

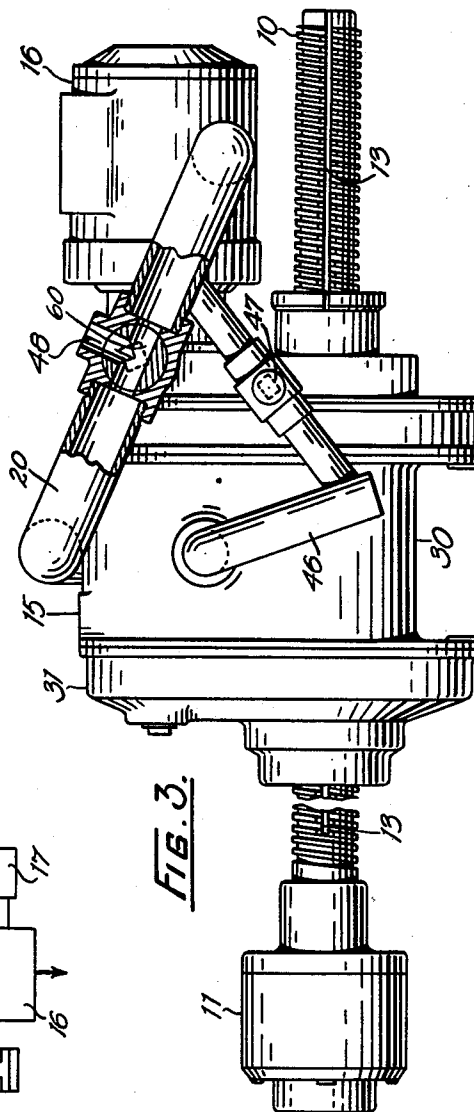
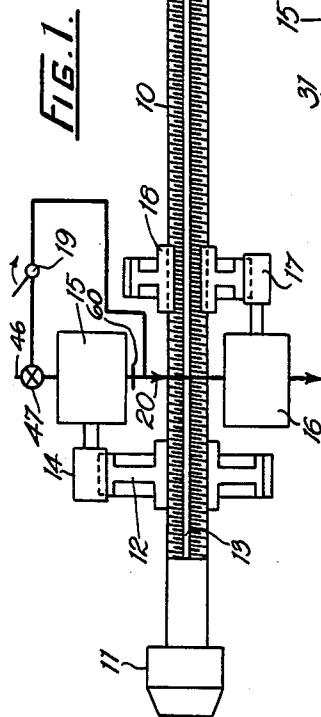
March 29, 1960

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ROTARY DRILLING MACHINES

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Filed July 5, 1956

2 Sheets-Sheet 1



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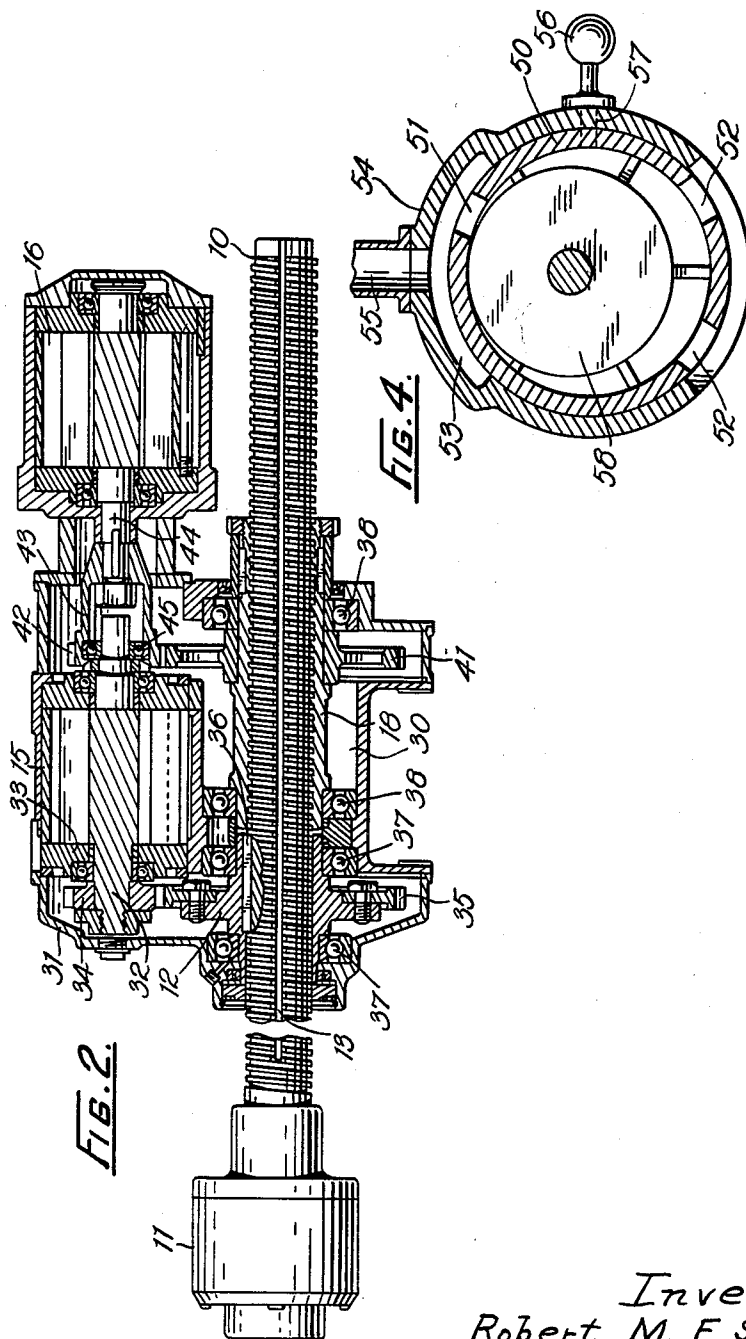
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ROTARY DRILLING MACHINES

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5 Claims. (Cl. 255—47)

This invention relates to rotary rock-drilling machines driven by motors utilizing pressure fluid and is a continuation-in-part of my abandoned application Serial No. 477,680, filed on December 27, 1954.

In machines of this kind in which the drilling tool is advanced under power, it is customary to use a single motor for both rotation and advance of the tool, the drives being transmitted through suitable gearing.

Since the optimum relationship between rotational speed and speed of advance is one that must of necessity vary considerably in practice, it is usual to provide means such as a gearbox to enable the relationship to be varied at will. However, this expedient is far from satisfactory since, even in the hands of an experienced operator sudden changes in the penetrability of the rock being bored or progressive blunting of the cutting formations may cause the tool to be over- or under-fed.

To avoid damage to the tool and the machine by over-feeding, it has been proposed to interpose a slipping clutch in the feed mechanism. This device, however, introduces a wearing part which has to be periodically replaced and is in any case no more than an energy-wasting palliative.

An object of the present invention is to provide a machine in which the rate of feed is automatically adjusted to suit the drilling condition.

A further object of the invention is to provide a drilling machine with two motors in which the behaviour of one motor is arranged to be governed by and be dependent on the behaviour of the other.

Another object of the invention is to provide a rock drilling machine in which such behaviour of the one motor is governed with reference to the power of the other motor or a parameter of the power of the other motor.

The invention is described hereunder with reference to the accompanying drawings, in which

Figure 1 is a diagrammatic view of one arrangement,

Figure 2 is a vertical section through a machine embodying the arrangement of Figure 1,

Figure 3 is a side view of the embodiment of Figure 2,

Figure 4 is a vertical section through one or each of the motors, where it or they are constructed to allow variation of the power output.

In Figure 1 the machine comprises a splined feedscrew 10 provided with a chuck 11 for the drilling tool. Rotation is imparted to the feedscrew by a ribbed collar 12 which engages the splines 13 and is driven through a geartrain 14 from the first air motor 15.

The exhaust of the motor is fed to the second motor 16 which, through gearing 17, rotates a feed nut 18 that is engaged with the screw-threading of the feedscrew 10.

Means is comprised to feed a portion of the stream of pressure fluid directly to the second motor 16, the proportion of the stream fed to the two motors being adjustable by a control cock 19. The by-pass is fed into the conduit 20 carrying the exhaust of the first motor 15, so that the by-passed pressure fluid supplements the back pressure at the exhaust of the first motor 15 and

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increases the admission pressure to the second motor 16, thus reducing the ratio of the power outputs of the first and the second motors. Thus the ratio of rotation power to feed power can be selected for the type of ground being bored and the type of bit or crown being used.

In Figures 2 and 3 a casing 30 encloses a part of the length of the feedscrew 10 and the gearing whereby it is driven. The two air motors 15 and 16 are arranged in an extension 31 of the casing 30, in line with one another.

The motors are of the eccentric rotor-sliding vane type and are conventional in operation.

The rotor shaft 32 of the motor 15 has mounted on it, outside the end wall 33, a pinion 34 which drives a gear wheel 35 that is bolted to a collar 12 that surrounds the feed shaft 10 and is engaged with it against relative rotation by keys 36 slidable in the splines 13 of feedscrew 10.

The collar 12 is journaled in the casing 30 in ball bearings 37.

The feed nut 18 is mounted for rotation in ball bearings 38 and is driven by a gearwheel 41 secured to it, which in turn is driven by a pinion 42. The pinion is carried by a cup-shaped extension 43 of the shaft 44 of the rotor of the second motor 16. The extension is supported for rotation on a ball bearing 45 the inner race of which is fitted onto the end of the shaft 32 of the first motor's rotor.

Pressure fluid is fed to the first motor 15 through a conduit 46 (Figure 3). The exhaust fluid from the motor passes along a conduit 20 to the intake of the second motor 16. The second motor may receive all or part only of the exhaust of the first motor, depending on the adjustment of a three way control cock 60, one way 48 of which is open to atmosphere.

Additionally, the second motor may receive part of the pressure fluid flowing in the conduit 46, the extent of the by-pass being controlled by the cock 47; for the purpose discussed above in connection with Figure 1.

The modified construction of Figure 4 is intended as an alternative arrangement to that illustrated in Figures 1 and 2, in that variation of the power outputs of the two motors, achieved in Figures 1 and 2 by adjustment of the cocks 47 and 19, is effected in Figure 4 by manual variation of the expansion ratios of one or both of the motors.

In Figure 4 the motor or each motor has a rotatable liner 50 having an inlet port 51 and two exhaust ports 52. The inlet port 51 registers with an arcuate chamber 53 defined between the liner and the casing 54 of the motor, which chamber receives pressure fluid through a conduit 55.

The liner is rotatable by means of a handle 56, the shank 57 of which moves within a slot (not shown) in the casing 54 and is screwed into a hole in the liner 50.

Movement of the handle 56 enables the inlet port 51 to be adjusted radially, to vary the expansion ratio of the motor; and also to reverse the motor by shifting the port to the other side of the contact zone of the liner and the rotor 58 of the motor.

The control means, whether it be the cocks 19 and 47 of the embodiment of Figures 1 and 2, or the handle 56 of Figure 4, allows the operator to control the motors with nicety. The ratio of the power outputs of the motors can be adjusted to meet widely varying drilling conditions, or, by having the second motor underrun the first to withdraw the tool from the hole.

While in the procedures discussed it is the rotational motor, the behaviour of which governs the behaviour of the feed motor, it will be realized that the reverse procedure may well be adopted.

In operation, when resistance to rotation of the tool increases, the first motor slows down, thereby decreasing the flow of pressure fluid through it. This in turn de-

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creases the flow of fluid to the second motor, thereby reducing the rate of feed. The reduced rate of feed reduces the resistance to the rotation of the tool which permits the first motor to speed up, thus increasing the rate of feed.

Thus the machine adapts itself to the drilling conditions it encounters as well as to the condition of the cutting formations. As these deteriorate, the machine automatically adjusts its rate of feed.

It follows that damage to the bit or crown by over-feeding is obviated, especially where the ground being drilled is of varying character.

I claim:

1. A rotary rock drilling machine comprising a drilling tool, feed mechanism for the tool, a motor driven by pressure fluid and arranged to rotate the tool and a second fluid-operated motor arranged to be rotated by a portion of the pressure fluid supplemented by the residual energy in the fluid exhausted from the first motor and arranged to drive the feed mechanism.

2. The machine of claim 1 including valve means be-

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tween the motors controllable to vary the portion of exhaust fluid from the first motor which is fed to the second motor.

3. The machine of claim 1 including means adjustably to vary the ratio of the power outputs of the two motors.

4. The machine of claim 3 in which the means to vary the output ratio consists in a by-pass between the inlet to the first motor and the inlet to the second motor and valve means operable to control flow of pressure fluid along the by-pass.

5. The machine of claim 3 in which the means to vary the output ratio consists in means to vary the expansion ratio of a motor.

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