a standard six-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with its heater pin openings one vertically above the other.

The heater is designed to operate at 2.5 volts. The transformer winding supplying the heater circuit should be designed to operate the heater at this recommended value for full load operating conditions under average line voltages. Since the performance of the 58 is susceptible to variations of applied heater voltage, it is desirable to minimize these variations as much as possible. A transformer having primary taps is recommended so that adjustment may be made to give 2.5 volts to the heater for the particular line voltage at each installation.

The cathode should preferably be connected directly to the mid-tap of the heater winding. This practice follows the recommendation that no bias be applied between heater and cathode, and that the resistance between them be kept as low as possible in order to prevent hum in the circuit. When this practice is not followed, the heater may be biased negative with respect to the cathode by not more than 45 volts. If the use of a large resistor is necessary between heater and cathode in some circuit designs, it should be by-passed by a condenser of at least 4 microfarads or objectionable hum may develop.

Control grid bias variation will be found effective in changing the volume of the receiver. In order to obtain adequate volume control, an available grid bias voltage of approximately 50 volts will be required. The exact value will depend upon the circuit design and operating conditions. This voltage may be obtained, depending on receiver requirements, from a potentiometer across a fixed supply voltage or by the use of a variable self-bias resistor in the cathode circuit.

The screen voltage may be obtained from a potentiometer or bleeder circuit across the B-supply source. Due to the screen current characteristics of the 58, a resistor in series with the high voltage supply may be employed for obtaining the screen voltage provided the cathode-resistor method of bias control is used. This method, however, is not recommended if the high voltage B-supply exceeds 250 volts. Furthermore, it should

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be noted that the use of a resistor in the screen circuit will have an effect on the change in plate resistance with variation in suppressor voltage in case the suppressor is utilized for control purposes.

The suppressor may be connected directly to the cathode or it may be made negative with respect to the cathode, as explained under DESIGN STRUCTURE CONSIDERATIONS. For the latter condition, the suppressor voltage may be obtained from a potentiometer or bleeder circuit for manual volume and selectivity control or from the drop in a resistor in the plate circuit of the automatic volume control tube.

Shielding of all the components of each stage is required in order to prevent inter-stage coupling and to combine stable operation of the 58 in radio-frequency circuits designed to give maximum gain per stage. Unless complete stage shielding is used, the amplification possibilities of this tube can not be realized. The use of radio-frequency filters in all leads entering the stage shields is advised to reduce coupling in external parts of the circuit. In constructing these filters, it is necessary to keep the impedance of the circuit from screen to ground as low as possible by the use of a high quality by-pass condenser. Unless proper attention is given to the elimination of external coupling and to provision for complete and effective stage shielding, the maximum volume control range capabilities of the 58 will not be experienced.

The shield-can design is an important factor influencing the effective grid-plate capacitance of the 58. When the shield-can is provided with a collar which closely fits the tubular part of the dome, the combined effect of the can construction and the internal shield will give low effective grid-plate capacity. If shielding is used, sufficient ventilation should be provided to avoid overheating of the tube.

In receivers employing a built-in loudspeaker, acoustic shielding may be necessary to prevent microphonic feed-back when a strong radio-frequency carrier voltage is present on the tube elements. It should be noted also that condenser plates may cause an audio howl due to mechanical feed-back from the speaker.

Application

As a radio-frequency amplifier the 58 is especially applicable to radio receiver design because of its ability to reduce cross-modulation effects, its remote "cut-off" feature, and its flexible adaptability to circuit combinations and to receiver design.

To realize the maximum benefit of the long "cut-off" feature of this tube, it is necessary to apply a variable grid bias and to maintain the screen at a constant potential with respect to the cathode. However, good results may be obtained by using a variable cathode resistance which, of course, reduces the screen potential with respect to the cathode by the same amount that the bias is increased, thus hastening the "cut-off" and reducing the ability of the tube to handle large signals. This undesirable effect may be nullified by means of a series resistor in the screen circuit.

The use of series resistors for obtaining satisfactory control of screen voltage in the case of four-electrode tubes is usually impossible because of secondary emission phenomena. In the 58, however, the suppressor practically removes these effects and it is therefore possible to obtain satisfactorily the screen voltage from the plate supply or from some high intermediate voltage providing these sources do not exceed 250 volts. With this method the screen to cathode voltage will fall off very little from minimum to maximum value of cathode-control resistor. In some cases, it may actually rise. This rise of screen to cathode voltage above the normal maximum value is allowable because the screen and the plate current are reduced simultaneously by a sufficient amount to prevent damage to the tube. It should be recognized in general that the series resistor method of obtaining screen voltages from a higher voltage supply necessitates the use of the variable cathode-resistor method of controlling volume. When screen and control grid voltages are obtained in this manner, the remote "cut-off" advantage of the 58 may be fully realized.

High Plate Load

The plate circuit load should be as high as is practicable. A tuned impedance load will be satisfactory for intermediate-frequency amplifiers operating at a fixed frequency. The gain per stage can be made as high as 200 or more with ordinary care in design. For other applications requiring uniform sensitivity over a wide band of radio frequencies, coupling devices to meet the specific requirements will be necessary. If a grid coupling resistor is required, its maximum value should not exceed 1.0 megohm.

As a frequency converter or a superheterodyne first detector, the 58 may be used to advantage. It is capable of producing under the proper conditions of grid and local oscillator voltage, a gain in the first detector stage of about one third that which can be obtained in an intermediate-frequency amplifier stage. In addition, this gain can be controlled as in the case of the radio-frequency amplifier by varying the d-c grid bias either from a separate supply or from a variable resistor in the cathode circuit. This is a particularly desirable feature in receivers employing automatic volume control, because it enables a much lower threshold input to be received without loss of amplification and permits the reception of high input voltages without loss of control.

When variable grid bias is used on the first detector, it is possible to use an oscillator voltage nearly equal to the grid bias at full sensitivity since only a very small signal is applied under such conditions. However, under these conditions, a fairly large interfering signal (of the order of one volt) may be present. It is desirable, therefore, to apply a peak oscillator voltage about one volt less than the grid bias to eliminate the possibility of cross-modulation caused by the first detector drawing grid current.

Without variable bias on the first detector, it is necessary to have the oscillator peak voltage considerably less than the grid bias. It should be less than the grid bias by an amount equal to the peak value of the largest signal to be received plus the corresponding value of any probable interference voltage. This method reduces the sensitivity to a great extent and is therefore not recommended. To compensate for the loss in sensitivity, a local-distance switch with a smaller value of grid bias may be used, but this practice is not usually to be commended.

As a grid bias detector, the 58 is not recommended. This is because the intentional elimination of a definite "cut-off" point makes the 58 rather insensitive and renders any approach to linear detection impossible.

As a dynatron oscillator, the 58 is not recommended.

82

FULL-WAVE MERCURY-VAPOR RECTIFIER

The 82 is a full-wave, mercury-vapor rectifier tube of the hot-cathode type for use in suitable rectifying devices designed to supply d-c power from an a-c power line. It is particularly recommended for supplying power of uniform voltage to receivers in which direct current requirements are subject to considerable variation. The excellent voltage regulation characteristic of the 82 is due to its low and practically constant voltage drop for any current drain up to the full emission of the filaments. Under normal operating conditions, the tube voltage drop is only about 15 volts. This desirable feature makes it possible to attain very high overall operating efficiency.

The 82 is not interchangeable with any other tube.

CHARACTERISTICS

FILAMENT VOLTAGE	2.5 Volts
FILAMENT CURRENT	3.0 Amperes
MAXIMUM A-C VOLTAGE PER PLATE	500 Volts, RMS
MAXIMUM PEAK INVERSE VOLTAGE	1400 Volts
MAXIMUM D-C OUTPUT CURRENT, Continuous	125 Milliamperes
MAXIMUM PEAK PLATE CURRENT	400 Milliamperes
TUBE VOLTAGE DROP, Approximate	15 Volts
MAXIMUM OVERALL LENGTH	4 11/16 Inches
MAXIMUM DIAMETER	1 13/16 Inches
BULB	S-14
BASE	Medium 4-Pin

Mercury Vapor Rectifier Considerations

The presence of mercury vapor in the 82 neutralizes the space charge voltage drop to a value where it is only about 15 volts at normal operating temperatures. This drop remains practically constant with any current drain up to the full emission of the filaments. It is apparent therefore that this tube under operating conditions has very low internal resistance, and that the current it delivers depends on the resistance of the load and the regulation of the power transformer. Sufficient protective resistance or reactance must always be used with this tube to limit its current to the recommended maximum value.

If current in excess of the total effective emission of the filaments is drawn, the tube voltage drop increases rapidly with current and thus causes harmful positive ion bombardment of the filaments. This bombardment may be so great as to cause permanent damage to the coating on the filaments in a short time.

It is characteristic of mercury vapor rectifiers that no appreciable plate current will flow until the plate voltage reaches a certain critical positive value. At this point the plate current rises steeply to a high value in a small fraction of a second. This surge of current reoccurring each time either plate becomes positive, may excite circuits in the vicinity of the tube to damped oscillation and result in noisy radio receiver operation. In receivers of low sensitivity, this noise may not be apparent but in very sensitive receivers it may be necessary to enclose completely the mercury vapor rectifier tube within perforated metal or wire screen shielding to eliminate objectionable noises. The shielding must be designed to provide sufficient ventilation to prevent overheating of the tube. It is usually necessary to place within the shield, small radio-frequency choke coils of low distributed capacity in series with each plate lead of the rectifier so that the slope of the current wave front to the filter is reduced sufficiently to eliminate impact excitation.

Installation

The base of the 82 is of the medium 4-pin type. Its pins

fit the standard four-contact socket which should be installed to operate the tube in a vertical position with the base down. Only a socket making very good filament contact and capable of carrying 3 amperes continuously should be used with the 82. Unless this precaution is followed, poor contact at the filament pins will cause overheating at the pins and socket, lowered filament voltage, and also high internal tube drop with consequent injury to the tube.

The bulb becomes hot during continuous operation. Provision should be made, therefore, for adequate natural ventilation to prevent overheating. This point must be given proper consideration if shielding is employed around the tube.

The filament is of the coated type and is intended for a-c operation from one of the secondary windings of a power transformer. This winding, provided with a center-tap or center-tap-resistor should supply at the filament terminals the rated operating voltage of 2.5 volts when average rated voltage is applied to the primary.

The high current taken by the filament and the danger of damage to the tube caused by applying plate voltage to the tube with its filament insufficiently heated, make it imperative that all connections in the filament circuit be of low resistance and of adequate current-carrying capacity. All wire connections should be carefully soldered.

Transformer Secondaries

The plate supply is obtained from a center-tapped high voltage winding on the power transformer. This winding should be designed so that the maximum a-c input voltage per plate will not exceed 500 volts RMS under varying conditions of supply line voltage. The return lead from the plates, i.e., the positive bus of the filter and load circuit, should be connected to the center-tap of the filament winding.

The secondary windings of the power transformer should be adequately insulated from each other to withstand the full peak voltage of the high voltage winding. Under recommended maximum operating conditions, the full peak voltage will be about 1400 volts. The resistance of the transformer windings should of course be low if full advantage of the excellent regulation capabilities of this mercury vapor rectifier is to be obtained.

Under normal conditions the filaments of this tube heat quickly when the set is "turned on" and are ready to supply full load current before the tubes in the receiver require it.

It is recommended that the entire equipment be disconnected from the a-c power supply whenever the 82 is removed from or installed in its socket.

Shielding of this tube, particularly in sensitive receivers, may be necessary to eliminate objectionable noise.

Radio-Frequency Choke coils, connected in series with each plate lead and placed within the shielding if used, are usually necessary in receivers having high sensitivity. The inductance of the chokes should be of the order of one millihenry or more.

A fuse having a rating approximately 50% in excess of normal load requirements should be inserted in the primary of the power transformer. This fuse is necessary to prevent damage to the power transformer in case of excessive current which may flow under abnormal conditions.

Application

The 82 is recommended for supplying d-c power to receivers, particularly those employing Class B amplification in the audio output stage. The direct current requirements of such receivers are such as to cause considerable variation in the load impressed on the rectifier tube. Unless the tube and its associated circuit can take care of the load demand with good regulation, unsatisfactory receiver performance will be obtained. To meet this operating requirement for extremely good regulation even though the load current is subject to considerable variation depending on the signal, the 82 is especially suited.

In order to take full advantage of the regulation capabilities of this mercury vapor rectifier, the resistance of the transformer windings (refer to "Installation" above), and the filter choke windings should be as low as practicable. Since the drop through the tube is practically constant, any reduction in rectified voltage when the load is increased, is due to the drop in the transformer and/or the filter windings.

If it is impracticable to use a transformer with sufficiently low resistance to give the desired regulation, improved regulation of the output voltage may be obtained by employing a bleeder across the filter circuit.

Filter circuits of the condenser input or the choke input type may be employed provided that the maximum voltages and currents tabulated under "Characteristics" are not exceeded.

High Rating Condenser Next to Rectifier

If the condenser input type of filter is used, consideration must be given to the instantaneous peak value of the a-c input voltage which is about 1.4 times the RMS value measured from plate to filament with an a-c voltmeter. It is important, therefore, that the filter condensers (especially the input one) have a sufficiently high break-down rating to withstand this instantaneous peak value. It should be noted that with condenser input to the filter, the peak plate current of the tube is considerably higher than the load current. With a large condenser in the filter circuit next to the rectifier tube, the peak current is often as much as four times the load current.

When, however, choke input to the filter is used, the peak plate current is considerably reduced. This type of circuit, therefore, is to be preferred from the standpoint of obtaining the maximum continuous d-c output current from the 82 under the most favorable conditions.

Under operating conditions, the 82 has a bluish-white glow filling the space within the plates and extending to some degree into the surrounding space outside the plates. This glow, caused by the mercury vapor, is an inherent operating characteristic of the 82.

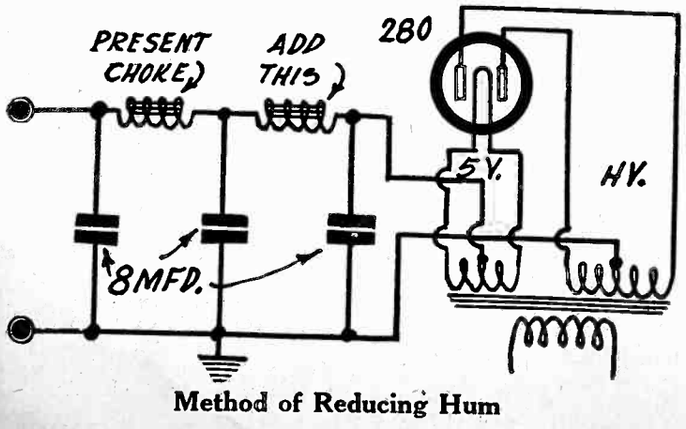
[Other Illustrations on Front Cover]

Application of Kirchhoff's Laws

IN APPLYING Kirchhoff's laws to complex electrical networks is it permissible to assume that the current in any mesh, or in any branch, flows in either of the two possible directions and still get the correct results? I ask this because I have attempted to apply the laws to several cases and in some it is not possible to tell beforehand in which direction the current will flow. If it is all right to make the assumption in what manner will the error show up finally in case the wrong direction is assumed?—F. C. W., Kansas City, Mo.

