

[54] **PRYING AND/OR FRICTIONLESS PROBING
DEVICE**

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Related U.S. Application Data

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abandoned.

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128/356, 5/81 R

[51] Int. Cl. **A61m 25/00**

[58] Field of Search **128/2 R, 2 M, 262,**
128/348, 356; 156/286, 287, 294; 5/81 R, 81
A

[56] **References Cited**

UNITED STATES PATENTS

3,178,732	4/1965	Stibitz	5/81
3,168,092	2/1965	Silverman	128/262 X
3,525,239	8/1970	Zeimer	128/262 X
2,794,758	6/1957	Harper et al.	156/286
2,513,527	7/1950	Sjodin	128/262 UX

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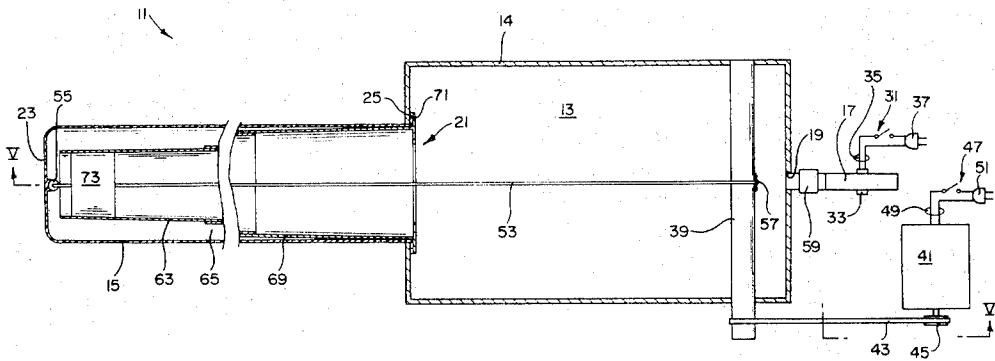
[57] **ABSTRACT**

A device having an unlimited number of uses. Certain of these uses depend upon the physical size of the device, etc. For example, one such size enables the device to be used as a catheter for unblocking clogged arteries of the human body, another size enables the device to

be used to insert exploratory sensing elements such as a microminiaturized television camera into certain cavities or ducts of the human body. Additionally, larger sizes might include a plurality of such devices grouped into a battery arrangement to lift and/or separate surfaces or objects having considerable weight, such as lifting a non-ambulatory patient from his bed or the like. Further, still larger sizes might be so arranged as to be capable of lifting an airplane which may have landed wheels up or for many other well known reasons conventional jacking apparatus may be unfeasible.

The principle of operation can easily be understood by comparing it to inflating a long balloon which was disposed inside out while in the deflated state, and the inflating or elongation process thereof proceeds along the length thereof having the outside surface reversed gradually and only at the extreme end thereof until the balloon is fully extended. The device includes an elongated flexible tubular member which resembles a balloon in that it is controllably inflated but which is not resilient as is a balloon. The device optionally includes telescoping rigid tubular sections which are pulled within the flexible tubular member to aid in supporting the expanded flexible tubular member. A second embodiment includes structure particularly adapted for lifting a patient from his bed or the like. The concept of this embodiment is to counteract the tendency of certain prior devices to curl upwardly after having worked under one leg of the patient, i. e., extend between his legs rather than beneath both legs, as desired. A third embodiment includes ties for causing the flexible tubular member to be elongated in cross section rather than round when inflated.

