

[54] **LOCKING ELECTRICAL CABLE
CONNECTION APPARATUS**

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DIG. 22

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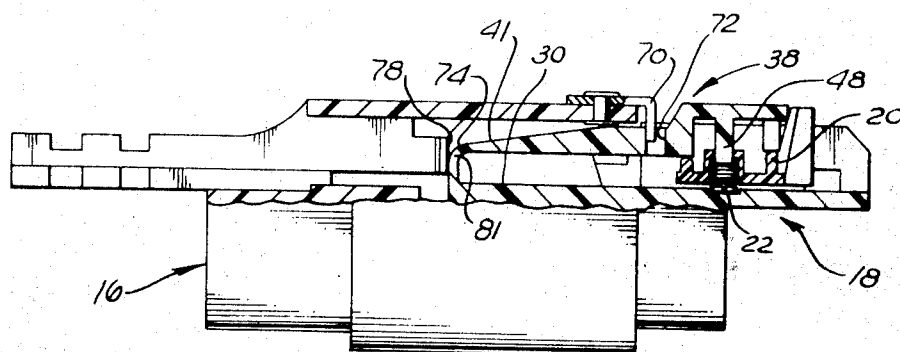
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[57] **ABSTRACT**

A plug-receptacle electrical connector is disclosed incorporating a positive-engagement coupling with a locking apparatus. The plug includes a body with an integral transversely-extending strap which is folded to a hinging position along a surface of the body to receive a latch bar on the receptacle, for a positive engagement. A coil helper spring is mounted under the hinge strap, for maintaining engagement with the latch bar and additionally to support a locking cam which may be rotated to lock the hinge strap in a raised position of engagement with the latch bar.

10 Claims, 5 Drawing Figures



LOCKING ELECTRICAL CABLE CONNECTION APPARATUS

BACKGROUND AND SUMMARY OF THE INVENTION

Over the years, a substantial number of detachable couplings or connectors have been proposed for mechanically joining electrical cables and electrically interconnecting individual conductors in such cables. For example, structures exemplary of such connectors are shown and described in U.S. Pat. Nos. 1,510,977 (Clark); 2,724,093 (Preston); 3,192,499 (West); and 3,553,398 (Seelbach). The provision of effective electrical connections between individual sets of conductors in a pair of cables is of considerable importance; however, additional considerations are also significant. Specifically, speed or ease of use, size, economy and reliability are important features.

With regard to reliability, cable connectors are frequently subjected to undesired parting forces, applied either directly to the connector or through the cables. Consequently, the need has been recognized for a connector which incorporates positive engagement so that undesired parting is less likely to occur. However, in spite of a wide variety of previously-proposed positive-engagement structures, many connectors still tend to be accidentally separated, sometimes with the resulting disconnection having rather severe consequences. Accordingly, a need exists for a locking cable connector which is compact, clean, easy and fast to operate and which may be economically produced, and finally, provides substantial protection against being undesirably parted.

In general, the present invention comprises a connector for electrical cables, that is improved as indicated above, utilizing a mechanically-simple arrangement and which may be economically manufactured as a clean, compact unit. The coupling includes a receptacle and a matingly received plug, each of which may comprise molded insulation material, e.g. plastic. The plug may take the form of a block with a transversely-extending strap integrally formed along with retaining means for holding the strap somewhat contiguous to the block so it can function as a hinged latch member. A coil helper spring is provided between the strap and the block for more effective latching action with the hinged strap. The spring also serves to support a rotary cam which may be moved manually to lock the hinged latch member raised in positive engagement with a latch bar that is carried on the receptacle of the connector.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which constitute a part of this specification, an exemplary embodiment exhibiting various objectives and features hereof is set forth, specifically:

FIG. 1 is a somewhat exploded or open perspective view of a connection structure in accordance with the present invention;

FIG. 2 is a partly sectioned front elevation view of the structure of FIG. 1 with the elements partly mated;

FIG. 3 is a view similar to that of FIG. 2 showing the components fully mated;

FIG. 4 is a fragmentary side elevation view of the structure of FIG. 3 in an unlocked configuration; and

FIG. 5 is a view similar to FIG. 4 in a locked configuration.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

As required, a detailed illustrative embodiment of the invention is disclosed herein. The embodiment exemplifies the invention which may, of course, be embodied in other forms, some of which may be radically different from the illustrative embodiment. However, the specific structural and functional details disclosed herein are representative and they provide a basis for the claims herein which define the scope of the invention.

