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- (21) Application No. 5219/75 (22) Filed 7 Feb. 1975 (19)
 (61) Patent of addition to No.1 496 485 dated 9 Dec. 1974
 (23) Complete Specification filed 9 Feb. 1976
 (44) Complete Specification published 12 Sept. 1979
 (51) INT. CL.² H01R 13/40
 (52) Index at acceptance
 H2E 24 3A4A 3C2D 3C2E 3D10 3D4 3E8A3
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(54) IMPROVEMENTS IN OR RELATING TO ELECTRIC PLUGS

(71) We, J. A. CRABTREE & COMPANY LIMITED, a British Company of Lincoln Worsk Walsall WE1 2DN, in the County of Stafford, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with improvements in or relating to electric plugs, and in particular to fused domestic mains plugs of the kind (herein referred to as being of the kind specified) comprising a base, a plurality of pin-receiving apertures in the base, pins located in the apertures, and a plug cover secured to the base, and is an improvement in or modification of the invention the subject of our UK Patent No. 1,496,485.

Conventionally, the fuse-carrying pin of an electric plug is secured to a terminal member comprising a fuse-receiving bracket, by means of a rivet, at the inner end portion of the pin. When assembled as part of an electric plug, the terminal member is seated against an interior surface of the plug base which bounds the pin-receiving aperture of the plug on the inner side, thereby preventing movement of the pin outwardly of the aperture.

One of the difficulties associated with such a construction is that, on removal of the plug cover (for example to change a fuse, or to carry out wiring alteration) the pin may drop from the plug base from the interior side thereof.

Thus, it has become practice, in the assembly of such an electric plug, particularly if the plug has insulating sleeves covering part of the pins, to utilise a construction in which movement of the assembly of pin and sleeve axially inwardly of the plug base is prevented.

With such, and similar constructions, it is conventional practice to assemble the plug by the insertion of an assembly of pin and sleeve into an associated pin-receiving aperture from the outside of the plug base, to present to the inner end portion of the pin

an appropriate terminal member, and to rivet said terminal member to said inner end portion.

This operation is somewhat time consuming, and it is one of the various objects of this invention to provide a superior method of assembly of an electric plug of the kind specified.

Another of the difficulties associated with such a construction is that, on withdrawal of a plug from an electric socket, the resistance to withdrawal movement of the fused pin is taken by the rivet, and in the event of breakage of the rivet (as may happen if the fused pin sticks in the socket) the plug may be withdrawn from the socket leaving the fused pin behind, and still in electrical contact with the live socket terminal.

It is thus a further of the various objects of this invention to provide an electric plug comprising a fuse carrying pin, which plug is both comparatively safe and convenient to use without the cost of the plug having been unduly increased.

This invention provides an electric plug comprising a base, a plurality of apertures in the base through each of which the shank of a respective plug pin extends from the interior of the plug, and a plug cover secured to the base, wherein one of the pins has secured to an inner end portion thereof a terminal member comprising a bracket adapted to receive one end of a fuse link, said pin being provided with a recess in a side face thereof and an insulating sleeve on the pin has an interior formation which extends into the recess, the insulating sleeve providing means adapted to transmit forces tending to withdraw the pin from the base to the base.

In this manner, the likelihood of separation of the said pin and the plug on withdrawal thereof from an electric socket is minimised.

Advantageously, the sleeve is provided with at least one, and preferably two transversely-extending formations adapted to engage surfaces of the plug base to restrain movement of the sleeve axially outwardly relative to the base.

Preferably, the sleeve is provided with restraining means, co-operable with the plug base, to restrain the sleeve and pin against axial movement relative to the base in a direction inwardly of the plug. Such means preferably comprises at least one resiliently-deformable formation which extends radially outwardly of the sleeve; conveniently, such transversely-extending formation co-operates with an interior surface of the associated pin-receiving aperture, to restrain relative axial movement between the sleeve and the plug base by frictional forces: alternatively, such transversely-extending formation is adapted to co-operate with a transversely-extending exteriorly-presented surface of the plug base, such as an outside face thereof.

Preferably said terminal member seats on a surface presented interiorly of the plug base through which forces tending to withdraw the pin from the base are normally transmitted to the plug base, said means provided by the insulating sleeve adapted to transmit to the base providing a safety feature. Alternatively said forces may be transmitted to the plug base jointly by the sleeve and terminal member, or the sleeve may serve to transmit such forces to the base whilst the terminal member provides a safety feature.

