SPECIFICATION AND APPLICATION DATA

WEARITE "STRATOSIL" VIBRATORS

Manufactured under Licence of the
OAK MANUFACTURING Co.
CHICAGO, U.S.A.

W R I G H T A N D W E A I R E L I M I T E D

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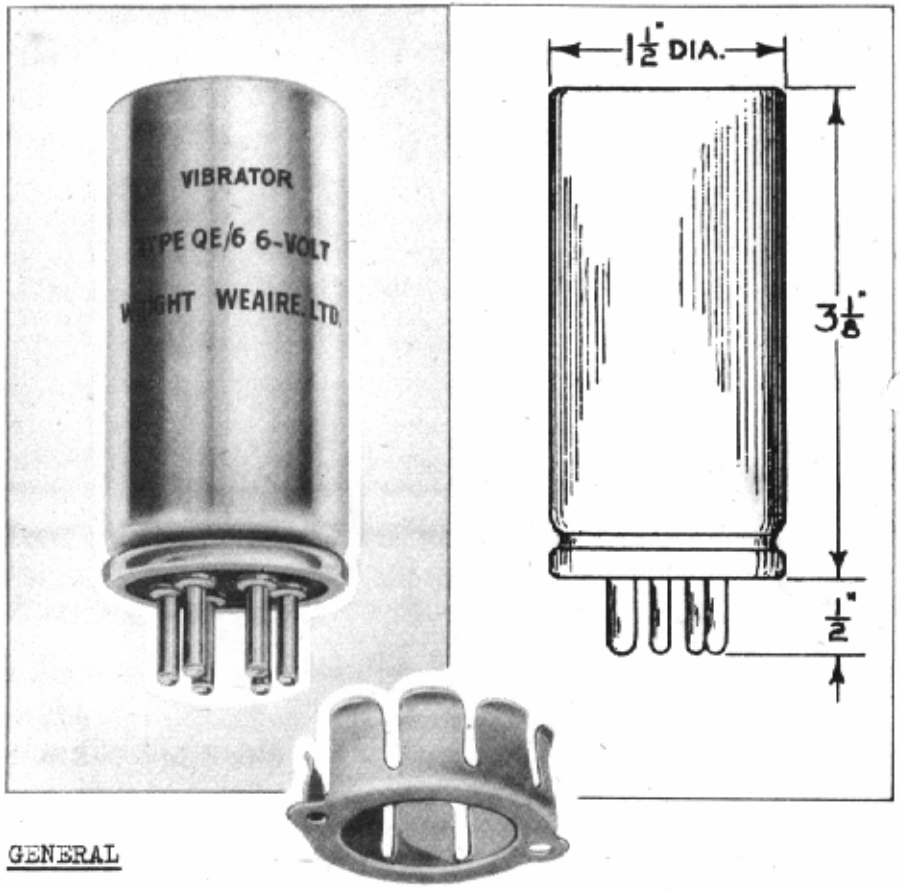
PRICE in Great Britain 6d

WEARITE STRATOSIL VIBRATORS

SPECIFICATION AND APPLICATION DATA



GENERAL

"Wearite" Stratosil Vibrators are completely sealed in cylindrical aluminium containers 1½" dia. and 3 1/8" long excluding pins which are ½" in length. The latter project through the neoprene board which forms a fully tropicalised seal. Weight 3½ ozs. Shipping Weight per 100 - 30 lb.

Earth clip, Type V.105. This is of zinc plated steel. Fixing holes on 1½" centres (4BA clearance), centre hole 1 1/8" dia. Weight ½ oz.

Bases - Standard U.X. 4, 5, 6 or 7-pin, according to series.

