



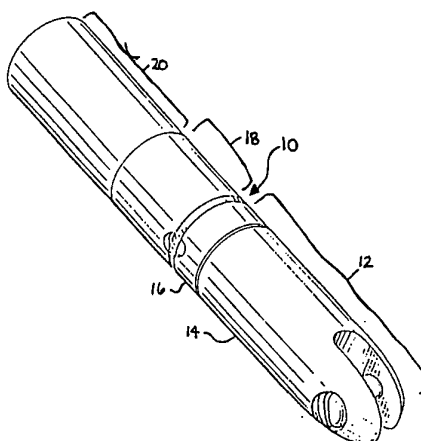
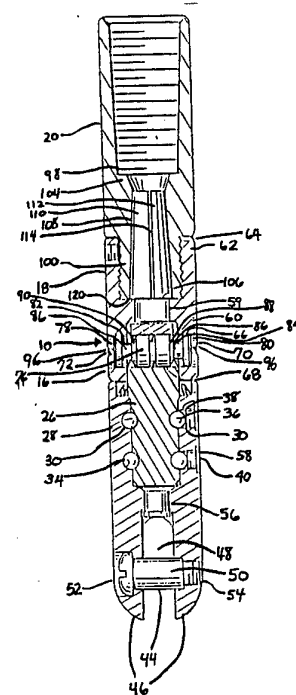
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : F16G 11/00	A1	(11) International Publication Number: WO 94/05929 (43) International Publication Date: 17 March 1994 (17.03.94)
(21) International Application Number: PCT/CA93/00364 (22) International Filing Date: 3 September 1993 (03.09.93) (30) Priority data: 940,912 4 September 1992 (04.09.92) US (71) Applicant: CANADA COUPLING, INC. [CA/CA]; 1292 Cliveden Avenue, Delta, British Columbia V3M 6G4 (CA). (72) Inventor: CLIFTON, David, G. ; 4608 Holly Park Wynd, Delta, British Columbia V4K 4S2 (CA). (74) Agent: KVAS, Christopher, J.; Kvas Miller, 577 Jarvis Street, Toronto, Ontario M4Y 2J3 (CA).		(81) Designated States: AU, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.

(54) Title: IMPROVED SWIVEL PULLING EYE WITH BREAKAWAY

(57) Abstract

An improved swivel pulling eye with breakaway combining a swivel component (12), a breakaway (18) and a cable holder (20) in a unitary body, providing a compact multi-functional device with advantages such as reduced cost and reduced assembly time as compared to prior devices of this nature. Its compact body reduces the chance of binding when pulling through arcuate areas or failure to rotate, as compared to an assembly of separate swivel, breakaway and pulling eye components.



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IMPROVED SWIVEL PULLING EYE WITH BREAKAWAY

Background of the Invention

1. Field of the Invention

This invention relates to swivel connector and pulling assemblies for
5 providing a rotatable connection between two lines, and more specifically to swivels
and pulling eyes including a breakaway feature..

2. Description of the Related Art

Swivel connectors are well known and have been produced in many
10 variations for years. U.S. Patent Application Ser. No. 07/479,847 and U.S. Patent
Application Ser. No. 07/764,816, a Continuation-In-Part of Ser. No. 07/479,847
disclose a swivel head and an improved swivel head, respectively, and are hereby
incorporated herein by reference.

U. S. Patent 4,687,365 issued August 18, 1987 to Promersberger is
15 representative of a swivel which employs bearings. Unfortunately, the design
shown in the patent is complicated to produce and includes many weak points.
Although the design is intended to provide failure, even a strengthening of the
breakaway shaft would not yield a very strong swivel. The threads may strip
causing total failure of the device. If the device was being used on a crane, the
20 load would fall to the ground, causing injury or death to anyone underneath the
load.

U. S. Patent 4,337,923 issued July 6, 1982 to Jackson A. Smith is
representative of a fiber optic pulling eye. In that patent, a central strength member
of the cable is exposed and inserted through a tubular body that includes a central
25 orifice into which the strength member is inserted. Opposed set screws are then
screwed into the body to contact and hold the central strength member in place.
The patent is an improvement over U.S. Patent 3,989,400 which utilized no central
strength member but instead crimped the actual wires or fibers to a central spike.

Pulling eyes of the swivel and non-swivel type have been built
30 including break-away features. In U.S. Patent 4,687,365 to Promersberger, a

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swivel is shown in which breakaway protection is created by a central load pin. That pin is oriented in the longitudinal axis of the device and may include a necked down region to decrease its breaking strength. The pin is threaded into the body of the device. When breakage occurs, it may be quite difficult to remove if the threads have smeared and welded the pin to the body.

Tremblay et al., U.S. Patent 4,635,989 discloses a cable clamp that includes several wedge pieces that cooperate with a threaded portion to a nut-like member to force the wedge piece onto a central strength member. If the threaded portion loosens or is not tight, the wedge loses its grip on the cable and the cable comes loose. This may necessitate withdrawing the entire cable being pulled back to its starting point.

