May 24, 1960 S. B. SILVERSCHOTZ 2,938,068

ELECTRICAL CONNECTORS

Filed Oct. 28, 1957 2 Sheets-Sheet 1

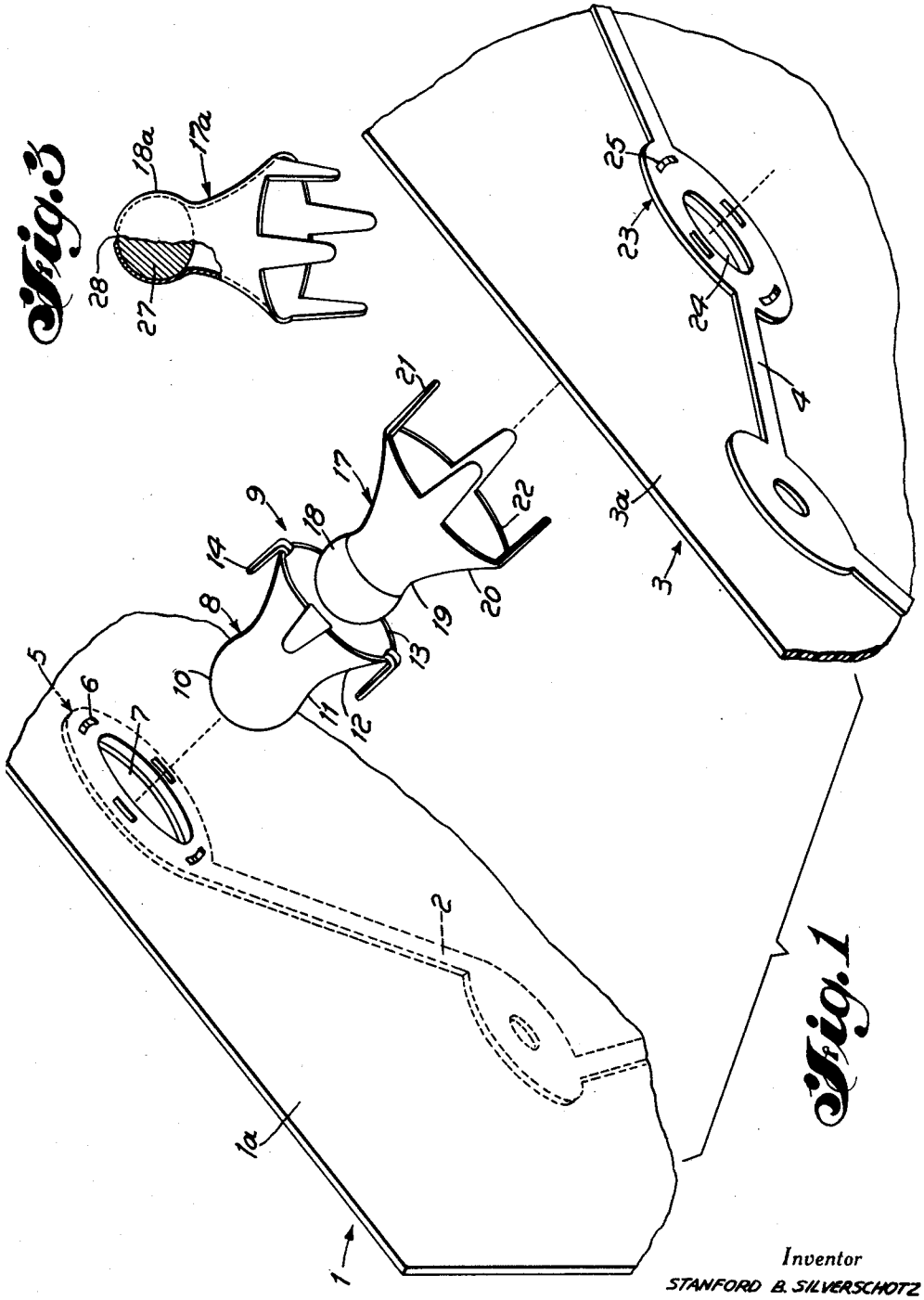


Fig. 1

Fig. 3

Inventor
STANFORD B. SILVERSCHOTZ
By Percy P. Lantzy
Attorney

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Fig. 2

