(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 631 345 A1**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **94109754.5**

(51) Int. Cl.[5]: **H01R 13/585**

(22) Date of filing: **23.06.94**

(30) Priority: **24.06.93 US 83043**

(43) Date of publication of application:
28.12.94 Bulletin 94/52

(84) Designated Contracting States:
DE FR GB

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(54) **Strain relief device and method of use.**

(57) A strain relief device using a pair of posts within a housing with a wire cable routed around the posts so that one portion of the wire cable presses back on to another portion and presses it against one of the posts as a pulling force is applied to the cable. The wire cable is cinched against one of the posts. As the pulling force increases, the cinching action increases proportionately. The strain relief is low profile and has a height approximately the equal to the diameter of the wire cable.

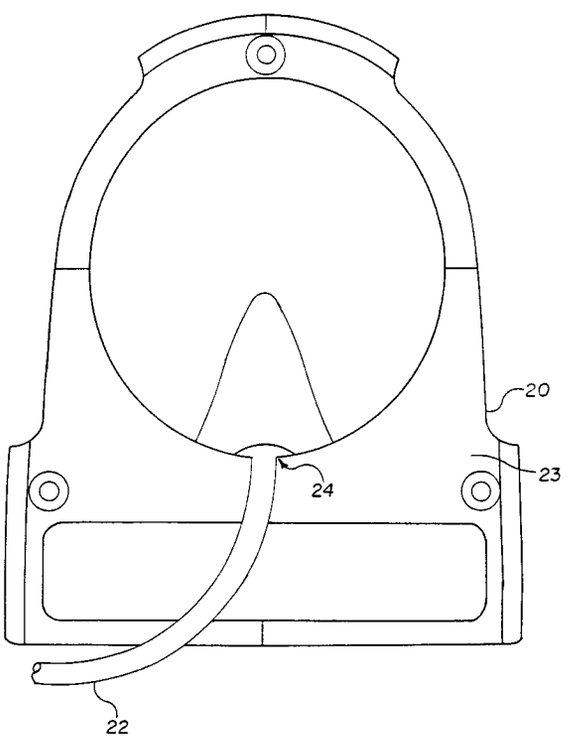

FIG. 2

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Technical Field

The present invention relates to devices for relieving the strain on an electrical wire cable.

Background of the Invention

Wire cables are often used to connect electrical equipment together. A power cord is a common electrical wire cable providing electrical power to a housing for an electrical device. A data cable connecting a pointing device to a computer is another example of a wire cable.

All electrical wire cables, whether they carry electrical power or data signals, should have some form of strain relief to prevent the wire cable from breaking or tearing loose from the housing to which it is attached. As shown in Figure 1, prior art strain relief devices 2 generally secure a wire cable 4 at a point of entry 6 into a housing 8. The wire cable 4 is solidly secured at a point of entry. The sheathing enclosing the wire conductors is typically bonded to the strain relief 2.

The drawback to this approach is that when a pulling force is applied to the wire cable 4, the sheathing will not move because it is bonded to the strain relief 2. However, the wire conductors inside the wire cable 4 stretch at a different rate than the sheathing, and tend to move when the pulling force is applied to the wire cable 4.

Therefore it can be appreciated that there is a significant need for a strain relief device that will secure a wire cable without causing it to break if a pulling force is applied.

Summary of the Invention

The invention is embodied in a strain relief device for a wire cable comprising a housing into which the wire cable is routed. The wire cable enters the housing through an aperture size to permit the entry of the wire cable. First and second posts secured within the housing are spaced such that the wire cable passes on one side of the first post and loops around the second post so that the wire cable presses against itself in an area near the first post. When strain is applied to the wire cable, the wire cable cinches itself around the posts.

In one embodiment the posts contain vertical ridges in the area where the wire cable contacts the posts. The ridges prevent slippage of the wire cable. A guide tunnel may be used to guide the wire cable into the aperture. A pair of guide posts may be used to route the wire cable from the first and second posts to circuitry within the housing.

Brief Description of the Drawings

Figure 1 is a prior art device used to relieve strain on a wire cable.

Figure 2 is a bottom plan view of a computer pointing device housing in which a strain relief device of the present invention is mounted.

Figure 3 is a top plan view of a housing bottom cover for the housing of Figure 2 with the bottom cover removed from the housing to show the inventive strain relief device.

Figure 4 is a perspective view of the bottom cover of the housing of Figure 2 showing the inventive strain relief from one side.

