

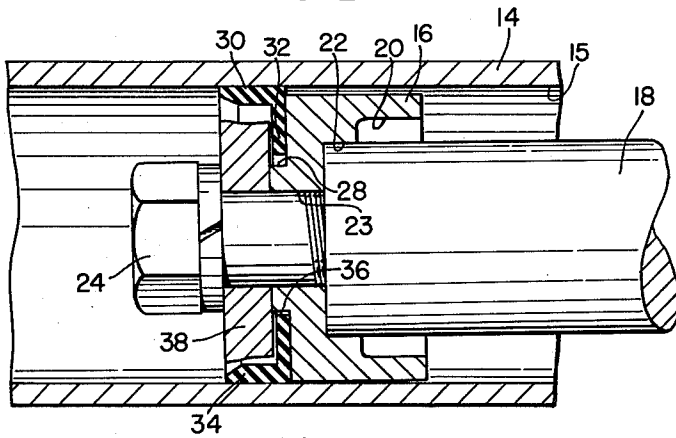
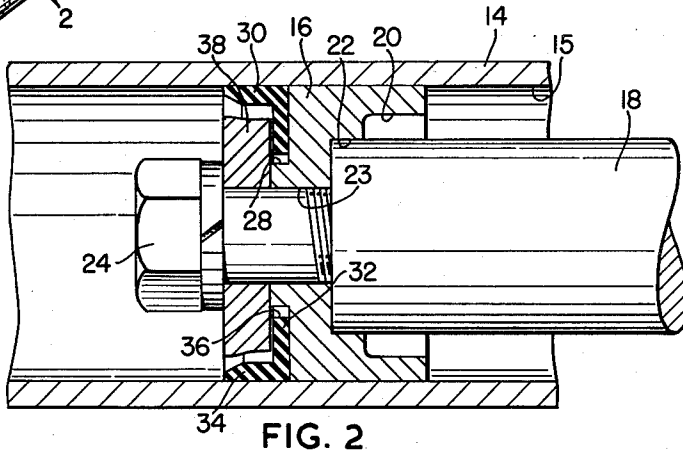
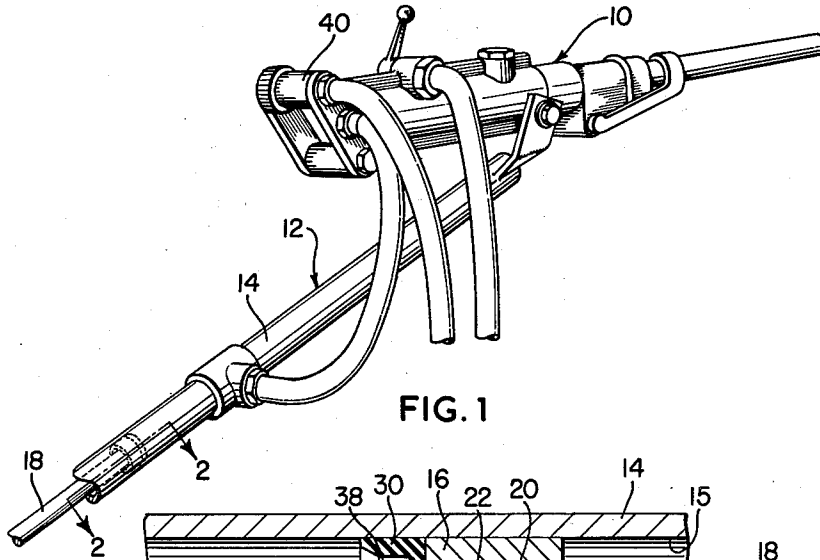
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SEALING MEANS

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SEALING MEANS

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This invention relates to pressure fluid seals and more particularly to a sealing device for rock drills having an extensible fluid operated feed leg for supporting and feeding the rock drill during the drilling operation.