The assumed direction of any current does not matter. If it is assumed that the current flows in a certain direction and that actually it flows in the opposite direction, the current obtained by solving the equations correctly will have a negative sign. Hence in setting down the problem any current may be assumed to flow in either of the two possible directions. This is true whether we work on the basis that the assumed currents flow in the meshes or in the resistors. Since, as a rule, we are not interested what the current in a mesh is, it is usually simpler to assign symbols to the currents flowing in the resistances.

Extra Filtration Will Reduce Hum



Method of Reducing Hum

When the filtering in the B supply is inadequate, as judged by the amount of hum that is heard in the loudspeaker, another filter section can be put in very easily.

This added section should consist of a choke in series with the line and a bypass condenser in shunt with it. The method of connection is shown at left, which is a diagram of a full-wave rectifier with two filter sections. The added choke is put between the filament of the tube and the present choke and the added condenser is connected between the filament and ground. The drawing indicates three 8 mfd. condensers. If three should not be available, a 4, or even a 2 mfd., unit can be put next to the rectifier tube.

It should not be supposed that adding filter sections alone will take out all hum in a receiver. Sometimes hum enters the signal circuit by way of the heaters, and this hum is not affected by the filter at all. To remove hum of this kind the midtap of the heater should be grounded. It is important to make the center of the heater as near ground potential as possible so that the average voltage between the cathode and the heater is zero.

New Condenser and Dial

Capacitor Turns 300 Degrees, Other 720

By Jasper Bellows

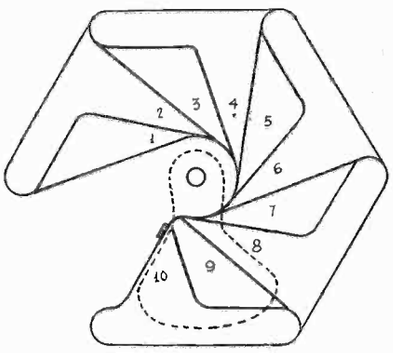


FIG. 1
This shows the principle of the 300 degree variable condenser invented by Dr. Kuchinka. It has 10 different stator plates and 11 or fewer rotor plates.

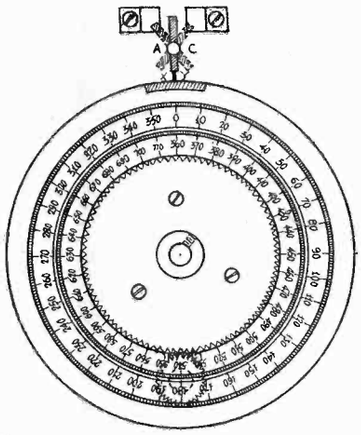


FIG. 2
A 720 degree dial with two scales and two pilot lights also invented by Dr. Kuchinka. The proper pilot light is turned on automatically.

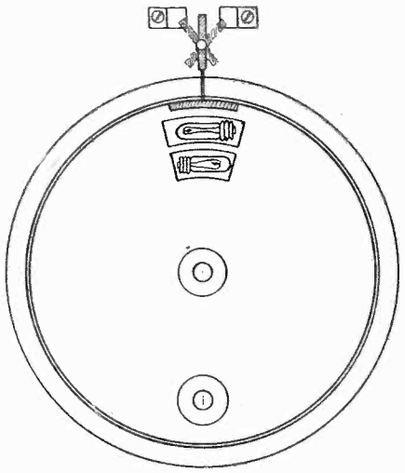


FIG. 3
This figure shows Dr. Kuchinka's dial with the transparent scale disc removed. This part is made of hard rubber.

A NEW type of variable condenser has been invented by Dr. Anton Kuchinka, 531 Broad Ave., Palisades Park, N. J. One of the features of the condenser is that the capacity varies over a 300-degree span of the dial. The sketch in Fig. 1 illustrates the construction. The dotted curve outlines the rotor plate, or plates, and the full lines the stator plates. There are ten different stator plates, marked from 1 to 10. The last, which is marked 10, covers 30 degrees, and thereafter the plates increase in steps of 30 degrees. No. 1 plate covers 300 degrees. The capacity increases as the rotor plates are turned clockwise and in the drawing they are placed in the position of maximum capacity.

Operation of Condenser

If we imagine the rotor plates be set in the position of minimum capacity in the 60-degree space where the stator plates are cut and then turn slowly in the clockwise direction, the capacity slowly increases because one of the rotor plates begins to engage plate No. 1 of the stator assembly. When we have turned 30 degrees more the second rotor plate begins to engage the second stator plate, the first two plates continuing their engagement. As we turn 30 degrees more the third rotor plate begins to engage the third stator plate. This continues until the rotor plates occupy the position of the dotted lines in the figure.

There is provision for six tie rods, one at each vertex of the hexagonal figure. This will make a rigid assembly. The two smallest plates are tied at two points on the periphery, the next at three points, and so on, until the last two plates, which are tied at six points.

The advantage of a condenser of this type is that for a given capacity the dial readings are spread out over 300 degrees instead of the usual 180 degrees. A disadvantage is that the capacity does not increase as uniformly as in some other condensers, but this is a disadvantage only when the condenser is to be used in a calibrated circuit of some kind, as a calibrated oscillator, for example.

A 720 Degree Dial

Another invention by Dr. Kuchinka is illustrated in Figs. 2 and 3. It is a 720 degree dial containing two different scales, one reading from zero to 360 degrees and the other from 360 to 720 degrees. It is of the slow motion, or close adjustment type, the coupling between the dial and the control knob being by means of a reduction gear. The method of driving the dial and also the position of the two scales are shown in Fig. 2.

In Fig. 3 the scales have been removed to show the pilot lights, of which there are two, and the switching arrangement by which the proper light may be selected. When the upper scale is to be read the upper pilot light is lit and when the lower scale is to be read the corresponding pilot light is lit. At the top of the dial is shown the switch. When the switch is in the neutral position neither light is on, when it is to the right, the upper is on, and when it is to the left the lower light is on. The switch can be operated manually or automatically. The details of the wiring are not shown.

It is not clear from the drawing in Fig. 2 just how the control knob shaft clears the dial since the small gear is directly behind the scale. The inventor does not disclose this feature, but presumably there is another gear. Neither does the inventor suggest an application for a dial that turns 720 degrees. However, there is a type of condenser that can be turned two or more complete revolutions with a continually increasing capacity to which the dial might be applied.

Transparent Scale

Of course, the scales are printed on a transparent material through which the light from the pilot lamps make the numerals and the graduations are visible. The scale is mounted on a hard rubber frame.

Although the dial has provision for 720 degrees and the condenser in Fig. 1 covers only 300 degrees, it is clear that the dial can be used on the condenser. That part of the outer scale which reads from zero to 300 degrees would be used.

TAPPING THE COIL IN A SUPERHETERODYNE

IN SOME COMMERCIAL superheterodynes I have noticed that the grid is connected to a tap on the tuned coil. What is the object of using the tap of the coil in preference to the top of the coil?—W.H.C., Lexington, Ky.

The tap is used for two reasons, first to prevent excessive oscillation and second, to reduce the effect of the input capacity of the tube. When the tap is used the capacity is only across a portion of the coil and therefore does not add so much to the minimum capacity in the circuit. For reducing the intensity of oscillation a voltage divider is also used at times. That resistance is connected between the coil and the grid. Another resistance is used as a grid leak.

Ingenious Harmonic Analyzer

Simple Determination of Distortion

By Brunsten Brunn

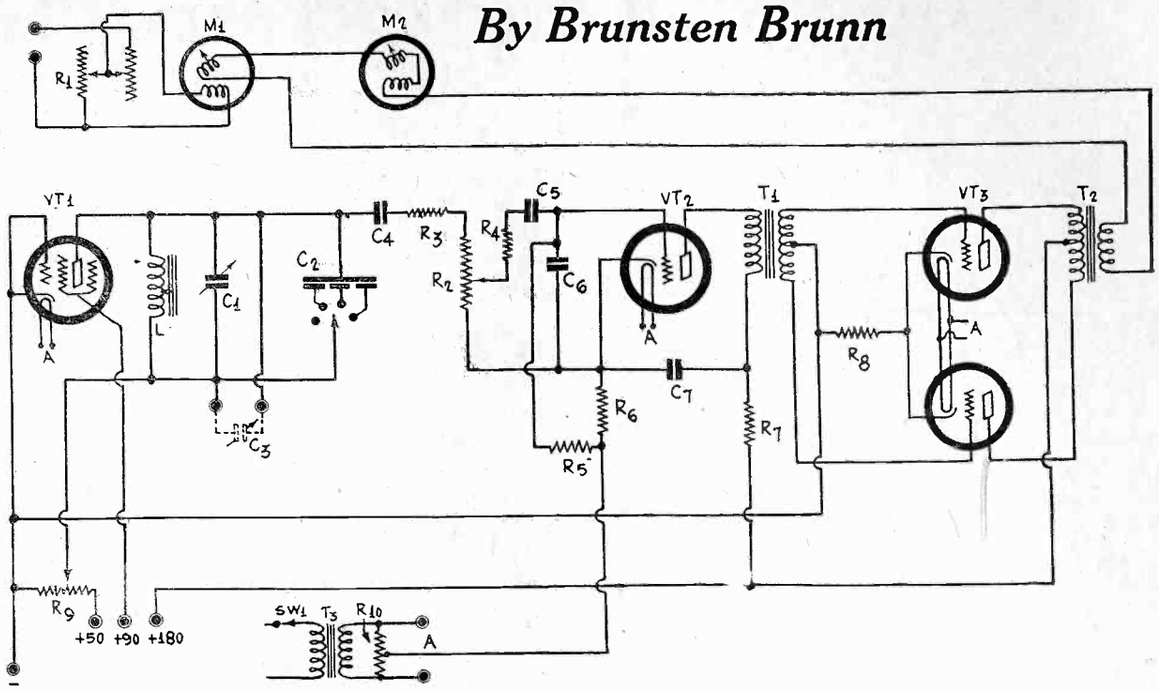


FIG. 1

The circuit of a simple harmonic analyzer by which distortion contained in the output of amplifiers can be measured.

THE method used by the Engineering Division of the Federal Radio Commission in determining empirical standards of reception, interference, and service area is explained by A. D. Ring, Senior Engineer, Engineering Division, Federal Radio Commission, in a paper entitled "Empirical Standards for Broadcast Allocation," printed in the April issue of "Proceedings of the Institute of Radio Engineers."

The average good service areas of stations of the difference classes and powers are defined with reference to the voltage intensity ratio of the desired signal to the undesired signal incidental to specified mileage and kilocycle separations between stations. It is pointed out that the empirical standards will be changed as soon as justified by additional data. Various graphs and formulas expressing the relation between field intensity and distance are given.

Simple Harmonic Analyzer

M. G. Nicholson and William M. Perkins, National Union Radio Corporation, Newark, N. J., present a simple harmonic analyzer applicable to the determination of the amount of distortion in the output of amplifiers.

The principle of the device can best be set forth with the aid of the diagram of the essential circuit, which is shown herewith in Fig. 1. The first tube, BT1, is a dynatron type audio frequency oscillator the frequency of which can be varied over a considerable range by means of C1, C2, and C3. The output of this oscillator is impressed on a single tube, audio frequency amplifier VT2, and the amount of input is varied by means of the potentio-meter R2. The output of VT2 is fed into a stage of push-pull, BT3. This part of the analyzer is only a source of audio frequency of relatively pure wave and variable frequency and intensity.

The signal to be analyzed is fed into the terminals at the left upper corner and the amount is controlled by the 400-ohm, constant impedance attenuator R1. The current admitted is passed through the stator coil of a dynamometer M1. The output of the audio oscillator, after amplification, is sent through the rotor coil of the same dynamometer. M1 is arranged so that when the moving coil is at rest the indicator points to the middle of the scale, which is divided into 3.5-0-3.5 milliamperes.

Slow Beat Necessary

When a reading is to be taken the audio frequency supplied to the moving coil is adjusted to very nearly the same value as the frequency of the current to be measured, whether this be the fundamental or any of the harmonics of the current to be anlyzed. In fact the difference between the two frequencies is of the order of 0.1 cycle per second. The beat between the two will appear as a swinging to and fro of the indicator of the scale, and the maximum swing in either direction is proportional to the intensity of either current. Hence if the current from the oscillator is held constant, the maximum deflection is proporional to the current being analyzed. This does not mean the entire current analyzed but only the particular harmonic to which the audio frequency has been adjusted.

Errors due to summation frequency terms and all other terms of the product of the modulation of the two voltages are eliminated by the fact that the inertia of the moving element prevents any observable response except on the very slow bat. If the beat frequency is faster than about 0.1 cycle, not even that will cause any appreciable deflection, which proves that all higher frequency components of the intermodulation are eliminated.

The instrument must be calibrated before it can be used. This is done by getting a relation between the deflection on M1 for known values of pure wave current impressed on the input terminals and for a constant value of current from the oscillator. The dynamometer M2 is used to measure the current from the oscillator and to indicate when that current has the constant value at which the calibration was effected.

Calibration can be effected by connecting a thermocouple of suitable range in series with the input terminals and then apply a suitable voltage. This may be from a 60 cycle line provided a limiting resistance or a stepdown transformer be used to cut down the current to the desired value.

