

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO CONNECTORS FOR ELECTRICAL CONTACTS

(71) We, E. I. DU PONT DE NEMOURS AND COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, of Wilmington, State of Delaware, United States of America, 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:—

The present invention relates to connectors for electrical contacts, for example, for the contacts of integrated circuits.

Integrated circuits are now being used in an increasing number of applications and are becoming increasingly complex. The more complex integrated circuits have a large number of contacts which each have to be connected to handle incoming and outgoing signals. Sockets for connecting the contacts of integrated circuits to printed circuits are known but have the disadvantage that if a large number of contacts are to be mounted simultaneously in such a socket it is necessary to apply force to the contacts to press them into position in the socket.

According to the present invention there is provided a connector comprising a housing of electrically insulating material having at least one row of contact receiving openings formed therein, each opening arranged to have a respective contact mounted therein and having a space for receiving a respective further contact, each opening having a movable wall, and operating means for moving said walls whereby the movable wall of each opening can, when a contact is mounted in that opening and a further contact is inserted into the corresponding space, press said mounted contact and said further contact together.

In a preferred embodiment the movable wall of each contact receiving opening is

hingedly connected to the housing and may be made from either electrically conducting or electrically insulating material. If the housing is manufactured from a resilient synthetic material, for example, thermoplastics material, the movable wall of each opening may be integrally formed with the housing. In this case the movable walls would be made considerably thinner than the rest of the housing to impart the required rigidity to the housing whilst enabling movement of the movable walls. Alternatively the housing could be made from a thermo hardening material. The movable walls could be integrally formed with the operating means.

Preferably the operating means comprises a plurality of ribs each having one end hingedly connected to a respective movable wall of a contact receiving opening, the other end of each rib being received in a respective recess in an elongate actuating member extending substantially parallel with respect to said row of contact receiving openings. In one embodiment the actuating member is a longitudinally movable slide and in another embodiment is a rotatable shaft. Locking means may be provided to lock the actuating member in the position thereof in which the movable walls of each opening press together the mounted contact and the further contact to ensure that good contact between the mounted and fixed contacts is maintained.

Preferably the housing has a plurality of ribs extending transversely with respect to the longitudinal axis of the actuating member, the ribs being arranged alternately on opposite sides of the longitudinal axis of the actuating member and having guide means for the actuating member. In this way, the ribs support the actuating member on the housing.

In a preferred embodiment the housing has two spaced parallel walls connected by

said transverse ribs, and a respective row of contact receiving openings is provided in each of said walls. In this embodiment the actuating member extends between said two walls.

Embodiments of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 shows a perspective view of an embodiment of a connector for the contacts of an integrated circuit with an integrated circuit positioned above the connector;

Figure 2 shows the connector of Figure 1 with the contacts of the integrated circuit inserted therein;

Figure 3 shows a perspective view of a further embodiment of a connector for the contacts of an integrated circuit with an integrated circuit positioned above the connector;

Figure 4 shows the connector of Figure 3 with the contacts of the integrated circuit inserted therein, and

Figure 5 shows schematically three connectors as shown in Figure 3 arranged in a row one behind the other.

The connector shown in Figures 1 and 2 comprises a housing 1 of synthetic material which has two spaced parallel walls 2 and 3. The walls 2 and 3 are connected together by a plurality of ribs 4 and 5. The ribs 4 connect upper portions of the walls 2 and 3 whilst the ribs 5 connect lower portions thereof. The ribs 4 and 5 are alternately arranged along the length of the housing 1. In Figure 1 one of the upper ribs 4 has been partly removed so that one of the lower ribs 5 is visible.

A plurality of contact receiving openings 6 are formed in each wall 2, 3 of the housing 1 and the upper portion of a contact 7 is mounted in each opening 6 so that the lower portion of each contact 7 projects below the housing 1. The upper and lower portions of each mounted contact 7 are offset with respect to one another to define an inclined intermediate portion 8 therebetween. The inclined portion 8 of each contact 7 abuts a shoulder 9 formed in the corresponding opening 6. The upper edge 10 of each contact 7 is bent and engages in a recess defined at the top of the corresponding receiving opening 6. The lower portion of each contact 7 extends through a slot 11 formed at the bottom of the receiving opening 6 so that each contact 7 is firmly held in its receiving opening 6. The upper portion of each contact 7 between the inclined portion 8 and the upper bent edge 10 is curved so that the upper portion is resiliently movable within its receiving opening 6.