This invention also provides a method of assembly of an electric plug of the kind specified, comprising the use of a plug base provided with a plurality of pin-receiving apertures, a pin having a recess in a side face thereof, an insulating sleeve which is a sliding fit on said pin, said sleeve having an interior formation adapted to be received within the recess on assembly of the pin and sleeve, the sleeve being also provided with at least one resiliently-deformable transversely-extending formation adapted, when an assembly of pin and sleeve is positioned in one of the pin-receiving apertures, to co-operate with the plug base to restrain movement of said assembly in a direction inwardly of the plug base, and a terminal member comprising a fuse-receiving bracket, and the steps, in sequence, of:

- (a) sliding the sleeve onto the pin;
- (b) securing the terminal member to an inner end portion of the pin; and
- (c) inserting the assembly of pin and sleeve into one of said pin-receiving apertures.

Preferably the pin is provided with a portion of reduced cross-section, and the sleeve is slidably mounted on said reduced portion, engaging a shoulder provided where the reduced portion terminates, to limit movement between the sleeve and pin in one direction.

There will now be given a detailed description, to be read with reference to the accompanying drawings, of an electric plug

which is a preferred embodiment of this invention, and a method by which said plug is assembled. It is to be appreciated that this embodiment and said method of assembly have been selected to illustrate this invention by way of example.

In the accompanying drawings:—

Figure 1 is a sectional front elevation of part of the preferred embodiment of this invention;

Figure 2 is a sectional side elevation of the view shown in Figure 1;

Figure 3 is a plan of the view shown in Figure 1, the plug pin having been removed; and

Figure 4 is an enlarged view, corresponding to Figure 2, of a modified form of plug also in accordance with this invention.

The preferred embodiment of this invention is an electric plug of the kind specified, comprising a plug base 10, a cover (not shown) for the base, and three pins, namely a live pin 26 and neutral and earth pins (not shown). Both the live and neutral pins of the plug are provided with insulating sleeves 40 of resiliently-deformable material extending from a portion of the pin which in use is within the plug, to a position along the length of the pin such, on withdrawal of the pin from the socket, by the time the sleeve is at least substantially clear of the socket opening, the pin will no longer be in electrical contact with socket terminals.

The base 10 is provided with three pin-receiving apertures of rectangular transverse section extending therethrough for each of the three pins, said apertures including an aperture 12 for the live pin 26.

The pin 26 has a portion of reduced cross-section which extends from an inner end thereof for a distance equal to the length of the sleeve and to a depth generally equal to the thickness of the sleeve. Thus, the sleeve may be slid onto said reduced portion (said reduced portion being indicated by the number 28 in the drawings) into engagement with a shoulder 29, provided where the reduced portion terminates, which shoulder serves as means to restrain movement of the sleeve relative to the pin longitudinally thereof away from said inner end portion.

The sleeve is provided, at its inner end, and on each of the side faces thereof of larger dimensions, with a pair of parallel slots, a portion of the sleeve between each pair of parallel slots being deformed outwardly from the body of the sleeve about an axis at right-angles to the longitudinal axis of the pin to provide a formation in the form of a resiliently-deformable flap which extends transversely to the longitudinal axis of the pin.

Extending from the outside face of the base into opposite side faces of larger dimension of the aperture 12 is a local enlarge-

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ment thereof provided by two channels 20, 20. The channels 20 are of a shape to accommodate the flaps 41, and extend short distances through the base, terminating at shoulders 22, 22 providing transversely-extending exteriorly-presented surfaces of the plug base.

Extending into the side faces of smaller dimension of the pin 26, and at positions spaced a short distance from the inner end portion of the pin, are two recesses 30, 30 of rectangular cross-section. The sleeve 40 is provided with similar interior formations 42, 42 which formations, when the sleeve is positioned on the pin, are received within said recesses 30, upper surfaces 44, 44 of said formations being flat, and abutting against upper surfaces 31, 31 of said recesses 30.

The sleeve 40 is also provided, on an inner end portion thereof, and on the side faces thereof of smaller dimension, with transversely outwardly-extending formations 46, 46.

In the assembly of the sleeve 40 and pin 26, the sleeve is slid over the inner end portion of the pin, sloping, under surfaces 43 of the formations 42 engaging the inner end face of the pin and aiding a deformation of the sleeve prior to movement of said inner formations 42 into the recesses 30.

