ENGINEERING DATA

ON

VIBRATORS

As applied to Automobile and House Radio Receivers and Allied Equipment.

FERROCART A/ASIA PTY. LTD.
(A DIVISION OF ELECTRONIC INDUSTRIES LTD.)
126-130 GRANT STREET, SOUTH MELBOURNE.
Telephone: MXY 220.

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Standard Ferrocart Vibrators, Manufacturers' Type.

1. GENERAL

Although vibrators of one form or another have been in use for many years in telephone exchanges, and other similar environments, it was not until the development of automobile radio receiving sets that compact and relatively inexpensive vibrators were produced capable of withstanding the wide fluctuations of battery voltage and mechanical jarring found in a modern automobile. Not only do modern vibrators operate in any physical position, function over a wide range of conditions and give long life, but they are quiet both mechanically and electrically.

All of the synchronous and all of the non-synchronous vibrators are identical in construction except that a different driving coil is used for each voltage, and different numbers and arrangements of prong bases are used.

2. NON-SYNCHRONOUS VIBRATORS

This type of vibrator is also called "Single" or "Valve Type" since it has a reed vibrating so as to make alternate contact with a single contact on either side, and hence requires a separate rectifier to produce direct current for high potential supplies used in battery operated radio receivers. They are intended for use with a full-wave or centre tapped primary winding of a step-up transformer. The reed is energized by means of a small electromagnetic coil which acts on a magnetic armature mounted on the free end of the reed. The coil is connected electrically between the reed and the fixed contact which closes when the reed is attracted by the coil. Thus when the starting switch is closed, the vibrator coil is in series with one half of the transformer primary winding. The resistance of the vibrator coil is high compared to that of the primary winding, so that no appreciable effect is produced at this instant in the primary winding. However, the vibrator coil attracts the reed armature, closing the initial or "starting" contact thereby short-circuiting the coil. This creates a direct path for battery current to flow through the primary winding. The momentum of the reed keeps the initial contact closed for a time, and then the elasticity of the reed causes it to swing back, open the initial contact and close the second or "rebound" contact.

3. WAVE-FORM

When the primary winding of the transformer is connected directly to the battery, a counter electromotive force is induced in all of the transformer windings, which is in opposition to the battery potential, in the primary winding. The induced potential remains practically constant as long as the contacts remain closed. When the contacts open, the induced potential in the transformer windings starts to reverse. However, the rate of reversal is controlled by a condenser usually connected in shunt to the high potential secondary winding, sometimes called a "buffer" condenser. This condenser usually is given such a value that the induced potential in the primary winding has reversed but has not yet equalled the battery potential by the time the alternate contacts close. Since the direction of current flow around the transformer core is reversed when the alternate contacts close, the counter electromotive force during the second half-cycle will have a polarity opposite to the first. The result is that the wave-form of potential in all windings consists of a series of flat-topped half-cycles of alternate polarity. Each flat-topped wave is connected to the following one by a sloping line terminating in an abrupt voltage change just as the contacts close. The slope of the wave between flat-tops, that is, while both sets of contacts are open, is controlled by the size of the buffer condenser.

4. RECTIFICATION

When current of this wave-form is rectified by a full-wave rectifier of any type, a series of current impulses is obtained, each having the characteristic flat-topped wave shape, but all of the same polarity. This is passed through a smoothing filter consisting of an iron cored reactor or "choke," with a filter condenser, usually electrolytic, connected across the circuit at both input and output ends of the filter reactor. The output current and voltage from the smoothing filter is quite steady and contains negligible ripple if the reactor and condensers are of proper values.

In the case of automobile radio receivers, the ground or common electrical point of the receiver is connected to the low potential battery, and is negative with respect to the high potential required for the anodes. If a hot cathode rectifier is to be used, the cathode must be at a potential several hundred volts positive with respect to the battery, which is the best available source for cathode heating current. To meet this problem, overseas engineers introduced the first indirectly heated cathode rectifier for automotive use, in which there was sufficient insulation between heater and cathode to permit a potential difference of several hundred volts between them. Thus the heater is operated from the battery, but the cathode operates at full positive "B" potential. From this original rectifier developed the present 84 or 6Z4 type.

5. SYNCHRONOUS VIBRATORS

Another method of rectifying the output of the vibrator transformer is to add a second set of contact points on the reed to engage with a second set of fixed contacts. Such vibrators are called "synchronous" since primary and secondary contacts operate in synchronism, also "double" since there are two complete sets of full wave contacts, and "tubeless" since no rectifier tube is required. The secondary contacts are adjusted to close after and open before the corresponding primary contacts, to prevent destructive arcing. This results in an advantage over the non-synchronous type of vibrator, in that the primary contacts open and close at times when the transformer is disconnected from its load. The transformer in a no-load or idle condition draws the relatively small exciting or magnetizing current from the battery, so that the primary contacts operate at moments when they are carrying very little current. This prevents appreciable arcing at the primary contacts.

On the other hand, the secondary contacts are not required to open or close with a large difference of potential across them, since the input condenser of the smoothing filter retains nearly its full charge during

the interval that it is disconnected from the transformer secondary winding, and the prior closing of the primary contacts produces the full no-load potential of the secondary winding before the secondary contacts are brought together. As soon as the secondary contacts close, the secondary voltage drops from the no-load to the full-load value, which is not much lower if the transformer is designed to have good voltage regulation. When the secondary contacts reopen, the secondary voltage rises again to its no-load value. Thus the secondary contacts operate at times when very little difference of potential across them exists. By the time the primary contacts open the secondary contacts have separated far enough to prevent a spark from occurring.

Synchronous vibrators therefore have several advantages over non-synchronous vibrators: They eliminate separate rectifiers while costing no more than non-synchronous vibrators which they equal in external dimensions; they are more efficient, since they eliminate the power required to heat rectifier cathodes, and also the space potential drop inside the electronic rectifier; and they will handle relatively large amounts of output power with less deterioration than non-synchronous vibrators.

