

March 19, 1946.

J. B. MILLER ET AL

2,396,872

PLUG CONNECTOR

Filed March 23, 1942

2 Sheets-Sheet 1

FIG. 1.

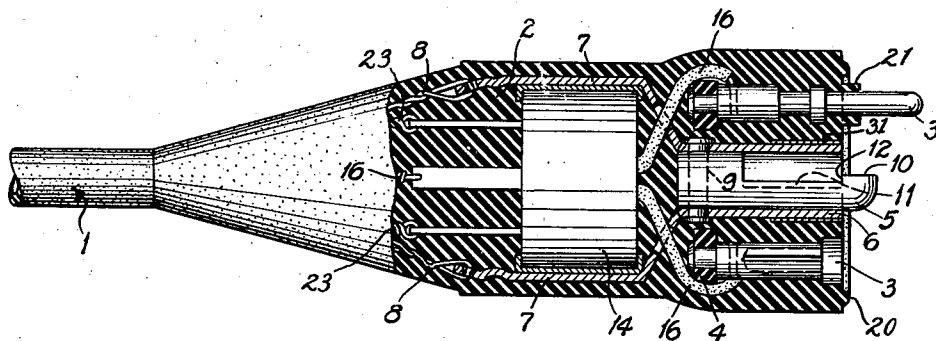


FIG. 2.

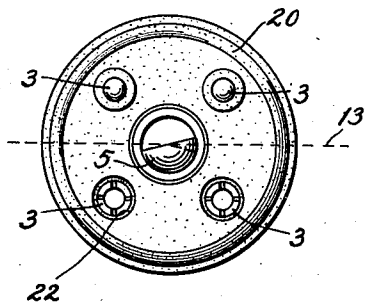


FIG. 3.

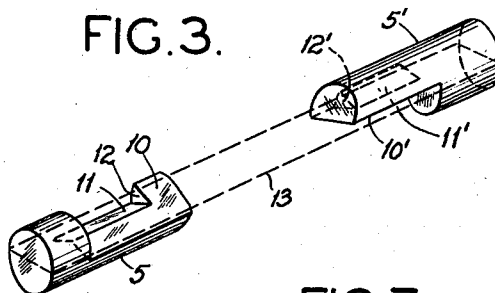


FIG. 7.

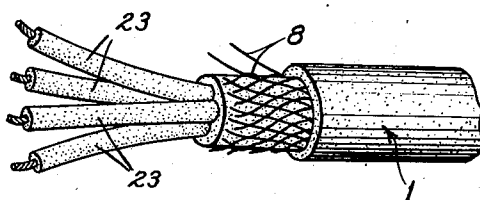
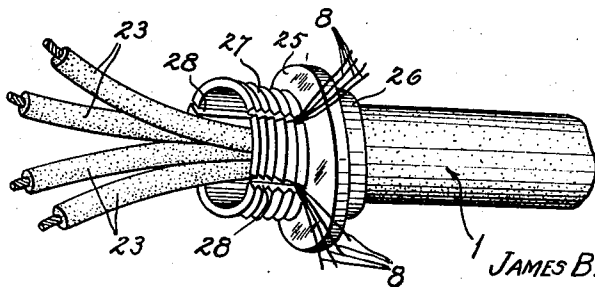


FIG. 8.



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FIG. 4.

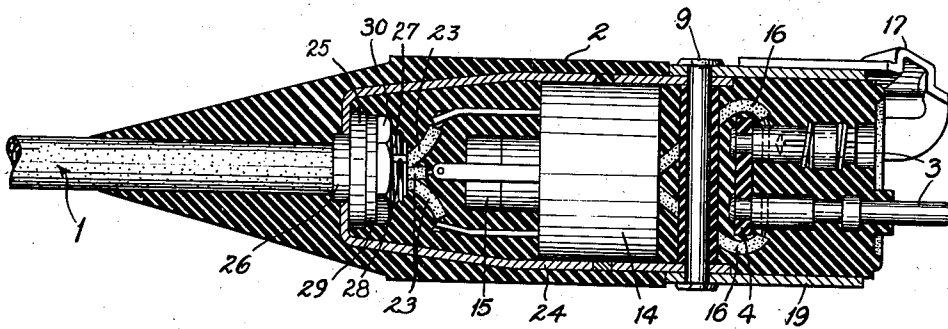


FIG. 5.

