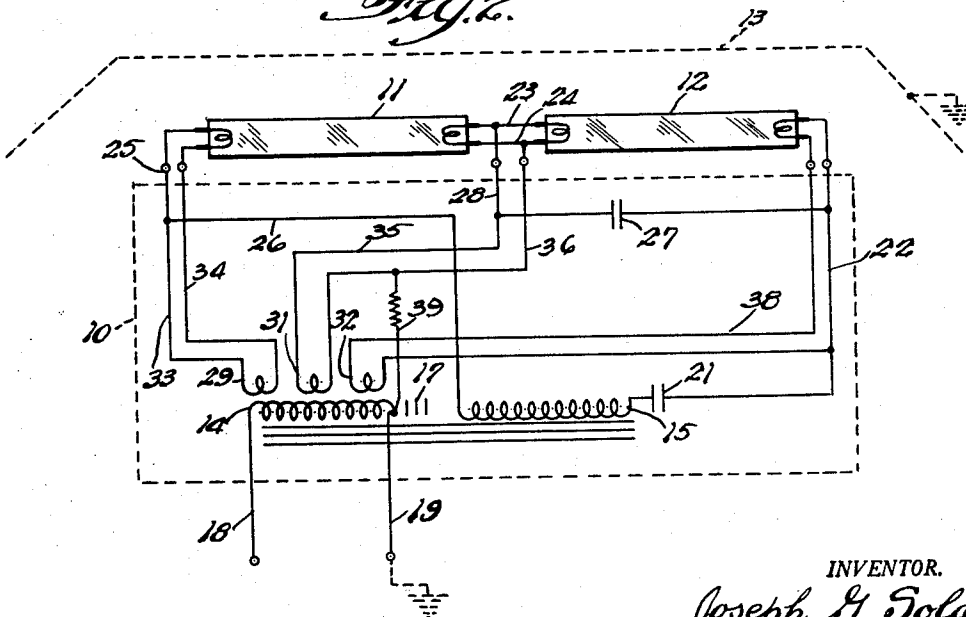
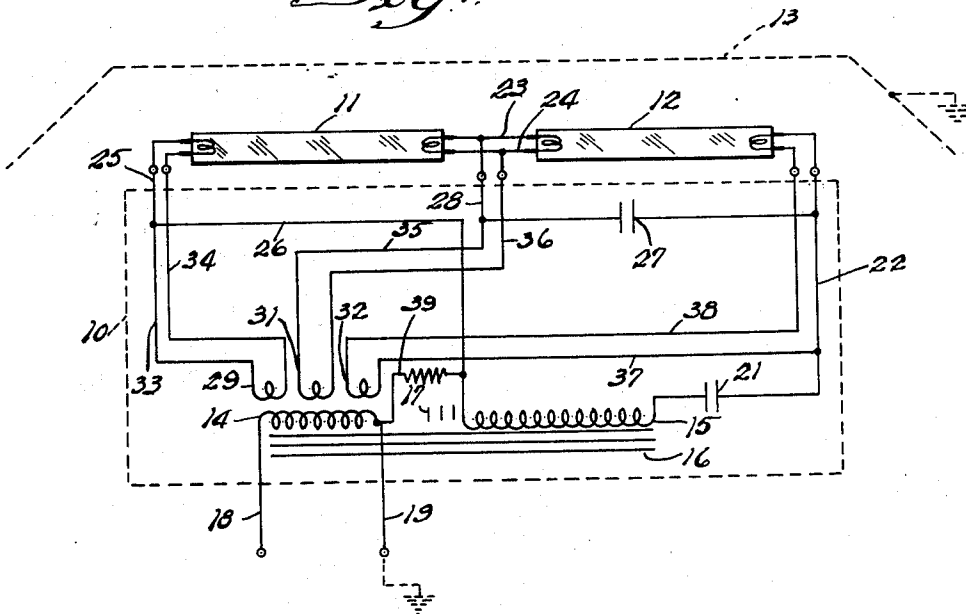


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SAFETY SYSTEM FOR FLUORESCENT LAMP BALLASTS

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SAFETY SYSTEM FOR FLUORESCENT LAMP BALLASTS

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This invention relates to safety systems for use in connection with ballasts for gaseous discharge devices, such for example as fluorescent lamps, and it is an object of the invention to provide an improved system of this character.

Fluorescent lamps, as well as other gaseous discharge devices, require a high voltage for starting and a ballast for limiting the current through the device after it has started. The presence of the high starting voltage is a hazard. Moreover, fluorescent lamps not infrequently are more difficult to start than is normal, or the starting thereof may be erratic, due perhaps to temperature, pressure and humidity conditions, the presence of static charges on some portions of the lamps or surrounding fixture, factors arising out of the distribution of static charges, impurities in the tube electrodes, or perhaps other causes. It has been found that starting may be facilitated, or certain starting difficulties eliminated, by grounding one of the terminals of the fluorescent tube, or by grounding some portion of the ballast which is electrically connected in circuit with the terminals of the ballast tube. Mounting the fluorescent tubes in close association with a metallic fixture has been found to be helpful as has also grounding that fixture.