6. SPLIT REED SYNCHRONOUS VIBRATORS

Radio receivers with output tubes having directly heated filaments present a special problem in connection with the grid bias for the output stage. Unless a bias battery is used there is no way to obtain a potential more negative than the negative end of the filaments using an ordinary synchronous vibrator, since the moving contacts of the secondary circuit are electrically common with the primary reed contacts, which in turn are connected to one side of the battery. To meet this difficulty, the split-reed synchronous vibrator was developed. It differs from the normal synchronous vibrator in that the reed is divided longitudinally, each section carrying a set of contacts electrically insulated from those of the other section. The armature is mounted on the free ends of the two reed sections by means of small insulators, while the fixed ends of both reeds are insulated from one another and from the frame. The circuit is arranged so that the secondary reed is negative, and is returned to common or ground through a resistor which is by-passed by a condenser. The potential created across this resistor by the "B" current flowing through it is then used for grid bias. The design and operation of split-reed vibrators is otherwise the same as ordinary synchronous vibrators.

Elimination of Vibrator Interference.

1. GENERAL

The introduction of a vibrator into a radio receiving set for the purpose of obtaining a high voltage B supply from a lower direct current supply such as a storage battery, at once raises problems concerning the interference such a vibrator causes due to interrupting a direct current at a constant rate. These problems are entirely apart from such questions as mechanical vibration transmitted directly from the moving elements of the vibrator to the radio set. The mechanical cushioning of present-day vibrators is such that this is not an important factor.

Electrical interference from the vibrator may occur due to the following kinds of action:—

(1) **DIRECT PICK-UP** from the vibrator circuit by unshielded coils, exposed grid leads or the antenna lead itself.

(2) **ANODE MODULATION** of any of the high frequency amplifier or detector tubes, due to improper filtering of the anode supply voltage.

(3) **HEATER MODULATION** of any of the high frequency amplifier or detector tubes, due to improper filtering of the direct current connections to the heaters.

(4) **CHASSIS-COUPLED VOLTAGE PICK-UP** in any of the high frequency circuits, usually grid circuits, due to the chassis base acting as a common path for currents of signal frequencies, and the interfering currents from the vibrator circuit.

2. DIRECT PICK-UP

In order to eliminate direct pick-up all high frequency coils should be enclosed in individual shields. Grid leads should be kept as short as possible. The antenna lead should be shielded over its entire length from the point where it enters the receiver to the antenna coil itself. An effort should be made to make the mechanical design of the receiver such that all the power supply components are grouped together and should be kept as far away from the high frequency input of the receiver as possible.

3. ANODE MODULATION

Anode modulation is easy to detect and comparatively simple to cure. The simplest method of detecting this form of interference is to connect a resistance load of such a value that the power supply is operating under normal load, then supply the anode voltages to the receiver from batteries; if there is still interference, with the power supply operating under these conditions, it is evident that interference is occurring in another portion of the circuit. However, if the interference is reduced when the receiver is operating from batteries, then the high frequency choke reactor in the B output circuit, if used, is either too small, it has too high distributed capacitance, or the associated radio-frequency by-pass condenser is too small. Generally it need not be larger than 0.05 to 0.1 M.F. The axis of the high-frequency reactor should be changed to make sure it is not coupling to either the iron-cored choke reactor or the vibrator transformer. On tube type circuits the r.f. by-pass condenser is seldom required.

4. HEATER MODULATION

Heater modulation is usually detected by operating the power supply from a separate battery. When the power supply is obtained from a separate battery, a shielded cable should be used, grounded to the chassis, to prevent radiation of interference from this cable which might entirely mask the heater modulation interference.

It must be kept in mind that if any change is made which reduces the power of an interfering noise or signal by one-half the apparent reduction will be slightly more than detectible by the ear. This corresponds to a change of 3 decibels in loudness, while an actual change of approximately 10 decibels is necessary to give the impression of a 50 per cent. reduction in loudness. Thus if the interference is coming equally from two sources, elimination of either one will not seem to help much, but if both sources are eliminated simultaneously, the interference ceases entirely. The use of an output meter on the audio output is suggested, as changes of noise of much less than one half are easily detected, especially if the interference is relatively steady.

It has been found that receivers having high sensitivity may require two h.f. reactors between the battery or d.c. power supply, and the heaters. The use of the chassis as a common connection for all of the heaters is not recommended due to the chance of voltage pick-up in the chassis. This may not show up on model receivers, but in production, the resistance of the grounding may vary slightly, and cause large changes in the amount of interference caused. The heater circuit should be grounded to the chassis at only one point. The usual method is to wire all heaters together, grounding one of them to the chassis. The heater to be grounded should be found by experimenting to find the best point, as this will vary with different designs. Care should be taken that there are no radiating loops formed by the heater circuit which might couple to some portion of the high frequency amplifier.

5. CHASSIS-COUPLED VOLTAGE PICK-UP

Voltage pick-up due to improper grounding of the power supply and high-frequency amplifier elements is the most common source of interference and also the most difficult to locate. The simplest method of locating the source of interference is to short the grids of the tubes, starting with the output tube and determine in which stage of the amplifier the noise is originating. A common source of trouble is found in receivers using automatic volume control. In such receivers the tuned circuits are completed through condensers by-passing the grid return to ground. When these condensers are grounded directly to the chassis, a voltage which is developed across the common impedance between the point where the condenser is grounded and the wiping contact of the variable condenser is picked up and applied to the grid of the tube. In order to eliminate this interference the by-pass condenser should return directly to the wiper of the section of the variable condenser tuning that particular coil. The condenser wiper should be bonded to the chassis through a piece of heavy flexible copper braiding. As a rule, it is desirable to ground the variable condenser at only one point on the chassis.

Elimination of Vibrator Interference.

6. LOCATING INTERFERENCE IN A COMPLETED RECEIVER

In order to check for interference on a completed receiver, the antenna lead-in should be grounded through a .0002 M.F. condenser. If the interference appears with the lead-in short-circuited in this manner, but does not appear with it open, it indicates improper grounding of the primary circuit of the antenna coil. In some cases, this type of interference can be eliminated by returning the ground end of the antenna coil primary to the condenser wiper. Sometimes it will be found that there is less interference when the Automatic Volume Control condenser or the primary of the antenna coil is grounded to some point on the chassis rather than on the condenser wiper. This is due to an out-of-phase voltage being picked up and balancing out the interference, or neutralizing it. As a rule, this method of eliminating interference leads to erratic receivers in production, as small changes in the impedance of the current paths will change the balancing-out effect a great deal.

In some cases, interference has been located in the grid circuit of the first audio frequency tube, due to the ground return of the volume control being at a point remote from the tube's cathode circuit. Where diode detection is used, it has been found that often a hum voltage is induced in the last high-frequency transformer through coupling with the power transformer. The grid lead of the first audio tube will pick up considerable interference if it is long and unshielded, or if it runs close to the power supply or heater wiring.