U.S. Patent Application Ser. No. 07/585,649 is directed to a pulling eye with breakaway, and is hereby incorporated by reference. Although a device including a pulling eye with breakaway exists, the need exists for a compact unit which serves the functions of a swivel, a breakaway and a cable holder thereby facilitating passage through arcuate areas, around corners, facilitating winding and unwinding of the cable from a spool and decreasing the likelihood of binding and breaking of the pin or failure to rotate to relieve stress.

The art described in this section is not intended to constitute an admission that any patent, publication or other information referred to herein is "prior art" with respect to this invention, unless specifically designated as such. In addition, this section should not be construed to mean that a search has been made or that no other pertinent information as defined in 37 C.F.R. § 1.56(a) exists.

Summary of the Invention

The invention provides a swivel pulling eye with breakaway combining a swivel head connector, a breakaway and a cable holder in a unitary body, providing a compact multifunctional device with advantages such as reduced cost and reduced assembly time as compared to prior devices of this nature. Its compact body reduces the chance of binding when pulling through arcuate areas or

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failure to rotate, as compared to an assembly of separate swivel, breakaway and pulling eye components. Its compact nature enables it to easily go around corners and easily wind on and off a spool of cable, unlike prior combinations of devices which are bulky and cumbersome.

5 The swivel head component includes a main body with a connector at one end and a bore at the other end. A cooperating second body defines a central, elongated shaft which includes at least one groove which functions as an inner bearing race. The shaft is constructed to be inserted into the central bore of the main body. The main body includes at least one outer race which may be
10 aligned with the inner race of said shaft to form a complete raceway for ball bearings. No cage is required for the bearings. Instead, the bearings are inserted into the raceway after the shaft is inserted into the central bore. The bearings are inserted through an opening in the side of the main body. That opening is then closed off to prevent loss of the bearings and to prevent dirt from entering the
15 races.

 The invention further provides a load limiting breakaway device which will fail before a load is placed on the cable being pulled which is too high. The second body of the swivel component communicates with the breakaway component. The breakaway component includes a main body having a threaded
20 bore.

 The swivel component and the breakaway component are held together by a breakaway pin. A passageway is formed through the breakaway body and the shaft of the second body of the swivel component such that a pin may be inserted from the exterior of the breakaway body through the passageway to couple
25 the bodies together.

 The pin connecting the two bodies is the weak link which provides the load limiting function. It includes two spaced annular grooves as weak points where breakage is limited and will occur. The annular grooves are cut into the pin, spaced such that the distance between the grooves is equal to the diameter of the
30 second body of the swivel component. In this way, the weakest portion of the pin

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actually resides within the shaft of said second body up to the interface between the two bodies. Failure of the pin will occur at the intersection or within the shaft. The pin will not shear across the interface to allow smearing of metal which could freeze the bodies together. Rather, the bodies will part cleanly without jamming the pin in either body passageway.

Such a construction allows the rapid reuse of the bodies forming the device since there is no need to drill out the passageways to remove a sheared and smeared pin. With a straight pin having no grooves, the shear may occur across the interface, leaving metal to smear across the surface of both bodies when they separate. The ragged ends of the sheared pins deform and seal the pin sections to the passageways requiring either a difficult removal or discarding of the device.

The pulling body comprises an elongated hollow body with a threaded end which may be threaded into the bore of the breakaway body. The elongated hollow body houses a cable holder.

As always, a product such as a cable puller should be dependable, easy to use and economical. The multipurpose cable puller of the invention provides all of these features. The simple design of the invention makes it easier to assemble than previous devices incorporating separate swivel and breakaway pulling eye components. In addition its compact design provides an added advantage over existing assemblies in that it is one compact unit which facilitates winding and unwinding off a spool of cable, and facilitates passage through arcuate areas and around corners, as it is less likely to bind and break the pin or fail to rotate to relieve stresses, as could happen with the use of a separate swivel, breakaway and cable holding components in a chain.

Brief Description of the Drawings

A detailed description of the invention is hereafter described with specific reference being made to the drawings in which:

FIG. 1 is a perspective view showing the invention;

FIG. 2 is a side elevational view thereof;

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FIG. 3 is a sectional view thereof, taken along line 3-3 in Fig. 2, and;

FIG. 4 is a view similar to that of Fig. 2 thereof, with parts cut away showing parts broken according to the invention.

5

Description of the Preferred Embodiments

The invention shown in the Figures provides a swivel pulling eye with breakaway which may be used for any application involving the need for a swivel connector and a cable holder. It may be used to connect a pulling cable to
10 a bundle of optic fibers or as a connection in a fishing line. The device includes a breakaway portion which would cause separation at a predetermined load limit to protect the line being pulled.

