Oct. 26, 1965 L. SINGER 3,213,473

PIPE CLEANING DEVICE

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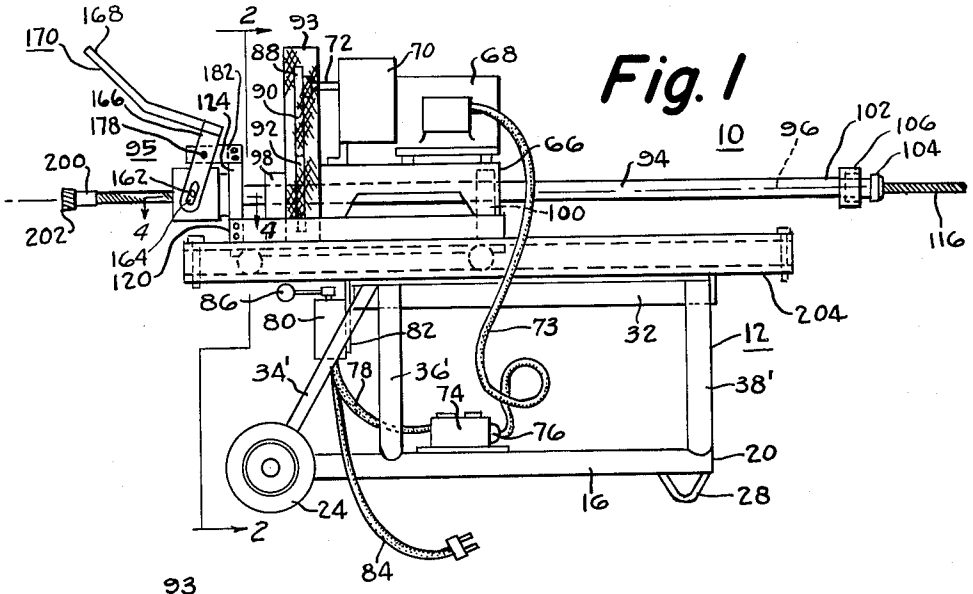


