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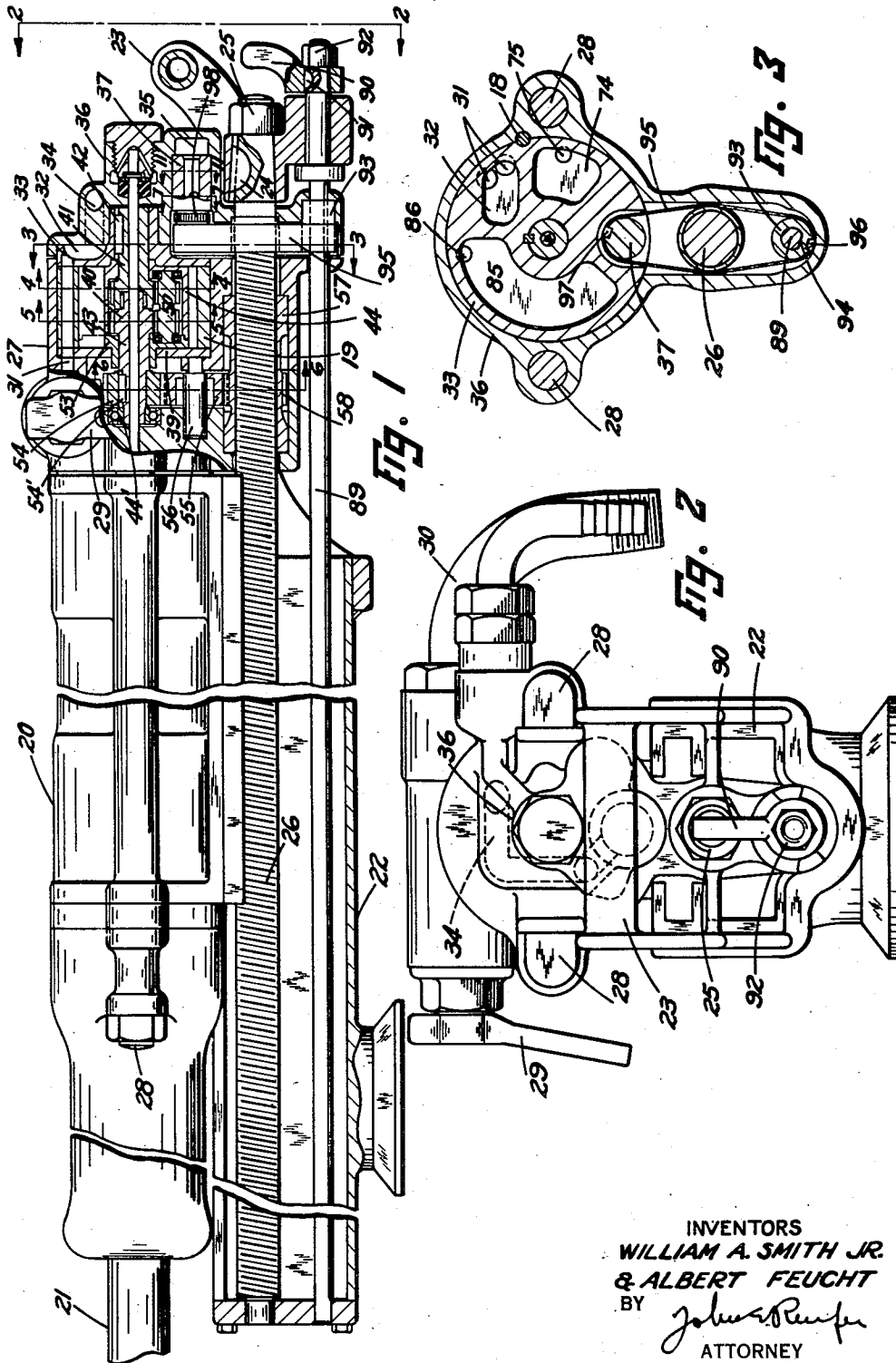
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# FEEDING MECHANISM FOR ROCK DRILLS

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## UNITED STATES PATENT OFFICE

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## FEEDING MECHANISM FOR ROCK DRILLS

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2 Claims. (Cl. 121-9)

This invention relates broadly to rock drills, but more particularly to an improved feeding mechanism for a rock drill of the drifter type.

