June 20, 1967 B. LEVINE ET AL 3,327,280

PROTECTIVE DEVICE FOR A TERMINAL MEMBER

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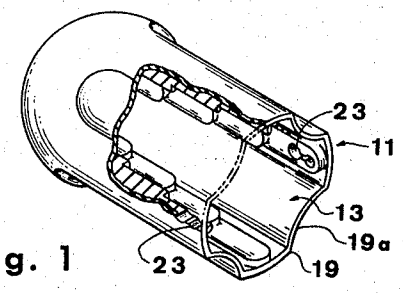


Fig. 1

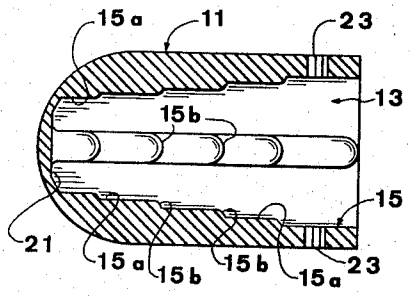


Fig. 2

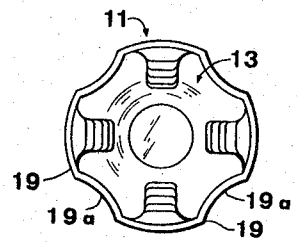


Fig. 3

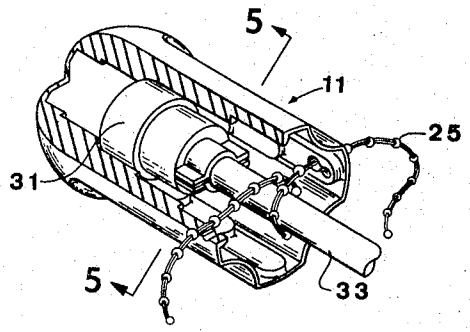


Fig. 4

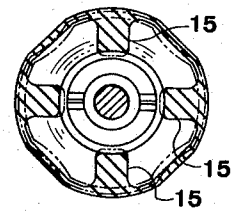


Fig. 5

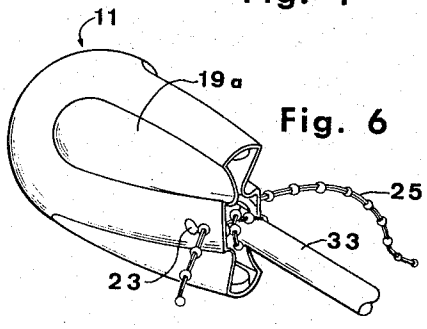


Fig. 6

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PROTECTIVE DEVICE FOR A TERMINAL MEMBER

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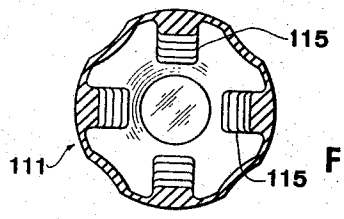


