

Dec. 14, 1937.

S. B. SANFORD

2,102,383

CONNECTING DEVICE

Filed May 8, 1936

2 Sheets-Sheet 1

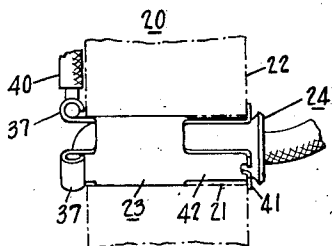


FIG. 1

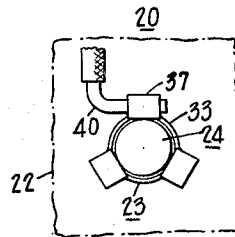


FIG. 2

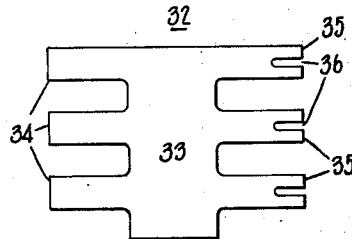


FIG. 4

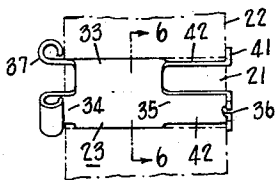


FIG. 5

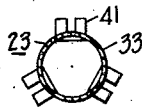


FIG. 6

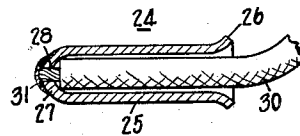


FIG. 3

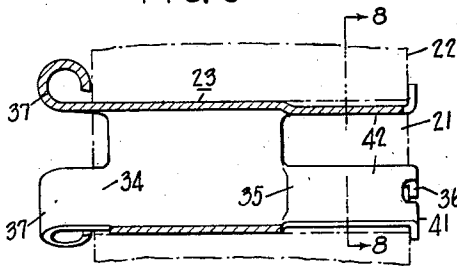


FIG. 7

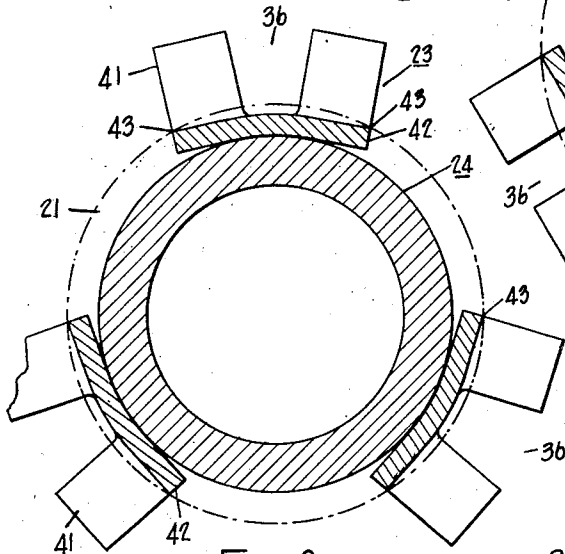


FIG. 9

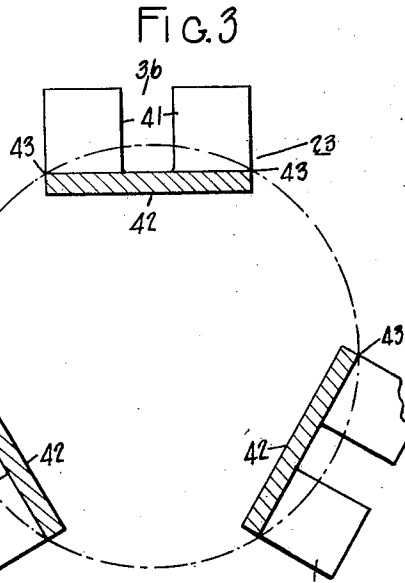


FIG. 8

Selden Bradley Sanford INVENTOR

BY *Walter C. Bradley*

ATTORNEY

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CONNECTING DEVICE

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2 Sheets-Sheet 2

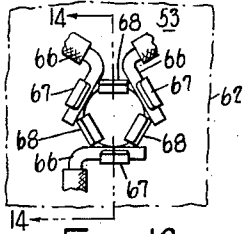


FIG. 12

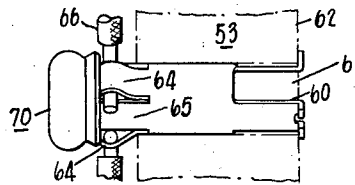


FIG. 11

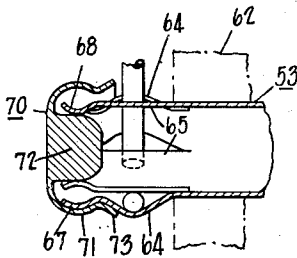


FIG. 14

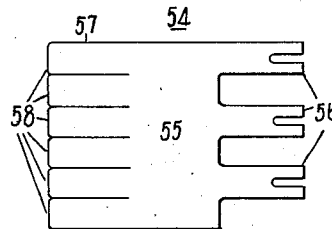


FIG. 13

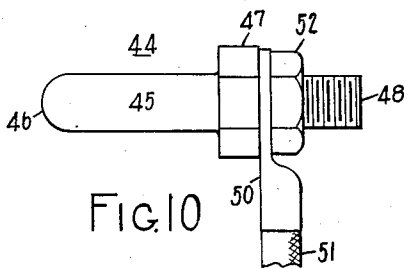


FIG. 10

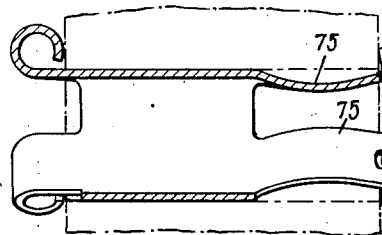


FIG. 15

Selden Bradley Sanford INVENTOR

BY: *Walter C. Bradley* ATTORNEY

UNITED STATES PATENT OFFICE

2,102,383

CONNECTING DEVICE

Selden Bradley Sanford, Yonkers, N. Y., assignor
to Otis Elevator Company, New York, N. Y., a
corporation of New Jersey

Application May 8, 1936, Serial No. 78,538

16 Claims. (Cl. 173—332)

The invention relates to connecting devices for electrical conductors.

In electrical control systems such as elevator control systems, a large number of conductors are employed. These involve not only the conductors in the elevator hatchways but also those on the control panels for the switches and relays on these panels and the conductors for the control mechanisms such as floor controllers. Many connections are made between the switches and relays on the control panel. Also, connections are made between the hatchway conductors, the conductors for the control mechanism and the switches and relays on the control panel. It is important that all these connections have good electrical contact and that this contact be maintained over extended periods of time. In a great many instances it is desirable to make these connections at terminals to facilitate the assembly and the repair and replacement of parts and equipment.

It is the object of the invention to provide a terminal for electrical conductors which enables the conductors to be readily and quickly connected and disconnected, which is economical to manufacture and install, and which occupies a minimum of space.

The invention involves a plug and socket connector in which the socket is mounted in an aperture in an insulated support and is so fabricated that the plug, when inserted in the socket, deforms the socket within the aperture of its support in such way that the plug is securely held in place and a positive electrical contact is made.

In carrying out the invention, the socket is formed from a blank of sheet material into a cylindrical body portion from which extend a plurality of contact blades or fingers. The size of the aperture and the size of the plug are such that, when the plug is inserted, the contact fingers are deformed transversely between the wall of the aperture and the plug to exert a force for retaining the plug in the socket and to provide a large area of electrical contact between the fingers and the plug. The socket is removably secured in its aperture.

Provision is made for a plurality of wires to be secured to the socket and further provision is made for securing at least one wire to the plug.

Features and advantages will become apparent from the following description and appended claims.

