Feb. 20, 1973 J. E. GORDON 3,717,071

ROPE FEED PISTON ASSEMBLY

Filed June 2, 1970 2 Sheets-Sheet 1

FIG. 1

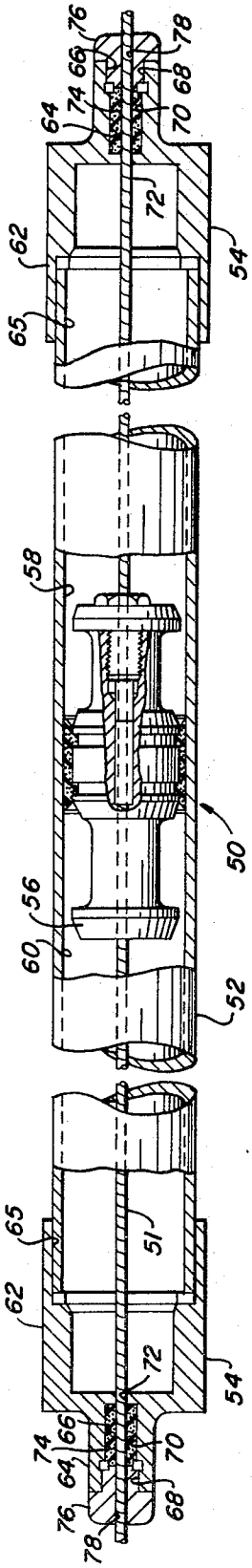
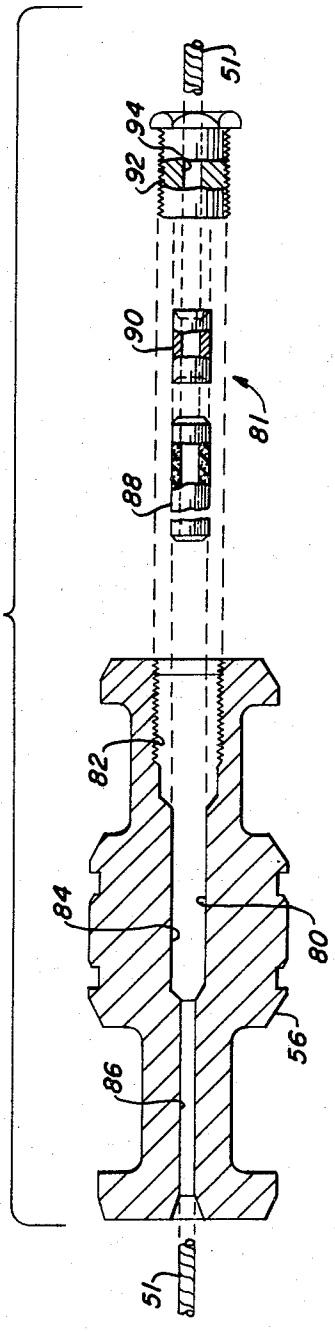


