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POTENTIAL SUPPLY MEANS FOR RADIO APPARATUS

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This invention relates to a potential supply means for radio apparatus, whereby a single low voltage battery or other source of low voltage electricity may be produced, to supply both low and high potential current for operating radio apparatus. While not restricted to any particular usage, the device of this invention finds ready application to portable radios and those installed in vehicles or other carriers having no convenient source of proper high potential current for energizing the plate and grid elements of radio receiver components.

Objects in addition to those above set forth are, the provision of simple, efficient, and light weight means for rendering a single low voltage battery utilizable for supplying all potentials of electrical current necessary to the operation of a radio apparatus, and the provision also of a novel thermionic valve and its arrangement in a special electrical circuit. A still further object is the provision of an efficient and highly desirable form of magnetic vibrator which is noiseless and therefore especially suited for use in connection with radio and various other devices.

These and other objects are attained by the means described herein and disclosed in the accompanying drawing, in which:

Fig. 1 is a diagrammatical view of the device of the invention, showing its cooperative relationship with a radio receiving apparatus and a current filter or "B" current supply means of high potential.

Fig. 2 is a view, similar to Fig. 1, showing a modified form of the invention employing a special thermionic valve.

Fig. 3 is a view showing a thermionic valve especially suited for use in the circuit of Fig. 2.

Various attempts have been made, heretofore to provide a device utilizing a low voltage battery, or other low voltage current supply, for supplying stepped-up high potential current for use in the "B" or plate and grid circuits of a radio receiving apparatus, but so far as we are informed such devices required the use of a separate low voltage battery for supplying proper current to the filament circuit of the vacuum tubes, or thermionic valves, of the radio receiver. One of the objects of the instant invention is to provide means whereby the same source of low potential current that supplies the electrical energy for the "B" circuit supplies also the current for the "A" or filament circuit above referred to.

Because of the use of a single and common source of electricity which is of low potential (usually from 3 to 6 volts), and because of the

fact that said source of electricity provides a direct current, the device of the invention is to be distinguished from devices employing a relatively high potential alternating current such as is found in common usage for household and similar commercial purposes. In the drawing, 5 indicates generally a radio receiving apparatus employing vacuum tubes or thermionic valves requiring for their operation low and high potential electrical currents; at 6 is indicated a filter or "B" current supply means of known construction, such as is disclosed in the patent of Grunow No. 1,818,947, and in the patent of Lauritsen No. 1,813,541; at 7 is indicated a source of low voltage current supply, generally a six volt battery or one of any low voltage proper for energizing the filaments of the radio receiver tubes; and at 8 is indicated generally a current interrupter or vibrator. While the interrupter is shown and described as a magnetic type of device, it is to be understood that the invention is not to be limited to the use of that type of interrupter, for a mechanical interrupter may be employed with equally satisfactory results.

Referring now to Fig. 1 of the drawing, the battery or source of low potential electricity 7 is connected in series arrangement with the primary winding or coil 9 of the transformer 10, by means of the conductors 12 and 13. A switch 14 controls flow of electricity through said primary winding. The conductor 13 has at its free end a contact point 15 adapted to make and break contact with a metallic vibrating element 16 which is electrically connected, at 17, to one end 18 of the primary winding 9, the other end 19 thereof being electrically connected to the conductor 12. A condenser 20 is shunted across the contact points, as is clearly illustrated in Fig. 1.

The interrupter illustrated comprises a magnetic metal block 21 attached to the vibratory member 16, which latter may be of resilient metal, and said block is of wedge shape. The wedge shaped block is adapted to be received in a tapered cut or opening 22 provided in one leg 23 of the transformer core. The block is at all times spaced from the walls of opening 22, so that the block is capable of vibratory movement transversely of the core. The vibrator interrupter is placed in and operated by the main magnetic field. This method of interrupting the primary circuit affords greater efficiency due to the fact that less current is required for its operation. From the foregoing it should readily be apparent that closing of the switch 14 will cause magnetization of the transformer core, resulting in the

attraction or inward movement of the block 21 whereby the circuit is broken at 15. Upon said breaking of the circuit, the block is released from the magnetic attraction of the transformer core, thereby effecting a closing of the circuit at 15 which results in another attraction of the block and consequent breaking of the circuit at 15. The above action goes on indefinitely and automatically, as in any other type of magnetic interrupter.

