

April 10, 1962

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3,029,362

APPARATUS FOR OPERATING A FLUORESCENT LAMP

Filed Dec. 14, 1954

3 Sheets-Sheet 1

FIG. 1

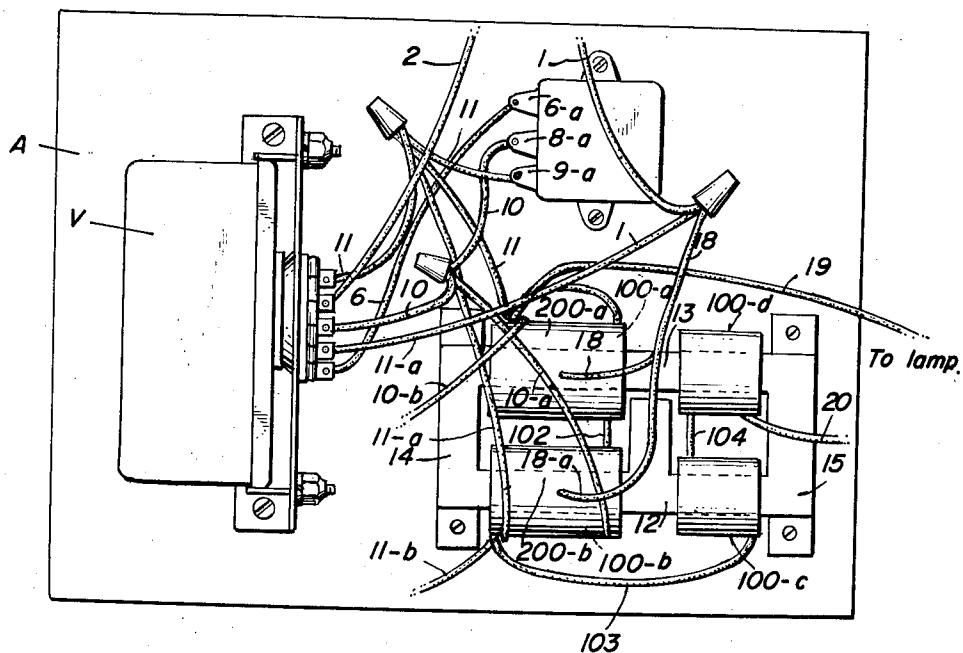
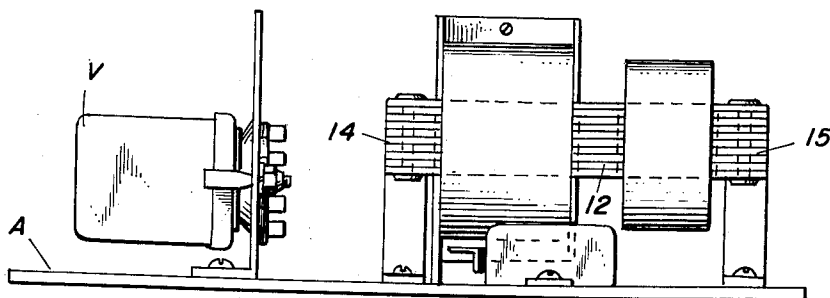


