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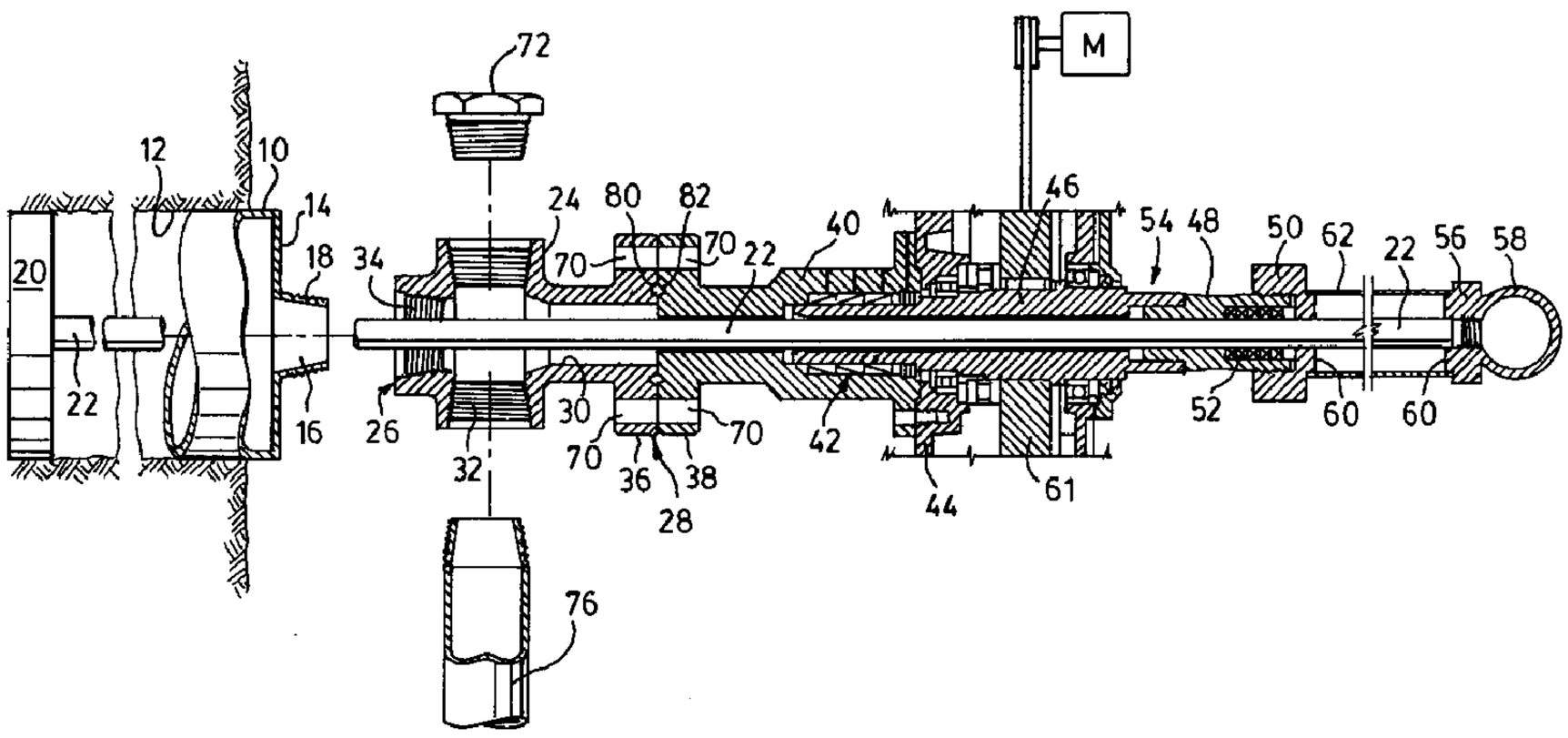
(54) **APPAREIL SERVANT A EMPECHER UNE ROTATION NON VOULUE D'UN REDUCTEUR POUR TETE DE PUITS, ET METHODE CONNEXE**

(54) **METHOD AND APPARATUS FOR SECURING A WELL HEAD DRIVE AGAINST UNINTENTIONAL ROTATION**




(57) An adaptor is provided for use with the combination of a pressure pipe down a drilled well, a rotary pump at the well bottom and a surface-located rotary drive for the pump. The adaptor is secured to the pressure pipe, and also to a housing member intended to remain stationary, and includes an axial (longitudinal) passage capable of receiving the drive string, and large enough to allow oil to pass through the passage around the drive string. The adaptor also has an open- ended transverse passage intersecting the longitudinal passage. One end of the transverse passage is closed and the other is connected to a discharge pipe extending generally radially away from the adaptor, such that the discharge pipe functions to restrain the adaptor against rotation.

