April 9, 1957 A. P. BUQUOR ET AL 2,788,501

ELECTRICAL CONNECTOR HAVING A MAGNETIC CONTACT

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Fig. 1.

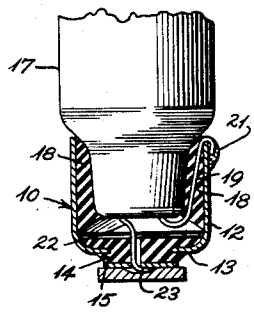


Fig. 3.

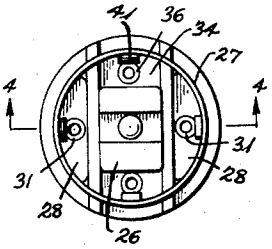


Fig. 5.

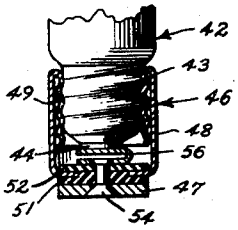


Fig. 2.

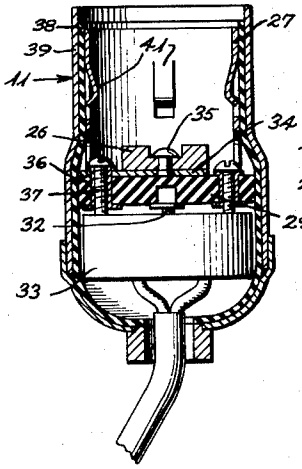


Fig. 4.

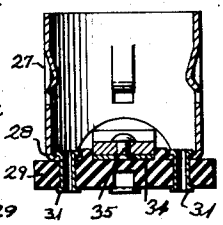


Fig. 6.

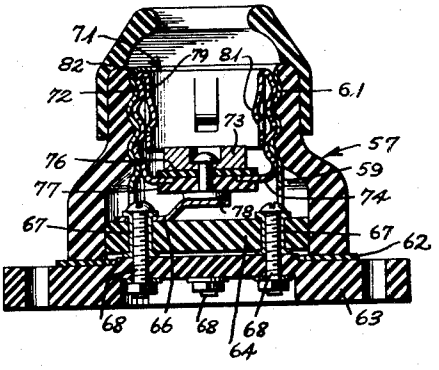


Fig. 8.

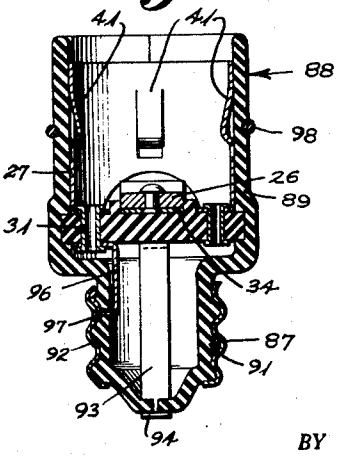
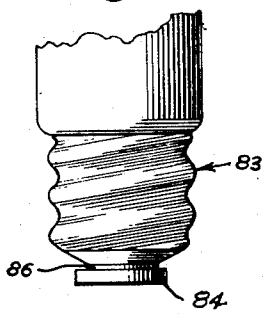


Fig. 7.



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ELECTRICAL CONNECTOR HAVING A MAGNETIC CONTACT

Adolph P. Buquor and John L. Buquor, Washington, D. C., assignors, by direct and mesne assignments, of seventy-five percent to said Adolph P. Buquor and twenty-five percent to Hugh R. Thomas, Nancy Thomas Rees, and Stephen L. Thomas, as tenants in common

Application December 16, 1948, Serial No. 65,562

10 Claims. (Cl. 339—12)

This invention relates to an electrical connector, and more particularly, to a quick detachable electrical connector for both sides of an electrical circuit in which a permanent magnet carried by one member of the connector and an armature of magnetic material carried by the other member of the connector are employed as contact members to complete one side of the circuit and to hold the two members of the connector securely together. The present invention is particularly adaptable for holding electric lamps in their sockets and results in the lamp being held securely in the socket by merely inserting the lamp into the socket with a single sliding motion. The lamp may be easily withdrawn from the socket with a reverse sliding motion, but remains in the socket so as to make effective electrical connections with both sides of the circuit even when subjected to shocks of considerable magnitude. Furthermore, vibration does not tend to loosen the lamp in the socket so that imperfect connections are avoided with resultant sparks and arcs which frequently form between the lamp base and the lamp socket when conventional structures are subjected to vibration.