FIG. 2



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FIG. 3

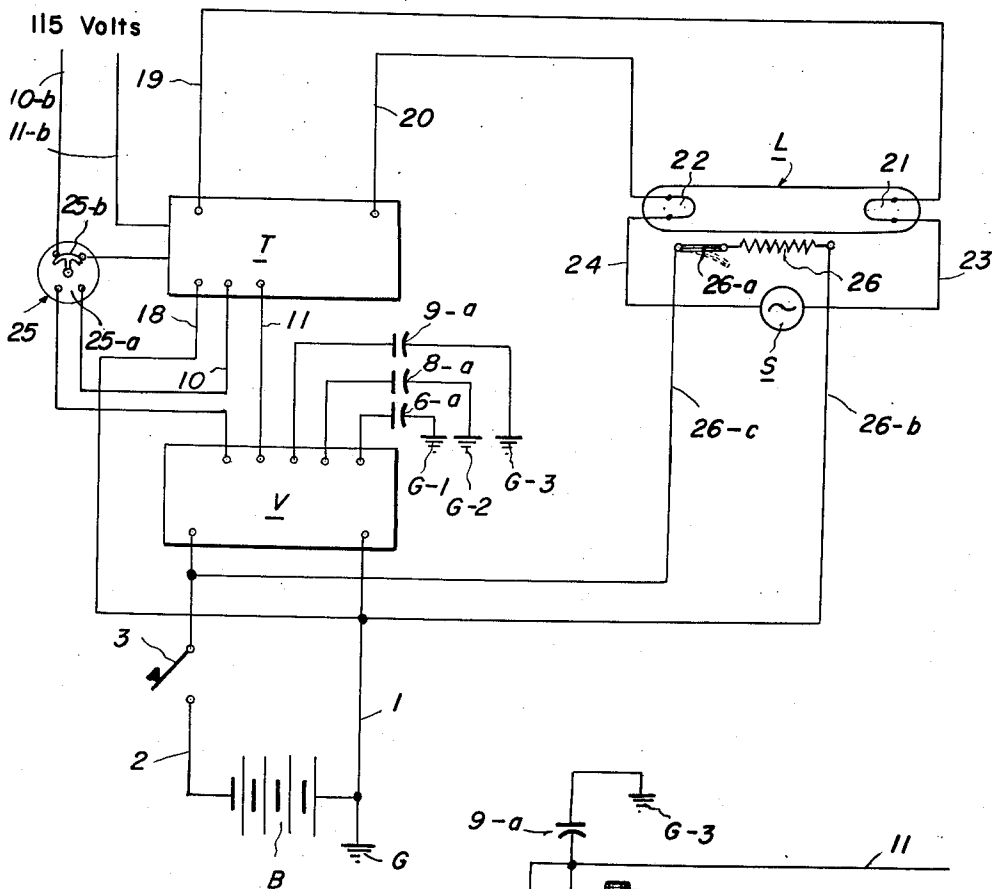
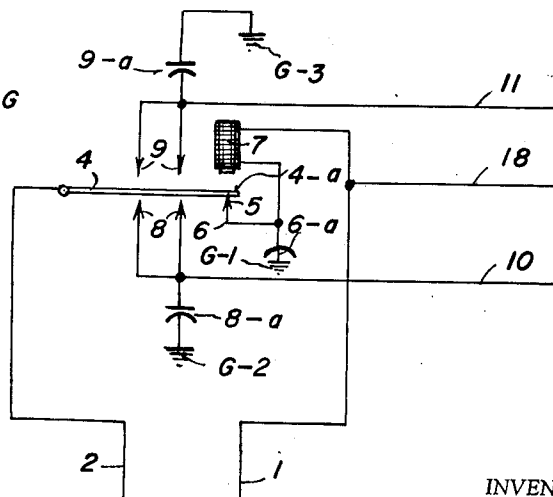


