

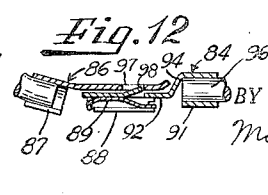
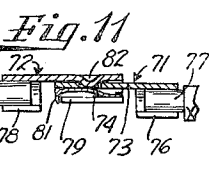
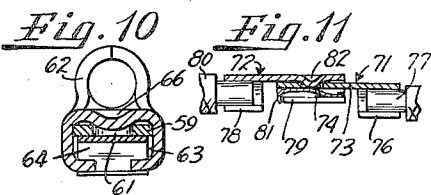
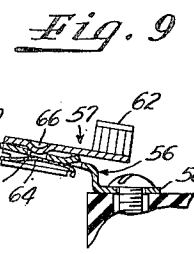
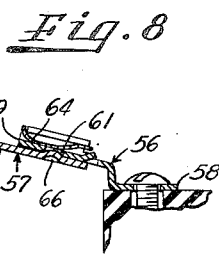
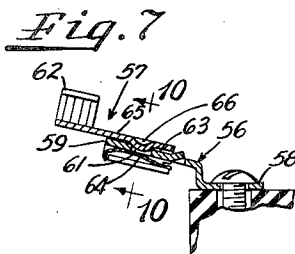
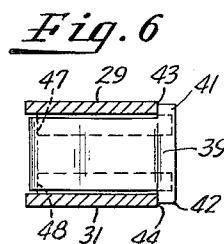
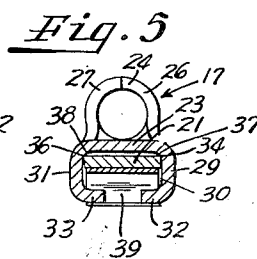
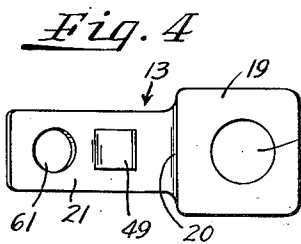
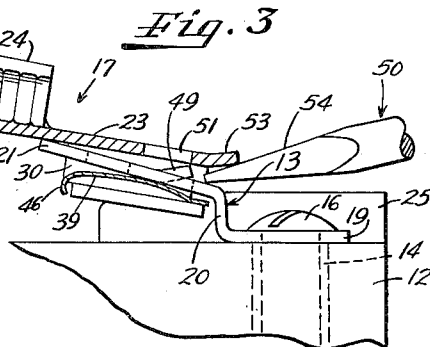
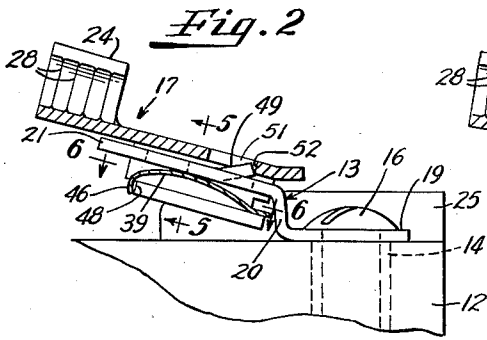
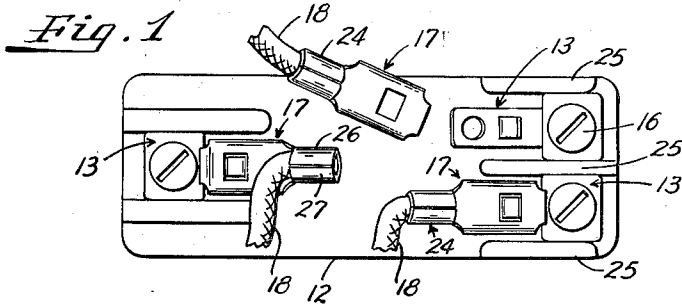
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SEPARABLE ELECTRICAL CONNECTOR

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SEPARABLE ELECTRICAL CONNECTOR

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1

This invention relates to separable connectors and more particularly to separable connectors for use in effecting connections in electric circuits.

An object of the present invention is to provide a novel separable connector of the above character that permits of connection and disconnection of the respective parts a relatively large number of times without impairment of its electrical conductive characteristics.

Another object of the invention is to provide a novel separable connector of the above character in which the component parts may be easily assembled and readily separated without special tools.