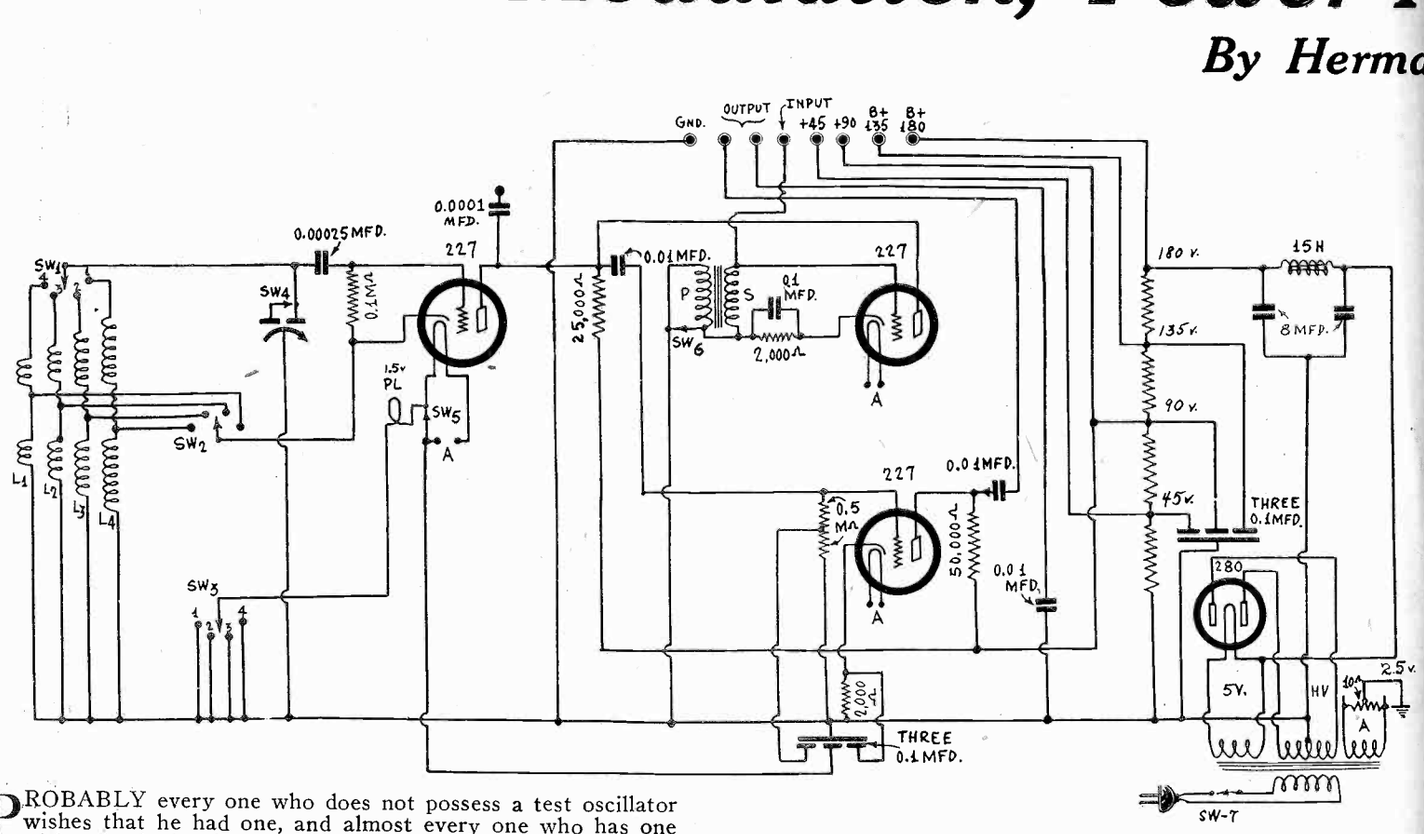
Electric Carillons

"Acoustical and Electrical Power Requirements for Electric Carillons," by A. N. Curtiss and Irving Wolff, RCA Victor Company, Inc., Camden, N. J., deals with a subject which is only remotely connected with radio. The authors show the importance of making noise level measurements in order to determine the acoustical or electrical power necessary to blanket any given area with satisfactory music, such as in outdoor public address systems and outdoor musical sources. Measurement were made on the bells of the Valley Forge carillon over a wide area. A sound meter and a variable local noise making machine were used and from the data obtained the accoustical and electrical requirements were calculated to produce satisfactory music. The equipment and procedure are fully explained.

In "Mica Condensers in High-Frequency Circuits" I. G. Maloff, RCA Victor Company, tells us a great deal about mica condensers as applied to high voltage, high frequency circuits. Each of the functions of condensers, such as storing electrical energy, block direct current, bypass high frequency currents, is discussed in detail. Conventional construction of mica condensers is described and methods given for arriving at satisfactory ratings in different applications. The author notes that the opinion that mica from India only was suitable for condensers is not tenable, as the Bureau of Standards has shown that some domestic mica is fully as good and some even better.

"Do-All" Oscillator, 150 to 20,0 Modulation, Power A

By Herma



PROBABLY every one who does not possess a test oscillator wishes that he had one, and almost every one who has one wishes he had a better one. This is very encouraging, because the demand for oscillators measures the demand for accuracy in radio work.

After looking over the requirements that an average class of work would impose it was decided that a test oscillator should afford radio frequencies of from 150 kc to 20,000 kc or higher, modulated-unmodulated. When not testing a circuit that is itself an oscillator the modulated service is virtually imperative, as it is unreliable to depend on circuit noises, rushing sounds and the like for resonance indication. On the other hand, when you are testing another oscillator, modulation is something of a nuisance, as it interferes with an exact determination of zero beat, or, rather, the modulation sometimes can not be distinguished from the near-zero beat.

Audio Power Amplifier Included

The test oscillator requires its own B supply, for a-c operation, and therefore it was deemed advisable to distribute the B voltage and bring out terminals so that a power supply would be at hand for those particular occasions when you crave a B voltage and haven't any, for some test at hand. Also occasions arise when some audio amplification is desired, to test a tuner or otherwise obtain modest speaker volume. So the circuit was arranged to afford a power amplifier, in which the word power is not to be taken too seriously, though the input is multiplied about 64 times.

In the choice of an audio oscillator, to provide the modulation, an audio transformer was selected, to work a —27 tube, as a dependable means, the transformer being hooked up so that its primary was to the ground side, and its secondary to the grid side. If oscillation does not result, connect the other terminal of the secondary to the ungrounded primary terminal and the free terminal of the secondary to grid, which is a reversal of the secondary connections.

Removal of Oscillation

Since the B supply may be used for other purposes than just for working the test oscillator, and it is possible for a-f oscilla- for working the test oscillator, and it is possible the r-f oscilla- unmodulated selection should be one that either stops the tube from functioning at all, or at least stops it from oscillating. Otherwise any external circuit worked from the built-in B supply of the test equipment would be modulated even with the switch set for "unmodulated" service, because the audio note is in the B current and runs through the rectifier in its entirety.

Moreover, it can not be removed by a small condenser, and one that is large enough would be impractical (50 mfd). So a tor and modulation when the B supply is to be used for some working to no purpose, so shut one off with SW-4, which interrupts the heater feed, and stop the other from oscillating.

It would not do to have a heater cut-off for selecting merely unmodulated r-f oscillation, for often one desires to change quickly from modulated to unmodulated service, and one would have to wait until the tube heats up to proper emission temperature. So only one tube may be rendered inoperative when the B supply or audio power amplifier is used assuch, while another switch merely removes the oscillation.

Frequency Distribution

The circuit consists of four tubes: the r-f oscillator, the a-f oscillator, an audio amplifier and a rectifier. The main reason for the amplification stage is to permit taking off various quantities of the total output without detuning the measuring circuit, and affording much greater intensity of oscillation voltage.

The circuit consists of four tubes: the r-f oscillator, the a-f oscillator, an audio amplifier and a rectifier. The main reason for the amplification stage is to permit taking off various quantities of the total output without detuning the measuring circuit, and affording much greater intensity of oscillation voltage.

On the r-f side, it was considered highly acceptable to include the broadcast band in its entirety on a single one of the four sheets of plotting paper (one sheet for each coil-condenser combination). To effectuate that, a two-gang 0.00035 mfd. condenser was used at the sum of the capacities for three frequency stages. Thus one sheet takes care of the intermediate frequencies. Another sheet covers the broadcast frequencies and the frequencies of the oscillator of a superheterodyne higher than the broadcast frequencies by the amount of the intermediate frequency. The one sheet takes care of oscillator frequencies of this sort for all intermediate frequencies up to 250 kc.

Can Reach 13 Meters

The tuning capacity, approximately 0.0007 mfd., with maximum actually lifted to 0.00074 mfd. by stray capacities, would not do very well for the highest frequencies, as the curve would be too hard to read to anything like accurate values, therefore only one section is used for the highest frequency band, to 17,700 kc, one section is used for the highest frequency band, to 20,000 kc, about 15 meters. ff the wiring is carefully done and the minimum capacity is kept low, the ranges may be extended at the two higher frequency curves quite importantly.

For instance, the frequency ratio of the two sections united

00 kc by Switching; nplification, Conversion Included

ernard

nay be lifted from 3.5 to 3.7 and that of the single section rom 3.0 to 3.3, so that the ranges would be 150 to 555 kc, 540 c to 1,998 kc, 1,900 kc to 7,030 kc, and 6,930 to 22,860 (about 3 meters). The lower frequency limit in any case is about the ame, 150 kc, or in wavelength, about 2,000 meters.

How to Calibrate

The minimum capacity of the tuned circuit is exceedingly mportant, and should be kept down. One means toward this nd is the use of the grid leak and condenser, because it tends o negative the effect of the grid current, in fact, reduce that urrent. Whenever an oscillator is oscillating violently there vill be grid current, and as the current flows through the grid eak (10,000 ohms between grid and cathode) the voltage drop cross the leak produces a negative bias, and this of course educes the amount of grid current, and may actually stop it. Oscillation being of less intensity at the higher frequencies, ecause of the greater losses, the grid current is lower, hence, trange happening, a higher frequency ratio obtains for the mallest coil than for any of the others. Also this accounts n part for changing of frequency ratios. The changes are not erious, but if they are in the direction of increased ratio they re usually welcome.

For the reason of minimum capacity alone, not to mention ubstitution of parts, the exact frequency ranges can not be iven actually for an oscillator that you may build. Indeed even he d-c voltages used, as well as the rating, hence voltage of he power transformer under load, will affect the result. Nevertheless graph paper is easily obtainable and you can run your wn curves, using broadcasting stations that are on the honor ist, or the weekly transmission from the Bureau of Standards.

For any such work it is necessary to have an oscillating voltge of a frequency equal to the one being tested or at most ne-half of one being tested, so that in the second instance armonics are used. The use of a higher frequency for the est source is not parctical—nothing is heard, unless there is scillation at the higher frequency also.

Weakness and Confusion

So, starting with the lowest frequency to be calibrated, we would have to get one still lower, and this is not practical either. So we go about the solution indirectly, by using a broadcast receiver and tuning in a station at 750 kc, and obtaining a squeal n the test oscillator at near full capacity of the tuning conenser, whereupon we have reason to assume that the fifth harmonic of the test oscillator is beating with the fundamental of he station. We can check up by testing for the sixth harmonic, y leaving the test oscillator unmolested, and tuning the reeiver to 900 kc, and the seventh, eighth, ninth and tenth harmonics at 1,050, 1,200, 1,350 and 1,500 kc. In the same way that we obtained the low frequency setting we can obtain the high requency setting of the test oscillator for the largest coil, and ikewise intermediate tuning points, and run a curve. It is dvisable to use no less than eight well-distributed points beore drawing in the curve. Soft strip solder of the uncored type nay be used to guide the pencil in tracing the tuning curve rom the points. Any points seriously off what should be a egular curve may be ascribed to experimental error, and if several points are badly off repetition of the entire calibration should be made.

The broadcast band offers a simple solution, by comparing he test oscillator directly with station fundamentals. For higher requencies the set alone may not render harmonics that are strong enough, and besides there may be a most confusing abundance of weak and unassignable harmonics, so it is well o tune in a station on the receiver at a frequency from which he second harmonic may be derived for the present low frequency setting of the test oscillator. Thus for beginning at 2,000 kc tune in a station on the set at 1,000 kc, and make the set oscillate at zero beat. The combined energy will be ample to make the test oscillator's second harmonic beat audible in the set's speaker.

In these tests the output of the test oscillator has its hot side connected to a wire that is wrapped around the aerial near the set for a foot or so, with no conductive connection.

The 5,000 kc transmission of the Bureau of Standards is accurate to one part in 5,000,000, or better, and may be used by building an oscillating set to tune in 5,000 kc, adjusting to zero beat, making the harmonics of the test oscillator you are building beat with the 5,000 kc, or, with the test oscillator's frequencies are higher, make the harmonics of the 5,000 kc set to beat with those of the test oscillator. Besides, other oscillation frequencies may be combined with the 5,000 kc, to render a multitude of different frequencies useful and handy. The subject was covered completely in the April 9th issue.

The transmissions from the Bureau of Standards are on Tuesday from 2 to 4 p.m. and from 10 p.m. to midnight. The transmission is in code, by interrupted continuous waves, so an oscillating receiver is needed. The rhythm can be detected readily even though you can not read code, as, except for announcements, also in code, the same "jargon" is sent out continuously.

The different bands are covered by picking up different coils, as well as by using a different capacity in one instance. Hence a switch is used for band selection, a great convenience, but one that may turn out to be a nuisance unless you have a switch

Novices to whom these directions are insufficient may get complete, detailed calibration instruction from next week's issue, May 7th.

Piloting the Switch

Of all the switches tried, many excellent, all had the vice that one could not be absolutely certain that the contact was made, although using the test oscillator on some other set or other oscillator would afford the solution. However, there is no comfort in housing any riddles in a piece of apparatus like a test oscillator, and therefore it is regarded as absolutely imperative to include one section of the switch for lighting a pilot lamp that definitely discloses contact and non-contact, or using some other means of indication. The tabs, points or throws of the switch are connected to ground (as is center of the 2.5 volt winding), so by connecting a pilot lamp to one side of the 2.5 volt winding and to switch arm or pole, half the voltage, or 1.25 volts, is picked up, and a 1-volt, 1.5 volt or even 2.5 volt pilot lamp may be used, and should be on the front panel.

This requirement of a pilot light or other indicating means to make certain of switch contact is stressed because of the considerable annoyance caused (to one not easily annoyed) by doubt as to whether the oscillator was oscillating. With no contact there is no oscillation. When you don't hear an expected squeal you wonder what's wrong and don't know whether to suspect the test oscillator or the tested circuit, and, wanting to do no injustice, probably blame yourself. The dilemma is heightened by the fact that some switches give the feel of contact at the very time there is no contact.

Constancy of Calibration

When the oscillator is calibrated it should be done with all four tubes working, and with the proper voltages used, 90 volts being sufficient for the plates of the three tubes. When measurements are to be made the same situation should obtain. The B supply should not be feeding anything else, because the voltage will drop due to the increased drain, and then the calibration will not hold.

The r-f oscillator circuit is stabilized against voltage changes affecting the grid circuit much, and has a substantially nonreactive plate circuit, but actual plate voltage changes of any considerable percentage of difference will change the calibration. When the B supply is being used for actuating an external circuit, while the r-f oscillator is being used as the measuring device, it should be realized that there will be an error of some importance, 5 per cent at least. For greatest accuracy do not use the test oscillator for anything except just measuring, while measurements are being made.

Coil Data

Using a diameter of 2 inches; no shielding on coils, the numbers of turns of wire are as follow:

Coil No.	*Maximum Actual Capacity*	*Turns*	*Wire*
1	740 mmfd.	228	No. 30 enamel
2	740 mmfd.	35	No. 24 enamel
3	740 mmfd.	7	No. 20 enamel
4	390 mmfd.	3	No. 18 enamel

Each winding is center-tapped. The tuning is from 150 kc to around 20,000 kc. Sufficient overlap is included.

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. Answers printed herewith have been mailed to University Members.

