

SPECIFICATION

Electric connector assembly manufacture

5 This invention relates to the manufacture of electric connector assemblies of the kind in which the connector contacts and associated conductor terminals are mounted in a pre-formed body of electrically insulating material, the conductors of a length of flexible insulated multiconductor cable are electrically connected to appropriate terminals of the connector, and a moulded connector body of electrically insulating material wholly or partially encapsulates the preformed body and the connector contacts and associated conductor terminals with an appropriate length of each contact exposed for effecting electrical connection to a contact of another connector and is permanently bonded to the insulating covering of a part of the length of cable. Electric connector assemblies of this kind will hereinafter, for convenience, be referred to as "of the kind described".

25 Electric connector assemblies of the kind described in the form of three pin electric plug assemblies are especially suitable for use with domestic electrical appliances because such appliances can be sold to the public with the electric plug permanently bonded to the flexible cable of an appliance, thereby eliminating the risk that an unskilled user of an appliance may connect a conventional three pin plug to an end of the flexible cable of the appliance in an incorrect manner which, when the appliance is used, may result in injury to the user and/or permanent damage to the appliance.

40 It has been found that, in manufacturing electric connector assemblies of the kind described, there is a risk that, during moulding of the connector body, a wire or wires of the exposed end of a cable conductor connected to one of the terminals will become detached from the terminals and will protrude through the moulded connector body. A connector assembly of the kind described in the form of a three pin electric plug assembly which is connected to a domestic electrical appliance and which has a live wire or wires protruding through the plug body is extremely dangerous, especially if handled with damp hands—as may be the case when the plug assembly is connected to a domestic washing machine.

55 It is an object of the present invention to provide an improved method of manufacturing an electric connector assembly of the kind described in which the risk that an electric connector assembly will be manufactured with a wire or wires of the exposed end of a cable conductor connected to one of the terminals protruding through the moulded connector body is eliminated or at least substantially reduced.

65 In the improved method according to the invention, a preformed body of electrically

insulating material, in which the connector contacts and associated conductor terminals are mounted and to appropriate terminals of which the conductors of a length of flexible insulated multi-conductor cable are electrically connected, is positioned in a mould of metal or metal alloy, for use in moulding the connector body, with the connector contacts arranged in electrical contact with a contact or contacts mounted in or protruding through, but insulated from, the wall of the mould and, during and/or after the moulding operation, a voltage source is connected the contact or contacts insulated from the mould wall and the wall of the mould, the arrangement being such that, in the event that a wire or wires of the exposed end of a cable conductor connected to one of the terminals should protrude through the moulded connector body to such an extent as to effect electrical contacts with the internal surface of the mould wall, a control circuit is completed which effects actuation of a visual and/or audible alarm.

To eliminate the risk that an operator will not reject a moulded connector found to be faulty by the method of the invention, preferably when the control circuit is completed it brings into automatic operation a guillotine or other cutting means which cuts the faulty moulded connector from the length of cable to which it is bonded, thereby ensuring that the rejected connector assembly will not be subsequently despatched to a customer.

The method of the invention is especially, but not exclusively, suitable for use in manufacture of electric connector assemblies in the form of three pin electric plug assemblies for use with domestic electrical appliances.

The method of the invention is also especially, but not exclusively, suitable for use in the manufacture of the electric plug assembly described and claimed in the Specification of out co-pending Patent Application No. 8007655, (Serial No 2050076A) filed on 6

110 March 1980. The electric plug assembly in this co-pending application has a moulded plug body comprising an inner moulded body which encapsulates at least the live and neutral terminals, and preferably all of the terminals, of the plug, and an outer moulded plug body which wholly or partially encapsulates the preformed body, the inner moulded body and the plug pins. The method of the present invention can be used in the manufacture of the inner moulded body only or, if desired, it can be used in the manufacture of both the inner moulded body and the outer moulded body. In all cases the risk that an electric plug assembly will be despatched to a customer with wires protruding through the moulded body of the plug is substantially eliminated.

The invention also includes apparatus for use in the manufacture of electrical conductor assemblies of the kind described by the method hereinbefore described.

The invention is further illustrated by a description, by way of example, of preferred apparatus for use in the manufacture of an electric plug assembly with reference to the accompanying drawings, in which:-

Figure 1 is a plan view from above of the lower part of a two-part mould;

Figure 2 is a sectional side view of the two-part mould taken on the line II-II in Fig. 1;

Figure 3 is a partial sectional side view taken on the line III-III in Fig. 1, and

Figure 4 is a sectional side view taken on the line IV-IV in Fig. 1.

The two-part mould shown in Figs. 1 to 4 is for use in moulding the inner moulded body of the plug of an electric plug assembly forming the subject of our co-pending Patent Application No. 8007655 (Serial No. 2050076A). The two-part mould 1 comprises

a lower metal part 2 and an upper metal part 3 which define between them two mould cavities 4 which can be fed with molten plastics via runners 5. The mould cavities 4 are identical and each is designed to mould an inner moulded body on a preformed base insert carrying plug pins and their associated terminals to which the conductors of a length of electric cable are permanently connected, the pins and conductor terminals being maintained in position in the preformed base insert by a preformed spider which is a snap-fit on the preformed base insert. Each mould cavity 4 has three rectangular apertures 6 for receiving the line and earth pins protruding from a preformed base insert and has upstanding bosses 7 which can be gripped by fuse clips carried in the fuse recess of a preformed base insert. Extending for each mould cavity 4, is a mould extension 8 for moulding an integral part of the inner moulded body around a part of a length of cable electrically connected to the terminals of the plug pins and a passage 9 for accommodating an adjacent part of the cable.