Another object of the invention is to provide separable connector of the above character that is rugged, that maintains its assembled position, and that does not depend upon close clearances for insuring electrical conductive connections between the component parts.

Another object of the invention is to provide a novel separable connector of the above character that is of minimum size, consistent with the electrical conducting requirements of the components with which it is used.

Another object of the invention is to provide a novel connector of the above character that does not require the use of solder to insure a positive electrical conductive connection.

Another object of the invention is to provide a separable connector of the above character that is simple in construction, compact and sturdy and is relatively inexpensive to manufacture.

Another object of the invention is to provide a novel separable connector of the above character comprising a female and a male member arranged for telescopic interconnection with means for insuring that the members are in alinement upon movement of the parts together.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which—

Figure 1 is a bottom view of a switch utilizing separable connectors embodying the present invention;

Fig. 2 is a longitudinal sectional view of a separable connector mounted on a switch;

Fig. 3 is a view similar to Fig. 2 in which the parts of the separable connector are in a position to effect their separation;

Fig. 4 is a top plan view of a terminal portion of the separable connector;

Fig. 5 is a view taken substantially along the line 5-5 of Fig. 2;

Fig. 6 is a sectional view taken substantially along the line 6-6 of Fig. 2;

Figs. 7, 8 and 9 are longitudinal sectional views of a modification of the separable connector with

2

a connector portion of the separable connector in different relative positions with respect to a terminal portion thereof;

Fig. 10 is a sectional view taken substantially along the line 10-10 of Fig. 7;

Fig. 11 is a modification of the separable connector shown in Figs. 7, 8 and 9 adapted to interconnect a plurality of electrical conductors, and

Fig. 12 is a modification of the separable connector shown in Figs. 2 and 3 adapted to interconnect a plurality of electrical conductors.

Referring now to Figs. 1-10 of the drawings, the invention is shown embodied in a separable connector for connecting a small precision switch 12 in an electric circuit. While the invention is shown embodied in a form for use with a small precision switch it is to be understood that the connector may be used for other types and sizes of switches and also may with slight modification as shown in Figs. 11 and 12 be used to interconnect a plurality of electric wires or cables and the like. As shown in Figs. 1-6 the separable connector comprises a male member 13 adapted to be secured to a terminal post 14 on the switch 12 as by a screw 16 and a female member 17 adapted to be connected to an electric wire 18 and shaped to be detachably interconnected with the male member 13 to provide a positive electrical conductive connection between the male member 13 and the female member 17.

As shown the male member 13 comprises a base or attachment portion 19, an offset narrow portion 21 defining a prong projecting outwardly from the base, and an upstanding portion 20 integrally connecting the prong 21 with the base portion 19. The base portion is shaped to be disposed between spaced outwardly projecting ribs 25 on opposite sides of the terminal post 14 to prevent rotation of the male member and is formed with an aperture 22 for the reception of the screw 16. The latter fixedly secures the base portion 19 to the terminal post 14 of the switch 12. The portion 20 as shown in Figs. 2 and 3 spaces the prong 21 from the base 19 a sufficient distance to permit interconnection of the female portion 17 and the male portion 13 and also serves as a stop to prevent the female member 17 from being pressed too far onto the male member 13. As shown in Fig. 5, the prong 21 has a cross-sectional area in which the upper edges are defined by relatively sharp corners for a purpose to presently appear. Where desired, to facilitate interconnection of the female member 17 and the male member 13, the prong 21 may be inclined with respect to the base portion 19 as shown in Figs. 2 and 3.

The female member 17 comprises a body portion 23 having an attachment portion, such as a sleeve 24, at one end shaped to receive a stripped end of a wire 18. In this embodiment