FIG. 5



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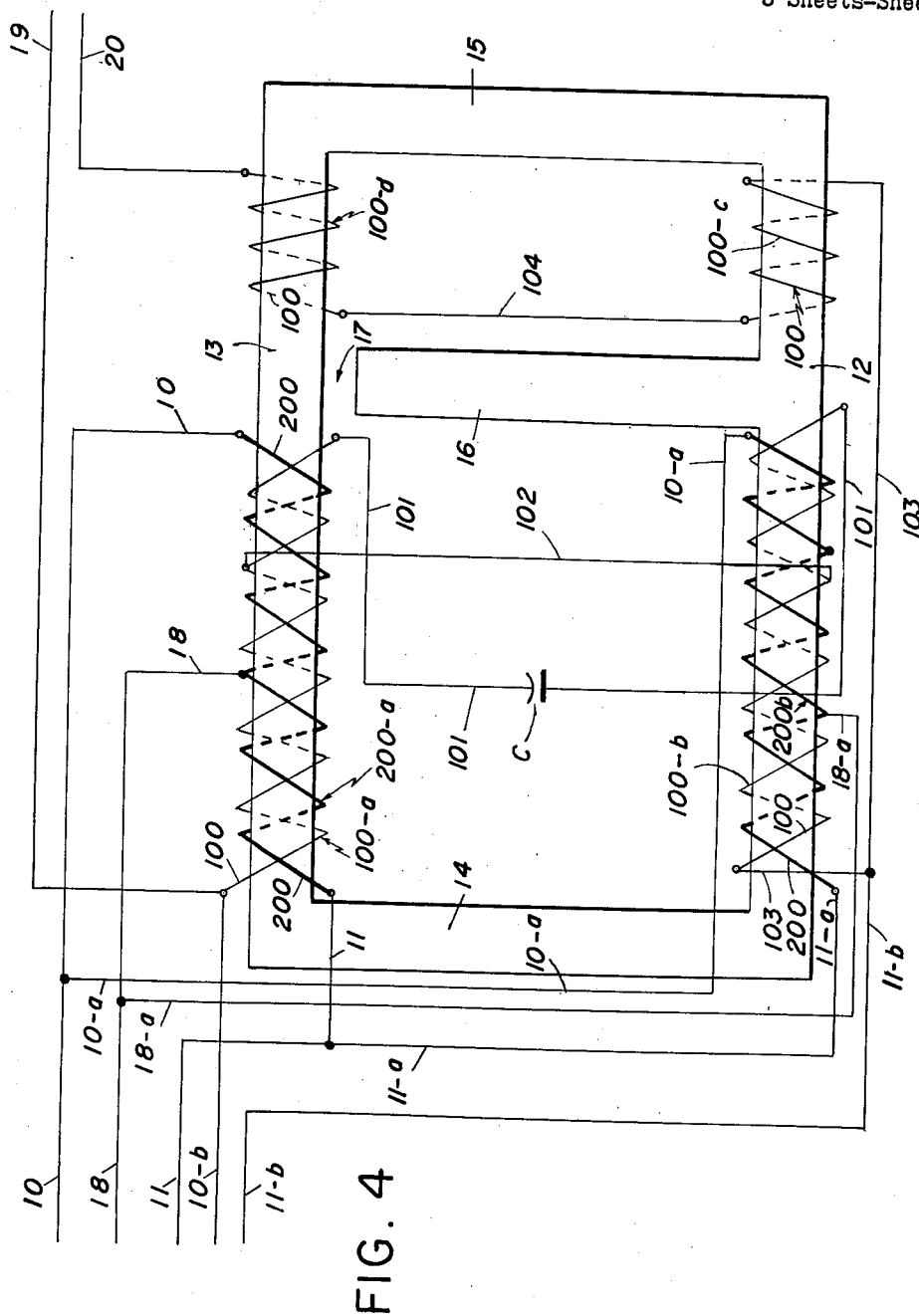
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APPARATUS FOR OPERATING A FLUORESCENT LAMP

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Filed Dec. 14, 1954, Ser. No. 475,168
7 Claims. (Cl. 315-86)

My invention consists in a new and useful improvement in apparatus for operating a fluorescent electric lamp, and is designed to provide means for operating such a lamp alternatively by using direct current supplied by a storage battery and by alternating current from a power line. The particularly novel feature of my improved apparatus is the combination of a vibrator to change the direct current supplied thereto by the battery into a pulsating current of increased voltage, and a novel transformer adapted to change the voltage either of the pulsating current supplied thereto by the vibrator or the alternating current from the power line into an alternating current of the proper voltage to operate the lamp. The valuable feature of my improved apparatus is the function of the transformer of supplying to the lamp the proper current for operation of the lamp without using the formerly required ballast.

While I have illustrated in the drawings and herein after fully describe one specific embodiment of my invention, it is to be distinctly understood that I do not consider my invention to be limited to said embodiment but refer for its scope to the claims appended hereto.

In the drawings:

FIG. 1 is a top plan of the apparatus.

FIG. 2 is a side elevation of the apparatus, the wires being omitted.

FIG. 3 is a wiring diagram of the apparatus.

FIG. 4 is a diagrammatic view of the transformer.

FIG. 5 is a wiring diagram of the vibrator.