In accordance with the preferred embodiment of the present invention, the central contact of a lamp socket or other socket for making electrical connections is in the form of a small permanent magnet, preferably made of a known or suitable alloy which provides a high intensity of magnetic flux as well as high retention of its magnetic properties over extended periods of time. Such magnets are known to the art and even when of small size, develop high magnetic attraction for an armature of magnetic material, such as soft iron. Similarly, the central contact of the lamp base or other plug forming a part of the electrical connector may be in the form of an armature, for example, a soft iron armature so that the permanent magnet of the socket attracts the armature in the lamp base to not only hold the lamp in position, but to provide an electrical connection for one side of the circuit. The other side of the circuit may be closed through suitable contacts held in engagement with each other by the magnet and armature, for example, the side walls of the socket may form one of the contacts and the side walls of the lamp base or other plug may form the other side of the circuit. If desired, appropriate spring fingers may be employed so as to provide effective sliding contact between the contacts for the other side of the circuit.

While the preferred embodiment of the invention contemplates the employment of a new type of socket and a new type of lamp base or other connector plug, it is possible to employ standard lamps with an adapter for the new type of socket or to employ standard sockets with an adapter for receiving the new type of lamp base. Furthermore, an adapter for a standard socket may be employed in conjunction with an adapter for a smaller sized lamp base, for example, the so-called candelabra base so that the present invention may utilize conventional types of sockets and lamp bases.

When employing the present invention, a lamp may be

inserted in a socket or withdrawn therefrom by a single movement, and in fact, the lamp is drawn into the socket after being partly inserted therein. This is a particular advantage where a large number of lamps are installed in marquees or large advertising signs where lamps are inserted or withdrawn from a distance by means of a pole provided with a suitable lamp clamp. No turning motion of the lamp is necessary and it will be apparent that a substantial saving of time and labor will be accomplished. The lamp does not loosen in the socket even under extreme vibration or extreme changes of temperature and this also results in a substantial saving of labor since it avoids the repeated tightening of lamps in the sockets usually found necessary, particularly in such structures as marquees or large advertising signs. One major advantage is that sparks or arcs in the socket, due to a loosened lamp, are completely avoided, thus eliminating radio interference. Furthermore, a broken lamp may be easily removed from a socket without danger of injury to the hands since it is merely necessary to pull the broken lamp from the socket without a twisting motion.

It is therefore an object of the invention to provide an improved electrical connector in which a lamp base or other plug is held in position in a socket by a permanent magnet and an armature which also form connecting elements completing one side of the circuit.

Another object of the invention is to provide an improved lamp socket and an improved lamp base utilizing the attraction of a permanent magnet to hold the lamp base securely in position in the socket.

A further object of the invention is to provide adapters for either conventional sockets or conventional lamp bases or both which can be utilized to hold a lamp in a socket by magnetic attraction so that positive connections are made to both sides of the circuit and the lamp does not loosen under vibration or temperature changes.

Other objects and advantages will appear in the following description of preferred embodiments of the invention illustrated in the attached drawings, in which:

Fig. 1 is a vertical section through an improved lamp base in accordance with the present invention;

Fig. 2 is a vertical section through an improved lamp socket in accordance with the present invention;

Fig. 3 is a top plan view of a socket element forming part of the structure of Fig. 2;

Fig. 4 is a vertical section of the element of Fig. 3 taken on the line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 1 of an adapter for a conventional lamp base;

Fig. 6 is a vertical section through a conventional lamp socket and an adapter for such socket;

Fig. 7 is a fragmentary elevational view showing a modified type of improved lamp base; and

Fig. 8 is a vertical section through a modified adapter for a conventional lamp socket.