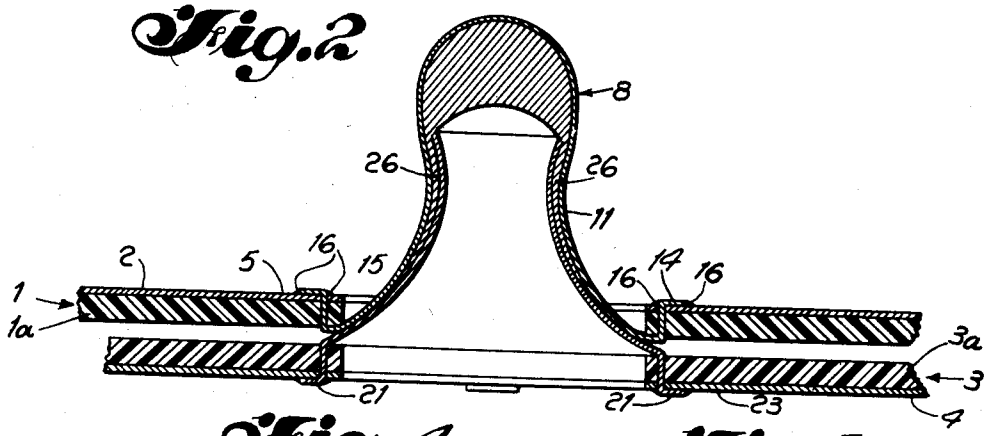


Fig. 4

Fig. 5

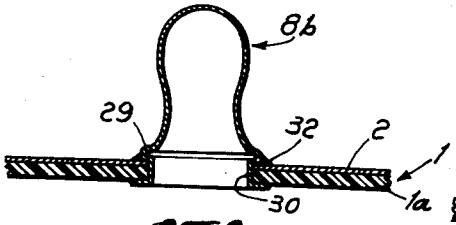


Fig. 6

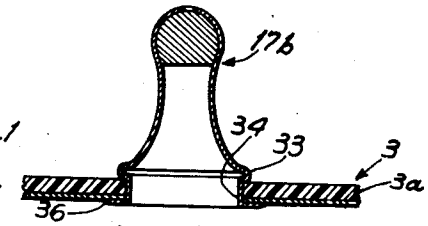


Fig. 7

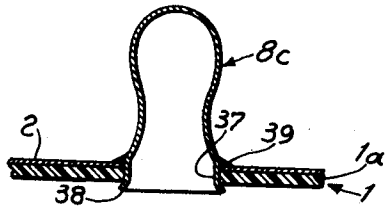
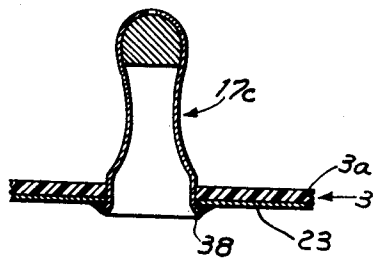
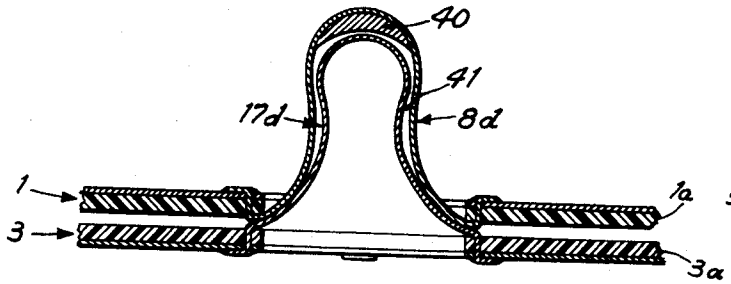