Referring initially to FIG. 1, a pair of cable ends 12 and 14 are terminated respectively by a receptacle 16 and a plug 18 jointly comprising the present connector. The receptacle 16 is shown partly sectioned to reveal the interior, while the plug 18 is illustrated with its component parts open and separated. The receptacle defines a space 19 to telescopically receive the plug 18 aligned therewith. Generally, the separate elements of the plug 18 are: a cam lock 20, a helper coil spring 22 and an integral or unitary body 24. The detailed shape of the body 24 is rather complex and the individual component parts thereof are considered and explained below. The lower portion of the body 24 (as depicted) comprises a block 26 of generally parallelepiped configuration supporting a plurality of electrical contact pins 28 which are matingly received in sockets 29 within the receptacle 16 as disclosed in detail below. It is to be understood that either the receptacle 16 or the plug 18 may carry the contact pins with the sockets borne by the other member. Consequently, the terms "plug" and "receptacle" refer essentially to the mechanical bodies involved in the connector and not the electrical contacts.

The upper surface 30 of the block 26 (plug 18) is bordered by a pair of longitudinal parallel ridges 32 and 34 rising perpendicularly from the surface 30 to define a channel 37 aligned with the cable 14, to which the plug is affixed by a cable tie 36. The channel 37 (defined between the ridges 32 and 34) is radially aligned with a transversely-extending strap 38 which is folded downward to be received in the channel 37 in which it functions as a spring-biased hinge and latch member. The strap 38, as indicated above is integral with the body 24 and, accordingly, has some natural tendency to dwell in the position as illustrated. As indicated, however, in operation, the strap 38 is folded down into the channel 37, in opposed facing relationship with the surface 30 (between the ridges 32 and 34) and retained in that position by a pair of transversely-extending stubs 40 which are loosely received in rectangular openings 42 defined in the ridges 32 and 34. Somewhat similarly, a pair of stress-relieving stops 44 extend laterally from the strap 38 and are received in aligned notches 46, which are provided in the ridges 32 and 34.

As it is folded downwardly, from the illustrated position of FIG. 1, the strap 38 engages the lock 20 which matingly receives a portion of the spring 22 so that these elements are affixed between the strap 38 and the body 24. Specifically, a small, cylindrical pin 48 extending from the strap 38 is matingly received through

a central bore 50 in the lock 20, which bore 50 also receives the spring 22 so that it bears against an internal shoulder. The lower end of the spring 22 is received in a circular indentation 52 defined in the surface 30. Accordingly, the lock 20 (freely suspended on the spring 22) is held matingly engaged between the pin 48 and the indentation 52 (FIGS. 2 and 3).

In view of the above preliminary structural description of the connector, a full understanding and appreciation thereof may now best be accomplished by considering the operation thereof to electrically connect the individual conductors of the cables 12 and 14. Accordingly, assume the presence of the receptacle 16 along with the plug 18 in which the strap 38 is folded against the surface 30 and held in that position by locking engagement between the stubs 40 and the openings 42. The spring 22 (FIG. 4) urges the lock 20 upwardly against the strap 38 thereby assisting the inherent resiliency of the strap 38 to tend to rise from the surface 30.

As the strap 38 is essentially a hinge that is pivoted at a corner 74 (FIG. 2) perpendicular movement is afforded in relation to the surface 30 permitting engagement with and release from a latch bar 70. That is, as the receptacle 16 receives the plug 18 in the space 19 (FIG. 2) the latch bar is moved over a tapered surface 41 of the strap 38, thereby moving the strap 38 downward to compress the coil spring 22. On completion of the insertion (FIG. 3) the latch bar 70 falls into an opening 72 in the strap 38, permitting the strap to swing upward by the hinge corner 74 and the force of the spring 22. Accordingly, the receptacle 16 and the plug 18 are positively engaged, the occurrence of which involves a snap action as the latch elements 70 and 72 engage.

Upon attaining a latched engagement, usually the connector will be locked by rotating the lock 20 from the position illustrated in FIG. 4 to the position illustrated in FIG. 3, which movement places a section of the lock 20 rigidly between the surface 30 (FIG. 3) and the strap 38. Accordingly, the strap 38 cannot be depressed to disengage the latching members 70 and 72. Thus, a very rigid connection or coupling is provided between the receptacle 16 and the plug 18.