In the drawings:

Figure 1 is a longitudinal view of a connector embodying the invention, illustrating the connector in assembled condition;

Figure 2 is a view of the rear end of the connector of Figure 1;

Figure 3 is a longitudinal section of the connector plug;

Figure 4 is a plan view of a blank from which the socket of the connector is made;

Figure 5 is a longitudinal view of the connector socket;

Figure 6 is a section taken along the line 6—6 of Figure 5;

Figure 7 is an enlarged longitudinal sectional view taken vertically through the socket of Figure 5;

Figure 8 is an enlarged section taken along the line 3—8 of Figure 5;

Figure 9 is a sectional view showing the position of the parts as shown in Figure 8 with the plug in place;

Figure 10 is a longitudinal view of a different form of plug;

Figure 11 is a longitudinal view of a modified form of socket;

Figure 12 is a view of the rear end of the socket of Figure 11, with the locking cap removed;

Figure 13 is a plan view of a blank from which the socket of Figure 11 is made;

Figure 14 is an enlarged fragmental section taken along the line 14—14 of Figure 12, with the locking cap in place; and

Figure 15 is an enlarged longitudinal sectional view of a socket showing a modified arrangement of contact fingers.

Referring to Figures 1 to 9 of the drawings, the connector 20 therein illustrated is supported in an aperture 21 of a suitable insulating body or panel 22. The panel is shown in dot-dash outline. Connector 20 comprises a socket 23 and a plug 24 which is adapted to be inserted within the socket. Referring particularly to Figure 3, plug 24 is formed of a tubular metallic stem 25. One end of the stem is flared outwardly to provide a flange 26. The other end is rounded at 27 for insertion in the socket. The rounded end is provided with an aperture 28 for receiving the bared end of the conductor 29. The conductor is inserted through the stem and is secured in the aperture as by solder 31. The flange 27 facilitates the insertion of the wire in the stem and also acts as a stop for the plug when the plug is inserted in the socket. By this construction, local bending of the conductor at the point at which it is soldered to the plug is prevented.

Socket 23 is formed from a blank 32 of sheet metal (see Figure 4). The blank comprises a body portion 33, three projecting arms 34 and three projecting arms 35. Arms 34 are equally spaced on one edge of the body portion. Arms 35 are equally spaced on the opposite edge of the body portion and are in longitudinal alignment with the arms 34. Each arm 35 is provided with a slot 36 in its outer end. The slots extend inwardly a short distance along the longitudinal centerlines of their respective arms.

In the completed or formed socket, the body

portion 33 of the blank is converted into a cylindrical shaped body so as to fit closely within the aperture 21 of the panel and so as to be capable of receiving the tubular plug 24 with a small clearance between the plug and the socket. The cylindrical shape imparted to the body portion positions the three arms 34 in equally spaced relation around one end of the cylindrical body. The arms 34 extend flatly from the cylindrical body and are curled outwardly at their free ends to provide loops 37 for receiving the ends of electric wires. This provides for three independent electrical connections to the socket. The wires are secured in the loops as by solder. In Figures 1 and 2 a connection for a wire 40 to one of the loops is illustrated. The cylindrical body is positioned in the aperture 21 of the panel with the loops arranged around the aperture preferably at the back of the panel. The loops thus also act as a stop to prevent movement of the socket toward the front of the panel.

Each arm 35 of the blank is shaped to form a spring finger 42 having a clip 41 on the free end thereof. The three spring fingers extend flatly from the cylindrical body and are arranged in equally spaced confronting relation within the aperture of the panel. Each clip 41 is bent outwardly at substantially a right angle to its respective arm on a line across the slot 36 near the inner end of the slot. The clips 41 are of a size to permit the socket to be inserted in or withdrawn from the panel aperture by pressing the contact fingers together, and to hold the socket in place in the aperture after it has been inserted. The flat faces of the spring fingers are positioned in chordal relation to the wall of the aperture as shown in Figure 8. The diameter of an inscribed circle tangential to the inner flat faces of the spring fingers is less than the diameter of the plug 24.

The plug, when inserted, flexes the fingers transversely. The outer edges 43 of the fingers are held by the wall of the aperture so that the center portions of the fingers are forced outwardly. This forms a transverse bend in each finger longitudinally thereof. The amount of bend is such as to provide a strong force for retaining the plug inserted in the socket and to provide a large area of electrical contact engagement between the plug and the fingers. Slots 36 in the clips 41 permit the transverse bending of the fingers.