Fig. 1

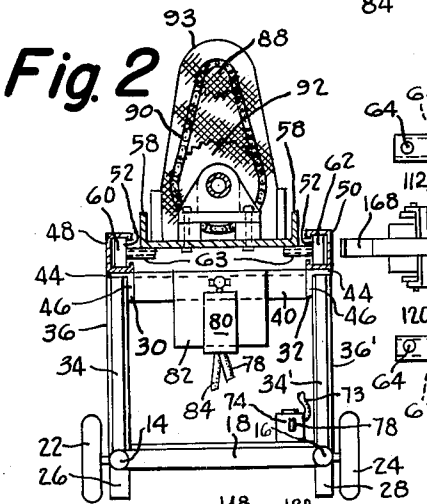


Fig. 2

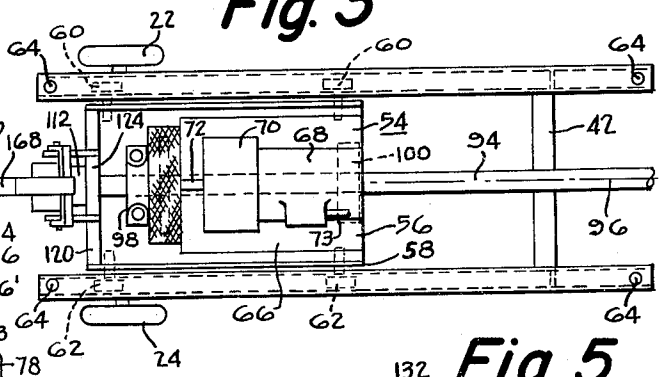


Fig. 3

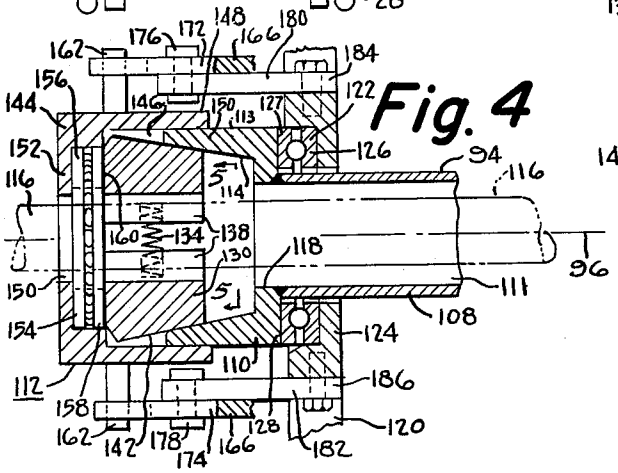


Fig. 4

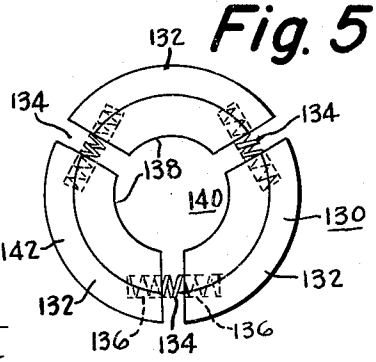


Fig. 5

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PIPE CLEANING DEVICE

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3 Claims. (Cl. 15—104.3)

The invention relates to a pipe cleaning device, and more particularly, to a device for rotating and feeding a pipe cleaning element or snake.

Although pipe cleaning devices for rotating and feeding a cleaning element provided with a cutting head at its end have been provided heretofore, such devices have been highly complex, expensive and difficult to operate.

Therefore, it is a primary object of the invention to provide a new and improved pipe cleaning device of rugged construction and high serviceability and which is readily portable from one location to another.

Another object of the invention is to provide a new and improved pipe cleaning device having a clamping means which can be actuated to engage a pipe cleaning element for rotating and feeding same, while becoming automatically disengaged upon release of its control lever.

Another object of the invention is to provide a new and improved pipe cleaning device which includes a highly simplified means for feeding or retracting the elongated pipe cleaning element or snake during the performance of a cleaning operation.

Another object of the invention is to provide a new and improved pipe cleaning device having a carriage slidably supported by and removable from a support structure.

Another object of the invention is to provide a new and improved pipe cleaning device which is highly reliable and inexpensive to produce, operate, and maintain.

The above objects of the invention are achieved by providing a pipe cleaning device comprising a portable frame structure including a pair of track elements at its top, a carriage means including a platform with a plurality of guide elements movably engaging the track element of the structure for positioning the carriage along the structure, a clamping means for receiving a cleaning element therein, rotatably mounted upon the platform of the carriage having means for controllably engaging the clamping means with the cleaning element, and drive means supported by the platform of the carriage for controllably rotating the clamping means.

The clamping means includes a guide tube for movably receiving therethrough the cleaning element which may be of elongated coil wire form, a plurality of bearing units rotatably supporting the tube upon said platform in position parallel to the pair of track means, and a clamp unit having a portion secured at one end of said tube for rotation with said tube and for receiving therethrough the cleaning element extending through the tube.

A control lever means may be provided for controllably actuating the control unit for engaging and clamping therewith the cleaning element extending therethrough for rotation by the drive means and longitudinal actuation by movement of the carriage means along the track elements of the structure for feeding or withdrawing the cleaning element from a pipe or other such object during a cleaning operation. The drive means includes a motor with a rotary drive shaft mounted on the platform of the carriage over the guide tube of the clamping means, a drive or wheel member attached to the shaft of the motor, a driven wheel member secured about the guide tube, and a coupling band element connecting the wheels for rotatably driving the guide tube.

The clamping means comprises a rotatable case having a tapered bore along its longitudinal axis, a clamping ring with a plurality of resiliently secured together segments having tapered outer surfaces for conforming with the surface of the bore and being at least partly received and

slidable into the bore of the rotatable casing in the direction of its longitudinal axis, and a pressure casing positionable with respect to the rotatable casing in the direction of said longitudinal axis by actuation of the control lever for moving the clamping ring in the direction into the rotatable casing. The casings and the ring are provided with respective openings for receiving the cleaning element therethrough and the ring when actuated by the control lever in the direction into the bore of the rotatable casing causes the segments of the ring to be compressed by the tapering surfaces of the bore for firmly engaging the cleaning element passing therethrough and the rotatable casing at its engaged surfaces within the bore for causing the cleaning element to rotate with the rotatable casing. The segments of the ring are resiliently secured, tending to expand the ring out of engagement with the cleaning element passing therethrough, and the surface of the bore of said movable casing is sufficiently tapered to allow the ring to slide in the direction out of the bore due to the tendency of the ring to expand when the lever actuates the pressure casing along longitudinal axis in the direction opposite to that for removing the ring into the bore of the rotatable casing.

