Sept. 15, 1942. A. G. MUELLER ET AL 2,296,115

OPERATING MECHANISM FOR DISCHARGE LAMPS

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Fig. 1.

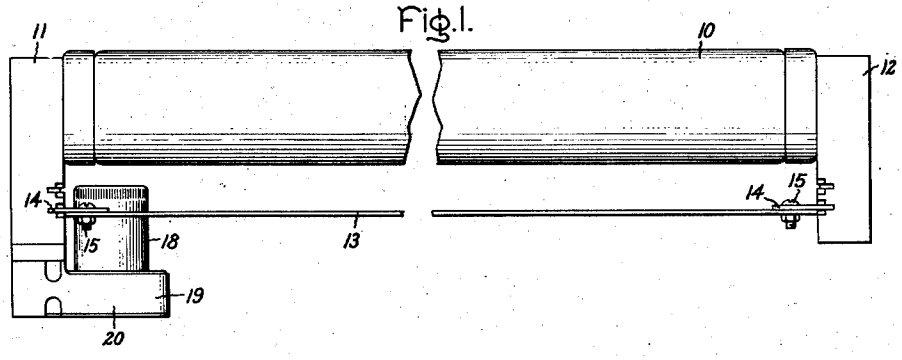


Fig. 2.

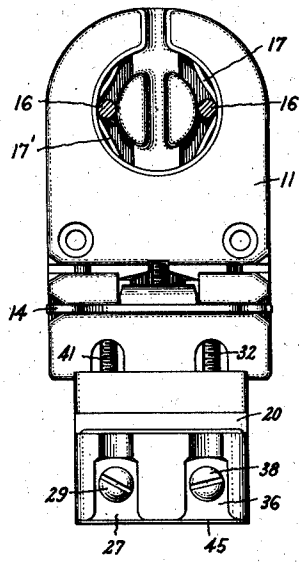


Fig. 3.

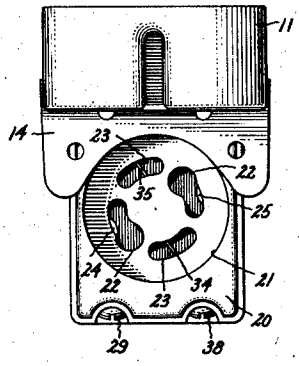


Fig. 4.

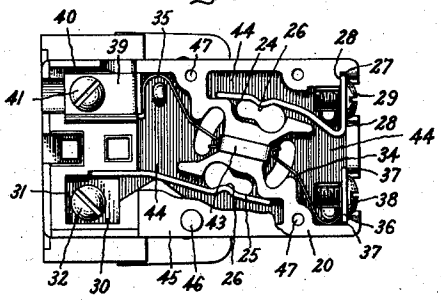
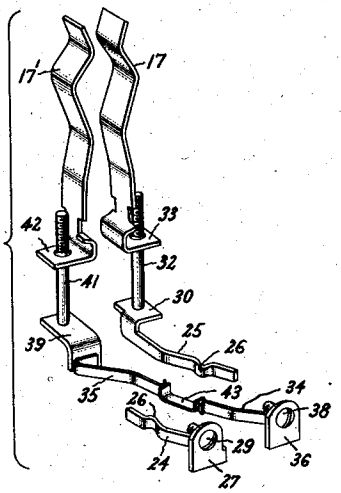


Fig. 5.



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Fig. 7.

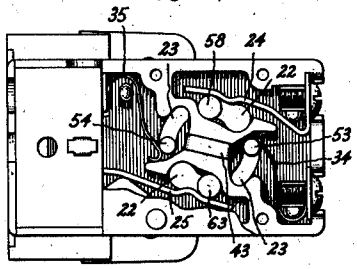


Fig. 6.

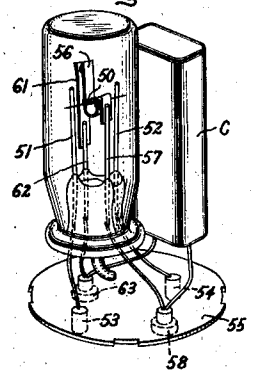


Fig. 8.