The inwardly facing wall of each receiving opening 6 is movable and is formed by

a resilient member 12 which is hingedly connected to the bottom of the receiving opening 6. In the embodiment illustrated each movable wall 12 is integrally formed with the respective housing wall 2 or 3 but is substantially reduced in thickness so that it is resiliently movable with respect to the receiving opening 6. One end of a rib 13 is hingedly connected to the upper portion of each movable wall 12. In the embodiment illustrated material is removed from each rib 13 from either side of the one end thereof connected to the corresponding movable wall 12 so that the rib 13 may be pivoted in the longitudinal direction of the housing 1. The rest of each rib 13 is sufficiently rigid so that it can apply a force to its associated movable wall 12 to press the movable wall 12 towards the contact 7 received within the receiving opening 6. The other end of each rib 13 engages with a snap fit in a recess 14 formed in a slide 15 extending longitudinally with respect to the housing 1 intermediate the two walls 2 and 3 and substantially parallel with respect to the rows of contact receiving openings 6. This slide 15 forms an elongate actuating member which acts, together with the ribs 13, as operating means for moving the walls 12. The slide 15 is guided in recesses 16 formed in the upper and lower ribs 4 and 5.

In the position illustrated in Figure 1, and in the right half portion of Figure 2, the ribs 13 are pivoted about their one ends so that the ribs 13 each extend at an angle with respect to the perpendicular to the surface of the wall 12 of the corresponding receiving opening 6. In this position little or no force is applied to the walls 12 by the ribs 13 and thus a space is defined within each contact receiving opening 6 between the wall 12 and the corresponding mounted contact 7. The distance between each wall 12 and its corresponding contact 7 is chosen to be greater than the thickness of further contacts 17 to be inserted in the contact receiving openings 6. As illustrated, the further contacts 17 are formed on an integrated circuit 18 and are inserted into the corresponding receiving openings 6 as illustrated in the right hand portion of Figure 2. When the further contacts 17 have been positioned in the receiving openings 6 the slide 15 is moved longitudinally in the direction of arrow 19 whereby the ribs 13 are moved to a dead centre or over centre position. The movement of the ribs 13 moves the walls 12 towards the mounted contacts 7 whereby the movable wall 12 of each opening 6 presses the corresponding mounted contact 7 and further contact 17 together. Locking means are provided on the slide 15 to hold the slide in the contact position thereof in which the movable walls 12 of each receiving opening 6 press the mounted contacts 7 and

the further contacts 17 together. The locking means comprise two projections 20 and 22 formed on the slide 15 and spaced apart by a distance equal to or slightly greater than the thickness of one of the ribs 4. A recess 21 is formed in the one rib 4 through which the projection 20 can be pressed, and in the contact position of the slide 15 the projections 20 and 22 engage either side of the one rib 4 to hold the slide 15 in position. The projection 22 also limits the longitudinal movement of the slide 15 in the direction opposite to that of arrow 19 by engagement with the upper rib 4 adjacent to the one rib 4.

The further contacts 17 can be released from engagement in the connector by moving the slide 15 in the direction opposite to that of arrow 19 whereby the force applied to the movable walls 12 by the ribs 13 is released. The contacts 17 can then simply be removed from the contact receiving openings 6.

The connector shown in Figures 3 and 4 is similar to that shown in Figures 1 and 2 but the structure of the operating means therefor is different. In the Figures the same reference numerals have been used for similar parts. The operating means of the connector shown in Figures 3 and 4 comprises a plurality of ribs 13 each having one end hingedly connected to a respective movable wall 12. As can be seen from Figure 3 material is removed from each rib 13 from the upper and lower surfaces of the one end thereof connected to the corresponding movable wall 12 so that each rib 13 may be pivotally moved in the vertical direction perpendicular to the longitudinal direction of the housing. The other end of each rib 13 engages in a recess 24 in a rotatable shaft 23 which acts as the actuating member for the connector. The shaft 23 extends longitudinally of the housing intermediate the two walls thereof and substantially parallel with respect to each row of contact receiving openings 6. A handle 25 is keyed to the shaft 23 so that the shaft 23 may be rotated thereby.