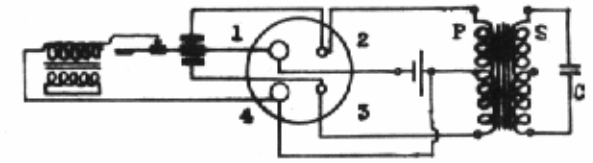
INTRODUCTION

The operation of electronic apparatus from low voltage D.C. sources is a requirement that often arises,

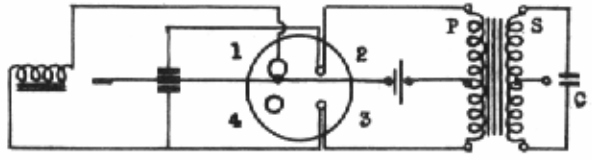
the most obvious being provision of the H.T. supply for mobile radio equipment. For such purposes "WEARITE" Vibrators have proved both an efficient and economical solution. The following notes will assist users of "WEARITE" Vibrators in obtaining the most satisfactory results by selection of the appropriate type of Vibrator and the correct operating conditions.

The principle on which a vibrator operates is generally well known, and may be summarised as follows. A steel reed carrying a pair of contacts is maintained in vibration by an electromagnet; this vibration effects switching of the battery voltage alternately in opposite directions across the primary winding of a suitable transformer. An alternating E.M.F. is induced in the secondary winding which may then be rectified if a D.C. output is required.

Two methods of energising the vibrator driving coil are in common use; the series driven vibrator makes use of an independent driving circuit and a separate driving contact on the reed as in "Wearite" Types N.S. and Q.F.A. The shunt driven type has the driving coil connected in shunt with one of the main contacts, by which it is periodically short-circuited. This type is represented by "Wearite" NSB, QF, QD, and QE units. There is no essential difference in operation of the transformer circuit with either of these two types, but both are available for replacement of existing vibrators (See Fig 1).



Series-driven vibrator type N.S.



Shunt-driven vibrator type N.S.B.

Fig 1. Basic vibrator circuits providing A.C. output.

It should be noted that due to the inductance in the circuit a very high inverse voltage is developed when the vibrator contacts open, which would cause rapid breakdown of the transformer and vibrator. It is necessary therefore to reduce this effect to a minimum by means of a correcting capacitor known as the "buffer" condenser ("C" in Fig 1), which may either be connected across the primary winding, or provided by reflection of an equivalent capacitor connected across the secondary. In the latter case it should be noted that the condenser must be rated to withstand about five times the normal working voltage of the transformer. The value of the buffer condenser depends somewhat on transformer design and circuit conditions. For a radio receiver it is normally of the order of 0.01-0.02 mfd. when connected across the secondary winding. If the waveform of the primary voltage is observed on an oscillograph the correct value of the buffer condenser is easily determined (See Fig 2).

Another method of checking this value is to connect an ammeter in one input lead and, with the secondary load disconnected, to adjust the value of buffer capacitor until the input current to the transformer is at a minimum. For vibrators operating on voltages greater than 12, it is advisable to connect the buffer capacitor across the primary winding; the value of this capacitor must then be increased as the square of the turns ratio (secondary/primary).

TRANSFORMER DESIGN

A correctly designed transformer circuit is most important if the life of the vibrator is not to be prejudiced. A low magnetising current (consequently low working flux density - 5000 - 6000 lines per sq.cm.), should be aimed at, also a low "total-loss" lamination material should be used for maximum efficiency. The nominal operating frequency of "Wearite" Vibrators is 105 cycles ± 7%, and the nominal contact closure time (sometimes known as the timing efficiency) is 40% mean for each pair of contacts, or 80% overall. This represents the percentage time of the operating cycle during which the battery current is flowing through the primary winding of the transformer, and governs the value of average voltage produced. Both these factors must be taken into consideration when designing the transformer, the core area (or turns per volt) required being half that needed on a 50 cycle supply, and as the primary winding (and secondary in the case of synchronous vibrators), is only in use half the time, the heating is reduced and the required copper area is only 0.707 that of a mains winding for the same current.