The invention is suitable for any application involving the need to pull a cable which has a central strength member or outer strength members. More
15 ideally, it will be used to pull fragile cables comprised of fine wires or fiber optics. It is used to connect a bundle of cables to a pulling cable so the cable can be pulled through a underground pipe in a street or the like. Those applications sometimes involve pulls of cable that are a half a mile or more in length. Since the individual wires or fibers of the cable have little strength, the connection must distribute the
20 pulling force in a way that the individual fibers and wires are not stretched, broken or otherwise damaged during the pull.

The invention as generally shown in the Figures provides a swivel pulling eye with breakaway, generally indicated at 10, having a swivel component 12 which includes a main body 14 which mates with a second body 16, a
25 breakaway body 18 and a pulling body 20 joined to form a complete unit.

Referring now to Figure 3, second body 16 of Swivel component 12 includes a shaft 26 which includes at least one inner bearing race 28. Main body 14 of Swivel component 12 includes at least one outer race 30. When shaft 26 is inserted into the central bore 32 of main body 14, the outer races 30 align with the
30 inner races 28 to form a channel 34 for holding ball bearings 36. An opening 38

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is provided through the exterior of the main body 14 to each outer race 30 through which ball bearings 36 may be inserted. After the ball bearings 36 have been inserted to fill each of the races 34 formed by the inner and outer races 28,30, the opening 38 may be closed by means of a plate and a screw or simply a bolt, depending on the opening formed. In the preferred embodiment shown in the figures, opening 38 is closed by bolt 40.

Thus assembled, the main body 14 and second body 16 form swivel component 12 which cannot be separated without failure of every ball bearing in the device. One end of main body 14 includes a cable connector 44 to which cables may be attached. Although any type of cable connector may be used, the most preferred is a cable connector 44 is of the clevis type, having tangs 46, a gap 48 and a shackle pin 50. Pin 50 includes a socket head 52 and threads 54. It is secured into openings in tangs 46. Cable connector 44 has a paraboloid-like profile which makes the device less capable of catching on something when being pulled.

To assemble, a seal 56 is placed over shaft 26 and the shaft is inserted into bore 22. Each of the inner and outer races 28, 30 are aligned and ball bearings 36 are inserted into openings 38. After each race is filled, opening 38 is closed by bolt 40. Thus assembled, the swivel component is able to rotate freely and will take severe thrust loads. It will be seen that each of the bearings would need to fail before the swivel could part. The seal 58 may be of any type of seal designed to limit entry of foreign material into the races. The seal may be as simple as a heavy grease. In the most preferred embodiment, an oil seal is employed. In some applications, no seal may be needed.

The breakaway body 18 has a central bore 59 with a first end 60 and a second end 62 which includes a threaded aperture 64. Breakaway body 18 also includes a passageway 66 from one side of the body to the other which passes through central bore 59. The second body 16 of the swivel component 12 includes an opening 68 through the shaft 26 which may be aligned with passageway 66 such that a breakaway pin 70 may be inserted.

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Breakaway pin 70 provides the means for holding the swivel and pulling components together to form the completed device 10. When a breakaway pin 70 is inserted into the aligned path defined by passageway 66 and opening 68, the bodies are secured together as a unit. Preferably, pin 70 is kept within device 5 10 by an o-ring 72 which is snapped into an annular groove 74 formed in the breakaway body as shown. The o-ring construction is preferred since it is very simple and allows a different pin to be inserted quickly. Also, the o-ring makes the pin self-centering and provides some give when the pin shears.

Breakaway pin 70 provides breakage at the load specified, and further 10 minimizes smearing of metal (or other material if not metal) across the surfaces at the interface of central bore 59 and shaft 26 when pin 70 breaks. Ordinary shear pins "shear" and smear metal at the interface of the passageways of the two parts. The smeared metal may reconnect the members and makes removal of the broken pin much more difficult. Often, it may be difficult to tell where the passageway is 15 due to a smearing of metal over and beyond the passageway.

Pin 70 includes a central core 76 and opposed heads 78,80 which are of the same diameter. Two spaced annular grooves 82,84 are formed in the pin 70 to provide a defined breakage area. Preferably, grooves 82,84 define a breakaway neck 86 and sloping shoulders 88,90. At the head, there is preferably a sharp 20 transition zone from the breakaway neck to the head as shown in the drawings.

The break strength of pin 70 may vary to accommodate loads anywhere from about 200 pounds to about 1600 pounds. Fig. 4 depicts the breakage of the pin 70 when the load limit is exceeded. As can be seen, the breakage occurs at zones 92,94 which are spaced such that they equal the diameter 25 of the shaft 26. In this manner, the shearing action of the shaft and central bore interface is directly at zones 92,94. The weakest parts of pin 70 are immediately at the interface or inside shaft 26. This insures that any breakage will occur at the interface and into the shaft - not across the interface of the central bore and shaft.

Breakaway pin 70 includes a central groove 96 into which a colored 30 o-ring is snapped. The break strength of the pin, anywhere from a load of about

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200 pounds to a load of about 1600 pounds, is indicated by the color of the o-ring. It is therefore very easy to select the proper pin in a bin of mixed pins as the color stands out.