## ABSTRACT OF THE DISCLOSURE

An adaptor is provided for use with the combination of a pressure pipe down a drilled well, a rotary pump at the well bottom and a surface-located rotary drive for the pump. The adaptor is secured to the pressure pipe, and also to a housing member intended to remain stationary, and includes an axial (longitudinal) passage capable of receiving the drive string, and large enough to allow oil to pass through the passage around the drive string. The adaptor also has an open-ended transverse passage intersecting the longitudinal passage. One end of the transverse passage is closed and the other is connected to a discharge pipe extending generally radially away from the adaptor, such that the discharge pipe functions to restrain the adaptor against rotation.

# METHOD AND APPARATUS FOR SECURING A WELL HEAD DRIVE AGAINST UNINTENTIONAL ROTATION

This invention relates generally to pump drives, and has to do particularly with a new design suitable for rotary pumps for oil wells.

## BACKGROUND OF THE INVENTION

Decades ago, most oil wells were operated by a downhole pump at or close to the bottom of a well, the pump being of a conventional reciprocating kind actuated by a rod string which in turn was reciprocated vertically by a pump jack.

Recently, however, many conventional reciprocating pumps have been replaced by rotary-drive progressive cavity pumps. The rotary pumps are particularly suited for the production of crude oil laden with sand and water.

With the introduction of the rotary pumps, a problem has arisen in connection with preventing rotation of the drive with respect to the casing or "pressure pipe" extending down the well.

In the field, it is common to guard against unexpected rotation of the drive by connecting a link chain around the piping in order to hold the drive in place. As the threaded connections begin to loosen, the chain holds the drive from rotational movement. However, the chains sometimes break, primarily because the tangential operating position of the chain makes it subject to very high loads. If the chain breaks when operators are standing too close to the drive, the sudden spinning of the drive and the centrifugal flinging out of the chain can be very hazardous.

## GENERAL DESCRIPTION OF THIS INVENTION

In view of the foregoing disadvantages of the use of chains on the currently-used rotary pumps for oil wells, the aim of the present invention is to provide a construction which will ensure that the drive for a pump of the kind under consideration cannot break free and begin rapid rotation.

More particularly, this invention provides, for use with the combination of a pressure pipe extending down a drilled well, a rotationally driven pump at the bottom of the well, and a surface-located drive for the pump, the drive including a prime mover and suitable means enabling the torque from the prime mover to be

transmitted along a drive string consisting of threadably connected segments extending down the pressure pipe, the combination further including a housing member intended to be stationary, the housing member having a bore for receiving the drive string, the housing member in part defining a sealing means to contain the pressure in the pressure pipe,

a method of restraining rotation of the drive during pumping, the method including:

a) providing an adaptor having a first end and a second end, the adaptor having an open-ended longitudinal passage extending from one end to the other end thereof, the longitudinal passage being capable of receiving the drive string therethrough, and an open-ended transverse passage intersecting the longitudinal passage, the adaptor having at said one end thereof first means for securing the adaptor to the pressure pipe, the adaptor further having at said other end thereof second means for securing the adaptor to said housing member;

b) securing the adaptor to both the pressure pipe and the housing member utilizing said first and second means, such that the drive string passes through said longitudinal passage;

c) closing one end of said transverse passage; and

d) connecting the other end of the transverse passage to a discharge pipe extending generally in the direction radially away from the adaptor,

whereby the discharge pipe acts to restrain the adaptor against rotation with respect to the pressure pipe, in the event that said first means fails to so restrain the adaptor.

Further, this invention provides, for use with the combination of a pressure pipe extending down a drilled well, a rotationally driven pump at the bottom of the well, and a surface-located drive for the pump, the drive including a prime mover and suitable means enabling the torque from the prime mover to be transmitted along a drive string consisting of threadably connected segments extending down the pressure pipe, the combination further including a housing member intended to be stationary, the housing member having a bore for receiving the drive string, the

housing member in part defining a sealing means to contain the pressure in the pressure pipe,

an adaptor comprising:

a) a first end and a second end,

b) an open-ended longitudinal passage extending from one end to the other end of the adaptor, the longitudinal passage being capable of receiving the drive string therethrough,

c) an open-ended transverse passage intersecting the longitudinal passage,

d) first means at said first end for securing the adaptor to the pressure pipe, and second means at said second end for securing the adaptor to said housing member, such that said drive string passes through said longitudinal passage,

e) a closure member for closing one end of said transverse passage;

wherein the other end of the transverse passage is adapted for connection to a discharge pipe extending generally in the direction radially away from the adaptor, whereby the discharge pipe acts to restrain the adaptor against rotation with respect to the pressure pipe, in the event that said first means fails to so restrain the adaptor.

Lastly, this invention provides, in combination:

a pressure pipe extending down a drilled well,

a rotationally driven pump at the bottom of the well,

a drive string consisting of threadably connected segments extending down the pressure pipe,

a surface-located drive for the pump, the drive including a prime mover and suitable means enabling the torque from the prime mover to be transmitted along said drive string,

a housing member intended to be stationary and having a bore for receiving the drive string, the housing member in part defining a sealing means to contain pressure in the pressure pipe, and

an adaptor which includes:

a) a first end and a second end,

b) an open-ended longitudinal passage extending from one end to the other end of the adaptor, the longitudinal passage being capable of receiving the drive string therethrough,

c) an open-ended transverse passage intersecting the longitudinal passage,

d) first means at said first end for securing the adaptor to the pressure pipe, and second means at said second end for securing the adaptor to said housing member, such that said drive string passes through said longitudinal passage,

e) a closure member for closing one end of said transverse passage;

whereby the other end of the transverse passage is adapted for connection to a discharge pipe extending generally in the direction radially away from the adaptor, whereby the discharge pipe acts to restrain the adaptor against rotation with respect to the pressure pipe, in the event that said first means fails to so restrain the adaptor.

## GENERAL DESCRIPTION OF THE DRAWINGS

Two embodiments of this invention are illustrated in the accompanying drawings, in which like numerals denote like parts throughout the several views, and in which:

Figure 1 is a longitudinal axial section through a portion of a rotary drive apparatus for a down-hole oil well pump, showing one embodiment of the invention;

Figure 2 is a view similar to that of Figure 1, showing a second embodiment of the invention; and

Figure 3 is a longitudinal sectional view of the second embodiment of this invention, shown to a larger scale.

## DETAILED DESCRIPTION OF THE DRAWINGS

Attention is first directed to Figure 1, which at the left shows the top end of a pressure pipe 10 (illustrated schematically). The pressure pipe 10 extends down a drilled well 12, in known manner. At the top, the pressure pipe is closed by an annular wall 14, which supports a frusto-conical nipple 16 which has an external pipe thread (tapering thread) 18.

At far left in Figure 1 a rotationally driven pump 20 is schematically illustrated.

Driving torque for operating the pump 20 is conveyed down the well by a drive string 22 typically consisting of threadably connected tubular or solid segments extending down the pressure pipe 10.

In accordance with this invention, the nipple 16 is threadably interlocked either directly to an adaptor 24 (known in the art as a Flow "T" adaptor), or indirectly to the adaptor 24 through an intermediate blow-out prevention fitting (not shown). The latter fitting is needed where oil under natural pressure would otherwise seek to escape from the well.

The adaptor 24 has a first end 26 and a second end 28, and an open-ended longitudinal passage 30 extending from one end to the other end of the adaptor 24. It will be noted that the passage 30 is large enough to receive the drive string 22 without contacting the same, thus leaving an annular space around the drive string 22 inside the adaptor 24, along which oil, or a mixture containing oil, can pass.

The adaptor 24 also defines an open-ended transverse passage 32 which intersects (and thus communicates with) the longitudinal passage 30.

At the first end 26 of the adaptor 24, first means are provided for securing the adaptor 24 to the pressure pipe 10. In the embodiment specifically illustrated in Figure 1, this first means is constituted by the combination of the exteriorly threaded nipple 16 and an internally threaded recess 34 which constitutes one end of the longitudinal passage 30.

At the second end 28 of the adaptor 24 there is provided a flange 36 which is intended to cooperate with a further flange 38 which is at the bottom of a housing member 40 which in part defines a sealing means 42 intended to contain the pressure within the pressure pipe 10, but which does not lie at the focus of the present invention. It is therefore not necessary to describe the sealing means 42 in any greater detail.

To briefly describe the remainder of the apparatus shown in Figure 1, the housing member 40 is secured with suitable fasteners to a portion 44 of a frame. The housing member 40 and the portion 44 define an internal recess within which a sleeve 46 is mounted for rotation. To the right of the sleeve 46 in Figure 1 there is illustrated a packing member 48 which cooperates with a nut 50 to compress packing 52 around the drive string 22, and thus provide a positive seal. The packing member 48 is threadably engaged with the sleeve 46 at the location 54.

The top end of the drive string 22 is threaded into a further nut member 56 which is shaped to define a ring 58 by which the entire drive string 22 can be raised upwardly and lowered. The nut 50 and the nut member 56 both have similarly shaped protuberances 60 which are linked together by a tail member 62. The protuberances 60 are non-circular, as is the tail member 62, which means that (due to the force urging the nut member 56 toward the nut 50 arising from the weight of the drive string 22), the nut 50 and nut member 56 will always rotate together.

The sleeve 46 is keyed to a pulley 61 which is rotated through an endless belt 63, driven by a prime mover (motor M). This illustration is merely a schematic representation.

Returning now to the adaptor 24, it is to be noted that the flanges 36 and 38 have matching bores 70 through which suitable fasteners (not shown) can be inserted and tightened.

A closure member 72, in the form of a threaded plug or cap, constitutes means by which one end of the transverse passage 32 can be closed and sealed against the leakage of pressurized oil.

The other end of the transverse passage 32 is adapted to be connected to a discharge pipe 76 extending generally in a radial direction away from the adaptor 24. The discharge pipe ultimately delivers oil to one or more holding tanks, and is normally configured in such a way as to make it sturdy and able to resist movement. Typically, the discharge pipe 76 (particularly in cold climates) undergoes a bend downwardly, so that it can run underground for at least part of its length, thus protecting it from extreme cold.

It will thus be seen that the provision of the transverse passage 32 in the adaptor 24, by allowing the connection of a radially directed discharged pipe (76), achieves considerable stability and resistance to torsional force.

The adaptor 24 is preferably a solid steel component of sufficient strength to withstand all exceptional loads that occur in such installations.

Illustrated in the drawing is an annular groove 80 in the flange 36, and a matching annular groove 82 in the flange 38. An O-ring seal is intended to be

lodge within these matching grooves, thus ensuring that no pressurized oil will leak out between the flanges 36 and 38.

Attention is now directed to Figure 2, in which the adaptor 24a differs from the adaptor 24 in Figure 1 only by providing, at the upper end of the adaptor 24a, an internally threaded frusto-conical recess 84 which is identical to the recess 34 at the other end. The provision of the threaded recess 84 in the Figure 2 embodiment provides flexibility in the use of the adaptor. The recess 84 is not utilized in the particular structure shown in the figures, but would allow a threaded connection to subsequent components, in the event that such use was desirable.

One of the reasons for providing the cap 72 for one end of the transverse passage 32 is the need for a standard maintenance tool connection.

Figure 3 is an expanded illustration of the adaptor 24a.

While two embodiments of this invention have been illustrated in the accompanying drawings and described hereinabove, it will be evident to those skilled in the art that changes and modifications may be made therein, without departing from the essence of this invention, as set forth in the appended claims.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. For use with the combination of a pressure pipe extending down a drilled well, a rotationally driven pump at the bottom of the well, and a surface-located drive for the pump, the drive including a prime mover and suitable means enabling the torque from the prime mover to be transmitted along a drive string consisting of threadably connected segments extending down the pressure pipe, the combination further including a housing member intended to be stationary, the housing member having bore for receiving the drive string, the housing member in part defining a sealing means to contain the pressure in the pressure pipe,

a method of restraining rotation of the drive during pumping, the method including:

a) providing an adaptor having a first end and a second end, the adaptor having an open-ended longitudinal passage extending from one end to the other end thereof, the longitudinal passage being capable of receiving the drive string therethrough, and an open-ended transverse passage intersecting the longitudinal passage, the adaptor having at said one end thereof first means for securing the adaptor to the pressure pipe, the adaptor further having at said other end thereof second means for securing the adaptor to said housing member;

b) securing the adaptor to both the pressure pipe and the housing member utilizing said first and second means, such that the drive string passes through said longitudinal passage;

c) closing one end of said transverse passage; and

d) connecting the other end of the transverse passage to a discharge pipe extending generally in the direction radially away from the adaptor, whereby the discharge pipe acts to restrain the adaptor against rotation with respect to the pressure pipe, in the event that said first means falls to so restrain the adaptor.

2. The method claimed in claim 1, in which said longitudinal passage has an internal tapered thread at said one end of the adaptor, the pressure pipe supporting a portion with an external tapered thread engageable with said internal thread, said step b) including threading the adaptor on the said portion.

3. The method claimed in claim 2, in which the transverse passage has an internal tapered thread at both of its ends, in which step c) includes screwing an externally threaded cap into said one end of the transverse passage, in which step d) includes threading the discharge pipe into the threaded other end of the transverse passage, and in which said second means includes a first flange on the adaptor, a second flange on the housing member and fastener means for securing the first and second flanges together.

4. For use with the combination of a pressure pipe extending down a drilled well, a rotationally driven pump at the bottom of the well, and a surface-located drive for the pump, the drive including a prime mover and suitable means enabling the torque from the prime mover to be transmitted along a drive string consisting of threadably connected segments extending down the pressure pipe, the combination further including a housing member intended to be stationary, the housing member having a bore for receiving the drive string, the housing member in part defining a sealing means to contain the pressure in the pressure pipe,

an adaptor comprising:

a) a first end and a second end,

b) an open-ended longitudinal passage extending from one end to the other end of the adaptor, the longitudinal passage being capable of receiving the drive string therethrough,

c) an open-ended transverse passage intersecting the longitudinal passage,

d) first means at said first end for securing the adaptor to the pressure pipe, and second means at said second end for securing the adaptor to said housing member, such that said drive string passes through said longitudinal passage,

e) a closure member for closing one end of said transverse passage;

wherein the other end of the transverse passage is adapted for connection to a discharge pipe extending generally in the direction radially away from the adaptor, whereby the discharge pipe acts to restrain the adaptor against rotation with respect to the pressure pipe, in the event that said first means fails to so restrain the adaptor.

5. The adaptor claimed in claim 4, in which said longitudinal passage has an internal tapered thread at said one end of the adaptor, the pressure pipe supporting a portion with an external tapered thread engageable with said internal thread, for securing the adaptor to the said portion.

6. The adaptor claimed in claim 5, further including an externally threaded cap, the transverse passage having an internal tapered thread at both of its ends, the discharge pipe being externally threaded at one end, whereby said externally threaded cap is threadably engageable with said one end of the transverse passage, and said one end of the discharge pipe is threadably engageable with the other end of the transverse passage, said second means including a first flange on the adaptor, a second flange on the housing member and fastener means for securing the first and second flanges together.

7. In combination:

a pressure pipe extending down a drilled well,

a rotationally driven pump at the bottom of the well,

a drive string consisting of threadably connected segments extending down the pressure pipe,

a surface-located drive for the pump, the drive including a prime mover and suitable means enabling the torque from the prime mover to be transmitted along said drive string,

a housing member intended to be stationary and having a bore for receiving the drive string, the housing member in part defining a sealing means to contain pressure in the pressure pipe, and

an adaptor which includes:

a) a first end and a second end,

b) an open-ended longitudinal passage extending from one end to the other end of the adaptor, the longitudinal passage being capable of receiving the drive string therethrough,

c) an open-ended transverse passage intersecting the longitudinal passage,

d) first means at said first end for securing the adaptor to the pressure pipe, and second means at said second end for securing the adaptor to said housing member, such that said drive string passes through said longitudinal passage,

e) a closure member for closing one end of said transverse passage;

whereby the other end of the transverse passage is adapted for connection to a discharge pipe extending generally in the direction radially away from the adaptor, whereby the discharge pipe acts to restrain the adaptor against rotation with respect to the pressure pipe, in the event that said first means fails to so restrain the adaptor.

8. The combination claimed in claim 7, in which said longitudinal passage has an internal tapered thread at said one end of the adaptor, the pressure pipe supporting a portion with an external tapered thread engageable with said internal thread, for securing the adaptor to the said portion.

9. The combination claimed in claim 8, further including an externally threaded cap, the transverse passage having an internal tapered thread at both of its ends, the discharge pipe being externally threaded at one end, whereby said externally threaded cap is threadably engageable with said one end of the transverse passage,

and said one end of the discharge pipe is threadably engageable with the other end of the transverse passage, said second means including a first flange on the adaptor, a second flange on the housing member and fastener means for securing the first and second flanges together.

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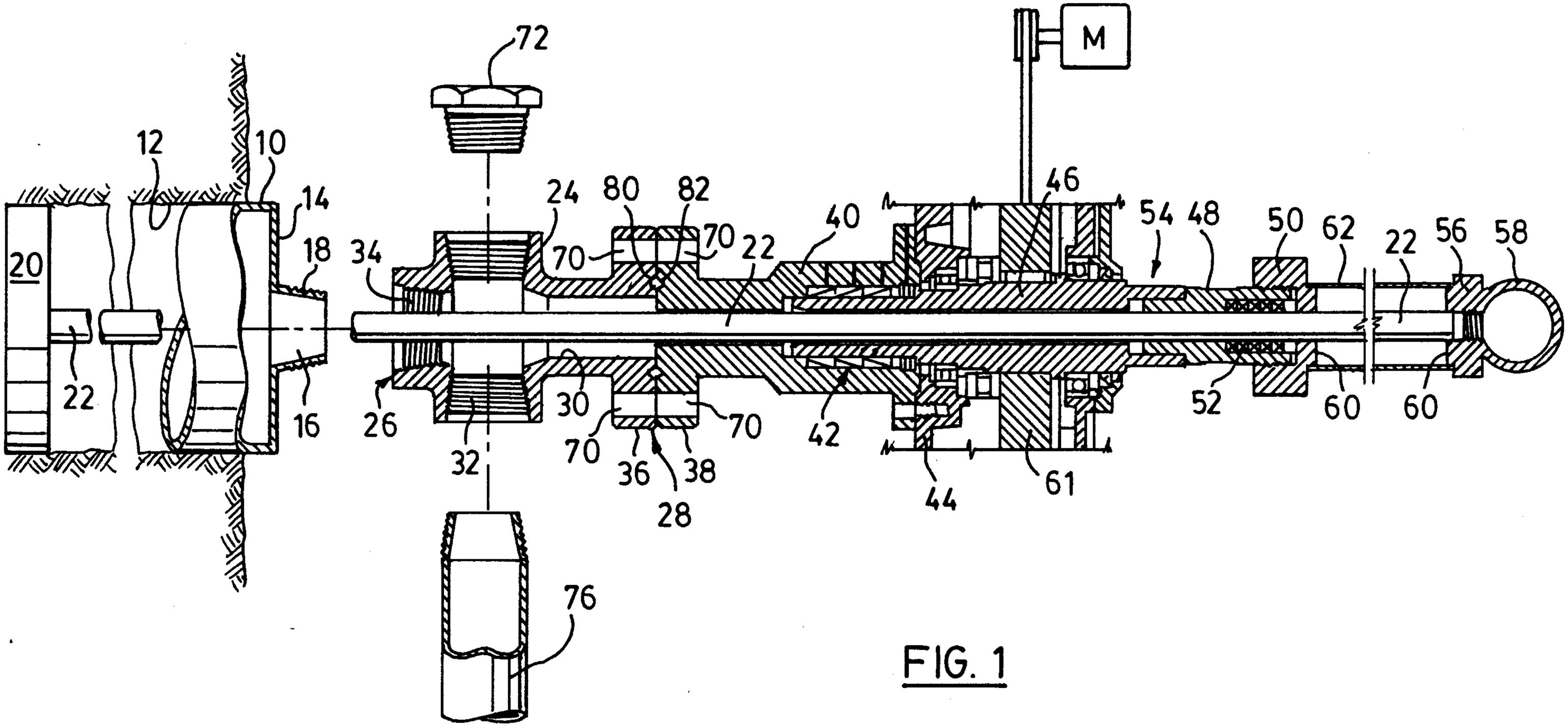