Figure 5 is a perspective view of the bottom cover of the housing of Figure 2 showing the inventive strain relief from another side.

Detailed Description of the Invention

As shown in Figures 2 and 3 for purposes of illustration, the present invention embodied in a strain relief device 18 mounted within a housing 20 for relieving strain on a wire cable 22. The inventive device prevents the wire cable 22 from breaking if a pulling force is applied to the wire cable.

As shown in Figure 2, a wire cable 22 is attached to the housing 20 which contains therewithin the device 18. The wire cable 22 enters the housing 20 through an aperture 24 in a bottom housing cover 23 sized to permit free passage of the wire cable. The size of the aperture 24 is such that the aperture itself does not provide strain relief.

As shown in Figure 3, the device 18 includes first and second posts 26 and 28, respectively, positioned within the housing and securely fastened to an inward side of the bottom housing 20. The posts 26 and 28 are integrally formed with and rigidly attached to the bottom housing cover 23 which is made of a plastic material. The posts 26 and 28 may alternatively be attached to the housing 20 by adhesives, screws or other well known fastening means. Alternatively, the posts 26 and 28 could be mounted on an intermediate platform, such as a printed circuit board, which in turn is securely fastened to the housing 20. The present invention is not limited by the manner in which the posts 26 and 28 are secured within the housing 20.

The posts 26 and 28 each have a retainer member 32 that is attached to the top of the post and projects outward beyond the posts to define a lip extending partially about the post. As will be described in more detail below, the wire cable 22 is wrapped about the posts 26 and 28. The member 32 prevents the wire cable 22 from slipping upward off the posts 26 and 28. In the presently preferred embodiment, the retainer member 32 only projects

outward from the posts 26 and 28 on their one side to permit the wire cable 22 to be more easily installed around the posts 26 and 28. As shown in Figure 4, posts 26 and 28 have a height, indicated by the reference numeral 30, which is greater than the diameter of the wire cable 22. Alternatively, the height 30 could be slightly less than the diameter of the wire cable 22 to provide a snug fit and help retain the wire cable 22 in position around the posts 26 and 28. If the wire cable 22 is a flat cable, the flat side of the wire cable fits under the retainer member 32 and flat against the posts 26 and 28. According to the principles of the present invention, the overall size of the strain relief 18 is approximately the size of the wire cable 22. The strain relief 18 may be used in situations where space is limited and there is a need for a low profile strain relief.

The posts 26 and 28 are positioned apart within the housing 20 so that there is sufficient space between the posts for the wire cable 22 to pass therebetween. The wire cable 22 has a free end 34 which is connectable to electronic circuitry (not shown) within the housing 20. The wire cable 22, starting from its free end 34, follows a path passing by (and in contact with a first side 26a of the first post 26. The path of the wire cable 22 then loops around the second post 28 so that the wire cable passes back on itself to form a loop with the wire cable contacting itself at a position 36 adjacent to the first side 26a of the first post 26. The wire cable 22 then passes straight from the second post 28 to and through the aperture 24 to the exterior of the housing 20. A cable tunnel 38 in the bottom housing cover 23 guides the wire cable 22 through the aperture 24. The first and second posts 26 and 28 are positioned relative to the aperture 24 so that the wire cable 22 will have a straight lengthwise portion 22a extending between the second post and the aperture and a bent lengthwise portion 22b bent toward the straight portion as a result of it passing around the first side 26a of the first post. The first side 26a of the first post 26 faces toward the straight portion 22a of the wire cable 22. As strain is applied to the wire cable 22 by applying a pulling force on the portion of the wire cable exterior of the housing 20, the first post 26 is positioned close enough to the straight portion 22a of the wire cable 22 that the straight portion will press against the bent portion 22b of the wire cable at the position area 36, and press the bent portion of the wire cable against the first side 26a of the first post 26, with a cinching force. Thereby, a self-tightening strain relief is provided. The greater the pulling force applied to the wire cable 22, the greater the cinching force that results. The wire cable 22 is strain relieved in a manner that does not require the wire cable to be solidly secured at the aperture where the wire cable enters the housing 20 as is typically done in the prior art such as shown in Figure 1.