The above and further objects and aspects of the invention will become more apparent from the following detailed description taken with reference to the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a pipe cleaning device embodying the invention,

FIGURE 2 is an end elevational view of a pipe cleaning device partially in section taken along the lines 2—2 of FIGURE 1,

FIGURE 3 is a top plan view of the device shown in FIGURE 1,

FIGURE 4 is an enlarged sectional view of the securing means of the device shown in FIGURE 1 taken substantially on the line 4—4 of FIGURE 1, and

FIGURE 5 is an enlarged view of the ring element of the securing means taken in the direction of the arrows 5—5 of FIGURE 4.

Like reference numerals designate like parts throughout the several views.

Refer to the figures which disclose a pipe cleaning device **10** embodying the invention having a frame and support structure **12** comprising a pair of parallel bottom tubular members **14, 16** having front and rear cross bracing members **18, 20**. The forward end of the tubular members **14, 16** rotatably support a pair of wheels **22, 24**, while the rear ends are each provided with a V-shaped support foot **26, 28**.

A pair of top angle brackets **30, 32** are respectively supported by a plurality of upwardly extending struts **34, 36**, and **38** extending from the horizontal member **14** and similar struts **34', 36'**, and **38'** extending upwardly from the horizontal member **16**. The angle bar members **30, 32** are supported at the tops of the respective struts **34, 36, 38** and **34', 36', 38'** by welding or other suitable means. Front and rear cross brace angle bars **40, 42** extend transversely between the longitudinal angle bars **30** and **32**, for maintaining the angle bars **30, 32** in spaced parallel relationship to each other.

Each of the angle bars **30, 32** is provided with a horizontal flange **44** and a vertical flange **46**. A pair of track members **48, 50** are respectively secured at the horizontal flange **44** of the angle members **30, 32** in parallel spaced relationship to each other along the longitudinal extending direction of the bar members **30, 32**. The track members **48, 50** are provided with a substantially hollow rectangular configuration in which the opposite inwardly facing side walls thereof are each provided with a longitudinal slot **52**.

A carriage means **54** comprising a substantially horizontal base plate **56** and longitudinally extending upstanding side flanges **58** includes pairs of guide elements or wheels **60, 62** for being received respectively within the cavities of the guide members **48, 50**. The wheels **60, 62** are each rotatably secured at one end of a retaining shaft **63** which extends through a respective slot **52** of the members **48, 50** and has its other end secured with the plate **56**. By such means, the platform **56** of the carriage **54** may be moved in the longitudinal direction along the track members **48, 50**. The ends of the track members may be provided with bolt means **64** extending therethrough to prevent the accidental removal of the carriage **54** from the track means, while said bolt means **64** are readily removable to allow removal or replacement of the carriage means **54** with the supporting structure **12**.

A bridge support **66** is mounted upon and secured with the platform **56** of the carriage means **54** and has mounted at the top thereof an electric motor **68** which drives a gear reduction unit **70** having a forwardly extending rotary drive shaft **72**. The motor **68** is connected by a long flexible electrical cable **73** with a punction box **74** which is secured with the horizontally tubular member **16**. The cable **73** is sufficiently long so that it does not restrict the movement of the carriage means **54** along its entire length provided by the track means **48, 50**. The end **76** of the cable **73** is provided with a plug which is readily removable from the junction box **74**, so that the carriage means **54** may be removed from the supporting structure **12** as described above.

The junction box **74** provides connection between the cable **73** and an electrical line **78** which connects to a motor control box **80**. The motor control box is secured by a vertical plate **82** with the cross brace bar **40** of the support structure **12** and has a cable **84** for connecting with a source of electrical power. The motor control box **80** is provided with a rotatable lever **86** having an off position, forward position, and a reverse position for respectively controllably de-energizing the motor **68** energizing it to run in its forward direction and in its reverse direction. Energization of the motor **68** in the forward direction results in the rotation of the drive shaft **72** in one direction, while the positioning of the motor box lever **86** to the reverse position results in the rotation of the shaft **72** in the opposite direction.