The presence of a grounding connection with the ballast makes it possible for a person standing on ground, for example, to come into contact with the available high voltage by holding onto the terminals at one end of a fluorescent lamp out of its socket while the other end is being inserted into an appropriate socket. It has been found, at least, in the case of certain recent developments in fluorescent lamps, that when one end of the lamp is inserted into the socket, and that socket is energized, the lamp may actually break down and conduct, thereby creating a serious shock hazard to the person installing the lamp. Accordingly, it is a further object of the invention to provide in a fluorescent lighting ballast, in which a circuit component is required to be grounded, an improved safety system having no substantial shock hazard.

Further objects of the invention will become apparent as the description proceeds and the invention may be better understood by reference to the accompanying drawing, in which:

FIGURE 1 is a circuit diagram of a fluorescent lamp ballast embodying the invention; and

FIG. 2 is a circuit diagram of another form of fluorescent lamp ballast embodying the invention.

Referring to the drawings, the invention is shown embodied in a ballast 10 (shown enclosed in a broken line rectangle) for energizing a pair of fluorescent lamps 11 and 12, for example, all of which may be mounted in a fluorescent lamp fixture 13 shown schematically by the broken line bearing this reference character. The fixture 13 is shown grounded, inasmuch as this is common practice in the lighting art.

The ballast 10 may be of the resonant type, such as is shown and claimed in the applicant's prior Patent No. 2,346,621 for Alternating Current Supply System, granted on April 11, 1944, and includes a primary winding 14, a secondary winding 15, and a core 16 upon which the primary and secondary windings are disposed. The transformer is of the high leakage reactance type, the leakage

reactance being provided, for example, by means of a shunt 17 magnetically disposed between the primary and secondary windings, and the primary winding 14 is provided with a pair of leads 18 and 19 for connection to a suitable source of alternating voltage, for example, one hundred ten volts and sixty cycles. The lead or conductor 19 may be designated as a ground connection so that when the ballast is installed and connected, this conductor becomes connected to ground as shown, such being common practice in the lighting art for safety reasons and for improving starting of the lamps.

The secondary winding 15 is provided with a sufficient number of turns with respect to the primary winding, whereby the voltage available to the fluorescent lamps 11 and 12 is sufficient to start them in sequence and to operate them in series. The secondary winding 15, independently of electrical connection to the primary winding, provides the voltage for starting and operating the fluorescent lamps 11 and 12 and is connected in series with them through a circuit which may be traced as follows: From the right end of secondary winding 15, through condenser 21, conductor 22 to one of the terminals at the right end of fluorescent lamp 12, through the fluorescent lamp 12, conductors 23 and 24 from the terminals at the left end of fluorescent lamp 12 to the terminals at the right end of fluorescent lamp 11, through the fluorescent lamp 11 and through conductors 25 and 26 to the left end of the secondary winding 15. A condenser 27 is shown connected from conductor 22 to a conductor 28 which, in turn, is connected to the conductor 23. By means of the condenser 27 and its connections which place it across lamp 12, the voltage of the secondary winding is applied to the fluorescent lamp 11 at the starting instant, whereby the full voltage is applied to fluorescent lamp 11 and it starts. Thereafter, the current in condenser 27 produces a sufficient voltage drop therein to strike fluorescent lamp 12 and the two fluorescent lamps, then, operate in series across the secondary winding, all as is well understood in this art. The condenser 21 cooperates with the secondary winding 15 to provide a condition approximating series resonance as is described in the applicant's aforesaid patent.

Other forms of ballasts and starting arrangements may, of course, be provided.

Three windings 29, 31 and 32 are wound coupled to the primary winding 14 so as to have voltages induced therein. The winding 29 is shown connected by means of conductors 25, 33 and 34 to the terminals at the left end of fluorescent lamp 12. The winding 31 is shown connected by means of conductors 23, 28, 35, 36 and 24 to the terminals at the right end of fluorescent lamp 11 and the terminals at the left end of fluorescent lamp 12. The winding 32 is shown connected by means of conductors 22, 37 and 38 to the terminals at the right end of fluorescent lamp 12. The windings 29, 31 and 32 provide heating current for the filaments of the fluorescent lamps 11 and 12 and remain energized while the lamps are operating.

Connected from the left end of winding 15 to the conductor 19 is an auxiliary circuit means 39. Through this auxiliary circuit means, connected as indicated, the terminals at the left end of lamp 11 become grounded when the ballast is installed and the lamp is disposed in its sockets. By virtue thereof, it has been found that the fluorescent lamps start with greater ease and do so consistently.

It has been found sufficient to ground any one of the terminals of the fluorescent lamps. Also the ground may be through any one of the circuit components of the ballast. Moreover, the grounding connection may be made internally of the ballast as shown in FIG. 1, or a separate lead may be brought out for the purpose. In

some instances it may be sufficient to make the grounding connection to the fixture 13 and, for example, may be made through the metallic case which ordinarily surrounds the ballast itself.