The first post 26 is generally circular in cross-sectional shape, with its retainer member 32 projecting outward on the side of the first side 26a where the wire cable 22 contacts the first post 26 and extends over the wire cable to hold it in place. Alternatively, the retainer member 32 of the first post 26 could circumferentially fully about the first post 26. As best shown in Figure 4, the first post 26 has a plurality of ridges 40 on its first side 26a under its retainer member 32 to help prevent slippage of the wire cable 22 relative to the first post. The first side 26a of the first post 26 has an arcuate surface when viewed in perpendicular cross section. The ridges 40 are axially oriented with respect to the first post 26 so that the wire cable 22 extends substantially perpendicular to the ridges. As the pulling force is applied to the portion of the wire cable 22 exterior of the housing 20, the straight portion 22a presses against the bent portion 22b which, in turn, is pressed against the vertical ridges 40 to inhibit slippage. The greater the pulling force, the more the bent portion 22b is pressed against the vertical ridges. Alternatively, the ridges 40 could be replaced by teeth-like protrusions to inhibit slippage.

The second post 28 has a first side 28a with an arcuate surface in cross section as seen in Figure 5. The retainer member 32 for the second post 28 projects outward on the side of the first side 28a where the wire cable 22 contacts the second post and extends over the wire cable to hold it in place. As with the first post 26, the retainer member 32 of the second post 28 could extend circumferentially fully about the second post 28. The second post 28 also has a pair of generally flat second and third sides 28b and 28c, respectively, oriented with respect to each other to form a "V" shape. The third side 28c of the second post 28 is oriented with its flat surface in alignment with a side of the aperture 24 and the cable tunnel 38 so that the straight portion 22a of the wire cable 22 passes in a generally straight line path between the first side 28a of the second post and the aperture. The second side 28b of the second post 28 is angled to permit the wire cable 22 to bend more sharply around the second post 28 as it passes between the first post 26 and around the first side 28a of the second post 28. In addition, the V shape provides greater strength to inhibit breaking the post 28 when a pulling force is applied to the wire cable 22. The second post 28 also has a plurality of vertical ridges 40 on its first side 28a under its retainer member 32 to prevent slippage of the wire cable 22 by the second post.

First and second guide posts 44 and 46, respectively, are also integrally formed with housing cover 23. The guide posts 44 and 46 serve to guide the wire cable 22 as it passes from the first post 26 to the electronic circuitry (not shown) to which the free end 34 of the wire cable is connected within the housing 20. The first guide post 44 is located near one side of the cable tunnel 38 and positioned to define the path of the bent portion 22b so that it bends about the first surface 26a of the first post 26 in a direction away from the straight portion 22a. The second guide post 46 is spaced apart from the first guide post 44 at a distance to permit the wire cable 22 to pass therebetween.

It is noted that the first and second posts 26 and 28, and the first and second guide posts 44 and 46, may have shapes other than illustrated and described. Preferably, the first and second posts 26 and 28 have a shaped that minimizes sharp corners where the posts contact the wire cable 22 to avoid cutting the wire cable. The invention may also be practiced with more than the first and second posts 26 and 28 to provide a cinching force on the wire cable 22. For example, three posts may be spaced apart to accomplish the same purpose. Also, the guide posts 44 and 46 could be eliminated.

With the present invention, the wire cable 22 is securely fastened to the housing 20 in a manner that inhibits breakage of the wire cable at the point of retention by the housing as is common in the prior art. The inventive strain relief device 18 may be manufactured, and may be sized for different types and sizes of wire cables.

It is to be understood that even though a specific embodiment of the present invention has been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail, yet remain within the broad principles of the invention. Therefore, the present invention is to be limited only by the appended claims.

Claims

1. A strain relief device for a wire cable, comprising:

a housing into which the wire cable is routed, said housing containing an aperture sized to permit the entry of the wire cable into said housing; and

first and second spaced apart members within said housing spaced at a sufficient distance to permit the wire cable to pass therebetween, said members being positioned such that a first portion of the wire cable passes by and engages a first side of said first member, loops around said second member and a second portion of the wire cable passes by and engages said first portion of the wire cable outward of said first member to press against said first portion of the wire cable as a pulling force is applied to a third portion of the wire cable that exits said housing through said aperture, so that the wire cable cinches itself against said first member when said pulling force is applied to said third portion of the wire cable.

2. The device of claim 1 wherein said first and second members each contain a retainer member projecting outward from said first and second members in a direction to extend over the wire cable and prevent the wire cable from sliding upward and off of said first and second members.

