

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO ELECTRIC FITTINGS

(71) We, ALWAR COMPANY LIMITED, a limited liability 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 we 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 fittings and the principal object of the invention is to provide improved means for wiring such fittings, that is to say for connecting the usual multi-conductor flexible lead thereto.
15 The invention is particularly but not exclusively applicable to plug connectors or "plug-tops".

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 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.

The present invention provides an electric fitting comprising a body having first and second relatively moveable body parts and securing means for securing two or more individual conductors of an electric lead in individual contact positions in the body, each of said contact positions being located in an individual valley on said first body part, a first clamping element of saw-tooth configuration in each of said valleys with the teeth lying across the valley, and second clamping elements of complementary saw-tooth configuration in corresponding posi-

tions on said second body part, such that conductors of a electric lead may be laid in the valleys over the first saw-tooth clamping elements and a single clamping movement of one body part relative to the other body part operates the securing means for all of the contact positions by gripping the conductors between the complementary clamping elements.

In a preferred embodiment of the invention, the clamping elements have cutting saw teeth adapted to cut through an insulating covering on a conductor during clamping movement of one body part relative to the other body part. Preferably the contact positions are provided adjacent to, and preferably approximately equidistant from, an opening in the body.

The two relatively movable parts of the body may comprise a main body part and a flap which is hinged thereto. If the fitting is made of plastics 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 moveable 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 so that the clamping component and the body portion form, in effect, a movable "jaw" and a fixed jaw which define between them an opening, as referred to previously.

In accordance with one important 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 configuration of the mould being such that the body is formed with a flap in the vicinity of the opening.

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 and below 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 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 perspective view of a flex connector in accordance with the invention;

Fig. 21 is a perspective view of a fragment of a junction box in accordance with the invention;

Fig. 22 is a perspective view of the rear of a socket in accordance with the invention.

As shown in Figs. 1-14, an electrical 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.

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 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 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 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 flap 2 when it is in 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 as valleys in the platform 17, extending from the opening channel 23 to the three contact positions 12, 14, 16. The end portions of the contact strips form clamping elements of saw-tooth configuration with the teeth lying across the respective valley.

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 an 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.

Fig. 19 shows an alternative clamping arrangement having saw-teeth with rounded ends which may be used in place of the cutting 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.

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.

Fig. 20 shows a flex connector having a strip body comprising two complementary parts, a base part 51 and a cover part 52. The base part is traversed by three valleys 53 separated by ridges 54, while the cover part has a complementary set of three ridges 55 flanked by valleys 56. Screw holes 57 for clamping screws are provided at the two ends of both body parts. At the bottom of the valleys 53 in the base part 51 and on the peaks of the ridges 55 in the cover part there are pairs of clamping elements 58 of one of the types shown in Figs. 18 and 19 although in this case the lower clamping element is not a contact strip. In the case of a connector for leads intended to carry 10 amps or less, the clamping members may most suitably be of the cutting saw-tooth configuration shown in Fig. 18. The channel 33 in the clamping member is aligned with the valley while the teeth lie across the valley.

When two lengths of three-conductor lead are to be joined, the ends of the "live" conductor are laid in overlapping relationship in

one of the valleys 53, the ends of the neutral conductor are laid in a second valley, and the ends of the earth conductor are laid in the third valley. The cover part 52 is then moved into engagement with the base part 51 so that ridges 55 enter into the valleys 53 and the conductors are gripped between the clamping members 58 in the valleys 53 and on the peaks of the ridges 55. If cutting saw-tooth clamping components such as those of Fig. 18 are used, the ends of the conductors need not be bared because the saw-teeth will cut through an insulating covering as the clamping movement is carried out. The two body parts are then secured in closed position by screws in the screw holes 57.

The junction box of Fig. 21 and the socket of Fig. 22 are seen to have moveable body parts very similar to those shown in Fig. 20. The clamping arrangement of Fig. 19 may be used. At the bottom of the valleys 53 in the base part 51 there are contact strips 59 which are connected to other conductive components (not shown) and which have end portions of saw-tooth configuration. There are complementary clamping elements on the ridges 55 of the cover part 52.

In the fittings of Figs. 20-22, the cover part may if desired be hinged to the base part at one end, with a simple securing screw in holes 57 at the other end.

Instead of providing clamping members separate from the contact strips with which they engage, it would be possible to modify the fittings 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 fittings according to the present invention have the substantial advantage that wiring of the fittings is simpler and quicker than with conventional fittings. When the contact positions are arranged adjacent to one another it is not necessary to cut the lead conductors to different lengths. When cutting 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, 130

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 an alternative construction of plug, more similar to a conventional 13 amp plug, it would be possible to use the cover of the plug as a clamping element.

Although the invention has been described in detail in its application to a 13 amp connector or plug-top, the invention can of course be applied to other forms of plug-connector including the proposed 16 amp type. Moreover, the invention can be applied to other forms of electric fittings, such as sockets, lamp-holders, ceiling roses, flex connectors, junction boxes and bayonet connectors.

Moreover the invention also has application to other forms of A.C. or D.C. electrical connection and could be applied for example in making an effective connection in the assembly of electronic equipment, and in the making of electrical connections in the auto industry.

In my Patent Specification No. 1 600 066 (7658/78), from which the present application is divided, I have claimed 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.

WHAT WE CLAIM IS:

1. An electric fitting comprising a body

having first and second relatively moveable body parts and securing means for securing two or more individual conductors of an electric lead in individual contact positions in the body, each of said contact positions being located in an individual valley on said first body part, a first clamping element of saw-tooth configuration in each of said valleys with the teeth lying across the valley, and second clamping elements of complementary saw-tooth configuration in corresponding positions on said second body part, such that conductors of a electric lead may be laid in the valleys over the first saw-tooth clamping elements and a single clamping movement of one body part relative to the other body part operates the securing means for all of the contact positions by gripping the conductors between the complementary clamping elements.

2. An electric fitting according to claim 1 wherein the clamping elements have cutting saw teeth adapted to cut through an insulating covering on a conductor during clamping movement of one body part relative to the other body part.

3. An electric fitting 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 fitting according to claim 1 or 2 wherein the valleys on said first body part are parallel valleys separated by ridges and said second body part has a complementary set of parallel ridges on which said second clamping elements are mounted.

5. An electric fitting according to any of the preceding claim wherein the two relatively moveable parts of the body comprise a main body part and a clamping part.

6. An electric fitting according to claim 5 wherein movement of the clamping part from a closed position to an open position uncovers the contact positions.

7. An electric fitting substantially as described herein with reference to Figs. 20-22 of the drawings.

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7. An electric fitting substantially as described herein with reference to Figs. 20-22 of the drawings.

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