of the invention, the female member is made from sheet metal parts and the sleeve 24 is defined by bending tabs 26 and 27 at one end of the body 23 upwardly and inwardly in a curved manner as shown in Figures 1 and 5. Preferably the inner walls of the sleeve 24 are corrugated as shown at 28 so that when the wire 18 is disposed in the sleeve 24 a good electrical connection is assured between the wire and the connector 17. The thickness of the material forming the sleeve is such that the sleeve may be securely clamped on the end of the wire by deforming the side walls of the sleeve. At its opposite end the female member 17 is formed with an opening or passage 30 for receiving the prong 21. Herein the opening 30 is defined by bending laterally extending tabs on the body portion 23 downwardly as shown in Fig. 5 to form sides 29 and 31 and bending the extreme ends of the tabs at positions spaced from the body 23 inwardly as shown at 32 and 33. It will be seen that with this construction the body 23, the sides 29 and 31, and the intumed portions 32 and 33 form a sheath defining a generally rectangular shaped opening 30 for receiving the correspondingly shaped prong 21 of the terminal 13. It is to be understood that other cross sectional shapes of the opening may be used where desired. The dimensions of the opening 30 are such that when the prong 21 is disposed wherein the upper edges 34 and 36 of the prong 21 make a wiping contact with the more rounded corners 37 and 38 between the body 23 and sides 29 and 31, respectively, defining the opening 30 and the center portion of the prong between its edges is spaced from the body 23 of the sheath, as seen in Fig. 5. The rounded corners 37 and 38 also form a guide means for the male member and insure that when the female member is telescoped on to the male member that the female and male members are in alignment. The latter is important in preventing short circuits between adjacent terminals on small precision switches where two connecting members may be in substantially parallel relation and close together such as shown in Figure 1. Since the edges of the male member always seat on some portion of the arc defining the corners this construction permits of fairly wide manufacturing tolerances on both the male and female member without affecting the electrical or mechanical characteristics of the connector.

Means is provided for urging the female member 17 and the male member 13 into a tight electrical conductive relation when the prong 21 is received in the opening 30. This is accomplished in the present instance by a resilient spring 39. The latter may have many different shapes as will be apparent to those skilled in the art. For purposes of illustration, as best seen in Fig. 5, the spring 39 is of substantially the same width as the opening 30 in the connector 17 and is arched intermediate its ends (see Figs. 2 and 3) so that when the connector 17 is telescoped over the prong 21 the resiliency of the spring 39 forces the relatively sharp edges 34 and 36 of the terminal 21 into engagement with the inwardly facing rounded edges 37 and 38, respectively, of the female member 17. As shown in Fig. 6, at one end the spring 39 is formed with laterally extending arms 41 and 42 shaped to fit in slots 43 and 44, respectively, formed at the forward end of the sides 29 and 31 of the female member 17. At its opposite end the spring 39 is turned down as shown at 46 to engage the shoulders 47

and 48 formed at the rear end of the connector by removing end portions of the intumed portions 32 and 33, as shown in Fig. 6. Thus, opposite ends of the spring 39 engage respectively the opposite axially facing edges of the sheath. The above construction positively secures the spring 39 in position in the female member 17 against accidental displacement while at the same time it permits the spring to flex between the position it assumes in which the ends of the spring 39 engage the ends of the sheath and a position in which the spring is flexed and at least one of the ends of the spring is out of engagement with the ends of the sheath as shown in Fig. 3. It is to be understood that the spring 39 operates to positively maintain the respective parts in a good electrical conductive relation even though the parts wear due to numerous connections and disconnections of the female member 17 and the male member 13.

Releasable interlocking means is provided for maintaining the female member 17 and male member 13 in an assembled electrical conductive relation so that the respective members cannot become accidentally displaced relative to each other. To effect the above in this embodiment as shown in Figs. 2 and 3, the prong 21 of the male member 13 is formed with a tongue 49 such as by depressing a portion of the prong out of the plane thereof and an opening 51 is formed in the body 23 of the female member 17 so that when the female member 17 is telescoped over the prong 21, the end of the tongue 49 engages a sidewall 52 of the opening 51. Under these conditions the female member 17 is interlocked with the male member 13 and cannot be accidentally removed. To facilitate telescoping of the female member 17 over the prong 21 of the male member 13, the tongue 49 is inclined in a direction away from the end of the prong 21 that is first inserted in the opening 30 of the connector 17 as shown in Fig. 2.

The female member 17 may be readily removed from the male member 13 by means of conventional tools such as a screw driver 50 and the like. Thus, as shown in Fig. 3 the forward end of the body 23 is formed with an upwardly inclined tab 53. To remove the connector 17, the bit end 54 of the screw driver 50 is inserted under the tab 53 so that the extreme end of the screw driver 50 rests on the lower end of the prong 21. Upward movement of the handle of the screw driver 50 raises the female member 17 from the position shown in Fig. 2 to the position shown in Fig. 3 against the pressure of the spring 39 so that the tongue 49 is out of the opening 51. In this position the female member 17 may be readily pulled off the prong 21 of the male member 13 to effect a disconnection of the parts.

