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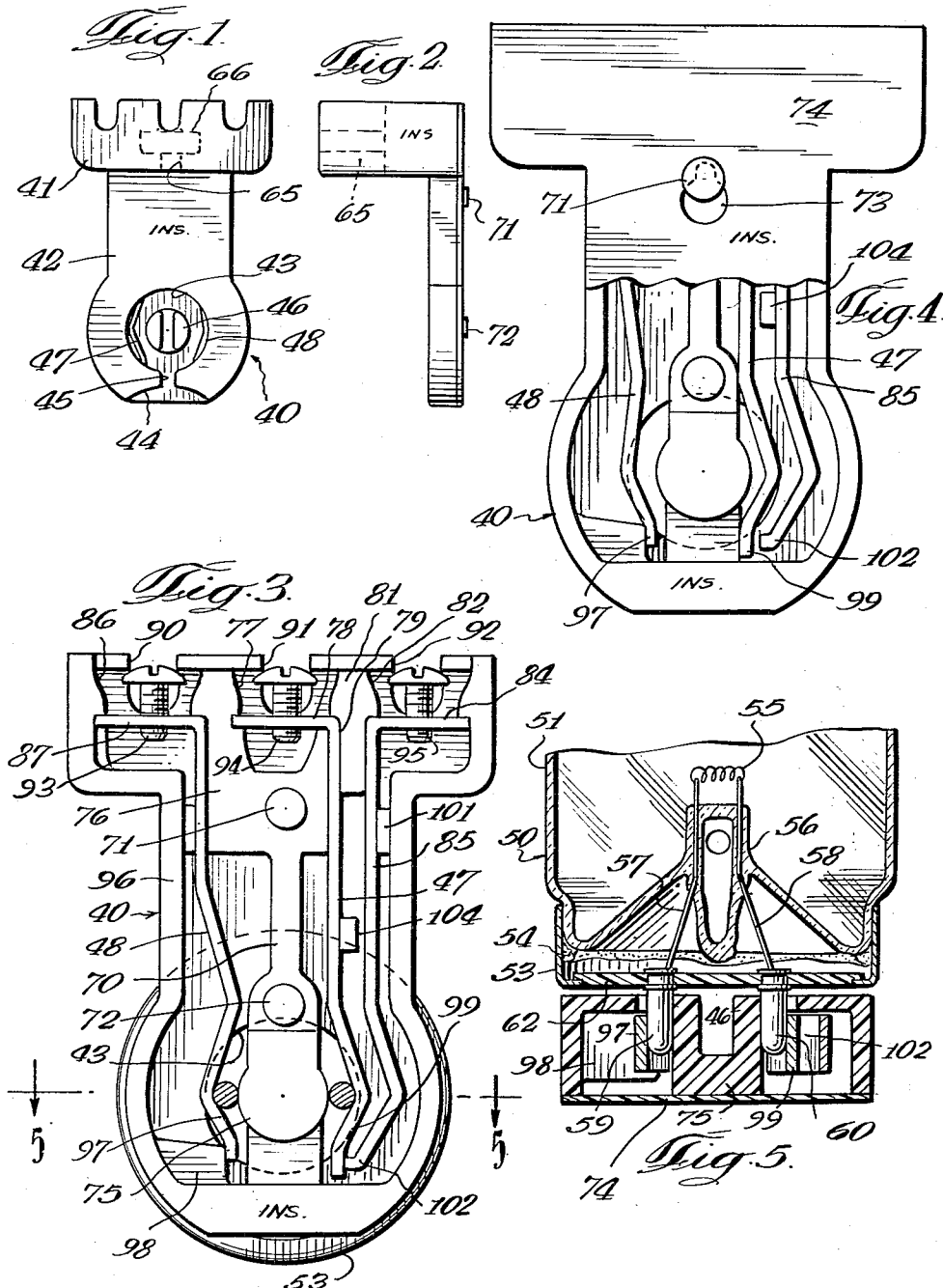
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2,767,349