7. COMPONENTS

Although the general construction of vibrator operated receivers follows the lines of a.c. sets, there are certain additional considerations with regard to some of the components having to do with the vibrator circuit.

8. VIBRATOR

Practically all vibrators now supplied to the industry have their own individual shields or metal housings. The shielding housing is not essential where the entire vibrator is enclosed within a shield together with the transformer and other components recommended to be so shielded. The vibrator housing will nearly always require grounding, however, especially if the housing projects into the unshielded space of the receiver. There are several ways in which the housing may be grounded. One most common way is to make a connection inside the vibrator, between the housing and the prong connected to the reed, which in turn is generally connected to the grounded side of the storage battery or d.c. source. Another method is to omit the internal strap, and ground the housing by means of a clamp surrounding the vibrator socket, having 6 or 8 spring fingers which grip the lower part of the housing firmly. Such vibrator ground clamps can also be obtained with bent or "formed" ears which fit into an annular groove at the lower edge of the housing, thereby preventing the vibrator from working loose from the socket, even if mounted in a position other than vertical. Another method less often used is to connect the housing to an otherwise insulated prong of the vibrator base plug, grounding the corresponding socket jack as desired for best results.

Elimination of Vibrator Interference.

9. PRIMARY RESISTORS

For 6-volt operation, it is generally found that improved operation is obtained if a resistor of from 50 to 100 ohms is connected from the reed of the vibrator to each stationary contact, the leads being as short as possible. The rating should be from ½ to 1 watt. For operation on other voltages, the resistance will vary approximately as the square of the voltage.

10. HIGH-FREQUENCY FILTER BETWEEN VIBRATOR CIRCUIT AND BATTERY

In stationary radio receivers containing vibrators, it is necessary to place a filter between the d.c. supply and the vibrator circuits to prevent interference from coupling to the signal circuits via the d.c. supply. In automobile receivers it is also necessary to prevent interference from the ignition system of the car from entering the radio receiver. It has been found that it is seldom necessary to use suppressor devices on the spark system of an automobile, if certain filter elements are added to the receiver, which are designed to operate at very high frequencies.

From one to three **air cored choke reactors** are used in the battery lead to the vibrator circuit, having from 30 to 100 turns of sufficiently heavy wire to carry the current. One form of choke which has been used satisfactorily in many sets consists of 74 turns of No. 16 A.W. Gauge wire (0.05 inch, 1.29 mm. diameter) wound with 4 layers insulated with paper, on a mandrel having a diameter of 5/16 inch (7.94 mm.). Single layer chokes are also used. When multilayer chokes are used, it is usually best to connect the inner end toward the d.c. supply; the outer end, toward the vibrator.

To prevent interference from the vibrator, **condensers** of approximately 0.5 M.F. are connected to ground from both sides of the choke nearest the vibrator, if more than one is used. These must have very low power factor at high radio frequencies, and must have short leads, of low resistance material. The ground return of these condensers should be as short as possible and soldered directly to the chassis. The ground connection to the vibrator reed should be soldered to the same point as these condensers.

To prevent spark interference from the automobile motor, low-capacity condensers called **spark plates** are used, generally connected between ground and the ends of the air-cored choke nearest the battery, if more than one is used. These condensers have a capacitance of from 10 to 100 mmf., usually between 20 and 50 mmf. One type of spark plate consists of a steel plate having an area of several square inches riveted to the radio case by insulated rivets, and insulated from the case by either mica or a good grade of insulating or fish paper, to give the desired capacitance. Spark plates are not required on non-automobile sets.

Elimination of Vibrator Interference.

11. HIGH-FREQUENCY FILTER IN HIGH-VOLTAGE OUTPUT CIRCUIT

To keep vibrator interference from reaching the anode supply circuit an air-cored high-frequency choke reactor is placed between the iron-cored choke reactor and the cathode of the rectifier tube, or centre tap of the secondary winding of the transformer in synchronous vibrator circuits. It has an inductance of from 0.5 to 5 milhenrys, and should be of "universal" or self-supporting construction, having low distributed capacitanoe. It should be physically small to restrict its external field.

A by-pass condenser of from 0.0005 to 0.1 M.F. capacitance may be required connected between ground and the side of the air-cored choke nearer the interference. In tube type circuits, this condenser is seldom required.

In some cases, the high-frequency filter is placed on the other side of the smoothing filter, that is, between the iron-cored choke and the tube anodes.

12. SMOOTHING FILTER

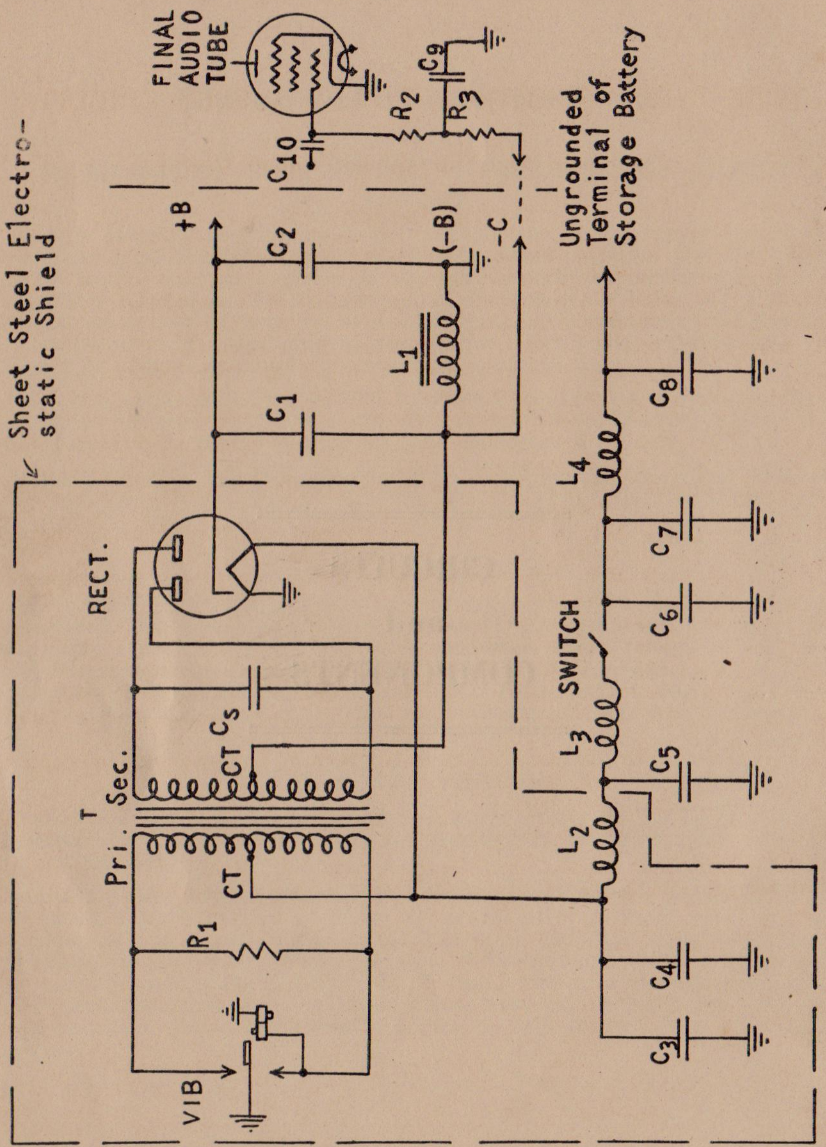
The rectified high-voltage direct current is smoothed out by means of an **iron-cored choke reactor**, shunted by electrolytic condensers much as in a.c. radio receivers. The **input filter condenser** may be from 4 M.F. up, and the **output filter condenser** from 6 M.F. up to as high as 30 M.F. if exceptionally good filtering is required. The choke usually has a resistance (d.c.) of from 200 to 500 ohms, with an inductance of from 5 to 30 henrys.