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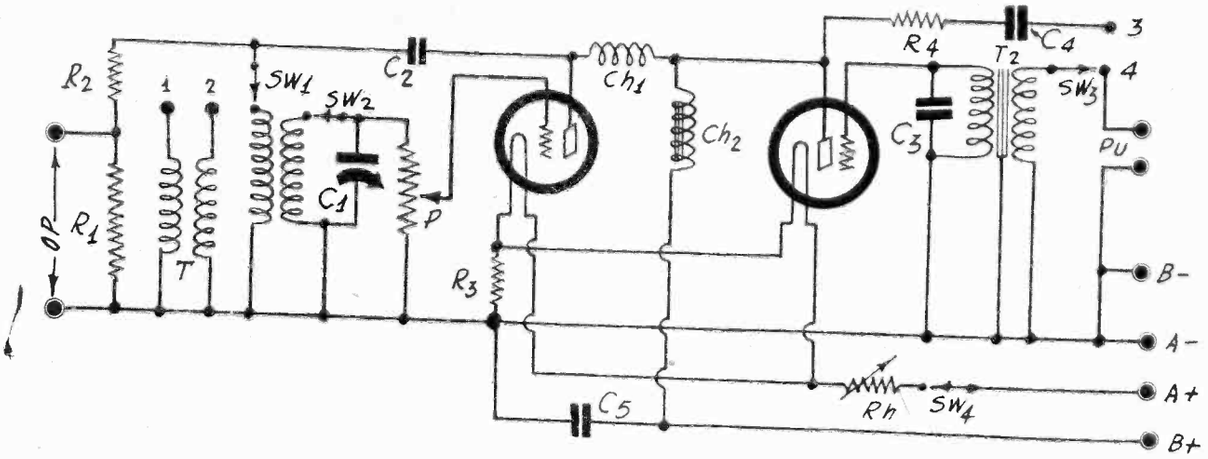


FIG. 1,004
A modulated r-f oscillator in which the audio oscillator may be converted into an amplifier for modulation with microphone or phonograph. Two-volt tubes are used to make the apparatus portable.

All-Wave Oscillator

HOW MANY tuning coils are needed in an oscillator if it is to cover the frequency range from 150 to 20,000 kc with a condenser that has a maximum capacity of 200 mmfd. and a minimum of 10 mmfd? I desire to construct a modulated oscillator of this kind with the least number of coils.—F. W. R., New York, N. Y.

If the circuit capacity can be reduced to 10 mmfd. the maximum capacity will be 210 mmfd. and the minimum will be 20 mmfd. The ratio is 10.5. The square root of this is the frequency ratio. That is, the frequency ratio for each coil is 3.24. The desired frequency ratio is 20,000/150, or 133. The number of coils required is obtained by the power of 3.24 which equals 133. Or the number of coils is obtained by dividing the logarithm of 133 by that of 3.24. We obtain 4.15 coils. Therefore we may possibly do it with four coils but it would be safer to use five, not only to have the ranges overlap but also because 10 mmfd. circuit minimum is too low. A frequency ratio of 2.6 was obtained for this concenser in a normal circuit, broadcast frequencies.

* * *

Test of Constancy of Oscillator

WILL YOU kindly suggest a method of testing the constancy of frequency of an oscillator. I have reason to believe that the frequency changes with changes in voltages and also with changes of temperature. I wish to make a test.—R. E. D., Dayton, Ohio.

Adjust the oscillator to zero beat with some convenient broadcast station which you know to maintain a constant frequency. For a test of constancy with respect to changes in voltages, make a change in the voltages, one at a time, and note the change in the beat frequency. If the circuit remains at zero beat there is no change. As a test of constancy with changes in temperature, make the adjustment for zero beat when the room is cold and then heat it to as high a temperature as practicable. Note the drift in the beat note as the temperature rises.

* * *

Improvement of Push-Pull Amplifier

THERE IS considerable noise in the output of my receiver, in the last stage is push-pull and uses two 238 pentodes. Can you suggest anything that can be done to eliminate the noise? What effect would a large condenser have across the grid bias resistor?—Y. R., Detroit, Mich.

It depends on what kind of noise that is to be eliminated. Hissing noises can often be eliminated by connecting a 0.25 meg. resistor across each half of the secondary of the push-pull input transformer. The effect of a large bypass condenser across the bias resistor would be to increase the gain on the low audio notes in case the circuit is not truly push-pull. In many cases the condenser across the bias resistor greatly improves the tone.

* * *

Automatic Volume Control

IF I CONNECT a suitable resistor in the B minus lead of a set and return the radio and intermediate frequency amplifier grids to B minus will the arrangement be an automatic volume control? What are the objections to this scheme?—R. N. S., Akron, Ohio.

There would be a certain degree of volume control, especially if all the tubes in the set were overbiased so that an increase in the signal would increase the total battery current. There are many objections to such an arrangement. First, it would be difficult to get the proper normal bias on the tubes. Second, the change in the voltage drop in the resistor would be small compared with the normal drop so that the range of the automatic control would not be great. It would be much better to use a separate tube for automatic volume control.

* * *

Photo-Electric Alarm Clock

WOULD it be practical to use a photo-electric cell in conjunction with an alarm clock if arranged so that an electric bell would ring at sunrise? Would there be any obstacles to such an arrangement?—P. C., Rye, N. Y.

It could be done all right but the time at which the bell would ring would be quite indefinite. Perhaps some days it would not ring at all on account of clouds and fog. In any case the bell would ring when the illumination attained a certain predetermined value, which might be before sunrise or some time after. An ordinary alarm clock is a simple and dependable device.

* * *

A Modulated Oscillator

WILL YOU kindly publish the circuit of a modulated oscillater in which the audio oscillator can be converted into an amplifier in case it is desired to modulate the radio oscillator by the output of a microphone or a pick-up unit? I wish to use the smallest battery tubes and a battery for B supply. Please give values of resistors and condensers. I plan to use plug-in coils to cover the different frequency bands.—G. W. C., Pueblo, Colo.

In Fig. 1,004 is a modulated oscillator of the type you request. When you want the audio tube to oscillate throw switch Sw3 from point (4) to point (3). As the switch stands the audio tube will amplify any signals put across the PU terminals and impress them on the oscillation generated by the first tube. The radio oscillator is arranged so as to pick up different coils with a switch but if plug-in coils are to be used just ignore coils (1) and (2). If a high frequency constancy is desired the slider on the potentiometer P should not be moved from the position in which the circuit was calibrated. The following values may be used: R1, 10,000 ohms; R2 100,000 ohms; P. 100,000 ohms; R3, 8 ohms (if the tubes are 230 and the filament battery voltage is 3 volts); R4, 10,000 ohms; Rh, 25 ohms; C1, 140 mmfd., C2, 0.001 mfd.; C3, about 0.01; C4, 1 mfd.; C5, 1 mfd.; plate voltage, 22.5 or 45 volts; Ch1, 10 millihenries; Ch2, 30 henries.

* * *

Resonant Voltage

IS THE VOLTAGE across a tuning condenser ever greater than the voltage impressed on the circuit? If so, will you kindly explain?—S. G. H., Greenwich, Conn.

It depends on the selectivity of the circuit. The greater it is the greater the voltage across the parallel tuned circuit. If the voltage is impressed in series with the coil, or by induction in the coil, and the effective resistance is R, the inductance L, and the capacity is C, then the voltage is multiplied by the square root of L/C divided by R. This is the voltage across the tuning condenser and since the coil is across it, also across the coil. If L equals 245 microhenries, C equals 350 mmfd.,

and R equals 15 ohms, then the factor is 55.7. This means that if the effective voltage induced in the circuit is one volt, the voltage appearing across the tuning condenser is 55.7 volts. If the resistance in the circuit had been less, that is, if the selectivity had been greater, the voltage would have been still greater. Also, if the ratio of the inductance to the capacity had been greater, for the same resistance, the voltage would have been greater.

* * *

Taking Tube Curves

PLEASE PRINT a circuit showing how grid voltage plate current curves may be taken on 236 screen grid tubes. The object of the circuit is to study the effect of different screen voltages when the tube is working into a high resistance. I wish to find out which is better, a low or a high screen voltage, and I also want to find out the effect of various resistances in the screen lead.—R. E. K., Cleveland, Ohio.

The circuit in Fig. 1,005 has been used for this purpose. You measure the grid voltage by means of V and the plate current by means of M. You will note that the cathode of the tube is connected to the positive side of the heater battery. This is to permit using the voltage of that battery for bias, which can be varied from zero to six volts by sliding the slider on the 400 ohm potentiometer. A load resistance of 100,000 ohms is shown in the plate circuit but you can use any value you like. M should be at least as sensitive as a 0-1 milliammeter. You can also use different values for plate voltage, which is the sum of E and Ed. No resistance is in the screen lead.

* * *

What Is a Potentiometer

WE ARE usually calling a resistor with two accessible terminals and an accessible slider a potentiometer. Occasionally, however, it is said that this is not a potentiometer at all, but a voltage divider. Just what is a potentiometer?—H. A. B., Richmond, Va.

A potentiometer is an instrument by which electric potentials are measured. In one well-known instrument of this kind a voltage divider is used, a divider of exactly the same type as we call a potentiometer in radio. It is for this reason that the misnomer of the voltage divider came into use. A static voltmeter logically could be called a potentiometer, but ordinarily the name is applied to the instrument that employs the voltage divider. In the true potentiometer the circuit is arranged so that no current is drawn from the source of voltage measured. One case with which all students of electricity are familiar is the measurement of the e.m.f. of a dry cell by means of the potentiometer of the voltage divider type. The voltage across the two terminals of the cell is measured when no current whatsoever is drawn from it.

* * *

Speed of Radio Waves

DO LIGHT and radio waves travel at the same speed in all substances? It is well known that the speed of both light and radio waves is the same in free space and is 186,000 miles per second, but is it the same in other media?—F. X. O'B, Boston, Mass.

No. The speed of electromagnetic waves depends on the refractive index of the medium through which they travel, which is a property of that medium. The refractive index can be defined as the ratio of the speed in vacuum to the speed in the medium. This depends on the frequency as well as on the medium.

* * *

Comment on Super-regenerator

WHY IS IT that in the super-regenerative circuit there is no oscillation at the high frequency just because the circuit oscillates at a lower frequency? What stops the high frequency oscillation?—R. B. N., Philadelphia, Pa.

First consider the circuit as an oscillator at the low frequency. The grid swings over the entire characteristic, from extreme negative to zero, or perhaps into the positive. Consider an instant when the grid is so much negative that the plate current is practically cut off. At this point there is very little amplification, if any, and therefore the circuit cannot oscillate at the high frequency even though there is considerable feedback. As the grid swings toward zero the tube becomes a better amplifier and the conditions for oscillation begin to be satisfied. Consequently the high frequency signal builds up. However, it takes considerable time for the circuit to build up oscillations that are not forced. But before that time is up the low frequency oscillator swings the grid to a point where the amplification is less and the tendency to build up the r-f oscillation is diminished. The high frequency oscillations do not have time to build up between the times when the circuit is biased so that it cannot oscillate.

* * *

Measuring A Resistance with a Voltmeter

MY VOLTMETER has a range of 0-150 volts and a sensitivity of 50 ohms per volt. I connected an external resistance in series with it and then connected it across a 45 volt battery. The meter read 23 volts. From these data is it possible to determine the resistance of the external resistance If so, please give the value and also explain how it is arrived at.—J. W. H., Fresno, Calif.

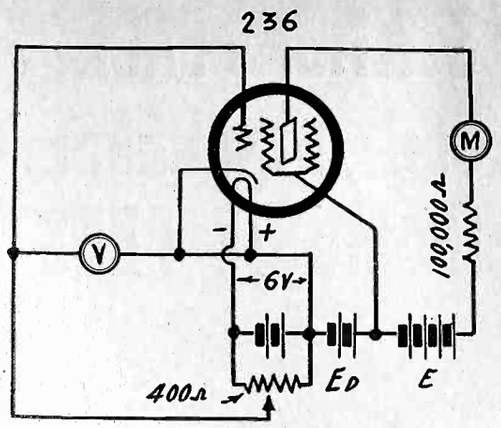


FIG. 1,005 A simple circuit for taking static curves on a 236 heater type tube.

Since the meter has a sensitivity of 50 ohms per volt, it requires 20 milliamperes to give full scale deflection. The current drawn by the meter at any setting is proportional to the deflection. Hence at 23 volts the current is 23/150 times 20 milliamperes, or 3.067 milliamperes. The reading of the meter in volts is the actual voltage across its terminals. The amount the meter reads less than the voltage of the battery is the drop in the external resistance. In this case we have 45-23, or 22 volts. Now we have the voltage drop in the resistance and also the current through it. Hence by Ohm's law we have R=22/0.003067 ohms. This turns out to be 7,175 ohms, which is the value of the external resistance.

* * *

Trapping Out Image Interference

WOULD it be practical to tune out image interference in a superheterodyne by trapping out the signal which causes the disturbance? I have a superheterodyne with an intermediate frequency of 465 kc and therefore the oscillator is tuned to 465 kc higher than the r-f tuners. What range should the trap cover in case the scheme is practical.—F. W. K. Denver, Colo.

Since the intermediate frequency is 465 kc the oscillator covers the range from 1,015 to 1,965 kc. The interfering frequency would always be 930 kc lower than the oscillator. Hence the trap should cover the range from 85 to 1,035 kc. But there is not likely to be any interference from a lower frequency than 500 kc, the distress signal wave. Hence the trap need not cover more than the 490 to 1,035 kc range, approximately.

* * *

Superheterodyne Will Not Function

I BUILT one of your superheterodynes but have been unable to make it work. It is wired correctly, for I have checked it several times and a friend of mine has also checked it. The set appears all right as a t-r-f receiver but not as a superheterodyne. What do you think is wrong?—F. R. W., Columbus, Ohio.

The first possibility is that the oscillator does not oscillate. This is often because the tickler leads have been connected in reverse. Turn them around and see what happens. Many oscillator coils require the terminal marked "B" go to plate and "P" to B plus, because the designations are on a die for t-r-f coils, and factories work on the same routine connections. If you hear plenty of squeals as you turn the dial that part is all right. After that it is only a matter of adjusting the shunt and series condensers in the oscillator. Follow the procedure outlined in the April 16th isue, when a complete treatise on simplified padding was published.

* * *

Ratio of Turns in an Oscillator

WHAT IS THE best ratio of turns of the plate and grid coils in an oscillator of the Hartley type? Should there be more turns in the grid or the plate circuit?—T. C. R., Omaha, Neb.

The best ratio of turns is $(u + 2)/u$, where u is the amplification constant of the tube. The smaller number of turns should be in the plate circuit. You will notice that when the amplification constant of the tube is high the ratio of turns should be very nearly unity, that is, the tap for the cathode should be near the center. For a low mu tube the ratio should differ considerably from unity. For example, a 171A mu 3, requires a ratio of 5/3. Thus if there are 80 turns on the coil 50 turns should be in the grid circuit and 30 in the plate circuit. A 227 has a mu of 9 and therefore the ratio should be 11/9. Out of 80 turns 44 should be in the grid circuit and 36 in the plate circuit. The use of the optimum turns ratio does not necessarily make the best oscillator for all purposes. In a superheterodyne, for example, it is more important to have a pure wave than to have the maximum amplitude of oscillation. Therefore the number of turns in the plate circuit should be smaller than the number determined by the optimum ratio.