Secured to said inner end portion of the pin 26 by a rivet 34 is a terminal member 36, said member 36 comprising a bracket adapted to receive one end portion of a cartridge fuse, said bracket being off-set from the longitudinal axis of the pin 26, the other end portion of said fuse being received by a further bracket connected to a live terminal of the plug.

Extending from the interior of the base 10 through the inner side thereof and bounding the aperture 12 is a recess 18, said recess being of a shape similar to that of the base of the terminal member 36 and providing a surface 19 presented interiorly of the plug base against which said member 36 may seat. Extending further into the base 10, at positions thereof one on either of the sides of smaller dimension of the aperture 12, are two channels 14, 14 (see Figures 1 and 3).

Subsequent to sliding of the sleeve 40 onto the pin 26, the pin 26 is riveted to the terminal member 36, and the assembly of pin/sleeve and terminal member is presented to the plug base, and the pin/sleeve inserted from the inside into the aperture 12 in the plug base. Such insertion is facilitated by the lead afforded by the triangular shape of the flaps, and subsequently involves a compression of the flaps 41, 41 prior to passage of said flaps beyond the shoulders 22, 22, whereupon the flaps spring out under said shoulders and restrain axial movement of

the pin/sleeve in a direction inwardly of the plug base.

The channels 20, 20 may if desired be omitted, the flaps in such a construction being situated axially further from the inner end portion of the pin, and designed to spring out under the outside face of the plug base.

In the assembled position of the pin/sleeve/terminal member, the outer formations 46, 46 of the sleeve seat against transverse-extending and interiorly-presented surfaces 15, 15 of the two channels 14. Thus, any forces tending to withdraw the pin from the base (acting in the direction A shown in Figure 1) are transmitted by said outer formations 46 to the plug base through the surfaces 15, 15, engagement between the surfaces 44, 44 of the interior formations 42 with the upper surfaces 31 of the recesses 30 restraining relative longitudinal movement between the pin and sleeve.

Whereas in the preferred embodiment hereinabove described the terminal member 36 is shown spaced a short distance from the surface 19 of the recess 18, causing all such forces as mentioned to be transmitted from the pin to the plug base through the insulating sleeve 40, if desired, the member 36 may be arranged to seat against the surface 19, whereby said forces are transmitted to the base jointly by the sleeve and bracket. Alternatively, said forces may be wholly transmitted to the plug base by the action of the member 36 against said surface 19, engagement of the outer formations 46, 46 of the sleeve against the surface 15 of the channels 14 in said circumstances acting as a safety feature preventing removal of the pin from the plug base in the event that the rivet 34 breaks.

Additionally, whereas in the preferred embodiment hereinabove described, the means provided on the sleeve and co-operable with the plug base to restrain the sleeve and pin against axial movement relative to the base in a direction inwardly of the plug is provided by said resiliently-deformable flaps 41, similar means also engaging the channels 20, 20 may be alternatively provided by solid formations integral with the sleeve, and provided in the moulding thereof. In such a construction, it is envisaged that the radial outward extent of the transversely-extending surfaces of such formations may be less than that provided by the flaps 41.

In the modified form illustrated in Figure 4, the aperture in the plug base is not provided with the local enlargement, in the form of said channels 20, 20 extending a short distance into the base from the outside thereof, and said resiliently-deformable formations (indicated by the numbers 41¹, 41¹) co-operate with an interior surface of the associated pin-receiving aperture 12¹, restraint to movement of the assembly of

pin/sleeve in a direction inwardly of the plug base being effected by frictional engagement between said formations 41¹, 41¹ and said interior surface of the aperture 12¹. The

5 formations 41¹, 41¹ are constructed as integral mouldings on the sleeve, and are formed to facilitate the insertion of the assembly of pin/sleeve into the aperture 12¹ from the inside face of the plug base.

10 Attention is drawn to the specification of our copending Application No. 32770/78 (Serial No. 1,552,242) which has been divided from this present application.

15 WHAT WE CLAIM IS:—

1. An electric plug comprising a base, a plurality of apertures in the base through each of which the shank of a respective plug pin extends from the interior of the plug, and a plug cover secured to the base, wherein one of the pins has secured to an inner end portion thereof a terminal member comprising a bracket adapted to receive one end of a fuse link, said pin being provided with a recess in a side face thereof and an insulating sleeve on the pin has an interior formation which extends into the recess, the insulating sleeve providing means adapted to transmit forces tending to withdraw the pin from the base to the base.

