

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN ELECTRIC FITTINGS

- (71) We, ALWAR COMPANY LIMITED, a Limited company organised under the laws of the Republic of Ireland, of 9 Clare Street, Dublin 2, Republic of Ireland, do hereby declare the invention, for which I pray that a patent may be granted to me and the method by which it is to be performed, to be particularly described in and by the following statement:
- 10 This invention relates to electric plug connectors and the principal object of the invention is to provide means for wiring such plugs that is to say for connecting the usual multi-conductor flexible lead thereto.
- 15 Plug connectors of the kind in use hitherto consist of a casing or body carrying two or more "pins" for engagement with a mating socket, each pin having associated with it, within the casing, means (usually including a screw) for securing one of the conductors of the flexible lead thereto. Wiring such a plug connector is a relatively delicate and time-consuming procedure, normally involving the taking apart of two or
- 20 more constituent parts of the casing or body, stripping the insulating and covering layers from the lead as necessary and arranging the lead so that the individual conductors extend from the point at which the lead enters the casing, to the above-mentioned securing means, which may involve trimming the individual conductors to different lengths, and then securing the conductors and re-assembling the casing or body.
- 25 The present invention provides an electric plug connector comprising a body having a bottom surface from which contact pins project, conductive tracks within the body leading from the contact pins to individual contact positions, and securing means for securing two or more individual conductors of an electric lead in said contact positions, said body comprising a main body part and a clamping part which is movable relative
- 30 thereto, wherein the bottom surface of the body has a recess which receives the clamping part, and the said contact positions are located in the said recess so that a single clamping movement of the clamping part relative to the main body part operates the

securing means for all of the contact positions.

In a preferred embodiment of the invention, the contact positions are provided adjacent to, and preferably approximately 55 equidistant from, an opening in the body, the opening being adapted to house the electric lead when the clamping part and main body part are in the clamped position.

The two relatively movable parts of the 60 body may comprise a main body part and a flap which is hinged thereto. If the plug is made of plastic material which has satisfactory properties, the flap may be integral with the main body part.

Alternatively, the body may be formed of two components, a main body part and a clamping component which can be detachably mounted on the main body part, or which may be permanently secured in movable relation to the main body part during the moulding of the body. The flap or other clamping component closes against a portion of the body in the said recess so that the clamping component and the body portion 75 form, in effect, a movable "jaw" and a fixed jaw which operate the securing means for the contact positions and which also define between them an opening, as referred to previously. 80

In accordance with one feature of the invention, the body may be moulded from a material with suitable creep resistance, mechanical strength, electrical properties and heat deflection temperature, with the 85 configuration of the mould being such that the body is formed with a flap in the vicinity of the opening.

When the body is moulded of plastics material, the metal parts may be inserted 90 into the mould before the plastics material is injected. Alternatively the main body part may have separate moulded constituent parts such as a base and cover and the metal parts may be inserted during assembly of the 95 plug connector, the main body part being consolidated as one piece by ultrasonic welding, pinning or adhering.

A plug connector in accordance with the invention may have two or more pins, in 100

accordance with any of the arrangements commonly encountered in existing electrical systems. In a preferred embodiment, the contact positions are provided adjacent to an opening in the body, so that the necessity is avoided, when wiring the connector, of having to trim the individual conductors of the flexible lead to length and arrange them in the body. Since the conductors are secured at contact positions adjacent the opening, the individual conductors can all be of the same length.

In the case of a fused plug having live, neutral and earth pins, the earth and neutral pins preferably each have a metal contact strip integral with or rigidly attached to the pin at the top thereof and extending at right angles thereto. The contact strips of the earth and neutral pins may extend through the body and terminate on the recessed surface of the main body part in respective contact positions.

A second recess may also be formed in the plug body, into which a cartridge fuse can be inserted. Preferably the second recess is set into the face of the body from which the pins extend. The cartridge fuse may suitably be snapped into engagement with a fuse holder formed by two clips, one of which is connected to the live pin by means of a metal strip and the other of which is connected to a contact strip which terminates on the recessed surface of the main body part in a third contact position.