13. SPARK FILTERS

Besides the spark plates and high-frequency chokes in the battery leads, interference filters or condensers are required on all other leads from or to the receiver.

In the antenna lead-in, a small high-frequency reactor as small as 20 to 40 turns, ¼ to ½ inch in diameter (6 to 12 mm.) is used, with by-pass condensers. In many cases, the lead-in is of shielded wire, which acts as a by-pass condenser. The other side of the antenna choke is by-passed by a small spark plate of from 5 to 20 mmf., usually with mica insulation. Any other leads, such as to dial lamps, external controls, etc., usually require spark plates to prevent bringing in interference from the spark system.

CIRCUITS and COMPONENTS



TUBE TYPE VIBRATOR B POWER SUPPLY CIRCUIT.

(Final Bias from Filter Choke Voltage Drop.)

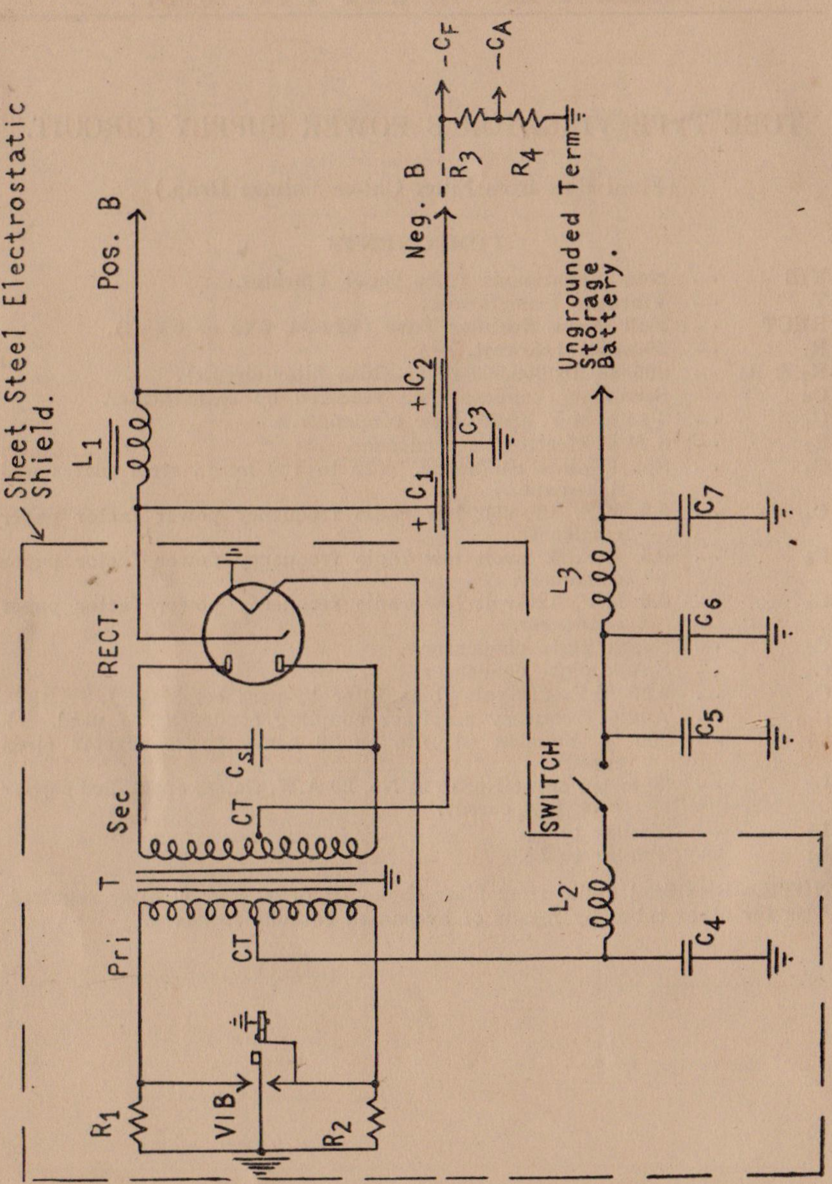
TUBE TYPE VIBRATOR B POWER SUPPLY CIRCUIT.

(Final Bias from Filter Choke Voltage Drop.)

COMPONENTS

VIB	—	Non-synchronous (tube type) Vibrator.
T	—	Vibrator Transformer.
RECT	—	Full Wave Rectifier Tube (6Z4-84, 6X5 or 6X5G).
R_1	—	200-ohm 1/3-watt.
R_2 & R_3	—	200,000 to 300,000 ohms (bias filter circuit).
C_s	—	Secondary condenser as required by transformer.
C_1	—	4 to 8 M.F. electrolytic condenser.
C_2	—	8 M.F. electrolytic condenser.
C_3	—	Spark plate condenser. (20 to 100 mmf., steel plates and fish paper.)
C_4	—	0.5 M.F. 120-volt low radio frequency power factor paper condenser.
C_5	—	0.5 M.F. 120-volt low radio frequency power factor paper condenser.
C_6	—	0.5 M.F. 120-volt low radio frequency power factor paper condenser.
C_7	—	Spark plate condenser.
C_8	—	Spark plate condenser.
C_9	—	0.25 M.F. 200-volt (bias filter by-pass condenser).
C_{10}	—	Audio frequency amplifier coupling condenser, if used.
L_1	—	200 to 400-ohm (d.c.) 5 to 30 henry choke reactor (iron cored).
L_2	—	30 to 100 turns No. 16 to No. 20 A.W. Gauge enamelled copper wire (air cored).
L_3	—	Similar to L_2.
L_4	—	Similar to L_2.