In the position illustrated in Figure 3 the ribs 13 are pivoted about their one ends and extend at an angle with respect to the perpendicular to the surface of the corresponding movable wall 12. In this position little or no force is applied to the movable walls 12 so that a space is defined in each opening 6 in which a contact 17 may be inserted. When the contacts 17 are in position the shaft 23 is rotated as indicated by the arrow 26 by means of the handle 25. Rotation of the shaft 23 pivots the ribs 13 about their one ends to a dead centre position in which each of the ribs 13 associated with the receiving openings 6 in one wall of the housing is aligned with the facing rib 13

associated with the receiving openings 6 in the other wall of the housing as is shown in Figure 4. The movement of the ribs 13 to the position illustrated in Figure 4 moves the movable walls 12 towards the mounted contacts 7 whereby the mounted contact 7 and the further contact 17 in each opening 6 are pressed together. In the contact position of the shaft 23 and the ribs 13 shown in Figure 4 the two rows of ribs 13 act against one another to maintain the contact position. The contacts 17 can be released from the receiving openings 6 by rotating the shaft 23 in the opposite direction to the arrow 26.

The lower portions of each contact 7 of a connector as described above may be soldered to printed circuits so that the further contacts 17 may be connected to the printed circuits by way of the connector. In the embodiment illustrated, the further contacts 17 form part of an integrated circuit 18.

A number of connectors as described above may be linked together one behind the other to form a row as shown schematically in Figures 1 and 5. The slides 15 or shafts 23 of the individual connectors could then be coupled for simultaneous movement so that all of the operating means of the connectors would be moved simultaneously. It would, however, also be possible to move the operating means of each connector individually.

The connectors described and illustrated are only shown by way of example and obviously modifications may be made to the structure thereof. For example, the connector could have a single row of contact receiving openings if required. Additionally, locking means could be provided for maintaining the rotatable shaft in the contact position. Further the mounted contacts could be arranged adjacent to the movable walls and each further contact inserted between the mounted contact and a fixed wall of the contact receiving openings, the mounted contacts being moved into contact with the further contacts upon movement of the movable walls.

WHAT WE CLAIM IS:—

1. A connector comprising a housing of electrically insulating material having at least one row of contact receiving openings formed therein, each opening arranged to have a respective contact mounted therein and having a space for receiving a respective further contact and each opening having a movable wall, and operating means for moving said walls whereby the movable wall of each opening can, when a contact is mounted in that opening and a further contact is inserted into the corresponding space, press said mounted contact and said further contact together.



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the further contacts 17 together. The locking means comprise two projections 20 and 22 formed on the slide 15 and spaced apart by a distance equal to or slightly greater than the thickness of one of the ribs 4. A recess 21 is formed in the one rib 4 through which the projection 20 can be pressed, and in the contact position of the slide 15 the projections 20 and 22 engage either side of the one rib 4 to hold the slide 15 in position. The projection 22 also limits the longitudinal movement of the slide 15 in the direction opposite to that of arrow 19 by engagement with the upper rib 4 adjacent to the one rib 4.

The further contacts 17 can be released from engagement in the connector by moving the slide 15 in the direction opposite to that of arrow 19 whereby the force applied to the movable walls 12 by the ribs 13 is released. The contacts 17 can then simply be removed from the contact receiving openings 6.

The connector shown in Figures 3 and 4 is similar to that shown in Figures 1 and 2 but the structure of the operating means therefor is different. In the Figures the same reference numerals have been used for similar parts. The operating means of the connector shown in Figures 3 and 4 comprises a plurality of ribs 13 each having one end hingedly connected to a respective movable wall 12. As can be seen from Figure 3 material is removed from each rib 13 from the upper and lower surfaces of the one end thereof connected to the corresponding movable wall 12 so that each rib 13 may be pivotally moved in the vertical direction perpendicular to the longitudinal direction of the housing. The other end of each rib 13 engages in a recess 24 in a rotatable shaft 23 which acts as the actuating member for the connector. The shaft 23 extends longitudinally of the housing intermediate the two walls thereof and substantially parallel with respect to each row of contact receiving openings 6. A handle 25 is keyed to the shaft 23 so that the shaft 23 may be rotated thereby.