Very little of the material of pin 70 is left attached to heads 78,80.

- 5 Thus, little metal is available to smear across the interface of the parts as they come apart. The remainder of the pin within opening 68 of shaft 26 is not smeared across the parts. Rather, it is loosely within the opening and may be readily removed and readied for a different pin. This allows the device to be reused without the need to drill out a smeared pin. Grooves 82,84 provide defined
- 10 breakage points where breakage is directed and limited. The spacing ensures that the pin stubs may be readily removed.

- The use of o-ring 72 improves the performance of the device 10. The o-ring provides some flex or give when the pin 70 breaks, allowing the broken heads 78,80 to move further out lessening any chance that they may smear against
- 15 the interfacing walls of the main and second bodies.

- The pulling body 20 is comprised of a generally tubular hollow casing 98 threaded at its fore end 100. Threaded fore end 100 connects to threaded aperture 64 of breakaway body 18. Hollow casing 98 defines a cavity 104 which changes in dimension as shown in the figures. Most of the casing includes a wide
- 20 cavity. At the threaded end 100, the cavity is much narrower and is wider at the tip than at the base, such that a tapered opening 106 is formed.

- Pulling body 20 may include any type of cable holder known in the art, including any traditional cable clamp such as a crimping type. The invention may pull any type of cable, including cable with an outer strength member or an
- 25 inner strength member. In the preferred embodiment shown in the figures, pulling body 20 is adapted to pull a cable (not shown) which includes a central strength member formed of steel or fiberglass running the length of the cable. The cable includes a plurality of fine wires or fibers about the central strength member and typically is encased in a layer of insulation. A portion of an end of the cable is
- 30 pared away to expose only the central strength member. The cable is then fed into

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cavity 104 until the strength member passes through the tapered opening of threaded fore end 100. The strength member of the cable is then securely held to nipple 100 by a clamping collet 108 comprising a pair of wedges, 110,112 inserted about the strength member of the cable. Each wedge includes a longitudinal groove 114 as
5 shown in Fig. 3. Each wedge is essentially a half of a longitudinally split, frustoconical ferrule. Each wedge tapers from the head 116 to the narrower tip 118.

Wedges 110,112 are inserted against the strength member and into the tapered opening of threaded fore end 100 until tight. Fore end 100 is then
10 threaded onto the threaded aperture 64 of breakaway body 18, further forcing wedges 110,112 into the fore end of cavity 104, causing the grip on the central strength member to increase. Aperture 64 of breakaway body 18 preferably includes a shoulder or stop 120 which will abut against the wedges and force them further into the nipple opening as the main body is threaded to the hollow casing.
15 Most of the pulling force exerted on the cable is carried by the connection of the central strength member to the device. Any tendency for the cable to slip outwardly causes a tightening on the strength member due to the tapering opening and tapered wedge design. As the cable is pulled it becomes more tightly held to the pulling component 20.

20 The swivel pulling eye with breakaway may be made from a wide variety of materials, including stainless steel, brass and plastics. The materials chosen will depend on the application, environment and strength desired.

The unitary construction of the swivel pulling eye with breakaway provides the advantages of a swivel head connector, a breakaway and a cable holder
25 without the inconvenience of separate components. Other advantages include reduced cost and reduced assembly time as compared to prior devices of this nature. Its compact body reduces the chance of binding when pulling through arcuate areas or failure to rotate, as compared to an assembly of separate swivel, breakaway and pulling eye components. Its compact nature enables it to easily go around corners

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and easily wind on and off a spool of cable, unlike prior combinations of devices which are bulky and cumbersome.

While this invention may be embodied in many different forms, there are shown in the drawings and described in detail herein specific preferred
5 embodiments of the invention. The present disclosure is an exemplification of the principles of the invention and is not intended to limit the invention to the particular embodiments illustrated.

This completes the description of the preferred and alternate
embodiments of the invention. Those skilled in the art may recognize other
10 equivalents to the specific embodiment described herein which equivalents are intended to be encompassed by the claims attached hereto.

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WHAT IS CLAIMED IS:

1. A swivel pulling eye with breakaway for cables comprising:
 - a) a swivel component including
 - i) a main body having first and second opposing ends,
 - 5 (a) the first of said ends including a cable connector,
 - (b) the second of said ends defining a central bore including at least one outer bearing race within said central bore, said second end including at least one opening through the exterior surface into said central bore through which ball bearings may be inserted,
 - 10 ii) a second body defining an elongated shaft constructed and arranged to closely fit within the central bore of the main body, said second body having fore and aft opposing ends, said fore end including at least one inner bearing race, each of said at least one inner bearing races being positioned on said shaft such that each inner race on said fore end is aligned with an outer race on the
 - 15 second end of the main body when said shaft is inserted into said central bore of the main body, said shaft further including a passageway adjacent said aft end from one exterior surface to the opposing exterior surface through which a pin may be inserted;
 - iii) a plurality of ball bearings positioned within each of said races
 - 20 formed by the inner and outer races of said main body and said second body;
 - iv) means for closing said opening through which ball bearings may be inserted;
 - b) a breakaway body comprising
 - i) a main body defining a central bore having fore and aft
 - 25 opposing ends, the fore end including two openings through the exterior surface into said central bore, said openings being directly opposite one another such that a passageway is formed from one side of the main body to the other through which a breakaway pin may be inserted, said main body further including an annular groove connecting the exterior openings of said passageway and into which an o-
 - 30 ring may be inserted, and the aft end defining a threaded aperture;