STATIONS FACE 300% INCREASE IN MUSIC FEES

Having contrasted the increase in advertising revenue received by broadcasting stations, notably the large chains, compared to decline of its own revenue from other sources, including sheet music and phonograph records, the American Society of Composers, Authors and Publishers has submitted a schedule of fees to the broadcasters calling for an increase of more than 300 per cent.

The Society owns or controls copyrights on music the world over, by arrangement with affiliated societies abroad.

A letter was sent to the National Association of Broadcasters, Press Building, Washington, D. C., by E. C. Mills, general manager of the Society, 1501 Broadway, New York City, informing the broadcasters "of the conclusions reached by our Society as to rates at which its license in behalf of members will be issued (beginning June 1st, 1932) covering the use of their copyrighted musical compositions in broadcast programs."

New Charge Accounts for Increase

The letter sets forth that "commencing as of June 1st, 1932, the following rates will prevail," and then announces continuation practically without change of the present rates, newly labeled "sustaining," but adds 5 per cent. of the amounts charged for use of the facilities of the station, this to be called the "commercial" rate.

The letter sets forth the details of rates as follows:

"SUSTAINING LICENSE: At approximately present rates, with such readjustments either upward or downward as will equalize the fee paid by stations operating under similar or equal conditions, taking into consideration power input, rate card, radio population and other pertinent factors, as and when any such existing inequalities are discovered. The sustaining license fee, upon an annual basis, to be payable in equal monthly installments, on or before the 10th of each month to cover the preceding month.

The 5% Charge

"COMMERCIAL LICENSE: At 5% of the amounts *charged* for use of the facilities of the station in respect of all commercially sponsored non-network programs. In the case of network programs, the fee of 5% is payable by the key station, based upon the gross amount charged for use of broadcasting facilities. Two or more stations simultaneously broadcasting the same program to be considered as a network.

"Accountings to be rendered on or before the 10th of each month covering operation of the previous calendar month, on forms provided by the Society. Such accountings to be under oath, signed by a responsible officer of the operating company, and subject to audit during customary business hours.

"Licenses under the above terms will be issued for any portion or all of the period from June 1st, 1932 to December 31, 1935, subject to cancellation by the Society only in event of breach thereof. All existing licenses will be continued at present rates until June 1st, 1932."

The Society's income from broadcasting stations for 1931 was about $933,000. and based on a total 1932 revenue to stations of $50,000,000 the additional fee would be $2,500,000, or a total of $3,433,000 to the Society for 1932, more than 3.6 times the 1931 assessment.

The present system of license fees is on a scale basis, depending on the station's power, the number of radio sets in the service area of the station, number of competing stations in the area and other factors. On this basis WEAF and WJZ each pays $37,500 a year to the Society, while small stations may pay only $250 a year, and non-commercial stations, as conducted by churches, educational institutions and the like, are charged nothing.

The power of the station is not a predominating consideration, as in one locality, for instance the South, it may be necessary to use five times as much power for satisfactory coverage in Summer, than for the same effective coverage in the North. The fundamental basis is therefore the number of listeners, and the "sustaining" fee is predicated on that largely, so that the more stations covering a given area, the smaller the fee for each station.

"Not Open to Any Bargaining"

Mr. Mills made the following statement:

"The 5 per cent. tax on gross fee was adopted unanimously by the Society's board of directors and that proposition is final and not open to any bargaining. Regarding the smaller stations, the method of determining the amount of the sustaining fee has not been definitely determined and is open to argument. The society is willing to accept any agreeable plan."

Some of the arguments presented against the Society's proposal are: (1) that this is no time to increase rates, when stations are having difficulty in meeting expenses; (2), a movement would be encouraged to seek legislation to dissolve the Society as a monopoly in restraint of trade, and to amend the Copyright Law and thus remove the Society's greatest legal bulwark; (3), individual stations are losing money and nevertheless are asked to pay more; (4) music is important, but its composers, authors and publishers can't claim that music alone makes the radio station, as the efforts of financiers, engineers, salesmen, manufacturers, advertisers, artists and others contribute largely to the final result.

The Society's Position

The Society takes the position that the broadcasters never find the time right for paying any more for anything, that the existence of the Society permits of dealing with one unit, instead of many scattered units, and that a greater total would be paid to the aggregate of individual firms or groups than as now proposed to the one group; that what individual stations may be experiencing, as an exception, has nothing to do with the fundamental principle; and that without music there would be no programs.

Two instances of Class A publishers are those of T. B. Harms and of M. Whitmark & Sons, each drawing $40,000 a year from the Society, and which firms, it is said, would be able to draw much more if they dealt direct with the broadcasters. Besides, composers are paid, for instance Irving Berlin, Sigmund Romberg and Jerome Kerns draw $5,000 a year. Also, small publishers, and composers of lesser note, draw various smaller amounts from the Society.

The financial reports of the large chains have been studied by the Society and the figures therein disclosed are taken as an indication of what the Society believes it should do. The upward trend of income of the three big chains has resulted in the Society's increase, directed principally at them, and only incidentally at other stations, and with a note of conciliation toward the small stations. For instance, stations run by newspapers principally for good-will, and on which little if any other advertising appears, are offered low-fee concessions on the "sustaining" part of the contract.

RISING INCOME OF BIG CHAINS BOOSTS RATES

"Lucky Strike Hour" as an Example

Some idea of the large amounts of money involved in particular broadcasts may be gleaned from probably the most expensive of all sponsored features, the Lucky Strike Hour. There may be 80 member stations in the network and WEAF as key station. The charge for these facilities for the hour may be $40,000. Each member station receives $50, although these stations' own rates are far in excess of that, normally around $300 an hour. The member stations take the chain program because it gives them an excellent program that wins a greater number of listeners to its wave. The advertising agency that handles the Lucky Strike accounts gets 15 per cent. from the key station. Thus $4,000 goes to member stations, $6,000 to the agency, leaving $30,000 to the key station, which handles the entire account, has to meet numerous charges, including enormous bills from the telephone company, and would pay the Society's "commercial" fee for all the stations for this hour, say, $2,000.

The Society says it has been difficult to arrive at any formula satisfactory to all hands, that many conferences were held with broadcasters, and that certain suggestions were adopted, but that in the last analysis the Society had to make its own decision, and has done so with full intention of carrying out the "commercial" rate as stated.

National Company Announces New Parts

National Company, of Malden, Mass., announces several new parts for short-wave use.

One is a radio frequency choke coil, of extremely small dimensions, on a core about the size of a pigtail resistor of 1-watt capacity, having a d-c resistance of 50 ohms, an inductance of 2.5 millihenries and a distributed capacity of only 1 mmfd. The extremely low distributed capacity is important for proper functioning at the very high frequencies. The winding will carry 125 ma without heating.

Also, a new Isolantite socket, UX, UY and six-prong; midget coil forms, using low-loss special dielectric, and a very small 270-degree straight frequency line tuning condenser are announced. The condenser has a constant impedance connection between rotor and frame. Descriptive literature is obtainable from the manufacturer.

TRADE WINDS

The experimenter must be buying parts these days judging alone from the new and enlarged displays of parts in the radio stores.

* * *

Amco Radio Stores, Inc., 65 Cortlandt Street, N. Y. City, are featuring a large window display of small parts for the experimenter and service man.

SLICK SLEUTHS CLOSING IN ON FELONS OF AIR

Washington.

Although facing enormous difficulties in combatting outlaw stations, some of which are used for bootlegging, drug-smuggling and alien "importation," the Radio Division of the Department of Commerce is making headway, and reports fewer such stations now operating.

A complete system has been worked out by these radio police based on a study of the special leanings of the offenders. For instance, in sending and receiving messages the outlaw operators prefer waves used by amateurs, hence the detective work is confined to short waves. Recently the amateur bands were narrowed down, and while this was not done simply to aid the tracking of criminals, it has assisted in the work by confining the observations to fewer frequencies.

Sending Has Personality

Agents of the Division listen to amateurs in their respective districts and familiarize themselves with the sending eccentricities. Where voice is used this is relatively easy, and when code is sent the pattern of the transmission is as distinctive and individual as a fingerprint, and the observers get these characteristics down pat. Therefore they know when some one other than the license holder is sending on a certain call or is using a wave without call or license. Incidentally, some infractions by amateurs have been turned up in this way, thus accounting for recent activity in suppressing unlicensed amateur transmitters and tightening up the license requirements, including annual examinations instead of mail renewals of temporary licenses.

One of the confusing aspects of the detective work is that the criminals—as contrasted with the mere offenders against department rules and regulations—change their special codes.

Secret Code Solution Easy

It is always an easy matter to pounce on the supposedly secret code, and in fact men who worked at deciphering coded messages during the war are aiding now in the fight against outlaw radio, and find it easy to solve all the codes used.

However, the shifting of codes and frequencies requires special concentration on these "annoyances." When an outlaw transmitter is spotted it is permitted to keep running, sometimes for months, until a great accumulation of evidence is amassed, whereupon a raid is made on the station. As the operators live in constant fear of being raided they sometimes provide ready means of escape, and all that the raiders then obtain is the pleasure of dismantling the plant. What an illicit transmitter looks like after such a raid does not coincide with the best standards of interior decorators.

One thing that distresses the air detectives is the uncommonly bad English used even in the codes.

Insight on Prices

While codes call for many phrases and even complete sentences in a few cryptic dots and dashes, nevertheless the education of the operators of criminal transmitters has been so badly neglected that false syntax is on the air at every hour. Thus amateurs are warned to brush up on their English to vie with Caesar's wife for virtuous position.

The copying of unfamiliar signals includes the making of phonograph records, if the situation requires. Other extremes are resorted to, some of them being kept secret, so that the culprits will be surprised at the completeness of the case against them. The watching listeners therefore have permanent records of current prices of cases of Scotch, rye and liqueurs and if by chance any of their personal investigations have encompassed the consumer market the sleuths may stand aghast at the enormous markup.

So far not a single code has been encountered that has not been completely deciphered, so that if the bootleggers' stuff is only as safe as their code it is highly dangerous.

From observations made it appears that some offenders are engaged in combined smuggling efforts, including narcotics, aliens and liquor, and that their chief concern is to land the narcotics, as the income from that alone pays all expenses, and what is derived from the two other sources is clear profit.

Both the Pacific and Atlantic Coasts are the stamping ground of the criminals, but the concentration has been found in New York City. Last year, it is said, fifty unlicensed stations were operating in the metropolitan area, of which 13 actually were silenced. Quite a few offenders are in prison in consequence, while others, suspecting that they themselves were being suspected, dismantled their stations and fled.

The location of a station is determined by using a loop-operated receiver of high sensitivity. The loop is used as an indicator of the direction from which the offending signals come. Sometimes it is hard to track down a particular transmitter, due to wave reflection, directional propagation or simply the moving of the transmitter from one place to another within a relatively small area, or the offender having several plants, and working one in one place, others in other places, all on the same night.

Vacations Upset British Programs

Washington

Addressing the American Association of Advertising Agencies, Senator Dill (Dem.) of the State of Washington, told of experiences in England on a visit. One Saturday afternoon there was no program from 1 to 3:30 p. m. One had to listen, if at all, to programs from Belgium or France.

In general, music is of high quality in the British broadcasts, he said.

He recalled an announcement made while he was listening in, while in London. The announcer said that as half the musicians were on their vacation, only the other half would constitute the orchestra for the next two weeks, and that when the half returned from their vacations there would be another fortnight of half-orchestra strength, while those heard the first two weeks were enjoying their respite. Thereafter, the announcer confided, the full orchestra again would be heard.

The American radio system is far superior to the European systems, Senator Dill stated. He recalled that most European systems are Government operated, a tax is levied on sets, and part of the money goes to the upkeep of the stations. In England 40 per cent. of the money is kept by the Post Office as a collection fee, while in Germany 50 per cent. goes directly to the Government treasury, the other 50 per cent. to the stations.

DIRECT PICKUP CALLED VITAL TO TELEVISION

Television transmission will be improved when motion picture technique is brought to the studios, said William Hoyt Peck, inventor of a scanner. He is now completing a new type of direct pick-up television camera, which uses his optically-corrected reflecting lens system.

"What do you think motion pictures would look like if the sets and close-ups were lighted by means of a single flickering beam which illuminated each part of the scene in turn?" asked Mr. Peck.

Moustaches and Beards

"That is the way television studios and artists are lighted at present. It is not surprising that, with illumination of this sort, many of the men and women seen over the air seem to have moustaches and sometimes very heavy beards.

"With a direct pick-up, such as I am building, the television studio can employ regular stage or motion picture illumination, affording artistic shots, detail and definition now considered as something still 'around the corner.'"

Will Use His Disc

In his transmitter, Mr. Peck will use a disc identical with that used in the receiver which has been on demonstration at the Hotel St. Moritz, New York City, for several weeks. The principal change made will be the replacement of the neon tube with a photoelectric cell.

The Peck system is said to transmit approximately five times as much light from the subject to the photo cell and thus give a much sharper signal.

Television Lecture

Lawrence I. Becker, president of the General Television Manufacturing Corp., 55 Van Dam Street, N. Y. City, and Ivan Block, chief engineer of the same company, lectured and demonstrated before the Radio-Television Club of the West Side Y.M.C.A. The lecture covered some of the important technical aspects of television in addition to explaining the functioning of the receiver used for the demonstration. The equipment is a new model designed to project a larger image than has been previously shown with home models.

Literature Wanted

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

Wm. R. Shannon, 155 Cottage St., Rochester, N. Y.

Radio Supply Shop, care of Paul Kiehnhoff, 116 Locust St., Woodland, Calif.

Perry F. Farson, 688 Monroe St., Brooklyn, N. Y.

Eino Herrdrickson, R. No. 4, Box 49, Cokato, Minn.

E. H. Oliver, P. O. Box 178, Vinton, Va.

Fred Savino, 121 Mott St., New York, N. Y.

C. M. Rocheleau, 18833 Hanna Ave., Melvindale, Mich.

T. E. Veltfort, Jr., 26 Keofferam Rd., Old Greenwich, Conn.

Paul W. Glass, Auto, Battery & Radio Service, Fallen Timber, Penna. (Automobile Kits)

Peter Boelsen, U.S.S. Akron, Lakehurst, N. J.

Ascorra Brothers, P. O. Box No. 2334, Lima, Peru.

A THOUGHT FOR THE WEEK

IT MIGHT INTEREST YOU to know that "Auf Wiedersehen," has been displaced as the best song seller by "Paradise," according to reports from all over the United States. And very soon another song will take the place of "Paradise" at the head of the list of best sellers. Radio certainly does make 'em and unmake 'em with speed and precision.