Details of a typical transformer to provide an unsmoothed output of 300 volts at 60 milliamps from a 6

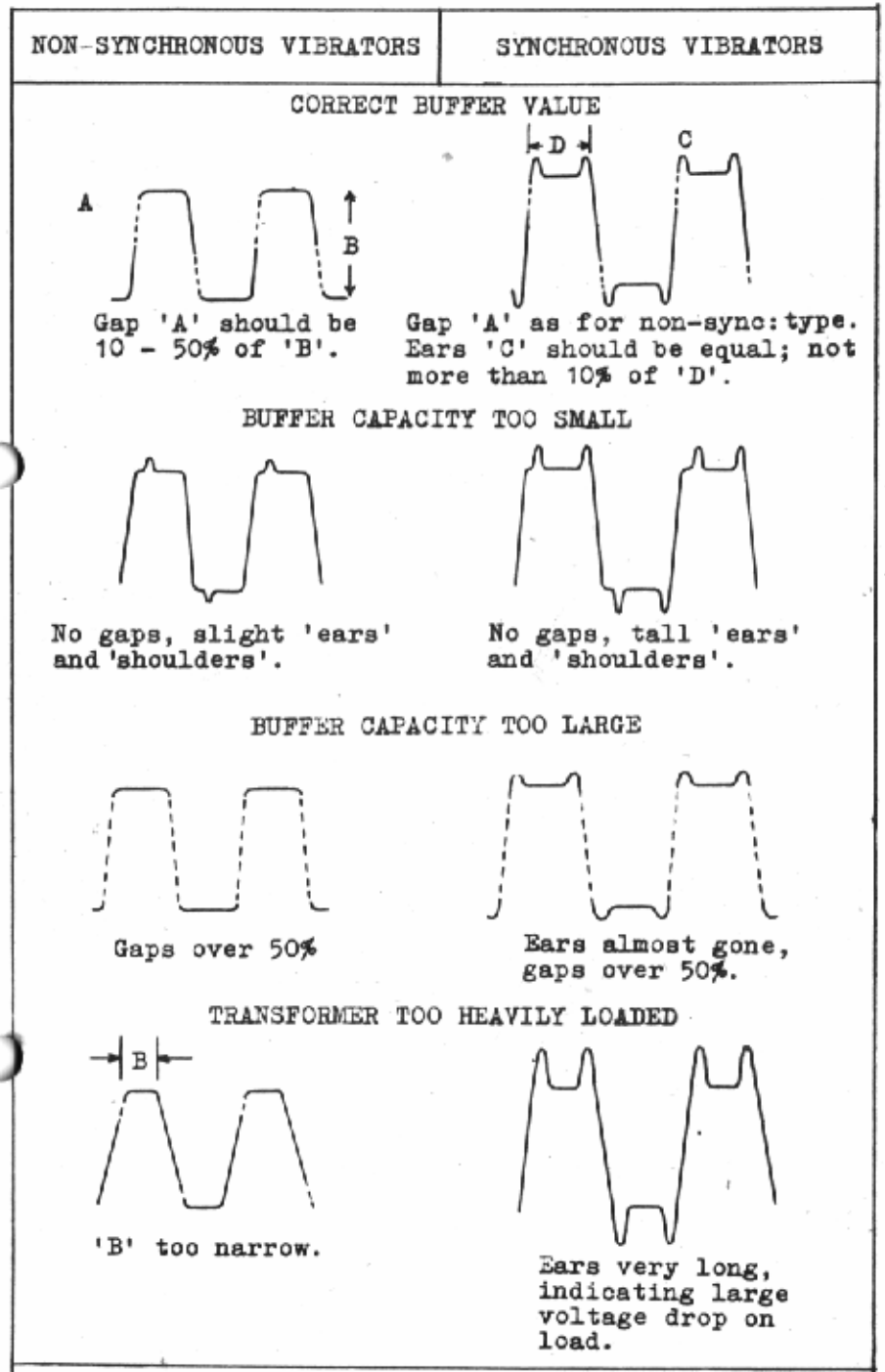


Fig 2. Characteristic waveforms under various circuit conditions.