The resilient block supporting member 16 preferably is supported adjacent its ends, upon the transformer, and by means of electrical insulators 24 so that the transformer core will not be included in the circuit of the primary winding.

The secondary winding 100 of the transformer comprises sufficient turns of fine wire to step up the voltage to a value sufficient for proper functioning of the plate and grid circuits 25 and 26, respectively, of the radio receiver 5. The secondary is center tapped in order to provide for full wave rectification. This is highly desirable as the power output is doubled by this arrangement. It increases the efficiency due to the fact that it lowers the primary current necessary for the same output. The ends 27 and 28 of the secondary winding are electrically connected to the anodes 29 and 30 of a suitable rectifying tube, which in the particular circuit illustrated, is a Raytheon rectifying tube of known construction. This tube, it should be noted, has no filament to be energized by the source of low voltage electricity 7, but depends for its operation upon the electron movement between its electrodes, maintained by means of a high electromotive force such as is supplied by the transformer secondary. The tube contains a suitable ionizable gas, as is well known to those skilled in the manufacture thereof. Inasmuch as the rectifier briefly described above is procurable on the market, further detailed description thereof is deemed unnecessary.

The cathode 31 of the tube is electrically connected, by means of a conductor 32, to one terminal 33 of the filter or B power supply means 6, while the other terminal 34 of the filter has electrical connection, by means of conductor 35, with a center tap 36 on the secondary winding of the transformer. The filter comprises the usual choke coils and condensers 37 and 38, respectively, as disclosed in the aforesaid patent of Grunow. The high potential output terminals 39 and 40 of the filter have electrical connection with the plate and grid elements 41 and 42, respectively, of the radio receiver tubes, as indicated at 48 and 49 in Fig. 1. By means of the conductors 43 and 44, electrical connection is made from the positive and negative terminals of the low voltage battery 7 to the filament elements 45 of said radio receiver tubes. At 46 is indicated conventionally the sound emitting means, or so called loud speaker, which is associated with the conventionally illustrated radio receiver 5 in accordance with common practice.

The operation of the above described device is as follows. Upon closing of the switch 14, electricity from the battery 7 is caused to flow through the primary winding of the transformer and through the interrupter 8, which, in the manner hereinbefore described, rapidly makes and breaks the circuit of the primary winding for setting up an induced alternating current of high potential, in the secondary winding of the transformer. The alternating current thereby

produced is rectified in the rectifier 47 whence it is conducted to the electrical filter device 6 having the return lead or conductor 35 which is electrically connected to the center tap of the secondary winding. From the output terminals 39—40 of the filter there is obtained a proper substantially continuous direct current which is supplied to the "B", or plate and grid circuit, of the radio receiving set. The same battery 7 that supplies current to the transformer supplies proper current also for energization of the filaments 45 of the receiver.

By means of the above described arrangement of elements, the radio receiver is operated by means of a single low potential source of electricity, such as a storage battery of six volts E. M. F.

Referring now to Figs. 2 and 3, the characters 5, 6, 7, 8, 9, and 10, indicate respectively the radio receiver, filter, storage battery of 6 volts E. M. F., interrupter, primary transformer winding, and the transformer core, as in Figure 1. The conductors 43 and 44 conduct the low potential current to the filaments of the radio receiver tubes, as in Fig. 1, and the terminals 39 and 40 of the filter are electrically connected to the plate and grid elements of said tubes, by means of the conductors 48 and 49, as in Fig. 1. The choke coils and condensers of the filter are indicated at 50 and 51, respectively.

Like in Fig. 1, the center tap 52 of the transformer secondary winding 53 is electrically connected to the minus (—) side of the filter, by means of a conductor 54. The opposite ends of the secondary winding are connected, by means of conductors 55 and 56, to the plates or anodes 57 and 58 of a thermionic filament type of rectifier comprising a filament 59 electrically insulated from, but substantially surrounded by, a cathode or electron emitting element 60. The electron emitting element may carry a coating of thorium oxide or other suitable substance known to emit electrons when heated and subjected to proper transmission conditions within the envelope or bulb 61 of the rectifier.

