TUBULAR CONNECTOR HAVING SPRING RETAINING MEANS

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3 Claims. (Cl. 255—27)

This invention pertains to new and improved connectors or plugs, each of which includes a socket and an adapter designed so as to be normally secured within the socket with which it is used.

Devices of this general character are normally employed so as to electrically connect individual electrical conductors within complete electrical cables, wires or conduits. A great many different types of electrical connectors or plugs have been developed and used in the past. Although such prior devices have been accepted for their intended purposes and uses, as a class these prior devices have not proved desirable for many present day applications.

At the present time electrical connectors or plugs are frequently subjected to severe or extreme vibrations for a prolonged period. They may also be subjected to an immersion in water, and they are frequently used under hazardous dust or other conditions. To be acceptable at the present time an electrical connector or plug must be capable of being satisfactorily employed without danger of malfunction under virtually all of these and other related different conditions. More than this, however, a connector or plug to be acceptable at the present time must be constructed in such a manner that it is comparatively inexpensive to manufacture and it must be connected in such a manner that it may be easily and conveniently used with a minimum of difficulty.

A broad object of the present invention is to provide new and improved connectors or plugs including a socket and an adapter adapted to be used with such a socket, which connectors meet the foregoing and various other related requirements for acceptability. A related object of this invention is to provide devices of this type which overcome many of the limitations and disadvantages of prior connectors or plugs such as are briefly indicated in the preceding discussion.

These and various other objects of this invention, as well as many specific advantages of it will be more fully apparent from a detailed consideration of the remainder of this specification, the appended claims and the accompanying drawings.

FIG. 1 is a perspective view of a new connector of this invention; FIG. 2 is an enlarged longitudinal sectional view, taken at line 2—2 of FIG. 1; FIG. 3 is a cross-sectional view taken at lines 3—3 of FIG. 2; FIG. 4 is a cross-sectional view corresponding to FIG. 3 showing the positions of various parts of the connector indicated in the preceding figures in a released position; FIG. 5 is a perspective view of a bushing used in the connector shown in the preceding figures; FIG. 6 is a perspective view of a spring utilized in a connector as shown in FIGS. 1 through 4; FIG. 7 is a perspective view of a modified spring capable of being used in place of the spring shown in FIG. 6 in the connector shown in FIGS. 1 through 4; FIG. 8 is a side elevational view of a modified connector of this invention, this view being broken away so as to show part of this connector in section; FIG. 9 is an enlarged cross-sectional view of the part of the connector shown in section in FIG. 8; FIG. 10 is a perspective view of a spring employed in the modified connector shown in FIG. 8; FIG. 11 is a perspective view of another spring capable of being employed in the connector shown in FIG. 8; and FIG. 12 is a cross-sectional view taken at line 12—12 of FIG. 11.

The accompanying drawings are primarily intended to clearly illustrate several presently preferred forms or embodiments of this invention. Connectors or plugs as herein described need not be formed precisely as illustrated in this drawing in order to utilize the essential features or principles of this invention since various changes of a routine design or engineering nature may be made in the preferred connectors shown without affecting the manner in which these connectors operate.

As an aid to understanding this invention it can be stated in essentially summary form that it concerns connectors or plugs, each of which utilizes a socket having an open end and an adapter part which is intended to be inserted and secured within the open end of the socket part. With a connector of this invention seal means as hereinafter described are utilized between the portions of the socket and adapter parts which are adapted to fit together and which are adapted to transmit to the parts to which they are attached.

The actual details of this invention will be more fully apparent from a detailed consideration of the remainder of this specification, including the appended claims and the accompanying drawings. In the drawings there is shown a complete connector or plug 10 of the present invention employing a socket part 12 and an adapter part 14. These parts 12 and 14 are secured to electrical conduits 16, and are utilized in order to electrically connect individual conductors 18 within these conduits 16.

The socket part 12 includes a generally cylindrical body 20 and a housing cap 22 including a cylindrical skirt 23 which is attached to the body 20 by means of threads 24. The housing cap 22 includes a top wall 26 having a centrally located opening 28 formed in it. This opening 28 is surrounded by an annular shoulder 30 which has a sloping surface 32 which slopes generally away from the opening 28. An internally tapered cylindrical neck 34 is formed upon the wall 26 so as to be located concentrically around the opening 28 and so as to extend from the wall 26 at the outer edge of the surface 32. This neck 34 is attached to a cylindrical skirt 36 of a retainer cap 38 by means of threads 40. The top 42 of the cap 38 is provided with a centrally located circular opening 44 which is normally spaced from the end of the neck 34 a comparatively short distance.