The shaft **72** is provided at its end with a driver wheel **88** which is linked by a flexible coupling band **90** with a driven wheel **92**. A wire guard **93** may be provided for enclosing the rotating wheels **88, 92** and the drive band **90** for safety purposes.

The driven wheel **92** is concentrically positioned about and secured with a guide tube **94** of a securing means **95**. The guide tube **94** is mounted for rotation about its longitudinal axis **96** by bearings provided by the forward and rear bearing blocks **98** and **100**. The guide tube **94**, as thus positioned, is parallel to and equidistant from the track means **48, 50** and extends in the longitudinal direction under the bridge support **66** of the motor **68** and gear reduction unit **70**. The rear end **102** of the tube **94** is provided with a flange **104** and a standard coupling **106** for connection to a guide tube similar to the guide tube **94** for extending the length of the guide tube **94** where a cleaning element or snake of long length is to be used and whipping action thereof is to be minimized when the cleaning element is rotated by the device **10**.

The forward end **108** of the guide tube **94**, as clearly shown by FIGURE 4, is secured with a rotatable casing or drum **110** of the securing unit **112** of the means **95**. The casing **110** has a cylindrical outer surface **113** and an inner wall **114** of conical section tapering in the direction towards the guide tube **94**, providing a bore opening therewithin. The guide tube **94**, which is hollow, provides an opening therethrough **111** for receiving therein vides an opening **111** therethrough for receiving therein an elongated cleaning element or snake **116**. The rotatable casing **110** is also provided with an opening **118** in alignment with the opening **111** provided in the tube **94** for also receiving the elongated element **116** therethrough.

The end **108** of the guide tube **94** and the rotatable casing **110** are rotatably supported within a bearing block **120** extending between the flanges **58** of the front end of the platform **56** of the carriage means **54**. The block **120** provides a ball bearing **122** in the central upwardly extending portion **124** of the block **120** of the thrust type having a race **126** non-rotatably secured with the portion **124** of the block **120** and a second rotatable race **127** engaging the shoulder **128** of the casing **110** for resisting thrust forces exerted thereon in the longitudinal direction towards the end **102** of the guide tube **94**.

The securing unit **112** also includes a slit ring **130** shown in enlarged form in FIGURE 5 comprising a plurality of segments **132** which are resiliently connected together by coil springs **134** which have their ends received within cylindrical openings **136** in the segments **132**. The ends of the springs **134** tend to move away from each other, expanding the ring **130**. The segments **132** are provided with inner surfaces **138**, providing an opening **140** through the ring **130** for allowing the passage and receipt therethrough of the elongated cleaning element **116**. The opening **140** is small enough when the segments **132** are collapsed against the force of their springs **134** to firmly engage and clamp the elongated cleaning element **116** therewithin. Each of the segments **132** of the ring **130** is provided with an outer tapered surface **142** which is a section of a cone, conforming with the surface **114** of the rotatable casing **110**. The ring **130** is receivable within the bore of the casing **110**, as shown in FIGURE 4 with the outer surfaces **142** of the segments **132** of the ring **130** engaging the bore surface **114** of the casing **110**, the ring **130** being slidable along the axis **96** of the guide tube **94** in the direction toward its end **102**. The tapered slope of the bore **114** in that direction causes the compression of the segments **132** of the ring **130**, reducing the size of the opening **140** provided by the inner surfaces **138**.

The ring **130** is actuated in the direction towards the end **102** of the guide tube **94** along the axis **96** by a pressure plate or outer casing **144** of substantially cylindrical form having an opening therein **146** providing an extending end **148** which contacts and receives therewithin the end **150** of the rotatable casing **110**. The opening **146** is of substantially cylindrical form and communicates with a central opening **150** in the front wall **152** of the casing **144** through which the elongated flexible cleaning element **116** may freely extend. A thrust bearing **154** is positioned proximate the wall **152** within the casing **144** with its central opening in alignment with the opening **150** of the casing **144** and having a stationary race **156** secured with the casing **144** and an exposed race **158** rotatable with respect to the first race **156** and controllably engaging the end wall **160** of the ring **130** for rotation therewith.

The casing **144** is provided with diametrically opposite outwardly extending pins **162** which are received within respective slots **164** in the arms **172, 174** of a U bracket **166** (see FIGURE 1) which is secured at its top with a forwardly extending lever **168** to provide a control means **170** for the securing unit **112**. Each of the arms **172, 174** of the bracket **166** (see FIGURE 4) is pivotally secured by bolt means **176, 178** with a respective horizontally extending member **180, 182** secured at its end **184, 186** with the central upwardly extending portion **124** of the bearing block **120**.

When a downwardly exterted force is applied to the end of the lever **168** of the control means **170**, the bracket **166** is caused to pivot about the bolt means **176, 178** in the counterclockwise direction, exerting a force upon the outer casing **144**, urging it in the direction towards the end **102** of the guide tube **94** along the axis **96**. This results in the application of a pressure by the casing **144**

on the end wall **160** of the ring **130**, urging the ring in the axial direction into the bore of the rotatable casing **110**. This movement, as explained before, results in the contracting or collapsing of the segments **132** of the ring **130**, causing the ring to firmly secure and grip the elongated element **116** or snake passing through its opening **140**. At this time, pressure is also applied between the contacting surfaces **142**, **114** respectively of the ring **130** and rotatable casing **110**, resulting in the ring **130** firmly frictionally engaging and rotating with the rotatable casing **110**. The pressure exerted on the ring **130** by the casing **144** is through the bearing **154**, allowing the ring **130** to rotate freely with respect thereto. Of course, the connection of the outer casing **144** with the control means **170** prevents its relative rotation and allows only its movement in the direction along the axis **96**. Similarly, the bearing **122** receives and transmits the thrust force exerted upon the ring **130** and casing **110** for exertion upon the bearing block **120**, thereby preventing the movement in the axial direction of the casing **110** and the guide tube **94** connected therewith.

When downward force is removed from the control lever **168** resulting in the removal of pressure applied to the wall **160** of the ring **130**, the ring **130** moves in the direction out of the bore of the casing **110** in the direction away from the end **120** of the guide tube **94**. This is caused by the tendency of the ring **130** to expand under action of its springs **134**, and since the tapered slope of the bore surface **114** is made sufficiently great to easily allow such outward movement. This movement automatically results in the release of an elongated cleaning element **116** which may have been clamped within the opening **140** of the ring **130**. Of course, this is an important factor in case of an emergency where the release of the control means **170** automatically results in the disconnecting of the snake or cleaning element **114**, stopping its rotation or actuation.

In operation, the pipe cleaning device **10** may readily be transported from one location to another location where it is required. In doing this, the carriage **54** may quickly be removed from the supporting structure **12** for ease of handling. The elongated cleaning element **116**, such as a snake comprising a flexible coiled wire element, is fed through the opening in the guide tube **94**, then through the openings provided therefor in the clamping unit **112** with the control lever **168** in its released condition. The diameter of the snake and the coupling **200** provided at the front end thereof provides sufficient clearance for same to be readily received and slipped through the openings and passages of the pipe cleaning device **10**. After the end of the element **116** with the coupling **200** has been extended through and past the securing unit **112**, a cleaning tool **202** or other such means well known in the art may be secured with the coupling **200** of the cleaning element **116**. The cleaning tool **202** may then be placed into the opening of a pipe or like means which is to be cleaned by sufficiently advancing the cleaning element **116** to its required position.

In advancing or feeding the element **116**, the carriage **54** may be moved to the rear ends **204** of the tracks **48**, **50** with the securing unit **112** in its disengaged position, so that the element **116** is not actuated therewith along the longitudinal or axial direction **96**. Upon its deposition at the end of the track **102**, the clamping unit **112** may be caused to engage the element **116** by the application of a downward force on the end of the lever **168**. The element **116** may now be advanced in the forward direction by moving the carriage along its tracks **48**, **50** in the forward direction. The rate and the amonut of advance may thus be directly controlled by the operator in manually actuating the carriage **54**. Of course, mechanical means may also be provided for moving and controlling the motion of the carriage along the track means **48**, **50**. This action may be continued for feeding the element **116** in the forward direction. Where the element **116** must be removed, the clamping action is applied during the forward and backward movement of the carriage means **54** along the track means **48**, **50** only when the carriaige means **54** is moved from its forward position towards the rear end **204** of the tracks **48**, **50**. This action, of course, may be continued until the element **116** is completely removed from the tube or means being cleaned.