The electron emitting element 60 has but one electrical connection, which is to the positive or plus side of the filter and effected by means of a conductor 62. The filament 59 of the rectifier is energized by the battery 7, with which it is placed in series connection by means of the conductors 63 and 64.

The interrupter of Fig. 2 is of ordinary construction, it being constituted of a metallic strip 65 resiliently mounted with an armature 66 in close proximity with an end of the transformer core 10, and adapted to alternately make and break connection with a fixed contact 67 which is electrically connected, by means of the conductor 68, to one terminal of the battery 7. At a point 69, one end of the primary winding 9 has electrical connection with the strip 65, while the opposite end of said winding is electrically connected to the other battery terminal through the conductor 70. The interrupter operates in the same manner as that of Fig. 1, to rapidly make and break the primary circuit of the transformer.

By means of the combination of Fig. 2, there is provided a very efficient means whereby both the "A" and "B" current supplies necessary for the operation of a radio receiving set, are supplied by a single low potential direct current source, such as a 6-volt storage battery of the type used in automobiles and other carriers.

What is claimed is:

1. The combination with a radio apparatus having elements therein requiring for their operation a low potential direct current and a high potential direct current, of an electrical circuit including a source of low potential direct current and the low potential direct current elements of the radio apparatus, a transformer having a primary winding and a secondary winding for high potential current, a current interrupter, an electrical circuit including the primary winding, the interrupter, and the above mentioned source of low potential direct current, a current rectifying means comprising a plurality of anodes, a filament, and an electron emitting cathode element electrically insulated from and substantially surrounding the filament, a current filter, and an electrical circuit including the opposite ends of the transformer secondary winding, the anodes of the rectifier, the cathode element, the filter, the high potential elements of the radio apparatus, and the mid-point of the transformer secondary winding, and another electrical circuit including the source of low potential direct current and the filament of the rectifying means.

2. A device of the character described having, in combination, a source of direct current of relatively low potential, a transformer having primary and secondary windings, connections between said source and said primary winding including an interposed circuit interrupting device, a rectifier valve connected with said secondary winding and including a heater element connected directly with said source and independently of said secondary winding, and output leads from said valve and said secondary winding.

3. In a device for transforming direct current of relatively low potential to direct current of relatively high potential for connection as a unit with the "B" circuit of a radio receiving set for motor vehicle installation, the combination of means connected with the storage battery of the motor vehicle for producing an alternating current of relatively high potential from the direct battery current of relatively low potential, and rectifier means for transforming the alternating current of relatively high potential into direct

current of relatively high potential including a heating means energized through an independent circuit by the direct battery current of relatively low potential.

4. A "B" battery eliminator for motor vehicle installations of radio receiving sets comprising, in combination, a storage battery in the vehicle, a transformer having primary and secondary windings, connections between said battery and said primary winding including an interposed circuit interrupting device, a rectifier valve operatively connected with said secondary winding and including a heater element connected directly with said battery and independently of said secondary winding, and output leads from said valve and said secondary winding for connection with the "B" circuit of the radio receiving set.

5. A converter for motor vehicle installations of radio receiving sets comprising, in combination with the storage battery of the vehicle as a source of low potential direct current; a circuit interrupting device; a transformer having primary and step-up secondary windings; a rectifier valve including a heating filament and plate and cathode elements; electrical connections including the battery, circuit interrupting device, primary winding and valve filament; and other electrical connections including the secondary winding, plate and cathode elements and having output leads; said two electrical connections having no direct electrical communication.

6. In a converter of the character described having a rectifier valve, the combination of an input circuit for connection with a storage battery as a source of low potential direct current, said input circuit including a circuit interrupting device, a transformer primary winding, and heating means for a rectifier valve, and an output circuit for connection with a receiving set circuit, said output circuit including a transformer secondary winding, and cooperating elements of the rectifier valve, there being no direct electrical connection between said input and output circuits.

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