NOTE.—Bias final audio from filter choke IR drop, R & C filter required. Bias for other tubes by means of by-passed cathode resistors.



TUBE TYPE VIBRATOR POWER SUPPLY CIRCUIT.

(Final and First Audio Bias from Series Resistors.)

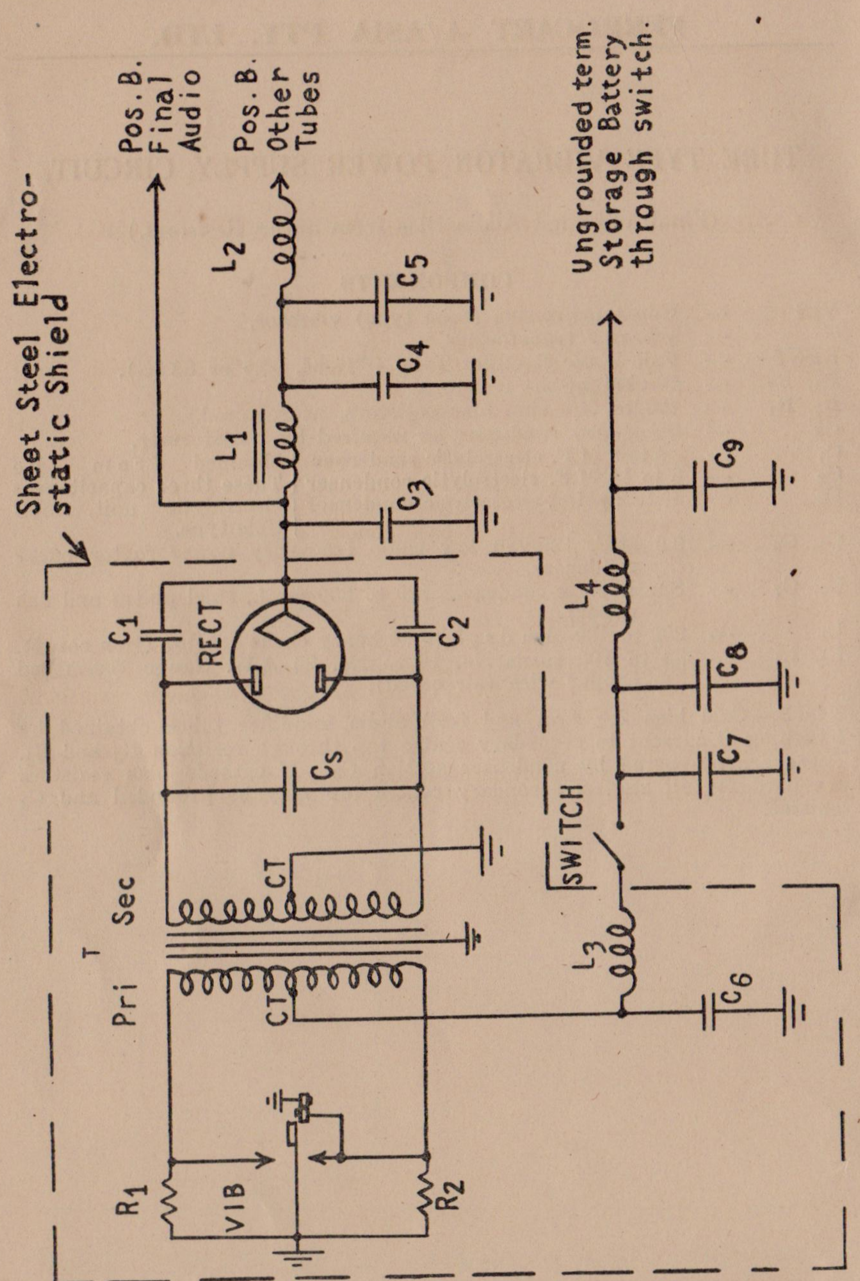
TUBE TYPE VIBRATOR POWER SUPPLY CIRCUIT.

(Final and First Audio Bias from Series Resistors.)

COMPONENTS

VIB	—	Non-synchronous (tube type) vibrator.
T	—	Vibrator transformer.
RECT	—	Full Wave Rectifier Tube (6Z4-84, 6X5 or 6X5G).
R_1, R_2	—	50-ohm ½-watt resistors.
R_3, R_4	—	100 to 500 ohm bias resistors, as required.
Cs	—	Secondary condenser as required by transformer.
C_1	—	4 to 8 M.F. electrolytic condenser } These three capacitances obtained from one electrolytic unit, multiple type.
C_2	—	6 to 10 M.F. electrolytic condenser }
C_3	—	10 to 20 M.F. electrolytic condenser }
C_4, C_5	—	0.5 M.F. 120-volt low radio frequency power factor paper condenser.
C_6, C_7	—	Spark plate condenser (20 to 200 mmf., steel plates and fish paper).
L_1	—	200 to 400-ohm d.c., 5 to 30 henry choke reactor (iron cored).
L_2, L_3	—	30 to 100 turns No. 16 to No. 20 A.W. Gauge Enamelled copper wire (air cored).

NOTE.—Grid bias for first and final audio amplifier tubes obtained by returning B current to secondary centre tap through resistors R_3 and R_4. These are by-passed by condenser section C_3. If cathode bias resistors are used for all stages, secondary centre tap may be grounded and C_3 omitted.



TUBE TYPE VIBRATOR POWER SUPPLY CIRCUIT.

Self-Heating Cathode Gaseous Tube Rectifier (OZ4 or OZ4G).