In certain cases it is desirable to provide a plug for the connector 20 which provides a detachable connection for one or more wires (see Figure 10). The plug 44 comprises a solid cylindrical body portion 45 having a rounded end 46 and an integral hexagonal stop 47 formed on the other end. An integral threaded stem 48 extends from the stop 47. The eyelet portion of the terminal 50 of a wire 51 is shown secured on the stem between the stop 47 and a nut 52.

If desired, a socket for the connector 20 may be constructed so as to provide detachable solderless connections for wires. Such a construction is shown in Figures 12 to 14, in which a socket 53 is formed from a blank 54 of sheet metal. Blank 54 comprises a body portion 55, three projecting arms 56 and a side portion 57. Arms 56 and the side portion 57 are arranged on opposite sides of the body portion. The side portion 57 is sliced inwardly to provide six equal projecting arms 58. In the completed socket, the body portion and arms 56 are shaped to form a cylindrical body and spring fingers 60 re-

spectively. The cylindrical body and spring fingers are adapted to be positioned in the aperture 61 of the panel 62, for cooperating with either the plug 24 or 44 in a manner as previously described for the cylindrical body and spring fingers of the socket 23 and will not be further described.

In the completed socket 53, the six arms 58 of the blank are shaped to provide spring clip connections for three wires. The cylindrical shape imparted to the body portion of the blank positions the six arms 58 in hexagonal arrangement on their respective end of the cylindrical body. Three of these arms are bulged outwardly and are designated by the numeral 64. The bulge of each arm is at a point substantially intermediate the ends thereof. The remaining three arms are straight and are designated by the numeral 65. The bulged arms 64 and the straight arms 65 extend in alternate arrangement from the end of the cylindrical body and project outside the aperture 61 of the panel. This interposes a bulged arm between the hexagonally disposed edges of two straight arms. Wires 66 are insertable between the inner flat faces of the bulged arms and the adjacent edges of the respective straight arms. A spring tension is provided by the arms to hold the wires in place. The free end of each bulged arm 64 is formed with an outwardly facing lip 67. Inwardly facing lips 68 are similarly provided for the straight arms 65. The lips 67 of arms 64 are positioned outside the circular alignment of the lips 68 of arms 65. A cap 70 is arranged to fit over the lips of arms 64 and 65. Cap 70 comprises an outwardly rounded body portion 71 and an inner circular plug portion 72. Plug portion 72 is interposed between the lips 68 of the straight arms. Body portion 71 fits around the lips 67 of the bulged arms, the lips conforming to the inner contour of the body portion. The diameter of the body portion is such as to force the lips 67 of the bulged arms in a direction inwardly toward relative circular alignment with the lips 68 of the straight arms. This locks the wires 66 interposed between the bulged arms and the edges of the straight arms securely in place. Body portion 71 is provided with a flared rim 73 and the end of the plug portion 72 is rounded. This facilitates the assembly of the cap over the lips of the arms. If desired, less than three wires may be locked in place, as each wire is locked in place individually.

The contact fingers of the sockets may be bent inwardly, if desired, to provide additional force to hold the plugs in place. Such arrangement is illustrated in Figure 15. In this construction, the spring fingers, designated 75, are illustrated as formed longitudinally arcuate inwardly toward the axis of the socket. Thus, when the plug is inserted within the socket, the spring fingers are flexed longitudinally as well as transversely, the longitudinal flexing exerting an additional pressure between the plug and the socket.

It is preferred to make the sockets of beryllium copper. The socket is first formed into shape and then heat treated. This material is elastic, fatigue resisting and of good conductivity.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A connector for electrical conductors comprising, an insulated supporting body having an aperture therein, a socket having a plurality of resilient fingers of conducting material within said aperture and extending longitudinally thereof, and a plug of conducting material for insertion into said socket, at least the portions of said fingers along their longitudinal center lines being out of contact with the wall of said aperture when said plug is out of said socket but said plug, when inserted within the socket, causing said fingers by their engagement with the wall of said aperture to bend about their longitudinal center lines, thereby exerting a force to retain the plug in place and providing good contact engagement.