The apparatus comprises a battery B, a vibrator V, a transformer T, a fluorescent lamp L and its starter S. Assuming that the apparatus is provided with a 30 watt lamp L, the electric values will be stated accordingly, such values varying according to the wattage of the lamp L. The battery B supplies 12 volts direct current to the vibrator through wires 1 and 2. The wire 1 is grounded at G. The wire 2 has a switch 3 for control of the circuit from battery B to vibrator V. The vibrator V (FIG. 5) has a resilient reed 4 to which wire 2 is connected. The free end 4-a of the reed 4 normally contacts point 5 connected by wire 6 with an electro-magnet 7 and grounded at G-1 through a capacitor 6-a. The electro-magnet 7 is connected by wire 1 with the battery B thereby completing the direct current circuit of the vibrator V. The vibrator V has two sets of points 8 and 9, respectively. The reed 4 alternately contacts the two sets as it vibrates in the ordinary operation of the vibrator. The sets of points 8 and 9 are grounded (G-2 and G-3) by suitable connections to the base of the apparatus A (FIGS. 1 and 2) through capacitors 8-a and 9-a. The vibrator V has out-put wires 10 and 11 leading from the sets of points 8 and 9, respectively, for a pulsating voltage of 20 volts.

The transformer T (FIG. 4) has a core consisting of a hollow quadrilateral member having sides 12 and 13 and ends 14 and 15, and a post 16 extending from the side 12 intermediate ends 14 and 15 toward side 13, its outer end being spaced from the side 13 sufficiently to provide an air gap 17 between the side 13 and the post 16, for magnetic leakage.

The secondary circuit coil 100 of the transformer T (FIG. 4) consists of 6,000 turns of insulated wire of

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twenty-seven gauge. This coil 100 has a portion 100-a which has 2,000 turns wound about that part of the side 13 of the transformer T to the left of the gap 17, and to the end of this portion 100-a which is adjacent the end 14 of the transformer T a wire 19 is connected. The coil 100 has a portion 100-b which has 2,000 turns wound about that part of the side 12 of the transformer T to the left of the post 16. The two ends of the portions 100-a and 100-b which are adjacent the post 16 are connected by wires 101 to a capacitor C. The 570 turn points of the portions 100-a and 100-b to the left of the post 16 are connected by a wire 102. The coil 100 has a portion 100-c which has 1,000 turns about that part of the side 12 of the transformer T to the right of the post 16. Wire 103 connects the end of portion 100-b which is adjacent the end 14 of the transformer T with the end of the portion 100-c which is adjacent the end 15 of the transformer T. The coil 100 has a portion 100-d which has 1,000 turns wound about that part of the side 13 of the transformer T to the right of the gap 17. A wire 104 connects the ends of the portions 100-c and 100-d which are adjacent the post 16. The end of the portion 100-d which is adjacent the end 15 of the transformer T has a wire 20 connected thereto. The wires 19 and 20 constitute the out-put wires of the transformer T to the lamp L (FIGS. 3 and 4).

The primary circuit coil 200 of the transformer T consists of 880 turns of insulated wire of twenty-one gauge. This coil 200 has a portion 200-a which has 440 turns wound over the portion 100-a of the secondary coil 100. The wire 10 from the vibrator V is connected to the end of the portion 200-a which is adjacent the gap 17. The coil 200 has a portion 200-b which has 440 turns wound over the portion 100-b of the secondary coil 100. The end of the portion 200-b which is adjacent the post 16 of the transformer T is connected to the wire by a wire 10-a. The wire 11 from the vibrator V is connected to the end of the portion 200-a which is adjacent the end 14 of the transformer T. The end of the portion 200-b which is adjacent the end 14 of the transformer T is connected to the wire 11 by a wire 11-a.

A wire 18 connects the wire 1 from the battery B with the mid-point of the portion 200-a of the primary coil 200. The mid-point of the portion 200-b of the primary coil 200 is connected to the wire 18 by a wire 18-a.

The out-put wires 19 and 20 of the transformer T (FIG. 3) are connected to the electrodes 21 and 22 in the ends of the lamp L, respectively. Wires 23 and 24 connect the electrodes 21 and 22, respectively, with the starter S which is normally closed, thus completing the secondary circuit of the transformer T.

As shown in FIGS. 3 and 4, the lamp L can be actuated by an alternating current of 115 volts from an ordinary power line. For this purpose, wires 10-b and 11-b connect the power line with the transformer T, as indicated in FIG. 4. The wire 10-b is connected to the end of the portion 100-a of the secondary coil 100 of the transformer T to which the out-put wire 19 is connected, and the wire 11-b is connected to the wire 103 which connects the portions 100-b and 100-c of the secondary coil 100.