Rock drills of this class are characterized by having a percussive motor pivotally connected to an elongatable pressure fluid actuated feed leg. In drilling into a substantially vertical face the operator spots a drill bit, actuated by such motor, into the face and engages an anchor element, secured to the feed leg, with a stationary surface, usually the ground. By actuation of suitable conventional controls, the operator activates the percussive motor and pressurizes the feed leg. Pressurization of the feed leg fulfills two functions: supports the percussive motor and the drill bit in a predetermined position; and feeds the drill bit into and the motor toward the work face. Such operation gives rise to conditions which cause rapid wear of certain parts of the feed leg.

In prior art feed legs the construction comprises an elongated tubular body having the end portions suitably closed to retain pressure fluid admitted thereto. One end of such tubular body is pivotally connected to the percussive motor. A piston, having a rod of reduced diameter secured thereto, is slidably disposed within the tubular body. As is known to those skilled in the art, the piston usually has deformable packing means rigidly secured thereto and having a diametrical dimension adapted to closely frictionally engage the bore of the tubular body to insure against the leakage of pressure fluid across the piston. During operation of the percussive motor the reaction of the forces applied to the drill bit is transmitted to the feed leg before they are absorbed by the ground. Such forces are of such a magnitude and act in such directions causing rapid wear of the piston and the packing rigidly secured thereto. Under conditions of sufficient wear, leakage of pressure fluid across the piston results in reducing the magnitude of the force for feeding the drill into the work face.

This invention not only defines the problem, as heretofore set forth, but discloses a new combination of elements coacting in a new manner to give a new and improved result. This invention contemplates the usual, piston-cylinder, feed leg and a deformable packing associated with the piston with the provision, however, of associating the deformable packing with the piston so that the packing is free to move in a radial direction relative to the piston. As in prior art devices, the piston of this invention wears for the same reasons but by allowing the deformable packing such freedom of movement a fluid tight seal between the head end and rod end of the piston is constantly maintained irrespective of the piston wear. This advantage increases the hours of operation between repairs and permits, when desired, sustained operation.

Accordingly one object of this invention is to provide a new and improved sealing device.

Another object of this invention is to provide a new and improved rock drill feed leg having means which maintains the feed leg at maximum efficiency irrespective of piston wear.

A further object of this invention is to provide a new and improved sealing device having a deformable packing gland movably captively retained on a piston relatively slidably disposed in a cylinder.

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A more specific object of this invention is to provide a new and improved sealing device, comprising a cylinder having a piston relatively slidably disposed therein with a deformable packing gland secured to such piston but being permitted to move radially relative to such piston.

These and other objects of this invention will become more readily apparent upon consideration of the following description taken in conjunction with the annexed drawings in which:

FIG. 1 is a fragmentary perspective view of a rock drill constructed in accordance with the principles of this invention;

FIG. 2 is an enlarged fragmentary sectional view of a portion of the device of FIG. 1 taken substantially along the line 2-2 of FIG. 1 but with the view turned 180°;

FIG. 3 is a fragmentary sectional view similar to FIG. 2 but showing the relationship of the part illustrated in FIG. 2 after the parts of the device have become substantially worn by normal operation of the device over an extended period.

In FIG. 1 there is shown a rock drill generally indicated at 10 pivotally secured to a fluid operated extensible chamber or extensible feed leg generally indicated at 12 comprising a tubular member 14 and a conventional piston and rod 16 and 18, respectively, which are relatively slidably disposed within a cylindrical bore 15 in the member 14 with the outer periphery of the piston 16, as shown in FIG. 2, closely fitting the bore 15 of the member 14. As viewed in FIG. 2 the right hand portion of piston 16 has concentric communicating axially spaced bores 20 and 22. The rod 18 has an end thereof disposed within the bore 22 and is maintained in this position by a suitable fastener such as bolt 24 which extends through another axial concentric bore 23 extending through the piston 16. The rearward end portion of rod 18 is provided with an internal threaded portion, not shown, for threadedly receiving the bolt 24 thus securing the piston 16 to the rod 18.

The left hand portion of piston 16, as shown in FIG. 2, is formed with an axially extending boss 28 being concentric with the bores 20, 22 and 23 and being of reduced diameter. A cup-shaped deformable packing member or sealing means 30 having a concentric circular opening 36 extending therethrough and located in the member 14 with the outer periphery thereof frictionally engaged with the bore 15 of the member 14. The packing member 30 comprises an annular portion 32 extending, as disposed in the member 14, in a radial direction and a tubular portion 34 extending axially, as disposed in the member 14. The respective portions 32 and 34 are integral.