In the position illustrated in Figure 3 the ribs 13 are pivoted about their one ends and extend at an angle with respect to the perpendicular to the surface of the corresponding movable wall 12. In this position little or no force is applied to the movable walls 12 so that a space is defined in each opening 6 in which a contact 17 may be inserted. When the contacts 17 are in position the shaft 23 is rotated as indicated by the arrow 26 by means of the handle 25. Rotation of the shaft 23 pivots the ribs 13 about their one ends to a dead centre position in which each of the ribs 13 associated with the receiving openings 6 in one wall of the housing is aligned with the facing rib 13

associated with the receiving openings 6 in the other wall of the housing as is shown in Figure 4. The movement of the ribs 13 to the position illustrated in Figure 4 moves the movable walls 12 towards the mounted contacts 7 whereby the mounted contact 7 and the further contact 17 in each opening 6 are pressed together. In the contact position of the shaft 23 and the ribs 13 shown in Figure 4 the two rows of ribs 13 act against one another to maintain the contact position. The contacts 17 can be released from the receiving openings 6 by rotating the shaft 23 in the opposite direction to the arrow 26.

The lower portions of each contact 7 of a connector as described above may be soldered to printed circuits so that the further contacts 17 may be connected to the printed circuits by way of the connector. In the embodiment illustrated, the further contacts 17 form part of an integrated circuit 18.

A number of connectors as described above may be linked together one behind the other to form a row as shown schematically in Figures 1 and 5. The slides 15 or shafts 23 of the individual connectors could then be coupled for simultaneous movement so that all of the operating means of the connectors would be moved simultaneously. It would, however, also be possible to move the operating means of each connector individually.

The connectors described and illustrated are only shown by way of example and obviously modifications may be made to the structure thereof. For example, the connector could have a single row of contact receiving openings if required. Additionally, locking means could be provided for maintaining the rotatable shaft in the contact position. Further the mounted contacts could be arranged adjacent to the movable walls and each further contact inserted between the mounted contact and a fixed wall of the contact receiving openings, the mounted contacts being moved into contact with the further contacts upon movement of the movable walls.

WHAT WE CLAIM IS:—

1. A connector comprising a housing of electrically insulating material having at least one row of contact receiving openings formed therein, each opening arranged to have a respective contact mounted therein and having a space for receiving a respective further contact and each opening having a movable wall, and operating means for moving said walls whereby the movable wall of each opening can, when a contact is mounted in that opening and a further contact is inserted into the corresponding space, press said mounted contact and said further contact together.

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2. A connector as claimed in claim 1, wherein the movable wall of each contact receiving opening is a resilient member hingedly connected to the housing.
- 5 3. A connector as claimed in claim 2, wherein said resilient members are integrally formed with said housing.
4. A connector as claimed in any preceding claim, wherein said operating means comprises a plurality of ribs each having one end hingedly connected to a respective movable wall of a contact receiving opening, the other end of each rib being received in a respective recess in an elongate actuating member which extends substantially parallel with respect to said row of contact receiving openings.
- 10 5. A connector as claimed in claim 4, wherein said actuating member is a longitudinally movable slide supported by said housing.
- 15 6. A connector as claimed in claim 5, wherein means are provided on said slide for limiting the longitudinal movement thereof and locking means are provided to lock the slide in the position thereof in which the movable walls of each opening press the mounted contact and said further contact together.
- 20 7. A connector as claimed in claim 4, wherein said actuating member is a rotatable shaft supported by said housing.
- 25 8. A connector as claimed in any of claims 4 to 7, wherein said housing has a plurality of ribs extending transversely with respect to the longitudinal axis of said actuating member, the ribs being arranged alternately on opposite sides of the longitudinal axis of the actuating member and having guide means for said actuating member.
- 30 9. A connector as claimed in any preceding claim wherein a respective contact is mounted in each contact receiving opening and wherein the movable wall of each opening is spaced from the associated mounted contact to define said space for receiving the further contact, said movable wall being movable towards said mounted contact by said operating means.
- 35 10. A connector as claimed in claim 9, wherein each of said mounted contacts has first and second elongate portions offset with respect to one another and connected by an intermediate portion, the first portion of each contact being mounted in the respective contact receiving opening with the intermediate portion abutting a shoulder formed in the opening, and the second portion of each contact projecting from the housing through a slot in the respective contact receiving opening.
- 40 11. A connector as claimed in any preceding claim wherein the housing has two spaced parallel walls and a respective row of contact receiving openings is provided in each of said walls; said operating means extending between said two walls.
- 45 12. A connector substantially as hereinbefore defined with reference to and as illustrated in Figures 1 and 2 of the accompanying drawings.
- 50 13. A connector substantially as hereinbefore defined with reference to and as illustrated in Figures 3 and 4 of the accompanying drawings.
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