RADIO WORLD

The First and Only National Radio Weekly

Eleventh Year

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

Peeking Into Periodicals

Halving Broadcast Frequency Quintuple the Result

THE April issue of the Bureau of Standards "Journal of Research" contains a report of studies made by the Bureau of field intensities of broadcasting stations. It has been found that when the frequency is halved the effectiveness is multiplied five times, for the same distance and power.

The report was prepared as a basis for correctly estimating the service areas of broadcasting stations, and required an enormous amount of work.

An announcement by the Department of Commerce, of which the Bureau of Standards is a subdivision, sets forth:

"Radio field intensity measurements form an accurate basis for estimates of the effectiveness of broadcasting stations, since this is known to be proportional to the square root of the power used. However, the relations between effectiveness, frequency, and distance are much complicated and may only be determined in practice by means of measurements of field intensity.

"Thousands of measurements of daytime field intensities have been made by the Bureau of Standards at various distances from broadcasting stations in the eastern part of the United States.

These measurements form the basis for estimates of the effectiveness at various distances of stations broadcasting on various frequencies; it was found that halving the frequency increases the effectiveness about five times for the same power and at the same distances.

"The measurements were found to be in good agreement with a theory given by Sommerfeld as early as 1909. With the aid of this theory, it was possible to estimate the daytime effectiveness of any broadcasting station east of Chicago and at any distance from the station, and this has now been prepared in the form of a graph."

* * *

Underwriters Fight Laxity In Fire Hazard Precautions

"RADIO," in its April issue, prints a full-page editorial entitled "Underwriters Taboo Cheap Midgets—Inspection Fee of $200 Demanded." The editorial was inspired by the passage of an ordinance by San Francisco making it a criminal offense to sell a radio not approved by the Underwriters' Laboratories. Such legislation is urged on all municipalities by the Underwriters, and indeed insurance companies notify policyholders of freedom from responsibility if a fire is caused by a radio set not thus approved. The San Francisco ordinance fixes a penalty of $400 fine and/or 30 days in jail.

"While we commiserate with the innocent dealer," the editorial sets forth, "we cannot question the justice of the requirements for safety against fire.

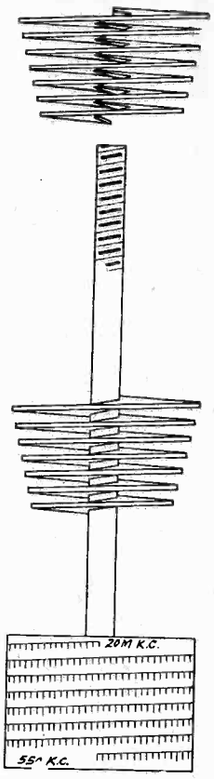
"These requirements," the editorial continues, "are that every radio set be equipped with a durable steel pan around the bottom of the chassis, so as to act as a shield and prevent the woodwork from igniting in the case of an electrical short; the power supply must be through heavy rubber-covered wire in the set and through heavy conducting cord to the supply socket; the set must be properly fused."

The manufacturer must submit a sample to the Underwriters, sending along check for $50, and if the set is approved $150 more must be paid.

The editorial prophesies that increased price of sets will result from the enforcement of such ordinances, except in the case of sets already approved by the Laboratories or intended for their approval.

FORUM

Mystery Circuit Suggestions



Details of dial-condenser arrangement suggested by H. V. Scruggs.

I am offering the following solution to the Mystery Circuit.

Since it is evident that the idea is to build an all-wave set with only one variably tuned circuit and without plug-in coils or switching devices, there are two conditions that must be met. First that the modulator must be untuned as shown, and can have no pre-selection. Second, since the above is true, all tuning must be done by the oscillator, which must have no repeat points and make use of no harmonics.

The only way this can be accomplished is to use an intermediate frequency higher than any frequency intended to be received. Furthermore it would be impossible to cover such a broad range of frequencies with any except a very high frequency oscillator.

By using an intermediate frequency of 30,000 kc, the entire range of from 500 to 20,000 kc can be covered by an oscillator with a frequency range of 19,500 kilocycles, or from 10,000 to 29,500 kc.

It would be very difficult to make an oscillator cover such a broad range at a frequency much lower than this. Using an intermediate frequency of 30,000 kc, there would be only one dial setting for each station, which is ideal, and no harmonics except the second harmonic between 20 and 30 meters. That is, when tuning stations between 15 and 20 meters, it will be possible to pick up stations between 20 and 30 meters, otherwise there will be no repeat points over the entire range except for harmonics of the stations themselves.

But, believe me, there will have to be some tall dial juggling to cover such a range. No gearing arrangement would be permissible on account of the backlash. Am submitting a sketch showing my idea of a solution of the dial problem. This consists of two spiral plates, one screwing into the other, and operated with a drum dial which follows the screw, making it possible to calibrate along a spiral. If the condenser makes seven revolutions and the drum is thirty centimeters in circumference that would give 2,100 divisions spaced one millimeter. This would more than cover all possible station allotments. Such a condenser would be rather difficult to make, but if this circuit proves successful, it would be worth while.

Am wondering if such a set has actually been built and tried by the author. I doubt if such a set can be built that will operate satisfactorily at such a high frequency and covering such a broad band. The moving of just one wire in the oscillator circuit even an eighth of an inch would ruin the calibration. There would have to be almost perfect shielding so that there would be no effect from objects placed on or around the receiver. Furthermore I doubt very much that there would be enough sensitivity except at relatively high frequencies, even though the second intermediate amplifier's sensitivity is made as high as possible.

Am anxious to see a detailed report on the performance of this set when, and if, it is built.

H. V. SCRUGGS,
121 Edna Place,
Macon, Ga

Tradiograms

By J. Murray Barron

Haynes-Griffin have moved to 46 E. 46th Street, in the Hotel Roosevelt, N. Y. City. Here they will serve a neighborhood high in buying power.

* * *

Kolster Radio, Inc., 360 Thomas Street, Newark, N. J., has added more than 300 employees. According to present plans the force will be increased in June.

* * *

Wholesale Radio Service Co., 100 Sixth Ave., New York City, has just installed a bargain counter. Sets, pick-ups, speakers, etc., are displayed.

* * *

The Universal Microphone Co. has moved to a new three-story building at 424 Warren Lane, Inglewood, California. This plant is larger than the old quarters.

* * *

P. R. Mallory & Co., Indianapolis, have placed on the market a B Battery Eliminator for automobile radios. It is the equivalent of four 45 volt B batteries, or 180 volts.

* * *

City Radio Co., 62 Cortlandt Street, N. Y. City, has a special display of the Hammarlund "Pro" Short Wave Receiver in the window.

STATION SPARKS

By Alice Remsen

The Garden Wall

FOR ANN LEAF AND BEN ALLEY CHARIS PROGRAM, WABC. WEDNESDAY, 3:15 p. m.

Come to me where the sweet lilacs grow!
Come to me where the western winds blow!
Come to me here by the garden wall,
Where the lilies grow straight and tall;
While the moon liquid gold is spilling,
And the birds sleepy notes are trilling.
Come to me! Dearest one of all!
I wait for you by the garden wall.

Lady moon riding lazily by,
Her steed the clouds that sail in the sky.
I wait in vain by the garden wall,
Listening dear, longing for your call;
While the night swiftly grows around me,
And the perfumes of flowers surround me.
Come to me! Dearest one of all!
I wait for you by the garden wall.

—A. R.

* * *

The Glorious Voice of Ben Alley and the beautiful music of Ann Leaf and her organ will transport you from this mundane sphere to a celestial garden, where flowers are always blooming, and the lover's friend, lady moon, is perpetually shining. Listen to them and you'll agree that they are delightful.

* * *

Phil Dolan, Well Known in Vaudeville, is singing over Station WEEI, Boston. He has teamed with Carl Moore and the two of them are now harmonizing for the Rexall account every Sunday evening at ten o'clock. Phil Dolan always had a very sweet tenor voice. It sounds great via the air waves.

* * *

Environment Will Tell! The winner of the Paul Whiteman Children's Auditions, conducted in the Times Square Studio of the National Broadcasting Company, was four-year-old Geraldine Doyle, who lives with her guardian, Miss Julia Rooney, sister of the famous Pat. Miss Rooney taught the little girl to sing and dance. The child sings in three languages and is also an expert tap dancer. She was selected from among 450 children who entered the auditions.

* * *

Frank Novak's Miami Music Masters may now be heard every Monday evening at 9:30 p. m. from WJZ. Frank is an unusual musician. He really plays twenty-three instruments and is a master of them all.

* * *

The Latest Romance of the Studios resulted in the marriage of Miss Finette Walker, stage and radio singer, to Ted Bergman, one of the best known actors appearing in dramatic programs over the Columbia network. The marriage took place at New York City Hall on April 5th. The bride is the daughter of Mr. and Mrs. Myron R. Walker of Washington, D. C. She attended George Washington University and later appeared in musical shows, including "My Maryland" and "The New Yorkers." She was featured also over Columbia's television station, W2XAB. The bridegroom has portrayed more than 800 dramatic roles in radio performances. He is now starred as Joe Palooka in the series of that name over the Columbia network.

* * *

Ted Jewitt, One of the Best of the NBC Announcers, has been appointed night program representative of the NBC. The position combines the duties of supervisor of announcers and general program operations during evening broadcasting. Ted is a fine lad and well deserves his promotion.

* * *

And Now Comes That Funny Fellow, Ed. Wynn, to radio.. He has signed a long-term contract for a Coast-to-Coast broadcast every Tuesday night for the retail dealers of the Texas Company, via NBC networks. As the broadcast comes at 9:30 and lasts for half an hour, Wynn is forced to close his show, "The Laugh Parade," on Tuesday nights. The actors in his company are willing to take this enforced holiday rather than see the show close down for the season.

* * *

The Kodak Week-end Hour, pioneer program sponsored by the Eastman Kodak Company, has returned to the air via Columbia's network. Nat Shilkret is its musical director. A series of guest stars will be presented; also a large novelty orchestra, the Kodak male quartet, and Thelma Kessler, soprano. Every Friday, 9:00 to 9:30 p. m.

* * *

Charlie Premmac Has a Program on WABC during which he sings in a different language on each program. Even Hindustani, Chinese, Japanese, Malayan, Tagolog Philippine dialect, and all European languages are included, Charlie is some little old dialectician, don't you think?

* * *

Max Smolen always gets Johnny McLaughlin, of Witmark's, to do his renowned impersonation of George M. Cohan, whenever maestro Max meets up with Johnny. Why? Well, Max thinks George M. is okay. Long before Max conducted the Bourjois "Evening in Paris" orchestra, he conducted the orchestra for many of the famous George M. Cohan shows.

* * *

Maria Cardinale, Popular Prima-Donna of Golden Blossoms on WJZ and Footlight Echoes on WOR, plans to spend the summer on her farm in the Catskills. Contrary to the usual procedure, she will motor into town for the week-end, as both her broadcasts are on Sunday.

* * *

Sidelights

THE BOSWELL SISTERS play practical jokes on their visitors by planting dummy cigarette lighters around their apartment—so if you ever visit them, bring along your own lighter . . . EMIL SEIDEL, pianist for Singin' Sam, earned his first pennies by serving as bugler for stage coaches traversing the Ozarks , , , The NBC is featuring quite a few singers from the South: JIMMY MELTON, from Florida; THE PICKENS SISTERS, from Georgia; CHARLES HOWARD, from Swanee; JOHN SEGAL, from Kentucky, and the McGRAVY BROTHERS, from South Carolina . . . ALFRED J. McCOSKER, director of WOR, has returned to New York after a twenty-one day cruise in the Caribbean with Mrs. McCosker; the use of Mr. McCosker's picture for that of Mr. Aylesworth, new president of RKO by a local theatrical weekly, caused quite a laugh along Radio Row . . . FREDERICK JENKS has joined the staff of WOR, succeeding Lester Scharff, who resigned . . . EDWARD REESE, known to listeners through his detective roles in the Eno Crime Club is one of radio's outstanding tennis players. He has won several invitation tournaments and club matches . . . TITO GUIZAR, Mexican tenor, of WABC, has written a song in English entitled "Kiss Me Once More." A few months ago he could not speak our language, but Tito is a fast worker . . . JACQUES RENARD is the official restaurant-finder for the group during the Camel vaudeville tour. . . . ALFRED CODONA, famous circus aerialist with Ringling and Barnum and Bailey shows, revealed in a radio interview over WABC that he doubled for Marion Davies in the movie, "Polly of the Circus," and also for Johnny Weismuller in some of the more difficult jungle scenes of "Tarzan" . . . PAUL SPECHT'S band was the first one to broadcast a program from an airplane flying over the English Channel, and also the first to broadcast from London to America; incidentally, he and Paul Whiteman are the only two modern jazz-band maestros listed in "Who's Who."

* * *

ANSWERS TO CORRESPONDENTS

P. FRANK, Croton-on-Hudson, N. Y.—Can't very well run my own biography, but might tell you that I was born in London, England, but am an American citizen and very proud of it. Glad you like the column.

S. B. SZFRANSKI, South Bend, Ind.—Sorry; have not yet heard from "Painted Dreams," WGN.

* * *

Biographical Brevities

ABOUT BUDDY ROGERS

Born in Olathe, Kansas, Buddy Rogers began his musical career there at the age of nine. A boy's band was organized by public subscription, and Buddy, son of the local newspaper editor, grabbed a baritone horn. Later he learned the trombone. Between rehearsals, concerts and school, Buddy worked in the office of the Olathe "Mirror," his father's paper. First a printer's devil, then a compositor and linotyper, and finally a columnist—that was his career as a member of the Fourth Estate. Finally came college. He went off to Lawrence to the University of Kansas.

After the first college year, Buddy was seized with the travel bug, and went off to Europe on a mule boat. While abroad he played trombone in an orchestra at Barcelona, Spain; then he went to Paris and stayed until, money exhausted, he was forced to come home in the steerage.

Then back to college for serious study. During this time he studied piano, trumpet, saxophone, guitar, drums and accordian. So when a chance to enter the movies presented itself, Buddy showed little enthusiasm. He wanted to follow a musical career. However, he took the screen offer and embarked upon a Hollywood jaunt, which brought him fame. Still down in his heart Buddy was a musician and he usually insisted upon parts being written into his scripts requiring him to play one or more instruments. He was successful from the start. Trim, bright-eyed and handsome, Buddy set a fashion, and became a much copied "collegiate type."

When his moving picture contract expired he thought of his music. An official of the NBC convinced him that he should come East and take up an orchestral career. He did so and bids fair to become just as successful in radio as he was in pictures.

* * *

Alice Remsen's Selections

SUNDRY SUGGESTIONS FOR WEEK COMMENCING MAY 1, 1932

May

1—Golden Blossoms.....WJZ— 7:00 p. m.
(Maria Cardinale, Willard Amison, Piano Duo)
1—Footlight Echoes.....WOR—10:30 p. m.
(Willie Robyn, Maria Cardinale, Alice Remsen)
2—Evening in Paris.....WABC— 9:30 p. m.
(Pierre Brugnon, Alice Remsen, Max Smolen)
3—Dramatic Stock Company.....WOR— 8:30 p. m.
(Corse Payton)
4—Big Time, Stanco Program..WEAF—8:00 p. m.
(Jack Arthur, Ed. Whitney)
5—The Beggars Bowl.....WOR—10:15 p. m.
(Basil Ruysdael)
6—Maxwell House Tune Blenders.....
WABC— 7:15 p. m.

