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VIBRATOR POWER SUPPLY

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Fig. 1.

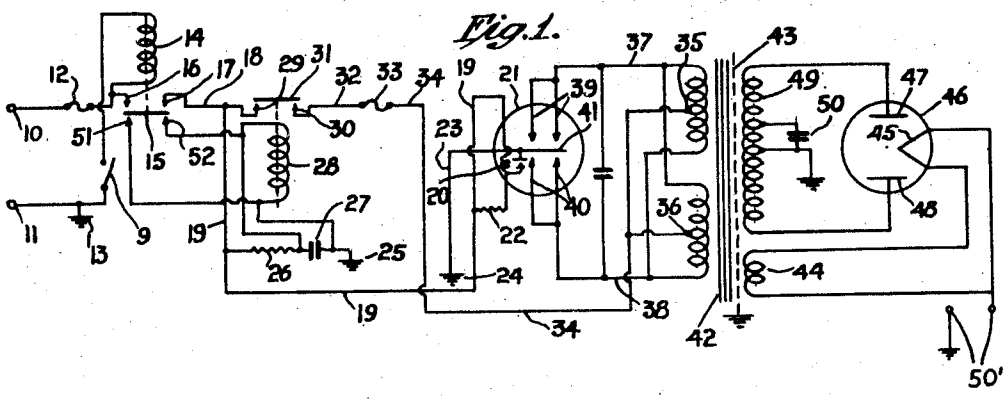
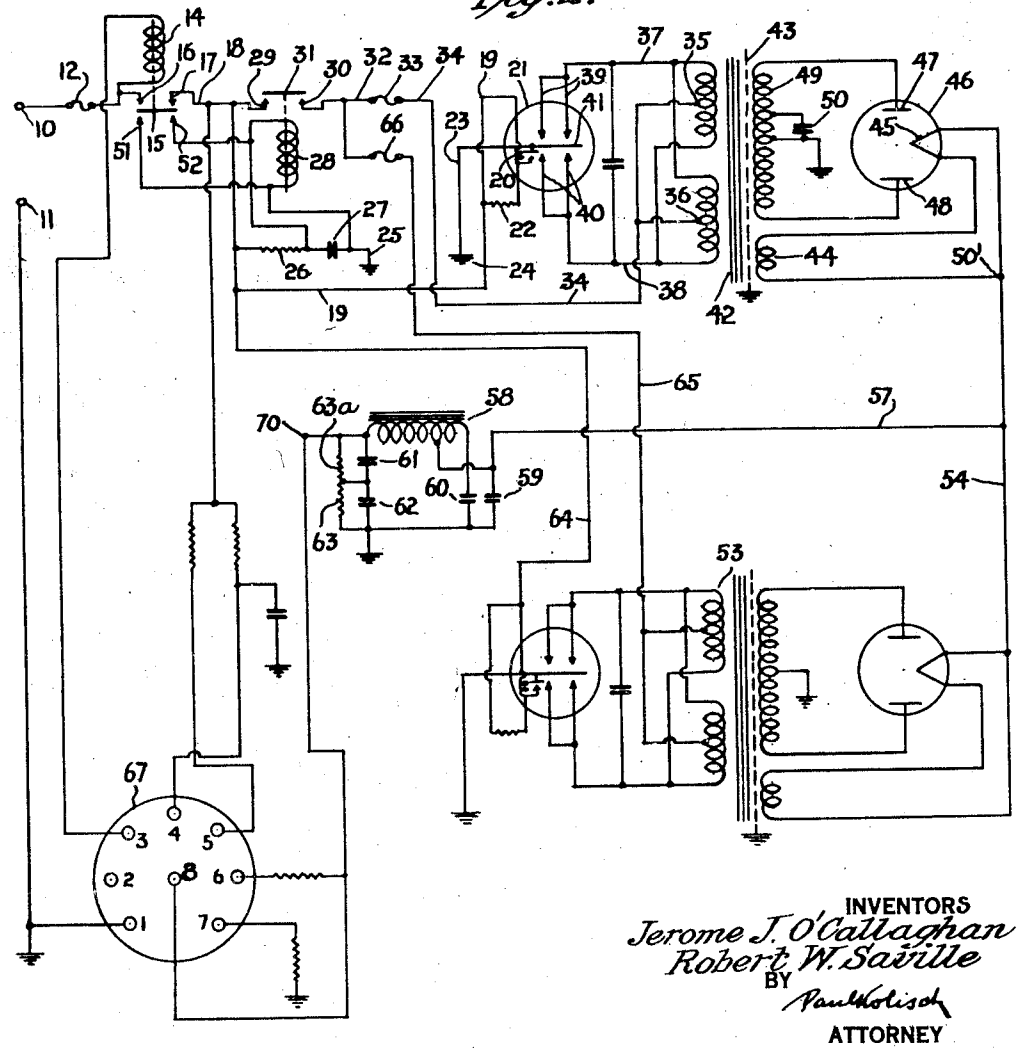


Fig. 2.