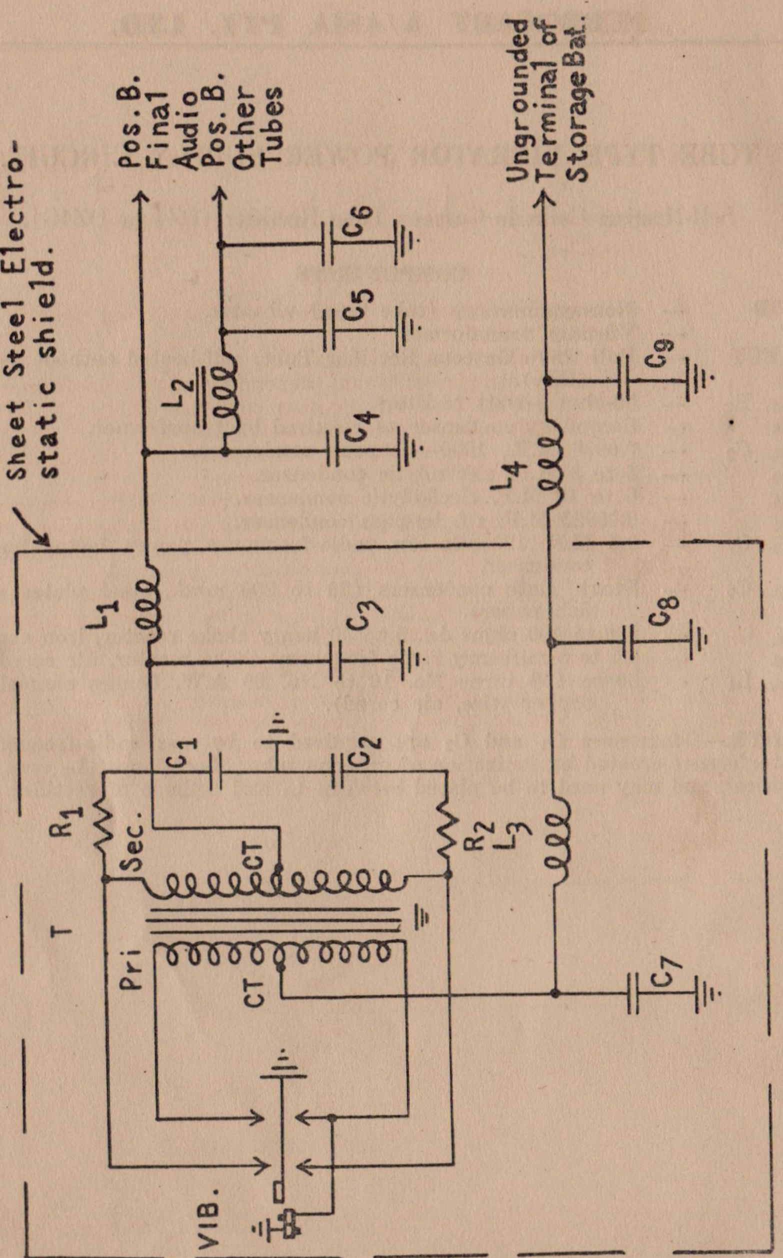
TUBE TYPE VIBRATOR POWER SUPPLY CIRCUIT.

Self-Heating Cathode Gaseous Tube Rectifier (OZ4 or OZ4G).

COMPONENTS

VIB	—	Non-synchronous (tube type) vibrator.
T	—	Vibrator transformer.
RECT	—	Full wave Gaseous Rectifier Tube, self-heated cathode type; (OZ4).
R_1, R_2	—	50-ohm ½-watt resistors.
Cs	—	Secondary condenser as required by transformer.
C_1, C_2	—	0.0008 M.F., 1000-volt peak condensers.
C_3	—	4 to 8 M.F. electrolytic condenser.
C_4	—	6 to 10 M.F. electrolytic condenser.
C_5	—	0.00025 M.F. r.f. by-pass condenser.
C_6, C_7	—	0.5 M.F. 120-volt low radio-frequency power factor paper condenser.
C_8, C_9	—	Spark plate condensers (20 to 200 mmf., steel plates and fish paper).
L_1	—	200 to 400 ohms d.c. 5 to 30 henry choke reactor, iron cored.
L_2	—	0.5 to 5-milhenry radio-frequency choke reactor, air cored.
L_3, L_4	—	30 to 100 turns No. 16 to No. 20 A.W. Gauge enamelled copper wire, air cored).

NOTE.—Condensers C_1 and C_2 are required to by-pass radio-frequency interference created by ionization of gaseous tube. Location of L_2 may be critical, and may need to be placed between L_1 and cathode of rectifier.



SYNCHRONOUS VIBRATOR B POWER SUPPLY CIRCUIT.

For use with indirectly heated cathode type tubes.

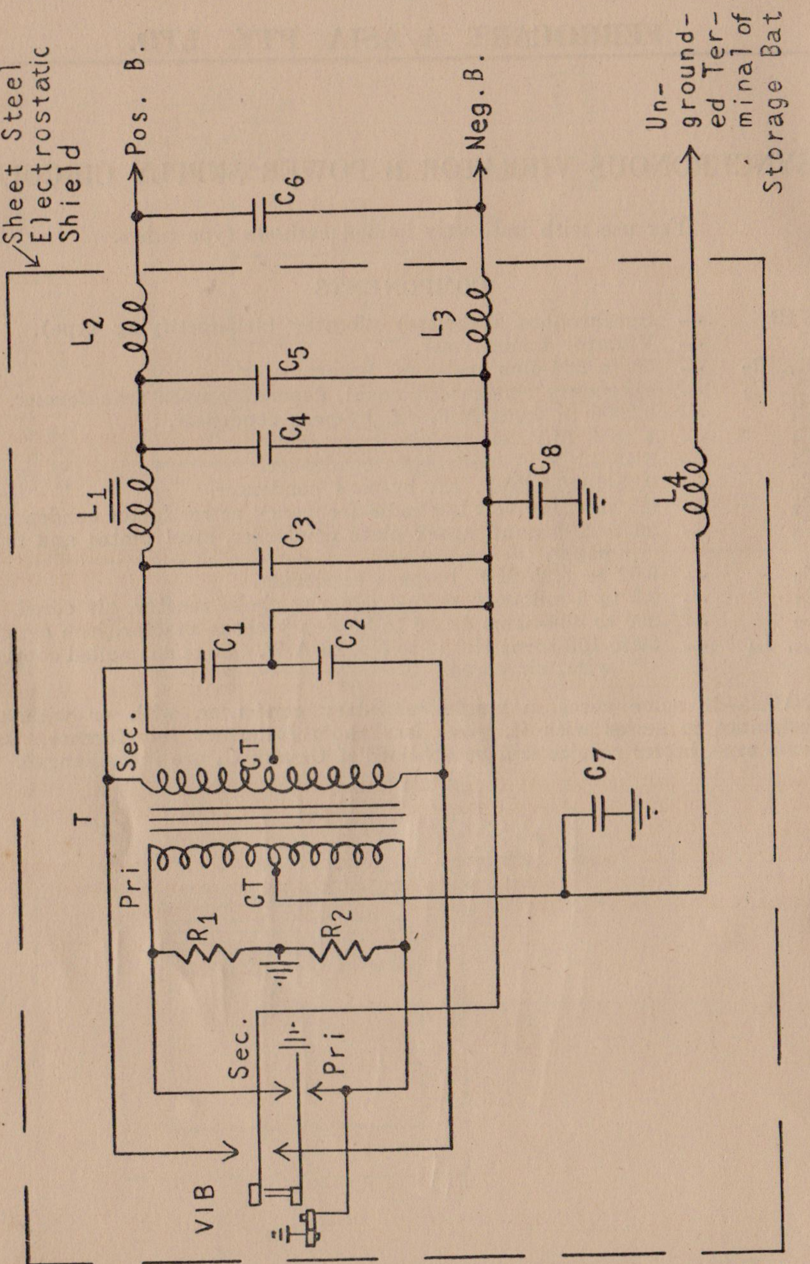
SYNCHRONOUS VIBRATOR B POWER SUPPLY CIRCUIT.