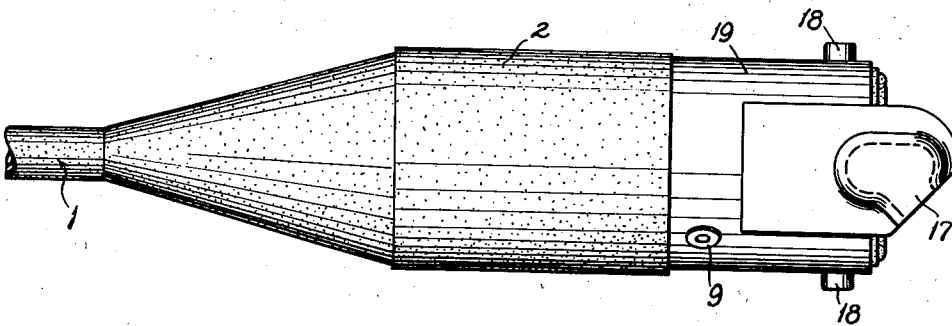
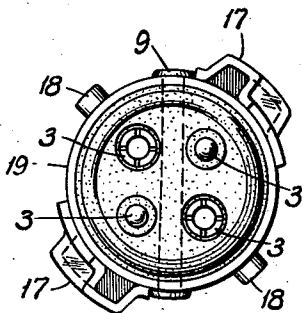


FIG. 6.



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PLUG CONNECTOR

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Application March 23, 1942, Serial No. 435,816

10 Claims. (Cl. 173-328)

This invention pertains to plug connectors for making separable connections between lengths of flexible cable or the like. More particularly, the invention pertains to such connectors as are provided with locking or latching devices for securing two complementary connectors together when mutually engaged.

One of the objects of this invention is to provide such a connector with latching means whereby two connectors may be quickly and easily engaged and latched together so as to prevent their being pulled apart but, at the same time, permitting them to be unlatched and separated without difficulty.

Another object is to provide such connectors with latching means securely anchored to the cable so as to avoid putting any excessive pulling stress upon parts of the connector.

Connectors of this type are used to a considerable extent in military operations for establishing communication circuits of various kinds, and very often such circuits must be established in the field. Under such circumstances it is desirable to provide securing means to prevent the connectors being pulled apart under severe conditions. Such cables may be made up in considerable lengths, sometimes as much as a quarter of a mile. Again, under some circumstances the cables must be dragged along the ground and over such obstacles as may be encountered. It is evident that such handling may put a severe tensile strain upon the cable and the connectors.

Another object of this invention, therefore, is to provide a connector with such latching or securing means which will be strong enough to withstand a heavy pull and which are securely anchored so that the pull comes upon the cable itself rather than upon the body of the connector.

Another object of this invention is to provide such a connector with latching means of improved construction and arrangement such that the latch is securely held in interlocking engagement and resiliently held against disengagement.

Further objects will appear from the following description of certain specific embodiments of the invention.

In accordance with the principle of this invention, a connector is provided having one or more plug-socket terminals so arranged as to be engageable with complementary terminals in a similar complementary connector. These terminals are embedded in the rubber-like body of the connector by means of a mounting permitting a certain degree of flexibility as to the alignment

of the terminals, while at the same time said terminals are securely anchored in said body. Latching means are mounted in the same body and securely anchored therein, said connector body being formed upon the cable and securely anchored thereto. The arrangement of the latching means with reference to the plug-socket terminals is such that the latching means are in condition or alignment to be securely interlocked when the mutually engaging terminals are in their normal alignment. Furthermore, the arrangement is such that when two complementary connectors are to be engaged, the plug-socket terminals are engaged first, after which the relative positions of the two complementary connectors must be shifted in order to bring the latching means into position for engagement. By such shifting, the already engaged terminals are forced out of their normal alignment against the resilient resistance of the rubber-like body. Accordingly, when the latching means have been finally brought to position for interlocking engagement, the connectors may be released so that the resilience of the bodies brings the terminals back to normal alignment and thereby moves the latching means to final interlocking engagement. In this manner, the resiliency of the body is utilized to provide a retaining force, tending to keep the latching means in interlocking engagement.