FIG. 2



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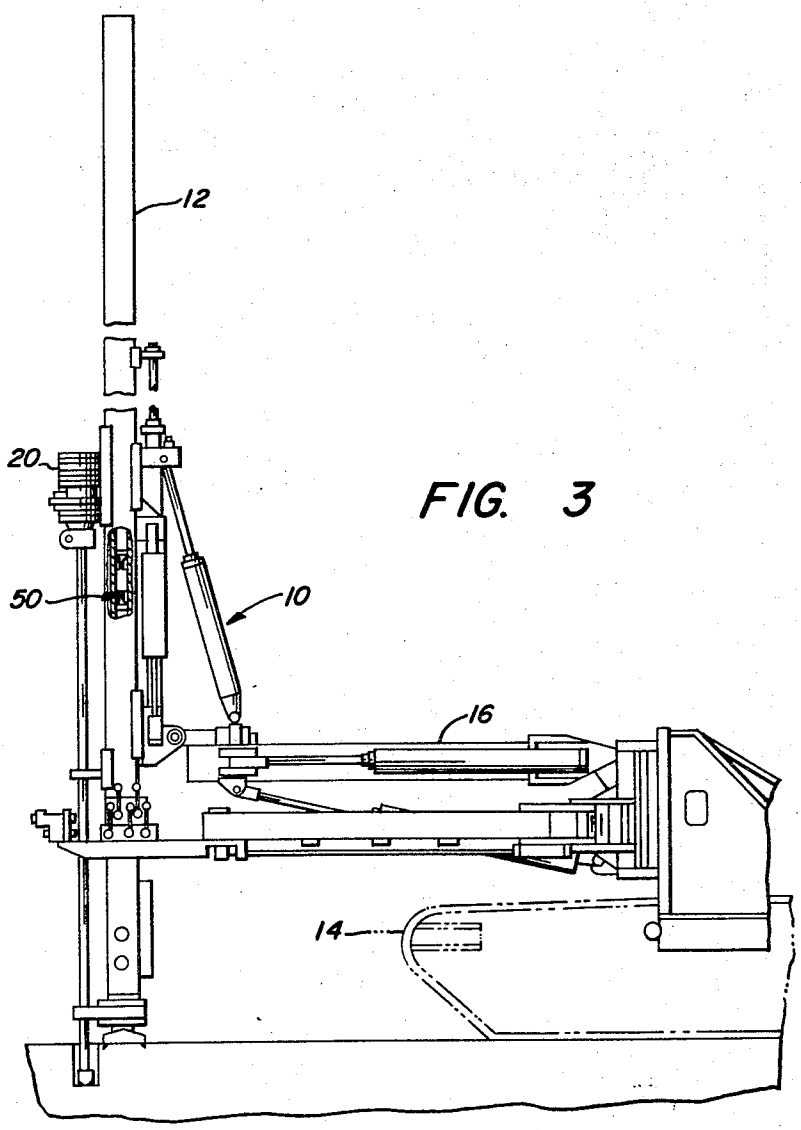


FIG. 3

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ROPE FEED PISTON ASSEMBLY

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ABSTRACT OF THE DISCLOSURE

A feed cable piston assembly and more particularly means for keeping the feed cable relatively free from dirt build-up and means for securing the feed cable to a driving piston head.

With some feed cable apparatus presently in use, a feed cable piston assembly is used to provide power for the feed cable apparatus. With such prior feed cable piston assemblies, the feed cable is generally terminated at the piston and fastened thereto. Experience has shown that such previous meas of fastening the end of the feed cable to the piston is unsatisfactory in that premature wear and breakage develops at the connection and because such connection is located within a relatively sealed piston chamber, such wear is difficult to observe and the breakage is difficult to repair without disassembly of the pisnot assembly.

By use of the present invention which includes a compression assembly for securing the feed cable to the piston, the cable is passed through the piston unbroken and accordingly occurrences of feed cable breakage and/or wear within the piston assembly is reduced.

Another feature of the present invention is passing the feed cable through sleeves made of urethane or the like. Such sleeves are secured at each end of the piston assembly and permit a controlled outward air leakage because of the uneven outer surface of the cable thereby preventing dirt from being carried by the feed cable to the interior of the piston assembly. The sleeves additionally provide a relatively frictionless wiping of the feed cable as it passes therethrough.

These and other objects and advantages of this invention will become more readily apparent from a reading of the following description and drawings, in which:

FIG. 1 is a side cross-sectional view of a feed cable piston assembly constructed in accordance with the principles of this invention;

FIG. 2 is an expanded side view, partly in section, of the piston head shown in FIG. 1 and the means for securing such piston head to a feed cable passing therethrough; and

FIG. 3 is a side-elevational view of a drilling device embodying the principles of this invention and with a portion of the mobile side supports and frames being omitted.

