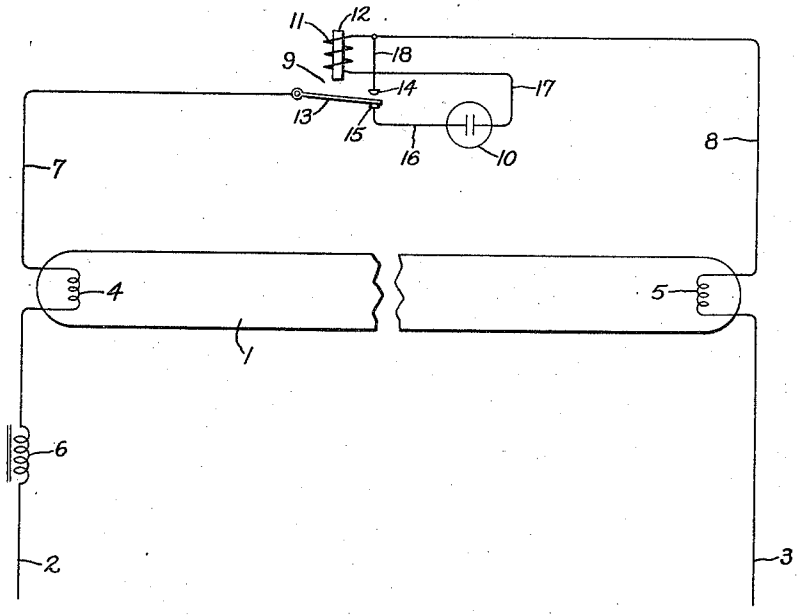
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CONTROL SWITCH FOR DISCHARGE LAMPS

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## CONTROL SWITCH FOR DISCHARGE LAMPS

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Our invention relates to a control switch for starting and operating gaseous discharge lamps and more particularly to a starting switch for fluorescent lamps of the type now in commercial use.

Such fluorescent lamps are usually connected in series with an inductive ballast across a source of electric power together with a control switch in parallel with the lamp but in series with the lamp electrodes. When the control switch opens the circuit between the electrodes, the inductive ballast provides a high voltage surge to start the lamp. Such control switches are known to the trade as "starters" and this term will be used in the description and claims to follow.

Our invention relates to a starter of the general type disclosed in Patent 2,212,427 issued on August 20, 1940 to Leo R. Peters and assigned to the same assignee as the instant application. In this patent a starter is disclosed in which a vibrating relay is connected in circuit with a glow lamp, the coil of the relay being in series with the glow lamp and the contacts of the relay short-circuiting both the glow lamp and relay coil when in closed position. While for certain applications, the starter of the Peters patent operates satisfactorily, it has been found that part of the inductive kick from the ballast obtained across the relay contacts when opened is absorbed in the glow lamp and relay coil and hence is not available across the lamp electrodes to help in starting the lamp. By our invention, however, a starter is devised which will apply full voltage developed from the inductive ballast across the lamp electrodes.

Therefore, one object of our invention is to provide a new and improved control switch or starter for operating discharge lamps, such as fluorescent lamps, which operates to apply full starting voltage obtained from the ballast across the lamp.

Another object of our invention is to provide an improved starter which comprises relatively few parts easily assembled and which is positive in operation to start the lamp.

In the drawing, our starter is shown in diagrammatic form connected into an operating circuit for a discharge lamp.

Referring to the drawing, a discharge lamp 1 is shown connected across the leads 2 and 3 of a suitable power source, for example a 115 volt alternating current source such as is used in residence or factory wiring systems. The lamp 1 may be of the positive column gaseous discharge type, such as a fluorescent lamp of the type now

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on the market. It is provided at opposite ends with electrodes 4 and 5 which may for example be of the filamentary cathode type coated with electron-emissive material and which are adapted to be heated to an emissive condition prior to starting the lamp. The lamp itself forms no part of our present invention. It should be manifest that our invention is applicable equally as well to other types of discharge lamps, for example those provided with indirectly heated cathodes or those provided with cathodes constructed for "cold cathode" starting without preheat. A ballast such as an inductance 6 is connected electrically in series with the discharge lamp 1 in the current supply lead 2.

A starter constructed in accordance with our invention is connected electrically in series with the electrodes 4 and 5 and in parallel with the discharge path through the lamp by conductors 7 and 8. The starter includes a magnetically operable relay 9 and a glow lamp 10 which themselves are electrically connected together in series. Relay 9 comprises a coil 11 having a pole 12 which operates the armature 13 between two spaced contacts 14 and 15. Normally, the armature 13 is in engagement with the fixed contact 15 and is held in this position by the spring action of the armature. Contact 15 is electrically connected to one electrode of the glow lamp by a conductor 16. The other glow lamp electrode is electrically connected to the relay coil by a conductor 17. Fixed contact 14 is connected to conductor 8 by a conductor 18 so that when the armature 13 is in contact with it the relay coil is open-circuited. The glow lamp may be of the neon glow lamp type such as are used for indicators and is designed to pass sufficient current to actuate the relay.