In the accompanying drawings two specific embodiments have been selected for illustration, although many other arrangements may be employed. In said drawings,

Figure 1 is a longitudinal sectional view of a connector embodying this invention.

Figure 2 is a right-hand end view of Figure 1.

Figure 3 is a perspective detail showing latch pins of a pair of complementary connectors.

Figure 4 is a longitudinal section of a connector illustrating another embodiment of the invention.

Figure 5 is a bottom view of Figure 4.

Figure 6 is a right-hand end view of Figure 4.

Figure 7 is an enlarged perspective view showing the structure of the cable 1, and

Figure 8 is a similar view showing the method of securing the strain-bushing to the cable.

Referring to the drawings, 1 indicates a flexible cable which is to be provided with one or more connectors so that another such cable may be connected thereto. The cable 1 may have any number of conductors. That selected for illustration in the drawings has four conductors. The cable 1 is preferably provided with a rubber out-

side sheath in a well-known manner. Molded on the end of the cable 1 is a resilient body 2 of rubber or similar flexible material.

Plug-socket terminals 3 are mounted in the connector by being imbedded in the body 2. These terminals may be either plugs or sockets, the term "plug-socket" being employed here to designate either or both. The terminals 3 are mounted in an anchor ring 4 of rigid material such as fiber, Bakelite, or the like. The terminals are fitted into the ring 4 with considerable clearance so as to permit lateral flexibility of the terminals with respect to the ring. However, the shanks of the terminals may be upset behind the ring 4 or other suitable means may be employed for anchoring the terminals in the ring against being pulled out when the connectors are separated. The ring 4 in turn is imbedded in the body 2 so as to provide secure anchorage for the terminals in the body. The terminals 3 may be arranged in any suitable pattern, in end view as seen in Figure 2. However, it is often desirable that all connectors which are to be used interchangeably, and also both connectors on opposite ends of the cable 1 where that cable has two connectors, have the same terminal pattern so that they may be interchangeable and it will never be necessary to change a long cable end-for-end in order to make a connection.

In the embodiment of Figures 1-3 a latch pin 5 is mounted in a sleeve 6 having a rearwardly extending portion 7. This sleeve is imbedded in the body 2 so as to be securely anchored therein. Where the cable 1 is provided with tension members such as cords 8, these are preferably secured to the portion 7 so as to transmit any pull on the sleeve to these tension members of the cable. The pin 5 may be secured to the sleeve 6 in any suitable manner as by means of a pin 9.

In Figure 3 the pin 5 is shown in perspective, as is also the pin 5' of the complementary connector. In the following, the same reference numerals, primed, will be applied to various parts of the complementary pin as are applied to the pin 5. This pin is cut transversely to provide two faces 10 and 11. In the embodiment shown both of these faces are planes and pass through the axis of the pin. However, they are angularly displaced from one another so as to provide therebetween a latching shoulder 12. The two pins are shown in Figure 3 in the same positions with respect to rotation about their axes as they will have when in interlocking engagement. When in such engagement the face 10' is in engagement with the face 11, the face 11' is in engagement with the face 10, and the two shoulders 12 and 12' are in engagement with each other. These two shoulders are interlocked so as to prevent endwise separation of the two pins. The plane 13, indicated in dotted lines in Figure 3, is an axial plane angularly midway between the faces 10 and 11. This plane is also indicated in dotted line in Figure 2.

As may be seen from Figure 2, the alignment of the pin 5 with respect to the terminals 3 is such that when a complementary connector of identical construction is engaged and moved into final locking engagement, the alignment of the complementary terminals will be identical with that of the terminals 3 shown in Figure 2, while the alignment of the pin 5' will be such as to be interlocked with the pin 5.

In order to engage two complementary connectors such as shown in Figures 1 and 2, the terminals 3 are first engaged with each other.