An elongated feed cable piston assembly **50** comprises: an elongated hollow cylindrical piston casing **52**; casing end caps **54** which sealingly receive respective ends of casing **52** within the inner ends thereof; and, as shown, a double acting piston head **56** which is slidingly and sealingly received within casing **52** thereby separating casing **52** into a retracting chamber portion **58** intermediate the rearward ends of head **56** and casing **52** and a feeding chamber portion **60** intermediate the forward ends of head **56** and casing **52**.

A suitable elongated load transmitting flexible member such as feed cable **51** has a continuous unbroken portion thereof extending longitudinally through assembly **50** and fixedly secured to piston head **56** in a manner as hereinafter described. For purposes of the hereinbefore and hereinafter description of piston assembly **50**, forward and rearward

shall refer respectively to the left and right as viewed in FIGS. 1 and 2.

End caps **54** have a generally cylindrical cross section and include an inner portion **62** and a smaller diameter outer portion **64**. Inner portion **62** has a bore **65** therein to receive the respective end of casing **52** therein as specified above and is provided with a fluid conducting connection **63** communicating between the interior of each end cap **54** and a source of pressure fluid (not shown) such as compressed air. Outer portion **64** has a three-stepped bore **66** extending axially therethrough. Bore **66** includes bore portions **68**, **70** and **72** which respectively progress inwardly from the outer ends of portion **64** and have respective decreasing diameters.

A cylindrical elastomeric sleeve **74** having an axial length and outer diameter thereof substantially equal to the respective axial length and diameter of bore portion **70** is received within bore portion **70**. An end cap plug **76** which has a central bore **78** therethrough is releasably received within bore portion **68** to retain sleeve **74** within bore portion **70**. Bore **78**, bore portion **72** and the inner bore of sleeve **74** are in axial alignment and have diameters thereof substantially equal to the outermost diameter of the feed cable **51** thereby permitting cable **51** to pass therethrough during the reciprocal operation of piston assembly **50**.

Pressure fluid leakage around the outside diameter of sleeve **74** is prevented by sleeve **74** seating against the inner end of plug **76** when the respective feeding or retracting chamber is pressurized from a suitable fluid pressure source (not shown). Leakage of pressure fluid does take place between the sleeve **74** and cable **51** due to the uneven outer surface of the cable **51** caused by the strands from which the cable **51** is manufactured. Such leakage prevents dirt and the like from being carried inside piston assembly **50**.

Inasmuch as sleeve **74** is made of an elastomeric material, the above described leakage is substantially constant regardless of the pressure within the feeding or retracting chamber for when the pressure within chamber **58** or **60** increases, such increase in pressure tends to compress the respective sleeve **74** and, as such, causes it to fit more snugly about cable **51** and thus reduce leakage at higher pressures. This compression of sleeve additionally compensates for excessive wear of sleeve **74** by maintaining a snug fit between sleeve **74** and cable **51**.

Piston head **56** has a three-stepped bore **80** extending axially therethrough for receiving feed cable **51** therein. Bore **80** includes bore portions **82**, **84** and **86** which respectively progress forwardly from the rearward end of piston head **56** and have respective decreasing diameters. Feed cable **51** is fixedly engaged with piston head **56** by means of a compression sleeve assembly **81** which is insertable within bore portions **82** and **84**.

Compression assembly **81** includes a cylindrical elastomeric compression sleeve **88** which has an axial length thereof less than the axial length of bore portion **84** and which is received within portion **84** such that the forward end thereof is seated at the forward end of portion **84** and the rearward end thereof is intermediate the axial ends of portion **84**. A suitable cylindrical spacer sleeve **90** is insertable axially within bore **80** such that the forward end thereof is engageable with the rearward end of sleeve **88** and the rearward end thereof is located intermediate the axial ends of bore portion **82**. Bore portion **82** has the rearward end thereof threaded for threadably receiving a compression screw **92** partially therein. Compression screw **92** has a bore **94** extending axially therethrough. Bore **94**, bore portion **86**, the inner bore of sleeve **90** and the uncompressed inner bore of compression sleeve **88** are in axial alignment and have diameters thereof substantially equal to the outermost diameter of feed cable **51**.