2. A connector for electrical conductors comprising, an insulated supporting body having an aperture therein, a socket having a body portion and a plurality of metallic spring fingers extending longitudinally from said body portion and positioned within said aperture, and a metallic plug for insertion into said socket, the longitudinal center portions of said fingers being out of contact with the wall of said aperture when said plug is out of said socket, said plug, when it is inserted, engaging the longitudinal center portions of the fingers and, with the edges of the fingers bearing against the wall of said aperture, flexing the fingers transversely outwardly toward said wall substantially throughout their length.

3. A plug and socket connector for electrical conductors comprising; an insulated supporting body having a cylindrical aperture therein; a socket having a plurality of longitudinally extending spring fingers of metallic elastic material positioned within said aperture in spaced chordal relation thereto; and a metallic plug adapted to be inserted in said socket, said plug being of a diameter such that said spring fingers are flexed transversely when said plug is in place in said socket.

4. A connector for electrical conductors comprising, an insulated supporting body having a cylindrical aperture therein, a metallic socket having a cylindrical body portion and a plurality of spaced, flat spring fingers extending longitudinally from said body portion and positioned within said aperture, and a metallic cylindrical plug for insertion into said socket, the diameters of said aperture and plug being such that, when said plug is inserted, the longitudinal edges of the fingers bear against the walls of the aperture and said plug contacts with the longitudinal center portion of said fingers, thereby flexing the fingers transversely substantially throughout their length.

5. A connector for electrical conductors comprising, an insulated supporting body having a cylindrical aperture therein, a socket having a cylindrical body portion and a plurality of spaced, metallic spring fingers extending longitudinally from said body portion and positioned within said aperture, each of said fingers being substantially in chordal relation to said aperture at its ends but being bent inwardly between its ends, and a cylindrical plug for insertion into said socket, said plug being of a diameter such that said fingers are flexed both transversely and lon-

gitudinally when said plug is inserted within the socket.

6. A connector for electrical conductors comprising, an insulated supporting body having an aperture therein, and a socket having a plurality of longitudinally extending metallic spring fingers within said aperture, at least one of said fingers having a longitudinal slot in its end and being bent outwardly on a line extending across the slot, said bent portion engaging said supporting body to form a stop against movement of said socket in one direction.

7. A connector for electrical conductors comprising, an insulated supporting body having a cylindrical aperture therein, and a metallic socket in said aperture, said socket having a cylindrical body portion and a plurality of spaced spring fingers extending longitudinally from said body portion, each of said fingers having a longitudinally extending slot in its end and being bent outwardly on a line extending across said slot, said bent portions forming stops against movement of said socket in one direction in said aperture, and said socket having a plurality of outwardly extending loops on its other end for connecting electrical conductors thereto and forming stops against movement of said socket in the other direction in said aperture.

8. An electrical connector comprising, a body portion having at least three adjacent blades extending therefrom in the same direction and formed to permit a wire to be inserted between the intermediate one of said blades and the other two blades, and a cap for cooperating with the tips of said blades to force the blades into relative positions locking said wire in place.

9. An electrical connector comprising; a body portion having at least three blades extending therefrom in the same direction and angularly disposed with respect to one another, the intermediate one of said three blades being bulged outwardly to receive a wire between its inner face and the adjacent edges of the other blades, the ends of the blades being formed with lips, and a cap for cooperating with said lips to force said blades into relative positions to lock said wire in place, the lips of said blades cooperating with said cap to hold said cap in locking position.

10. An electrical connector comprising, a cylindrical body portion having six blades extending longitudinally in hexagonal arrangement from one end thereof, three of said blades being straight and in alternate arrangement with the remaining three blades which are bulged outwardly, each of said bulged blades being adapted to receive a wire between its inner face and the adjacent edges of the two adjacent straight blades, the ends of said straight blades being formed with arcuate lips facing inwardly and the ends of said bulged blades being formed into arcuate lips facing outwardly, and a cap for said blades having an outer portion and a center plug, said outer portion engaging the lips of the bulged blades and the plug engaging the lips of said straight blades when said cap is applied to force said blades into relative positions to lock said wires in place, the inside of said outer portion of said cap being of the same shape as the lips on said bulged blades, thereby retaining said cap in place.

SELDEN BRADLEY SANFORD.