Since it may be desirable to rotate the element **116** when it is being advanced, this is accomplished by the motor **68** through the gear reduction unit **70** and the coupling means provided by the wheels **88**, **92** joined by the band **90** when the lever **86** of the motor control box **80** is placed in its forward or reverse position. Thus, when the lever **168** of the securing means **95** is actuated for gripping the element **116**, the element is rotated in its forward or reverse direction by the energization of the motor **68**, while the unit **116** is advanced or retracted by the movement of the carriage **54** along the tracks **48**, **50** of the supporting structure **12**. If the motor control box **80** is placed in its off position, the element **116** may be advanced or retracted without the rotary action provided by the motor **68**.

The feeding and retracting means of the pipe cleaning device **10** is of highly simplified form and allows the accurate control of the rate at which the element **116** is advanced or retracted. This simplicity is not afforded by prior art devices which are highly complex and costly, and do not provide the flexibility afforded by the disclosed device. The ease of handling of the cleaning element **116** and the efficiency resulting from the utilization of the device **10** are of great advantage as are the reliability and durability embodied therein.

It will, of course, be understood that the description and drawings, herein contained, are illustrative merely, and that various modifications and changes may be made in the structure disclosed without departing from the spirit of the invention.

What is claimed is:

1. A pipe cleaning device comprising a portable frame structure including a pair of track elements at its top; a carriage means including a platform with a plurality of guide elements movably engaging the track elements of said structure for freely positioning said carriage along said structure; a clamping means for receiving and engaging a conformable non-rigid elongated cleaning element therethrough rotatably mounted upon the platform of said carriage and having means for providing for releasable engagement of said clamping means with said cleaning element at successive locations along its length; and drive means supported by the platform of said carriage for controllably rotating said clamping means; said clamping means including an elongated guide tube extending along the track elements of said frame structure for movably receiving therethrough said cleaning element of elongated coiled wire form, a plurality of bearing units rotatably supporting said tube upon said platform in position parallel to said pair of track means, a clamp unit having a portion secured at an end of said tube for rotation with said tube and for receiving therethrough the cleaning element extending through said tube, and a control lever for controllably actuating said control unit for engaging and clamping therewith the cleaning element extending therethrough for rotation by said drive means and for controllably clamping said element with said clamping means for longitudinal actuation of said cleaning element by movement of said carriage means along the track elements of said structure for feeding or withdrawing said cleaning element from a pipe during a pipe cleaning operation; said clamp unit comprising a rotatable casing having a tapered bore along its longitudinal axis, a clamping ring with a plurality of resiliently secured together segments having tapered outer surfaces for conforming with the surface of said bore and being at least partly received and slideable into the bore

of said rotatable casing in the direction of its longitudinal axis, and a pressure casing positionable with respect to said rotatable casing in the direction of said longitudinal axis by actuation of said control lever for moving said ring in the direction into said rotatable casing; said casings and said ring providing respective openings for receiving and said cleaning element therethrough; said ring remaining stationary except when actuated by said control lever in the direction into the bore of said rotatable casing for causing the segments of said ring to be compressed by the tapered surface of said bore for firmly engagaing said cleaning element passing therethrough and said rotatable casing at its engaged surfaces within said bore for causing said cleaning element to rotate with said rotatable casing; said drive means including a motor with a rotating driveshaft mounted on the platform of said carriage means over the guide tube of said clamping means, a driver wheel member attached to the shaft of said motor, a driven wheel member secured about said guide tube, and a coupling band element coupling said wheels for rotatably driving said guide tube.

2. The device of claim 1 in which said rotatable casing is secured to and rotates with said guide tube of said clamping means and said pressure casing is provided with a thrust bearing for engaging and actuating said clamping ring.

3. The device of claim 2 in which the segments of said ring are resiliently secured tending to expand said ring out of engagement with said cleaning element passing therethrough and the surface of the bore of said movable casing is sufficiently tapered to allow said ring to slide in the direction out of said bore due to the tendency of said ring to expand when said lever actuates said pressure casing along said longitudinal axis in the direction opposite to that for moving said ring into the bore of said rotatable casing.

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