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ii) a breakaway pin for insertion into the main body passageway and shaft passageway of the swivel component to lock the main body to the second body of the swivel component; and

5 iii) an O-ring snapped into the annular groove of said main body to prevent a breakaway pin from leaving the passageways formed in said main and second bodies such that an assembled device will stay together; and

 c) a pulling body comprising a generally cylindrical elongated hollow casing having fore and aft ends, said fore end including threads constructed and arranged to thread into and engage with the threaded aperture of the breakaway
10 body, and a cable holding means.

2. The swivel pulling eye with breakaway of claim 1 wherein said breakaway pin includes two annular rings spaced from each other such that the distance between the rings is equal to the diameter of said shaft, such that shearing
15 of said pin will occur inside the shaft passageway, said rings providing break points in the pin.

3. A swivel pulling eye with breakaway for cables comprising:

- 20 a) a swivel component including
- i) a main body having first and second opposing ends,
 (a) the first of said ends including a cable connector,
 (b) the second of said ends defining a central bore including at least one outer bearing race within said central bore, said second end including at least one opening through the exterior surface into said central bore
25 through which ball bearings may be inserted,
- ii) a second body defining an elongated shaft constructed and arranged to closely fit within the central bore of the main body, said second body having fore and aft opposing ends, said fore end including at least one inner bearing race, each of said at least one inner bearing races being positioned on said shaft
30 such that each inner race on said fore end is aligned with an outer race on the

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second end of the main body when said shaft is inserted into said central bore of the main body, said shaft further including a passageway adjacent said aft end from one exterior surface to the opposing exterior surface through which a pin may be inserted;

5 iii) a plurality of ball bearings positioned within each of said races formed by the inner and outer races of said main body and said second body;

 iv) means for closing said opening through which ball bearings may be inserted; and

 v) means for sealing the connection between said main body and
10 said second body from elements;

 b) a breakaway body comprising

 i) a main body defining a central bore having fore and aft
opposing ends, the fore end including two openings through the exterior surface into
said central bore, said openings being directly opposite one another such that a
15 passageway is formed from one side of the main body to the other through which
a breakaway pin may be inserted, said main body further including an annular
groove connecting the exterior openings of said passageway and into which an o-
ring may be inserted, and the aft end defining a threaded aperture;

 ii) a breakaway pin for insertion into the main body passageway
20 and shaft passageway of the swivel component to lock the main body to the second
body of the swivel component, said pin including two annular rings spaced from
each other such that the distance between the rings is equal to the diameter of said
shaft, such that shearing of said pin will occur inside the shaft passageway, said
rings providing break points in the pin; and

25 iii) an O-ring snapped into the annular groove of said main body
to prevent a breakaway pin from leaving the passageways formed in said main and
second bodies such that an assembled device will stay together; and

 c) a pulling body comprising a generally cylindrical elongated hollow
casing having fore and aft ends, said fore end including threads constructed and

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arranged to thread into and engage with the threaded aperture of the breakaway body, and a cable holding means.

4. The swivel pulling eye with breakaway of claim 3 wherein said inner
5 races are machined into the shaft and said outer races are machined into the interior walls forming the central bore of said swivel body.

5. The swivel pulling eye with breakaway of claim 3 wherein said
swivel body includes a grease fitting through which lubricant may be inserted to
10 contact any bearings within said device.

6. The swivel pulling eye with breakaway of claim 3 wherein the hollow
casing of said pulling body is constructed and arranged such that the opening
therethrough is wider at the fore end and tapers to a narrower opening intermediate
15 the aft end.

7. The swivel pulling eye with breakaway of claim 6 wherein the cable
holding means includes a pair of wedge bodies constructed and arranged to be
insertable into said hollow casing body from said fore end, said wedges each
20 including a longitudinal groove which when both wedges are held together define a central bore through which a central strength member of a cable may be inserted;
said wedges being tapered to include a narrow and a wide end, such that together
the wedges may be inserted into said casing fore end but may not pass therethrough;
said wedges being further constructed and arranged such that when a cable having
25 an outwardly extending central strength member is inserted into the hollow casing from the aft end, said strength member is gripped by the grooves of said wedges
such that a withdrawing force applied to said cable pulls said wedges further into said tapered fore end thereby tightening the grip on said strength member.