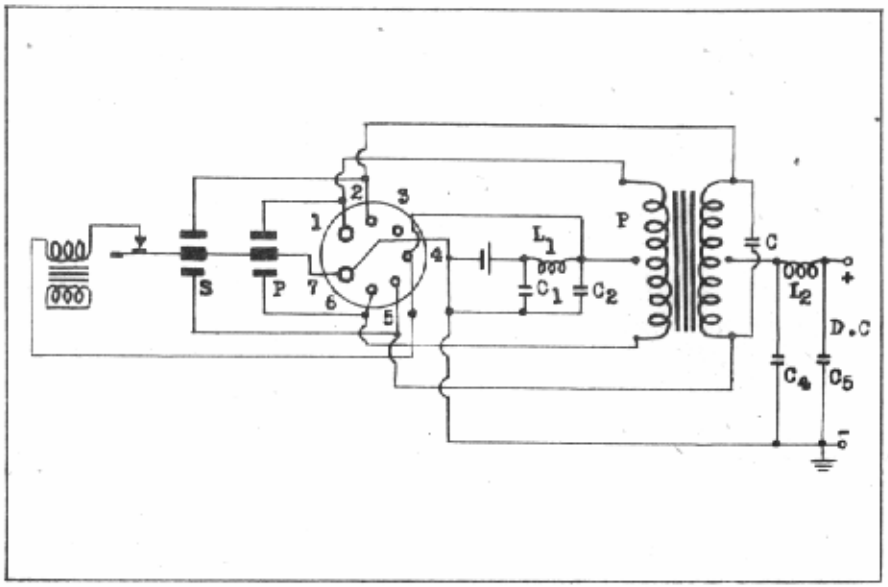


Fig 3. Basic circuit for synchronous vibrator Type QFA providing D.C. output, (excluding reservoir condenser and smoothing circuit). When vibrator QF is used omit connections to Pin No.4. Component values as for Fig 4.

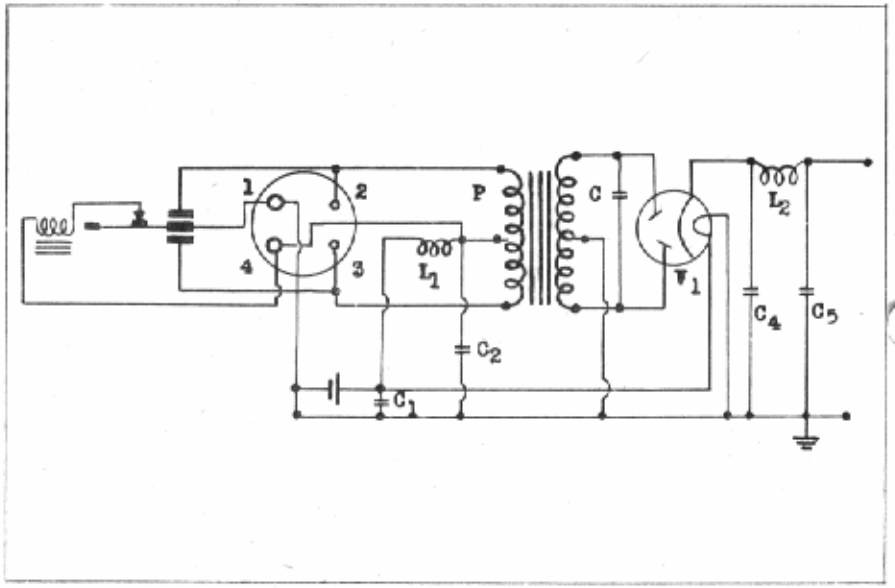


Fig 4. Circuit for simple power supply using Wearite non-synchronous vibrator Type NS with valve rectification, (excluding reservoir and smoothing circuit). When vibrator NSB is used omit connection to Pin No. 4.

or 12 volt synchronous vibrator, are as follows:

Laminations: 0.020" thick, 1½" stack, type similar to 43A (Scott).

