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VIBRATOR SYSTEM FOR SUPPLYING A PLURALITY OF DIRECT CURRENTS WITH DIFFERENT VOLTAGES

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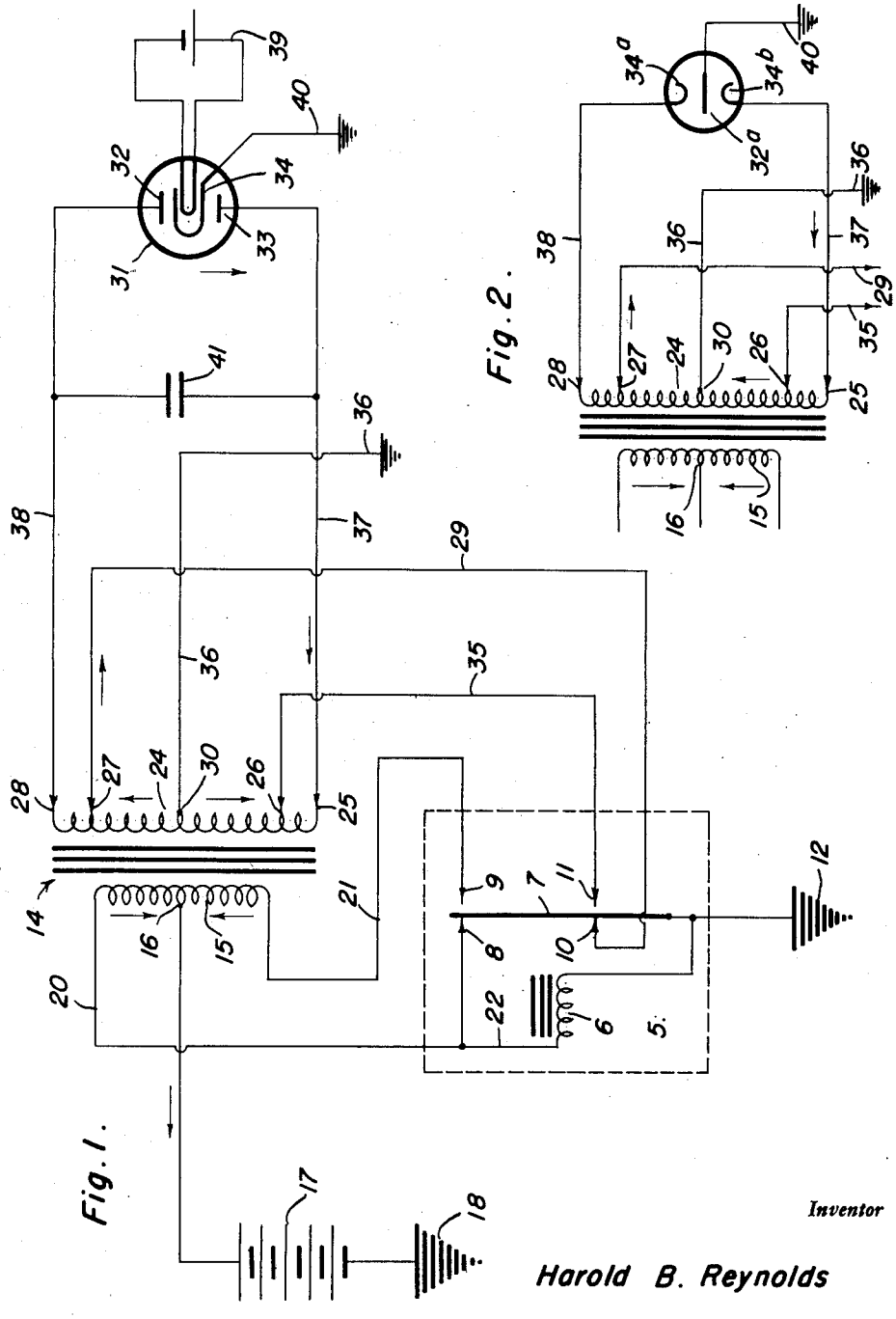



Fig. 1.




Fig. 2.

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## VIBRATOR SYSTEM FOR SUPPLYING A PLURALITY OF DIRECT CURRENTS WITH DIFFERENT VOLTAGES

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5 Claims. (Cl. 171—97)

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This invention relates to power supply systems for supplying D. C. currents, and it has more particularly reference to vibrator systems in which low voltage D. C. currents are converted into D. C. currents of higher voltage.

The invention has for its main object to provide a power supply system of the above type in which D. C. currents with at least two different voltages may be supplied by a single vibrator system either simultaneously or alternatively.