The term "ground" as used in this application comprehends the earth as well as any artificial ground, such as a large metallic surface, for example, a lamp fixture which may not be connected to earth.

A person standing on ground while the ballast is energized and grasping the right end of fluorescent lamp 11 out of its socket, while the left end is disposed in its socket, will be in no danger of shock since the left end of fluorescent lamp 11 is connected to ground through conductors 25, 26, the circuit means 39, and conductor 19. The filament at the left end of fluorescent lamp 11 is heated by winding 29 and the lamp is in condition to start when the proper voltage is applied thereto. If the person grasps the left end of fluorescent lamp 11, a circuit to ground may be traced through the fluorescent lamp, conductors 23 and 24, fluorescent lamp 12 and condenser 27 in parallel, conductor 22, condenser 21, secondary winding 15, circuit means 39 and conductor 19 to ground. If a person grasps the left end of fluorescent lamp 12, a circuit may be traced to ground as follows: Through fluorescent lamp 12, conductor 22, condenser 21, secondary winding 15, circuit means 39 and conductor 19 to ground. If a person grasps the right end of the fluorescent lamp 12, a circuit may be traced to ground as follows: Through fluorescent lamp 12, conductors 23, 28, condenser 27, conductor 22, condenser 21, secondary winding 15, circuit means 39 and conductor 19 to ground. In the latter three instances, the possibility of shock to the person exists since the filaments of the lamps are heated by the windings connected thereto. To eliminate this shock hazard, the circuit means 39 may comprise a sufficiently high impedance or resistance, for example of the order of one million ohms, which will limit any current flow in the circuits traced to a negligible or non-hazardous value.

The circuit of FIG. 2 is the same as that of FIG. 1 with the exception that the auxiliary circuit means 39 is connected at one end to conductor 36 instead of to conductor 26. In this case, when either the left end of fluorescent lamp 11, or the right end of fluorescent lamp 12, is grasped by a person, no shock hazard exists since each of the other ends of these lamps is connected to ground through conductor 36, circuit means 39 and conductor 19. When the right end of fluorescent lamp 11 is grasped, a circuit to ground may be traced through fluorescent lamp 11, conductors 25 and 26, secondary winding 15, condenser 21, conductor 22, fluorescent lamp 12 in parallel with condenser 27, conductor 36, circuit means 39, and conductor 19 to ground. If the left end of fluorescent lamp 12 is grasped, a circuit to ground may be traced through the fluorescent lamp 12, conductor 22, condenser 21, secondary winding 15, conductor 26, conductor 25, fluorescent lamp 11, conductors 24 and 36, circuit means 39 and conductor 19 to ground. In these latter two instances, a shock hazard may exist but the circuit means 39, having sufficient impedance, for example, a resistance of a million ohms as already indicated, the current which may flow is reduced to a negligible or non-hazardous value. Other circuits to ground from the lamp terminals may perhaps be found but their shock hazard is also removed as described.

The hazardous conditions referred to arise in part because the filaments of the lamps are energized since the heating windings are connected to the filaments whenever the fluorescent lamp terminals are disposed in the appropriate sockets.

While the circuit means 39 have been shown connected at one end to a conductor 19, which may be designated as a grounding connection, and in FIG. 1 the other end has been shown connected to conductor 26 terminating in a ballast lead 25 and in FIG. 2 has been shown connected to conductor 36 also forming a ballast lead, the circuit means 39 may be connected to other components.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since many modifications may be made, and it is, therefore, contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

The invention having thus been described, what is claimed and desired to be secured by Letters Patent is:

1. Ballast means for use with fluorescent lighting tube means and a grounded source of A.C. power, said ballast means comprising a circuit including a primary winding for connection to said grounded source, a circuit including a secondary winding for applying A.C. voltage across said tube means, said primary and secondary windings being coupled magnetically but isolated electrically, and high impedance auxiliary circuit means connected between the circuit of said primary winding and the circuit of said secondary winding whereby grounding of any point in the circuit of said secondary winding will complete a circuit through said primary winding circuit and including said auxiliary circuit means, the impedance of said auxiliary circuit means being sufficient to limit the current therethrough to a value less than that creating a shock hazard.

2. Ballast means for use with fluorescent lighting tube means and a grounded source of A.C. power, said ballast means comprising a circuit including a two-terminal primary winding for connection to said grounded source whereby one of said terminals is grounded, a circuit including a secondary winding for applying A.C. voltage across said tube means, said primary and secondary windings being coupled magnetically but isolated electrically, a grounded elongate metallic fixture adjacent said tube means, and high impedance auxiliary circuit means comprising a large series resistance connected between said grounded terminal of the primary winding and the circuit of said secondary winding whereby grounding of any point in the circuit of said secondary winding will complete a circuit through said primary winding circuit and including said auxiliary circuit means, the impedance of said auxiliary circuit means being sufficient to limit the current therethrough to a value less than that creating a shock hazard, a circuit being established from ground through said auxiliary circuit means, said secondary winding, the tube means and the metallic fixture to aid in initiating operation of the tube means.

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