A rigid cylindrical sleeve 46 fitting closely within the interior of the neck 34 normally bears against the top 42 and against an elastomeric sleeve 48. This sleeve 48 may be conveniently formed out of neoprene, rubber or various other equivalent materials. Preferably it fits closely within the interior of the neck 34 so that one end of it bears against the sloping surface 32. If desired, the outer surface of the sleeve 48 (not separately numbered) may be tapered slightly so that the end of the sleeve 48 adjacent to the surface 32 is of smaller dimension than the other end of the sleeve.

The entire structure formed upon the top wall 26 may be considered a "holding means" which is, as referred to
in the preceding brief summary of a connector of this invention, designed so as to be utilized in securing one of the conduits 16 to the socket part 12. In utilizing this "holding" structure the conduit 16 is simply inserted through the cap 38 and the sleeves 46 and 48 and is adjusted as to terminate within the housing cap 22. When the conduit 16 is so located the retainer cap 38 may be tightened down upon the neck 34. As this occurs the sleeve 46 is, of course, pushed against the sleeve 48. The pressure applied to the sleeve 48 then causes this sleeve to expand inwardly against a substantial area on the interior of the conduit 16. The tapered outer configuration of the sleeve 48 is considered to facilitate this inward expansion.

Such engagement between the exterior of the conduit 16 and the sleeve 48 forms a water-tight seal between these two parts. This engagement serves an additional function. The sleeve 48 when so expanded engages a sufficient amount of surface of the conduit 16 so as to essentially hold this conduit 16 in such a manner that as tension is applied to it this tension is transmitted directly to the housing cap 22 instead of being transmitted through the conductors 18. This is considered to be important inasmuch as these conductors are relatively weak and are not capable of withstanding the full effect of the forces which may be applied between a conductor and a complete connector or plug or any part of it.

It is considered significant that these results are achieved without resorting to damaging the exterior of the conduit 16. Because of its comparatively soft, resilient character, the sleeve 48 is capable of firmly engaging the exterior of the conduit 16 so as to achieve the above results without "biting into" or otherwise deforming the conduit 16 in a detrimental manner. It is also considered significant that in this type of structure no forces are applied against the sleeve 48 which would tend to twist it in a manner which might cause it to be torn or broken. This is because as the retainer cap 38 is twisted the rigid sleeve 46 slides against the interior of this cap 38 and does not transmit forces to the sleeve 48 which would cause this sleeve to be twisted around the conduit 16 in a detrimental manner. As a consequence of this a sleeve 48 may be reused many times, and does not tend to "break up" within the neck 34.

Within the socket part 12 the individual conductors 18 which are actually conduit 16 are connected to metal terminals 50 mounted upon a disc-like dielectric insert 52. This insert 52 holds metal sockets 56 which are connected to the terminal 50 and which extend from it generally away from the housing cap 22. These sockets 56 are of a known type and are adapted to receive correspondingly shaped metal prongs 54 secured to another disc-like dielectric insert 58 carried within the adapter part 14. The prongs 54 also carry terminals 60 corresponding to the terminals 50 previously described. It will be recognized that the terminals 50 and 60, the prongs 54 and the sockets 56 may be conventional items of hardware adapted to establish conventional electric connection between individual conductors 18 in the conduits 16.

In the connector or plug 10 the body 20 contains an internal cylindrical recess 61 which is adapted to hold the insert 52. This insert 52 may be Inserted in place through the use of an appropriate, conventional adhesive (not shown); other equivalent mechanical means may be employed for the same purpose. In this connector 10 the body 20 includes an internal beveled or tapered shoulder 62 which diverges away from a surface of the insert 52 generally toward a normally open end 64 of the body 20. The body 20 is also provided with an internal cylindrical surface 66 which leads from this end 64 toward shoulder 62; a continuous annular groove 68 is located so as to extend around the interior of the surface 66 between the end 64 and the shoulder 62. This groove 68 is adapted to hold an outwardly ex-
ble of withstanding extreme amounts of vibration. The particular shape of the spring 72 utilized is considered to be advantageous in withstanding such vibration. It is considered to be substantially impossible for the spring 72 shown to vibrate in such a manner as to disengage the flange 78. The inherent resiliency of the ring 84 is considered to aid in maintaining contact between the flange 78 and edge 74 of the spring 72 at all times by tending to push the body 86 in a direction in which such contact is maintained. When the spring 72 is used as herein described it is capable of effectively transmitting forces between the socket and adapter parts 12 and 14.