For use with indirectly heated cathode type tubes.

COMPONENTS

VIB	—	Synchronous (tubeless) vibrator (self-rectifying type).
T	—	Vibrator transformer.
R_1, R_2	—	50 to 250-ohm resistors, ½-watt.
C_1, C_2	—	Secondary condensers, equal, depending upon transformer.
C_3	—	0.0005 to 0.001 M.F. r.f. by-pass condenser.
C_4	—	4 to 8 M.F. electrolytic condenser.
C_5	—	6 to 12 M.F. electrolytic condenser.
C_6	—	0.05 to 0.5 M.F. r.f. by-pass condenser.
C_7	—	0.5 M.F. 160-volt low radio-frequency power factor condenser.
C_8	—	20 to 200 mmf. spark plate condenser, steel plates and fish paper.
C_9	—	0.02 to 0.25 M.F. by-pass condenser.
L_1	—	0.5 to 5-milhenry radio-frequency choke reactor, air cored.
L_2	—	200 to 400-ohms d.c., 5 to 30 henry choke reactor, iron cored.
L_3, L_4	—	30 to 100 turns No. 16 to No. 20 A.W. Gauge enamelled copper wire, air cored.

NOTE.—In some cases, a single secondary condenser, with or without resistance in series with it, gives less radio frequency interference. In some case, better results will be obtained if C_3 and C_4 are interchanged.



SPLIT-REED SYNCHRONOUS VIBRATOR B POWER SUPPLY CIRCUIT.

For use with Receivers having Filament Type, Directly Heated Tubes.

SPLIT-REED SYNCHRONOUS VIBRATOR B POWER SUPPLY CIRCUIT.

For use with Receivers having Filament Type, Directly Heated Tubes.

COMPONENTS

VIB	—	Split-Reed Synchronous Vibrator.
T	—	Vibrator Transformer.
R_1, R_2	—	100-ohm 1/3-watt resistors.
C_1, C_2	—	Secondary condensers, equal, as required by transformer.
C_3	—	4 to 8 M.F. electrolytic condenser.
C_4	—	6 to 12 M.F. electrolytic condenser.
C_5	—	0.05 to 0.25 M.F. r.f. by-pass condenser.
C_6	—	0.01 to 0.05 M.F. r.f. by-pass condenser.
C_7, C_8	—	0.1 to 0.5 M.F. 120-volt low r.f. power factor paper condensers.
L_1	—	200 to 400-ohm d.c. 5 to 30 henry choke reactor, iron cored.
L_2, L_3	—	Dual radio frequency choke reactor, 0.5 to 5-milhenry, each.
L_4	—	30 to 100 turns No. 16 to No. 20 A.W. Gauge enamelled copper wire, air cored, single or double layer.

NOTES.—Condensers C_1 and C_2 may require resistors in series with them, or better results in elimination of interference may be obtained by substituting a single secondary condenser, with or without series resistance. Primary resistors R_1 and R_2 may not be required.

Negative B lead connected to ground through bias resistors, with suitable by-pass condensers, thereby obtaining grid bias for directly heated, filament type cathode tubes.

Where greatest power efficiency is required, as for battery operated receivers in remote locations with limited charging means, filament type tubes with split-reed vibrator power supply is recommended.

NOTES

VIBRATORS.