A further object of the invention consists in a vibrator system in which the polarity of the D. C. currents furnished at the desired voltage may be selected according to requirements.

An object of the invention consists of a vibrator system furnishing output currents under at least two different voltages which is simple and effective and which is adjustable over a wide range so that the voltages of the D. C. currents furnished by the system may be selected in accordance with the requirements of a particular case.

Further objects of the invention will be apparent from the detailed specification.

The invention is illustrated in the accompanying drawing showing one embodiment by way of example and one modification thereof. This example is intended to explain the principle of the invention and the best mode of applying this principle, and this explanation will supply the expert skilled in the art with the information required to apply the principle to other cases. Further applications and modifications are therefore not necessarily departures from the invention.

In the drawing:

Figure 1 is a diagram of a vibrator system for converting low voltage D. C. currents into D. C. currents of higher voltage.

Figure 2 is a diagram of part of the system, illustrated in Figure 1 showing a connection for reversed polarity of the converted high voltage D. C. current.

According to the prior art the problem of converting a D. C. current of low voltage into a high voltage D. C. current has been solved by means of an electromagnetic vibrator, including a vibrator reed, operated by an electromagnet coil, which cooperates with stationary contacts mounted on opposite sides of the reed, and with a transformer and a rectifier. Various constructions show marked differences with respect to the number of stationary contacts with which the vibrator reed cooperates and with respect to their connections with the transformer. One of the best known arrangements of this type uses two pairs of contacts, one of which is connected with the ends of the primary of the transformer, the center point of which is connected with the low voltage source of current, while the ends of the secondary coil and its center are connected to the

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anodes and to the cathode of a full wave rectifier respectively.

The second contact pair of the vibrator reed controls the vibrator electromagnet.

This arrangement, especially when provided with inductance coils and condensers for smoothing out the ripples of the converted D. C. current, has been widely used, but it is clear that it can only furnish a single converted D. C. voltage and, as a rule, it only furnishes a current of one polarity.

The main feature of the invention consists in an improved arrangement of the above described type, from which at least two high D. C. voltages may be derived which may have any desired polarity. The use of more than one high D. C. voltage has many advantages which will be obvious, as the various apparatus operating at a medium voltage for instance, can now only be operated with resistances annihilating a large part of the energy and producing heat, which processes are both objectionable in many cases, for instance in the case of a car.

According to the invention, as will be seen in Figure 1, the vibrator 5 consists of an electromagnet coil 6 and a vibrator reed 7 cooperating with a pair of fixed contacts 8, 9 and with a further pair 10, 11. The vibrator reed 7 is grounded at 12. The fixed contacts 8, 9 are connected by means of leads 20, 21 with the ends of the primary 15 of a transformer 14 the center point 16 of which is connected with the low voltage battery 17 grounded at 18. In the case of a car, for instance, the "ground" 12, 18 is replaced by a connection with the chassis.

The circuit 20, 21 including the primary has a branch 22 which contains the vibrator coil 6 and which leads to the grounded end of the vibrator reed 7.

When the reed 7 is attracted by the coil 6 one half of the primary is energized by the contact of 7 with contact 8 the current flowing (when the positive pole of the battery is grounded) from ground 12 over reed 7 and conductor 20 to point 16 and battery 17. When the reed swings back, the current flows from 12 to 9 and over 21 to point 16 and battery 17. The current impulses therefore flow in opposite directions through primary 15.

The secondary 24 of the transformer 14 is provided with adjustable end connections 25, 26 which, by means of conductors 37, 38 respectively, are connected with the anodes 32, 33 of the full wave rectifier 31, the cathode 34 of which is connected with the high tension lead 40 from which the high tension D. C. may be taken off, or which contains the "grounded" apparatus to be provided with high tension current. Moreover the center point 30 of coil 24

is provided with a similar high tension lead 36, which may be connected with another type of apparatus.

A condenser 41 may bridge the coil 24 as usual.

The vibrator contacts 10, 11 are connected with adjustable intermediate points 26, 27 of the secondary 24. A heating circuit 39 is provided for heating the cathode 34 of the rectifier, if necessary.

The load devices or apparatus (not shown) which have to be supplied with different voltages are connected with the conductors 40 and 36 respectively. Considering for instance the load device fed by the D. C. voltage which has been rectified in the diode rectifier 31 it will be seen that it is provided with its high voltage current in the following manner.