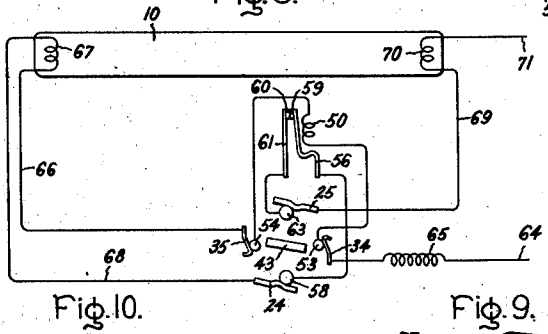


Fig. 10.

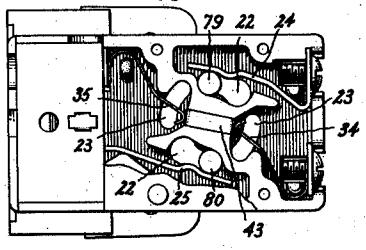


Fig. 9.

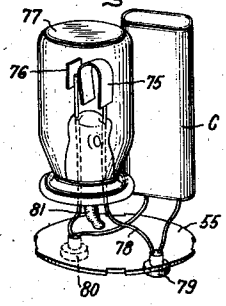
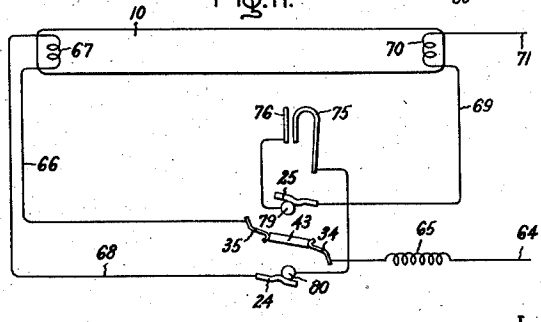


Fig. 11.



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UNITED STATES PATENT OFFICE

2,296,115

OPERATING MECHANISM FOR DISCHARGE LAMPS

Adolf G. Mueller and John M. Pistey, Fairfield, Conn., assignors to General Electric Company, a corporation of New York

Application July 11, 1941, Serial No. 401,934

8 Claims. (Cl. 200—51)

Our invention relates to an operating mechanism for tubular discharge lamps and more particularly to a starting arrangement for fluorescent lamps.

Fluorescent lamps of the type now in commercial use are provided with a starting switch which, in most instances, is mounted on the associated lamp socket so that the switch is readily accessible for replacement. Starting switches are employed to provide a means for automatically controlling the heating of the lamp cathodes in order to light the lamp. To this end, the switch closes a circuit through the cathodes for a predetermined time interval, for example, on the order of one to four seconds, to permit heating of the cathodes and thereafter opens the circuit causing a glow discharge to take place between the cathodes, lighting the lamp. Several forms of starting switches are now on the market. Some starting switches utilize an electric discharge device and are known to the trade as "glow switches." An example of such a "glow switch" is shown in Patent 2,280,550 issued on April 21, 1942 to Wayne C. Smitley, and assigned to the same assignee as the instant application. Other types of switches utilize a heating resistance operating a bimetallic strip to open and close circuit controlling contacts. A switch of this type is shown in Patent No. 1,951,112 issued to Günter Wels on March 13, 1934, and assigned to the same assignee as the instant application.

Since the types of switches aforementioned operate on somewhat different principles, provision must be made for connecting these switches into the operating circuit for the fluorescent lamp in various ways. For example, a glow switch is mounted directly in parallel across the cathodes of the lamp while a resistance heater operated switch of the type referred to is connected in the lead line of the current supply as well as across the lamp filaments. This means that it has been necessary in the past to provide separate types of sockets for mounting the various forms of starting switches, the sockets varying according to the number of contact members which it is necessary to connect to the starting switch and lamp circuit. We propose to overcome the necessity of providing a separate socket for each type of switch by providing a new and improved socket which is adapted to accommodate either of the types of starting switch aforementioned.

It is an object of our invention to provide a new and improved socket for starting switches capable of accommodating starting switches of various types.

It is another object of our invention to provide an operating mechanism for fluorescent lamps in which provision is made for connecting various types of starting switches into the operating circuit of the mechanism without the necessity of changing the wiring connections of the circuit.