Part No.	Ferrocart Type No.	Type	Voltage	No. pins base	Bobbin ohms.	Output Voltage	Sec. current each side	Freq. Reed	Base Chart	No. of Test Transformer
PM 104	18978	Synch.	6	5	55	150	10 mils.	100	G	PT 455
PM 126	18178	Sp. Reed	6	6	55	90	10 „	100	N	PT 194
PM 131	18938	Non Syn.	6	6	55	230	20 „	100	D	PT 232
PM 132	18938	Non Syn.	12	6	260	230	20 „	100	D	PT 182
PM 237	18938	Non Syn.	6	6	33	230	20 „	150	D	PT 232
PM 238	18938	Non Syn.	12	6	144	230	20 „	150	D	PT 182
PM 410	18978	Syn.	2	5	5.7	90	10 „	100	G	TP -152
PM 411	D18978	Syn.	4	6	26	150	10 „	100	O	TP-97 Delco
PM 412	18978	Syn.	4	5	26	150	10 „	100	G	TP-97
PM 413	18978	Syn.	6	6	55	150	10 „	100	I	PT 455
PM 414	D18978	Syn.	6	6	55	150	10 „	100	O	PT 455 Delco
PM 415	18978	Syn.	12	6	260	150	10 „	100	I	TP-75
PM 415A	The same as PM 415; except that the can is not soldered, and the earth lead is omitted.								G	Transmission
PM 416	18978	Syn.	12	5	260	150	10 „	100	G	TP-75
PM 417	18978	Syn.	32	5	1,000	150	10 „	100	A	TP-45
PM 418	18938	Non Syn.	6	4	33	230	20 „	150	A	PT 232
PM 419	18938	Non Syn.	12	4	144	230	20 „	150	N	PT 182
PM 420	18178	Sp. Reed	12	6	260	250	20 „	100	H	PT 421
PM 433	18978	Syn.	6	5 UY	55	150	10 „	100	I	PT 455
PM 469	18978	Syn.	24	6	750	200	10 „	100	C	TP 1208
PM 471	18938	Non Syn.	6	5 UY	33	230	20 „	150	I	PT 232
PM 472	18978	Syn.	4	6	26	150	10 „	100	I	TP-97
PM 525	18978	Syn.	32	6	1,000	150	10 „	100	H	TP-45
PM 526	18978	Syn.	4	5 UY	26	150	10 „	100	N	TP-97
PM 529	18178	Sp. Reed	2	6	5.7	90	10 „	100	N	PT 413
PM 530	18178	Sp. Reed	4	6	26	150	10 „	100	I	TP-97
PM 535	18978	Syn.	12	6	260	150	10 „	100	J	TP 75 Kingsley
PM 535A	The same as PM 535; except for Base connections									”
PM 541	18978	Syn.	2	6	5.7	150	10 „	100	I	TP-152
PM 570	18978	Syn.	32	5 UY	1,000	150	10 „	100	H	TP-45
PM 582	18978	Syn.	12	5 UY	260	150	10 „	100	H	TP-75
PM 598	18938	Non Syn.	32	6	1,000	150	10 „	100	D	TP-45
PM 807	18978	Syn.	14.5	6	260	150	10 „	100	I	TP-75 R.A.A.F.
Is the same as PM 415A, but is adjusted to suit 14.5V; and can is soldered.										
PM 402	18978	Syn.	6	6	55	230	20 „	100	D	PT 232 Homecrafts
(is wired as a Non Syn.)										valve testers
PM 593	—	Syn.	12	6	260	230	20 „	100	D	PT 182 Ferrocart
(is wired as a Non Syn.)										
PM 640	—	Syn.	6	6	55	150	10 „	100	J	PT 455 Ferrocart
*PM 652	—	Sp. Reed	6	6	55	250	10 „	100	N	PT 667
*PM 357	—	Sp. Reed	12	6	260	250	20 „	100	N	PT 421

NOTE:

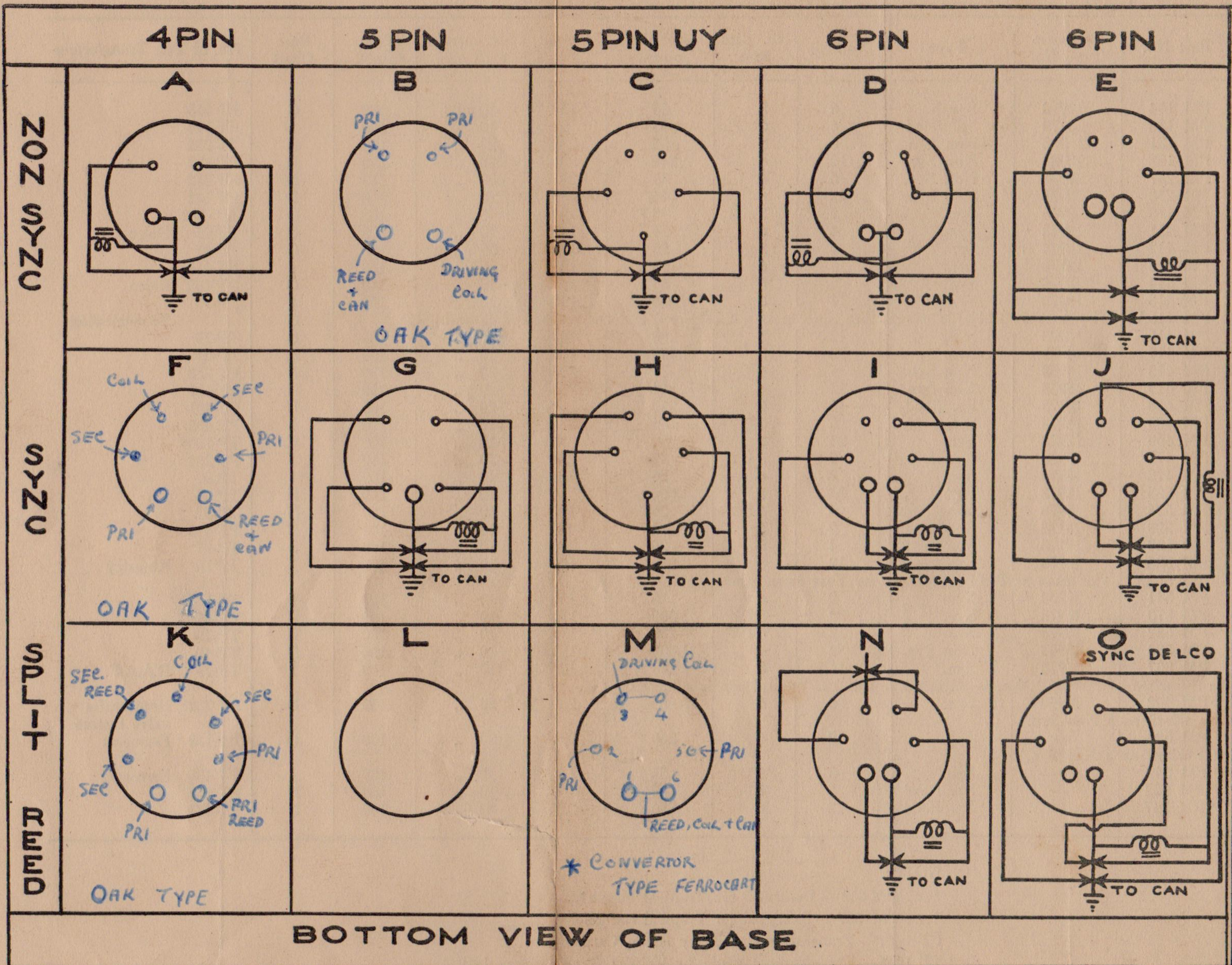
* = PM 652 — Designed for Tropical conditions.

* = PM 357 — Designed for Tropical conditions.

PT type — Transformers made by Radio Corporation.

TP type — Transformers made by Trimax Transformers Ltd.

Base connections "J" correspond to Oak type V5124.



* = 32 VOLT OPERATION

5000 Ω RESISTOR FROM PIN 3 to PIN 4 = 110 VOLT }
10,000 Ω " " " " " = 220 " } OPERATION.

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