When it is desired to disconnect the socket and adapter parts 12 and 14 the bushing 68 is merely forced toward the spring 72 so as to slide within the interior of this spring, deforming this spring outwardly away from the flange 78. When the spring 72 is temporarily deformed in this manner the adapter part 14 may be easily withdrawn from the socket part 12. Deformation of the spring 72 as the parts 12 and 14 are being disengaged is facilitated by enlarging the diameter of the spring through the use of a wedged shaped protrusion 92 on the exterior of the bushing 88. This protrusion 92 contains side edges 94 which are adapted to fit against the edges 76 as the bushing 88 is moved toward the extremity 82 in order to force the edges 76 apart, effectively enlarging the entire diameter of the spring 72.

Preferably a small alignment notch 91 is provided in the periphery of the flange 78. This notch 91 is engaged by a pin 95 mounted on the body 20 so as to extend along the surface 66, and serves to prevent rotation of the spring 72 so that the protrusion 92 is aligned with the edges 76 when the bushing 88 is in a position to be moved into contact with this spring.

It is normally preferred to incorporate within the complete connector 10 means for assuring alignment of the socket and adapter parts 12 and 14 when these parts are being secured to one another. Although such means may merely consist of markings (not shown) on the peripheries of the socket and adapter parts it is normally preferred to utilize with the invention parts which mechanically insure alignment during assembly. Such parts are the pin 96 and the notch 98 shown in the drawing. This pin 96 is formed upon the adapter part 14 so as to extend from it and so as to fit within a notch 98 made in the interior of the socket part 12. With this construction an elongated slot 102 is provided in the bushing 88 so as to permit movement of this bushing as previously described. Various other equivalent mechanical means (not shown) can be employed so as to achieve the same alignment objectives.

In order to prevent accidental movement of the bushing 88 towards the spring 72 it is preferred to have the body 20 sufficiently long so that the bushing 88 can be withdrawn so that the pin 96 is located outside of the slot 102. When this is done the bushing 88 can be rotated so that the pin 96 hits against the end of this bushing 88. In this position the bushing 88 cannot engage the spring 72.

In FIG. 7 of the drawings there is shown a spring 96 which may be employed in the connector 10 instead of the spring 72 previously described. This spring 96 is an upper, flat terminal or end flange 98 of a split ring character and a plurality of equally spaced resilient fingers 108. When the spring 96 is employed the flange 98 is shaped within the groove 65 in the connector 10 so that these fingers 108 extend inwardly from it and converge generally towards the interior of the socket part 12. Thus, the fingers 108 extend in the same general manner as the principal portion of the spring 72.

In a connector such as the connector 10 the spring 96 serves in the same general manner as the spring 72. Hence, the use of this spring 96 is not separately discussed in this specification. It is noted, however, that a protrusion such as the protrusion 92 need not be employed when the spring 96 is used inasmuch as the spring 96 contains no edges corresponding to the edges 76 for such a protrusion to engage.

In FIG. 8 of the drawing there is shown a modified connector 110 of the present invention which is the same as the connector 10 previously described except in regards as are set forth in this specification. For this reason various parts of the connector 110 which are the same as, or substantially the same as corresponding parts of the connector 10 are not separately identified herein, and are designated both in this specification and in the accompanying drawings by the primes previously used to designate such parts. Further various internal parts of the connector 110 which are the same as various internal parts of the connector 10 are not separately shown in the drawings and are not described herein.

The connector 110 differs from the connector 10 in the construction of the spring 112 utilized in it so as to secure the socket and adapter parts 12' and 14' to one another. In the connector 110 the spring 112 having a shape as illustrated in FIG. 10 of the drawings is utilized instead of the spring 72 previously described. This spring 112 fits within a groove 68' which corresponds to the groove 68, but which is of larger dimension than the groove 68. As shown in FIGS. 8 and 9 of the drawings the spring 112 has a flat bottom 114 which is located adjacent to the side 116 of the groove 68' adjacent to the beveled or tapered shoulder 62' within the interior of the connector 110. This spring 112 also has a cylindrical periphery 118 located adjacent to, but spaced from the bottom 120 of the groove 68'. This spring 112 also has a tapered internal surface 122 which is tapered so as to extend in generally the same direction as the shoulder 62'.