In the accompanying drawings, Fig. 1 is a view of a fluorescent lamp mounted in a lamp holder provided with a starter socket constructed according to our invention; Fig. 2 is a front view of the combined lamp holder and starter socket; Fig. 3 is a plan view of the device shown by Fig. 2; Fig. 4 is a view of the interior of the starter socket with the cover plate removed; Fig. 5 is an exploded view showing the arrangement of the contact members of the starter socket and lamp holder; Fig. 6 is a view of one type of starter which may be mounted in our socket; Fig. 7 is a view of the socket showing the starting switch in mounted position; Fig. 8 is a circuit diagram of the arrangement for operating the lamp utilizing the starter of Fig. 6; Fig. 9 is a view of another form of starter; Fig. 10 is a view of our socket showing the starter of Fig. 9 in mounted position, and Fig. 11 is a circuit diagram showing an arrangement for operating the lamp using the starter of Fig. 9.

Referring to the drawings, we have shown a fluorescent lamp 10 mounted at each end in lamp holders 11 and 12 which, in turn, are mounted on a support or reflecting surface 13 by means of mounting brackets 14 secured to the reflector by screws 15. The lamp holders herein illustrated are of the type disclosed in Reissue Patent 21,545 issued to Anthony J. Marshaus on August 27, 1940, and assigned to the same assignee as the instant application. It should be manifest, however, that other forms of lamp holders may be employed inasmuch as the particular type of lamp holder forms no part of the present invention. The arrangement of the mounting bracket 14 and the manner in which it is adjusted on the lamp holder is described in the copending application of Frank C. De Reamer, Serial No. 393,786, filed May 16, 1941, and assigned to the same assignee as the instant application. Each end of the lamp is provided with spaced contact pins 16 which are seated in the body of the lamp holder in engagement with spaced contact members 17 and 17', in the manner shown by Fig. 2. The operating mechanism for the fluorescent lamp includes a starter

switch 18 which it is desirable to mount in a position such that it is readily accessible for replacement.

To this end, one of the lamp holders 11 is provided with a socket 19 for the starting switch, the socket 19 being mounted on the base of the lamp holder and extending laterally therefrom, as shown by Figs. 1 to 3, inclusive. The starting switch 18 is mounted in the socket 19, in the manner shown by Fig. 1. In mounted position, a portion of the starting switch extends through an opening in the reflector surface 13 so that it is readily accessible upon removal of the lamp 10 from the holders. Normally, the starter socket 19 and the base of the lamp holder 11 are concealed within a lighting fixture of which the reflecting surface 13 forms a part.

The starter socket comprises a body 20 of insulating material such as a molded plastic in one face of which is provided an annular recess 21 for receiving the starter switch 18. Starter switches of the type mentioned are customarily mounted within a container which is adapted to fit within the recess 21. For making electrical connection with the starter switch, the socket is provided with receptacle means including a plurality of openings formed in the bottom of the recess and which receive the contact pins provided in the base of the starter housing. These pins are illustrated in Figs. 6 and 9 and will be fully described later.

In the arrangement of the openings in the receptacle means, two diametrically opposed keyhole slots 22 are provided for receiving two of the contact pins of the starting switch while another pair of arcuate slots 23 is located between the keyhole slots 22 for receiving two other pins. The slots 22 and 23 are arranged concentrically, as shown by Fig. 3. Cooperating with the keyhole slots 22 are flexible contact members 24 and 25 which extend partly into the planes of the openings of the keyhole slots for engagement with the starter contact pins. Each contact member is formed of relatively heavy spring material, such as spring bronze, and is provided with a projecting portion 26 which cooperates with the contact pin and locks it in position in the narrower portion of the corresponding keyhole slot. At one end, flexible member 24 is bent over to form a terminal portion 27 which rests in grooves 28 in the outer wall of the socket housing and is provided with a terminal screw 29 for connection to an electrical circuit. The other flexible member 25 is formed with a flat terminal portion 30 which rests in a recess 31 formed in the base of the socket housing; the terminal portion is electrically connected to one of the lamp holder contact members, in any suitable manner, as by the elongated screw 32 which extends from the base of the socket into the base of the lamp holder where it is threaded into a terminal portion 33 forming part of the contact member 17.