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VIBRATOR POWER SUPPLY

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3 Claims. (Cl. 175—365)

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This invention relates to improvements in vibrator power supplies and auxiliary apparatus therefor. Such vibrator power supplies are used, inter alia, for the conversion of low voltage direct current, for example the six volt battery supply available in automobiles and the like, into a direct current power supply having a potential of the order of magnitude of several hundred volts.

Vibrator power supplies include a vibrating reed-type contact maker which acts to shift the low voltage supply from one portion of the primary winding of a transformer to the other portion of such primary winding, this shifting action causing a change of magnetic flux and thereby exciting the secondary or high voltage winding of such transformer. The high voltage output of the transformer is rectified by any suitable means such as a thermionic rectifier, and is then filtered to a degree corresponding with the particular requirements for such high voltage power.

Vibrator power supplies have frequently given trouble at the vibrating reed controlled contact and one purpose of this invention is to minimize or avoid such reed controlled contact trouble.

It has been ascertained that when a vibrator shows distress, this usually takes place at the instant when the voltage from the power source is applied thereto but before the vibrating reed has reached its normal fully oscillating condition. It is probable that one source of distress is due to the fact that the time during which contact lasts is much longer when the reed is first commencing to move than after the reed is in full oscillation. Such longer time of contact allows the input current from the source of power to the transformer primary to reach an excessive value, and when the contacts of the vibrator break such excessive or abnormal current, an excessive counter E. M. F. is set up which may cause the contacts to arc and thus become damaged.

One purpose of this invention is to prevent the application of actual power supply current to a vibrator until the reed of the vibrator has been set into oscillation and has reached its normal or full amplitude of vibration.

Another purpose of this invention is to provide, in a vibrator power supply, delay relay means which will delay the application of power to the

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contacts of a vibrator, until a predetermined length of time has elapsed after the application of driving power has been made to the reed of such vibrator.

Yet another object of this invention is to provide automatic means for the substantially instantaneous re-setting of the time delay relay just referred to, whenever the main circuit to the power supply is opened, thus giving rise to the desired time delay even in case of accidental opening of the main circuit followed by a quick re-closure.

Referring now to the accompanying drawing,

Fig. 1 is a schematic representation of a vibrator power supply incorporating therein the time delay device of this invention;

Fig. 2 is a schematic showing of a vibrator power supply having two power conversion units, and also including an output filter and other control devices commonly associated with such supply units.

Referring now to Fig. 1, at 10 and 11 are shown leads from a low voltage direct current supply. Fuse 12 may be inserted in series with lead 10 and lead 11 may be grounded as shown at 13. A main relay 14 has its winding shunted across these leads and the switching on and off of the power supply is accomplished by any convenient switch 9.

The movable contact member 15 of relay 14 is normally held down by gravity or any other suitable means such as a spring. When relay 14 is excited from the power supply, contact 15 will rise and bridge the two upper contacts 16 and 17. Current can then flow through conductors 18 and 19 into reed actuating coil 20, located in vibrator 21. This coil is preferably shunted by a non-inductive resistor 22 and the return current path is obtained through conductor 23, grounded at 24. The application of current to main relay 14 is, then, followed by the excitation of vibrator 21 so that the reed 41 thereof is set into oscillation.

Shunted from conductor 19 to the ground indicated at 25 is a time delay circuit including, connected in series, a resistance 26 and a condenser 27. Shunted across condenser 27 is the winding of a relay 28. The main power supply to the vibrator and transformer passes from lead 18 through contacts 29 and 30, the inter-

connection of which later is determined by the movable contact member 31 of relay 28. This movable contact member is normally held away from the fixed contacts by any suitable means such as a spring, until the excitation of relay 28 causes it to bridge such contacts and to allow the main power supply to flow through lead 32, protective fuse 33 and lead 34 into the center points 35 and 36 of the transformer primary. The other primary terminals of the transformer are connected respectively by leads 37 and 38 to the vibrator terminals 39, 39 and 40, 40. The vibrator reed 41 serves alternately to ground these contacts, thus alternately completing the circuit through the respective primary windings of the transformer 42.

The transformer 42 is preferably provided with an electrostatic shield 43 situated between its primary and secondary winding. Low voltage winding 44 serves to heat the cathode 45 of a thermionic rectifier 46, the two anodes 47 and 48 of which are fed by the high voltage winding 49 of the transformer. A buffer condenser 50 may optionally be connected across a portion of this secondary winding and the center of the winding is grounded so as to afford a return path for the output current. The output voltage appears between the points 50' and as hereinafter described, may be suitably filtered.