With the reed 7 in the position shown in the drawing a current flows from ground 12 connected with the reed over contact 8 and conductor 20 through the portion of the coil which is uppermost in the drawing to central point 16 and from there to the battery 17 and to ground 18. With the current flowing through coil 15 in the direction of the upper arrow in the figure shown alongside the primary coil 15, the current flow induced in the secondary coil 24 will be in the direction of the upper arrow alongside said secondary coil in the figure and therefore a current will flow from the ground over the load device in line 40 through the plate 33 to conductor 37 to connection point 25 of the secondary coil 24 and through the secondary coil between the connection points 25 and 27, through conductor 29, through contact 10 and reed 7 to ground 12. The voltage of this current is clearly proportional to the number of turns through which the induced current passed which, in this case, is the number of turns between the connection points 25 and 27.

The coil 6 which originally attracted the reed and moved it to the position shown in the drawings has been short circuited by the connection between the ground 12 and the contact 8 and therefore the reed now swings back.

When the reed comes into contact with contacts 9 and 11 the current through the primary coil 15 flows from ground 12 over contact 9 conductor 21 and over the lowermost portion of coil 15 to point 16 and to battery 17 and ground 18. The current flow through the primary coil therefore occurs in a direction which is indicated by the lower arrow alongside of primary coil 15. When the current through the primary coil flows in this direction the induced current in the secondary coil will be in the direction of the lower arrow alongside secondary coil 24 and therefore the current will flow from ground over the load device apparatus in line 40 and through plate 32, conductor 38, connection point 28 of the secondary coil 24 through the secondary coil formed between the connection points 28 and 26 and from connection point 26 through conductor 35 to contact 11 which is now in operative contact with the reed 7 and through the reed 7 to ground 12. Again the voltage of this current is proportional to the number of turns between the connection points 28 and 26 which in this case is equal to the number of turns between the points 25 and 27.

If a grounded load device or apparatus is now considered which is connected with line 36 and if the vibrator reed again is assumed to swing to the left the current induced in coil 24 flows



from 36 to 30 and to point 27 and from there to contact 10 and to the grounded reed 7. Likewise if the reed swings to the right the induced current in the coil flows from 36 to point 30 and from there to point 26 and to contact 11 and to the reed. The number of secondary turns included in the circuit is now smaller and the voltage of the current will be smaller. The conductor 36 has in this case a negative polarity.

If the polarity of the output or delivery end 40 is to be reversed the rectifier may be connected in the manner shown in Figure 2. In this case, for instance, when the reed 7 has again moved towards the left, current will flow from ground 12 over contact 10 lead 29, point 27 to the end 28, lead 38 and the cathode 34a. The voltage is in this case determined by the number of turns between 27 and 28 and the polarity of the current flowing through lead 40 to the apparatus is reversed.

It will be clear that the magnitude of the voltage will be determined by the adjustment of the tapping points 25, 26, 27, 28 on the transformer coil. The polarity of 36 in the example shown in Figure 2 may also be negative, if desired. Upon a movement of reed 7 to the left induced current will flow, from 36 to 30 to 27 and over 29 to 10 and to ground. Upon a movement of reed 7 to the right the induced current flows from 36 to 30 and to 26 and over 35 and 11 to ground 12. The voltage again differs from that obtained on output lead 40.

It will of course be clear that in all cases the polarity of the D. C. outlets may be changed by reversing the battery or the circuit breaker points of the primary or of the secondary at the vibrator.

The vibrator system may be used anywhere where a plurality of D. C. voltages is desirable, such as in cars, in railroad cars, in systems using tools with so-called vibrating motors, etc.

It will be clear that the specific features mentioned in the above description may be changed or replaced by others and that other unessential changes may be made without affecting the invention.

Having described the invention, what is claimed as new is:

1. A vibrating system for converting D. C. currents into D. C. currents of a different voltage, comprising a source of D. C. currents, a vibrator with a vibrating reed connected with the source of current and two pairs of stationary vibrator contacts cooperating with said reed, a transformer with a primary and secondary winding, the former being connected with the first pair of contacts and with the source of currents, a full wave rectifier unit, provided with a central electrode and two half wave rectifying electrodes, a secondary coil, tapped at the center and provided with two pairs of connections, said pairs of connections being located on opposite sides of the central tapping point, each pair of connections leading to one of the two half wave rectifying electrodes of the rectifier unit, and to one contact of the second pair of stationary vibrator contacts respectively, and two D. C. output lines, one connected with said central tapping point of the secondary coil and the other connected with the central electrode of the rectifier unit, the currents induced in the secondary coil flowing over one portion of the coil connected with one-half wave rectifying electrode on one side and with the contact of the second vibrator contact pair in contact with the reed for the time

being on the other side, the current flowing through the conductor connected with the central tapping point passing through a portion of the coil connected with the center tapping point and the point of connection with one of the vibrator contacts of the second pair of contacts, thus producing a unidirectional flow of current having a D. C. voltage differing from the voltage produced in the output line connected with the rectifier unit.