Secondary: (wound first), 3200 turns, 38 swg enamelled copper wire, tapped at 1600 turns: 0.001" paper between layers. Outer cover of three layers 0.005" paper.

Screen: one layer 38 swg enamelled copper wire, covered three layers 0.005" paper.

Primary: (6 volt), 48 turns 16 swg enamelled copper wire, tapped 24 turns.

Primary: (12 volt), 96 turns 20 swg enamelled copper wire, tapped 48 turns.

RECTIFICATION

When a D.C. output is required, valve or metal rectifiers may be employed; half-wave rectification however is not recommended. Alternatively the synchronous (self-rectifying) vibrator may be used, in which the reed carries an additional pair of contacts which automatically reverses the output connections at the appropriate part of the operating cycle, so that a D.C. output is obtained (see Fig 3). It should be noted that the input and output circuits have a common connection of the primary and secondary contacts via the reed. In order to reduce arcing at the contacts, these are adjusted during manufacture so that the secondary circuit closes after, and opens before, the primary circuit. "Wearite" vibrators typical of this class are Types QFA, QE, QD, and QF. Where isolation of the input and output circuits is necessary, as in polarity changing circuits, or where bias is to be derived from a resistor in the negative H.T. line, the split-reed vibrator Type QXA should be used. Whichever system of rectification is used it is essential that the smoothing circuit should be of the condenser input filter type, and in general, capacities of 8 mfd. with a choke of 10 Henrys ("Wearite" CLF1) will be satisfactory.

R.F. SUPPRESSION

When vibrator power supplies are to be used in conjunction with radio apparatus some measure of R.F. suppression is necessary which may be provided by suitable R.F. chokes and condensers in the input and output circuits. Values cannot be given which will meet every case, but the circuit arrangement shown in Fig 4 is

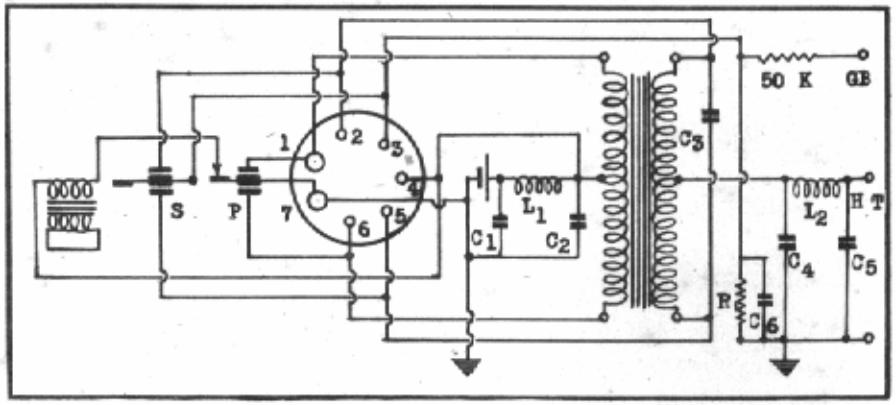


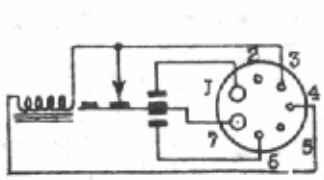
Fig 5. Basic circuit for Split Reed Vibrator Type QXA. Grid bias derived from resistor R. C.6 = 50uf, working voltage dependent on bias required.

suitable for normal radio service operating on the usual short, medium and long wave bands. It must be emphasised however, that great care is necessary in the design of vibrator power units to reduce radiated interference to a minimum by careful screening. The whole power pack should be enclosed in an iron box, and all earth connections should be common to one point on the chassis. It is often necessary to use heavy screened leads from the battery, and it is sometimes found that earthing the screening at a suitable point will considerably reduce interference. When directly heated valves are used in the receiver the filament supply leads should be by-passed by a capacitance of 200-500 mfd. and a choke of about 50 micro-Henrys should be connected in the "hot" filament lead.