In order to do this the complementary connectors must be brought into such relation to each other with respect to rotation about their axes that their latch pins 5 and 5' will be in the relative positions indicated in Figure 3. When in this position the faces 10 and 10' are angular to each other, and the two latch pins interfere when the two connectors are moved toward each other. Accordingly, the two connectors must be rotated relatively to each other in such a manner that, as seen in Figure 3, the pin 5 rotates counterclockwise and the pin 5' clockwise until the faces 10 and 10' come into parallel relation with each other. In order to do this the terminals 3 must be moved out of their normal alignment against the resilient resistance of the rubber body in which they are embedded. When the faces 10 and 10' have been brought into parallel relation they may be slipped past each other by pushing the two connectors together. At the same time each plug terminal 3 moves into its complementary socket terminal. When the shoulders 12 and 12' have cleared each other, the resilience of the rubber body will cause the two connectors to return to normal alignment by a rotary movement which brings said shoulders 12 and 12' into latching engagement with each other. In order to disconnect the two connectors, of course, the reverse procedure must be carried out.

The sleeve 6 provides a guide for the complementary latch pin 5' to guide it into engagement with the pin 5 and to retain it in alignment when engaged. In molding the sleeve 6 in the body 2, a separator 31, of paper or other suitable material, may be positioned between the outer end of the sleeve and the surrounding rubber to prevent adhesion of the rubber to this part of the sleeve. This frees the sleeve partly from the body so as to render it easier to rotate relatively to the body in order to engage the pins 5 and 5'.

Just prior to the final movement which carries the shoulders 12 and 12' clear of each other, circular beads 20, formed on the end faces of the two connectors, come into engagement with each other, and these are compressed during the final movement toward each other so as to provide a water seal. At the same time an upstanding collar 21, which is formed around each of the plug terminals 3, moves into a complementary recess 22 around the socket terminal so as to form an additional seal around each pair of terminals.

Many of these cable units are used to set up phonetic circuits for military communications. In such cases it is often desirable to have circuit accessories such as loading coils, condensers, and the like assembled with the unit. In the structure shown in Figure 1, such a loading coil assembly is shown at 14 and may or may not have associated therewith condensers 15, Figure 4, or other accessories. One or more of the terminals 3 may be connected by conductors 16 to these accessories. The accessories may also be connected in any suitable manner to the conductors 23 of the cable 1. These circuit accessories are permanently connected and embedded in the body 2 so that their relation to the circuit and the terminals 3 is made permanent. The rearwardly extending portions 7 of the sleeve 6 extend past these accessories in a rearward direction or toward the cable so as to be anchored in the body 2 at such a portion thereof as to avoid any liability of stress due to a pull on the latch pin 5 being placed upon the accessories 14 and 15, or upon that part of the body 2 in which they are embedded. Accordingly, these acces-

sories and their connections are protected from all such stresses.

In the embodiment illustrated in Figures 4, 5, and 6 the terminals 3 may be arranged and secured in the body 2 in the same manner as described for Figure 1, and the accessories 14 and 15 may also be similarly mounted. In this embodiment, however, the latching means are in the form of hook elements 17 engageable by studs 18 on the complementary connector. The elements 17 and 18 are mounted on a ring 19 which surrounds the body 2 at its outer end. The elements 17 and 18 and the ring 19 are connected to a rearwardly extending yoke 24, which is embedded in the body 2 and extends rearwardly beyond the accessories 14 and 15 so as to be anchored therebeyond in the manner described for the portion 7 of Figure 1. In the arrangement shown, each connector is provided with two hooks 17 and two studs 18. In this case, also, the alignment of these latching elements, as shown in Figure 6, is such that when in interlocking engagement the elements 3 of the two complementary connectors are also in normal alignment. Accordingly, in order to engage the latching means, the terminals must be forced out of their normal alignment and the resiliency of the body in restoring them to normal alignment brings the latching elements into their final alignment for interlocking engagement.

In order to anchor the yoke 24 to the cable 1, a strain-bushing 25 is formed with a reduced portion 26 adapted to seat in an opening in the end of the yoke 24, as shown in Figure 4. The other end of the bushing is threaded as indicated at 27, and this threaded portion is slit by a plurality of longitudinal slots 28. This bushing is first seated in the yoke and then the end of the cable is slipped through the bushing from the rear. The wires 8 which reinforce the cable and take up endwise tension thereon are usually arranged as shown in Figure 7. After passing the cable through the bushing 25, the wires 8 are separated into groups and the different groups passed through the slots 28, as shown in Figure 8, after which a clamping washer 29 is placed around the threaded portion of the bushing and so as to rest upon the wires 8, and a clamping nut 30 is screwed onto the threads 27 so as to clamp the washer 29 firmly against the wires 8. This, therefore, provides a secure anchorage for the cable to the yoke 24 so that any pull on the latching devices will be transmitted directly to the cable without straining any of the intermediate parts molded in the body 2.