5 Claims, 10 Drawing Figures



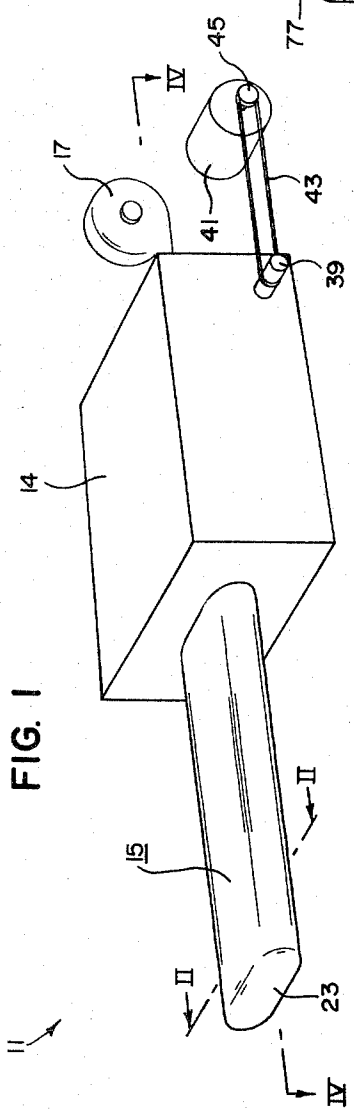
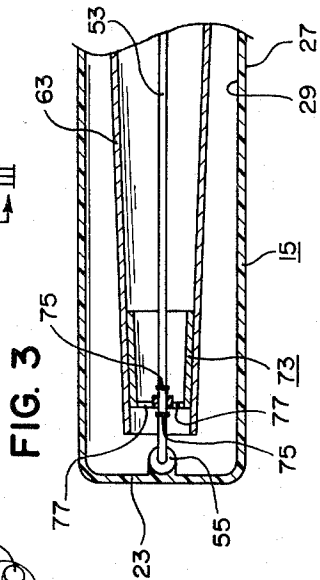
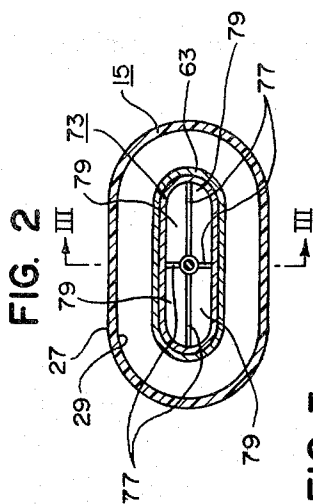
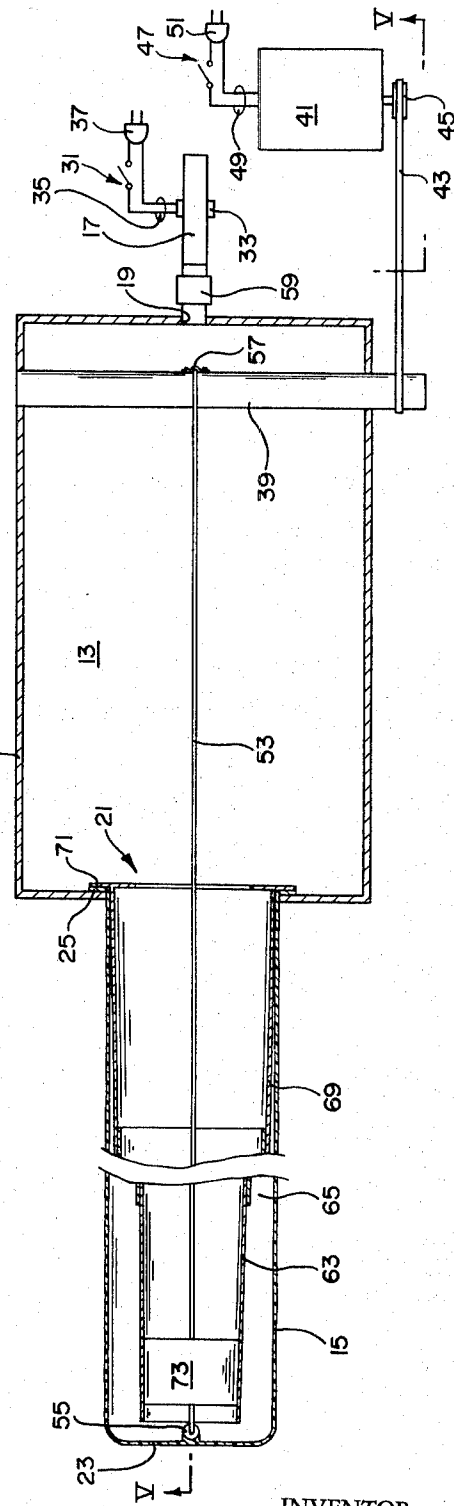
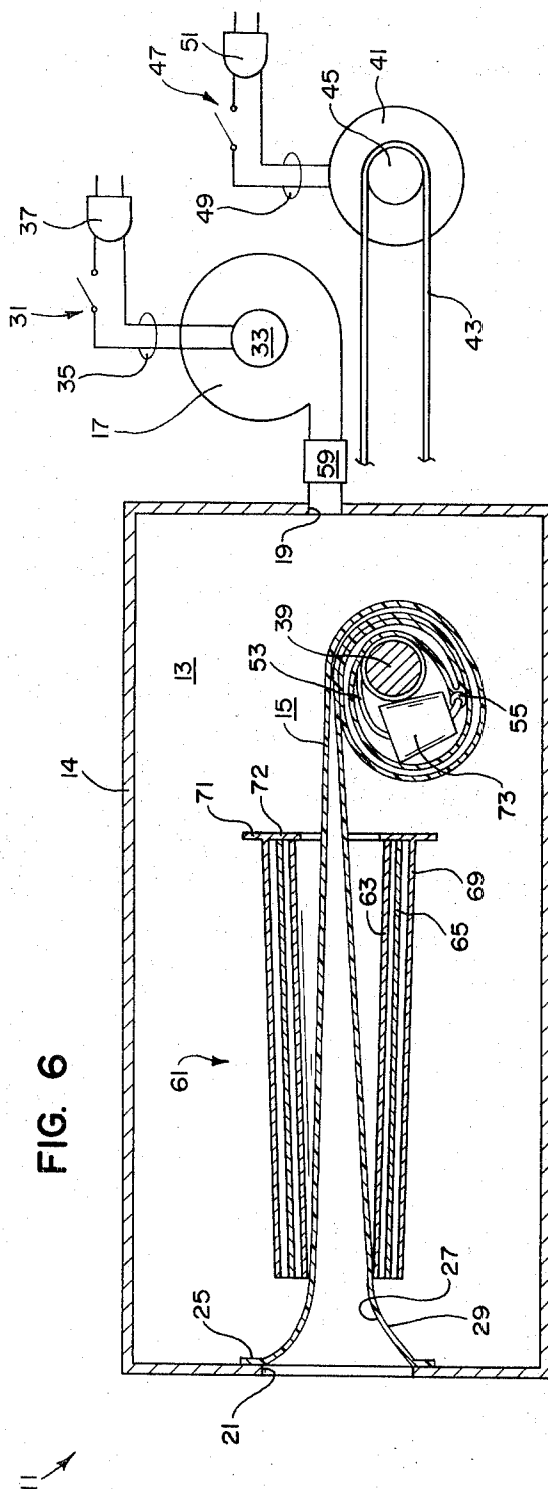
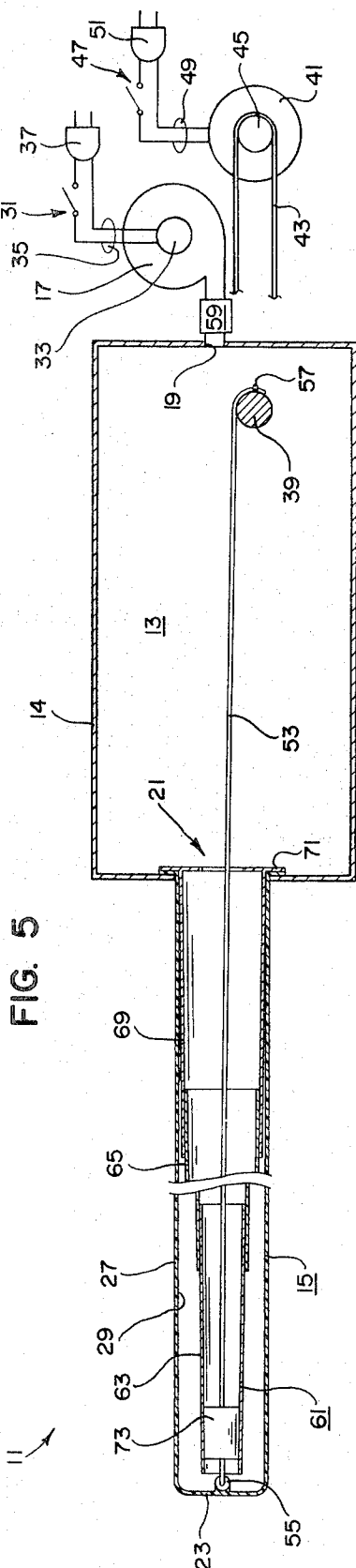