2. A vibrating system for converting D. C. currents into D. C. currents of a different voltage, comprising a source of D. C. currents, a vibrator with a vibrating reed connected with said source of current and two pairs of stationary vibrator contacts, cooperating with said reed, a transformer with a primary and secondary winding, the former being connected with its ends with the first pair of contacts and with its center with the source of currents, a secondary coil with a central tapping point and with two adjustable connections at each side of said central tapping point, an output circuit for converted high voltage D. C., connected with the central tapping point, said output circuit being supplied with D. C. over a portion of the secondary coil, enclosed between the central tapping point and between one of the two connections on both sides of the central tapping point connected with one of the stationary vibrator contacts of the second contact pair, and a second output circuit simultaneously supplied with a high voltage differing from that of the first named output circuit, said output circuit including a full wave rectifier unit with a central electrode and two half wave rectifying electrodes, and further including a portion of the secondary coil, contained between the connection of said coil and one-half wave electrode of the rectifier on one side of the center tapping point and the connection of the coil with the vibrator contact of the second pair of stationary vibrator contacts located on the other side of the center tapping point.

3. A vibrator system for converting D. C. currents into similar currents of different voltage, comprising a source of D. C. currents, a vibrator with a vibrating member and with fixed vibrator contacts, a transformer having a primary and a secondary winding, means including a pair of fixed vibrator contacts for interrupting the current flowing through the primary coil, a central connection with the secondary coil means for producing a converted D. C. voltage, said means including connections of the secondary coil on opposite sides of said central connection with a pair of fixed vibrator contacts, and means for producing a further D. C. voltage differing from the first named voltage, including a full wave rectifier and connections of the same with the secondary coil on both sides of the central tapping contacts.

4. A vibrator system for converting D. C. currents into similar currents of different voltage, comprising a source of D. C. currents, a vibrator with a vibrating member, a transformer having a centrally tapped primary and a secondary winding, a first pair of fixed vibrator contacts for interrupting and controlling the current flow through the primary coil, a plurality of connections of the secondary coil with outer circuits on either side of said central tapping point, one connection on either side of said central tapping point leading to one fixed contact of a second pair of vibrator contacts, cooperating with the vibrator member and alternatively making contact with the same, a further connection on each side made at a different point, a rectifying means connected with the aforesaid further connection and with an output line, the current to be rectified flowing through a portion of the coil contained between its connection with the rectifying means and one of the connections with a contact of the second pair of stationary vibrator contacts, the voltage of said current being proportional to the portion of the coil included, a further output circuit connected with said central tapping point, said output circuit carrying currents rectified by the vibrator member and the second pair of stationary vibrator contacts, said current flowing alternatively through a portion of the coil contained between the central tapping point and the fixed contacts of the second pair of vibrator contacts.



5. A vibrator system for converting D. C. currents of low voltage into currents of different voltage comprising a source of D. C. currents, a vibrator with a vibrating member connected with said source of current, a transformer having a primary and a secondary winding, means including a first pair of fixed vibrator contacts for interrupting the current and controlling the direction of current flow through the primary coil, two output circuits for converted D. C. currents, one of said circuits being connected with a central tapping point of the secondary coil and the other with the ends of the secondary coil, the latter connections including a rectifying unit with two electrodes, each electrode being connected with one end of the coil, a second pair of vibrator contacts on both sides of the vibrating member, the contacts of said second pair of vibrator contacts being connected with further points of connection on the secondary coil, arranged on both sides of the central tapping point of said coil, the output circuit including the rectifying unit having two alternatively active branches, each branch including one connection between an electrode of the rectifier unit and the secondary coil and a connection of the said coil with one of the contacts of the second pair of stationary vibrator contacts and a portion of the coil between the said connection point, thus producing a D. C. voltage proportional to the number of turns of the enclosed portion of the coil, and a second output circuit connected with the center point of the secondary coil being simultaneously completed by connections with the contacts of the second pair of vibrator contacts and the portion of the coil enclosed between the center tapping point of the secondary coil and the points of connection with the second pair of vibrator contacts, the voltage of the rectified current being dependent on the number of turns between said center point and the connection point which is independent of the number of turns included in the output circuit containing the rectifier unit.

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