The male member 13 and female member 17 may be formed as stamped metal parts or the like. The male member 13 and the female member 17 are extremely easy to use. For example to use these parts it is only necessary to strip the end of a wire 18, insert the wire in the sleeve 24 and deform the sleeve to insure a good contact between the female member 17 and the wire 18. After the male member 13 is mounted on the switch such as shown in Figs. 2 and 3 by means of a screw 16, the female member 17 may be readily telescoped over the prong 21. The wiping contact between the edges 34 and 36 of the prong 21 and the corresponding rounded portions 37 and 38 respectively, together with the action of the spring 39 insures that a positive

electrical conductive connection is assured. Moreover the interaction between the edges 34 and 36 and the rounded corners 37 and 38 also insures that the male and female members are maintained in positive alignment. As shown in Figure 1 the wire 18 may be inserted in either end of the sleeve 24. This permits of great flexibility in making connections.

In Figs. 7, 8, 9 and 10 there is shown another embodiment of the invention. In this embodiment the separable connector includes a male member 56 and a female member 57. In general the male member 56 is formed in the same manner as that described for the embodiment shown in Figure 1 and includes a base portion 58 and an offset prong 59. Intermediate its ends the prong 59 is formed with an aperture 61. The female member 57 comprises a deformable sleeve 62 shaped to receive the end of an electric wire and a body portion 65 having an axially facing opening 63 shaped to receive the prong 59 as described for the embodiment illustrated in Figs. 1-6. A spring 64 is disposed in the opening 63 of the female member 57 in the manner previously described for urging the female member 57 and male member 56 into a tight electrical conductive engagement. The body portion 65 is formed with a depressed portion 66 intermediate its ends shaped to interfit in the opening 61 in the prong 59 to form a means for interlocking the male member 56 and the female member 57. In this embodiment of the invention the female member 57 may be removed manually from the male member 56 without the use of tools by merely applying an axial pulling force on the female member 57.

This embodiment of the invention permits of more mounting positions of the female member 57 with respect to the male member 56 than the embodiment shown in Figs. 1-6. For example, in Fig. 7 the female member 57 is mounted on the male member 56 in its normal position. In Fig. 8 the female member 57 is shown in an inverted position, and in Fig. 9 the female member 57 is shown in an end for end position.

The foregoing constructions permit of great versatility in making connections between an electric circuit and a switch. As described, the connections between a switch and an external circuit may be made entirely without the use of solder. Where desired, however, the connector may be eliminated and the electric connecting wires 18 may be connected directly with the male member 13. In such case the stripped end of a wire 18 is disposed in the hole 61 (see Fig. 4) formed in the prong portion 21 of the male member 13 and the wire is soldered to the male member in a conventional manner.

Fig. 11 shows a modification of the connection means in Figs. 7, 8 and 9 adapted for interconnecting a plurality of electric wires or conductors. The parts shown in Fig. 11 may be formed in the same general manner as described hereinbefore for the connection means shown in Fig. 7. As shown the separable connector comprises a male member 71 and a female member 72. In general the male member 71 includes a prong 73, having an opening 74 intermediate its ends, projecting outwardly from a sleeve portion 76 shaped to receive an end of an electric wire 77. The sleeve 76 may be formed as hereinbefore described from deformable material so that the sleeve may be crimped on the wire 77. The female member 72 includes a sleeve portion 78 shaped to receive the end of an electric wire 80

and a sheath portion 79 shaped to receive the prong 73 in a manner to effect a positive electrical connection as described for the embodiments of the invention shown in Figs. 1-10. To minimize the space required for the connection means, the sleeve 78 is disposed in spaced axial relation to the sheath 79. A spring 81 disposed in the sheath as described hereinbefore for the embodiment shown in Fig. 2 urges the female member 72 and the male member 71 into tight electrical conducting relation when the prong portion 73 is disposed in the sheath 79. A projection 82 formed on the interior of the sheath 79 shaped to interfit in the opening 74 in the male member 71 locks the female member 72 and male member 71 in a positive electrical conducting assembled relation.