As shown in FIGS. 2 and 3 the packing member 30 has the opening 36, preferably but not necessarily circular, formed therethrough. The diameter of opening 36 is substantially greater than the diameter of boss 28 and the thickness of annular portion 32 is less than the axial length of boss 28. The packing member 30 is disposed on the left hand face of the piston with the boss 28 extending through the opening 36.

In order to captively retain the packing member in the position shown a retaining means or washer-like element 38 is slidably disposed on the shank of bolt 24 and, when the bolt is tightened in rod 18, the adjacent face of washer 38 is brought in tight contact with the adjacent surface of boss 28. The outer diameter of the washer 38 is substantially greater than the hole formed in packing member 30 and of lesser diameter than the inner diameter of tubular portion 34. When the above structure is assembled as described the piston 16 is free to move radially relative to the packing member 30 thus the packing member 30 maintains a fluid tight seal which insures against leakage

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of pressure fluid across the piston 16 irrespective of piston wear. Such a cooperation of the piston 16 and the packing member 30 is due to the fact that the piston 16 is free to move in a radial direction relative to the packing member 30 by virtue of the difference in diameters of the hole 36 in the packing member 30 and the diameter of boss 23. Also by making the axial thickness of the annular portion 32 less than the axial distance of the boss 23 radial freedom of movement of packing member 30 is insured.

In order to practice the principles of this invention it is not necessary that the boss 23 be an integral part of piston 16 as shown and described. Other constructions, such as forming the locating boss on washer element 38 or by providing a distinct annular element having a bore there-through slightly larger than the shank of bolt 24 disposed between the element 38 and the piston 16. Whatever construction is used care must be taken to insure radial freedom of movement of packing member 30 relative to piston 16.

The extensible feed leg 12 is used as a single acting fluid operated jack in a manner well known in the art, pressure fluid being admitted to the upper portion of the tubular member 14 shown to the left in FIG. 2, under the control of a suitable three positioned fluid control valve 40 in a first position communicating with a suitable source of fluid pressure (not shown). Pressure fluid admitted into the bore 15 in the member 14 at the left hand side of the piston 16, as seen in FIG. 2, will force the packing member 30 against the adjacent surface of the piston 16 making the packing member 30 cooperable therewith to retain the pressure fluid within the cylindrical member 14. When sufficient pressure is applied within the cylinder 14 the pressure will cause the cylinder 14 to move to the left thus increasing the length of the extensible feed leg 12 to position and apply feeding motion to the rock drill 10. It is to be noted that during this portion of the operation the annular portion 32 of the packing member 30 is maintained in abutting engagement with the adjacent surface of the piston 16 by the force of the pressure fluid within the tubular member 14. A second or neutral position of the fluid control valve 40 traps the pressure fluid within the cylindrical member 41 causing the feed leg 12 to act as a rigid support. A third position of the valve 40 allows the pressure fluid within the member 14 to be vented to the atmosphere allowing the feed leg 12 under external forces applied either by the weight of the drill mechanism 10 or by manual forces exerted by the operator to collapse moving the member 14 to the right in FIG. 2 during which motion the packing member 30 will be held in contact with the adjacent face of piston 16 by the frictional resistance of the packing member 30 with the bore 15 of the tubular member 14. It is again to be noted that the forces acting upon the packing member 30 will maintain contact of the annular portion 32 on the packing member 30 with the adjacent face of the piston 16 so that in normal operation the desirable looseness of the packing member 30 on the cylindrical boss 23 has no affect upon the operation of the device. In case external forces should be applied to axially extend the member 14 relative to the member 18 without the normally expected use of the pressure fluid within the cylindrical member 14 the packing member 30 would move slightly away from the adjacent face of piston 16 because of its frictional contact with the bore 15 but its movement would be limited by the washer-like element 38. Whenever the packing 30 is in a position away from the face of the piston 16 normal operation, either extending or retracting the feed leg 12, would again bring the packing member 28 in co-operating relationship and abutting engagement with the adjacent face of piston 16.