FIG. 4



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FIG. 7

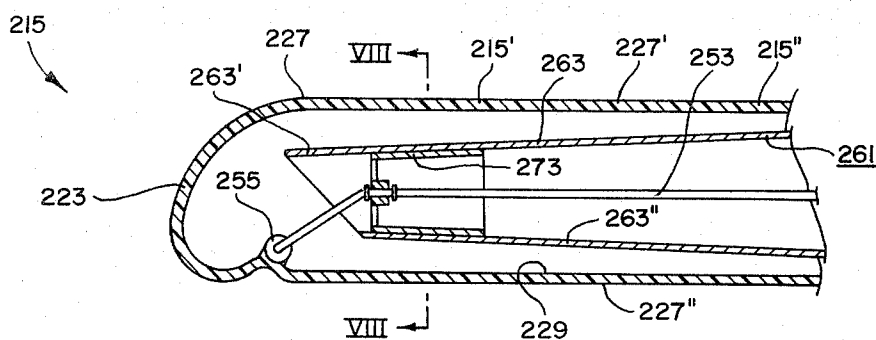


FIG. 8

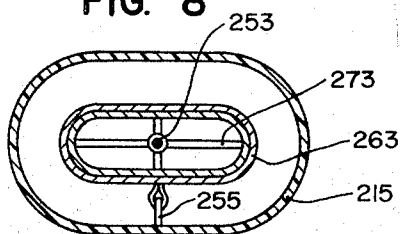


FIG. 9

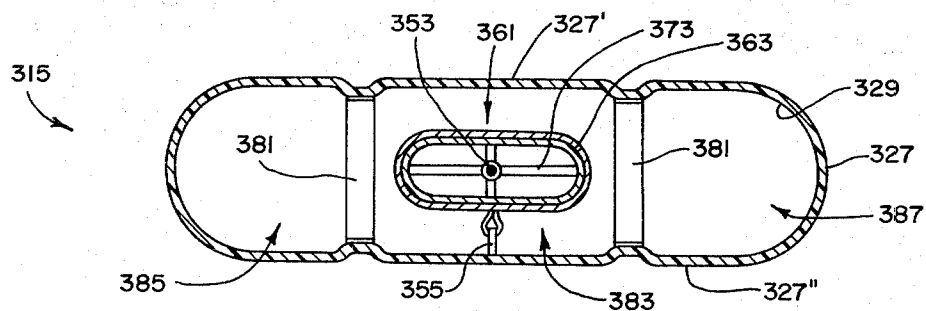
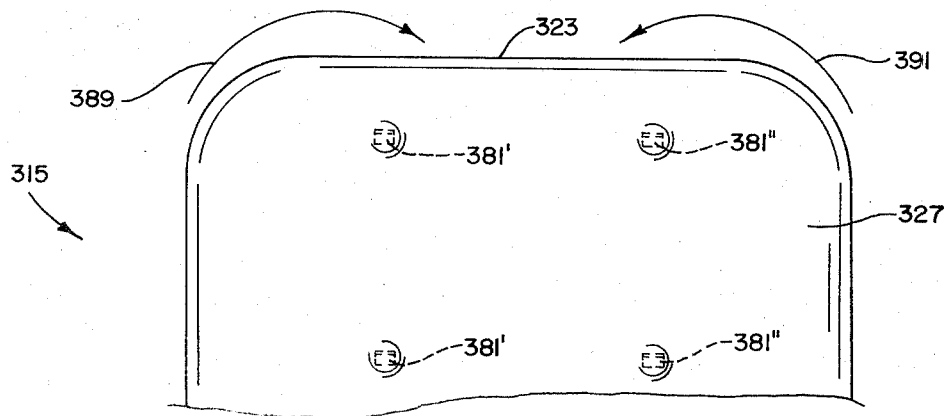


FIG. 10



PRYING AND/OR FRICTIONLESS PROBING DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of my co-pending application Ser. No. 94,664, filed Dec. 3, 1970, entitled "Prying and/or Frictionless Probing Device," now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to prying, separating and/or probing devices.

2. Description of the Prior Art

Numerous prying devices are well known and range from the simple bar-like lever and fulcrum to some of the more elaborate devices, e. g., hydraulic and/or pneumatic jacks. One particular method and apparatus for moving objects is disclosed in the Koll et al. U.S. Pat. No. 3,493,979.

Other devices known by the applicant include the Sjodin U.S. Pat. No. 2,513,527; the Harper et al. U.S. Pat. No. 2,794,758; the Silverman U.S. Pat. No. 3,168,092; the Stibitz U.S. Pat. No. 3,178,732; and the Zeimer U.S. Pat. No. 3,525,329. Certain of the above references incorporate a retracting cord or lanyard, e. g., the '732 patent wherein the retracting cord 7 is attached centrally of the end or closure of the flexible sleeve or tubular member 1. The remaining ones of the above references are void of a retracting cord or lanyard. A particular problem prevails when attempting to direct a probe, i. e., after having worked its way under one of the patient's legs the weight of this leg causes the protruding end of the device to curl upwardly resulting in the device extending between the legs of the patient rather than beneath both legs, as desired.

SUMMARY OF THE INVENTION

The concept of the present invention is to provide a prying, separating and/or frictionless probing device for unlimited uses. Certain of these uses are definitely related to a particular physical size, etc. For example, one such size enables the device to be used as a catheter in unblocking clogged arteries of the human body, another size enables the device to be used to insert exploratory sensing elements, i. e., a microminiaturized television camera, a fiber optic system, or a sigmoidoscope, into certain cavities or ducts of the human body. Additionally, larger sized devices might include a plurality of such devices grouped into a battery arrangement to lift and/or separate surfaces or objects having considerable weight, i. e., lifting a non-ambulatory patient from his bed or the like. Further, still larger sized devices might be so arranged as to be capable of lifting an airplane which may have landed wheels up or for many other well known reasons conventional jacking apparatus may be unfeasible.

An important feature of the present invention is the unique manner in which it crawls between surfaces substantially without generating friction, i. e., lubricant is not required when using the device as a catheter. Likewise, when used to lift a patient from his bed, the bed linen and/or the clothing of the patient are scarcely disturbed and the patient is not pinched, rubbed or annoyed in the slightest by the lifting process.