STATION'S RATE FOUND IMMUNE FROM CONTROL

Washington.

W. M. Chesaldine, one of the examiners of the Interstate Commerce Commission, has reported to the Commission, after a hearing, that the Commission has no power to regulate the rates charged by broadcasting companies to clients who use the station facilities for advertising, and therefore recommends the dismissal of the complaint of Sta-Shine Products Co., Inc., against WGBB, Freeport, N. Y., and the National Broadcasting Company. Sta-Shine alleged that the National Broadcasting Company's rates were unreasonable and oppressive, that it had to seek other radio outlets for desired advertising, and that WGBB, one of these outlets, also charged excessive rates.

The examiner reported that, while it would seem from the literal reading of the Transportation Act that it embodied a case like this, the fact is that the act was passed before broadcasting existed, and that one must look to the Interstate Commerce Act for a solution, whereas the Interstate Commerce Act makes no provision for control of stations' rates, charges, rules, regulations and practices.

Stations Not Common Carriers

The Interstate Commerce Commission does have jurisdiction over persons and companies engaged in interstate communication service for hire, where messages are received for transmission to a particular recipient and destination, the examiner held, and such companies are common carriers, but broadcasting stations are not.

The examiner in his report said in part:

"Since broadcasting was unknown at the time of the passage of the Transportation Act it is reasonable to assume that the Congress did not intend to pass any law to regulate the charges and practices of broadcasting concerns.

"It can not be supposed that it was looking into the future and attempting to regulate a mere potential service, one that might or might not be developed, and particularly a service so distinct and different in character from the means of transmission of intelligence then known.

Different from Point-to-Point Service

"What it had in mind must have been the transmission of messages by wireless from a definite sender to a definite receiver, that is, point-to-point wireless communication as was then being performed by the United States Army and Navy and commercial concerns which held themselves out to perform such service for the public as common carriers for hire by means of signals, an entirely different type of communication from that of ordinary broadcasting.

"The mere fact that the subject-matter under consideration may be within the literal language of the statute is not sufficient to bring it within its intent.

"The very nature of defendants' business prevents them from opening up their facilities to all who would wish to use them, without regard to the value or propriety of the matter to be broadcast to the listening public. Listener goodwill is the broadcaster's greatest asset, for without it he could not hope for commercial success.

"The Congress is even now giving grave consideration to the quality of broadcasts being put on the air, with a view to improvement, because of the growing dissatisfaction with the present use of radio broadcasting facilities.

"As the Congress established the Federal Radio Commission as its agency to supervise and control matters and things arising out of radio activities, may it not be presumed that it gave to the Commission such powers as it then deemed necessary and appropriate to adequately take care of and protect the public interest in radio broadcasting?

"And as one of the purposes of the bill was to centralize control over radio, may it not further be presumed that if it then thought that the rates, charges, rules, regulations and practices of radio broadcasting concerns should be regulated, supervised or controlled, it would have then taken proper action and placed those powers with that Commission?

Some Congressmen Disagreed

"And this, notwithstanding opinions expressed by certain members of Congress when the radio bill was being considered by that body that the Interstate diction over and authority to regulate and control the rates and charges of a broadcaster, and that section 14 of the Radio Act makes a finding by the Interstate Commerce Commission, in the exercise of authority conferred upon it by law, that the charges and practices of a licensee with respect to the transmission of radio communications or service are unreasonable or discriminatory, a basis for revocation of a license of a broadcaster by the Radio Commission.

"But these facts do not invest the Interstate Commerce Commission with such powers of regulation. We must look to the Interstate Commerce Act for any power the Interstate Commerce Commission may possess in this respect, and we must conclude that the act does not give it the power or authority to regulate or control the rates, charges, rules, regulations and practices of defendants.

"The Commission should therefore conclude, and find, that it has no jurisdiction over the matters and things here complained of. The complaint should be dismissed."

Trade to Act on Short-Wave Blurbs

Following its policy of issuing statements regarding phases of radio in which it has reason to believe that the public is being or may be misled, Radio Manufacturers Association, Inc., will issue a statement on short-wave converters and sets. Recently it issued a statement on television.

The short-wave statement will inform the public of the limitation on short-wave reception and will refer to the exaggerated claims made by some manufacturers (not mentioning their names) as to the performance that the short-wave devices will produce.

The statement is being prepared by Dr. E. C. Brigham, director of the Association's engineering division. It is asserted that exaggerated claims injure business in short-wave devices.

NEW SHOW POLICY IMPENDS

After having changed its policy from indorsing public radio shows to one of not sponsoring any of them, which non-encouragement policy has existed for two years, Radio Manufacturers Association, Inc., is expected to return to its former policy, and in consequence indorse the Radio and Electrical World's Fair, to be held in New York City and Chicago, as well as other public shows elsewhere.

WARNING GIVEN BY CALIFORNIA ON TELEVISION

San Francisco.

Individual States are beginning to take cognizance of the peril in investing in many of the television stocks offered for sale, particularly as television enterprises are not "going businesses" at this time, and all endeavors are of an experimental nature.

Following the warning by the New York Stock Exchange against too ready acceptance of prophecies made in prospectuses of television companies, and the activities in the same direction of the National Better Business Bureau, the State Division of Corporations (California) has issued a warning to corporations. Members of the Division have been notified to scrutinize applications for authority to float stock to finance television enterprises.

Experimental, Not Commercial

Information on the television situation was obtained from many sources. A letter from the Federal Radio Commission, signed by its secretary, set forth that companies qualified to conduct research work have been granted television transmitting licenses, but these were only a few, and besides television is experimental, not commercial, at this time.

There are two general classes of television companies. One consists of companies having transmitting facilities, and operating under Federal license to conduct this experimental work. The other class consists of manufacturers of television receiving equipment who hope to make a financial success of their efforts on the basis of transmissions made by such stations. As for the stations, they not only have no direct source of revenue for their television work but are under heavy expense in conducting it.

Caldwell's Warning Quoted

For instance, the report of the Radio Corporation of America to its stockholders recently mentioned the heavy expense of television experiments, but justified it as a necessity in keeping up with the advances in all forms of the radio art, and so that the corporation will be fully prepared when commercial television arrives.

The State Division of Corporations cited some remarks made by Orestes H. Caldwell, former Federal Radio Commissioner, and at present editor of McGraw-Hill technical periodicals, as follows:

"Before any lyman invests his hard-earned dollars in television securities he should inform himself to some extent about the television art and the likelihood of improvement. He should also insist on witnessing a television demonstration, to observe the crudities of present television for himself."

NO SETS TO FRANCE NOW

The quota imposed by France restricting the importation of American radio sets has resulted in the stoppage of shipments of sets from this country to that market, as the quota has been exhausted, and there is no indication of any opening for new sets until on or after July 1st, Arthur Moss reported to Radio Manufacturers Association, Inc.

AMATEURS PUT UNDER GREATER RESTRICTIONS

Washington.

Sweeping changes in the regulations covering the issuance of certain amateur radio licenses, for the purpose of reducing violations of the radio code, were ordered by Director W. D. Terrell of the Radio Division of the Department of Commerce.

The change involving the greatest number of amateur radio operators was the one, effective at once, preventing renewal of temporary class licenses. Director Terrell pointed out that a large percentage of the trouble comes from this class of operator.

Examinations Required

In the future, temporary licenses, which may be obtained by mail, will be good for one year only and no new temporary licenses will be issued after April 15th, 1933. All holders of temporary licenses must arrange to take an examination for a regular license before their temporary licenses expire if they wish to continue operating their stations.

Examinations may be taken in any of the district or sub-district offices, or in cities designated and visited by the radio examiners.

Director Terrell also announced that, starting at once, no unlimited amateur phone licenses will be issued by mail. They must be obtained by taking the examination in the various designated places.

Must Hold Amateur License

The third change makes it necessary for operators of amateur stations to hold amateur licenses regardless of what other licenses the operators may hold. This is effective July 1st, 1932. The order reads:

"Amateur stations will be operated only by operators holding amateur operator's licenses. Amateur stations now being operated by holders of any commercial class of license will be required to pass the regular amateur examination and obtain an amateur license."

Commercial Operators Curbed

The reason for this order is that many commercial operators are not familiar with the rules covering amateur station operation and also may not be familiar with the technique of operating a high frequency station.

New Canadian Station to Have Detroit Studio

Sandwich, Ont.

Ground was broken here for the transmitter of CKWO, which will start broadcasting May 31st. The towers, 200 feet high and 500 feet apart, will be the highest in the Dominion.

The station will broadcast Canadian programs as well as features of international interest through its hookup with the Columbia Broadcasting System. Studios will occupy the twelfth floor of the Guaranty Trust Building in Windsor, with supplementary studios in Detroit, Mich.

"The Border Cities Star," a Canadian newspaper, will broadcast news. The station is owned by Essex Broadcasters Limited.

Earl Receiver Under Charges

Newark, N. J.

On an affidavit signed by C. Wallace Vail, counsel for the receivers of the Earl Radio Corporation, charging that there was a shortage of about $185,000, Vice-Chancellor Church removed Harry G. Hendricks as one of the two receivers and ordered his arrest. Hendricks had put up a surety bond as co-receiver.

Oscar A. Klamer, the other receiver, was on a trip in the mid-west when action was taken against Hendricks, who was actually in control of the funds. Klamer continues as co-receiver.

Vail, the complainant, stated that instead of $332,288 that should be on deposit to the receiver's account there is $144,566, this money in three banks. Vail said that Hendricks had drawn checks amounting to more than $100,000 payable to himself and to the Livingston Sand and Gravel Company.

BOARD HEARS DOOM PROPHET

Washington.

Unable to arive at a conclusion even after having received the report of its chief examiner, Ellis A. Yost, who had held a protracted hearing on the case, the entire membership of the Federal Radio Commission turned out for a new hearing on the wave squabble between WMCA and WNYC, both of New York City.

WNYC is municipally operated. WMCA is owned and operated by the Knickerbocker Broadcasting Company, which also controls WPCH.

WMCA proposes that the 810 kc channel of WPCH be assigned to WNYC, so WPCH and WMCA will share 570 kc, which WNYC and WMCA now share. But WNYC objects, on the ground it has held 570 kc since 1924, when it went on the air, and that 810 kc is a "graveyard" channel. The examiner recommended that WNYC not only be kept on 570 kc but be given more time, the extra amount being taken from WMCA's time.

Counsel for WMCA said that the station spends more money each year than any other regional station. He gave the following figures: investment, $100,000; revenue, $500,000; expenses, $340,000.

WNYC contended that as it is a non-commercial station it is entitled to more time and should not be shifted to an undesirable frequency. Edward P. Joyce, Jr., of counsel for the municipal station, predicted that it will be going strong in years to come, when all commercial stations are off the air. He intimated blurb advertising is killing interest in commercial stations, whereas municipal and other non-commercial stations are rendering real and enduring service.

New Attachment Plug

C. D. Wood Electric Company, 565 Broadway, New York City, has a new attachment plug, for connecting to convenient outlets of a-c and d-c lines, that requires only putting the bared cable ends under two springs and screwing down the cap to make the contact permanent. The bottom is entirely closed up, so there is no danger of shorting.

BOARD REPORT TO THE SENATE NEARLY READY

Washington.

The first survey ever made of the entire scope of broadcasting in the United States, with comparative data from other countries to serve as background to possible remedies to be applied here, is nearing completion. These data were requested of the Federal Radio Commission by a Senate resolution. It is expected this report will be submitted to the Senate on May 9th.

The Commission has gone to considerable pains to make the report inclusive, and some of the broadcasting agencies, particularly the two large chains, have hired extra personnel to take care of answering the questions.

The Commission sent out a questionnaire to the broadcasting stations, and while replies were sent in quickly, evidently some were made too quickly. The questionnaires had to be returned in many instances due to incomplete, contradictory or undecipherable information. In one instance the questionnaire had to be returned twelve times before the proper answers were given.

Government Ownership Studied

The questionnaire relates to the number of hours devoted to educational and advertising features, the financial investment and expenses of the stations, their gross and net profits (or losses), their equipment and other statistical matter.

In foreign countries the Commission has appointed representatives, if the country is well organized for radio service, so that first-hand information will be obtained on programs, technique, ownership and control. Especially interesting is the subject of Government control or ownership, as obtains in most European countries that have any extensive radio service. The Senate has shown interest in the possibility of a Government monopoly of radio in this country.

"Nearly all the United States stations have reported, and we have made studies of our own in some instances, but we are still to hear from some foreign countries," said Commissioner Harold A. Lafount. "Besides having representatives act for us in some instances abroad, we have written to the proper agencies of the foreign governments, and expect to have all data on hand for submission to the Senate by May 9th."

Board Will Simply Report Facts

The question regarding the divisions of time arises from the Senate interest in having a greater number of hours devoted to educational purposes, possibly by enacting a law setting a minimum percentage. It is claimed by some Senators that there are too many advertising hours, and it is pointed out by them that stations showing an excellent profit from the conduct of advertising programs could afford to send out more educational matter. Since this part of the discussion came up in the Senate many stations have increased the number of hours devoted to educational programs.

The Commission will merely submit a report of facts, without recommendations. However, the report will contain an estimate by foreign countries as to how their systems work out.

COMPETITION, RCA REPLY TO MONOPOLY SUIT

Wilmington, Del.

The answer of the Radio Corporation of America to the amended and supplemental complaint in the Government's suit to have licensing and cross-licensing patent agreements set aside as violating the anti-trust laws, was filed before Judge John P. Nields in the Federal District Court. RCA, one of several defendants, not only denied that no monopoly was created or exists in the radio broadcasting and communications fields, but submits that there is instead keen competition.

In substantiation of this position RCA cites that the defendants and their subsidiaries own or control only seventeen broadcasting stations out of the total of more than 600 licensed by the Federal Radio Commission, RCA actually owning eight stations and leasing four. Also, RCA Communications, a subsidiary, handles less than 20 per cent. of the trans-oceanic telegraph communication between this country and foreign countries, and less than 1 per cent, of domestic communication, the answer sets forth.

Less Than 20% of Set Business

Broadcast receivers are manufactured by more than thirty-five concerns, it is set forth, total productive capacity more than 20,000,000 sets a year, compared to the present annual consumption of about 3,500,000, and the business done by the defendant, it is set forth, is less than 20 per cent. of the total business.

As for tubes, it is stated that there are about thirty concerns making tubes, productive capacity 150,000,000 tubes a year, compared to present consumption of about 50,000,000 tubes, of which business RCA Radiotron Company, a subsidiary, gets less than 40 per cent.

These statements are made to show that not only is competition keen, but that RCA and subsidiaries do not get so high a percentage of the total business in these directions as even to suggest that there is any monopoly.