FIG. 1

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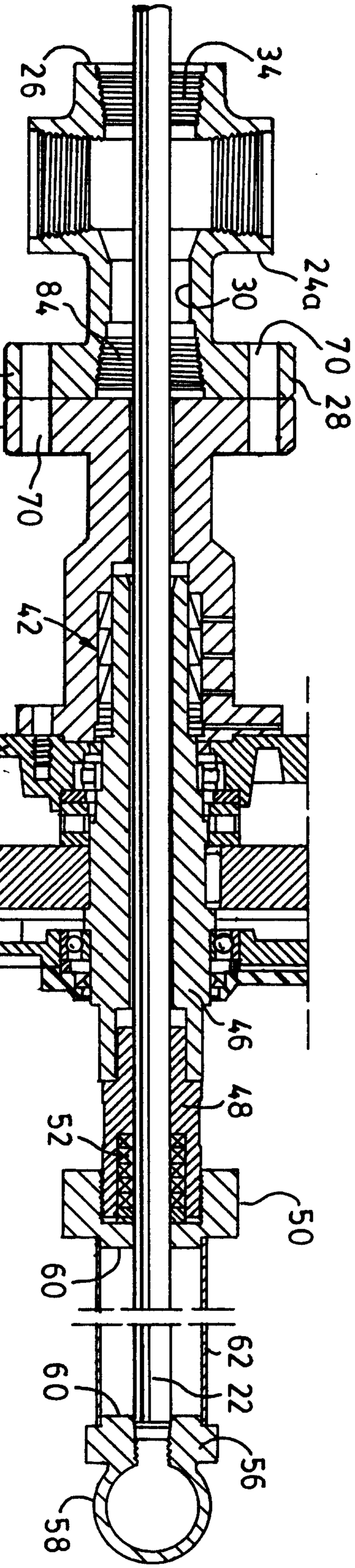
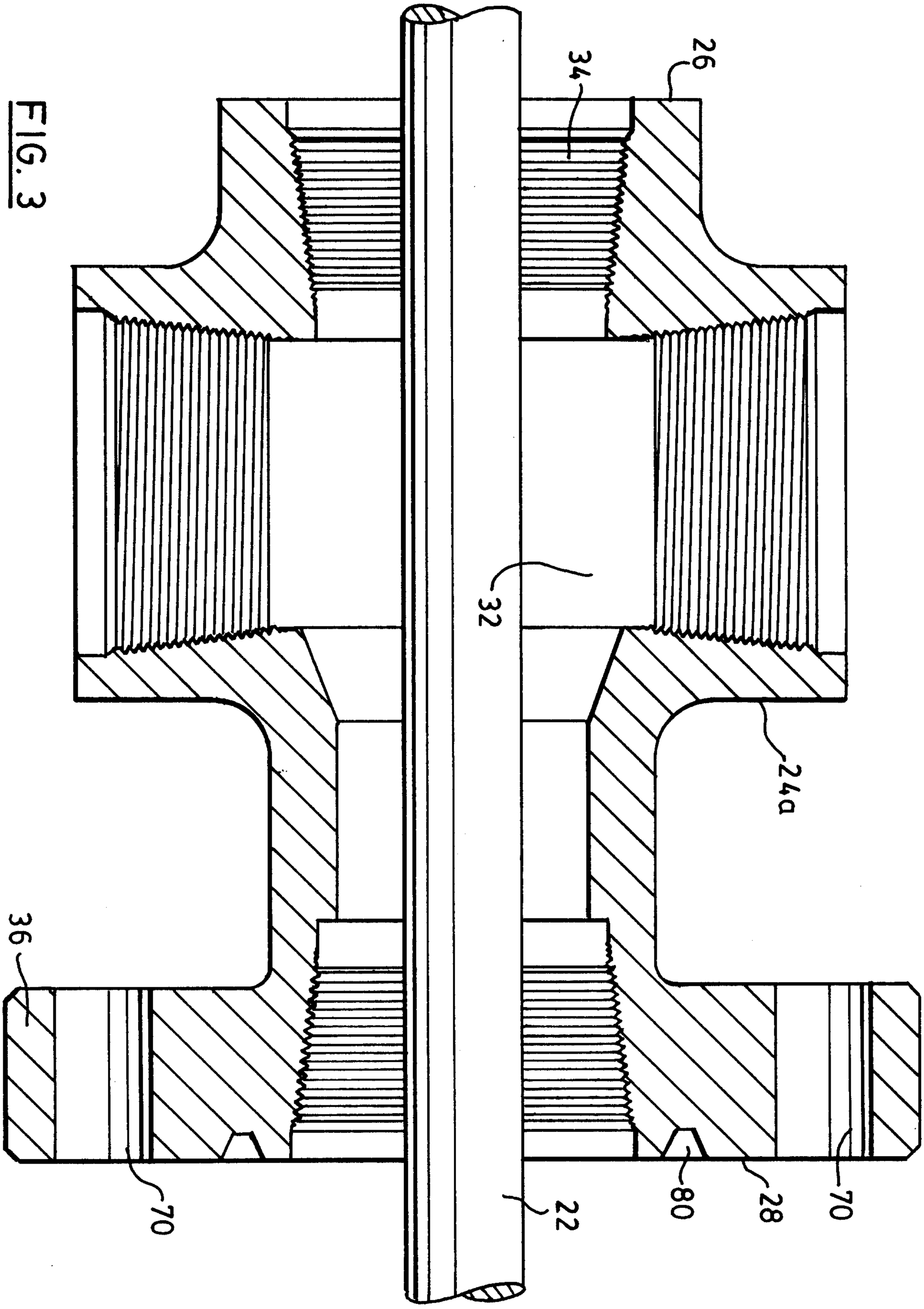