FLUORESCENT LAMP SOCKET AND LIGHTING SYSTEM

Filed July 14, 1953

3 Sheets-Sheet 1



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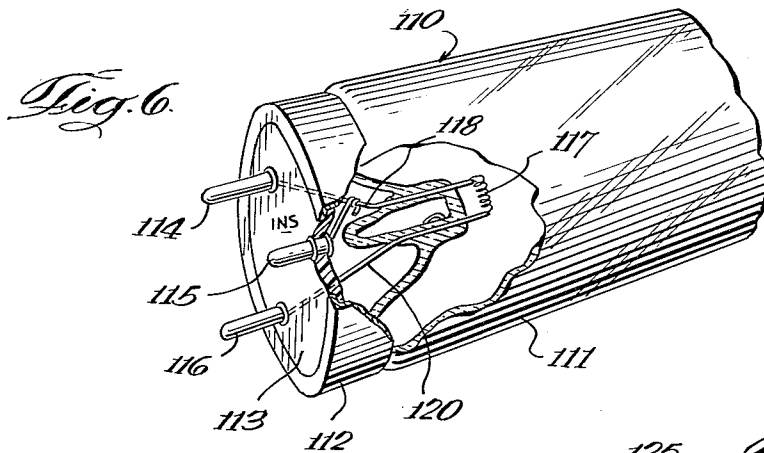
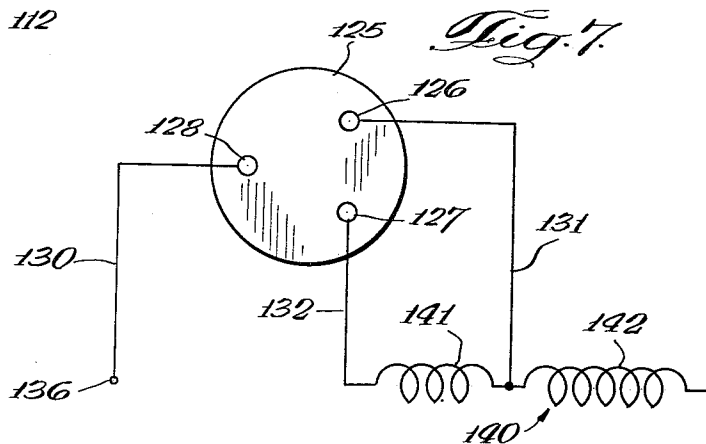
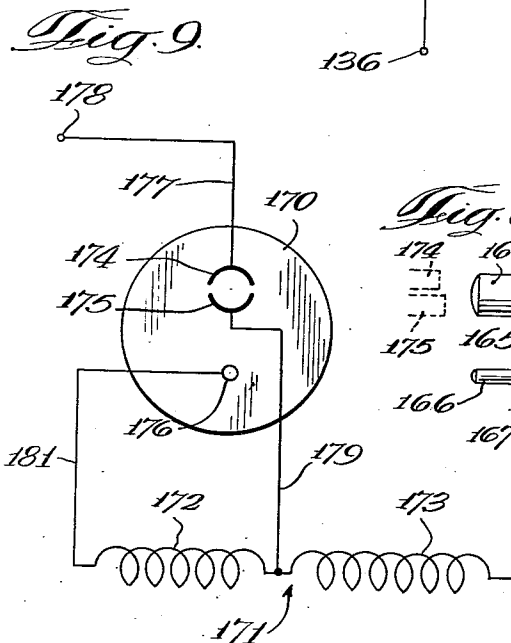
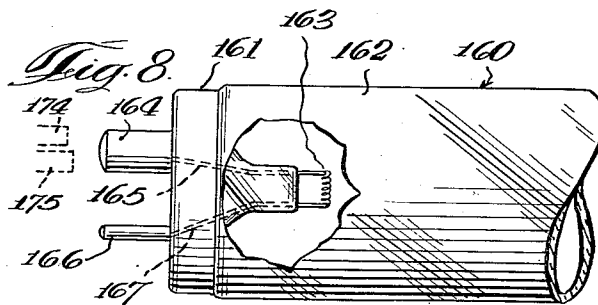
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FLUORESCENT LAMP SOCKET AND LIGHTING SYSTEM

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3 Sheets-Sheet 2



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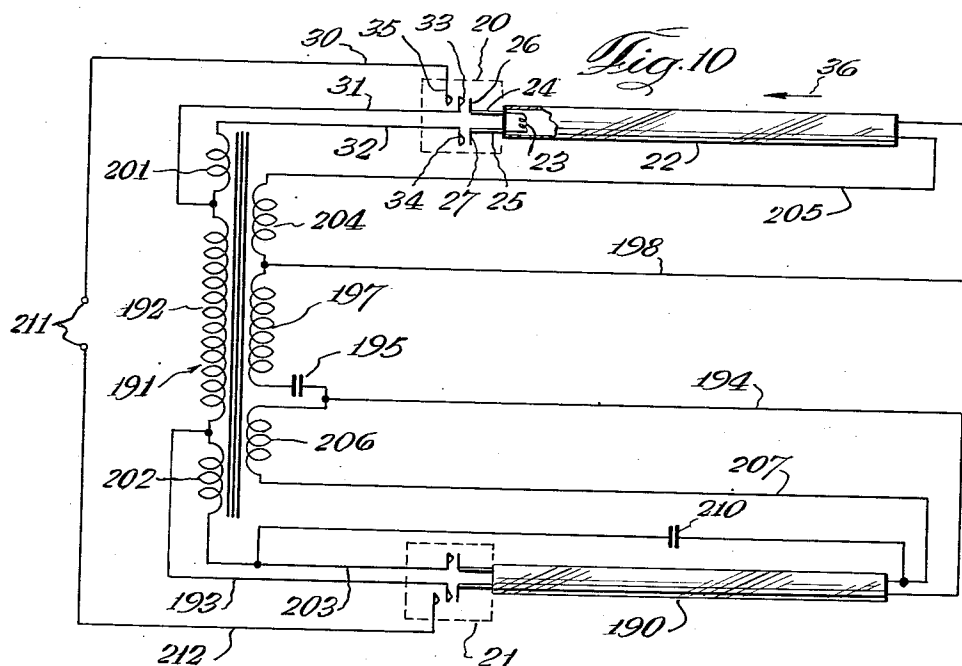
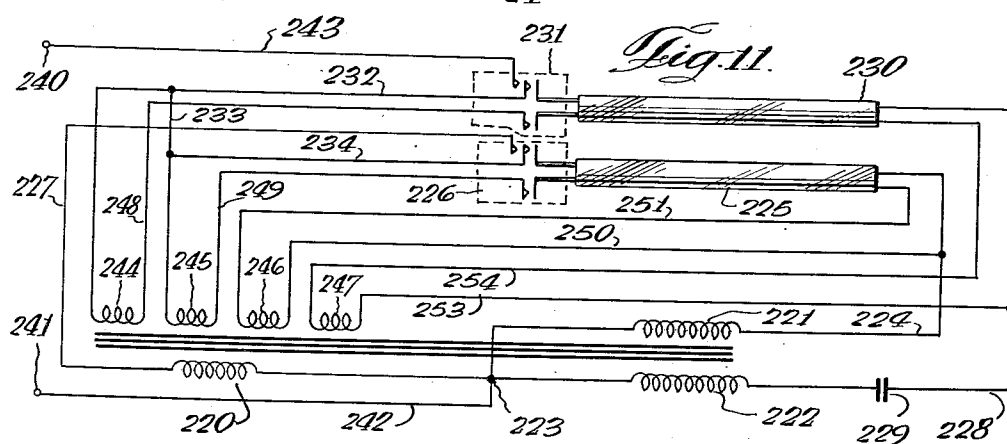
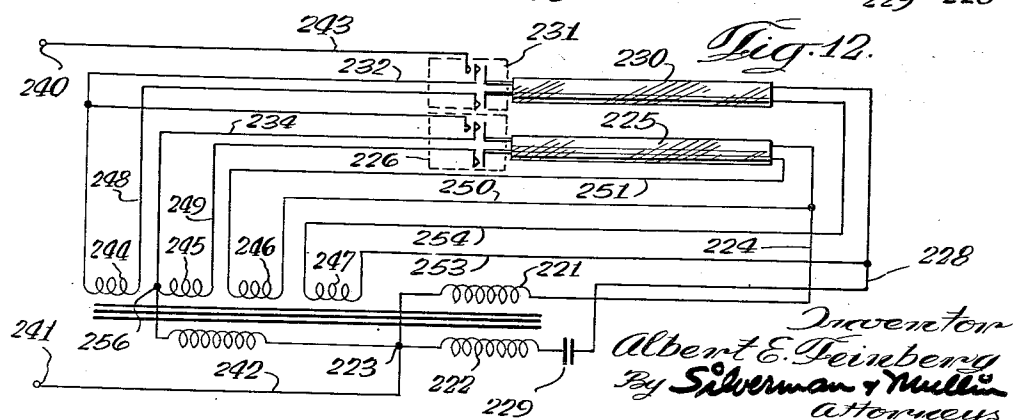
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FLUORESCENT LAMP SOCKET AND LIGHTING SYSTEM