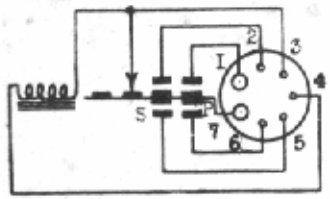
The simple R.F. suppression circuit of Fig 4 may also be applied to the synchronous vibrator of Fig 3, and the choke "L1" must be in the battery lead common to both vibrator and transformer. Suitable R.F. chokes and vibrator transformer for Figs 3 and 4 are manufactured by "Wearite". The transformer provides 250-0-250v. at 60m/a and for 6 volt input is type T1125 and for 12 volt, T1123. L1 is type DN 1129, L2 DN 1132. Condensers C1 and C2 = 0.5 mfd. 50v. C3 = .01 mfd. 2000v. C4 = .25 mfd. 500v. C5 = .01 mfd. 500v. Rectifier Valve V1 = 6X5, EZ35, or OZ4.

POWER RATING

The power output obtained from a vibrator power supply is limited by the maximum permissible contact current, and for a 6 volt "Wearite" Vibrator it will be of the order of 5 amperes, giving an

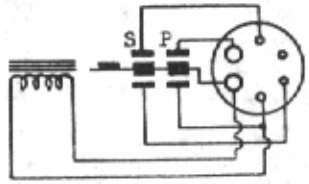


SERIES LP

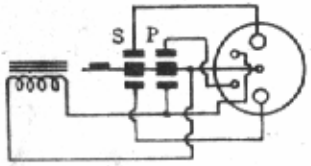


SERIES QGA

Low consumption types, circuit arrangements as for type NS and QFA. A resistance of 150 ohms must be connected across pins 3 & 4.

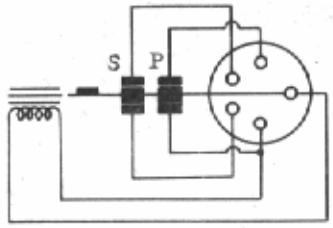


SERIES QE

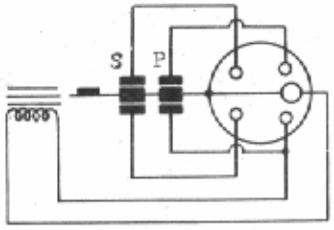


SERIES QD

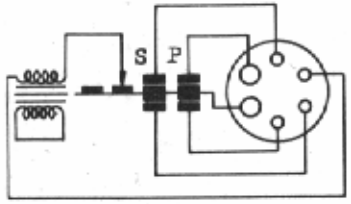
Circuit arrangements as for type QF



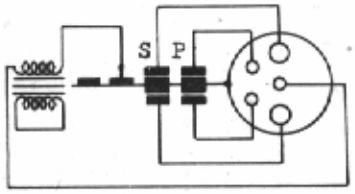
SERIES QL



SERIES QH



SERIES QEA



SERIES QDA

Fig 6.

input power of approximately 30 watts. When designing vibrator power supplies, the fact that the overall efficiency of the unit is unlikely to exceed 70% must be taken into consideration, in which case the available output power would be 21 watts. Where higher power than this is required, the rectified output from two power supplies may be used and the load divided between the two packs. (Note: In the case of 12 volt vibrators the current should not exceed 4 Amps; or for 24 volts 2.5 Amps.)