Referring more particularly to the drawings, the lamp base 10 of Fig. 1 is particularly adapted for use with the lamp socket 11 of Fig. 2. The lamp base 10 of Fig. 1 may include an outer metallic sleeve 12 having a cylindrical portion and a lower inwardly directed flange 13. The flange 13 may be sealed in the usual insulating button 14 of glass or other insulating material and the button 14 may have a copper or other metallic contact disc 15 fused to the lower portion thereof as is conventional in lamp manufacture. The lower portion of the glass envelope 17 of the lamp may be affixed in the upper open end of the sleeve 12 by the conventionally employed insulating cement 18. One connection to the lamp filament (not shown) may be in the usual manner by means of a conductor 19 extending upwardly through the insulating cement 18 to a soldered connection 21 at the upper periphery of the sleeve 12. The other connection

to the lamp filament may be through a conductor 22 extending downwardly through apertures in the insulating button 14 and disc 15 to a soldered connection at 23 to the disc 15. A disc 24 of soft iron or other magnetic material having a recess therein for receiving the lower end of the conductor 22 may be soldered to the disc 15.

The disc of magnetic material is adapted to engage a small permanent magnet 26 forming a part of the lamp socket 11 of Figs. 2 to 4. The lamp socket 11 may include an inner metallic sleeve 27 having lower inwardly directed flanges 28, shown most clearly in Figs. 3 and 4, suitably secured to an insulating disc 29, for example, by the tubular rivets 31. As shown in Fig. 2, a screw 32 may be employed to make an electrical connection for one side of the circuit between a switch 33, shown diagrammatically in Fig. 2, and the sleeve 27. The permanent magnet 26 may be secured to a conducting element 34 by means of a rivet 35 which may be in turn secured to the insulating disc 29 by means of a tubular rivet 36. As shown in Fig. 2, a screw 37 may be employed to make an electrical connection for the other side of the circuit between the magnet 26 and the conductor member 34 with the switch 33. As also shown in Fig. 2, the socket element and switch may be surrounded by a sleeve of insulating material 38 in turn surrounded by the conventional metallic casing 39. The inner metallic sleeve 27, forming part of the socket element, may have spring fingers 41 struck inwardly therefrom for engagement with the outer metallic sleeve 12 of the lamp base, shown in Fig. 1. The switch 33 may be of any type conventionally employed in lamp sockets.

It will be apparent that the lamp base 10 of Fig. 1 may be inserted into the lamp socket 11 of Fig. 2 so that the disc 24 of the lamp base 10 engages the magnet 26 of the lamp socket 11. This closes one side of the electrical circuit by making a positive connection between the disc 24 and the magnet 26. The disc 24 of magnetic material remains in close contact with the magnet 26 under substantially any conditions of vibration and changes in temperature and with the magnetic alloys available on the market, small permanent magnets can be fabricated which require a substantial force to separate the disc 24 from the magnet 26. An effective contact is produced even with such magnetic materials but if desired, the surfaces of both the magnet 26 and the disc 24 may be given a thin coating (not shown) of copper or other conducting material both for rust-proofing purposes and to improve the electrical contact.

The other side of the circuit to the lamp is completed through the sleeve 12 of the lamp base 10 making sliding contact with the spring fingers 41 struck from the inner conducting sleeve 27 of the lamp socket 11. The sleeve 12 as well as the sleeve 27 may be made of copper, brass or bronze or other corrosion-resistant material, and it will be apparent that effective sliding contact will be produced between the sleeve 12 and the spring fingers 41 and that the magnet 26 and disc 24 hold the lamp base in the socket so that the sleeve 12 and the spring fingers 41 remain in contact. Upon partial insertion of the lamp base 10 into the socket 11, the lamp base will move inwardly into the socket by reason of the attraction between the magnet 26 and the disc 24. It will, of course, be apparent that the parts may be reversed by attaching the magnet to the lamp base or other connector plug and the armature to the interior of the socket and that a similar reversal may be employed in the other modifications of the invention described below. The magnet will, however, usually be of greater bulk and weight than the armature and also of greater cost, so that it is preferred to make the magnet a part of the socket which is usually the more permanent installation.