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3 Sheets-Sheet 3



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FLUORESCENT LAMP SOCKET AND LIGHTING SYSTEM

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15 Claims. (Cl. 315—97)

This invention relates generally to fluorescent lighting and more particularly is concerned with a construction for a fluorescent lamp socket and lighting systems used in combination therewith.

It has previously been known to provide sockets of a type referred to as "shunting" sockets for use in lighting systems in which it has been desired to open the power line supplying the transformer serving to ballast the gaseous discharge devices. When the open circuit voltage existing in such systems between sockets intended to have a lamp engaged therein is above a certain value, safety dictates that such shunting sockets be used.

Prior to the advent of the so-called instant-start lamp, fluorescent lamps were operated by means of circuits which utilized various types of starting devices. These were lamps with pre-heat filaments, and the voltages at which the lamps ignited and operated were generally low, that is to say, never of the order of over several hundred volts. The instant-start circuit eliminated the starters, initiating ignition without pre-heating of the filaments, but required a considerably higher starting voltage than the former pre-heated lamps. With the elimination of starters and filaments came special lamps which were not intended to have any appreciable filament current. These lamps also started with high voltages, and even operated at voltages higher than those of the pre-heat type.

Recent developments have carried this art to a type of circuit known as "rapid-start" to distinguish the same from instant-start. In this type of circuit high voltages are used, but the lamp itself has a filament which is supplied by current through the medium of filament windings. The filaments are so constructed that there are no destructive effects if current flows through them at all times. Also, through the use of starting voltages higher than those of pre-heat systems, starter switches are not needed. The lamps respond in much the same manner as the instant-start, but the circuits have certain advantages over the instant-start circuits, as well as the pre-heat start circuits. The general ratio of open circuit to operating voltages is two to one, but even at this comparatively lower voltage, it is desirable to have sockets and circuits which enable the line connections to be broken in the event the lamps are removed. The presence of the filament windings is complicating and heretofore, insofar as I am aware there have been no sockets like those described herein and no circuits have been successfully devised to accomplish the opening of the line with removal of lamps.

It is an important object of the invention to provide new and improved sockets or similar devices for use in connection with rapid start lamps which will open the line when the lamps are removed from the circuit.

A corollary object lies in the provision of novel circuitry to enable the use of such sockets or devices and the achievement in safe lighting systems of the advantages to be derived through using rapid start lamps and ballasts.

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The apparatus for use in starting and operating rapid start lamps is considerably cheaper than that for use in instant-start circuits. In the first place the voltages are lower and hence the size of ballast is smaller. Also there are no abnormal conditions which arise in case one lamp becomes extinguished in a lead-lag circuit. In instant-start systems there would be overheating. The flicker of starter switch operated circuits is eliminated, as well as the conditions caused by starter switches becoming short circuited.

A further object of the invention is to provide novel construction of a socket for use with a bi-pin lamp which will connect the lamp to two electrical leads and thereafter connect a third electrical lead to one of the first two, all in the order named.

In connection with the above object, one of the problems met in the type of circuit with which this invention is concerned lies in the prevention of line current from passing through the filament of the lamp. In the event a lamp is inserted into a circuit which is "alive," if the filament is connected to be in series with the line, even for an instant, there may be damage thereto. The invention contemplates sockets or connections which will prevent this from ever occurring.

Further objects of the invention lie in the provision of special sockets for use with rapid start lamps where the lamp is to be either inserted in the socket in axial movement, or in other cases where the lamp is inserted in the socket and then twisted to a contacting position.

Other objects are concerned with the provision of novel systems for using rapid start lamps in which the circuit is a lead-lag type or in which the circuit is a series type.