The device includes a chamber leading into an elongated flexible non-resilient tubular member which is closed at the outer end thereof, a fluid pump for selectively delivering fluid under pressure to the chamber to expand outwardly the flexible walls of the tubular member and to fully extend it longitudinally as the pressure within the chamber increases.

The device also includes a motor-driven roller disposed within the chamber and a lanyard which is attached at the one end thereof to the outermost end of the tubular member and at the other end thereof to the roller so that rotatably driving the roller causes the tubular member to be reversibly pulled or rolled inwardly within itself into the chamber, i. e., pressure on the fluid is reduced to nil, and the roller convolutely winds the lanyard so as to pull the outermost end of the flexible tubular member from within. This displaces the fluid and causes the flexible tubular member to be reversed or have its outside surface pulled within itself until it is completely within the chamber.

Extending or outrolling the flexible tubular member is accomplished by allowing the fluid under pressure to be admitted to the chamber and allowing the lanyard to be unwound from the roller, i. e., this initially causes a blossoming action of the flexible tubular member. In other words, the positive pressure within the chamber blossoms or unfoldingly initiates a protruding portion of the tubular member adjacent and outwardly from the chamber and as the pressure builds up, an elongation process proceeds in a growth-like manner longitudinally of the end thereof until the flexible tubular member is fully extended to an outrolled position.

Another important feature of the device of the present invention is that the elongation process substantially proceeds along a path of least resistance, i. e., the growing end of the flexible tubular member crawls along ever probing so as to bend itself up, down, left or right, to the shape of the canal or duct in which it might have been placed. Equally important is the fact that this growth-like process can be reversed for frictionless withdrawal.

An alternate embodiment of the device is particularly directed towards overcoming the above-mentioned problem that prevails when attempting to direct the probing device beneath a patient. The tendency for the protruding end of the device to curl upwardly between the legs of the patient is obviated by attaching the lanyard to the flexible tubing adjacent the lower part thereof rather than to the closure thereof or centrally as taught by the '732 patent, i. e., the lanyard of the present invention is attached to the flexible tubing a spaced distance inwardly from the closure thereof and adjacent the downwardly directed portion of the continuous wall of tubing. In this manner, the device has a tendency to dip downwardly at the transient end thereof and to maintain a positive engagement with the surface supporting the patient. In other words, this downward dipping tendency prevails regardless of the extent to which the probe may be extended, e. g., half-way paid out or totally paid out, etc., thus counteracting the tendency of the weight of the patient's leg to cause the end of the probe to curl upwardly.

The device optionally includes telescoping rigid tubular sections which are pulled within the flexible tubular member to aid in supporting the expanded flexible tubular member. Obviously, the rigid telescopic tubular members would not be recommended when the device

is used as a catheter. However, a typical environment in which the rigid telescopic tubular members might be beneficial would be when a plurality of such devices are grouped into a battery arrangement to lift and/or separate surfaces or objects having considerable weight, e. g., lifting a non-ambulatory patient from his bed or the like.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the device showing the flexible tubular member in an expanded outstretched or outrolled position.

FIG. 2 is a sectional view taken as on the line II—II of FIG. 1.

FIG. 3 is a sectional view taken as on the line III—III of FIG. 2, showing a lanyard attached centrally of the closure means of the flexible tubular member.

FIG. 4 is a sectional view taken as on the line IV—IV of FIG. 1, schematically showing a means of energizing the fluid pump and the roller motor.

FIG. 5 is a sectional view taken as on the line V—V of FIG. 4, showing the same schematic as described for FIG. 4.

FIG. 6 is a view substantially identical to FIG. 5 except the flexible tubular member is foldably collapsed and is withdrawn inwardly to an inrolled position, the rigid tubular members are also shown withdrawn and enclosed within the chamber.

FIG. 7 is a sectional view similar to FIG. 3 but showing a second embodiment wherein the lanyard is attached to the continuous wall of the flexible tubular member a spaced distance from the closure means.

FIG. 8 is a sectional view similar to FIG. 2 but taken on the line VIII—VIII of FIG. 7.

FIG. 9 is a sectional view similar to FIG. 7 but showing a third embodiment wherein certain opposite portions of the continuous wall of the flexible tubular member are tied together to hold them closer together than are certain other opposite portions to maintain the inflated flexible tubular member in an oval cross section.

FIG. 10 is a top view showing the outer portion of the third embodiment of the probing device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The prying, separating and/or frictionless probing device of the present invention is herein characterized by the numeral 11 and it is anticipated that the device 11 will have infinite uses. Accordingly, a random sampling of the broad span of intended uses for the device 11 will herein be referenced, as examples in passing, in order to more clearly disclose the significance of the device 11. In other words, these anticipated uses are given by way of illustration and not limitation. The device 11 generally comprises a sealably enclosed chamber 13, an elongated flexible tubular member 15, and a mechanically driven fluid pump 17.

The chamber 13 is shown in the drawings to be formed by a box-like structure 14. However, the shape of the structure 14 and/or the chamber 13 is irrelevant, and it is anticipated that in actual practice the structure 14 and/or the chamber 13 would have a variety of shapes, depending upon the particular ultimate intended use. Regardless of the ultimate intended use, the chamber 13 will be provided with inlet and outlet

openings 19, 21. The distal end of the tubular member 15 includes a closure portion 23. The tubular member 15 preferably is formed from conductive neoprene when the device 11 is intended for medical uses. However, the tubular member 15 may be formed from any of the well known filament reinforced sheet rubber materials, e. g., rubber coated nylon, when used to lift and/or separate surfaces or objects having considerable weight, e. g., lifting a non-ambulatory patient from his bed or the like. In either event, the closure portion 23 preferably is integrally formed with the tubular member 15 so that the tubular member 15 and the closure portion 23 thereof are impervious to the fluid emitted from the pump 17, i. e., the fluid may be air or a substance having more density thereto such as water or the like.

The proximal end of the tubular member 15 is sealably secured to the structure 14 in any well known manner, e. g., a fluid impervious bonding agent or the like. FIG. 6 of the drawings best illustrates the preferred manner in which the tubular member 15 is secured to the structure 14, i. e., the proximal end of the member 15 is provided with a flange portion 25. The flange 25 has an outer perimeter slightly greater than the dimensions of the outlet 21 so that the flange 25 may be fixedly attached to the structure 14 or the interior surface of the chamber 13 circumjacent the outlet 21. In other words, the chamber 13 is sealed from without, thus communicating the interior of the tubular member 15 with the inlet opening 19 of the chamber 13, as best viewed in FIGS. 4 and 5 of the drawings.