Fig. 9

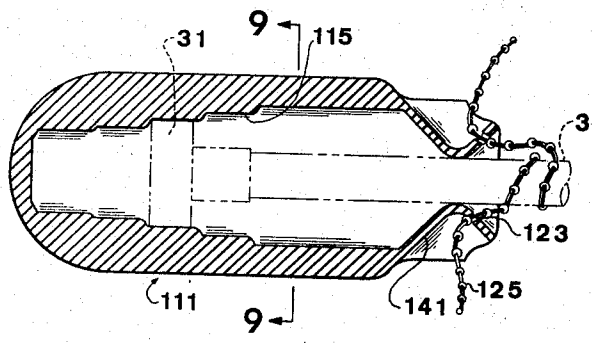


Fig. 8

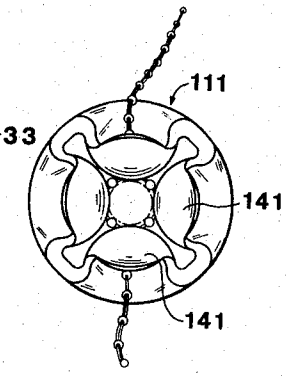


Fig. 10

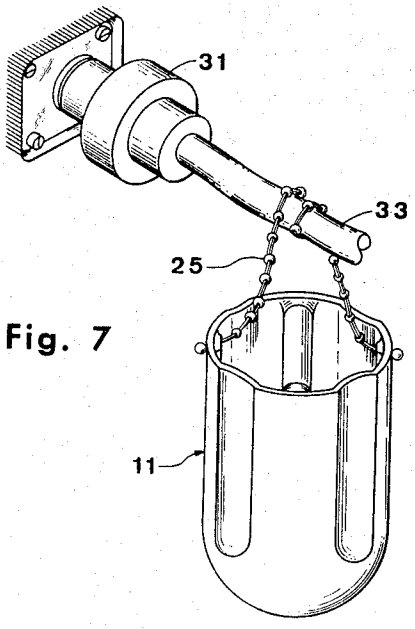


Fig. 7

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United States Patent Office 3,327,280
Patented June 20, 1967

3,327,280

PROTECTIVE DEVICE FOR A TERMINAL MEMBER

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Filed May 12, 1965, Ser. No. 455,285
10 Claims. (Cl. 339—36)

This invention relates to a protective device, and more particularly to a device for protecting a protruding terminal member, in particular a relatively easily damaged terminal member such as an electrical connector carried by an electrical cable.

In the electrical and electronics arts it is common practice to employ a cable having a relatively large number of individual electrical wires, and to connect the cable through a single terminal with each of the wires individually and separately connected to connection elements on the terminal connector. Many of these terminal connectors are very easily damaged when dropped or otherwise subjected to impact or abuse, and it relatively expensive to replace such terminal connectors in view of the cost of the connectors and the labor involved.

It is accordingly an object and feature of this invention to provide a terminal member protector which will afford protection against impact damage to terminal members such as electrical connectors.

A further object and feature resides in the provision of a terminal member protector which for a given particular size protector is capable of being fitted to a multiple number of sizes of terminal members.

Still other objects, features and attendant advantages will become apparent to those skilled in the art from a reading of the following detailed description of several physical embodiments of the invention, taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a perspective view of one physical embodiment of the invention, with a portion thereof broken away for clarity of view.

FIGURE 2 is a longitudinal section view of the arrangement of FIGURE 1.

FIGURE 3 is an end view of the arrangement of FIGURE 1, as viewed from the open end thereof.

FIGURE 4 is a further view of the embodiment of FIGURE 1 with an electrical terminal member in place, the protector being shown in partial section for purposes of clarity.

FIGURE 5 is a section view taken on the line 5—5 of FIGURE 4.

FIGURE 6 is a further perspective view of the arrangement of FIGURE 1, with the draw line or chain pulled tight to aid in retention of the protector device on the terminal member and cable.

FIGURE 7 is a perspective view illustrating the inactive position of the terminal protector when the electrical terminal is electrically connected to a terminal block or other electrical connector.

FIGURE 8 is a longitudinal sectional view of a modified embodiment according to the invention, with a terminal member and cable shown in phantom in place therein.

FIGURE 9 is a section view taken on the line 9—9 of FIGURE 8.

FIGURE 10 is an end view of the arrangement of FIGURE 8 as viewed from the open end of the protector.

Referring now in detail to the figures of the drawing, in the embodiment of FIGURES 1–7 the invention takes the form of a terminal member protector **11** having an annular body in the form of a cup formed of elastic material such as vulcanized natural or synthetic rubber, or plastic, or other suitable elastic material. The cup **11** has a central cavity **13** open at one end and closed as at **21** at the opposite end, and adapted to receive a terminal member such as an electrical connector **31** which may be carried by a cable **33**. The annular inner wall of the cavity **13** is formed by a plurality of inwardly extending ribs **15** circumferentially spaced apart and separated by a corresponding plurality of arcuately-curved web portions **19**.

The ribs **15** are adapted to engage the annular periphery of the electrical terminal member **31**, and in order to provide for varying sized terminal members **31** the ribs **15** are formed in longitudinal steps **15***a* disposed at decreasing distances from the longitudinal axis of the cup **11** as viewed from the open end of protector cup **11**. Preferably, the shoulders **15***b* connecting the respective adjacent steps along their longitudinal extent are longitudinally tapered (as shown in FIGURE 2) to provide both for end stop abutment for differing sized terminal members and for ease of insertion of intermediate sized terminal members.