Other objects of the invention lie in the provision of novel systems in which the lamps and sockets are constructed to prevent line current from flowing through the filament windings, but in which removal of the lamp from the circuit will open the line.

Many other objects will occur to those skilled in the art, but it is desired to emphasize that the invention has a broad purpose of enabling the advantages of the rapid start systems to be achieved along with the advantages to be achieved through the use of sockets or constructions which will open the energizing line to the ballast. Obviously considerations of safety are of greater value when coupled with simplicity of structure, ease of fabrication and installation, and economy which I also consider attributes of this invention.

As required by the patent statutes I have illustrated numerous embodiments of the invention, both diagrammatically and through the use of the usual illustrations, from an inspection of which, when considered along with the detailed description, the invention and all of its advantages should be readily understood. Obviously considerable variation in the minor details may be made without in any way departing from the spirit or scope of the invention.

In the drawings in which the same or similar characters of reference are used to designate the same or similar parts or elements throughout the several figures of the drawings:

Fig. 1 is a front elevational view of a lampholder or socket constructed in accordance with my invention, of the type in which the lamp is inserted, given a quarter of a turn and thereby locked in position.

Fig. 2 is a side elevational view of the lampholder of Fig. 1.

Fig. 3 is a rear elevational view of the lampholder of Figs. 1 and 2, showing a lamp in place, the rear cover plate of the lamp holder having been removed to show the arrangement of the contacts.

Fig. 4 is a view similar to that of Fig. 3 but with the

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lamp removed, and only a portion of the rear cover plate shown.

Fig. 5 is a sectional view taken generally along the line 5—5 of Fig. 3 and in the indicated direction.

Fig. 6 is a perspective view of one end of a lamp of the rapid start type the same having three pins and intended for use with a push-in type of socket.

Fig. 7 is a diagrammatic illustration of a socket and the pertinent portions of a system constructed in accordance with the invention, designed to use the lamp of Fig. 6.

Fig. 8 is a side elevational view of the end of another form of a fluorescent lamp constructed in accordance with the invention, a portion being broken away to show the connections to the filament.

Fig. 9 is a diagrammatic illustration of a socket and the pertinent portions of a system constructed in accordance with the invention, designed to use the lamp of Fig. 8.

Figs. 10, 11 and 12 are circuit diagrams of rapid-start systems for fluorescent lighting which embody the invention.

At the outset it is desired to point out that there are symbols used in the illustrations herein which are intended to designate the connections between the lamp bases and the sockets of the invention which are new, insofar as I am aware. They illustrate the manner of operation of the sockets, and their illustration in the particular symbolic form is not intended to disclaim any novelty that exists therein, even in the broadest aspects of the invention. Each of the connections is characterized by the provision that the line is not connected into the circuit until after the primary winding has been connected to provide a path for the line current.

At this point, therefore, attention is first directed to Fig. 10, in which I have enclosed the connections by dotted rectangles 20 and 21. Considering only the connection 20, the lamp 22 has a filament 23 which is connected to the pins 24 and 25. In this symbolical illustration each of the pins 24 and 25 has a portion at right angles thereto and integrally formed therewith, designated respectively 26 and 27. Three leads extend from the transformer to the connection 20. Without at this point going into the details of the system, suffice it to say that the lead 30 extends from the line, the lead 31 extends from the primary winding, and the lead 32 extends from the filament winding. It is desirable for preserving the filament that when the connection is completed the line lead 30 will be connected to the filament 23 only after the primary and filament leads 31 and 32 are connected. The leads 31 and 32 are shown terminating in right angle contacts 33 and 34 which face the conductor portions 26 and 27 respectively. Spaced to the rear of the contact portion 33 is another right angle contact 35 which is the termination of the line lead 30.

The illustrated symbolical connection operates through a theoretical movement of the lamp 22 to the left, i. e., in the direction of the arrow 36. First the conductor portions 26 and 27 engage the contacts 33 and 34 respectively, thereby closing the circuit of the filament winding and the primary. Then, as movement of the lamp is continued, it moves the contact 33 into engagement with the line contact 35. Obviously, it is impossible to connect the line lead 30 to the filament winding until after the primary lead 31 has been connected, thereby preventing line current from flowing directly through the filament 23.

In Figs. 1 through 5 I have illustrated a socket which is of generally conventional configuration, but which is constructed in accordance with the invention. This structure is called a lampholder, and the lamp with which the same is used is the usual bi-pin type. The lamp is inserted in the lampholder, given a quarter turn, and it locks itself.

The lampholder or socket is designated generally by

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the reference character 40, and is usually formed from molded plastic or phenolic condensate resin. As seen in Figs. 1 and 2, there is a pedestal formation 41 and a standard 42 arranged at right angles thereto. The standard 42 has a circular recess 43 in its face spaced above the pedestal, entrance to which is gained by a guide recess 44 and a pin passageway 45. A central split peg 46 separates the contact arms 47 and 48 only portions of which may be seen in Fig. 1, and provides a path for the pins of the lamp when inserted.

In Fig. 5 I have illustrated a portion of a conventional rapid start lamp 50 which comprises a glass envelope 51 set into a metal base 53 and sealed by cement 54. The filament 55 is mounted upon the stem press 56 and leads 57 and 58 connect the same with the base pins 59 and 60 respectively. The pins 59 and 60 may be mounted in any suitable manner, but I have shown the same riveted to the insulating disc 62 which closes off the end of the base 53.