The tubular member 15 has an outrolled position, as best illustrated in FIG. 5; an inrolled position, as best illustrated in FIG. 6; and infinite positions thereof between the outrolled and inrolled positions. When the tubular member 15 is in the outrolled position (FIG. 5), a surface 27 thereof contiguously engages the surface or surfaces of the substance being worked upon, e. g., when the device 11 is being used as a catheter, the surface 27 contiguously engages the interior walls of the vein and/or arteries of the human body, or when used to cushion or separate freight or the like, the lower portion of the surface 27 would engage the surface upon which the freight is resting, and the upper portion of the surface 27 would engage the bottom of the freight or the like. Additionally, the fluid contiguously engages an inner surface 29, i. e., the tubular member 15 being impervious to the fluid.

However, when the tubular member 15 is in the inrolled position (FIG. 6), the outer surface 27 is reversed as the tubular member 15 is withdrawn into the chamber 13, i. e., the inner surface 29 is still in contact with the fluid but the pressure on the fluid has diminished substantially to zero lbs. per square inch. Movement of the member 15 from the outrolled position to the inrolled position includes structure yet to be disclosed.

FIGS. 1 and 2 of the drawings depict the cross section shape of the member 15 as having a major and a minor axis. In actual practice, it is anticipated that some intended uses of the device 11 would be better served when the tubular member 15 has a circular cross section, e. g., when the device 11 is used as a catheter or the like.

The device 11 also includes a switch 31 which may be selectively activated so as to deliver fluid under pressure to the inlet opening 19 of the chamber 13 to

expand outwardly the flexible walls of the member 15 and to fully extend the member 15 longitudinally as it ultimately reaches the outrolled position. In other words, the pump 17, being mechanically driven by an electric motor 33 or the like, has a typical power cord 35 having the one end thereof attached to the motor 33 and the other end thereof terminating with a plug 37 for insertion into a conventional electrical outlet. One of the conductors of the power cord 35 is interposed by the switch 35 in a manner well known to those skilled in the art.

Certain environments may be such that the device 11 may preferably be limited to the structure just disclosed, e. g., in lifting heavy objects the collapsed tubular member 15 may manually be placed between the surfaces to be separated. In this instance, activating the pump 17 pressurizes the chamber 13 and causes the flexible walls of the member 15 to expand outwardly, thus prying, separating, and/or lifting such an object. Obviously, certain remote or isolated locations might dictate that the pump 17 be mechanically driven by an internal combustion engine or the like, a feature which is anticipated to be within the scope of the present invention.

However, the device 11 preferably includes a roller assembly 39 disposed within the chamber 13, as best viewed in FIGS. 4, 5 and 6. The roller assembly 39 is journaled to the box-like structure 14 of the chamber 13. One end of the roller 39 protrudes outwardly from the chamber 13 (FIG. 4). The roller assembly 39 preferably is sealed to the box-like structure of the chamber 13 adjacent the protruding end thereof in order to prevent fluid from escaping outwardly from the chamber 13, a well known procedure obvious to those skilled in the art.

Additionally, the device 11 preferably includes a prime mover, e. g., an electric motor 41 for rotatably driving the roller assembly 39. An endless belt 43 frictionally engages a pulley 45 and the roller assembly 39 in a manner obvious to those skilled in the art. Further, the motor 41 is provided with a switch 47 for selectively activating the motor 41 so that the roller assembly 39 may be selectively rotatably driven, i. e., a power cord 49 has the one end thereof attached to the motor 41 and the other end terminating at a plug 51. The plug 51 is intended to be inserted into any convenient electrical outlet. One of the two conductors making up the power cord 49 is interposed by the switch 47 in a well known manner obvious to those skilled in the art. It should be understood that the single pole single throw switches 31, 47 as shown in the drawing may conveniently be grouped into one single pole double throw switch having an intermediate or off position. In which instance, one of the plugs 37, 51 is superfluous, a well known procedure for those skilled in the art.

Attached to the roller assembly 39 is the one end of a lanyard 53, the other end of the lanyard 53 being fixedly attached to the closure portion 23 of the member 15 in any well known manner, e. g., an eyelet 55, preferably being formed integrally with the closure portion 23, receives the lanyard 53. The lanyard 53 has a knot or the like (not shown) adjacent the end thereof which precludes the lanyard 53 from slipping out of the eyelet 55. It should be understood that the roller assembly 39 preferably includes a clamp 57 for bindingly attaching the one end of the lanyard 53 to the roller 39, a well known procedure obvious to those skilled in the

art. Additionally, a valve 59 is included and is positioned between the chamber 13 and the pump 17 for reasons yet to be disclosed.

From the above disclosure, it should be obvious that we now have unique structure for retrievably reeling the tubular member 15 from the outrolled position to the inrolled position. Assuming the device 11 to be in the outrolled position as previously described and best illustrated in FIG. 5, accordingly, the object is to withdraw the flexible member 15 from other structure, e. g., from an artery or the like.

This is accomplished by moving the switch 31 to the off position, thus stopping the pump 17 while the valve 59 preferably is fully opened. The switch 47 is sequentially moved to the closed position, which activates the motor 41, causing the roller assembly 39 to be rotatably driven in a clockwise direction, as when viewed in FIGS. 5 and 6, thus causing the lanyard 53 to be convolutely wound about the roller 39.

The closure portion 23 of the tubular member 15, having the lanyard 53 attached thereto, is pulled inwardly, collapsing the flexible walls circumjacent the closure portion 23 so that the outer surface 27 is reversibly rolled inwardly and the fluid is displaced outwardly from the chamber 13 through the valve 59. This inrolling or longitudinally shortening process of the flexible member 15 will continue until the member 15 reaches the inrolled position or the switch 47 is opened. In other words, the flexible member 15 may be maintained in a static condition at any one of infinite positions between the inrolled and outrolled positions by placing both switches 31, 47 in the off position and closing the valve 59.

It is anticipated that some intended uses of the device 11 may be such that the physical length of the box-like structure 14 for the chamber 13 is substantially equal to the length of the tubular member 15. In this instance, the flexible member 15 is inrolled or turned within itself so that the outer surface 27 thereof is directed inwardly and the tubular member 15 is reversed and completely housed within the chamber 13.

However, the preferred length of the member 15 exceeds the physical length of the box-like structure 14 for the chamber 13. In this regard, the tubular member 15 is withdrawn in like manner as previously described and a portion thereof is convolutely wound about the roller 39 as best viewed in FIG. 6 of the drawings.

It should be understood that conventional structure normally associated with the field of hydraulics would preferably be included with the pump 17 when warranted by the density of the fluid substance, e. g., in the event hydraulic fluid or sterilized distilled water were to be the fluid, a reservoir (not shown) and other associated plumbing, i. e., bypass lines, etc., well known to those skilled in the art preferably would be incorporated. Further, the outer or inner surface of the closure portion 23 may be provided with suitable structure or device for attaching various devices or exploratory sensing elements thereto, e. g., a microminiaturized television camera, a fiber optic system, or the like, not shown. In the case of the structure on the outer surface, the electrical circuit required to operate any such device would be sealably passed through the structure of the closing portion 23 and carried internally of the tubular member 15, conceivably taking the place of the lanyard 53.

An important feature of the present invention is the unique manner in which it crawls between surfaces substantially without a sliding motion so that no friction is generated. In fact, lubricant is not required nor is it recommended when using the device 11 as a catheter. Also, it will be understood that there is no transfer of germs, e. g., from the opening of the urethra at the genitalia to the bladder, with the use of the present invention. In other words, assuming the device 11 to be in the inrolled position as best viewed in FIG. 6 and the device 11 is miniaturized so that the dimensions of the tubular member 15 are compatible with the duct or canal in which the catheter is intended to be inserted, it is anticipated that the device 11 could possibly go into the ureter to remove kidney stones, i. e., the tubular member 15 following the urethra and ureter passing through the bladder and being controllably stopped when the tubular member 15 engages the kidney stone. At this point, the tubular member 15 preferably would be withdrawn, and the inrolling action of the outer surface 27 thereof would retrieve the kidney stone, and it would be inrolled and suspended between adjacent portions of the outer surface 27 and carried outwardly from the ureter, the bladder, and the urethra. A substantially equally important feature of the device 11 is that the above operation can be carried out with greatly reduced pain to the patient, as compared with previous catheters, a particularly significant feature for a male patient.

Continuing now with disclosing the outrolling operation of the device 11, the outlet 21 of the box-like structure 14 forming the cavity 13 is brought into proximity with the particular duct, e. g., the urethra, the switch 37 is moved to the closed position, and the switch 47 and valve 59 are in the open position. The pump 17 delivers fluid under pressure to the inlet 19 which creates a positive pressure within the chamber 13. It should be understood that this action has the same effect as placing a suction source adjacent the outlet opening 21, since the ambient pressure on the outer surface 27 of the member 15 is lower than the pressure on the inner surface 29 of the member 15. Accordingly, the portion of the tubular member 15 circumjacent the flange portion 25 thereof is forced out through the outlet opening 21.

In other words, the tubular member 15 commences to blossom, i. e., initiating a protruding portion circumjacent the flange portion 25 thereof, outwardly from the chamber 13. An elongation process of the member 15 proceeds in a growth-like manner longitudinally adjacent the end thereof, until the flexible member 15 is fully extended to the outrolled position shown in FIG. 5, i. e., until either the valve 59 is closed or the switch 31 is opened. It should be understood that at this same time the roller assembly 39 yieldably pays out the tubular member 15 and/or the lanyard 53 as the pressure within the chamber 13 is maintained or increased by the pump 17, i. e., the inertia of the armature for the motor 41 keeps tension on the lanyard 53. Quite significantly, the elongation process proceeds along a path of least resistance, i. e., the flexible member 15 crawls along ever probing so as to bend itself up, down, left or right, to the shape of the canal or duct in which it might have been placed. Equally significant is that this elongation process can be reversed when desired, the details of which were previously disclosed.

It may be preferable in certain environments of the device 11 to include an optional rigid tubular assembly 61, e. g., when larger sized device 11 are grouped into a battery arrangement to lift and/or separate surfaces or objects having considerable weight. One such object might be a non-ambulatory patient which may easily be lifted from his bed by simply operating the controls of the device 11. The function of the rigid tubular assembly 61 is that it aids in supporting the expanded flexible tubular member 15. It is anticipated that certain environments may be such that the physical length of the box-like structure 14 forming the chamber 13 is substantially equal to the length of the flexible member 15. In this event, the rigid tubular assembly 61 preferably would be a single section. However, more than likely, the physical length of the device 11 will be relatively short. Accordingly, the rigid tubular assembly 61 would be formed from a plurality of telescoping tubular members 63, 65, 69 as best viewed in FIGS. 5 and 6.

Any well known method for interlocking the members 63, 65, 69 one to the other is acceptable for the purpose herein disclosed. I prefer to incorporate an interlocking feature which includes ever-decreasing cross section tapered walls for the plurality of telescoping members 63, 65, 69. It should be understood that the taper as depicted for the members 63, 65, 69 in FIGS. 5 and 6 is exaggerated in order to more clearly illustrate the structural feature. The tubular members 63, 65, 69 may be formed from any well known rigid substance, e. g., metal or a high density plastic or the like, and have a cross sectional shape substantially identical to that selected for the flexible member 15.

The rigid tubular assembly 61 has a normal position as best viewed in FIG. 6 of the drawings in which the tubular assembly 61 is enclosed within the chamber 13 and an extended position as best viewed in FIG. 5 of the drawings in which the assembly 61 protrudes outwardly through the outlet opening 21 of the chamber 13. It can readily be seen from FIG. 5 of the drawings that the tubular assembly 61 is received within the flexible member 15 when the flexible member 15 is in the previously described outrolled position, i. e., the tubular assembly 61 being in the just-described extended position.

Further, it can be seen from FIG. 6 of the drawings that the flexible member 15 is received within the tubular assembly 61 when the flexible member 15 is in the previously described inrolled position, i. e., the tubular assembly 61 being in the just-described normal position.