As stated above, the interconnecting webs **19** between the respective ribs are arcuate in form and thereby provide an extra length of flexible material which when pulled to a straighter configuration will enable the ribs to be somewhat expanded from their inactive position, and thereby accommodate intermediate sizes of terminal members which do not precisely fit the openings formed between particular stepped portions **15***a* in the inactive position as shown in FIGURES 1–3. Thus, a complete range of sizes of connectors **31** may be accommodated by the illustrated terminal member protector **11** within a range extending from the smallest rib opening size to slightly in excess of the largest rib opening size. It will be apparent that for the most part the terminal members will be displaced to a greater or lesser extent by the intermediate sizes and therefore the elastic flex straightening deformation of the web portions **19** to their more straightened configurations will result in such instances in a resilient grip being exerted on the terminal member **31** through the respective rib portions **15***a* in engagement therewith.

If desired, finger grips **19***a* may be provided by forming reverse-curved deformations in the curved web portions **19**. In such instances the reverse-curved portions **19***a* serve to provide also an increased curvilinear length of web between the adjacent ribs, and thereby afford an increased potential expansion of the ribs by elastic flex straightening of the curved webs, as shown particularly in FIGURE 5, wherein the inactive or quiescent position of the ribs and webs is illustrated in broken lines and the extended gripping position of the ribs is illustrated in full lines while showing the connector in place while being so gripped.

In order to aid in retention of the protector **11** on the electrical terminal member and cable, there is provided a retention line **25** in the form of a nodular flexible line, of plastic or the like, or a chain, as may be desired, which extends through a pair of slotted openings **23** formed in opposed ribs **15**. The line-receiving openings **23** have one portion thereof larger than the nodules of the line **25**

and a second connected portion smaller than the nodules on the line **25** in order to permit ease of insertion and adjustment of the nodular line while also enabling ease of locking of the nodular line in a desired position by simply laterally moving the line within a slotted opening from the larger to the smaller portion or vice versa, as may be desired to enable either adjustment or locking. In use the line **25** extends through the two openings **23** and is preferably wrapped once or more about the cable **33**, and the line is then pulled further through the openings and locked, preferably in the position of FIGURE 6. It will be apparent that for the larger sizes of connectors **31** which are more closely adjacent to the open end of the protector device **11** the open end will not be pulled into as closed a position as shown in FIGURE 6 due to physical limitations, but in such case the line **25** will nevertheless serve quite adequately to retain the protector **11** on the electrical connector **31** and cable **33**.

It will thus be readily seen that the entire assemblage of cable **33**, electrical terminal member **31** and terminal member protector **11** may be dropped or struck without damage to the electrical terminal member **31**, within, of course, the physical limits of elasticity of the protector **11**, which limits for rubber, etc., are quite substantial.

When it is desired to make electrical connections between the electrical connector **31** and another connector such as a terminal block or another cable-carried connector, it is only necessary to loosen the line **25** and slip the protector **11** off the connector **31**, while still retaining the protector **11** on the cable **33**, as shown in FIGURE 7. This will permit service use of connector **31** while insuring against loss of the protector **11** during such service use, and also enabling ready access thereto when subsequently needed again.

In FIGURES 8–10 there is shown a modified embodiment of the invention in which the open end of the protector cup **111** has a plurality of reverse-curved elastic folds **141** extending inwardly toward the longitudinal axis of the protector **111** and terminating at a radial position inwardly of the radial position of the ribs **115**, so to enable engagement thereby with the cable **33** and thereby aid in the retention of the protector on cable **33** and terminal member **31**. In this embodiment the nodular line-receiving openings **23** are formed in the reverse-curved elastic folds **141** of the protector **111**, and it will be apparent that substantially little or no deformation of the main rib portion of the protector **111** is necessary in order to lock the protector device onto the cable and terminal connector.

While the invention has been illustrated and described with respect to several physical embodiments thereof, it will be readily apparent to those skilled in the art that various modifications and improvements may be made without departing from the scope and spirit of the invention. Accordingly, the invention is not to be limited by the specific illustrated embodiments contained therein, but only by the scope of the appended claims.