Fig. 8





Inventor
STANFORD B. SILVERSCHOTZ
By
Attorney

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ELECTRICAL CONNECTORS

Stanford B. Silverschotz, Manhattan, N.Y., assignor to International Telephone and Telegraph Corporation, Nutley, N.J., a corporation of Maryland

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9 Claims. (Cl. 174—84)

This invention relates to electrical connectors and more particularly to a snap-on electrical connector for printed circuits.

The extensive use of printed circuitry in electronic equipment requires an electrical connector device of inexpensive, simple, and sturdy construction that can be used to interconnect two or more printed circuits and provide a secure and continuous conductive path between the printed circuits.

A object of this invention is a snap-on electrical connector consisting of a stud and a matching socket for connecting two electrical circuits.

A further object is the provision of a fusible connector which, after the socket element is snapped on the stud element, the two elements can be fused together and thus provide a secure and sturdy continuous conductor path between the two connector elements.

A feature of this invention is a connector comprising a pair of elements, one in the form of a socket and the other in the form of a stud, the socket and the stud being of corresponding size so that the stud is receivable with a snap fit in the socket in contact relation with the inner surface of the socket, and one of the elements carrying fusible material which, when subjected to an elevated temperature, fuses and forms an integral connection between the elements.

A further feature of this invention is that each element may be fastened to an electrical circuit by means of prongs protruding from the bases of the elements, the prongs being receivable in openings at coupling points in the circuits. The prongs are then upset on the opposite side of the circuit, thereby securely gripping the electrical circuits. To further insure good mechanical and electrical connection, the upset prongs are soldered to the electrical circuit.

Another feature is that instead of prong fastening, each element of the connector is fastened to the electrical circuit by spinning over a portion of the base of the elements, thereby securely gripping the electrical circuit between the spun-over portion and a bulging bead on the element and then soldering the spun-over portion to the electrical circuit.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an exploded view of two printed circuits with the snap-on electrical connector of this invention;

Fig. 2 is a cross-section view of the assembly of two printed circuits connected together by means of the snap-on electrical connector of this invention;

Fig. 3 is another embodiment of the stud portion of the snap-on electircal connector;

Figs. 4 and 5 show another embodiment of the snap-on electrical connector elements;

Figs. 6 and 7 show still another embodiment of the elements of the snap-on electrical connector; and

Fig. 8 shows a cross-section view of two printed circuits connected by a snap-on electrical connector with the fusible material contained within the socket element before the application of heat to melt the fusible material.

With reference to Figs. 1 and 2, there is shown a first printed circuit 1 composed of a dielectric 1*a* with printed circuitry 2 thereon, and a second printed circuit 3 having dielectric 3*a* with conductive circuitry 4 thereon. On the first printed circuit 1 there is shown a coupling point 5 with four slotted holes 6 situated about the periphery of the center hole 7. The socket element 8 of the snap-on electrical connector 9 is hollow and consists of a dome-shaped head 10 with a contracted neck 11, and a frusto-conical body 12 joining the contracted neck 11. The base 13 of the body 12 is wider than the head 10; the head 10 and the rest of the socket 8 being small enough to pass through the hole 7 with the exception of the base 13. Protruding upwardly from the base 13 are four prong-like members 14, which are adapted to pass through the slots 6 in the coupling point 5. It will be observed that the printed circuitry on the printed circuit board 1 is on the opposite side of the board from where the socket 8 enters the hole 7. The socket 8 is pushed up through the hole 7 and the prongs 14 pass through the matching slots 6 until base 13 bottoms on the board 1 at 15, Fig. 2. The prongs are then upset upon the conductive portion of the coupling point 5, gripping the printed circuit 1 between the upset prongs 14 and the base 13. To insure good mechanical and electrical connection between the socket 8 and the printed circuit 1, the upset prongs 14 are then soldered to the coupling point preferably by means of dip soldering, as shown at 16.

The stud element 17 of the electrical connector 9 comprises a dome-shaped head 18 with a contracted neck 19 and a frusto-conical body 20 joining the contracted neck 19. Four prong-like members 21 parallel to the vertical axis of the stud protrude outwardly from the base 22 of the body 20. The printed circuit 3 has a coupling point 23 connecting portions of the printed circuitry 4, and which has a center hole 24 and four slots 25 spaced approximately 90 degrees apart about the periphery of the hole 24. The stud 17 is on the opposite side of the printed circuit 3 from where the printed circuitry 4 is located. The prongs 21 are pushed through the matching slots 25 until the base 22 bottoms on the dielectric 3*a* of the printed circuit 3. The prongs 21 are then upset on the coupling point 23, thereby securely gripping the printed circuit 3 between the upset prongs 21 and the base 22 of the stud. As in the case of the socket prongs, the stud upset prongs 21 are also soldered to the coupling point 23. As explained above, the socket element 8 and the stud element 17 are separately fastened to the printed circuits 1 and 3. When this is done, the stud 17 is snapped into the socket 8, thereby connecting the two printed circuits.

To make a positive electrical and mechanical connection, however, this invention provides a fusible material carried by the stud 17. The dome-shaped head 18 is preferably made of fusible material although it may comprise a head as shown for 17*d*, Fig. 8, with fusible material carried on the outer surface thereof. When the stud 17 is snapped into the connector 8, heat is applied to the connector to melt the fusible material, thereby causing it to flow by capillary action into the spaces 26 between the inside surface of the socket 8 and the outside surface of stud 17, so that the stud 17 and the socket 8 form an integral part. The snap-on feature is a time-saving device which keeps the two elements of the connector 9 together while heat is applied to melt the fusible material.

Fig. 3 shows at 17*a* another embodiment of the stud element of the connector. In this embodiment the fusible material instead of forming the whole of the dome-shaped head is contained as a ball or pellet of solder 27 within the dome-shaped head 18*a*. A hole 28 is provided at the top of the head to provide an outlet for the solder to flow outwardly of the stud when heat is applied thereto.

Figs. 4 and 5 show another embodiment of both elements of the electrical connector. In this embodiment a bulging bead 29 is provided in the frustro-conical body of the socket 8*b*. The base 30 below the the bead 29 is made small enough to pass through the hole 7 in the coupling point 5 of the printed circuit 1. The bulging bead 29, however, is larger than the hole 7 so that the socket 8*b* will rest on the printed circuitry 2 at the bead 29. The protruding portion of the base 30 is then spun over, thereby securely gripping the printed circuit 1 between the bead 29 and the spun-over portion 31 of the base 30. As explained before, to secure a good mechanical and electrical connection to the printed circuitry 2, the socket 8*b* is soldered to the printed circuitry 2 by applying solder to the bead 29 at its point of contact 32 with the coupling point 5 by means of dip soldering, or the like. The stud 17*b* is also provided with a bulging bead 33 on its frusto-conical body with a base portion 34 smaller in diameter than the hole 24 of the coupling point 23. The base portion 34 is pushed through the hole 24 until the bead 33 rests on the dielectric 3*a*. The protruding portion 35 of the base 34 is then spun over upon the coupling point 23, and solder 36 is applied around the spun-over portion 35 securely joining it to the coupling point 23.

In Figs. 6 and 7 is shown still another embodiment of both the socket and stud elements of the connector. The stud 8*c* as in Figs. 1 and 2 has a dome-shaped head with a contracted neck and a frusto-conical body. At the base of the frusto-conical body and adjoining it is a cylindrical portion 37, which has a diameter smaller than the diameter of the hole 7. This cylindrical portion 37 flares out to a base 38, which has a diameter larger than the diameter of the hole 7. The socket 8*c* is pushed through the hole 7 until the base 38 bottoms on the dielectric 1*a* of the printed circuit 1. Solder is then applied on the opposite side to the printed circuitry 2 and the socket 8*c* as shown at 39, thereby securing the socket both mechanically and electrically to the printed circuit 1. The stud 17*c* is constructed in a similar manner to that in Fig. 5. Here the base 38 bottoms on the coupling point 23, and solder is applied to securely join the base 38 of the stud 17*c* to the printed circuitry of the printed circuit 3.

In the embodiments of Figs. 4 and 5 and 6 and 7, it is understood that after the socket and stud elements are joined to the respective printed circuits, the stud may be snapped into the socket and the fusible material therein melted to form an integral connection as described above in the embodiments of Figs. 1 and 2.

It is not necessary for the stud to carry the fusible material. The fusible material can be carried inside of the socket 8*d* as shown in Fig. 8. The fusible material 40 is placed on the inside surface of the head. In Fig. 8 the connection is shown before heat has been applied to melt the solder 40 to cause it to flow within the space 41 between the stud 17*d* and the socket 8*d*. However, it is understood that after the heat is applied, the solder 40 will then flow by means of capillary action to fill the space 41 between the stud and the socket.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A connector for the conductors of electrical circuits comprising a pair of elements, one in the form of a conductive socket and the other in the form of a conductive stud, the socket and stud elements being of corresponding shape with said stud slightly smaller than said socket so that the stud is receivable in said socket in electrical contact relation with the inner surface of said socket, one of said elements having fusible material carried thereby which when subjected to an elevated temperature fuses and forms an integral connection between said elements, each said conductors having openings at coupling points in said circuit and each of said elements having prongs adapted to be received in said openings and said prongs being adapted to be upset on the opopsite side of said conductors thereby securely gripping the conductors of said electrical circuit.

2. A connector for the conductors of electrical circuits comprising a pair of elements, one in the form of a conductive socket and the other in the form of a conductive stud, the socket and stud elements being of corresponding shape with said stud slightly smaller than said socket so that the stud is receivable in said socket in electrical contact relation with the inner surface of said socket, one of said elements having fusible material carried thereby which when subjected to an elevated temperature fuses and forms an integral connection between said elements, and each of said elements are receivable in an opening at a coupling point in said circuit and said element is adapted to be bent over on said circuit, thereby securely gripping said circuit, and solder bonding said bent-over portion to said circuit.

3. A connector for electrical circuits according to claim 1 further including solder bonding said conductors of prongs to said electrical circuit.

4. An electrical apparatus comprising an assembly of first and second members having thereon electrical circuits which include corresponding coupling holes to receive a connector; a first connector element of conductive material in the form of a hollow socket having prongs receivable in holes in said first member to secure said element to the circuit of said first member, a second connector element of conductive material of stud form receivable in conductive coupling relation in the socket of said first element, said second connector element having prongs receivable in holes of said second member to secure said second element to the circuit of said second member, whereby the circuits of said members are coupled together when the stud element of one member is inserted in the socket element of the other member.

5. An electrical apparatus comprising an assembly of first and second members having thereon electrical circuits which include corresponding coupling holes to receive a connector, a first connector element of conductive material in the form of a hollow socket receivable in a coupling hole in said first element, means to spin over the base of said socket to secure said first connector element to the circuit of said first member, a second connector element of conductive material of stud form receivable in conductive coupling relation in the socket of said first element, said second connector element being receivable in a coupling hole in said second member, means to spin over the base of said stud to secure said second connector element to the circuit of said second member whereby the circuits of said members are coupled together when the stud element on one member is inserted in the socket element of the other member.

6. A snap electric connector arrangement for printed circuitry comprising in combination a first printed circuit, a hollow socket, a plurality of prong-like members protruding from the base of said socket, said socket with said prongs being adapted to pass through matching holes in said first printed circuit from one side, with said prongs to be upset on the opposite side of said printed circuit thereby gripping said first printed circuit between

said upset prongs and said base, a second printed circuit, a stud carrying fusible material, a plurality of prong-like members protruding from the base of said stud, said stud with said prongs being adapted to pass through matching holes in said second printed circuit from one side with said prongs to be upset on the opposite side of said second printed circuit thereby gripping said second printed circuit between said upset prongs and said base, said socket being adapted to be snapped on over said stud and to retain said stud within said socket, said stud being adapted to fuse said socket when heat is applied to null said fusible material, thereby securing a continuous conduction path between said first and second printed circuits.

7. A snap electrical connector arrangement for printed circuitry comprising in combination a first printed circuit, a hollow socket having a dome-shaped head with a contracted neck, a frusto-conical body joining said head, a plurality of prong-like members protruding from the base of said body, said body with said prongs being adapted to pass through matching holes in said first printed circuit from one side with said prongs to be upset on the opposite side of said printed circuit thereby gripping said first printed circuit between said upset prongs and said base, means to solder said upset prongs to said first printed circuit, a second printed circuit, a stud comprising a dome-shaped head with a contracted neck and carrying fusible material, a frusto-conical body joining said head, a plurality of prong-like members protruding from the base of said body, said body with said prongs being adapted to pass through matching holes in said second printed circuit from one side, with said prongs to be upset on the opposite side of said second printed circuit thereby gripping said second printed circuit between said upset prongs and said base, means to solder said upset prongs to said second printed circuit, said socket being adapted to be snapped on over said stud and to retain said stud within said socket, said stud being adapted to fuse to said socket when heat is applied to null said fusible material, thereby securing a continuous conduction path between said first and second printed circuits.

8. A snap electrical connector arrangement for printed circuitry comprising in combination a first printed circuit, a hollow socket having a dome-shaped head with a contracted neck, a frusto-conical body joining said head, a cylindrical body, a bulging bead joining said cylindrical body to said frusto-conical body, said cylindrical body being adapted to pass through a matching hole in said first printed circuit, means to spin over the protruding end of said cylindrical body thereby gripping said first printed circuit between said spun over portion and said bulging bead, means to solder said bulging bead to said first printed circuit, a second printed circuit, a stud comprising a dome-shaped head with a contracted neck and carrying fusible material, a frusto-conical body joining said head, a cylindrical body, a bulging bead joining said cylindrical body to said frusto-conical body, said cylindrical body being adapted to pass through a matching hole in said second printed circuit, means to spin over the protruding end of said cylindrical body thereby gripping said second printed circuit between said spun-over portion and said bulging bead, means to solder said spun-over portion to said second printed circuit, said socket being adapted to be snapped on over said stud and to retain said stud within said socket, said stud being adapted to fuse to said socket when sufficient heat is applied to said fusible material to melt said fusible material, thereby securing a continuous conduction path between said first and second printed circuits.

9. A snap electrical connector arrangement for printed circuitry comprising in combination a first printed circuit, a hollow socket having a dome-shaped head with a contracted neck, a frusto-conical body joining said head, the base of said body being larger in diameter than said head, said socket with the exception of said base being adapted to pass through a matching hole in said first printed circuit, means to solder said socket body to said first printed circuit, a second printed circuit, a stud comprising a dome-shaped head with a contracted neck and having fusible material, a frusto-conical body joining said head, the base of said body being larger in diameter than said head, said stud with the exception of said base being adapted to pass through a matching hole in said second printed circuit, means to solder said stud body to said second printed circuit, said socket being adapted to be snapped on over said stud and to retain said stud within said socket, said stud being adapted to fuse to said socket when sufficient heat is applied to said fusible material to melt said fusible material, thereby securing a continuous conduction path between said first and second printed circuits.

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