2. An electric plug according to claim 1 wherein the terminal member seats on a surface presented interiorly of the plug base through which forces tending to withdraw the pin from the base may be transmitted to the base.

3. An electric plug according to Claim 2 wherein such interiorly-presented surface is provided by a recess extending into the plug base from the inner side thereof.

4. An electric plug according to any one of the preceding claims wherein the sleeve is provided with at least one transversely-extending formation adapted to engage a surface of the plug base to restrain movement of the sleeve axially outwardly relative to the base.

5. An electric plug according to Claim 4 wherein the sleeve is provided with two such formations, which extend in radially opposite directions, each of which being adapted to engage a transversely-extending and interiorly-presented surface of the plug base.

6. An electric plug according to Claim 5 wherein the two transversely-extending and interiorly-presented surfaces of the plug base are provided by channels provided by local enlargements of the associated plug-receiving aperture extending short distances into the plug base from an inner side thereof.

7. An electric plug according to any one of the preceding claims wherein the sleeve is provided with restraining means, co-operable with the plug base, to restrain the sleeve and

pin against axial movement relative to the base in a direction inwardly of the plug.

8. An electric plug according to Claim 7 wherein said restraining means is provided by resiliently-deformable formations which extend radially outwardly of the sleeve and which frictionally engage the surface of the aperture.

9. An electric plug according to any one of the preceding claims wherein the fuse-receiving bracket is offset from the longitudinal axis of the pin.

10. A method of assembly of an electric plug of the kind specified, comprising the use of a plug base provided with a plurality of pin-receiving apertures, a pin having a recess in a side face thereof, an insulating sleeve which is a sliding fit on said pin, said sleeve having an interior formation adapted to be received within the recess on assembly of the pin and sleeve, the sleeve being also provided with at least one resiliently-deformable transversely-extending formation adapted, when an assembly of pin and sleeve is positioned in one of the pin-receiving apertures, to co-operate with the plug base to restrain movement of said assembly in a direction inwardly of the plug base, and a terminal member comprising a fuse-receiving bracket, and the steps, in sequence, of:

- (a) sliding the sleeve onto the pin;
- (b) securing the terminal member to an inner end portion of the pin; and
- (c) inserting the assembly of pin and sleeve into one of said pin-receiving apertures.

11. A method according to Claim 10 wherein said resiliently-deformable formation is adapted to co-operate with a transversely-extending exteriorly-presented surface of the plug base.

12. A method according to Claim 11 wherein said transversely-extending exteriorly-presented surface of the plug base is provided by a local enlargement of the associated pin-receiving aperture extending a short distance into the plug base from the outside thereof.

13. A method according to Claim 10 wherein said resiliently-deformable formation extends radially outwardly of the sleeve and is adapted to co-operate frictionally with an interior surface of the associated pin-receiving aperture to restrain movement of the assembly inwardly of the plug base.

14. A method according to any one of Claims 10, 11, 12 and 13 wherein there are two such resiliently-deformable formations on opposite sides of the sleeve, and are constructed to facilitate insertion of the assembly of pin and sleeve into the associated pin-receiving aperture.

15. A method according to any one of Claims 10 to 14, wherein the terminal

pin/sleeve in a direction inwardly of the plug base being effected by frictional engagement between said formations 41¹, 41¹ and said interior surface of the aperture 12¹. The

- 5 formations 41¹, 41¹ are constructed as integral mouldings on the sleeve, and are formed to facilitate the insertion of the assembly of pin/sleeve into the aperture 12¹ from the inside face of the plug base.
- 10 Attention is drawn to the specification of our copending Application No. 32770/78 (Serial No. 1,552,242) which has been divided from this present application.

15 WHAT WE CLAIM IS:—

1. An electric plug comprising a base, a plurality of apertures in the base through each of which the shank of a respective plug pin extends from the interior of the plug, and
- 20 a plug cover secured to the base, wherein one of the pins has secured to an inner end portion thereof a terminal member comprising a bracket adapted to receive one end of a fuse link, said pin being provided with a
- 25 recess in a side face thereof and an insulating sleeve on the pin has an interior formation which extends into the recess, the insulating sleeve providing means adapted to transmit forces tending to withdraw the pin
- 30 from the base to the base.