In the operation of this device, the closing of main relay 14 is followed by the excitation of vibrator 21 and the commencement of oscillation by reed 41, to the driving coil of which full voltage has been applied by such closure of the main relay. The closure of relay 14 also applies voltage to the time delay circuit 26—27. Due to the well known characteristics of such a circuit, the voltage across condenser 27 requires an appreciable time to build up to maximum, the length of such time being determined by the electrical values of resistor 26 and capacity 27. Relay 28 will not be actuated until the voltage, derived from condenser 27 and applied thereto, reaches some predetermined value. The time constant of the circuit comprising elements 26 and 27, and the minimum potential at which relay 28 will close, are so chosen that the contacts of relay 28 will not be closed until sufficient time has elapsed for reed 41 to have reached its fully oscillatory state. This time delay then prevents premature application of actual power supply voltage to the contacts of vibrator 21 for the reasons previously described.

When main relay 14 is released for any reason the contact member 15 will immediately assume its lower position, and in so doing it will make connection between contact points 51 and 52. These contact points are connected directly across the winding of relay 28 and accordingly are likewise in shunt with condenser 27. This means that the opening of the main relay will cause the immediate de-excitation of relay 28 and the rapid and complete discharge of condenser 27. When relay 14 is again excited the time delay circuit 26—27 will likewise again be ready to function as above described, owing to the fact that condenser 27 has been completely discharged and must be again recharged, with a time delay, before relay 28 can function and close the main power supply circuit.

In Fig. 2 there is indicated an additional vibrator, transformer and rectifier unit at 53. This unit may be in all respects similar to the one previously described and may have its output coupled in parallel therewith by lead 54. The output

of the other unit unites with the output of unit 53 and the combined outputs are led by conductor 57 to a filter unit comprising a choke coil 58 and filter condensers 59, 60, 61 and 62 together with resistors 63 and 63A. The details of this filter unit are well known in the art and do not form a part of the instant invention. The power output is available between point 70 and the ground. Unit 53 derives its reed exciting energy through conductor 64 which is shunted from lead 19, the main power supply to the unit being derived through lead 65 and fuse 66 branched off from lead 32. It is evident that the cycle of operation of unit 53 will be identical with that of the other parallel connected unit, as previously described. The control of relay 14 may conveniently take place over terminals 1 and 3 of a control plug 67. The various other conductors, resistors and capacities shown as connected to terminals 4, 5, 6, 7 and 8 of such control plug place, when interconnected and connected, at terminals 1 and 8, to the opposite poles of a battery, different predetermined potentials at various points of the circuit. These connections are required for the proper operation of the circuit but are not part of the instant invention and since they are well known in the vibrator power art a detailed description thereof is thought to be superfluous.

What is claimed is:

1. In a vibrator power supply, a vibrator including an actuating means and main contacts, a main control relay, a pair of contacts closed by said main relay when excited, said contacts acting to determine the voltage supply to the actuating means of the vibrator, a time delay circuit in parallel with said actuating means and comprising a resistance and capacity in series, an ancillary relay connected in shunt to said capacity so as to be responsive to voltage developed across the capacity, a pair of contacts closed by said ancillary relay when excited and acting to determine the supply of voltage to the main contacts of the vibrator, a pair of contacts connected directly across said capacity and closed by said main relay when the relay is not excited, so as rapidly to discharge said capacity and to accelerate de-excitation of said ancillary relay upon the de-excitation of said main relay.

2. A vibrator power supply unit including a first relay having upper and lower contacts, the upper contacts being arranged for closing and opening the low voltage supply circuit to the unit, a vibrator having upper and lower contacts and actuating means, a transformer having primary windings alternately connected to the low voltage supply circuit by means of said vibrator contacts, means for withdrawing relatively high voltage energy from said transformer, a time delay circuit including a second relay and a resistance in series, a condenser in shunt of the winding of the second relay, the low voltage being applied to the time delay circuit at the same time as it is applied to the vibrator, and the second relay being actuated when the voltage across the condenser reaches a critical value, said second relay having contacts the closure of which supplies through the upper contacts of the first relay energy to the contacts of the vibrator and transformer primary windings, and a short circuit across the condenser controlled in the lower contacts of the first relay to accelerate the release of said second relay.

3. In a power apparatus for vibrators, at least one vibrator including an actuating means and main contacts, a starting device including two relays, the first relay upon closure determining

the application of power to elements including the actuating means of the vibrator and the winding of the second relay, and a time delay circuit having a resistance in series and a capacity in shunt with said winding, said second relay upon closure determining the application of power to elements including the main contacts of the vibrator, said first relay also having contacts directly short circuiting the winding of the second relay and causing the relatively immediate release thereof, upon opening of said first relay.

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