Disposed adjacent the arcuate slots 23 is a second set of flexible contact blades 34 and 35, each of which extends into the plane of a corresponding slot 23 for engagement with a contact pin on the starter. The contact blades 34 and 35 are made of relatively light spring material, such as phosphor bronze. Contact blade 34 is secured in any suitable manner, as by spot welding, to a terminal plate 36 mounted in spaced grooves 37 in an end wall of the socket housing; the terminal plate is provided with a screw 38 for making an electrical connection therewith. The other flexible blade 35 is likewise provided with a terminal plate 39 seated in a recess 40 in the other end of the housing. The terminal plate 39 is connected in any suitable manner to the other lamp holder contact blade 17' as, for example, by an elongated screw 41 extending from the bottom of the socket housing to the base of the lamp holder where it is threaded into a terminal portion 42 formed on the other contact member 17'.

Disposed between the contact blades 34 and 35 is a current conducting member 43 which may take the form of a U-shaped strip, the ends of the U engaging the ends of the flexible blades 34 and 35. This strip rests in a groove (not shown) in the bottom face of the socket housing. Normally, the contact blades are spring biased into electrical engagement with the current conducting member 43 except when they are moved away from the member upon engagement with the starter contact pins as the latter are rotated in the arcuate slots.

The pairs of flexible members move within recesses 44 formed in the bottom face of the housing and they are held in assembled position by a cover plate 45, of any suitable insulating material, such as sheet fiber, which extends over the recesses and is fastened to the base by drive pins 46 secured in openings 47. The cover plate also holds the conducting member 43 in assembled position.

The starter socket thus far described is adapted to support either of the types of starting switches aforementioned and may be used to mount the switches in the lamp operating circuit without any changes in the structural arrangement of the elements or in the wiring of the lamp. The structures of the various starting switches and the manner in which the switches cooperate with the mounting socket will now be described.

In Fig. 6, we have illustrated a starter of the type described in the aforementioned Wels Patent 1,951,112. This starter includes a heater resistance 50 connected by lead lines 51 and 52 to contact pins 53 and 54, respectively, which are mounted in an insulating disk 55 forming a part of the housing for the starter switch. A bimetallic element 56 is located immediately adjacent the heating resistance 50 to be heated thereby and is connected by a lead line 57 to the contact pin 58 likewise mounted in the disk 55. At its other end the bimetallic strip 56 is provided with a contact surface 59, for example, a silver contact. Cooperating with the contact 59 is a like contact 60 mounted on a relatively rigid contact blade 61 which, in turn, is connected by a lead 62 to still another contact pin 63 mounted in the disk 55. For the purpose of reducing radio interference, a condenser C is connected across the pins 63 and 58, and thus across the contacts 59 and 60. To insure proper mounting of the starting switch in the socket, the contact pins 58 and 63 are provided with enlarged ends which fit into the enlarged portions of the keyhole slots quite readily but which cannot be inserted into the arcuate slots 23.

When a starter of this type is mounted in the socket, the contact pins 58 and 63 are inserted into the larger portions of the keyhole slots and rotated into the narrower portions where they engage the flexible contact members 24 and 25. The pins snap past the projecting portions 26 on the flexible members so that the pins are held locked in seated position. At the same time,

the enlarged heads on the pins contact the under side of the base adjacent the narrower portions of the slots so that the starter cannot be pulled out of the socket except by first rotating it. Simultaneously, the contact pins 53 and 54 engage the flexible blades 34 and 35, respectively, and move them out of engagement with the current conducting member 43 so that these contact pins are placed in electrical engagement with the blades. By this arrangement, the starter switch is properly connected into the operating circuit of the fluorescent lamp.