Also RCA reminds the court that the patent cross-licenses were not entered into secretly with the American Telephone & Telegraph Company, Westinghouse Electric & Manufacturing Company, General Electric Company and others, but that, quite otherwise, the proposed agreements were submitted to the Attorney General at the time (1919), and amendments as later proposed, and no objection was raised to them, until recently. Moreover, in the beginning a United States Navy Admiral, "designated by the Government to sit with the Board of Directors of the Radio Corporation, made a written appeal to such directors 'to enter the wireless field of South America at as early a date as possible.'"

The answer traces the history of the Radio Corporation of America. General Electric Company in 1919 negotiated with the Marconi Wireless Telegraph Company of America with the view of purchase, the stockholders of Marconi being foreigners, although the corporation was a New Jersey corporation.

Cites Government Appeal

"These negotiations," states the answer, "were undertaken in response to a direct appeal from officers of the Government of the United States to create an American-owned radio communications company with capital, facilities and patent rights sufficient to enable it to compete on equal terms against the foreign radio and cable companies which then dominated international communications."

General Electric organized the Radio Corporation of America and the new corporation bought out Marconi.

General Electric made radio apparatus for RCA, in 1919, and RCA sold it, but the business was modest, for the apparatus was not up to the highest possible standards of the time, due to the ownership of patents by other concerns which patents had to be utilized for the production of most efficient apparatus. These patents were held by several companies, and rights thereto were acquired either by purchase direct, or under cross-licensing patent agreements, as later consummated with the Telephone Company, Westinghouse, Western Electric and others.

The formation of the various subsidiaries of RCA is narrated in the answer, these including the RCA Radiotron Company, as the tube concern; RCA Victor as the manufacturer and seller of broadcast receivers; the National Broadcasting Company, which at first was jointly owned by RCA, the General Electric and Westinghouse, but which is now 100 per cent. owned by RCA; and RCA Communications Company, to carry on foreign communications service by radio.

The "Clause 9" Explanation

In 1927 RCA and associates began to license set and tube manufacturers, and later, on the strength of a legal decision of the United States Court in the case of Westinghouse v. Diamond State Fibre Company, holding a similar arrangement not to violate the Clayton Act, RCA required that set licensees be restricted to initially equipping receivers with only RCA tubes. This provision in the license (clause 9) was later held, in the case of Lord v. Radio Corporation of America (United States Supreme Court) to violate the Clayton Act. On February 6, 1928, RCA eliminated the clause from the contracts.

In conclusion the answer sets forth:

"The defendant denies that it has been a party, whether by means of the acts and agreements alleged in said amended and supplemental petition or by any other means, to any contract, combination or conspiracy in restraint of trade or commerce among the several States, or with foreign nations, or to any monopolization, or attempt to monopolize, or combination or conspiracy with any other person or persons to monopolize, any part of the trade or commerce among the several States, or with foreign nations."

Other defendants in the suit include General Electric, International General Electric, American Telephone & Telegraph, Western Electric and General Motors.

For RCA the answer was prepared by Charles F. Curley, solicitor and of counsel; Charles Neave, Manton Davis and Stephen H. Philbin, of counsel. The personal appearances before the court at the submission of the answer were by John W. Davis, Charles M. Beralin, John W. Roy and Porter R. Chandler.

All Stock in NBC Now Owned by RCA

Wilmington, Del.

In its answer to the Federal Government's monopoly suit RCA sets forth that it caused the National Broadcasting Company (called Broadcasting Company in the answer) to be organized in 1926, and that the new company acquired WEAF from the American Telephone & Telegraph Company on October 30th of that year. The NBC now owns and operates WEAF. The answer continues:

"This defendant admits that by written documents, profert of which is hereby made, it granted to Broadcasting Company a non-exclusive license under the patent rights of this defendant to use apparatus in the field of broadcasting. This defendant alleges that similar rights have been and are freely granted by this defendant and by Telephone Company to hundreds of others, many of whom are engaged in the broadcasting business in active competition with Broadcasting Company.

"The stock of Broadcasting Company was originally divided between this defendant, General Electric and Westinghouse, but that stock is now all owned by this defendant."

SENATORS ASK STATIONS PAY $670,000 FEES

Washington.

A proposal to levy license fees on broadcasting stations, to yield about $670,000 annually, has been written into a House bill to amend the radio law by the Senate Committee on Interstate Commerce.

The schedule of license fees would range from $120 for the lowest-powered stations to $5,000 for the highest-powered stations, payable annually.

Senator Dill (Dem.), of the State of Washington, who reported the bill to the Senate, said that the fees have been so arranged that the total amount would pay approximately the cost of administration of the law affecting stations, which are under jurisdiction of the Federal Radio Commission.

Alien Restriction

The House bill, providing that broadcasting licenses may not be held by any company, firm, or corporation which has an alien director or officer, or where more than one-fifth of the capital stock is under foreign control, was reported favorably to the Senate by the Interstate Commerce Committee.

The same bill prohibits lotteries and other chance enterprises on the same basis as applies to mail under the U. S. Postal Laws and Regulations. The bill prohibits broadcasting any information about "any lottery, gift enterprise, or similar scheme offering prizes dependent in whole or in part upon chance or lot."

The Senate Committee also inserted an amendment transferring the Radio Division of the Department of Commerce to the Commission.

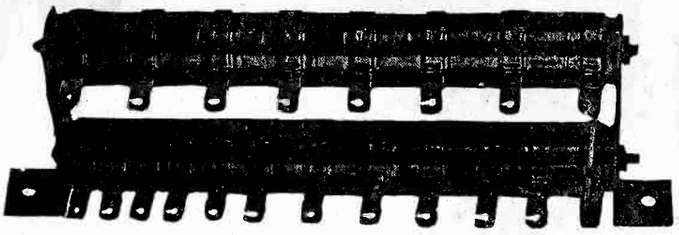
Another Citizenship Requirement

The Senate Committee also reported favorably a bill amending the law relating to qualifications of radio operators to provide for licenses to United States citizens only.

The bill provides that the words "citizen of the United States" be inserted instead of "persons" in the present law, making the revised paragraph read: "to prescribe the qualifications of station operators, to classify them according to the duties to be performed, to fix the forms of such licenses, and to issue them to such citizens of the United States as he finds qualified."

FREE—PARTS of QUALITY

MULTI-TAP VOLTAGE DIVIDER



THE resistance values between the twenty taps of the fine Multi-Tap Voltage Divider are lower left to right, 0, 50, 50, 100, 200, 400, 450; 500; 550; 650; top right to left, 700, 800, 2,000, 2,000, 3,000 and 3,000 ohms. The total is 17,100 ohms and affords nineteen different voltages.

The Multi-Tap Voltage Divider is useful in all circuits, including push-pull and single-sided ones, in which the current rating of 100 milliamperes is not seriously exceeded and the maximum voltage is not more than 400 volts. Higher voltages may be used at lesser drain. Conservative rating, 40 watts.

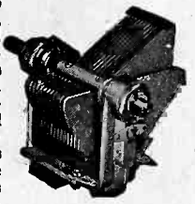
The expertness of design and construction will be appreciated by those whose knowledge teaches them to appreciate parts finely made.

When the Multi-Tap Voltage Divider is placed across the filtered output of a B supply which serves a receiver, the voltages are in proportion to the current flowing through the various resistances. By making connection of grid returns to ground, the lower voltages may be used for negative bias by connecting filament center, or, in 227 and 224 tubes, cathode to a higher voltage.

If push-pull is used, the current in the biasing section is almost doubled, so the midtap of the power tubes' filament winding would go to a lug about half way down on the lower bank.

Send $4 for 35 weeks subscription and order PR-MTVD, as a premium. Shipping weight, 2 lbs.

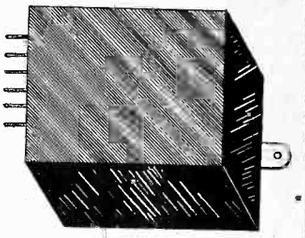
HAMMARLUND .0005 SFL



Hammarlund's precision .0005 mfd. condenser, removable shaft, protruding front and rear, and permitting reversing the condenser, as where two condensers are used on opposite sides of a drum dial. This is a most excellent condenser for calibrated radio frequency oscillators, short-wave converters and adapters and TRF or Superheterodyne broadcast receivers. Lowest loss construction, ridigity; Hammarlund's perfection throughout.

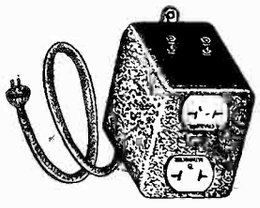
Sent free with 6 mos. subscription, 26 weeks, at $3. Order PR-HSFL. Shipping weigh, 1 lb.

FILTER BLOCKS



An excellent filter block, providing very high capacity for the B filter, a total of 14 mfd., with by-pass capacities of .1 and .5 mfd. This block is for standard 245 filtration (DC rating is 350 volts continuous). It is suggested that the 6 mfd. be placed next to the rectifier and the 8 mfd. at the other end of the B supply choke coil. No other filtration capacity is necessary. The physical dimensions are 5 inches wide x 4 inches front to back x 3 inches high. This Flechtheim block will be sent free with a $6 subscription (52 weeks). Order PR-FLB. Shipping weight, 4 lbs.

"B" ELIMINATOR - "A" BATTERY RELAY

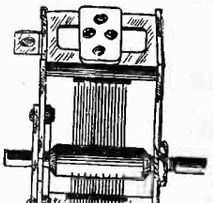


Here is a mighty handy and serviceable product for those who operate sets with storage battery and B eliminator—a genuine Brach relay, that switches charger on and set off, also set on and charger off.

Connect relay's cable plug to 105-125 volt AC line. Connect B eliminator cable plug to relay socket so marked; connect trickle or other charger's plug to relay socket so marked; connect one side of A battery to binding post, other side to A set. Then turning on your set turns on B eliminator and turns off charger, turning off set turns on charger and turns off B eliminator.

Send $1.50 for a 3 month's subscription, 13 weeks, and get this relay (PR-BRL) free. Shipping weight, 1 lb.

SCOVILL .00035 MFD



A single tuning condenser of .00035 mfd. capacity, with brass plates and mounting feet. It may be mounted on a front panel, by removing the mounting brackets and drilling a 1" diameter hole large enough to pass the locknut. This condenser, made by Scovill, increases capacity in a clockwise direction. It is useful both for broadcast and short-wave work. Send $1 for an 8-weeks trial subscription and get this condenser free. Order PR-SC-35. Shipping weight, 1 lb.

THE SUPERHETERODYNE

This is a new volume by Anderson and Bernard dealing with the principles and practice of the Superheterodyne method of receiving. It explains the function of the oscillator, the modulator, the premodulator selector, and the intermediate frequency amplifier. It explains the cause of repeat points and gives methods for avoiding them or minimizing their effect. It expounds the relative advantages and disadvantages of high and low intermediate frequencies, and shows the effect of selectivity on the quality.

It illustrates various forms of oscillators and tells of the advantages of each. Different types of modulators and pick-up systems are explained and their advantages stated. Different methods of coupling in the intermediate frequency amplifier are shown. Order PR-ABSA, free with 3 months' subscription (13 issues) @ $1.50

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RADIO WORLD, now in its tenth year, is the first and only national radio weekly, and publishes the latest, up-to-the-second news of circuits, both of kit types and of 1931 commercial receivers, as well as news of happenings in the broadcasting field. Lists of broadcast and short-wave stations are published regularly. You get your information weekly—which means quickly—and you get it accurately, so be sure to become or remain a subscriber for RADIO WORLD. We are able to offer now specially attractive premiums, and ask you to make your choice from the variety of parts offered on this page and on the opposite page. When ordering, please use coupon. We do not pay shipping charges.

The regular subscription rates are: $6 for one year, 52 issues, one each week; $3 for 6 months (26 weeks); $1.50 for three months (13 weeks); $1 for 8 weeks; 15c per single copy. All copies postpaid.

RADIO WORLD, 145 W. 45th St., New York, N. Y.

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- ☐ PR-BRL, 1.50 for 13 weeks (3 mos.); shipping weight, 1 lb.
- ☐ PR-ABSA, $1.50 for 13 weeks (three months); shipping weight, 1 lb.
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- ☐ PR-SC-35, $1 for 8 weeks; shipping weight, 1 lb.

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☐ If renewing an existing subscription for RADIO WORLD, please put a eross in square.

Anderson's Auto Set

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

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

Set of tubes for car receiver (Cat. 630-TUK), @.....**$11.80**

SHORT WAVE SWITCHES

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

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

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

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

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

Battery Set 15 to 200 Meters

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

PARTS REQUIRED: 4 plug-in coils, **$1.50**; Hammarlund 0.00014 mfd. tuning cond., **$1.20**; Hammarlund 0.0002 tuning cond., **$1.35**; three UX sockets, **30c**; audio trans., 70c; 50,000 ohm leak, **10c**; 300 turn honeycomb, **30c**; 0.00025 mfd., clips, **15c**; 6.5 ohm limiting resistor for filament circuit, **15c**; 20-ohm rheostat, **40c**; 20-100 mmfd. equalizer, **20c**; battery switch, **20c**; 6 bind. posts, **30c**; bind. post strip, **10c**; vernier dial, **50c**; two knobs, **10c**; 7 x 10 bakelite panel, **$1.25**; 7 x 10 baseboard, **25c**.

Designed by Jack Tully.

Complete parts, with blueprint, less tubes, (Cat. SW-DAF), @ **$9.10**

Two 230 tubes @ total of.....**$1.92**

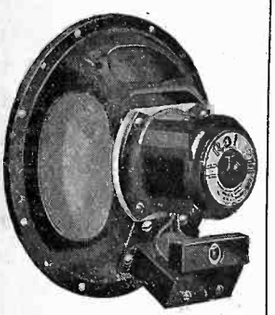
INTERMEDIATE FREQUENCY TRANSFORMERS

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

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

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

ROLA DYNAMIC SPEAKERS



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

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

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

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

BROADCAST COILS WITH 80-METER TAP

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

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

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

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

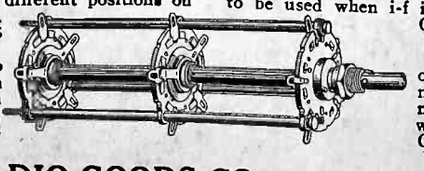
For 0.0005 mfd. order Cat. M-05-C @ **$2.45**

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

LONG SWITCHES

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

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



SUPER CONDENSERS

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

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

NATIONAL DRUM DIAL

National Velvet Vernier drum dial, type H, for ¼" shaft. An automatic spring take-up assures positive drive at all times. Numbers are projected on a ground glass. Rainbow wheel changes colors in tuning. Order Cat. ND-H @ $3.13.

Precision Parts

800 TURN HONEYCOMB coil, total diameter 1¾ inches; will tune to 175 kc. with 0.0001 mfd. (or 20-100 mmfd equalizer). Cat. HC-800 @.....**$ .50**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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