The member 69 of the tubular assembly 61 preferably terminates at the proximal end thereof with an outwardly directed flange portion 71, as best viewed in FIGS. 5 and 6 of the drawings. The flange portion 71 contiguously engages the flange portion 25 when the tubular assembly 61 is in the just-described extended position, the flange 71 serving as a mechanical stop for limiting the outward movement thereof. In addition, an inwardly extending flange 72 is provided on member 69 with flange 72 serving as a mechanical stop for limiting inward movement of members 63, 65 relative to member 69.

The device 11 also includes a stopper assembly 73 as best viewed in FIGS. 2, 3, 5 and 6. The stopper assembly 73, formed from high density plastic or the like, has an exterior shape substantially complementary and conforming to the interior wall of the tubular member 63 adjacent the distal end thereof. The assembly 73 is

positioned adjacent the closure portion 23 of the tubular member 15 and is fixedly attached to the lanyard 53. From FIG. 3 of the drawings, it may be seen that a pair of clamps 75 bindingly engage the lanyard 53 on either side of inwardly directed support structure for the stopper assembly 73.

From FIG. 2 of the drawings, it may be seen that the stopper assembly 73 includes a plurality of radial ribs 77 defining passageways 79, thus providing said inwardly directed support structure for the stopper assembly 73. The clamps 75 bindingly engage the lanyard 53, i. e., one clamp 75 being positioned outwardly from the ribs 77 and the other clamp 77 being positioned inwardly of the ribs 77, as best viewed in FIG. 3. The stopper assembly 73 maintains a fixed position with respect to the closure portion 23 regardless of the position of the tubular member 15 or the rigid tubular assembly 61.

In other words, the stopper assembly 73 will contiguously or plug-like engage the tubular member 63 when substantially 50 percent of the length of the tubular member 15 protrudes from the outlet 21. Further displacement of the tubular member 15 towards the outrolled position thereof causes the stopped assembly 73 to start extending the tubular assembly 61, i. e., the member 63 is carried outwardly through the outlet 21 and the succeeding tubular members 65, 69 are carried outwardly from the chamber 13 through the outlet 21 as the tubular member 15 approaches the previously described outrolled position (FIG. 5).

It should be understood that since the tubular member 69 contiguously engages the inner surface 29 of the tubular member 15, the fluid contained in the tubular member 15 adjacent the distal end thereof would be trapped and present withdrawal or collapsing inrolling difficulties if it were not for the passageways 79 provided in the stopper assembly 73, as previously described. Accordingly, when the tubular member 15 is in the outrolled position (FIG. 5) and it is desired that it be placed in the inrolled position (FIG. 6) as previously disclosed, the fluid adjacent the distal end of the tubular member 15 between the inner surface 29 and the outer walls of the tubular members 63, 65 is directed through the passageways 79 of the stopper assembly 73. This fluid is then carried within the tubular assembly 61 to the valve 59 in a manner like that previously described. Additionally, the closure portion 23 collapses inwardly and the wall of the member 15 circumjacent thereto initiates the inrolling movement toward the previously disclosed inrolled position.

In other words, the rigid tubular assembly 61 does not interfere with the movement of the tubular member 15 in any way. The tubular member 15 urges the outermost member 63 toward the outlet 21 as the tubular member 15 is traveling toward the previously disclosed inrolled position. Further, the inrolling action of the tubular member 15 moves the succeeding tubular members 65, 69 toward and subsequently through the outlet 21 as the tubular member travels toward the inrolled position.

A second embodiment of the tubular member for the device is herein disclosed and is character referenced by the numeral 215 as depicted in FIGS. 7 and 8 of the drawings. The tubular member 215 includes a closure portion 223 for sealing the tubular member 215 from without. When the tubular member 215 is in the outrolled position, the outer surface 227 thereof contigu-

ously engages the surface or surfaces being worked upon, e. g., an upper portion 227' thereof engaging the patient to be lifted and a lower portion 227'' engaging the bed or the like supporting a patient. Additionally, the fluid under pressure engages the inner surface 229. In other words, the surface 227 constitutes the exterior, and the surface 229 constitutes the interior when the tubular member 215 is in an outrolled position as previously described for the principal embodiment thereof. It should be understood that the tubular member 215 as depicted in FIG. 7 of the drawings is in the aforementioned outrolled position.

The second embodiment also includes a lanyard 253 substantially identical to the lanyard 53 for the principal embodiment. An eyelet 255 is included and is attached to the interior surface 229 of the tubular member 215 rather than to the closure portion. More specifically, the eyelet 255 is attached to the inner surface 229 adjacent the lower portion 227'' and a spaced distance from the distal end or closure portion 223 adjacent the lower part thereof. Locating the eyelet thusly will counteract the tendency of the weight of the patient's leg to cause the transient end of certain probes to curl upwardly, i. e., the probe of prior devices as well as the tubular member 15 of the instant invention.

It should be understood that the end of the tubular member 215 is not always the closure portion 223. For example, when the tubular member 215 is almost fully inflated or paid out to the outrolled position, a reference point 215' might constitute the end thereof. On the other hand, when the tubular member 215 is inflated or paid out to a lesser degree, i. e., closer to the inrolled position, a reference point 215'' would constitute the end thereof, etc. However, regardless of the degree of inflation of the tubular member 215, i. e., whether it is halfway paid out or totally paid out, etc., the transient end of the tubular member 215 will have a tendency to dip downwardly toward the lower portion 227''. Therefore, when a weight, e. g., one leg of a patient, is placed on the upper portion 227', the lower portion 227'' will not lift up from the bed or the like. In other words, the aforementioned problem of the probe working between the legs of the patient is obviated by the tubular member 215.

From FIGS. 7 and 8 of the drawings, it may be seen that the second embodiment may include the optional rigid tubular assembly 261 which is similar to the assembly 61 previously disclosed for the principal embodiment. Therefore, only the member 263 corresponding to the member 63 is depicted in the drawings. It should be pointed out that the distal end of the tubular member 263 preferably is sloped as shown in FIG. 7 as opposed to being straight like the member 63 previously described. In other words, the tubular member 263 has an upper portion 263' and a lower portion 263'' with the upper portion 263' extending beyond the lower portion 263'' as clearly shown in FIG. 7 of the drawings.

The second embodiment also includes a stopper assembly 273 which is substantially identical to the stopper assembly 73 previously described for the principal embodiment. Therefore, a description of the stopper assembly 273 would be redundant.