3. The device of claim 1 wherein said first member has a plurality of ridges on a side surface of said first member to inhibit slippage of the wire cable past said first member.

4. The device of claim 3 wherein said ridges are oriented on said first member in a direction substantially perpendicular to the direction the wire cable is passed by said first side.

5. The device of claim 1 wherein said first side of said first member has an arcuate cross-section.

6. The device of claim 1 wherein said second member has an arcuate first side the wire cable passes by and engages as the wire cable loops around said second member.

7. The device of claim 6 wherein said second member has first and second flat sides forming a wedge, said first flat side facing said first member and deflecting the wire cable between said first and second members, said second flat side guiding the wire cable to said aperture.

8. The device of claim 1, further including a cable tunnel positioned between said second member and said aperture to guide the wire cable to said aperture.

9. The device of claim 1, further including a guide member to guide a first end of the wire cable to circuitry within said housing.

10. A strain relief device for a wire cable, comprising:

a housing into which the wire cable is routed;

an aperture in said housing sized to permit the entry of the wire cable into said housing; and

first and second spaced apart members within said housing spaced at a sufficient distance to permit the wire cable to pass therebetween, said members being positioned such that a first portion of the wire cable passes by and engages a first side of said first member, loops around said second member and a second portion of the wire cable passes by and engages said first portion of the wire cable outward of said first member to press against said first portion of the wire cable as a pulling force is applied to a third portion of the wire cable that exits said housing through said aperture, said first member applying a bending force to said first portion of the wire cable so that the wire cable cinches itself against said first member when said pulling force is applied to said third portion of the wire cable.

11. A strain relief device for a wire cable, comprising:

a housing into which the wire cable is routed;

first and second members positioned within said housing and positioned so that a first portion of the wire cable forms a first portion path when routed between said first and second members:

a third member positioned within said housing between said first and second members and applying a bending force to a second portion of the wire cable so that said second portion overlaps said first portion path of said first portion and said first portion presses said second portion of the wire cable against said third member, the wire cable looping around said second member with the second portion passing between said second member and said third member so that a pulling force on a third portion of the wire cable outside said housing causes said first portion to press against said second potion of the wire cable and causes the wire cable to cinch against said third member.

12. The device of claim 11 wherein said first member is a wall portion of said housing formed to define an aperture sized to permit the entry of the wire cable into said housing.

13. The device of claim 11, further including a guide member to guide a first end of the wire cable to circuitry within said housing.

14. The device of claim 11 wherein said second and third members each contain a retainer member projecting outward from aid second and third members to extend over the wire cable and prevent the wire cable from sliding upward off of said second and third members.

15. The device of claim 11 wherein said third member contains a frictional member on a side surface of said third member to inhibit slippage of the wire cable past said third member.

16. The device of claim 15 wherein said frictional member comprises a plurality of vertical ridges on said side surface.

17. The device of claim 15 wherein said side surface has an arcuate cross-section.

18. The device of claim 11 wherein said second member has an arcuate first side the wire cable passes by and engages as the wire cable loops around said second member.

19. The device of claim 11 wherein said second member has first and second flat sides forming a wedge, said first flat side facing said third member and deflecting the wire cable between said second and third members, said second flat side guiding the wire cable to said first member.

20. A method of providing strain relief device for a wire cable, comprising the steps of:

(a) routing the wire cable between first and second members positioned within a housing so that a first portion of the wire cable forms a substantially straight line path when routed between said first and second members; and

(b) looping the wire cable around said second member and through a space defined by said second member and a third member positioned within said housing at a point between said first and second members, said third member applying a bending force to a second portion of the wire cable so that said second portion overlaps said straight line path of said first portion, said first portion of the wire cable pressing said second portion against said third member so that a pulling force on a third potion of the wire cable outside said housing causes said first portion to press against said second potion of the wire cable and causes the wire cable to cinch against said third member.

21. A method of providing strain relief device for a wire cable, comprising the steps of:

(a) routing the wire cable between first and second members positioned within a housing so that a first portion of the wire cable forms a first portion path when routed between said first and second members; and

(b) looping the wire cable around said second member and through a space defined by said second member and a third member positioned within said housing at a point between said first and second members to bend the wire cable and form a curved portion of the wire cable so that said curved portion of the wire cable overlaps said first portion path, said first portion pressing said curved portion of the wire cable against said third member so that a pulling force on a third potion of the wire cable outside said housing causes said first portion to press against said second potion of the wire cable and causes the wire cable to cinch against said third member.