In inserting the lamp into the lampholder 40, the pins 59 and 60 are aligned with the pin passageway 45 and the cleft of the peg 46, moved to the bottom of the recess 43 and given a quarter turn. This causes the resilient contact arms 47 and 48 to seize the pins and hold the lamp. The socket or holder 40 may be attached to a lamp fixture in any desired manner, but that illustrated is provided with a vertical slot 65 in the front end of the pedestal for passage of a bolt, having an enlarged portion 66 to receive a nut therein. This is conventional construction.

Referring now to Figs. 4 and 5, the interior of the lampholder is substantially hollow, and provides various bosses and projections to seat the contact arms arranged in accordance with my invention. There is a central web 70 which has a pair of studs 71 and 72 set therein. These studs are headed and are for engagement with the key-hole slots (one being shown at 73) of the back cover 74. This removable cover may be fiberboard or the like, or may be a plate permanently attached. The web 70 has a portion 75 bridging the recess 43 and forming the back of the peg 46. The web has an enlarged portion 76 provided with a central recess 77 across which the contact leg 78 of the arm 48 is disposed. Various slots are formed to hold the leg 78. One of these, indicated at 79 separates the portion 76 from a boss 81 formed between recess 77 and another recess 82 across which there is disposed the leg 84 of still a third arm 85. Between the portion 76 and the left hand side of the holder 40 is a third recess 86 across which the leg 87 of the arm 48 extends.

Each of the legs 78, 84 and 87 has a contact screw by means of which electrical leads may be attached and the holder 40 has recesses 90, 91, and 92 to accommodate passage of the wires. The screws are designated 93, 94 and 95.

The construction of the arms 47, 48 and 85 is of some importance, as will be pointed out. The ordinary holder of this construction has a framing portion, just as shown at 96, and except for their securement at their leg portions and perhaps just above, the resilience of the contact arms (of which prior structures had only two) is permitted to remain uncontrolled. It will be seen, however, that as for the arm 48, its free end 97 is prevented from moving to the left, as viewed in Figs. 3 and 4 by a stop boss 98. Because of this, as the lamp is inserted and rotated, and the pins tend to spread the free ends of the contact arms, practically all of the movement will be taken by the free end 99 of the arm 47. The arm 85 extends parallel with the arm 47, being confined between bosses 81 and 101. Its free end 102 forms a contact adapted to engage the free end 99 of the arm 47. Obviously, then, when the lamp pins force the arms 47 and 48 apart, the ends 99 and 102 will engage in electrical contact.

In normal condition, i. e., with no lamp in place, move-

ment of the arm 85 into engagement with the arm 47 is prevented by a boss 104 which serves as a stop member.

With a lampholder such as that just detailed connected into a circuit, the same connection as described in Fig. 10 may be achieved. Thus, the line lead 30 would be connected to the screw 95 and arm 85; the primary lead 31 would be connected to the screw 94 and the arm 47; the filament lead 32 would be connected to the screw 93 and arm 48. When the lamp 50 would be inserted in the socket and turned, as it is turned, the pins 59 and 60 would engage the bends of the arms 47 and 48, thereby completing the circuit from the filament winding and primary to the filament 55. As rotation is continued, and only after contact had been made with the primary and filament leads, contact is made with the line lead.

The same effect can be obtained through the use of a three pin lamp such as illustrated in Fig. 6. The lamp 110 has an envelope 111, base 112, an insulating insert 113, and mounts three pins 114, 115 and 116. The filament 117 is connected by lead 118 to pin 114, and pin 115 is also connected internally to the lead 119 as shown. Lead 120 connects the other side of the filament to pin 116.

Note that the pin 115 is considerably shorter than the pins 114 and 116. This enables the connection to be made in the manner described above. At 125 in Fig. 7 I have shown an ordinary wafer-type socket which is constructed to receive the pins of the lamp 110 in an axial movement. There are female connectors for receiving the pins, same being designated 126, 127 and 128 for the respective reception of pins 114, 115 and 116. It will be noted also that the distances between the respective pins are unequal so that it is impossible to insert the wrong pins in the socket 125. The reference numeral 130 represents the line lead which may be similar to the line lead 30 shown in Fig. 10. The lead 130 is shown extending to a power terminal 136. This lead connects with the contact 128 of the socket 125 and eventually, that is when the lamp is in place, the pin 115 will be electrically connected with the line lead 130.

I have shown a part of the transformer 140 which includes a filament winding 141 adapted to be connected for energizing the filament 117. There is shown also a primary winding 142 which is connected by the primary lead 131 to the contact 126. The filament 141 is connected by lead 132 to the contact 127.

It will be seen that when the lamp 110 is pushed home into the socket 125, before the line lead 130 is in any way connected to the filament, the circuit through the filament and the connection to the primary 142 has been closed by reason of the pins 114 and 116 engaging the contacts 126 and 127. As motion of the tube 110 is completed to seat the same in the socket, thereafter the short pin 115 engages the contact 128 thereby energizing the primary. Obviously on removal of the lamp from the socket the reverse occurs, that is to say, the line is broken before the filament circuit is open, preventing any likelihood of line current flowing through the filament.

Another arrangement is shown in Figs. 8 and 9. In Fig. 8 there is illustrated a fluorescent lamp 160 having a base 161, envelope 162 and a filament 163 within the lamp connected to a large base pin 164 by means of a lead 165 and to a smaller base pin 166 by a lead 167. The socket for use with this type of lamp is shown at 170 in Fig. 9. There is also illustrated a portion of a transformer 171 which has a filament winding 172 and a primary winding 173. The socket 170 is polarized, that is to say, non-symmetrical so that there is only one way which the pins 164 and 166 may be inserted therein. The upper pin 164, as viewed in the drawings, is intended to be inserted between a pair of arcuate contact members 174 and 175 so that the entrance of the pin bridges the two contact members.