When power is applied to the lighting system, current flows from lead 2, through ballast 6, lamp filament 4, conductor 7, normally closed relay contacts 13 and 15 to the glow lamp 10. Because the voltage impressed on the glow lamp is above its ionization voltage sufficient current is now passed through the glow discharge in the lamp 10 to energize the coil of the relay. The circuit to the coil is completed through conductor 17, coil 11, conductor 8, lamp filament 5 to the other current lead 3. When full line voltage is applied to the glow lamp it breaks down and passes sufficient current to energize the relay. However, at this point the current flowing through the circuit including the glow lamp is not sufficient to provide for any appreciable heating of the filamentary lamp electrodes.

As soon as the relay 9 is energized the armature 13 is pulled by the armature 12 into engagement with the other relay contact 14. This disconnects the coil 11 and the glow lamp 10 from the circuit and deenergizes the relay so that the spring armature 13 begins to move back to its original position. However, for the time during which the relay is open-circuited a relatively heavy current flows through the ballast 6 and through the lamp filaments across the shunt path formed by conductor 7, armature 13, conductor 18, and conductor 8. This current serves to preheat the lamp filaments to a considerable extent even though it exists for the relatively short time interval during which the armature 13 is in engagement with the fixed contact 14. More important still, a relatively large current flows through the ballast 6 during this period and sets up a strong magnetic field which is used to develop a high voltage across the lamp electrodes as soon as the armature 13 leaves the contact 14.

When the circuit through the contact blade 13 and contact 14 is interrupted, the magnetic field in the ballast collapses and provides a high inductive voltage kick or impulse which is applied across the lamp filaments to start the lamp. It is a feature of our invention that the full voltage developed in the ballast is applied to the lamp. When armature 13 leaves contact 14 to open the circuit, there is an appreciable time interval transitional movement before it reengages contact 15. During this time interval both the glow lamp 10 and relay coil 11 are out of the circuit. And it is during this time interval that the high voltage kick is applied to the lamp. Since both the glow lamp 10 and relay coil 11 are out of the circuit, they cannot absorb any of the power in the voltage kick delivered to the lamp. The arrangement provides for faster, surer lamp starting because full voltage is applied to the lamp.

In the event that the lamp fails to light on the first attempt, the cycle of operation will be repeated until the lamp lights. Each time the relay operates, further preheating of the filaments will take place and a succession of high voltage kicks will be applied to the lamp. In fact, the relay switch will vibrate at its natural frequency to deliver a series of impulses.

When the lamp lights, the voltage across the lamp electrodes is immediately reduced to that across the discharge column in the lamp. This voltage is insufficient to break down the glow lamp so that the starter is maintained inoperative while the lamp is lighted. No current is consumed in the starting switch during operation of the lamp. Flow of current through the lamp is limited to a proper value by the ballast 6.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. A starter for use in an operating circuit for a discharge lamp including a ballast and a source of power and adapted to be connected between the lamp electrodes comprising, in combination, a relay having a magnetic coil, a movable contact member operated thereby and spaced contacts one of which is normally in engagement with the movable contact member, a glow discharge device electrically connected in series with said one contact and said magnetic coil and a connection from said other contact by-passing the magnetic coil, said glow discharge device being operative upon application of power to cause said magnetic coil to be energized to move said contact member into engagement with said other contact to by-pass said coil whereby current flows through the ballast and electrodes, said movable contact member having an appreciable time interval transitional movement to its normal position for opening the circuit through both of said contacts and for effecting the application of a high voltage from the ballast to the lamp electrodes.

2. A starter for a discharge lamp adapted to be connected between the electrodes of the lamp comprising, in combination, a relay having a coil operated movable contact member normally in engagement with one of two spaced contacts, a glow discharge device electrically connected in series with said one contact and the relay coil to complete a circuit through the starter between the lamp electrodes and a connection from the other spaced contact by-passing the relay coil, said movable contact member having an appreciable time interval transitional movement to its normal position for effecting the application of a starting voltage exclusively across the electrodes of said lamp.

3. A starter for discharge lamps comprising, in combination, a glow discharge device, a magnetic relay having a series connected coil and normally closed contacts electrically connected in series with said glow discharge device and being operable upon passage of current through the device to interrupt the circuit therethrough, said relay being provided with normally open contacts by-passing the relay but being adapted to close upon energization of the relay, said relay having an appreciable time interval transitional movement to the normally closed position for effecting the application of a starting voltage directly across said electrodes.

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