Fig. 12 shows a modification of the separable connector shown in Fig. 2 adapted for interconnecting a plurality of electric wires or conductors. As shown this connector comprises a male member 84 and a female member 86. The female member 86 includes a sleeve 87 for receiving an electric conductor, a sheath portion 88 and a spring 89 arranged in the same general manner as that described in the embodiment shown in Fig. 2 except that the sleeve 87 is disposed in spaced axial alignment with the sheath 88 in lieu of being disposed on the opposite side of the female member 86 as shown in Fig. 2. The male member 84 comprises a sleeve portion 91 and a prong portion 92 extending axially outwardly from the sleeve 92. Adjacent the sleeve portion 91 the prong 92 is inclined toward the center axis of the sleeve to define a shoulder 94. The purpose of the shoulder is to define a stop against which the end of a wire 96 abuts when the wire is received in the sleeve 91 and to prevent the female member from being pressed too far onto the male member. The male and female member may be held in their interconnected relation by a tongue 97 interfitting in an opening 98 in the manner described for the embodiment shown in Figs. 2 and 3.

From the foregoing it will be seen that the invention renders itself equally well to making connections between an electric cable or wire and a switch or between a plurality of electric cables or wires. It is apparent that this construction is extremely simple yet positive in its action. As pointed out hereinbefore positive electrical connections may be made without the use of solder. By being made from stamped parts the components of the connection means can be made in a very inexpensive manner.

I claim:

1. In a separable connector, the combination of a female member of electrical conductive material comprising a body, a portion at one end of the body for attachment to an electric conductor and a generally rectangular shaped opening at the opposite end of the body, the corners defining said rectangular opening adjacent the body being slightly rounded, a male member of electrical conductive material having an attachment portion shaped for connecting the male member in an electric circuit and a prong connected to said attachment portion shaped to be receivable in said generally rectangular opening and having spaced edges shaped to engage the female member at positions on said rounded corners to align the female and male members when the parts are telescoped together, and spring means acting between said female member and said prong portion to maintain the parts

in electrical conductive relation, the spring means acting in a direction to force said spaced edges of the prong portion into engagement with the rounded corners of the opening upon movement of the parts together.

2. In a separable connector the combination of a female member comprising a body having an attachment portion at one end for connecting the female member into an electric circuit and an opening at the opposite end defined in part by generally arcuate surfaces, a male member comprising an attachment portion shaped for connecting the male member in an electric circuit and a prong portion connected to said attachment portion shaped to be received in said opening in the female member and having spaced edges shaped to engage the female member at positions on said arcuate surface to align the female and male members when the parts are telescoped together, and spring means acting between said female member and said prong portion in a direction to force said spaced edges of the prong into engagement with the arcuate surfaces of the opening as the parts are telescoped together to maintain the parts in electrical conductive relation.

3. In a separable connector the combination of a female member comprising a body having an attachment portion at one end for connecting the female member into an electric circuit and an opening defined by spaced side walls extending outwardly from the body, a male member comprising an attachment portion shaped for connecting the male member in an electric circuit and a prong portion connected to said attachment portion shaped to be received in said opening in the female member and having spaced edges shaped to engage the female member at positions on said side walls adjacent the body to align the female and male members when the parts are telescoped together, and spring means acting between said female member and said prong portion to force said spaced edges into engagement with the side walls of the opening adjacent the body as the parts are tele-

scoped together to maintain the parts in electrical conductive relation.

4. In a separable electrical connector, the combination of a male member having an attachment portion for connecting the male member in an electrical circuit and a prong extending outwardly from said attachment portion and shaped to have a generally rectangular cross section, a female member having an attachment portion for connecting the female member in an electric circuit and a sheath portion shaped to releasably receive said prong, said sheath portion having a flat body of lesser width than said prong, depending side portions spaced apart a distance greater than the width of the prong and rounded corner portions connecting the side portions with opposite edges of said body and shaped to be engaged by corner edges of the prong and space the prong from the body portion of the sheath when the prong is received in the sheath and spring means in said sheath having its opposite ends engageable with opposite extreme ends of the sheath to mount it in the sheath disposed to act between said prong and said sheath to bias the respective parts into electrical conductive relation.

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