This surface 122 is located adjacent to the end 124 of the bushing 88' remote from the flange 90'. This end 124 is preferably provided with a comparatively small tapered surface 126 which corresponds in configuration to the surface 125. The spring 112 preferably also includes an internal flange 128 located on the extremity of the spring 112 adjacent to the bottom 114 of the spring 112. The flange 128 in the embodiment of the spring 112 illustrated in FIGS. 8, 9 and 10 of the drawings is of a generally rectangular configuration and corresponds in shape to the shape of a groove 130 formed in the periphery of the body 80'.

The spring 112 operates in substantially the same manner as the spring 72 previously described. This spring 112 is of a split ring character and is provided with longitudinally extending edges 76' corresponding to similar edges 76 on the spring 72. The spring 112 is conveniently located within the groove 68' by bringing the edges 76' together and snapping the spring 112 in place. When it is snapped in place the adapter and connector parts 12' and 14' may be secured to one another in the same manner in which the parts 12 and 14 are secured together. These parts 12' and 14' may similarly be released from one another by forcing the bushing 88' toward the socket part 12'. This brings the surface 126 into engagement with the surface 125 and causes the spring 112 to be expanded so that the flange 128 disengages the groove 130. At this point the socket and adapter parts 12' and 14' may be easily pulled away from one another.

The connector 110 may utilize a protrusion (not shown) corresponding to the protrusion 92 previously described for the purpose of engaging the edges 76' although such a protrusion need not be used in this connector 110. In the connector 110 the spring 112 may be replaced by other springs having different shapes than this specific spring 112. As an example of this a spring 134 shown in FIG. 11 of the drawings may be employed in the same manner as the spring 112. Since various parts of the spring 134 are identical or substantially identical to the corresponding parts of the spring 112, these parts are not separately described herein, and are designated in the accompanying drawing by the primes.
of the numerals previously used to designate corresponding parts of the spring 112. From a consideration of the drawings it will be realized that a spring 134 does not employ a separate flange 128, but instead the extremity of the surface 129' and the bottom 114' join together so as to serve together as a flange.

Those skilled in the art to which this invention pertains will realize that connectors or plugs as herein described and as illustrated in the accompanying drawings may be easily and conveniently manufactured at a comparatively reasonable or nominal cost. They will also realize that those connectors or plugs may be easily and conveniently used whenever desired with a minimum amount of difficulty in either connecting or disconnecting individual conduits, wires or the like. Because of the nature of this invention and the fact that various features of it can be employed in various different devices which differ from the precise connector 10 illustrated in the drawing and described herein as to appearance, various constructional details or the like, this invention is to be considered as being limited solely by the appended claims forming a part of this disclosure.

I claim:

1. A connector which includes:
   a socket part having an open end and a shoulder tapered inwardly from said end;
   an adapter part adapted to fit within said open end or said socket part, said adapter part including a tapered extremity conforming to the configuration of said tapered shoulder and a flange extending around said adapter part;
   spring means for holding said adapter part within said socket part so as to hold said tapered extremity against said tapered shoulder by engaging said flange on said adapter part when said adapter part is located within said end of said socket part;
   said spring means being secured to said socket part adjacent to said open end and extending toward the interior of said socket part and towards said tapered shoulder from said end of said socket part, said spring means being of a slit-ring character and including edges leading between the ends thereof, said edges being formed so that the extremity of said edges adjacent to said tapered shoulder are closer together than the other extremities of said edges adjacent to the other end of said spring means held by said socket part so that the diameter of said spring means adjacent said tapered shoulder is less than the diameter of said spring means held by said socket part;

2. Alignment means for preventing rotation of said spring means with respect to said socket part;
   alignment means extending between said adapter part and said open end of said socket part to insure alignment of said parts;
   release sleeve means including wedge means for engaging said edges of said spring means between the ends thereof so as to increase the diameter of said spring means and move said spring means out of engagement with said flange on said adapter part, said release sleeve means being movably mounted on said adapter part;
   guide means on said release sleeve means for guiding said release sleeve means so that said wedge means will engage said edges of said spring means when said release sleeve means is moved on said adapter part towards said socket part.

3. A connector as defined in claim 1 wherein said alignment means comprises: a pin mounted on said adapter part and a notch on said socket part, said pin fitting within said notch.

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CARL W. TOMLIN, Primary Examiner.

JOSEPH D. SEERS, Examiner.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION
Patent No. 3,193,309

Arthur Morris

July 6, 1965

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 28, for "or" read -- of --.

Signed and sealed this 30th day of November 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents