Sept. 23, 1969 J. A. WILSON 3,468,549

LINE WIPER

Filed Nov. 26, 1965

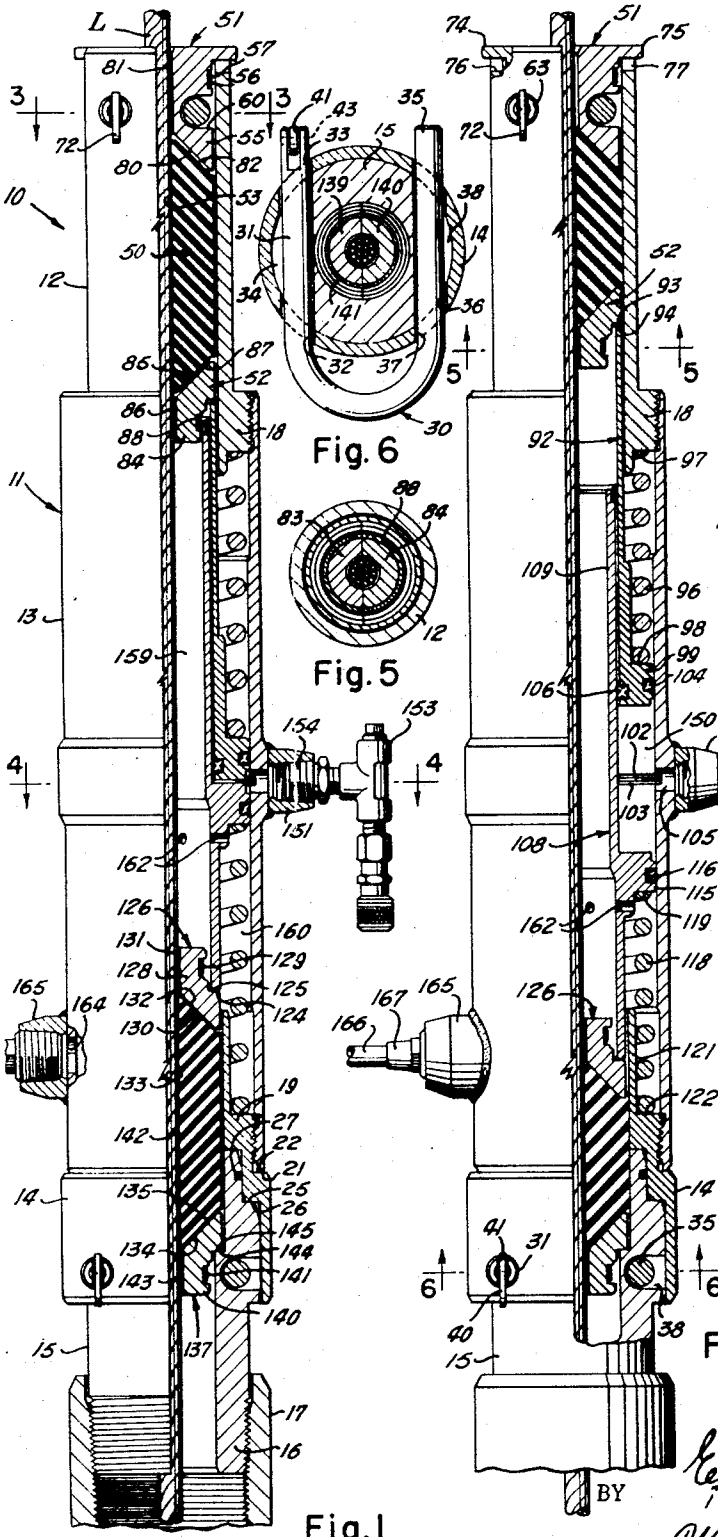


Fig. 1

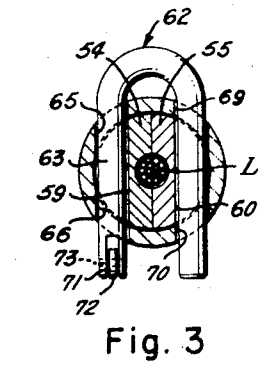


Fig. 3

Fig. 6

Fig. 5

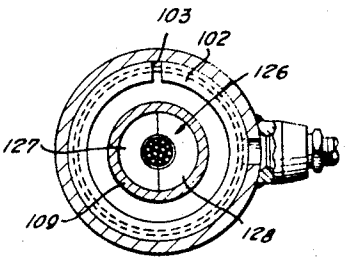


Fig. 4

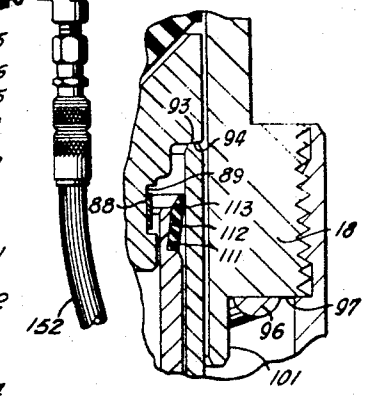


Fig. 7

Fig. 2

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LINE WIPER

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ABSTRACT OF THE DISCLOSURE

A stripping device connectable to an end of a flow conductor through which a flexible wire line is movable into and from the conductor for closing the annular space therebetween and wiping or stripping liquids from the line during its movement from the flow conductor.

This invention relates to devices through which an elongate member is movable into and from a flow conductor which limit flow of fluids from the flow conductor past the elongate member and which wipe or strip liquids carried by the elongate member during its withdrawal from the flow conductor.

An object of this invention is to provide a new and improved device securable to the upper end of a flow conductor, such as a string of well tubing or casing, through which an elongate member, such as a flexible braided or solid wire line, a small diameter pipe, or a rod, is movable into and from the relatively large diameter flow conductor which has resilient means for engaging such elongate member to restrict fluid flow from the flow conductor and for wiping or stripping liquids carried by the elongate member during its movement from the large flow conductor.

Another object is to provide a device of the type described having a housing provided with two longitudinally spaced resilient elements which are longitudinally compressible for movement into engagement with the elongate member, wherein the lower element is employed to restrict fluid flow from the flow conductor past the elongate member and the upper element is used to remove liquids from the cavities or interstices of the elongate member which are carried upwardly therewith.

Still another object is to provide a device of the type described wherein the resilient elements are simultaneously longitudinally compressed by a pair of pistons by fluid pressure introduced into the housing from the exterior thereof.

A further object is to provide a device of the type described wherein the resilient elements may be easily removed, as when replacement of the resilient elements is made necessary due to their wear without requiring removal of the device off the elongate member.

A still further object is to provide a device having an elongate tubular housing whose longitudinal passage has opposite end portions of reduced internal diameter in which are disposed resilient tubular seal elements and an intermediate portion in which are disposed a pair of pistons which are movable longitudinally in opposite directions to simultaneously compress the two resilient elements into operative engagement with an elongate member as it moves therethrough.

Still another object is to provide a device of the type described having means for exhausting fluids from the housing which may move upwardly with or past the elongate member through the lower resilient element.

Additional objects and advantages of the invention will be readily apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIGURE 1 is a vertical, partly sectional view, with some parts broken away, of a device embodying the invention mounted on the upper end of a flow conductor and showing the resilient elements in their normal non-compressed condition;

FIGURE 2 is a view similar to FIGURE 1 showing the resilient elements in longitudinally compressed operative condition;

FIGURE 3 is a sectional view taken on line 3—3 of FIGURE 1;

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 1;

FIGURE 5 is a sectional view taken on line 5—5 of FIGURE 2;

FIGURE 6 is a sectional view taken on line 6—6 of FIGURE 2; and

FIGURE 7 is a fragmentary enlarged sectional view of a portion of the device.

Referring now to the drawings, the device **10** embodying the invention includes a housing **11** having a top section **12**, a middle cylinder section **13**, a connector section **14** and a bottom section **15**. The bottom housing section has a bottom end portion **16** which is threadable into the top end portion of a flow conductor **17**, such as a well tubing or casing. The top housing section **12** has an external annular flange **18** which is threaded in the upper end of the cylinder housing section and the connector housing section **14** has an internally threaded intermediate portion **19** on which is threaded the lower end of the cylinder housing section. Downward movement of the cylinder section on the connector section is limited by the engagement of the annular bottom end shoulder or surface **21** of the cylinder housing section with the upwardly facing annular shoulder **22** of the connector section.

The upper portion of the bottom housing section extends upwardly into the connector section, its upward movement relative thereto being limited by the engagement of its annular external shoulder **25** with the downwardly facing internal annular shoulder **26** of the connector section. An O-ring **27** disposed in an external annular recess of the bottom housing section seals between the bottom and connector housing sections.

The connector housing section is releasably secured to the bottom housing section by a connector yoke **30** whose leg **31** extends through the aligned apertures **32** and **33** of the connector section and an external recess **34** of the bottom housing section and whose other leg **35** extends through the aligned recesses **36** and **37** of the connector housing section and the recess **38** of the base. The connector yoke is releasably held against withdrawal from the connector and bottom housing sections by a latch **40** which extends through an external longitudinal slot **41** in the leg **31** and is pivotally mounted on a pin **43** which extends through the slot. The latch is mounted on the pin at a point spaced above its center of gravity so that the latch is normally held by gravity in the perpendicular position illustrated in FIGURES 1 and 2 wherein it will engage the outer surface of the connector portion to prevent withdrawal of the yoke. The latch may be pivoted into longitudinal alignment with the leg **31** whereupon the yoke may be withdrawn from the bottom and connector housing sections to permit upward movement of the connector, cylinder and top housing sections from the bottom housing section.

A tubular resilient element **50** is mounted in the top housing section between upper and lower aligned guides **51** and **52**, respectively. The resilient element is provided with a longitudinal slit to permit insertion of a line L into its longitudinal passage **53**. The upper guide has two complementary sections **54** and **55** releasably secured

together by a resilient split retainer band 56 disposed in an external annular recess 57 of the upper guide above oppositely opening recesses 59 and 60 of its sections 54 and 55, respectively. The upper guide is releasably held against movement in the housing by a connector yoke 62 whose leg 63 extends through the aligned apertures 65 and 66 of the housing section and the recess 59 of the guide section 54 and whose other leg 68 extends through the aligned recesses 69 and 70 of the top housing section and the recess 60 of the guide 55. The end of the leg 63 is provided with a longitudinal slot 71 through which extends the latch 72. The latch is pivotally mounted on a pin 73 rigidly secured to the leg 63 and which extends through its slot 71. The latch is mounted on the pivot pin at a location above its center of gravity so that the latch normally assumes the vertical position illustrated in FIGURES 1 and 2 to prevent withdrawal of the connector yoke from the housing. When the latch is pivoted to a position where it is in longitudinal alignment with the leg 63 of the connector yoke, the connector yoke may be withdrawn from the housing to permit removal of the upper guide.

The two sections 54 and 55 of the upper guide have radially outwardly extending lugs 74 and 75 which extend outwardly through slots 76 and 77, respectively, of the top housing section. The bottom surface 80 of the upper guide 51 is of frusto-conical shape sloping downwardly and outwardly from the central vertical passage 81 of the guide and conforms to the frusto-conical top end surface 82 of the resilient element 50.

The lower guide 52 also has two complementary sections 83 and 84 and a frusto-conical surface 85 which extends upwardly and outwardly from its central vertical passage 86 and engages the correspondingly shaped bottom end surface 87 of the resilient element 50. The two sections of the lower guide are releasably secured to one another by a split resilient retainer band 88 disposed in a suitable external annular recess 89 of the lower guide.

The lower guide 52 is movable upwardly in the housing by an upper tubular piston 92 whose top annular end surface 93 engages the downwardly facing annular shoulder 94 of the lower guide. The upper piston is biased downwardly by a spring 96 whose top end engages the bottom annular shoulder 97 of the external flange 18 of the top housing section and whose bottom end engages the top annular surface 98 of the external annular flange 99 of the upper piston. The upper housing section has a dependent reduced spring retainer portion 101 about which the upper end portion of the spring is disposed. Downward movement of the upper piston in the housing is limited by a split snap ring 102 whose outer portions are received in an internal annular recess 103 of the cylinder housing section 13 and whose inner portions extend inwardly of the internal surfaces of the cylinder housing section.

The piston flange has an external annular recess in which a suitable resilient seal means 104, such as a "quad" ring, is disposed which seals between the piston flange and the cylinder housing section above its lateral port 105. The piston also has an internal annular recess in which is disposed a similar seal means 106 which seals between the upper piston and the external surface of a lower tubular piston 108 whose top reduced portion 109 extends upwardly into the upper piston. A resilient wiper ring 111 disposed in an externally and upwardly opening recess 112 of the lower piston is secured to the lower piston in any suitable manner, as by bonding, and adhesive or the like, or may be retained thereon by the frictional engagement of the ring with the lower piston. The upwardly and outwardly extending upper lip 113 of the wiper ring engages the internal surfaces of the upper piston to prevent passage of foreign material, such as sand and the like, between the two pistons.

The external annular flange 115 of the lower piston has an external annular recess in which is disposed a seal means 116 which seals between the piston flange and the internal surface of the cylinder housing section below the lateral port 105 thereof. Upward movement of the lower piston in the housing is limited by the engagement of the top surface of its flange 115 with the bottom surface of the retainer ring 102. The lower piston is biased upwardly by a spring 118 whose top end engages the bottom annular surface 119 of the flange 115, whose lower end portion is disposed about the upper reduced portion 121 of the connector housing section 14 and whose bottom end engages the top annular shoulder 122 thereof. The bottom end shoulder or surface 124 of the lower piston engages the upwardly facing shoulder 125 of an upper guide 126. The guide 126 is identical in structure to the lower guide 52 and has two sections 127 and 128 which are releasably secured together by a resilient split retainer band 129. The bottom frusto-conical annular surface 130 of the guide 126 extends downwardly and outwardly from its central vertical passage 131 and engages the frusto-conical top end surface 132 of the tubular lower resilient member 133. The bottom frusto-conical surface 134 of the lower resilient element 133 engages the frusto-conical top end surface 135 of the lower guide 137. The guide 137 is identical in structure to the guides 52 and 126, and has two sections 139 and 140 releasably secured to one another by a resilient split retainer band 141. The resilient element 133 and the guide 137 have central vertical passages 142 and 143, respectively. Downward movement of the lower guide 137 is limited by the engagement of its downwardly facing shoulder 144 with the upwardly facing internal shoulder 145 of the bottom housing section 15. The resilient element has a longitudinal slit through which the line L may be inserted into its central passage 142.

An internally threaded tubular nipple 151 is rigidly secured to the housing, as by welding, and about the lateral port 105 by means of which fluid may be introduced into or exhausted from the annular housing chamber 150 between the two piston flanges. A flexible conduit 152 is connected to the nipple by a suitable fitting assembly 153 whose end portion 154 is threaded in the nipple.

Fluid from the longitudinal passage 159 of the lower piston may flow outwardly into the annular passage 160 between the housing and the lower piston through the space between adjacent vertical surfaces of the two guide sections 127 and 128 and also through the apertures 162 of the lower piston located below its external flange 115. The liquids may flow out of the chamber 160 through a lateral port 164 of the cylinder housing section, a nipple 165 secured to the cylinder housing section, as by welding and a conduit 166 connected to the nipple by a suitable fitting 167 threaded in the nipple.

In use when certain well operations are to be performed which require that tools be moved through a flow conductor 17 such as a string of tubing by means of a flexible line such as the braided wire line L, the bottom housing section 15 is secured to the top end of the flow conductor by means of its external threaded bottom end portion 16. The line is then passed downwardly through the assembly of the connector, cylinder and top housing sections and the pistons, mounted therein. The lower guide 137 is positioned on the line by moving the split ends of the retainer band 141 into alignment with the adjacent ends of the two guide sections 139 and 140 whereupon the two sections of the guide may be pivoted to provide a passage through which the line is moved into its vertical passage 143. The resilient force of the retainer band 141 then holds the two guide sections together and the guide is then moved downwardly into the bottom housing section until its downward movement is arrested by the engagement of its shoulder 144 with the internal shoulder 145 of the bottom housing section. The resilient element 133 is then disposed about the line by distorting the element outwardly at its longitudinal slit to provide the radial passage through which the wire line L is passed into the passage 142 of the resilient element. The upper guide 126 is then installed on the wire line above the resilient element 133

in the same manner as described in connection with the lower guide **137**. The resilient element **133** and the guide **137** are moved downwardly until downward movement of the resilient element **133** is arrested by the engagement of its bottom conical end surface **134** with the shoulder **135** of the lower guide. The assembly of the lower connector housing section **14**, the cylinder housing section **13** and the top housing section together with the two pistons and their biasing springs is then lowered to the position illustrated in FIGURES 1 and 2. The connector housing section **14** is then connected to the bottom housing section by the insertion of the connector yoke **30** through the aligned apertures of the connector housing section and the recesses **34** and **38** of the bottom housing section. The guide **52**, the resilient element **50** and the upper guide **51** are then disposed about the line above the upper end of the top housing section, in the same manner as described in connection with the guides **126** and **137** and the resilient element **133**, and are inserted downwardly into the top housing section until their downward movement is arrested by the engagement of the downwardly facing shoulder **94** of the guide **52** with the top end shoulder **93** of the lower piston **92**. The lower connector yoke **62** is inserted through the apertures of the top housing section and the recesses of the upper guide **51** to the position illustrated in FIGURES 1 and 2 and the upper guide is thus secured against movement relative to the housing. The device is then in operative condition.

The weight of the tools connected to the line then causes the tools to descend through the flow conductor as the line is unwound from the usual drum of a power hoist. The pressure in the chamber **150** is maintained at a value sufficiently high that the lower resilient element **133** is compressed longitudinally, and is therefore moved toward engagement with the line, with sufficient force to prevent excessive fluid flow from the flow conductor past the lower resilient element **133**. When it is desired to move the tools upwardly, the pressure in the chamber **150** is increased. The pressure in the chamber **150**, and therefore the force with which the two resilient elements are forced toward engagement with the line, is preferably increased to such value that the lower resilient element **133** is not compressed with such force that it prevents all movement of well fluids upwardly through the central passage **142** of the resilient element **133** into the housing above the lower sealing element since this force would necessarily be so great, because of the high pressure in the flow conductor, as to cause undue wear of the lower resilient element. As a result, a certain amount of well fluids in the various cavities or interstices of the line may move upwardly with the line through the lower sealing element. The lower resilient element however prevents any excessive fluid flow past the sealing element and thus closes the upper end of the flow conductor. Substantially no pressure differential exists across the upper resilient element **50**, since the conduit **166** normally opens to the atmosphere at a location remote from the device **10**, and the compressive force exerted on the upper resilient element **50** by the upper piston causes the substance of the upper resilient element to flow into the cavities of the wire line and prevents movement of the well liquids with the line through the upper resilient element. Any such well liquids wiped or stripped from the line collect in the passage **159** of the lower piston above the guide **126** and flow through the apertures **162** into the chamber **160** thence to the port **164** and then through the port, the nipple **165** and the conduit **166** to a desired location remote from the device **10**.

It will be apparent that the two resilient elements are held under compression by substantially equal forces since the area of the downwardly facing surfaces of the upper piston between the line of sealing engagement of the seal means **106** with the upper extension **109** of the lower piston and the line of sealing engagement of the seal means **104** with the internal surfaces of the cylinder housing section above the port **105** is equal to the area of the upwardly facing surfaces of the lower piston between the line of sealing engagement of the seal means **106** with the upper extension **109** of the lower piston and the line of sealing engagement of the seal means **116** with the internal surface of the cylinder housing section below the port **105**, and since the springs **96** and **118** which resist opposite longitudinal movement of the two pistons are of equal strength. Due to the upward pressure differential across the lower resilient element created by the pressure of the well liquids in the string of tubing, the lower resilient element **133** while it serves the purpose of preventing all, or substantially all, flow of well fluids between the line and the lower resilient element is not moved into such intimate engagement with the wire line as to prevent movement of well liquids present in cavities in the line past the resilient element. This would require that the lower piston exert a greater downward force on the lower resilient element and would cause excessive wear of the lower sealing element. Any well liquids which are present in interstices or cavities of the line are, however, wiped or stripped from the wire line by the upper resilient element **50** even though it is held under the same longitudinal compressional force as the lower seal resilient element since there is no pressure differential thereacross which would tend to oppose flow of the substance of the upper resilient element into the external cavities of the line.

If it is thereafter again desired to permit the line to move downwardly through the device, the pressure in the chamber **150** is decreased by permitting escape of fluids therefrom through the conduit **152** whereupon the springs **96** and **118** move the two pistons towards one another and the resilient force of the two resilient elements **50** and **133** causes them to expand to move back toward their normal positions. The pressure in the chamber **150** may, of course, be so adjusted as to cause the lower seal element **133** to engage the line with sufficient force to limit or prevent flow of fluid upwardly from the flow conductor between the line and the lower resilient element during such subsequent downward movement of the line.

As the line moves through the resilient elements **50** and **133**, the portions of the resilient elements which define their longitudinal passages **53** and **142** abrade will wear during the movement of the line. As such abrasion occurs and the total volumes of the resilient elements gradually decrease due to this abrasion, the line guides **52** and **126** are moved toward the guides **51** and **137**, respectively, to maintain the resilient elements under longitudinal compression therebetween and the inwardly divergent frusto-conical surfaces **80** and **85** of the guides **51** and **52** cause the substance of the upper resilient element **50** to flow inwardly toward the line and the corresponding inwardly divergently frusto-conical surfaces **132** and **135** of the guides **126** and **137** similarly cause the outer portions of the lower resilient element to flow inwardly toward the line. When the two elements have worn away to such an extent that their volumes are reduced to such a degree that the resilient elements no longer function properly, the worn elements may be easily replaced by reducing pressure in the chamber **150** to atmospheric pressure by venting it to the atmosphere through the conduit **152** and removing the lower connector yoke **30** from the housing. The connector housing section **14**, the cylinder housing section **13** and the top housing section together with the pistons and the upper resilient element **50** together with its two guides are then moved upwardly on the line and from the bottom housing section. This upward movement of these components of the device from the bottom housing section leaves the lower resilient element **133** and its guides in position in the bottom housing section. The guide **126** may be moved upwardly on the line to permit upward removal of the lower resilient element **133** from the bottom housing section whereupon a new resilient element may be positioned on the line by distorting the resilient element out-

wardly about its slit to provide a radial passage through which the line may be moved into the vertical longitudinal passage of the new element. The bottom connector section **14** is then again telescoped over the bottom housing section and reconnected thereto by the yoke **30**.

The upper connector yoke **62** is then removed from the top housing section and the guide **51** is then moved upwardly on the line above the top housing section. The lugs **74** and **75** of the guide **51** project outwardly of the outer surface of the upper top housing section and facilitate removal thereof from the top housing section. The upper resilient element **50** is removed from the top housing section. A new resilient element is placed about the line below the upper guide **51** and above the top housing section and the resilient element and the guide **51** are then moved back downwardly into the top housing section. The yoke **62** is again inserted into the top housing section to again secure the guide **51** against removal from the housing. The device **10** may again be employed to close the top of the flow conductor about the line and to wipe or strip fluids from the line as it is moved through the device.

It will be apparent that one of the pistons may be caused to exert a greater longitudinal force on its associated resilient element than the other piston by employing springs **96** and **118** of different strength or by making the area of the surfaces of one of the pistons exposed to the pressure in the chamber **150** greater than the area of the other piston exposed to this pressure. For example, if it is desired that the lower piston exert a downward force on the lower resilient element **133** greater than the upward force exerted on the upper resilient element by the upper piston, the spring **118** may be made weaker than the spring **96** or the passage of the cylinder housing section below the port **105** may be made of greater diameter than the diameter thereof above the port **105**.

It will now be apparent that a new and improved device for containing the pressure in the flow conductor while permitting the movement of an elongate member, such as a flexible wire line L. has been illustrated and described which comprises a pair of longitudinally spaced upper and lower tubular resilient elements **50** and **133** and a pair of pistons simultaneously movable by fluid pressure introducible into the housing of the device for compressing the sealing elements longitudinally and causing them to be moved toward and held in engagement with the line which is movable therethrough, the lower element minimizing movement of fluids between the line and the lower resilient element from the flow conductor and the upper resilient element wiping or stripping well fluids carried by the line in the cavities thereof.

It will further be seen that the pistons are telescopical to form with the housing of the device a chamber into which fluid under pressure may be introduced between the two pistons to cause them to move in opposite longitudinal directions and that biasing means, such as springs **96** and **118**, bias the two pistons away from their associated resilient elements to permit the longitudinal expansion of the two resilient elements to their normal positions when the pressure in the chamber between the pistons is reduced.

It will further be seen that the longitudinal passage of the tubular housing **11** has an upper end portion of reduced internal diameter provided by the top housing section **12** in which is disposed the upper resilient element **50**, a lower end portion of reduced internal diameter provided by the bottom and connector housing sections **14** and **15** in which is disposed the lower resilient element **133**, and an intermediate enlarged portion provided by the cylinder housing section **13** in which are slidably positioned the external flanges **99** and **115** of the upper and lower pistons **92** and **108**, respectively, so that the resilient elements are moved into sealing engagement with the housing and into operative engagement with the elongate member on line L when the fluid under pressure is introduced into the chamber **150** of the device.

It will further be apparent that while the operation of the device has been described in connection with an elongate member L illustrated and described to be a braided wire line, the elongate member could be a solid line, a rod, or a flow conductor.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A device through which an elongate member is movable, said device including: a housing having a longitudinal passage therethrough, said passage having upper and lower end portions of reduced diameter and an intermediate portion of enlarged diameter; an upper resilient element disposed in said upper end portion and a lower resilient element disposed in said lower end portion, said resilient elements having longitudinal passages therethrough; a first tubular guide engaging the bottom end surface of said lower resilient element for limiting its downward movement in passage, a second tubular guide in said passage releasably secured to said housing and engaging the top end surface of said upper resilient element for limiting its upward movement in said passage, a third tubular guide in said lower end portion engaging the top end of said lower resilient element; a lower tubular piston in said housing engageable with said third guide and having an intermediate external flange sealingly engageable with the internal surface of said housing at said intermediate portion of said passage; a fourth tubular guide engaging the bottom end surface of said upper resilient element, said guides having longitudinal passages longitudinally aligned with said passages of said resilient elements, an upper tubular piston having a lower portion telescoped over an upper portion of said lower piston above its flange and having an external flange sealingly engageable with the internal surface of said housing at said intermediate portion of said passage, said pistons and said housing defining an annular chamber between said piston flanges; and means for introducing fluid under pressure into said chamber between said piston flanges to move said lower piston downwardly to cause said lower piston to exert a downward force on said third guide means to compress said resilient element longitudinally and into engagement with an elongate member movable through said guides and said resilient elements and to move said upper piston upwardly to cause said upper piston to exert an upward force on said fourth guide to compress said upper resilient element longitudinally and into engagement with an elongate member movable through said pistons, said resilient elements and said guides.

2. The device of claim **1**, and seal means sealing between said pistons, and wiper means carried by said lower piston means engageable with internal surfaces of said upper piston above said last mentioned seal means for preventing movement of foreign material between said pistons.

3. The device of claim **2**, and means biasing said lower piston upwardly and said upper piston downwardly in said housing.

4. The device of claim **3**, wherein said housing has outlet port means for conducting fluids from within said housing and between said resilient elements to the exterior of said housing.

5. The device of claim **1**, and means biasing said lower piston upwardly and said upper piston downwardly in said housing.

6. The device of claim 5, and wherein said housing has outlet port means for conducting fluids from within said housing and between said resilient elements to the exterior of said housing.

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166—77; 277—62, 73, 116.2