The problem of line current flowing through the filament is decreased by virtue of the fact that it is almost

certain that both contact members 174 and 175 will be simultaneously engaged by the pin 164. The other pin 166 is intended to engage the contact 176. Note that the contact member 174 is connected to a line lead 177 which in turn is connected to a power terminal 178. The contact member 175 is connected by primary lead 179 to the juncture between the primary and filament windings. The contact member 176 (which of course is of a female type, as are the combined contact members 174 and 175) is connected by the lead 181 with the filament winding.

In order to assure that the base pin 164 will not be connected to the line lead 177 for any substantial time, as for example, in the event the lamp 160 is canted during insertion in the socket 170, a novel construction may be utilized. The length of the respective arcuate contact members 174 and 175 may be different. Thus, as indicated by the broken lines of Fig. 8 the arcuate member 175 may be slightly longer to receive and engage against the pin 164 just prior to contact of the member 174 with the pin. In this manner line current will not flow through the filament 163.

Considering now Figs. 10, 11 and 12 I have illustrated therein circuits utilizing connections of the type described and providing fluorescent lighting systems in which the removal of any lamp will immediately open the source of power and deenergize the transformer or ballast serving the lamps. In each case the lamps are of the rapid start variety and filaments of the lamp must be provided with current through the medium of filament windings on the transformer.

In Fig. 10 there is illustrated a series circuit in which the lamps may be ignited one after the other but when ignited they operate in series. I have referred to and described the connection of the upper lamp 22 into the circuit and referred to a similar connection 21 for the lower lamp which is designated by reference character 190. Since the connection 21 operates in an identical manner there will be no need to describe the same. The transformer 191 is provided with a primary winding 192 connected in series with the lamp 190 through the connection 21 by way of the lead 193. The other terminal of the lamp 190 is connected by the lead 194 through a series condenser 195 to the secondary winding 197. The secondary winding 197 connects by way of the lead 198 to the lamp 22 which, as has been explained, is connected to the primary lead 31 thereby completing the circuit. There are four filament windings on the transformer 191 inductively coupled to the primary winding 192. Each serves a filament at the ends of the respective lamps 22 and 190. Thus, the filament winding 201 serves the left hand filament 23 of the lamp 22 through the leads 31 and 32. The filament winding 202 serves the left hand filament of the lamp 190 through the leads 193 and 203, and through the connection 21. Filament winding 205 serves the right hand filament of the lamp 190 through the leads 194 and 207.

It will be noted that the circuit is arranged so that each of the filament windings 201 and 202 has a terminal in common with a terminal of the primary winding 192, while the filament windings 204 and 206 have terminals substantially in common with terminals of the secondary winding 197. A shunting condenser 210 is connected across the lamp 190 to assist in starting the lamp 22.

From the description which has already been made it will be understood that the circuit is energized from a source of A. C. power terminals of which are shown at 211. One lead 30 from the terminals 211 connects with one side of the primary 192 through the connection formed by contacts 33 and 35, and lead 31. The other side of the line connects to the second side of the primary winding 192 by way of the lead 212 through the connection 21 and lead 193. When either of the lamps is removed from its mountings the line immediately will open, thereby de-energizing the transformer 191 and preventing dangerous open circuit voltages from existing

in the fixture with which the lighting system may be associated. It will be obvious that when the lamps are inserted into their respective sockets and the connections 20 and 21 made, in the event the power source terminals 211 are "hot," the circuit to the respective filaments and the primary winding will be completed before contacts 33 and 35 are brought together so that current from the line will not flow through the filament winding.

In Fig. 11 I have shown what is known as a lead-lag circuit in which there is a primary winding 220 and two secondary windings 221 and 222, both connected in parallel and hence having a common juncture 223 with the primary winding 220 in order to form an auto-transformer arrangement. The secondary winding 221 is connected by lead 224 to a lamp 225 and thence back to the primary by way of connection 226 and the lead 227. The secondary winding 222 is connected by way of lead 228 through a series condenser 229 to the lamp 230 and thence by way of connection 231, lead 232, jumper 233, lead 234, connection 226, lead 227, to the primary. This circuit as described will be recognized by those skilled in the art as conventional insofar as electrical relations between components are concerned. Novelty rests, it is believed, in the manner of connecting the same so that removal of either lamp will open the line connection. Power for the circuit of Fig. 11 is obtained from the usual A. C. power source connected across the terminals 240 and 241. One side of the primary winding 220 is connected to the terminal 241 by way of a juncture 223 and the lead 242. The other side of the primary winding 220 is actually in series with both of the connections 226 and 231. From the connection 231 it extends by way of the lead 243 to the terminal 240. The four filament windings are designated 244, 245, 246 and 247. The winding 244 serves the left hand filament of the lamp 230 by way of the leads 232 and 248. The filament winding 245 serves the left hand filament of the lamp 225 by way of the leads 234 and 239. The filament winding 246 serves the right hand filament of lamp 225 by way of the lead 250 which connects with the lead 224, and the lead 251. In the same manner the filament winding 247 serves the right hand filament of the lamp 230 by way of the leads 253 and 254 and the lead 228. If desired, a single filament winding may be substituted for windings 244 and 245 thereby serving the specified lamp filaments in parallel without changing the manner in which the safety feature of the circuit functions.

It should be obvious that no description has been included giving the details of the connections 226 and 231 since these are identical with the connections 21 and 20 of Figs. 12 which are not described but merely designated by broken line rectangles.