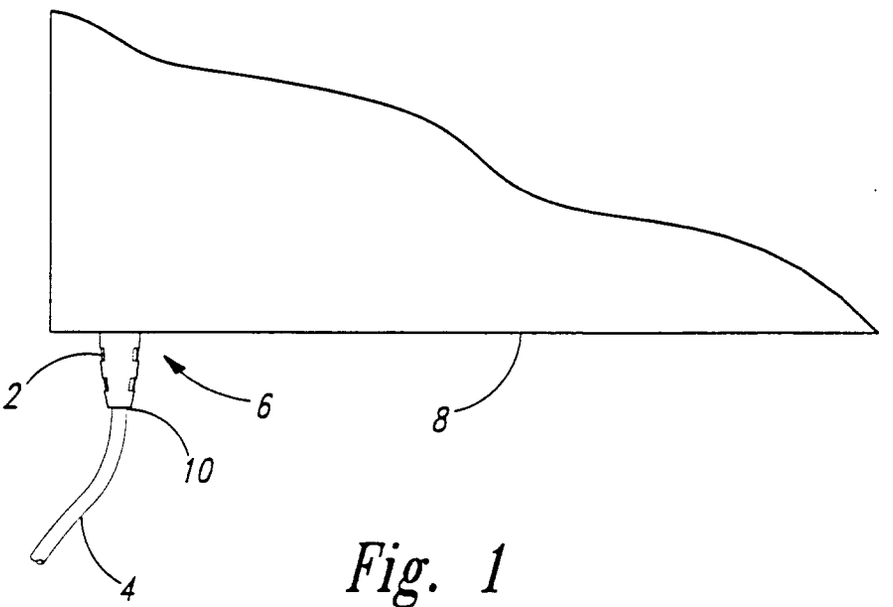

Fig. 1
(Prior Art)