It is not practicable to obtain increased output by connecting vibrators in parallel owing to non-synchronism which would result in damage to both vibrator and transformer; neither should the primary and secondary contacts of a synchronous vibrator be parallel connected with the object of obtaining increased output (as a non-synchronous vibrator) for as explained above the timing factors of primary and secondary contacts differ considerably.

SPECIAL TYPES

The power required to energise the driving coil of all the vibrators referred to above is of the order of 1.5 watts. Low consumption types are available, (LP and QGA) requiring only 0.45 watts, the time efficiency of these units (72-76%) being rather lower than normal. The circuit arrangements correspond to those of the NS and QFA (See Fig 6).

Two further types of synchronous vibrator are available for replacement purposes, viz., QE and QD; these are electrically similar to type QF but have different base arrangements (See Fig 6).

REPLACEMENT VIBRATORS

For the convenience of vibrator users we give below a table showing the correct "Wearite" Vibrator to use as a replacement. It must be remembered however that corresponding types are not necessarily equivalent in their rating, and the user should verify that the normal input current of the circuit does not exceed the maximum rating for the corresponding "Wearite" Vibrator In order to safeguard the units a fuse rated to 'blow' at 50% overload should always be connected in the input circuit. Continual 'blowing' of the fuse may be due to a defective vibrator (contacts fused together or shorted), but the fundamental cause may lie in other components or unbalanced circuit conditions.

A vibrator should not be replaced until it is certain that it is defective: if the circuit fault is not cleared the new vibrator will rapidly be destroyed. As a guide to the location of faults the following notes may be of assistance.

Before testing a power pack always disconnect it from the receiver or other load. Non-operation of vibrator may be caused by low battery voltage, blown fuse, broken or bad connection in L.T. lead: check the voltage between primary centre tap and the reed socket of vibrator; this should equal the battery voltage. Where the vibrator operates but there is only low H.T. or no output, this may be due to one of the following: faulty L.T. connections, shorting filter or buffer condenser, rectifier, or transformer winding; or filter choke shorting to earth. A worn vibrator is sometimes the cause of low output and intermittent operation. When replacing a vibrator with one of different manufacture the value of the buffer condenser may have to be changed. This value should be carefully checked as outlined above. The fitting of a buffer condenser of the correct value is most important.

VIBRATOR REPLACEMENT GUIDE

Subject to the input current not being in excess of 5 amperes (for 6 volt vibrators) and 4 amps. for 12 volt types, the following "WEARITE" Vibrators are suitable replacements for their American counterparts. It is most important to check for correct "buffering" conditions. "WEARITE" Vibrators have the can isolated and this should be earthed effectively.

"WEARITE" TYPE NSB6, REPLACEMENT FOR:

A.T.R. - 314, 323, 324B, 334,
317, 324, 324C, 340,
322, 324A, 330, 344.

DELCO. - 8504, 8506, 8508,
8516, 8517, 8520,
8523, 8524, 8526,
8527, 8529, 8532,
8533, 8534, 8539,
8540, 8541, 8542,
1209810, 1209811, 1209812,
1209813, 1212966, 1213655,
1213881, 1215198, 1215909,
5040000, 5042240, 5042703, (cont'd)

"WEARITE" TYPE NSB6, REPLACEMENT FOR: (cont'd)

DELCO (cont'd) 5043025, 5052378, 5057220, 5061036, 7239123, 7239124, 7239439.

ELECTRONICS - 1703, 2041.

JAMES - PJ1, PJ2, PJ3, PJ3S, PJ11, PJ15S, PJ16, PJ17, PJ18,

MALLORY - 253, 253Y, 294, 500P, 501P, 505P, 507P, 508P, 509P, 510P, 650, 825C, 826C, 839, 850, 853, 859, 866, 869, 901M, 902M, 903M, 1100.

MEISSNER - 403, 405, 407, 414, 415, 450, 454, 464, 495.

PHILCO - 41-3170, 41-3186, 41-3170D, 41-3367, 41-3398, 38-5036, 83-0017, 83-0025, 83-0026.