In this circuit, current from an alternating current supply line 64 flows through a current limiting reactor 65 to the contact blade 34, then through the contact pin 53, resistance 50 to the other contact pin 54, contact blade 35, then by a lead line 66 to a left-hand filament 67 of the lamp, lead line 68 to the contact blade 24, contact pin 58, to the movable contacts 59 and 60, and then to the other contact pin 63, contact blade 25, by a lead line 69 to a right-hand filament 70 of the lamp, and thence to another supply lead 71. Since contacts 59 and 60 are normally closed when current is turned on from the supply lines, it flows through the path just described giving an immediate heating of the cathodes 67 and 70. Heater resistance 50 is also in circuit so that heat is generated to bend the bimetallic strip 56 to open the contacts 59 and 60. The thermal capacity of the strip 56 is such, however, that the contacts are not immediately opened but a time delay occurs, for example, a delay of one to four seconds, so that current flows through the lamp cathodes for a sufficient length of time to heat them to a point at which they become emissive. After the predetermined time delay, the bimetallic strip 56 is heated sufficiently to open the contacts 59. When this occurs, the shunt path through the starter switch across the filaments is broken down so that the reactor 65 provides a surge of current causing a glow discharge to take place between the filaments 67 and 70, lighting the lamp. Since the heating resistance 50 is connected in series with the supply line and lamp the contacts 59 and 60 are maintained in open position as long as the current supply is turned on. In this manner, it will be manifest that our socket makes provision for connecting a starting switch of the type described directly into the lamp operating circuit simply by plugging the switch into the socket. Moreover, our starter socket is adapted equally as well to support starter switches of other types, such as a glow switch starter of the type described in the aforementioned Smitley Patent 2,280,550.

This type of starting glow switch is illustrated by Fig. 9 and comprises a U-shaped bimetallic member 75 and a cooperating electrode 76, both of which are enclosed within a glass envelope 77 under vacuum. The bimetallic element 75 is connected by a lead 78 to a contact pin 79 while the electrode 76 is connected to a similar contact 80 by a lead 81. A capacitor C is connected across these elements for the purpose of reducing radio interference. The contact members 79 and 80 are mounted on an insulating disk 55, the same as in the case of the starter of Fig. 6 and are provided with enlarged heads so that they may be inserted in the keyhole slots 22 only. It will be noted that the starter of Fig. 9 is provided with only two contact pins whereas the starter of Fig. 6 is provided with four.

The glow switch starter of Fig. 9 is mounted in the starter socket in the manner disclosed by Fig. 10 with the contact pins 79 and 80 seated in the keyhole slots 22 in engagement with the contact members 24 and 25, respectively. The contact blades 34 and 35 remain in electrical engagem nt with the current conducting member 43 so that a connection is maintained directly across these blades in the manner shown by Figs. 10 and 11. In the operation of the starter of Fig. 9, closure of an operating switch of the current supply causes a glow discharge to take place in the evacuated envelope between the electrode 76 and the other bimetallic electrode 75. This glow discharge causes the bent end of the bimetallic strip 75 to contact the electrode 76, closing the circuit through the switch and stopping the glow discharge. When the circuit closes, current flows from the supply line 64 through the reactor 65 to the contact blade 34, thence through the current conducting member 43 to the other contact blade 35, lead line 66, left-hand cathode 67, the other contact member 24, contact pin 80, the closed contacts 75 and 76, contact pin 79, the other contact member 25, the right-hand cathode 70 to the other supply line 71. Since closure of contacts 75 and 76 stops the glow discharge, the bimetallic strip cools off to open the contacts. However, the thermal capacity of the strip is such that a short time interval occurs before the contacts open, for example, an interval of one to four seconds. During this interval, the cathodes are heated to an emissive point so that upon opening of the contacts the reactor provides a surge of current across the lamp cathodes, causing a glow discharge and lighting the lamp.

It will be apparent that in the circuit arrangements of Figs. 8 and 11 the starter socket and the lamp holder are wired into an operating circuit for the lamp in exactly the same way, irrespective of which type of stater is used. Either one of the two types of starters disclosed herein may be inserted in the starter socket and an appropriate connection is automatically made to the operating circuit by engagement of the starter pins with the corresponding flexible contact members of the socket. If the heater type starting switch shown by Fig. 6 is employed, the additional contact pins 53 and 54 cooperate with the corresponding contact blades 34 and 35 and move them out of engagement with the current conducting member 43 whereas if the glow switch starter of Fig. 9 is used, the contact blades 34 and 35 are connected to the current conducting member 43 in a normal manner so that a circuit extends from the reactor directly to one of the lamp holder contacts.

Our socket provides for a considerable saving in manufacturing cost since it is necessary to manufacture only a single type of socket for both of the aforementioned types of starters now on the market. The arrangement is one in which either type of starter switch may be connected into the lamp operating circuit without making any external changes in the circuit connections to the lamp. While the starter socket 19 has been illustrated and described as mounted on the base of the lampholder, it should be manifest that it may be mounted separately from the lamp holder by replacing the screws 32 and 41 with appropriate lead wires.