Fig. 12 is another lead lag circuit the construction and arrangement of which is identical to that of Fig. 11 with one exception. In this case instead of the connection of the primary winding 220 directly to the connection 226 by lead 227, the primary winding is connected as shown at 256 to the left side of the filament winding 245. The line contact member of the connection 226, instead of being connected as shown in Fig. 11 to the primary winding is connected to the left hand side of the filament winding 244. The identical operations and effect is obtained as in Fig. 11 and hence it is believed not necessary further to describe Fig. 12.

It is believed that the invention has been sufficiently set forth such as to enable those skilled in the art to utilize the same and understand the construction thereof. A great many variations are possible without varying from the spirit or scope of the invention as defined in the appended claims. What it is desired to claim by Letters Patent of the United States is:

1. The combination with a fluorescent lighting system which includes a transformer having at least a primary and a secondary winding, a filament winding inductively coupled with the primary winding, and at least one fluores-

cent lamp having a filament in an end thereof and arranged to have the filament winding electrically connected to energize the said filament, a source of A. C. power for electrical connection across the primary winding, of connector means between the lamp end and the transformer which comprises, three leads, a first lead extending to a terminal of the source, a second lead extending to a juncture between the primary and filament windings, and a third lead extending to the side of the filament winding opposite said juncture, a first make-break connection between the third lead and one side of the filament, a second make-break connection between the second lead and the second side of the filament, and a third make-break connection between the first lead and the second make-break connection, said connector means including base pins on the said lamp end adapted to establish or open the make-break connections upon movement of the lamp, and the secondary winding being connected with the lamp.

2. The combination with a fluorescent lighting system which includes a transformer having at least a primary winding and a secondary winding, a filament winding inductively coupled to the primary winding, at least one fluorescent lamp having a filament in an end thereof and connected to be energized by the windings of the transformer with the filament winding energizing the filament, and a source of A. C. power connected across the primary winding, of a three contact lamp holder having a first lead connected from one terminal of the source to one contact, a second lead connected from one terminal of the primary winding and one side of the filament winding to the second contact, a third lead connected from the second side of the filament winding to the third contact, base pins on the lamp connected with the filament and adapted to engage the contacts when the lamp is inserted in the lamp holder, at that time connecting one side of the filament to the first and second contacts and the other side of the filament to the third contact.

3. The combination with a fluorescent lighting system which includes a transformer having at least a primary winding and a secondary winding, a filament winding inductively coupled to the primary winding, at least one fluorescent lamp having a filament in an end thereof and connected to be energized by the windings of the transformer with the filament winding energizing the filament, and a source of A. C. power connected across the primary winding, of a three contact lamp holder having a first lead connected from one terminal of the source to one contact, a second lead connected from one terminal of the primary winding and one side of the filament winding to the second contact, a third lead connected from the second side of the filament winding to the third contact, base pins on the lamp connected with the filament and adapted to engage the contacts when the lamp is inserted in the lamp holder, at that time connecting one side of the filament to the first and second contacts and the other side of the filament to the third contact, the contacts being arranged so that the second and third contacts are engaged electrically before the first contact is engaged.

4. The combination with a fluorescent lighting system which includes a transformer having at least a primary winding and a secondary winding, a filament winding inductively coupled to the primary winding, at least one fluorescent lamp having a filament in an end thereof and connected to be energized by the windings of the transformer with the filament winding energizing the filament, and a source of A. C. power connected across the primary winding, of a three contact lamp holder having a first lead connected from one terminal of the source to one contact, a second lead connected from one terminal of the primary winding and one side of the filament winding to the second contact, a third lead connected from the second side of the filament winding to the third contact, base pins on the lamp connected with the filament and adapted to engage the contacts when the lamp is inserted in the lamp holder, at that time connecting one

side of the filament to the first and second contacts and the other side of the filament to the third contact, the contacts being arranged so that the second and third contacts are engaged electrically before the first contact is engaged and comprising resilient arms, the second and third of which are engaged by separate pins of the lamp and the first of which is normally spaced from the second arm but engaged by the second arm through movement of the second arm when the pins are inserted in the lamp holder.

5. The combination with a fluorescent lighting system which includes a transformer having at least a primary winding and a secondary winding, a filament winding inductively coupled to the primary winding, at least one fluorescent lamp having a filament in an end thereof and connected to be energized by the windings of the transformer with the filament winding energizing the filament, and a source of A. C. power connected across the primary winding, of a three contact lamp holder having a first lead connected from one terminal of the source to one contact, a second lead connected from one terminal of the primary winding and one side of the filament winding to the second contact, a third lead connected from the second side of the filament winding to the third contact, base pins on the lamp connected with the filament and adapted to engage the contacts when the lamp is inserted in the lamp holder, at that time connecting one side of the filament to the first and second contacts and the other side of the filament to the third contact, the contacts being arranged so that the second and third contacts are engaged electrically before the first contact is engaged, said lamp having three pins, and the lamp holder having said contacts arranged to be engaged by the respective pins when the lamp is inserted in the lamp holder, the pin arranged to engage the first contact being substantially shorter than the other two.

6. The combination with a fluorescent lighting system which includes a transformer having at least a primary winding and a secondary winding, a filament winding inductively coupled to the primary winding, at least one fluorescent lamp having a filament in an end thereof and connected to be energized by the windings of the transformer with the filament winding energizing the filament, and a source of A. C. power connected across the primary winding, of a three contact lamp holder having a first lead connected from one terminal of the source to one contact, a second lead connected from one terminal of the primary winding and one side of the filament winding to the second contact, a third lead connected from the second side of the filament winding to the third contact, base pins on the lamp connected with the filament and adapted to engage the contacts when the lamp is inserted in the lamp holder, at that time connecting one side of the filament to the first and second contacts and the other side of the filament to the third contact, said lamp pins being two in number and each connected with an end of the filament, the lamp holder having two pin-seizing openings with the first and second contacts disposed in one opening spaced from one another and adapted to be bridged electrically when a pin is inserted therein, and the third contact being disposed in the second opening.