It will be seen, therefore, that this invention provides a connector in which the resilient body is active to retain the latching devices in engagement with each other, and those devices are securely anchored so as to withstand a heavy pull on the cable without subjecting the parts of the connector to any excessive strains. While several embodiments of the invention have been described in the foregoing specification, it will be understood that other embodiments are contemplated by the invention when within the scope of the appended claims. Moreover, while each embodiment has been described as a unitary structure, it is understood that individual features or subcombinations thereof may be useful by themselves without references to other features or the complete combination, and that the employment of such individual features or subcombinations is contemplated by this invention when within the scope of the appended

claims. It is obvious, furthermore, that various changes in the details of construction may be made within the scope of the appended claims without departing from the spirit of the invention, and that therefore the invention is not limited to the specific details shown and described.

The invention having thus been described, what is claimed is:

1. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, and latching means embedded in said body for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, said latching means being positioned in interlocking alignment with the complementary latching means when said terminals are in engaging alignment with their complementary terminals, and supported in such alignment by said body so as to necessitate movement out of such alignment against the resilient resistance of said body during the approach thereof to interlocking position.

2. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, a metallic anchoring means anchored to said body and the cable, and latching means secured to said anchoring member for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, said latching means being positioned in interlocking alignment with the complementary latching means when said terminals are in engaging alignment with their complementary terminals, and supported in such alignment by said body so as to necessitate movement out of such alignment against the resilient resistance of said body during the approach thereof to interlocking position.

3. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, a metallic sleeve anchored to said body and the cable, latching means secured to said sleeve arranged for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, said latching means being in interlocking alignment with the complementary latching means when said terminals are in engaging alignment with their complementary terminals, and supported in such alignment by said body so as to necessitate movement out of such alignment against the resilient resistance of said body during the approach thereof to interlocking position.

4. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, one or more circuit accessories connected with said terminals and embedded in said body, latching means anchored within said body for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, and anchorage means for said latching means anchored to said body beyond said accessories toward the cable.

5. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, one or more circuit accessories connected with said terminals and embedded in said body,

latching means arranged for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, and anchorage means for said latching means anchored to said body beyond said accessories toward the cable, said latching means being in interlocking alignment with the complementary latching means when said terminals are in engaging alignment with their complementary terminals and supported in such alignment by said body so as to necessitate movement out of such alignment against the resilient resistance of said body during the approach thereof to interlocking position.

6. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, and a latch pin anchored centrally in said body and insulated thereby from the cable conductors, extending axially thereof and having angularly offset faces providing therebetween an angular shoulder adapted for engagement with a similar shoulder on a complementary connector to prevent the connectors being pulled apart, said angular shoulder being in interlocking alignment with said complementary shoulder when said terminals are in engaging alignment with their complementary terminals and supported in such alignment by said body so as to necessitate movement out of such alignment against the resilient resistance of said body during the approach to or departure from the aforesaid interlocking position.

7. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, and latching means arranged for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, said latching means having parts interfering with similar parts on said complementary means necessitating forcing

ing said parts out of their interfering positions against the resilient resistance of said body in order to move said latching means into latching engagement.

8. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals embedded in said body, latching means arranged for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, anchor means securing said latching means to said conductor cable, said anchor means being molded in the resilient body and said latching means having a part interfering with a part on the complementary connector necessitating forcing said parts out of their interfering positions against the resilient resistance of said body in order to move said latching means into latching engagement.

9. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals molded in said body, latching means arranged for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, an anchoring yoke molded in said body, and secured to said latching means, and means securing said yoke to a tension member within the cable.

10. A connector for flexible conductor cables, comprising, a resilient rubber-like body, one or more plug-socket terminals molded in said body, latching means arranged for interlocking engagement with complementary latching means on a complementary connector to prevent pulling the connectors apart, an anchoring yoke molded in said body, and a clamping collar anchored to said yoke and surrounding the cable and having means for clamping a tension member within the cable.

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