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8. A swivel pulling eye with breakaway for cables containing a central strength member comprising:

a) a swivel component including

i) a main body having first and second opposing ends,

5 (a) the first of said ends including a clevis type cable connector having tangs with openings, a gap and a shackle pin secured into the openings in said tangs, said shackle pin including a socket head and threads,

(b) the second of said ends defining a central bore including at least one outer bearing race within said central bore, said second end
10 including at least one opening through the exterior surface into said central bore through which a ball bearing may be inserted,

ii) a second body defining an elongated shaft constructed and arranged to closely fit within the central bore of the main body, said second body having fore and aft opposing ends, said fore end including at least one inner bearing
15 race, each of said at least one inner bearing races being positioned on said shaft such that each inner race on said fore end is aligned with an outer race on the second end of the main body when said shaft is inserted into said central bore of the main body, said shaft further including a passageway from one exterior surface to the opposing exterior surface through which a pin may be inserted;

20 iii) a plurality of ball bearings positioned within each of said races formed by the inner and outer races of said main body and said second body;

iv) means for closing said opening through which ball bearings may be inserted; and

v) means for sealing the connection between said main body and
25 said second body from elements;

b) a breakaway body comprising

i) a main body defining a central bore having fore and aft opposing ends, the fore end including two openings through the exterior surface into said central bore, said openings being directly opposite one another such that a
30 passageway is formed from one side of the main body to the other through which

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a breakaway pin may be inserted, said main body further including an annular groove connecting the exterior openings of said passageway and into which an o-ring may be inserted, and the aft end defining a threaded aperture;

5 ii) a breakaway pin for insertion into the main body passageway and shaft passageway of the swivel component to lock the main body to the second body of the swivel component, said pin including two annular rings spaced from each other such that the distance between the rings is equal to the diameter of said shaft, such that shearing of said pin will occur inside the shaft passageway, said rings providing break points in the pin; and

10 iii) an O-ring snapped into the annular groove of said main body to prevent a breakaway pin from leaving the passageways formed in said main and second bodies such that an assembled device will stay together; and

 c) a pulling body comprising

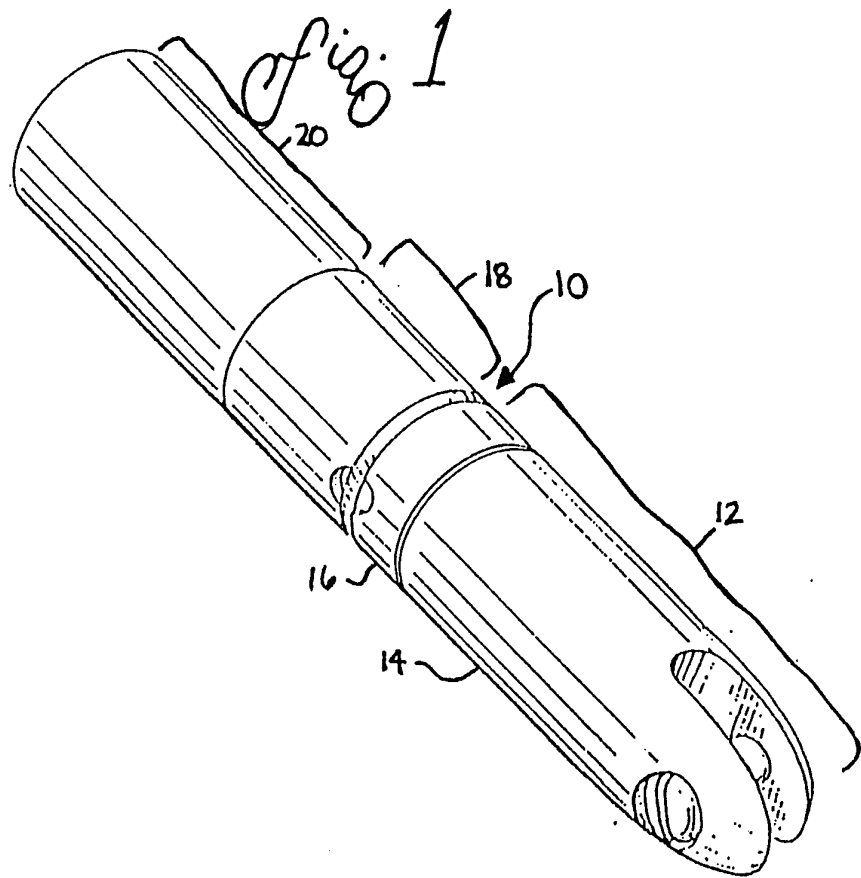
 i) a generally cylindrical elongated hollow casing having fore
15 and aft ends, said fore end including threads constructed and arranged to thread into and engage with the threaded aperture of the breakaway body, said hollow casing being constructed and arranged such that the opening therethrough is wider at the fore end and tapers to a narrower opening intermediate the aft end; and

 ii) a pair of wedge bodies constructed and arranged to be
20 insertable into said hollow casing body from said fore end, said wedges each including a longitudinal groove which when both wedges are held together define a central bore through which a central strength member of a cable may be inserted; said wedges being tapered to include a narrow and a wide end, such that together the wedges may be inserted into said casing fore end but may not pass therethrough;
25 said wedges being further constructed and arranged such that when a cable having an outwardly extending central strength member is inserted into the hollow casing from the aft end, said strength member is gripped by the grooves of said wedges such that a withdrawing force applied to said cable pulls said wedges further into said tapered fore end thereby tightening the grip on said strength member.