One object of this invention is to provide a rock drill with a fluid actuated feeding motor of the rotary type constructed and arranged in a manner forming a simple and compact assembly.

Another object of this invention is to produce an improved fluid actuated rotary motor provided with self contained rotation speed reducing means of simple and efficient construction.

Another object of this invention is to provide a rock drill equipped with an automatic feeding mechanism carried by the drill for slidable movement therewith, with improved remote feed control means preferably operable from the rear end of the shell supporting the drill.

Other objects and advantages more or less ancillary to the foregoing reside in the specific construction and aggroupment of the elements peculiar to this structure, as will become apparent from a more complete examination of this specification.

In the drawings:

Fig. 1 is a side elevational view, partly in section, of a rock drill embodying the invention.

Fig. 2 is an enlarged end elevational view of the rock drill looking in the direction of the arrows 2-2 in Fig. 1.

Fig. 3 is an enlarged cross sectional view taken in a plane indicated by line 3-3 in Fig. 1.

Fig. 4 is an enlarged cross sectional view taken in a plane indicated by line 4-4 in Fig. 1.

Fig. 5 is a view similar to Fig. 4 but taken in a plane indicated by line 5-5 in Fig. 1.

Fig. 6 is an enlarged cross sectional view taken in a plane indicated by line 6-6 in Fig. 1.

Figs. 7 to 10 inclusive are enlarged cross sectional views taken in a plane indicated by line 7-7 in Fig. 1 and showing the valve in different positions.

Figs. 11 to 14 inclusive are enlarged cross sectional views taken in a plane indicated by line 11-11 in Fig. 1 showing the position of the valve corresponding to that shown in Figs. 7 and 10 respectively.

Fig. 15 is an enlarged longitudinal sectional view taken in a plane indicated by line 15-15 in Fig. 8, while Fig. 16 is a view similar to Fig. 15 showing some of the movable parts in a different position.

Referring to the drawings, 20 represents a fluid actuated rock drill or drilling motor having a fluid actuated piston (not shown) reciprocable

therein for delivering impacts to a drill steel 21. The drilling motor is slidable on a support or shell 22 having welded to the right end thereof in Fig. 1, hereinafter referred to as the rear end of the apparatus, a handle 23 to which is secured by a key 24 and nut 25, a stationary feed screw 26, which screw extends longitudinally from one to the other end of the shell 22.

A feed motor housing 27 is secured to the drilling motor 20 by side bolts 28, thereby causing the housing 27 to form a part of the drilling motor slidable therewith on the support 22. This housing accommodates a transversally disposed throttle valve rotatable through a handle 29, and having motive fluid admitted therein via a connection 30, which connection also supplies motive fluid to ports 31 independently of the throttle valve. The ports 31 lead into a pocket 32 formed within a plate 33 rigidly secured within the housing 27. From the pocket 32 the motive fluid is free to flow through a passageway 34 into the rear end of a longitudinally disposed bore 35 provided within a housing 36 which forms a cover for the housing 27. Rotatable within the bore 35, there is a feed control or valve 37, the purpose of which will be explained later.

Secured within the housing 27 by a pin 18, there is a stator 19 provided with a cylindrical chamber 38 closed at one end by the plate 33 and at the other end by a similar bearing plate 39. Extending longitudinally through the chamber 38, in eccentric relation with the center axis thereof, there is a shaft generally designated by 40, which shaft is formed of two portions, one, the portion 41 being rigidly secured against rotation in the plate 33 by a key 42, while the other portion 43 is a rotatable portion having one end journaled within the adjacent end of the stationary portion 41, while the other end is journaled within a ball bearing 44.

Rotatable within the chamber 38 of the stator 19, there is a rotor 44 operatively supported by the shaft 40. This rotor carries the usual vanes 45 radially slidable in operative engagement with the inner wall of the chamber 38. Internally the rotor 44 is adequately machined to fit on the shaft 40, and is provided, intermediate its ends, with an enlarged central cavity 46 accommodating two gears 47 and 48, the gear 47 being formed on the inner end of the shaft stationary portion 41, while the gear 48 is similarly provided on the inner end of the shaft rotatable portion 43. The rotor 44 is also formed with two diametrically opposed cavities 49-49 which are parallel to the center axis of the cavity 46 and open thereinto

as shown in Figs. 4 and 5. Within each of the cavities 49, there is journaled within adequate bearings a spindle 50 formed with two gears or pinions 51 and 52, the pinions 51 meshing with the gear 47, while the pinions 52 mesh with the gear 48. To facilitate assembly the rotor 44 includes a removable disc 53 closing the normally open ends of the cavities 49.