With such an arrangement of the compression sleeve assembly **81** as hereinabove described piston head **56** is fixedly secured to feed cable **51** by initially threading cable **51** through the piston head **56**, the compression sleeve **88**, the spacer sleeve **90** and the compression screw **92**. After such initial threading, the piston head **56** is adjusted to the desired location on the length of cable **51**. The compression screw **92** is then tightened thereby exerting an axial force on compression sleeve **88** through spacer sleeve **90** which communicates therebetween. The axial force compresses sleeve **88** thereby resulting in the elastomeric body thereof flowing into and around all the crevices formed by the wire strands of cable **51** and thus obtaining a firm but undamaging grip on cable **51**. The compressed sleeve **88** additionally provides a fluid tight seal within bore **80**.

It is to be noted that a feed cable assembly **50** as described hereinbefore is intended for use in any type of apparatus making use of a feed cable to feed and/or retract an element during the operation of such an apparatus. An example of the use of a feed cable assembly of this invention is shown and illustrated in my copending United States application Ser. No. 43,138, filed June 3, 1970 and assigned to the same assignee as is this invention.

The above copending application shows and more completely describes the employment of this invention in a drilling apparatus **10** such as that depicted in FIG. 3 which includes a drill guide frame assembly **12** supported and rendered movable over a surface by a crawler support **14** of a type well known in the art. Frame assembly **12** is suitably movably supported by a well known boom assembly **16**. Frame assembly **12** supports a drill motor **20** thereon, which motor **20** is axially movable with respect to frame assembly **12** by means of the feed cable assembly **50** of this invention.

Although preferred embodiments of various features of this invention have been described and illustrated herein, one skilled in the art can readily embody the principles of this invention in other forms to obtain the same operation and advantages without departing from the scope of the invention, for example: although a double acting piston assembly is described hereinabove the invention herein can be adapted for use with a single acting piston assembly such as by feeding an element by means of the feed cable assembly of this invention and retracting by other mechanical means or gravity; the compression sleeve can be positioned in other locations than as described; different means of providing an axial force on the sleeve **88** are contemplated; a compression assembly can be provided at each end of the piston head if desired; sleeve **88** can be constructed of partially elastomeric materials and partially of other materials; other means for wedging the feed cable to the piston head are contemplated; and the like.

The description herein does not limit the structure of this invention and the invention is defined by the scope of the claims set forth hereinafter.

What is claimed is:

1. A feed piston assembly comprising: a substantially cylindrical elongated body element; an axial bore through said body element; an elongated load transmitting member having a continuous portion extending through said bore; a deformable member received within said bore and encompassing a portion of said load member; means attached to said body element for compressing said deformable member into frictional and sealing engagement with said portion of said load member and said body bore; a casing having an elongated intermediate portion with an axially extending bore therethrough within which said piston receiprocates; end portions of said casing having bores therethrough axially aligned with said bore through said intermediate portion; and said load transmitting member being a driving cable passing through said aligned bores.

2. A piston assembly as specified in claim **1** wherein said deformable member is formed at least partially of elastomeric material.

3. A piston assembly as specified in claim **1** additionally including elastomeric wiping sleeves fixedly disposed about said cable within said bores through said end portions, said wiping sleeves having an outer diameter thereof substantially equal to the diameter of respective bores through said end portions and having an axially extending bore therethrough of a diameter substantially equal to the outermost diameter of said driving cable to provide for a preselected amount of pressure fluid leakage outwardly between said cable and said casing ends.

4. A piston assembly as specified in claim **1** wherein said means attached to said body element includes a member having at least a portion thereof threadably received within said body bore.

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173—147