FIG. 2

FIG. 3

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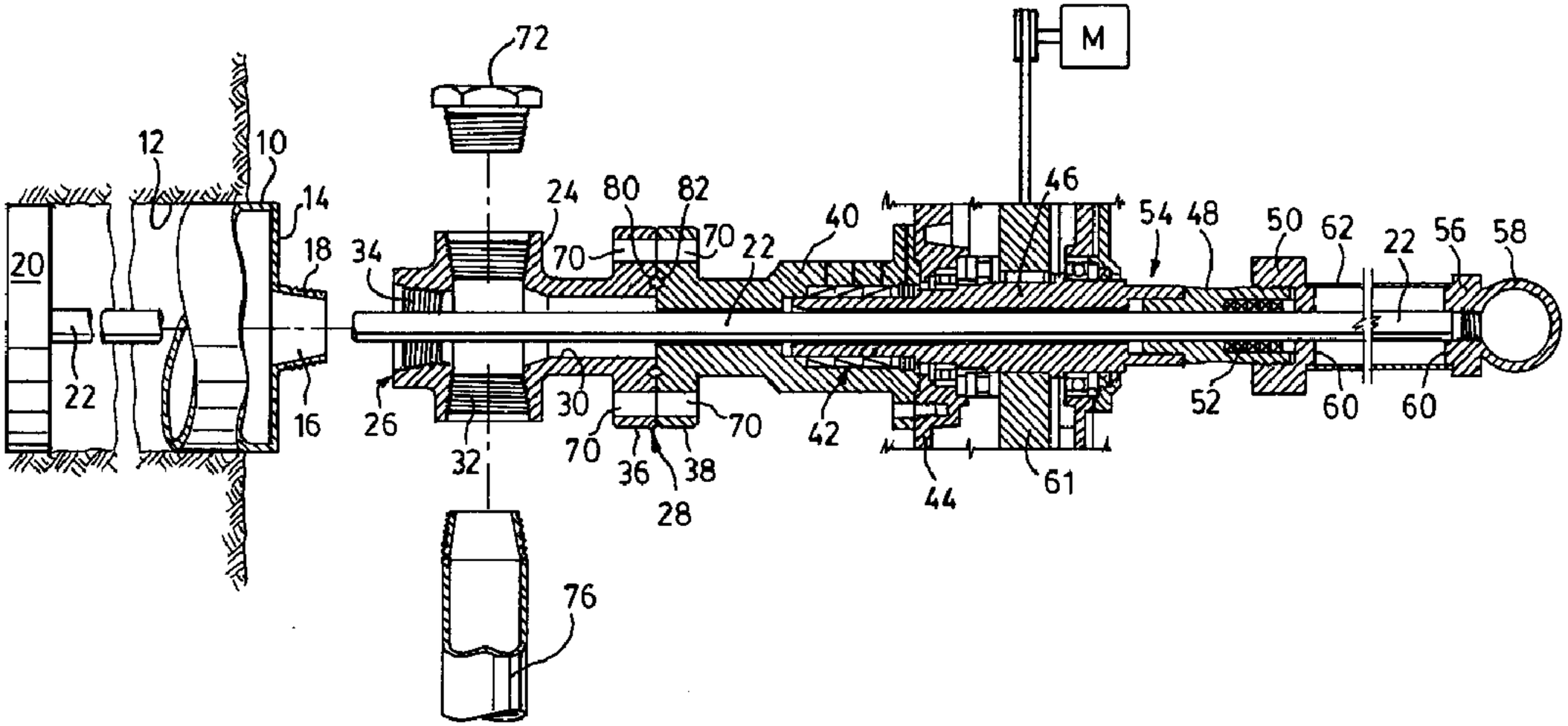
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