We claim:

1. A terminal member protector comprising:

an annular body of resiliently elastic, substantially non-rigid material, having a central terminal-member-receiving cavity formed therein,

a plurality of longitudinal terminal-member-engaging circumferentially-spaced inwardly-extending ribs formed on said annular body and forming a portion of the walls of said cavity,

said cavity walls being further formed by a plurality of arcuately-curved web portions, thinner than said ribs and connecting adjacent ribs, the linear arcuate length in cross-sectional direction of at least one of said arcuately-curved webs being greater than the distance between said ribs at the respective points of intersection of the respective web with the respective adjacent said ribs to enable elastic flexing of said curved web portions to a straightened configuration in accommodating and resiliently holding terminal members of various cross-sectional sizes.

2. Apparatus according to claim **1**, each of said ribs being formed in longitudinal steps of decreasing distance from the axis of said annular body for lateral engagement with differing sized terminal members to be protected,

and tapered end shoulders connecting adjacent steps for end abutment by differing sized terminal members and for ease of insertion of intermediate-sized terminal members to be protected.

3. Apparatus according to claim **2**, said ribs and webs being interconnected at one end of said body to form a closed cup, and said body being open at the opposite longitudinal end for mounting on a terminal member to be protected.

4. A terminal member protector comprising:

an annular body of elastic material, having a central terminal-member-receiving cavity formed therein,

a plurality of longitudinal terminal-member-engaging circumferentially-spaced inwardly-extending ribs formed on said annular body and forming a portion of the walls of said cavity,

said cavity walls being further formed by a plurality of arcuately-curved web portions thinner than said ribs and connecting adjacent ribs, the linear arcuate length in cross-sectional direction of at least one of said arcuately-curved webs being greater than the distance between said ribs at the respective points of intersection of the respective web with the respective adjacent said ribs,

each of said ribs being formed in longitudinal steps of decreasing distance from the axis of said annular body for lateral engagement with differing sized terminal members to be protected,

tapered end shoulders connecting adjacent steps for end abutment by differing sized terminal members and for ease of insertion of intermediate-sized terminal members to be protected,

said ribs and webs being interconnected at one end of said body to form a closed cup, and

said body being open at the opposite longitudinal end for mounting on a terminal member to be protected, and a terminal member-engageable flexible line connected to said annular body for securing said body to said terminal member.

5. Apparatus according to claim **4**,

said flexible line having a nodular surface,

said annular body having two spaced openings formed at its open end for engagement by said nodular surfaced line,

one of said openings having a reduced width portion thereof of smaller width than the nodule diameter of said nodular line and larger than the reduced portion between nodules.

6. Apparatus according to claim **1**, said arcuately-curved web portions having an exteriorly concave section and being of substantially the same radius of curvature as the remaining portion of said annular body.

7. Apparatus according to claim **1**, said arcuately-curved web portions having a circumferentially reverse-curved shape in cross-section to provide said longer length.

8. Apparatus according to claim **7**, said reverse-curved shape of said web being convex-concave-convex as viewed exteriorly of said body.

9. A terminal member protector comprising:

an annular body of elastic material, having a central terminal-member-receiving cavity formed therein,

a plurality of longitudinal terminal-member-engaging circumferentially-spaced inwardly-extending ribs formed on said annular body and forming a portion of the walls of said cavity,

said cavity walls being further formed by a plurality of arcuately-curved web portions thinner than said ribs and connecting adjacent ribs, the linear arcuate

length in cross-sectional direction of at least one of said arcuately-curved webs being greater than the distance between said ribs at the respective points of intersection of the respective web with respective adjacent said ribs, said body being open at one longitudinal end and closed at the opposite end, said open end having a plurality of reverse-curved elastic folds extending inwardly toward the longitudinal axis of said body and terminating at a radial position inwardly of the radial position of the terminal-member-engaging surface of said ribs, for aid in retention of said body on a terminal member.

10. Apparatus according to claim 1, wherein said annular body is a unitary structure incorporating said ribs and web portions.

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