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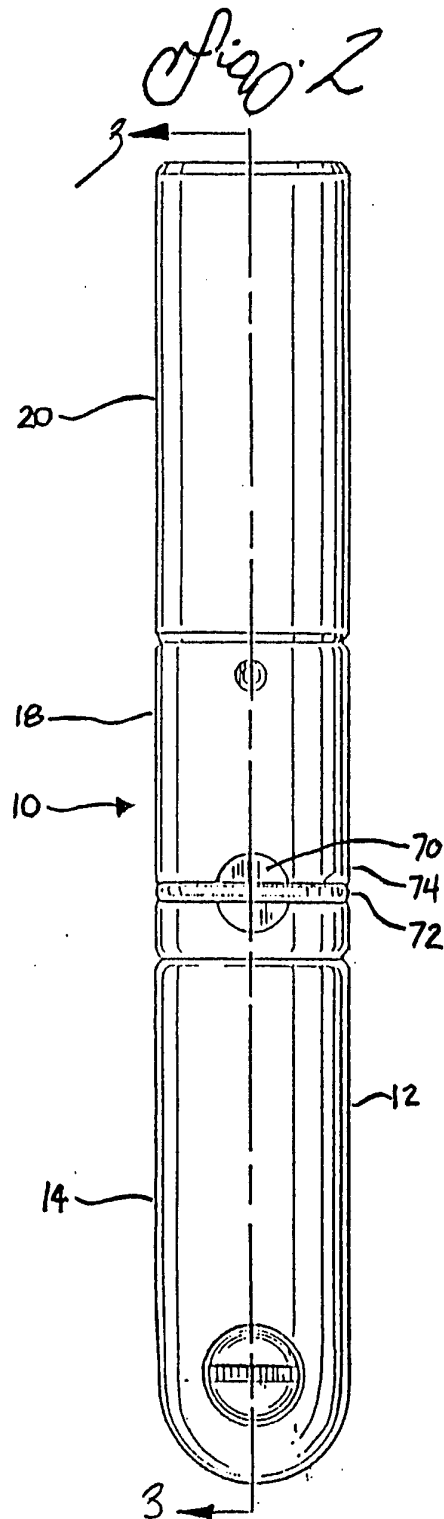
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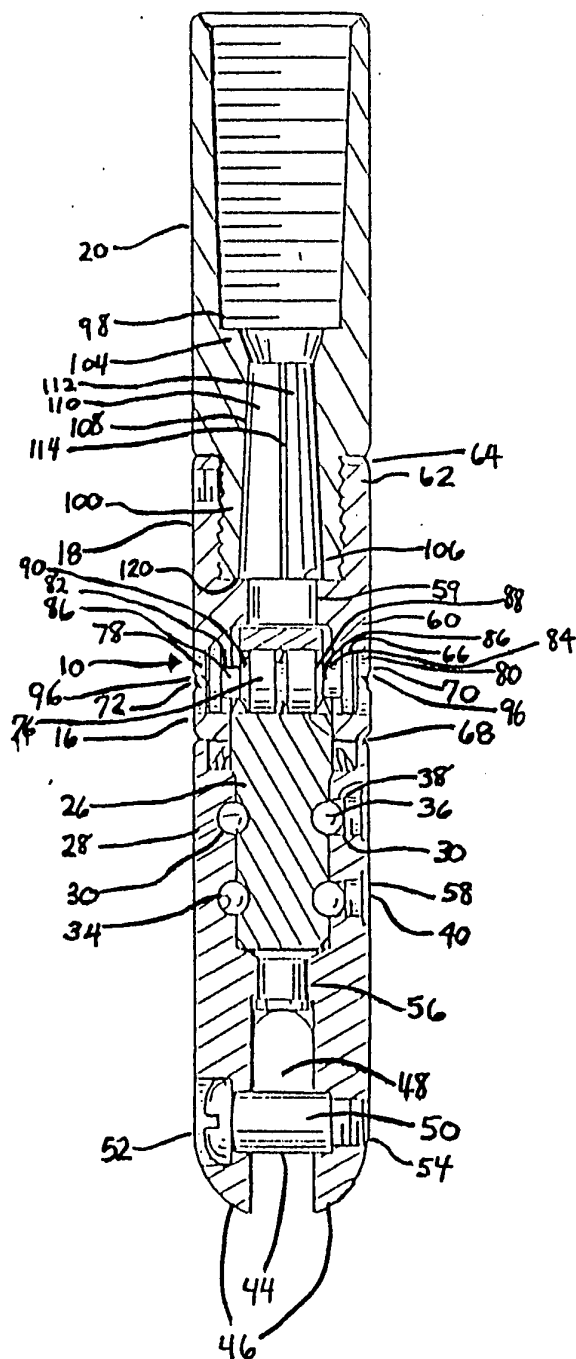
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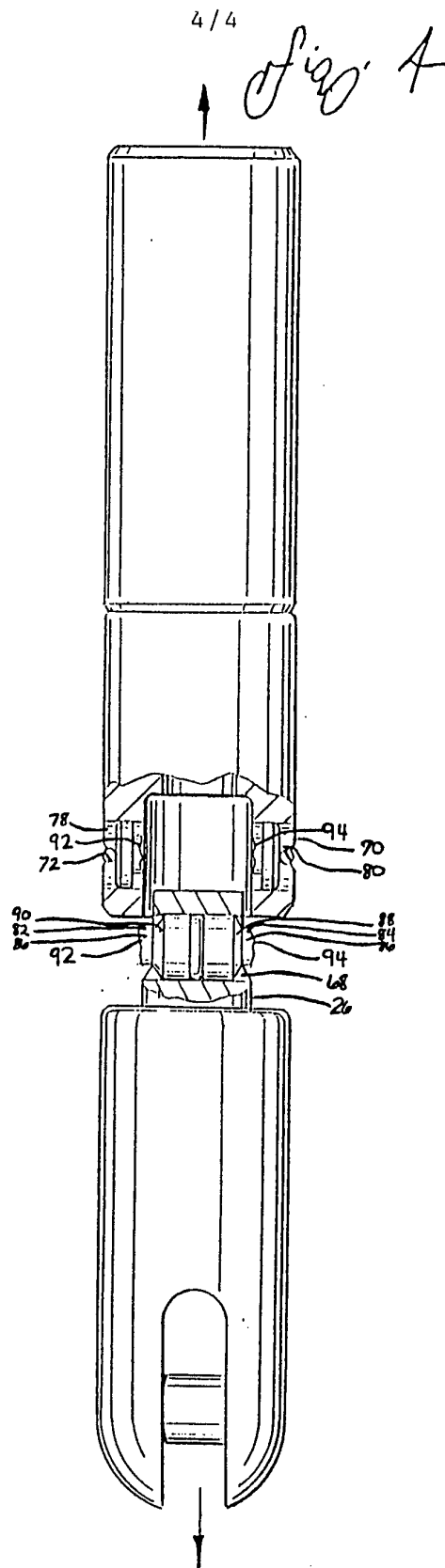