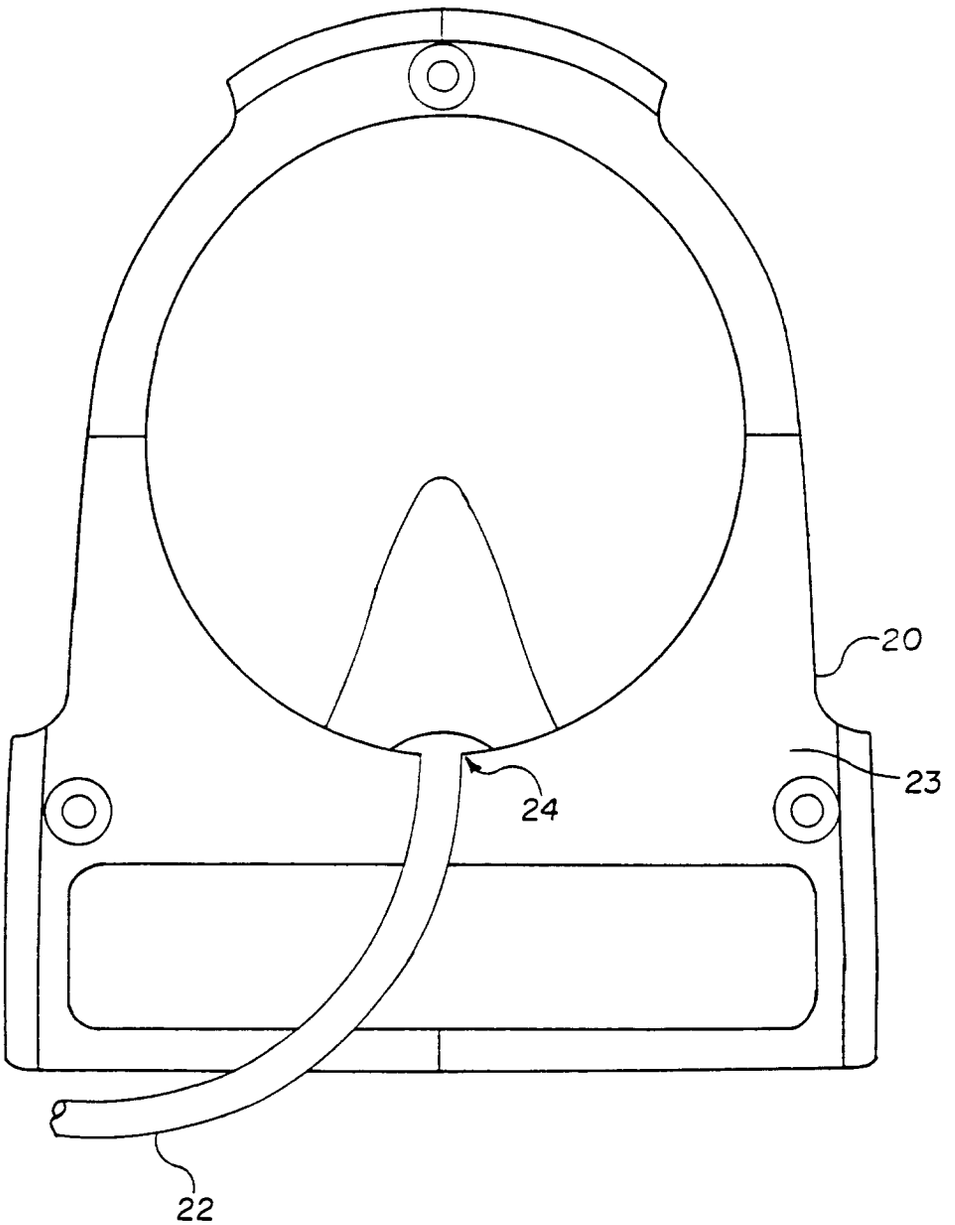

FIG. 2

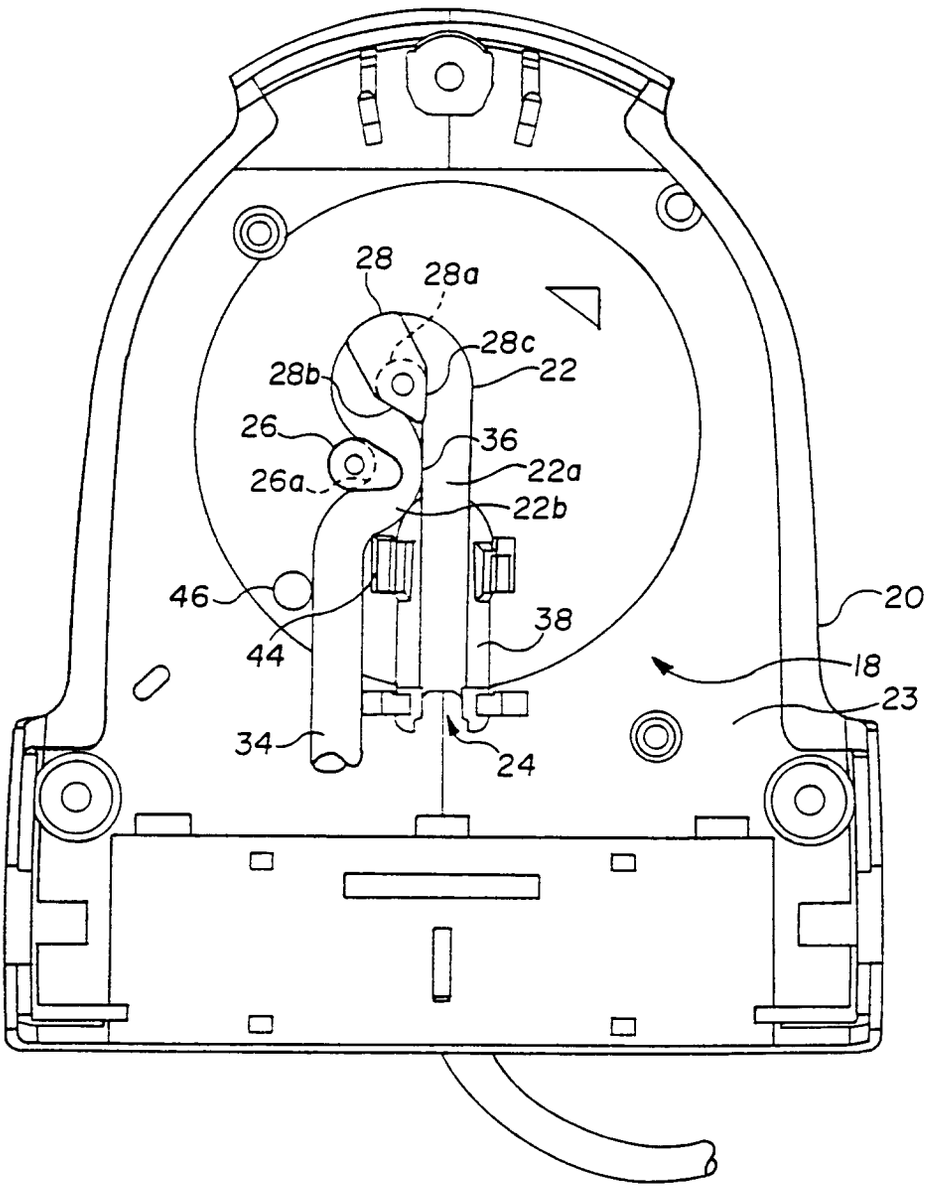

FIG. 3

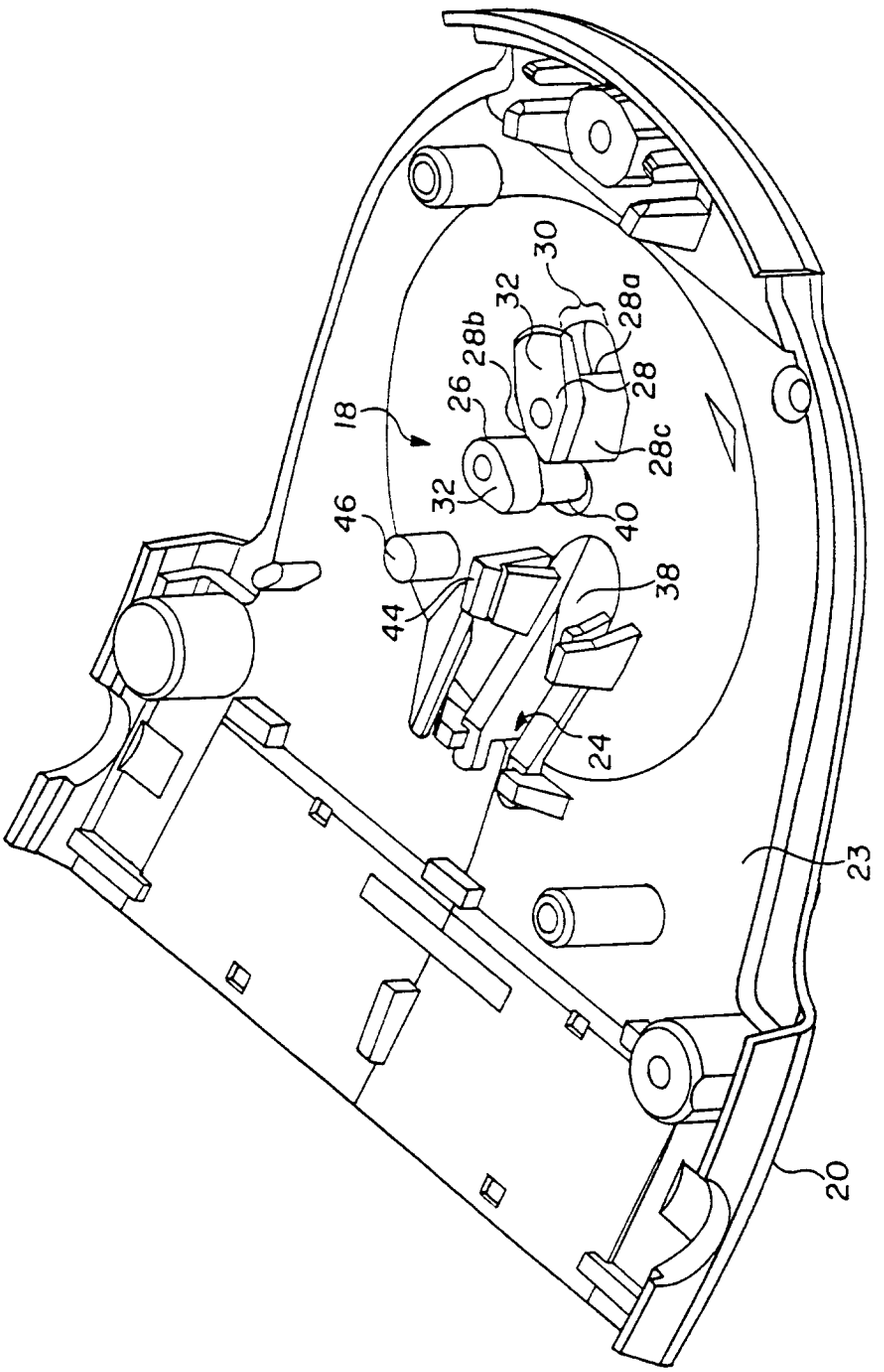

FIG. 4

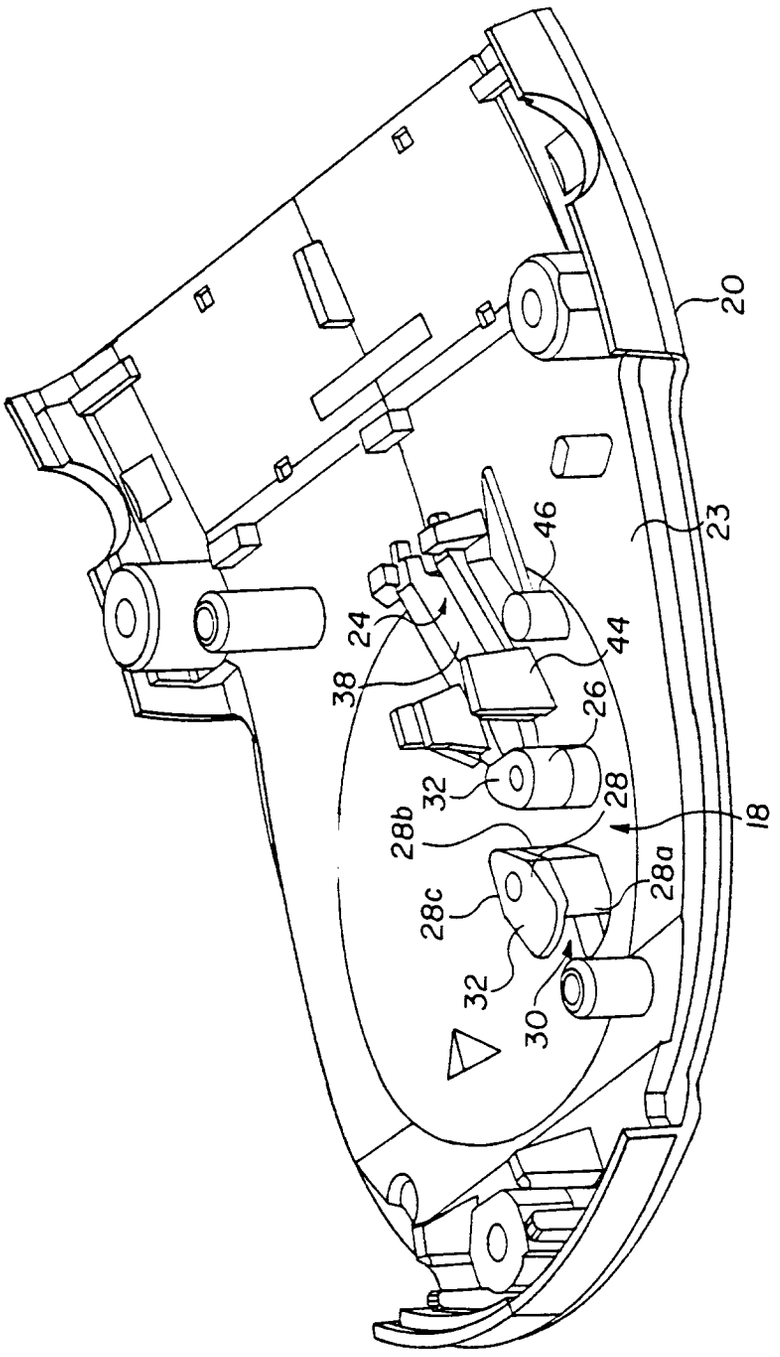

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 10 9754

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	FR-A-1 006 090 (WEHRMANN) * page 1, right column, line 19 - line 30; figure 3 *	1,10,11, 20,21	H01R13/585
A	DE-C-450 673 (DREEFS) * page 2, line 5 - line 36; figure 2 *	1,10,11, 20,21	
A	RESEARCH DISCLOSURE, no.339, July 1992, HAVANT GB, XP000316052 ANONYM 'Self-Tightening Cable Strain Relief Device' * the whole document *	1,10,11, 20,21	
A	GB-A-2 223 132 (HAYES) * page 6, line 11 - line 20; figure 4 *	1,10,11, 20,21	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5) H01R H05K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 October 1994	Horak, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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