A third embodiment of the tubular member is herein disclosed and is character referenced in FIGS. 9 and 10 of the drawings by the numeral 315. The tubular member 315 has a closure portion 323 corresponding to the

previously disclosed closure portions 23, 223, an outer surface 327 corresponding to the previously described outer surfaces 27, 227, i. e., having an upper portion 327' and a lower portion 327'', an inner surface 329 corresponding to the previously described inner surfaces 29, 229, and other corresponding structure, e. g., lanyard 353, eyelet 355, rigid tubular assembly 361, and stopper assembly 373. A detailed disclosure of the above-mentioned corresponding structure would also be redundant. The main feature of the tubular member 315 is that tie means 381 are included for holding the upper portion 227' in a relationship close to the lower portion 227'', thus causing the tubular member 315 to be elongated in cross section rather than round when inflated or when in the outrolled position. From FIG. 10 of the drawings, it may be seen that the ties 381 are arranged in two rows, i. e., one row being the ties 381' and the other row being ties 381''. The rows 381', 381'' extend along the length of the flexible tubular member 315 establishing an inner channel 383 and a pair of outer channels 385, 387.

It should be pointed out that when the tubular member 315 is moved from the inrolled position towards the outrolled position, i. e., in the same manner as previously described for the tubular member 15, the lanyard 353, substantially identical to lanyard 253 passes through the inner channel 383 as shown in FIG. 9 of the drawings. Conversely, returning the tubular member 315 to the inrolled position is effective to cause the lanyard 353 to pull the outer portion of the tubular member 315 defining in part the outer channels 385, 387 into the inner channel 383, i. e., in the direction of the respective arrows 389, 391. In other words, when the tubular member 115 is in the inrolled position, the inner surface 329 and the ties 381 would be on the exterior thereof, and the surface 227 would be on the interior thereof, i. e., like that shown in FIG. 6 of the drawings for the principal embodiment. Also, it should be pointed out that channels 383, 385 and 387 may be formed otherwise than by individual ties 381, as for example, by making ties 381' and 381'' respectively into continuous strips, without departing from the spirit and scope of the present invention.

Although the invention has been described and illustrated with respect to preferred embodiments thereof, it is to be understood that it is not to be so limited since changes and modifications may be made therein which are within the full intended scope of the invention.

I claim:

1. A device for prying or probing comprising chamber means having inlet and outlet openings, elongated flexible tubular means having proximal and distal ends, said distal end of said flexible tubular means including closure means for sealing the interior of said tubular means from without, said proximal end of said flexible tubular means being sealably attached to said chamber means adjacent said outlet opening thereof, said flexible tubular means being communicated with said inlet opening of said chamber means, fluid pump means, means for selectively activating said pump means to deliver fluid under pressure to said inlet opening of said chamber means to selectively stiffen said flexible tubular means as said fluid under pressure causes the flexible walls of said flexible tubular means to expand outwardly, said flexible tubular means having at least an outrolled position in which said flexible tubular means is extended longitudinally protruding outwardly from

said outlet opening of said chamber means and an inrolled position in which said flexible tubular means is foldably collapsed and is withdrawn inwardly through said outlet opening of said chamber means, rigid tubular means having at least a normal position in which said rigid tubular means is enclosed within said chamber means and an extended position in which said rigid tubular means protrudes outwardly through said outlet opening of said chamber means, means for inserting a portion of said rigid tubular means within said flexible tubular means when said flexible tubular means is in said outrolled position and said rigid tubular means is in said extended position, lanyard means for inserting a portion of said flexible tubular means within said rigid tubular means when said flexible tubular means is in said inrolled position and said rigid tubular means is in said normal position, roller means disposed internally of said chamber means and rotatably attached to said chamber means, a prime mover, means for selectively activating said prime mover so as to selectively rotatably drive said roller means, said lanyard means having one of the ends thereof fixedly attached to said closure means of said flexible tubular means internally thereof and the other end of said lanyard means being fixedly attached to said roller means, deactivating said fluid pressurizing means and sequentially activating said prime mover being effective to cause said flexible tubular means to be retrievably reeled from said outrolled position to said inrolled position, said rigid tubular means including a plurality of telescoping tubular members, and means for interlocking said telescoping tubular members one with the other.

2. The device of claim 1 in which said interlocking means includes ever decreasing cross section tapered walls for said plurality of telescoping members.

3. The device of claim 1 in which said means for inserting said rigid tubular means within said flexible tubular means includes stopper means, said stopper means having passageways therein positioned adjacent said closure means, and being fixedly attached to said lanyard means for plug-like engaging a portion of said rigid telescoping tubular means.

4. The device of claim 1 in which said rigid tubular means consist of high density plastic.

5. A device for prying or probing comprising chamber means having inlet and outlet openings, elongated flexible non-resilient tubular means having proximal and distal ends, said distal end of said flexible tubular means including closure means integral said flexible tubular means for sealing the interior of said flexible tubular means from without, said proximal end of said flexible tubular means being sealably attached to said chamber means adjacent said outlet opening thereof, said flexible tubular means being communicated with said inlet opening of said chamber means and having at least an outrolled position and an inrolled position thereto, means for selectively delivering fluid under pressure to said inlet opening of said chamber means to expand outwardly the flexible walls of said flexible tubing means and to fully extend said flexible tubular means longitudinally when said flexible tubular means is in said outrolled position, roller means disposed within said chamber means, a prime mover, means for selectively activating said prime mover so as to selectively rotatably drive said roller means, lanyard means having one of the ends thereof fixedly attached to said flexible tubular means adjacent the lower part of said

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closure means and internally thereof, the other end of
 said lanyard means being fixedly attached to said roller
 means, deactivating said fluid pressurizing means and
 sequentially activating said prime mover being effective
 to cause said flexible tubular means to invert itself 5
 along the length thereof while going from said outrolled
 position to said inrolled position and to simultaneously
 be retrievably reeled onto said roller means, and tie
 means for holding certain opposite portions of the wall
 of said flexible tubular means closer together than are 10
 certain other opposite portions thereof, said tie means

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being arranged in two rows extending along the length
 of said flexible tubular means establishing an inner
 channel and a pair of outer channels, moving said flexi-
 ble tubular means from said inrolled position towards
 said outrolled position being effective to pass said lan-
 yard through said inner channel, and returning said
 flexible tubular means to said inrolled position being
 effective to cause, said lanyard to pull the portions of
 said flexible tubular means defining in part said outer
 channels into said inner channel. 10

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