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fig. 3

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 93/00364

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.C1.5 F 16 G 11/00		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.C1.5	F 16 G G 02 B H 02 G	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ^o	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	CA,A,1221525 (TEKNA) 12 May 1987, see page 3, line 26 - page 5, line 27; figures 1,3 ---	1,3,8
A	US,A,4687365 (PROMERSBERGER) 18 August 1987, see column 2, line 4 - column 4, line 41; figures 2,7 (cited in the application) ---	1,3,8
A	USPTO, Official gazette, page 202, 7 September 1909, see abstract no. US933625, & US,A,933625 (CLARKSON) ---	1,3,4,8
A	DE,U,6904695 (THALER) 19 June 1969, see page 6, lines 1-21; figure 1 --- -/-	1,3,6,7, 8
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>^o Special categories of cited documents : ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
10-11-1993		01.12.93
International Searching Authority		Signature of Authorized Officer
EUROPEAN PATENT OFFICE		C. Baron

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,5122007 (SMITH) 16 June 1992, see whole document (cited in the application) ---	1,2,3,8
A	US,A,2633375 (WILCOXON) 31 March 1953, see whole document ---	1,3,4,5 ,8
A	GB,A, 635558 (BUTLER) 12 April 1950, see page 3, lines 16-26; figures 1,4 ---	7,8
A	US,A,4635989 (TREMBLAY) 13 January 1987 (cited in the application) ---	
A	US,A,3989400 (SMITH) 2 November 1976 (cited in the application) ---	
A	US,A,4337923 (SMITH) 6 July 1982 (cited in the application) -----	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

CA 9300364

SA 78781

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 24/11/93
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CA-A- 1221525	12-05-87	None	
US-A- 4687365	18-08-87	None	
DE-U- 6904695	19-06-69	None	
US-A- 5122007	16-06-92	WO-A- 9317476	02-09-93
US-A- 2633375		None	
GB-A- 635558		None	
US-A- 4635989	13-01-87	None	
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		AU-A- 1605576	26-01-78
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		FR-A,B 2319225	18-02-77
		GB-A- 1516454	05-07-78
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		JP-A- 52012493	31-01-77
		JP-B- 59036486	04-09-84
		SE-B- 424489	19-07-82
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US-A- 4337923	06-07-82	CA-A- 1138176	28-12-82