RADIART - 3260, 3261, 3264, 3320, 3399, 3417, 3741, 3782, 3806, 3818, 3865, 3888, 4251H, 4260, 4301, 4313, 4631, 5300, 5301, 5305, 5308, 5310, 5313, 5314, 5320, 5320P, 5321, 5322, 5322P, 5323, 5323P, 5325P, 5326P, 5327P, 5330, 5340M, 5341M, 5342M.

TURNER - T1, T2, T3S, T3SP, T11, T15S.

UTAH - NP4, NP40, NP41, NP44, NP46, NP47, NP48, NP49, NP476, NP482, NP483, NP484, NP485, NP489, NP490.

"WEARITE" TYPE NSB12 - REPLACEMENT FOR:

A.T.R. - 315, 1241, 1324,

JAMES - 12PJ21.

MALLORY - G49, G650, G826C, G253, G850

MEISSNER - 311.

RADIART - 3774, 5300-12.

TURNER - 12T21.

UTAH - 12NP482, 12NP489.

"WEARITE" TYPE QD6, REPLACEMENT FOR:

A.T.R. - 525, 537.

DELCO - 8617, 8628, 8632, 8642, 5053183.

JAMES - PJ63, PJ57.

MALLORY - 249, 2897, 725C, 742.

MEISSNER - 719, 781.

RADIART - 4255, 4255H, 4414, 5406, 5454.

TURNER - T63.

UTAH - SP71, SP72.

"WEARITE" TYPE QD12, REPLACEMENT FOR:

A.T.R. - 1525, 1548.

DELCO - 8757.

MALLORY - G725C, G249.

MEISSNER - 310.

RADIART - 4255-12, 5406-12, 5418-12,

TURNER - 12T63.

UTAH - 12SP71.

"WEARITE" TYPE QE6, REPLACEMENT FOR:

A.T.R.	-	522, 522P, 527.
DELCO:	-	8538, 8613, 8634, 5052525.
ELECTRONICS	-	2089.
JAMES	-	PJ58.
MALLORY	-	246, 246A, 264, 743, 951P.
MEISSNER	-	712, 786.
PHILCO	-	41-3222, 41-3553.
RADIART	-	4416, 4612, 5411, 5420P, 5435.
TURNER	-	T58.
UTAH	-	SP66, SP664, SP646.

"WEARITE" TYPE QL 6, REPLACEMENT FOR:

A.T.R.	-	520, 520A, 534,
DELCO	-	8610, 8611, 1211375, 1211573, 5050651, 5053185
JAMES	-	PJ61
MALLORY	-	45, 45A, 245, 245A
MEISSNER	-	715, 787
RADIART	-	4402, 4403, 5409, 5413
TURNER	-	T61
UTAH	-	SP5, SP56, SP57

"WEARITE" TYPE QL 12, REPLACEMENT FOR:

MALLORY	-	G245, G749C
RADIART	-	5409-12
UTAH	-	12SP5

"WEARITE" TYPE QEA 6, REPLACEMENT FOR:

OAK	-	Type 85

"WEARITE" TYPE QEA 12, REPLACEMENT FOR:

OAK	-	Type 85Y

"WEARITE" TYPE QDA 6, REPLACEMENT FOR:

OAK	-	V5326, V5447, V7866

"WEARITE" TYPE QDA 12, REPLACEMENT FOR:

OAK	-	V5594, V7867

"WEARITE" TYPE NS 6, REPLACEMENT FOR:

OAK	-	Type 83

"WEARITE" TYPE NS 12, REPLACEMENT FOR:

OAK	-	Type V6512

PRICES OF WEARITE "STRATOSIL" VIBRATORS:

Type:	NS and NSB	... 30/- each
Type:	QD, QE, QF, QH, QL, QDA, QEA, QFA, QGA, QXA	... 35/- each