A double switch 25 is provided which is adapted in one position to close break 25-a in wire 10 and in another position to close break 25-b in wire 10-b, so that switch 25 can be manipulated to service lamp L from either the battery B or the power line. It is obviously that, if desired, the switch 3 between the battery B and the vibrator V can be associated with the mechanism of the switch 25 to insure that when the circuit from the vibrator V

to the transformer T is opened the circuit from the battery B to the vibrator V is also opened.

The transformer T is so designed that when the circuit from vibrator V to transformer T is closed the in-put 20 volts pulsating current from vibrator V to the primary coil 200 is transformed to an out-put alternating current of approximately 50 volts when the starter S is closed, before the lamp L is actuated. When the flow of this current causes the starter S to open, the out-put of the transformer T is a voltage of 200 volts, that is the out-put is 200 volts under no load. When the current passes through the gas in the lamp L and lights the lamp L, the voltage drops to 100 volts which is the proper voltage for a 30 watt lamp.

The transformer T is also so designed that, when the circuit from the power line to the transformer T is closed, the in-put 115 volts alternating current to the secondary coil 100 of the transformer T is transformed to an out-put alternating current of approximately 50 volts, and the lamp L is actuated as above described.

As shown in FIG. 3, my apparatus can be provided with a heating unit 26 with suitable thermostatic control switch 26-a connected to battery wires 1 and 2 by wires 26-b and 26-c, for heating the lamp L for quicker starting in very cold weather.

My apparatus is designed for use of vehicles, such as trucks, trailers for freight and passengers, and power boats. Such vehicles are ordinarily provided with storage batteries, and have not heretofore been equipped with fluorescent lamps because the direct current of the battery will not operate such lamps. My apparatus now makes possible the use of such lamps on such vehicles. Since my apparatus is adapted to operate the lamp by means of alternating current supplied by a power line, the lamp can be operated by alternating current when the vehicle can be moved to a point where such current is available.

Having described my invention, what I claim is:

1. In an electrical auto-transformer which does not have electrical isolation between its in-put and its out-put for operating a fluorescent lamp alternatively by direct current from a storage battery and by alternating current from a conventional power line, the combination of a single primary circuit coil; a single secondary circuit coil which is electrically connected with the lamp; and means for alternatively electrically connecting the battery with said primary circuit coil and the power line directly with said secondary circuit coil.

2. A transformer, according to claim 1, which com-

prises a core consisting of a hollow, quadrilateral member, a post extending from one side of said core toward its opposite side, the free end of said post being spaced from said opposite side to provide an air gap between said opposite side and said post for magnetic leakage, a secondary coil comprising four portions, two of said portions being wound on said two sides of said core between one end of the core and the post, respectively, and the other two portions being wound on said two sides between the post and the other end of the core, and a primary coil comprising two portions wound over the first mentioned two portions of said secondary coil, said primary coil being electrically connected with said battery and said secondary coil being electrically connected with the lamp.

3. A transformer, according to claim 1, in which said primary circuit coil is so related to said secondary circuit coil that an in-put pulsating direct current supplied from the battery to said primary circuit coil is transformed to an out-put alternating current from said secondary circuit coil to the lamp.

4. A transformer, according to claim 1 in which said secondary circuit coil is adapted to transform an in-put 115 volts from the power line to an out-put 50 volts to the lamp.

5. A transformer, according to claim 1, in which there is a hollow core having two parallel portions, a secondary circuit coil having two portions wound about said core portions, respectively, and a primary coil having two portions wound over said two portions of said secondary circuit coil, respectively.

6. A transformer, according to claim 5, in which a capacitor is inserted in said secondary circuit coil between its said two portions.

7. A transformer, according to claim 1, in which the core comprises a hollow rectangular member having two sides upon which said coils are wound, and a post extending from one of said sides toward the other of said sides, the free end of said post being spaced from said other side to provide a gap, said post being adapted to prevent excessive magnetic leakage, and the size of said gap determining the amount of said leakage.

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