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

1. A socket comprising a base of insulating material having receptacle means in a face thereof, said receptacle means comprising a plurality of

concentrically arranged arcuate slots for receiving the contact pins of an electrical device and flexible contact blades adjacent each slot for engaging a corresponding contact pin, and means for normally electrically connecting two of said contact blades, the contact pins of the electrical device being adapted to be inserted in said arcuate slots and rotated therein, rotation of the pins causing them to engage said two contact blades to move them out of electrical connection with each other.

2. In a socket for mounting an electrical device having a plurality of contact pins, a base of insulating material, a pair of opposed keyhole slots, a pair of opposed arcuate slots located between said keyhole slots, all of said slots being arranged concentrically, contact members cooperating with said keyhole slots, said contact members being provided with projecting means, other contact elements cooperating with said arcuate slots, means for electrically connecting said last-mentioned contact elements, the contact pins of the electrical device being adapted to be inserted in said slots and rotated therein, the pins in said arcuate slots engaging the last-mentioned contact elements upon rotation to move them out of electrical connection with each other, the contact pins inserted in said keyhole slots being locked therein by engagement with the projecting means on said first-mentioned contact members.

3. In a socket for mounting an electrical device having a plurality of contact pins, a base of insulating material, a pair of opposed keyhole slots, a pair of opposed arcuate slots located between said keyhole slots, all of said slots being arranged concentrically, contact members cooperating with said keyhole slots, said contact members being provided with projecting means, other contact elements cooperating with said arcuate slots, and a current conducting member mounted on said base, the last mentioned contact elements being normally biased into engagement with said conducting member unless some of the contact pins are seated in said arcuate slots to engage said last-mentioned contact elements to move them out of engagement with said current conducting member, others of the contact pins being held in locked position in said keyhole slots by the projecting means on said first-mentioned contact members.

4. In a socket for mounting an electrical device having a plurality of contact pins, a base of insulating material, a pair of opposed keyhole slots, a pair of opposed arcuate slots located between said keyhole slots, all of said slots being arranged concentrically, contact members cooperating with said keyhole slots, other contact elements cooperating with said arcuate slots, means for electrically connecting said last-mentioned contact elements, the contact pins of the electrical device being adapted to be inserted in said slots and rotated therein, the pins in said arcuate slots engaging the last-mentioned contact elements upon rotation to break the electrical connection therebetween, and means for locking the contact pins inserted in said keyhole slots in engagement with the corresponding contact members.

5. In a socket for mounting an electrical device having a plurality of contact pins, a base of insulating material, a pair of opposed keyhole slots, a pair of opposed arcuate slots located between said keyhole slots, all of said slots being arranged concentrically, contact members cooperating with said keyhole slots, other contact elements cooperating with said arcuate slots, and a current conducting member mounted on said base, said last-mentioned contact elements being normally biased into electrical engagement with the current conducting member.

6. A socket comprising a base of insulating material having receptacle means in a face thereof, said receptacle means comprising a plurality of concentrically arranged elongated slots for receiving the contact pins of an electrical device by rotation therein, flexible contact blades adjacent each slot for engaging a corresponding contact pin, and a current conducting member located between two opposite slots, corresponding opposite contact blades being normally biased into engagement with said current conducting member unless engaged by some of the pins and moved out of engagement therewith upon rotation of the pins in said slots.

7. A socket comprising a base of insulating material having receptacle means in a face thereof, said receptacle means comprising a plurality of concentrically arranged elongated slots for receiving the contact pins of an electrical device and movable contact blades adjacent each slot for engaging a corresponding contact pin, two of said contact blades being normally electrically interconnected, the contact pins of the electrical device being adapted to be inserted in said slots and rotated therein, rotation of the pins causing them to engage said two contact blades to move them out of electrical connection with each other.

8. A socket comprising a base of insulating material having receptacle means in a face thereof, said receptacle means comprising a plurality of concentrically arranged elongated slots for receiving the contact pins of an electrical device and movable contact blades adjacent each slot for engaging a corresponding contact pin, and a current conducting member with which two of said contact blades are normally engaged for electrically interconnecting them, the contact pins of the electrical device being adapted to be inserted in said elongated slots and rotated therein, rotation of the pins causing them to engage said two contact blades to move them out of electrical connection with said current conducting member.

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