While both lamp bases and sockets of improved construction, as shown in Figs. 1 to 4, are preferred, it is entirely possible to modify conventional lamp bases and sockets by means of adapters, as shown in Figs. 5 and 6. Thus, a conventional lamp base 42 having a lower outer metallic sleeve 43 having convolutions in the form of a screw thread and a lower contact 44 may be threaded into an adapter 46 provided with a lower disc 47 of magnetic material such as soft iron. The adapter 46 may include an outer cylindrical sleeve 48 and an inner sleeve 49 formed with screw threads to receive the screw threaded sleeve 43 of the lamp base 42. The disc 47 may be secured to and insulated from the sleeve 48 by means of insulating members 51 and 52 engaging a lower inwardly directed flange 53 forming part of the sleeve 48. A rivet 54 may secure the insulating members 51 and 52 together as well as securing the disc 47 and an upper contact member 56 to the insulating members 51 and 52. The outer sleeve 48 of the adapter 46 is electrically connected to the sleeve 43 forming part of the lamp base and the contact member 56 makes contact with the lower contact 44 of the lamp base and is connected to the disc 47 through the rivet 54 so as to be insulated from the sleeve 48.

A conventional socket 57 of the outdoor type is shown in Fig. 6 and includes an outer sleeve of insulating material surrounding a conventional socket element 59 provided with an inner conducting sleeve 61 having convolutions forming a screw thread. The outer insulating casing 58 is screw-threaded upon the sleeve 61 so as to be held in engagement with a gasket 62 between the sleeve 58 and a base 63 of insulating material which is secured to the insulating element 64 of the socket element. The conducting sleeve 61 may be secured to the insulating element 64 by tubular rivets (not shown). A central contact member 66 may also be secured to the insulating element 64 of the socket element by means of tubular rivets 67 and the insulating element 64 of the socket element may be secured to the base 63 of the socket by means of screws 68, at least two of which form the electrical connections between the external circuit and the central contact member 66 and also the conducting sleeve 61.

An adapter 71 may have an outer conducting sleeve 72 having screw-threaded convolutions to enable the adapter to be screw-threaded into the sleeve 61. The sleeve 72 of the adapter 71 may have a small permanent magnet 73 secured to a lower inwardly directed flange 74 forming a part of the sleeve 72 by means of insulating members 76 and 77 and a rivet 78, the rivet also forming a lower electrical connection between the permanent magnet 73 and the central contact 66 of the socket. The adapter 71 may also have an inner cylindrical sleeve 79 having spring fingers 81 struck inwardly therefrom to make contact with the sleeve 48 of the adapter 46 of Fig. 5. It will be apparent that the lamp base 42 having the adapter 46 thereon may be inserted into the socket 57 having the adapter 71 therein to complete both sides of the circuit in the same manner as described with respect to Figs. 1 to 4. Thus, in accordance with Fig. 6, a standard socket provided with an adapter may be employed with a lamp having a candelabra base also provided with an adapter. The socket 57 of Fig. 6 may also be provided with a sleeve 82 of flexible insulating material such as rubber. It will be apparent that the flexible sleeve 82 may be arranged to snugly fit the lower portion of the glass of the lamp base 42 so as to prevent moisture from entering the socket 57 when the lamp and adapter of Fig. 5 is inserted in the socket 57. The flexible sleeve 82 is preferably constructed of one of the heat-resistant synthetic rubbers known to the art.

From the above discussion of Figs. 1 to 6, inclusive, it is apparent that:

(1) Both the lamp base and the lamp socket may have improved structures such as shown in Figs. 1 and 2.

(2) A conventional lamp may be provided with an adapter such as shown in Fig. 5 and employed with a lamp socket having an improved structure such as shown in Fig. 3.