7. In a system of the character described, a fluorescent lamp holder for receiving the end of a fluorescent lamp therein, said lamp having two pins, said holder having a circular recess with first and second resilient contact arms on opposite sides of the recess, the recess having an entrance for the pins in diametrical movement at right angles to the two arms so that rotation of the lamp will bring the pins into engagement with the contact arms, terminals for connecting electrical leads to the contact arms, and a third arm having a contact normally spaced from the first of said resilient contact arms, but adapted to be engaged thereby when the pins are moved into engagement with the resilient contact arms, and said third arm having an independent terminal.

8. A holder as described in claim 7 in which the arms are elongate and secured to the holder at a point spaced from the recess, the first arm having its end adjacent the recess free to move away from the recess by the pressure of one of said pins, but the second arm having its end adjacent the recess fixed to transmit substantially all of the pin movement to the said first contact arm.

9. A holder as described in claim 7 in which the arms are elongate and secured to the holder at a point spaced from the recess, the first arm having its end adjacent the recess free to move away from the recess by the pressure of one of said pins, but the second arm having its end adjacent the recess fixed to transmit substantially all of the pin movement to the said first contact arm, and the third arm being biased in the direction of the said first arm, the holder having a stop member preventing the third arm from engaging the first arm when the pins are not in engagement with said first and second arms.

10. A fluorescent lighting system, comprising a transformer having a primary, secondary and at least two filament windings, two fluorescent lamps each having a filament at least at one end thereof, a source of A. C. voltage for energizing the primary winding, the primary winding being connected between the filament ends of the lamps, and the secondary connected between the opposite terminals of the lamps, each filament winding being connected across a filament and having a terminal in common with respective opposite terminals of the primary winding, each lamp having a safety connection with the transformer and line such as to break the circuit of the source with the primary when the lamp is removed, each of said safety connections comprising a first separable electrical connection between one side of the lamp filament and the common terminal of a filament winding with the primary, a second separable electrical connection between the second side of the said lamp filament and the opposite terminal of said last-mentioned filament winding, and a third separable connection between the said source and said common terminal, all of said connections being made or separated as the lamp is physically associated with or disassociated from the system.

11. A fluorescent lighting system, comprising a transformer having a primary, secondary and at least two filament windings, two fluorescent lamps each having a filament at least at one end thereof, a source of A. C. voltage for energizing the primary winding, the primary winding being connected between the filament ends of the lamps, and the secondary connected between the opposite terminals of the lamps, each filament winding being connected across a filament and having a terminal in common with respective opposite terminals of the primary winding, each lamp having a safety connection with the transformer and line such as to break the circuit of the source with the primary when the lamp is removed, each of said safety connections comprising a first separable electrical connection between one side of the lamp filament and the common terminal of a filament winding with the primary, a second separable electrical connection between the second side of the said lamp filament and the opposite terminal of said last-mentioned filament winding, and a third separable connection between the said source and said common terminal, all of said connections being made or separated as the lamp is physically associated with or disassociated from the system, the third separable connection being disposed to be made last and separated first.

12. A fluorescent lighting system, comprising a fluorescent ballast having a primary and two secondary windings, a condenser, two fluorescent lamps, the lamps being connected to the primary and secondaries in lead-lag arrangement, each secondary being in auto-transformer relation to the primary and in series with its respective lamp and the condenser being in series with one secondary, both secondaries being parallel relative one another, a source of A. C. power having two terminals for connection to energize the primary winding, one terminal being

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connected to one side of the primary, each lamp having a filament at least at one end thereof, at least two filament windings on the transformer, one arranged to energize each filament, a separable connection one between each lamp end and the system, which comprise make-break connections between the terminals of the filament windings and the respective filaments, a make-break connection between the second terminal of the primary and a terminal of one filament winding, said terminal of said one filament winding being connected to a terminal of the second filament winding, and a make-break connection between said last-mentioned terminal and the second source terminal, whereby removal of either lamp from the system will interrupt the continuity of the primary-source circuit.

13. A system as described in claim 12, in which the movement of the lamps operates the separable connections, and in which the make-break connections between the source and second filament winding terminal and between the primary and first filament winding are established last during inserting movement of the lamps, and separated first when lamps are removed from the system.

14. A fluorescent lighting system, comprising a fluorescent ballast having a primary and two secondary windings, a condenser, two fluorescent lamps, the lamps being connected to the primary and secondaries in lead-lag arrangement, each secondary being in auto-transformer relation to the primary and in series with its respective lamp and the condenser being in series with one secondary, both secondaries being parallel relative one another, a source of A. C. power having two terminals for connection to energize the primary winding, one terminal being

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connected to one side of the primary, each lamp having a filament at least at one end thereof, at least two filament windings on the transformer, one arranged to energize each filament, a separable connection one between each lamp end and the system, which comprise make-break connections between the terminals of the filament windings and the respective filaments, the second terminal of the primary winding being connected with a terminal of one filament winding, a make-break connection between a terminal of the second filament winding and said terminal of said one filament winding, and a make-break connection between said second source terminal and said terminal of said second filament winding, whereby removal of either lamp from the system will interrupt the continuity of the primary-source circuit.

15. A system as described in claim 14 in which the movement of the lamps operates the separable connections, and in which the last two mentioned make-break connections are established last when the lamps are inserted in the system, and broken first when the lamps are removed.

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