Referring to FIG. 3 wear occurring on the radial surface of the piston 16 will cause misalignment of the piston 16 in relation to the inner surface of the tubular member 14. With the device of the present invention such misalignment is not transferred to the packing mem-

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ber 28, thus making it possible for the feed leg 12 to be efficiently operated even with a badly worn piston, thereby increasing the useful life of the device beyond the normal useful life span of the devices of the prior art. It is to be appreciated that the principles of this invention are generic in nature since they apply to all fluid actuated devices which incorporate sealing means. The description of this invention in connection with a rock drill is merely representative.

Having described a preferred embodiment of the invention it will be realized that modifications thereof may be made without departing from the broad scope of this invention. Accordingly it is respectively requested that this invention be interpreted as broadly as possible and be limited only by the prior art.

What is claimed is:

1. An apparatus for preventing leakage of pressure fluid from an expansible chamber being adapted to feed a rock drill comprising, an enclosed elongated chamber including a closely fitting boundary wall having relative axial movement with respect to said chamber in response to pressure fluid selectively admitted to and discharged from said chamber, deformable sealing means having the outer periphery thereof complementary to and frictionally engaging the inner surface of said chamber, means for securing said sealing means to said boundary wall, said last mentioned means including an offset boss portion formed on said boundary wall and an opening extending through said sealing means similar to said boss but being of greater dimension to permit transverse freedom of movement of said boundary wall relative to said sealing means.

2. An apparatus for preventing leakage of pressure fluid from an expansible chamber comprising, a cylinder having one closed end wherein said cylinder has an inner wall, a member mounted therein having relative axial movement with respect thereto wherein said member has an outer wall slidably engaged with said inner wall, said cylinder and said member defining an expansible chamber, deformable sealing means having the outer periphery thereof complementary to and frictionally engaging said inner surface of said cylinder, means for securing said sealing means to said member, said last mentioned means including; an offset boss portion formed on said member, an opening extending through said sealing means similar to said boss but being of greater dimension, to permit lateral radial movement of said member relative to said sealing means.

3. A sealing device for an extensible leg adapted to support and feed a rock drill comprising, an elongated tubular member, a piston disposed in said member having relative axial movement with respect to said member in response to pressure fluid selectively admissible to said member, said piston having a surface located in a plane normal to the axis of said member, a deformable sealing device having integral portions, one of said portions being annular and being locatable in abutting relation against said piston surface and another of said portions being tubular and being in slidably frictional engagement with the interior surface of said tubular member, means securable to said piston for captively retaining said sealing device in frictional engagement with said tubular member while allowing displacement of said piston in said plane due to wear thereof.

4. A sealing device for an extensible leg adapted to support and feed a rock drill comprising, an elongated tubular member, a piston disposed in said member having relative axial movement with respect to said member in response to pressure fluid selectively admissible to said member, a deformable sealing device having integral portions, one of said portions being annular and being locatable in abutting relation with the head end of said piston and another of said portions being tubular and being in slidably frictional engagement with the interior surface of said tubular member, an axially extending boss

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portion formed on said piston having a smaller diameter than the hole formed in said one portion of said sealing device with the axial extent of said boss being greater than the thickness of the annular portion of said sealing device, means securable to said piston for captively retaining said sealing device on said boss and in frictional engagement with said tubular member while allowing displacement of said piston relative to said sealing device.

5. A sealing structure comprising, an enclosed elongated chamber including a closely fitting boundary wall respectively movable along the central axis of said chamber in response to pressure fluid selectively admitted to and discharged from said chamber, deformable sealing means having the outer periphery thereof complementary to and frictionally engaging the inner surface of said chamber, means for locating said sealing means on one end of said reciprocable boundary wall including spacer

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means extending axially outward of said one end of said boundary wall, and said sealing means having an opening encompassing said spacer means and which is of greater lateral extent than the lateral extent of said spacer means to permit movement of said boundary wall relative to said sealing means transversely of said central axis.

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