Preferably the ends of the contact strips in the contact positions are shaped to co-operate with clamping members on the clamping part, so that the end portions of the contact strips and the clamping members on the clamping part form the securing means for the conductors of the electric lead.

The invention is illustrated in the accompanying drawings in which:

Fig. 1 is a perspective view from the rear of the bottom of one embodiment of a plug in accordance with the invention having a flap clamping means, the flap being shown in the open position;

Fig. 2 is a longitudinal sectional view of a plug of the kind shown in Fig. 1;

Fig. 3 shows a view from above of the base component of a plug of the kind shown in Fig. 1;

Fig. 4 shows a view from below of the cover component;

Fig. 5 shows a view from below of the base and cover components assembled and fused together with metal parts in position but omitting the flap;

Fig. 6 shows a top view of the flap;

Fig. 7 shows a view from below of the plug of Fig. 3 with the flap closed and a fuse in position;

Fig. 8 shows an elevation of a "live" pin

with associated contact strip and first fuse holder;

Fig. 9 shows a view from below of the "live" pin of Fig. 8;

Fig. 10 shows a view from below of a second fuse holder and contact strip associated therewith;

Fig. 11 shows an elevation of a neutral pin with associated contact strip;

Fig. 12 shows a view from below of the pin and contact strip of Fig. 11;

Fig. 13 is an elevation of an earth pin and associated contact strip;

Fig. 14 is a rear view of the earth pin and contact strip of Fig. 13 but inverted relative to Fig. 13;

Fig. 15 shows an elevation of an alternative "live" pin and associated contact strip for a plug which does not have a fuse;

Fig. 16 shows a view from below of the "live" pin and contact strip of Fig. 15;

Fig. 17 is a perspective view from the rear of the bottom of an alternative embodiment of a plug in accordance with the invention having a detachable clamping means, not in the form of a flap;

Fig. 18 is a diagrammatic perspective view of a saw-tooth clamping member and a saw-tooth end portion of a contact strip;

Fig. 19 is a view similar to Fig. 16 but showing rounded tips on the saw-teeth;

Fig. 20 is a diagrammatic perspective view of an alternative block-tooth clamping member and corresponding contact strip end portion;

Fig. 21 is a view similar to Fig. 18 but showing a rounded block-tooth configuration;

Figs. 22 and 23 are diagrammatic perspective views of further alternative clamping members and contact strip end portions;

Fig. 24 shows in cross section an encircling tab which may be used as a fuse cover or fuse holder in the plug of Figs. 1-14.

Fig. 25 shows a plan view of the tab of Fig. 24.

Fig. 26 shows a longitudinal section through the tab of Figs. 24 and 25.

As shown in Figs. 1-14, an electric plug of the 13-amp fused type comprises a body having a main body part 1 and a flap 2 hinged thereon. The body part 1 retains three flat pins, namely an earth pin 3, a neutral or negative pin 4 and a live or positive pin 5, the last of which has a fuse 6 associated with it. The pins extend from the bottom surface 18 of the main body part. The bottom surface 18 has a recess 51 which receives the flap 2. The fuse 6 is mounted in a second recess 7 in the body. The main body part is formed from a base 40 and a cover 41. In the preferred embodiment, the base and cover are injection moulded from plastics material, a glass-reinforced thermoplastic polyester being particularly preferred.

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As shown in Fig. 3, the base has apertures 43, 44, 45 for the three pins 3, 4, 5 and apertures 42 for two fuse holders. As shown in Fig. 4 the bottom surface of the cover has grooves for receiving the metal components of the plug. During manufacture, the metal components are put in place in the base and the cover is then applied on top. After assembly, the base and cover are united, preferably by ultrasonic welding or alternatively by adhesion.

The base 40 has a skirt portion 47 while the cover has a raised deck portion 48, both of which combine to form a platform 17 in the recess 51 at the rear of the body.

The live pin 5 (shown more particularly in Figs. 8 and 9) has a contact strip 8 secured to the top end thereof, the contact strip 8 extending at right angles from the pin and diagonally forwardly across the body of the plug (as shown in dotted outline in Fig. 5) to a first fuse holder 9 located in second recess 7. A second fuse holder 10 located at the other end of second recess 7 is connected to a dog-leg contact strip 11 (see Fig. 10) which extends rearwardly (as shown in dotted outline in Fig. 5) to a "live" contact position 12 in the recess 51. The end portion of the contact strip in the contact position 12 is formed with a saw-tooth configuration.

The neutral pin 4 (shown more particularly in Figs. 11 and 12) has a short contact strip 13 secured to the top end thereof, the contact strip extending at right angles to the pin and rearwardly in an axial direction (as shown in dotted outline in Fig. 5) to a neutral contact position 14 in the recess 51, where the end portion of the contact strip has a saw-tooth configuration.

The earth pin 3 (see Figs. 13 and 14) has a long contact strip 15 secured to the top end thereof and extending rearwardly in an axial direction to an earth contact position 16 in the recess 51, where the end portion of the contact strip 15 has a saw-tooth configuration.

As can be seen from the dotted outlines in Fig. 5, contact strips 8 and 15 cross each other but they are electrically insulated (for example by an air gap or layer of insulator) from each other. The contact strips are enclosed within the main body part except where they terminate on the surface in the contact positions.

The three contact positions 12, 14 and 16 are arranged in an arc on platform 17 in recess 51 at the rear of the main body part 1. The earth contact strip 15 has teeth of its saw-tooth configuration lying transversely to the axis of the body, while the live and neutral contact strips have their teeth lying at inclinations of about 60° to the axis of the body. The axis of the body is a line passing through the earth pin and midway between

the live and neutral pins. The space formed by the recess 51 is filled by a flap 2 when it is in the closed position. Flap 2 is hinged about a rod 52 set in a bay portion of the recess between pins 4 and 5. The flap 2 is guided in its pivoting movements by wings 19 of the main body part which define the side walls of the recess 51. When the flap is closed it is secured in clamped position by two fixing screws 20 which pass through holes 21 in the flap and are received in threaded sockets 22 in the platform 17 (or alternatively screw posts set into the platform).

The rear part of the platform 17 is interrupted by an opening channel 23 of semi-circular cross-section extending axially inwardly. The corresponding part of the flap also defines an opening channel 24 of semi-circular cross-section. When the flap is closed, the two opening channels combine to form a circular opening for housing an electric lead.

Three lead channels 25, 26, 27 are provided in the platform 17, extending from the opening channel 23 to the three contact positions 12, 14, 16.

The inward surface of the flap carries three clamping members 28, 29, 30 in locations corresponding exactly to the three contact positions 12, 14, 16. Each clamping member comprises a saw-toothed projection which complements the saw-tooth configuration of the respective contact strip in the corresponding contact position. Thus when the flap is closed, clamping member 28 seats down on contact strip 11 in "live" contact position 12; clamping member 29 seats down on contact strip 13 in neutral contact position 14; and clamping member 30 seats down on contact strip 15 in earth contact position 16. The clamping member may be metal components having root portions moulded into the flap or they may be formed of the plastics material of the flap.

Flap 2 is provided with a cord grip screw 31 which extends upwardly through the flap into opening channel 24. The upper end of cord grip screw 31 is broadened out into a head having a textured surface. When the flap is closed, the screw 31 may be tightened from outside the plug to press the lead against the body 1 in the opening channel 23 which also has a textured surface. Thus the lead is gripped independently of the clamping action of the clamping members 28, 29 and 30.

The flap 2 and the main body part 1 form, in effect, a movable "jaw" and a fixed "jaw" which define between them an opening for the introduction of a lead. The flap portion may be moulded in a transparent material to facilitate the wiring of the plug.

When the plug is to be wired, the flap 2 is opened by releasing fixing screws 20. The ends of the three conductors of a flexible

lead are separated and are laid into the three lead channels 25, 26, 27, so that the ends of the conductors lie on the contact strips 11, 13, 15 in contact positions 12, 14, 16. The flap is then closed by manual pressure, with the conductor ends gripped in the three contact positions, fixing screws 20 are then tightened to clamp the jaw firmly in the closed position, and the opposed saw-tooth surfaces of the clamping members and contact strips cut into the insulating covering of the conductors and make the necessary metal-to-metal contact with the latter. If desired, the ends of the conductors may of course be bared before they are inserted into the contact positions, and this may be necessary for some industrial uses. In addition, some leads may have no insulating covering at the ends. Finally the cord grip screw 31 is tightened.

The contact positions at which the individual conductors of the lead should be inserted may be identified, for example by marking on the body, either three colour-markings of the standard colours used to identify live, neutral and earth or alternatively the words LIVE, NEUTRAL and EARTH, the initial letters thereof or the names of the 3 colours. The marks may suitably be moulded into the surface of the body adjacent to the contact positions.

The body of the plug can be moulded so as to be of similar shape to plugs as in use hitherto. Moreover, the top of the body (i.e. the surface opposite the side where the pins are provided) may if desired be shaped to provide a gripper knob for ease of withdrawal of the connector from a socket. Alternatively, the top of the body may be shaped to provide, at opposite sides thereof, depressions having roughened or "textured" surfaces, so as to facilitate the body being gripped between the finger and thumb.

As previously mentioned, the plug body is formed with a second recess to receive a cartridge fuse. This second recess may be located at various positions of the body, but in all cases the metal strips attached to the clips forming the fuse holder are shaped so as to form, when the fuse is inserted, the necessary conducting track between the live pin and the contact position.

In the case of a plug which does not have a fuse, the live pin may be connected directly to the live contact position. A suitable live pin and contact strip are illustrated in Figs. 15 and 16. Other components of the plug would be the same as shown in Figs. 1-14, omitting the fuse 6 and second recess 7.

Fig. 17 shows an alternative embodiment in which flap 2 is replaced by a slider 32 which can be lifted away from the main body part 1 of the plug. The slider 2 is guided in its up-and-down movements by

the wings 19 of the body. In other respects this embodiment of the invention is similar to that shown in Figs. 1-14.

Fig. 18 shows a saw-tooth clamping arrangement in greater detail. Channels 33 are provided in clamping member 34 and also in contact strip 35 to accommodate a conductor. When the clamping member is secured against the contact strip, the conductor passes over the peaks and into the troughs of the saw-tooth configuration, thus ensuring a relatively large area of secure contact and reducing the chances of arcing between the conductor and the contact strip. For extra penetration through an insulating covering, additional saw-teeth may be provided on the clamping member and contact strips of Figs. 1-14.

Figs. 19-23 show alternative clamping arrangements which can be substituted for the saw-teeth arrangement of Fig. 18 and which in particular may be used in place of the saw-tooth clamping members and contact strips in the plug of Figs. 1-14 if it is not desired to cut through the insulating covering of the conductors. In the arrangement of Fig. 19, there are saw-teeth with rounded ends. In the arrangement of Fig. 20 there is a single block tooth which presses a conductor into a trough of corresponding shape. In Fig. 21, there is a block tooth of similar configuration but with rounded corners. Fig. 22 shows an arrangement which is particularly suitable for use with copper conductors. An elongated projection 82 is received into a channel 83 which is also the channel in which the conductor lies. Fig. 23 shows an arrangement in which a "pip" 84 is received in a depression 85 which registers with it. The depression is provided in channel 86 in which the conductor lies.

If desired, any of the above-described clamping arrangements may be modified to incorporate spring-loading. For example, the clamping members in the flap 2 of the plug of Figs. 1-14 may be spring loaded.

Figs. 24-26 show an encircling tab which may be used as a fuse cover or fuse holder in the plug of Figs. 1-14, to aid easy withdrawal. Fig. 24 shows the tab in cross section, Fig. 25 shows a plan view of the tab and Fig. 26 shows a longitudinal section through the tab. The fuse is held in core 90 and a window 91 is provided for inspection of the fuse.

Instead of providing clamping members separate from the contact strips with which they engage, it would be possible to modify the plug of any of the above figures by employing members in the form of resilient clasp members e.g. of U-shape, located between the co-operating "jaws". When the jaws are moved apart, the clasp members have an open formation, so that the conductor ends can be inserted between them. The jaws are

then clamped into engagement, thus causing the clasp members to close into gripping engagement with the conductor ends. The clasp members may be of metal or any other suitably durable and reliable material.

The plug connector according to the present invention has the substantial advantage that wiring of the plug connector is simpler and quicker than with conventional plug connectors currently in use. When the contact positions are arranged adjacent to one another it is not necessary to cut the lead conductors to different lengths. When saw-tooth clamping elements are used, the insulating covering need not be removed from the ends of the conductors. The simultaneous securing of the conductors in contact positions by a clamping movement is not only convenient but it leads to substantially improved conduction and dissipation of heat. In a conventional plug in which each conductor is secured separately to a pin by a single 5 BA screw, the maximum pressure exerted on the conductor has been calculated at 1793 p.s.i. With a plug according to the present invention, it is possible to use two 4 BA fixing screws, leading to a pressure applied to each conductor which has been calculated at 2093 p.s.i.

30 In the plug shown in Figs. 1-14, wiring can be carried out without removing the fuse, and yet the fuse can be replaced without dismantling the plug. The cord grip as described with reference to Figs. 1-14 is more effective and durable than the cord grips used in conventional plugs and the danger of a lead being pulled out of the plug is minimised.

When the plug is installed in a socket, the flap 2 is inaccessible and so there is no danger of the clamping part being loosened unless the plug is removed from the socket.

Some of the electric fittings disclosed herein are also described and claimed in my Application No. 8028462 (Serial No. 1600067) divided herefrom.

WHAT I CLAIM IS:

1. An electric plug connector comprising a body having a bottom surface from which contact pins project, conductive tracks within the body leading from the contact pins to individual contact positions, and securing means for securing two or more individual conductors of an electric lead in said contact positions, said body comprising a main body part and a clamping part which is movable relative thereto, wherein the bottom surface of the body has a recess which receives the clamping part, and the said contact positions are located in the said recess so that a single clamping movement of the clamping part relative to the main body part operates the securing means for all of the contact positions.

2. An electric plug connector according

to claim 1 wherein the said contact positions are provided adjacent to an opening in the body.

3. An electric plug connector according to either of the preceding claims wherein the contact positions are arranged in an arc so as to be equidistant from an opening in the body.

4. An electric plug connector according to any of the preceding claims wherein movement of the clamping part from a closed position to an open position uncovers the contact positions.

5. An electric plug connector according to any of the preceding claims wherein the clamping part is a flap hinged to the main body part.

6. An electric plug connector according to any of the preceding claims 5-7 wherein the clamping part slides between wing portions of the main body part.

7. An electric plug connector according to any of the preceding claims wherein the contact pins and conductive tracks are of metal.

8. An electric plug connector according to claim 7 wherein the main body part is injection moulded of plastics material.

9. An electric plug connector according to claim 8, wherein the metal parts were inserted into the mould before the plastics material was injected.

10. An electric plug connector according to claim 7 wherein the main body part has separate constituent parts moulded of plastics material and the metal parts have been inserted during assembly of the constituent parts, after which the main body part has been united as one piece.

11. An electric plug connector according to any of the preceding claims wherein the conductive tracks have the form of metal contact strips attached to the contact pins and extending through the main body part to respective contact positions.

12. A fused electric plug connector according to any of claims 1-10, wherein the live contact pin is connected to a fuse holder and a second fuse holder is provided with a metal contact strip extending through the main body part to a contact position, while the conductive tracks leading from the other pins have the form of contact strips extending through the body to other contact positions.

13. A plug connector according to either of claims 11 and 12, wherein the ends of the contact strips in the contact positions are shaped to co-operate with clamping members on the clamping part.

14. A plug connector according to claim 13 wherein the contact strips in the contact positions and the clamping members on the clamping part have saw-tooth configurations.



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then clamped into engagement, thus causing the clasp members to close into gripping engagement with the conductor ends. The clasp members may be of metal of any other suitably durable and reliable material.