As will be seen on referring to Fig. 2, the lower metal part 2 of the mould 1 incorporates, beneath each mould cavity 4, a metal plate 12 which is electrically insulated from the metal part 2 by a surrounding layer 11 of electrically insulating material and which has throughbores in alignment with the rectangular apertures 6. When a preformed base insert is positioned in the mould cavity 4, the pins protruding from the preformed base insert pass through the rectangular apertures 6 into the throughbores in the metal plate 12 and effect electrical contact with spring-loaded contacts (not shown) protruding transversely into the throughbores. As will be seen, the rectangular apertures 6 in each mould cavity 4 are substantially larger in cross-sectional area than the pins so that the pins do not effect electrical contact with the metal part 2. The upstanding metal bosses 7 in each mould cavity 4 are in electrical contact with the

metal plate 12 but are electrically insulated from the lower metal part 2 by a layer of electrically insulating material. The metal plates 12 are electrically connected to spring-loaded terminals 16 by insulated metal rods 14 which extend through bores 15 in the metal part 2 without making contact with the metal part. As will be seen on referring to Fig. 4, one spring-loaded contact 16 is connected to its associated metal rod 14 by a connecting strap 17, the two spring-loaded contacts 16 thereby being staggered in a vertical plane.

In use, the two-part mould 1, which is connected to earth, is caused to traverse in a direction parallel to the larger side of the mould to bring the spring-loaded contacts 16 into electrical contact with two fixed contacts of a control circuit (not shown). In its simplest form, the control circuit comprises a voltage source connected via a main relay and key switch to two parallel arms, each connected to one of the fixed contacts via a relay operated switch.

When the two-part mould 1 is moved in a direction parallel to the larger side of the mould to bring the spring-loaded contacts 16 into electrical contact with the two fixed contacts of the control circuit, the voltage is applied and molten plastics material is fed into the two mould cavities 4 via the runners 5 to mould inner moulded bodies on preformed base inserts accommodated in the mould cavities. If neither of the inner moulded bodies formed in the mould cavities has a stray wire from one of the cable conductors protruding through the moulded body and in contact with the metal wall of the mould cavity, then the control circuit will not be completed to earth and the inner moulded bodies, found to be satisfactory, can be extracted from the mould cavities.

On the other hand, if a stray wire from a cable conductor in one of the mould cavities 4 protrudes through the inner moulded body and is in contact with the metal wall of the mould cavity, then the control circuit is connected to earth and the relay in that one of the parallel arms electrically connected to the spring-loaded contact associated with the mould cavity housing the faulty inner moulded body, causes a normally open switch to close and operate a visual alarm indicating which of the two mould cavities 4 has a faulty inner moulded body. At the same time, the main relay of the control circuit closes to operate both an audible and visible alarm indicating that there is a faulty inner moulded body in the mould and causes the normally closed switch to open. The key switch has to be reset by a supervisor before a further moulding operation can be effected and hence serves as a safety device since a supervisor can ensure that the faulty inner moulded body is removed from the mould and is severed

from the cable so that it cannot be used in the manufacture of a moulded plug assembly. After the supervisor has reset the key switch, the mould operator is free to load the mould cavities again for a further moulding operation.

In some circumstances, detection of a faulty inner moulded body by the control circuit can also bring into automatic operation a guillotine which cuts the length of the cable connected to the fault inner moulded body being used in the manufacture of a moulded plug assembly.

15 CLAIMS

1. A method of manufacturing an electric connector assembly of the kind described, which method comprises positioning in a mould of metal or metal alloy for use in moulding the connector body, a preformed body of electrically insulating material, in which the connector contacts and associated conductor terminals are mounted and to appropriate terminals of which the conductors of a length of flexible insulated multi-conductor cable are electrically connected, with the connector contacts arranged in electrical contact with a contact or contacts mounted in or protruding through, but insulated from, the wall of the mould and, during and/or after the moulding operation, connecting a voltage source between the contact or contacts insulated from the mould wall, and the wall of the mould, the arrangement being such that, in the event that a wire or wires of the exposed end of a cable conductor connected to one of the terminals should protrude through the moulded connector body to such an extent as to effect electrical contact with the internal surface of the mould wall, a control circuit is completed which effects actuation of a visual and/or audible alarm.

2. A method as claimed in Claim 1, wherein, when the control circuit is completed it brings into automatic operation a guillotine or other cutting means which cuts the faulty connector from the length of cable to which it is bonded.

3. A method as claimed in Claim 1 or 2, wherein the electric connector assembly is in the form of a three pin electric plug assembly for use with a domestic electrical appliance.

4. Apparatus for use in the manufacture of an electric connector assembly of the kind described, which apparatus comprises a mould of metal or metal alloy, for use in moulding the connector body, having at least one electric contact mounted in or protruding through, but insulated from, the wall of the mould; a voltage source connected between, or adapted to be connected between, the contact or contacts insulated from the mould wall and the wall of the mould; and, associated with the voltage source and said contact or contacts, a control circuit incorporating a

visual and/or audible alarm, the arrangement being such that, in the event that a wire or wires of the exposed end of a cable conductor connected to one of the terminals of an electric connector assembly being manufactured in the mould, should protrude through the moulded connector body to such an extent as to effect electrical contact with the internal surface of the mould wall, the control circuit is completed which effects actuation of the visual and/or audible alarm.

5. Apparatus as claimed in Claim 4, wherein a guillotine or other cutting means is operatively connected in the control circuit in such a way that, when the control circuit is completed, the guillotine or other cutting means is automatically operated to cut the faulty moulded connector from the length of cable to which it is bonded.

6. Apparatus for use in the manufacture of an electric plug assembly substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

7. A method of manufacturing an electric plug assembly substantially as hereinbefore described with reference to the accompanying drawings.

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