2. An electric plug according to claim 1 wherein the terminal member seats on a surface presented interiorly of the plug base through which forces tending to withdraw the pin from the base may be transmitted to the base.
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3. An electric plug according to Claim 2 wherein such interiorly-presented surface is provided by a recess extending into the plug base from the inner side thereof.
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4. An electric plug according to any one of the preceding claims wherein the sleeve is provided with at least one transversely-extending formation adapted to engage a
- 45 surface of the plug base to restrain movement of the sleeve axially outwardly relative to the base.

5. An electric plug according to Claim 4 wherein the sleeve is provided with two such formations, which extend in radially opposite directions, each of which being adapted to engage a transversely-extending and interiorly-presented surface of the plug base.
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6. An electric plug according to Claim 5 wherein the two transversely-extending and interiorly-presented surfaces of the plug base are provided by channels provided by local enlargements of the associated plug-receiving aperture extending short distances into the
- 60 plug base from an inner side thereof.

7. An electric plug according to any one of the preceding claims wherein the sleeve is provided with restraining means, co-operable with the plug base, to restrain the sleeve and
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pin against axial movement relative to the base in a direction inwardly of the plug.

8. An electric plug according to Claim 7 wherein said restraining means is provided by resiliently-deformable formations which extend radially outwardly of the sleeve and which frictionally engage the surface of the aperture.
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9. An electric plug according to any one of the preceding claims wherein the fuse-receiving bracket is offset from the longitudinal axis of the pin.
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10. A method of assembly of an electric plug of the kind specified, comprising the use of a plug base provided with a plurality of pin-receiving apertures, a pin having a recess in a side face thereof, an insulating sleeve which is a sliding fit on said pin, said sleeve having an interior formation adapted to be received within the recess on assembly of the pin and sleeve, the sleeve being also provided with at least one resiliently-deformable transversely-extending formation adapted, when an assembly of pin and sleeve is positioned in one of the pin-receiving apertures, to co-operate with the plug base to restrain movement of said assembly in a direction inwardly of the plug base, and a terminal member comprising a fuse-receiving bracket, and the steps, in sequence, of:
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- (a) sliding the sleeve onto the pin;
- (b) securing the terminal member to an inner end portion of the pin; and
- (c) inserting the assembly of pin and sleeve into one of said pin-receiving apertures.
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11. A method according to Claim 10 wherein said resiliently-deformable formation is adapted to co-operate with a transversely-extending exteriorly-presented surface of the plug base.
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12. A method according to Claim 11 wherein said transversely-extending exteriorly-presented surface of the plug base is provided by a local enlargement of the associated pin-receiving aperture extending a short distance into the plug base from the outside thereof.
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13. A method according to Claim 10 wherein said resiliently-deformable formation extends radially outwardly of the sleeve and is adapted to co-operate frictionally with an interior surface of the associated pin-receiving aperture to restrain movement of the assembly inwardly of the plug base.
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14. A method according to any one of Claims 10, 11, 12 and 13 wherein there are two such resiliently-deformable formations on opposite sides of the sleeve, and are constructed to facilitate insertion of the assembly of pin and sleeve into the associated pin-receiving aperture.
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15. A method according to any one of Claims 10 to 14, wherein the terminal



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member is secured to the inner end of the pin by a riveting operation.

16. A method according to any one of Claims 10 to 15 wherein the terminal member seats on a surface presented interiorly of the plug base.

17. A method according to Claim 16 wherein said interiorly-presented surface is provided by a recess extending into the plug base from the inner side thereof.

18. A method according to any one of Claims 10 to 17 wherein the fuse-receiving bracket is offset from the longitudinal axis of the pin.

19. A method according to any one of Claims 10 to 18 wherein the sleeve comprises means through which forces tending to withdraw the pin from the base may be transmitted to the base.

20. A method according to Claim 19 wherein said means comprises at least one formation extending transversely outwardly of the sleeve, and adapted to engage a transversely-extending and interiorly-presented surface of the plug base to restrain move-

ment of the sleeve, and hence of the assembly of pin and sleeve, axially outwardly relative to the base.

21. A method according to any one of Claims 10 to 20 inclusive wherein the pin is provided with a portion of reduced cross-section, and the sleeve is slidably mounted on said reduced portion, engaging a shoulder provided where the reduced portion terminates, to limit movement between the sleeve and pin in one direction.

22. A method of assembly of an electric plug of the kind specified, when carried out substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1979.
 Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
 from which copies may be obtained.



* C L M S *

ERRATUM

SPECIFICATION NO. 1552241

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THE PATENT OFFICE
4 February 1980

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