Considering the locking structure in greater detail, it is to be noted that a tab 54 (FIG. 1) radially extending from the lock 20 for manual actuation is sectioned in FIGS. 4 and 5 to better illustrate the operation. A platform 60 (FIG. 4) at the base of the lock 20 supports an axially-extending cam member 62 diametrically opposed from a rider pin 64. The cam member 62 engages a downward projection 66 from the strap 38 while the pin 64 rides under a cam member 68 (FIG. 1) which is integral with the strap 38. As the tab 54 is revolved (right) from a position adjacent the ridge 32 to a position adjacent the ridge 34, the cam surfaces engage and the lock 20 is forced downwardly, compressing the spring to a configuration as illustrated in FIG. 5, closing the space between the strap 38 and the surface 30. Thus, the lock 20 holds the strap 38 in an elevated position, substantially parallel to the surface 30.

In using the connector in a locked configuration, substantial force may be applied across the cables 12 and 14 thereby stressing the latching members 70 and 72. To the extent that such force is applied to the unit,

the stops 44 received in the notches 46 (FIG. 1) prevent stress loads from entering the hinge corner 74, which might otherwise forcefully uncouple the unit. Also related to the use of the connector, an integral transversely-extending leaf spring 78 (FIG. 1) is engaged by the inner end 81 (FIG. 3) of the block 26 providing a force on the latching members 70 and 72 so that the unit is somewhat more rigid and has a greater immunity to vibration.

To uncouple the connector, the tab 54 (FIG. 1) on the lock 20 is moved to the left to revolve the lock 20 from a locked position (FIG. 5) to a released position (FIG. 4). As a consequence, the elements are positioned so that the strap 38 and lock 20 may be urged downwardly thereby compressing the spring 22. With the strap 38 depressed in such a position, the opening 72 is below the latch bar 70 so that plug 18 may now be withdrawn from the receptacle 16.

In the manufacture of units in accordance herewith, the entire receptacle may be formed as a single integral molding, after which pins or sockets may be affixed therein. Specifically, as indicated in FIG. 2, sockets 82 are affixed in elongate channels 84. Additionally, the latching bar 70 is affixed to the receptacle 16 as by a rivet 86; the latching bar 70 comprising an L-shaped bracket.

The plug 18 may be similarly formed by molding techniques, producing the lock 20 as a separate member. As with the receptacle, the plug may be formed of various plastic materials having good insulating characteristics. Subsequent to formation, the plug is completed very simply by inserting the pin 48 (FIG. 1) through the lock 20 which in turn receives the spring 22, then pressing the combination so that the spring drops into the indentation 52 and the stubs 40 are forced into the openings 42. Of course, pins 28 (FIG. 2) are fitted into elongate channels 90 of the plug and fixed therein. Thus, the structure is very economical to manufacture, being simple, clean in function and appearance as well as fast and easy to use. Accordingly, the structure hereof affords a particularly sturdy and durable connection apparatus which will resist substantial forces in relatively-economical designs. Of course, various designs are readily apparent and, accordingly, the scope hereof is in accordance with the claims set forth below.

What is claimed is:

1. An electrical connection apparatus for use with a receptacle to interconnect conductors, comprising:
 - a block of insulating material for receiving at least one of said conductors and including a transversely-extending integral strap, defining a latch member for engagement with said receptacle;
 - means for retaining said strap partially folded in substantially coplanar relationship with an opposed surface of said block; and
 - locking means including a cam structure to engage and hold said strap in a raised position of engagement with said receptacle.
2. An apparatus according to claim 1 further including a helper spring affixed to urge said latch member of said strap into engagement with said receptacle.
3. An apparatus according to claim 2 wherein said helper spring comprises a coil spring affixed between said opposing surface of said block and said strap.

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4. An apparatus according to claim 3 wherein said locking member comprises a cam member supported for rotation by said spring for engaging said strap.

5. An apparatus according to claim 4 wherein said cam member includes at least two diametrically opposed cam surfaces radial of said spring.

6. An apparatus according to claim 1 further including means on said block for engaging said strap to limit the movement thereof parallel to said block whereby to accept stresses applied to said apparatus.

7. An apparatus according to claim 1 wherein said block and strap comprise an integrally molded unit.

8. A connector structure incorporating an apparatus

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as defined by claim 1 with a receptacle comprising means defining a space to telescopically receive said block and receiving at least one other of said conductors.

9. A connector structure according to claim 8 further including a helper spring affixed to urge said latch member of said strap into engagement with said receptacle.

10. A connector structure according to claim 9 wherein said locking member comprises a cam member supported for rotation by said spring for engaging said strap.

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