(3) A conventional lamp socket may be employed

with an adapter as shown in Fig. 6 and employed with a lamp having an improved structure such as shown in Fig. 1; or

(4) Both a conventional lamp base and a conventional socket may be provided with adapters as shown in Figs. 5 and 6.

It will, of course, be understood that in any case the lamp base will be modified or adapted to have the correct size to fit the particular socket or socket with adapter employed, or that the socket or adapter will be of the correct size to fit the particular lamp or lamp with adapter employed. The structures of the present invention may be employed with lamps and sockets of substantially any size, for example, for flash lights or pilot lights in radios or Christmas tree lights, up to lamps having mogul bases or larger and may obviously be adapted to lamps having dual filaments with bases and sockets providing connection for two or more circuits. The present invention is particularly advantageous for single use lamps, such as photographers' flash lamps, which require frequent replacement. In general, the structures of Figs. 1 to 4 and 7 are preferred since adapters such as shown in Figs. 5, 6 and 8 may loosen in their sockets or on their plugs in the same manner as conventional screw-threaded connections. However, adapters have the advantage that conventional lamps and sockets may be employed while still realizing a substantial saving of time and labor in replacing defective lamps.

A further modified lamp base **83** is shown in Fig. 7 which is conventional in all respects except that a disc **84** of magnetic material, such as soft iron, has been soldered to the lower contact element **86**. It will be apparent that the lamp base of Fig. 7 may be employed in the socket of Fig. 2 so that a small-sized, such as a candelabra base, in accordance with Fig. 7, may be employed in the standard socket of Fig. 6 provided with an adapter of the correct size to receive the base of Fig. 7. It will be further apparent that the base of Fig. 7 can still be employed in standard screw-threaded sockets of the correct size to fit the base of Fig. 7.

Another adapter for a standard socket is shown in Fig. 8. This adapter may have a base portion **87** of the correct size to fit a standard socket and a socket portion **88** of the correct size to receive lamp bases such as those shown in Fig. 1 and Fig. 7, or even a lamp base with an adapter as shown in Fig. 5. The adapter of Fig. 8 may include a split outer casing **89** of insulating material surrounding a socket element which may be of the type shown in Figs. 3 and 4. The base portion of the adapter **87** may have a screw-threaded portion **91** having a metallic sleeve **92** provided with screw-threaded convolutions to be screw-threaded upon the portion **91** to hold the two halves of the split sleeve **89** together. A connector **93** having a portion **94** extending to the exterior of the base portion **87** to form a lower central contact and an upper portion connected to the conductor element **34** attached to the permanent magnet **26** may be employed to connect the permanent magnet **26** to one side of the circuit through the central contact portion **94**. Similarly, a connector **96** extending through a slot **97** in the walls of the base portion **87** into engagement with the metallic sleeve **92** may have its upper portion connected to the inner conducting sleeve **27** of the socket element through the tubular rivet **31**. The upper portion of the split casing **89** may be held together in any suitable manner, for example, by a spring split ring **98**. Otherwise the socket element of Fig. 8 may be the same as that of Figs. 3 and 4. It will be apparent that the base portion **87** of the adapter of Fig. 8 may be of the correct size to fit any conventional socket and that the socket portion **88** may be of the correct size to receive the lamp base of Fig. 1 or of Fig. 7 or the base of Fig. 5 with its adapter **46**.

From the above description of the invention, it is apparent that we have provided a novel electrical connector for completing both sides of an electrical circuit, one side being completed through a permanent magnet and an armature of magnetic material therefor. While the invention has particular utility for holding a lamp base in a socket therefor while making electrical contacts which are not subject to disconnection by vibration or temperature changes, it is further apparent that the present invention may be advantageously employed for any type of quick detachable electrical connection for completing both sides of a circuit.

We claim as our invention:

1. A detachable electrical connector, which comprises, a connector socket element having an opening for slidably receiving a connector plug element and a side wall provided with a side contact element, an end contact element supported in said socket element, defining a bottom for said opening and insulated from said side contact element, a plug element having a side contact for sliding contact with the side contact element of said socket element upon insertion of said plug into said socket and an end contact element insulated from the side contact element of said plug element for contact engagement with the end contact element of said socket element, one of said end contact elements being an armature member of magnetic material and the other of said end contact elements being a unitary body and a permanent magnet in and of itself for attracting said armature member and retaining said plug element against movement away from said end contact in said socket, said plug element being of substantially the same transverse dimensions as said socket opening to be physically held thereby against relative transverse movement.

2. A detachable electrical connector, which comprises, a connector socket element having an opening for slidably receiving a connector plug element and a side wall provided with a side contact element, a unitary body comprising permanent magnet in and of itself constituting an end contact element supported in said socket element and insulated from said side contact element, a connector plug element having a side contact element for sliding contact with the side contact element of said socket element upon insertion of said plug into said socket and an armature element of magnetic material constituting an end contact element insulated from the side contact element of said plug element for contact engagement with the end contact element of said socket element, so that said magnet holds said plug element against movement away from said end contact in said socket element, said plug element being of substantially the same transverse dimensions as said socket opening to be physically held thereby against relative transverse movement.

3. A socket for a detachable electrical connector, which comprises, a connector socket element having an opening for slidably receiving a connector plug element and a side wall provided with a side contact element, a unitary body comprising permanent magnet defining a bottom for said opening in and of itself constituting an end contact element and insulated from said side contact element.

4. A detachable electrical connector for an electric lamp, which comprises, a connector socket element having an opening for receiving the base of an electric lamp and a side wall provided with a side contact element, an end contact element, defining a bottom for said opening supported in said socket element and insulated from said side contact element, an electric lamp having a base provided with a side contact element for sliding contact with the side contact element of said socket element upon insertion of said base into said socket element and an end contact element insulated from the side contact element of said base for contact engagement with the end contact element of said socket element, one of said end contact elements being an armature member of

magnetic material and the other of said end contact elements being a unitary body and a permanent magnet in and of itself for attracting said armature member and retaining said base against movement away from said contact in said socket, said base element being of substantially the same transverse dimensions as said socket opening to be physically held thereby against relative transverse movement.

5. A detachable electrical connector for an electric lamp, which comprises, a connector socket element having an opening for receiving the base of an electric lamp and a side wall provided with a side contact element, a unitary body comprising permanent magnet in and of itself constituting an end contact element supported in said socket element, defining a bottom for said opening and insulated from said side contact element, an electric lamp having a base provided with a side contact element for sliding contact with the side contact element of said socket element upon insertion of said base into said socket element and an armature element of magnetic material constituting an end contact element insulated from the side contact element of said base for contact engagement with the end contact element of said socket element, so that said magnet holds said base against movement away from said contact in said socket element, said base element being of substantially the same transverse dimensions as said socket opening to be physically held thereby against relative transverse movement.

6. A detachable electrical connector comprising, a socket element and a plug element slidably receivable therein, a side wall of said socket element having a side contact element thereon, an end contact element defining the bottom of said socket and being insulated from said side contact element, said plug element having a side contact to engage the side contact element in said socket and an end contact element, insulated from said side contact, arranged to directly engage the end contact

element in said socket, one of said end contact elements being an armature of magnetic material and the other of said end contact elements being a bipolar magnet with both poles thereof being arranged to engage said armature and hold said plug in said socket.

7. A connector as defined in claim 6 wherein said poles both terminate in substantially coplanar end surfaces extending transversely of said socket and plug and wherein said armature has an end face extending transversely of said socket and plug a sufficient distance to simultaneously engage the end surfaces of said magnet.

8. A connnector as defined in claim 6 wherein the said bipolar magnet comprises the end contact element in said socket.

9. A connector as defined in claim 6 wherein said plug element comprises the base portion of an electric lamp.

10. A connector as defined in claim 6 wherein said plug element comprises the base portion of an electric lamp and wherein said bipolar magnet comprises the end contact element in said socket.

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