The plug connector according to the present invention has the substantial advantage that wiring of the plug connector is simpler and quicker than with conventional plug connectors currently in use. When the contact positions are arranged adjacent to one another it is not necessary to cut the lead conductors to different lengths. When saw-tooth clamping elements are used, the insulating covering need not be removed from the ends of the conductors. The simultaneous securing of the conductors in contact positions by a clamping movement is not only convenient but it leads to substantially improved conduction and dissipation of heat. In a conventional plug in which each conductor is secured separately to a pin by a single 5 BA screw, the maximum pressure exerted on the conductor has been calculated at 1793 p.s.i. With a plug according to the present invention, it is possible to use two 4 BA fixing screws, leading to a pressure applied to each conductor which has been calculated at 2093 p.s.i.

In the plug shown in Figs. 1-14, wiring can be carried out without removing the fuse, and yet the fuse can be replaced without dismantling the plug. The cord grip as described with reference to Figs. 1-14 is more effective and durable than the cord grips used in conventional plugs and the danger of a lead being pulled out of the plug is minimised.

When the plug is installed in a socket, the flap 2 is inaccessible and so there is no danger of the clamping part being loosened unless the plug is removed from the socket.

Some of the electric fittings disclosed herein are also described and claimed in my Application No. 8028462 (Serial No. 1600067) divided herefrom.

WHAT I CLAIM IS:

1. An electric plug connector comprising a body having a bottom surface from which contact pins project, conductive tracks within the body leading from the contact pins to individual contact positions, and securing means for securing two or more individual conductors of an electric lead in said contact positions, said body comprising a main body part and a clamping part which is movable relative thereto, wherein the bottom surface of the body has a recess which receives the clamping part, and the said contact positions are located in the said recess so that a single clamping movement of the clamping part relative to the main body part operates the securing means for all of the contact positions.

2. An electric plug connector according

to claim 1 wherein the said contact positions are provided adjacent to an opening in the body.

3. An electric plug connector according to either of the preceding claims wherein the contact positions are arranged in an arc so as to be equidistant from an opening in the body.

4. An electric plug connector according to any of the preceding claims wherein movement of the clamping part from a closed position to an open position uncovers the contact positions.

5. An electric plug connector according to any of the preceding claims wherein the clamping part is a flap hinged to the main body part.

6. An electric plug connector according to any of the preceding claims 5-7 wherein the clamping part slides between wing portions of the main body part.

7. An electric plug connector according to any of the preceding claims wherein the contact pins and conductive tracks are of metal.

8. An electric plug connector according to claim 7 wherein the main body part is injection moulded of plastics material.

9. An electric plug connector according to claim 8, wherein the metal parts were inserted into the mould before the plastics material was injected.

10. An electric plug connector according to claim 7 wherein the main body part has separate constituent parts moulded of plastics material and the metal parts have been inserted during assembly of the constituent parts, after which the main body part has been united as one piece.

11. An electric plug connector according to any of the preceding claims wherein the conductive tracks have the form of metal contact strips attached to the contact pins and extending through the main body part to respective contact positions.

12. A fused electric plug connector according to any of claims 1-10, wherein the live contact pin is connected to a fuse holder and a second fuse holder is provided with a metal contact strip extending through the main body part to a contact position, while the conductive tracks leading from the other pins have the form of contact strips extending through the body to other contact positions.

13. A plug connector according to either of claims 11 and 12, wherein the ends of the contact strips in the contact positions are shaped to co-operate with clamping members on the clamping part.

14. A plug connector according to claim 13 wherein the contact strips in the contact positions and the clamping members on the clamping part have saw-tooth configurations.



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15. A fused plug connector according to claim 12 wherein the fuse holders are located in a second recess in the back face of the plug so that a fuse can be inserted or removed without dismantling the plug.

16. A plug connector according to any of the preceding claims having a cord grip comprising a screw having a head at each end, the non-drivable head being located inside the plug and having a textured surface for urging a lead against a textured surface on another part of the plug.

17. An electric plug connector according to any of the preceding claims wherein the clamping part is formed of transparent material.

18. An electric plug connector substantially as described herein with reference to Fig. 1 of the drawings.

19. An electric plug connector substantially as described herein with reference to Figs. 1-14 of the drawings.

20. An electric plug connector substantially as described herein with reference to Fig. 17 of the drawings.

21. An electric plug connector according to claim 13 wherein the contact strip ends and clamping members are substantially as described herein with reference to any of Figs. 18-23 of the drawings.

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