The rotatable portion 43 of the shaft 40 extends from the rotor 44 into the casing 27 where it carries a gear 54 secured thereon by a key 54', which gear meshes with an idler 55 rotatable on a stationary shaft 56.

Rotatable on the stationary feed screw 26, there is a rotatable feed nut 57 operatively carried by the housing 27 against axial movement relative thereto, and formed with a gear 58 meshing with the idler 55.

Adjacent a bore 35 within which is rotatably mounted a valve 37, there is a parallel bore 59 having pressed therein a bushing 60, which bushing is formed with a partition 61 having ports 62 extending therethrough affording communication between the inner portion 63 of the bushing with the outer portion 64 thereof. Slidable within the inner portion 63, there is a small valve or governor 65 formed with a neck 66 and a head 67, which head has a tip 68 engageable with the partition 61. Adjacent the partition 61, the inner portion 63 of the bushing 60 is slightly enlarged as at 69 to provide an annular clearance between the head 67 of the governor 65 and the inner wall of the bushing 60. A compression spring 70 constantly urges the governor 65 into engagement with the partition 61. Adjacent the neck 63, the bore 49 is provided with an annular groove 71 in constant communication with the interior of the bushing 60 through a port 72 and with the bore 35 through a port 73.

From the outer end portion of the bushing 60, motive fluid is free to flow into a pocket 74 formed within the plate 33, and therefrom into the chamber 38 of the stator 19 through a port 75 and groove 76.

The valve 37 rotatable within the bore 35 is formed with a central bore 77 and with a radial port 78 capable of communication with the port 73 leading to the governor 65. Within the vertical plane passing through the port 73, the valve 37 is also provided with a semicircular groove 79 in constant communication with an exhaust port 80. In the same vertical plane, the housing 36 is provided with a passageway 81 leading from the valve 37 into the pocket 74 provided within the plate 33.

Within another vertical plane, the valve 37 is provided with another radial port 82 and a semicircular groove 83, the port 82 being capable of communication with a passageway 84 which leads into a pocket 85 within the plate 33, from where fluid may be admitted into the rotor chamber 38 via a port 86 and groove 87, while the semi-annular groove 83 is in constant communication with an exhaust port 88. From the stator chamber 38, the motive fluid may exhaust to the atmosphere through exhaust ports 17.

Below the feed screw 26, the support 22 carries a rotatable rod 89 extending longitudinally thereof with one end protruding through the rear end of the support to receive a handle 90 secured on the rod by a key 91 and a nut 92. Slidable on the rod 89, there is a sheave 93 mounted thereon against relative rotation by means of a flat 94 extending the full length of the rod. This sheave is connected to the front end of the valve

37 by an endless flexible strip 95 passing thereover, through which rotation of the rod is transmitted to the valve. To prevent slippage, the strip is provided with a key 96 located within a corresponding groove formed within the sheave 93 and a key 97 also located within a corresponding groove formed within the valve 37. The sheave 93 is located within the lower end portion of the cover 36 of the housing 27 against axial movement relative thereto as shown in Fig. 1, thereby causing the sheave, upon slidable movement of the drilling motor 20 on the support 22 to slide on the rod 89. In order to prevent accidental rotation of the valve 37, it is provided with peripherally disposed serrations 98 frictionally engaged by a spring pressed plunger 99 slidable within a bore 100, which bore is closed by a plug 101.

In the operation of the apparatus, when motive fluid is admitted into the throttle valve (not shown) through the connection 30, it will also flow through the passageways 31 into the pocket 32 and therefrom into the rear end of the bore 35 through the passageway 34. In the position of the valve 37 shown in Figs. 7 and 11, admission of the motive fluid into the stator 19 is prevented by the valve closing the ports 73, 81 and 84, thereby preventing operation of the feed motor.

When it is desired to feed the drilling motor rapidly to the work, the valve 37 may be positioned as shown in Figs. 9 and 13. In this instance motive fluid from the rear end of the bore 35, will flow through the valve center port 77 and therefrom into the pocket 74 via the passageway 81. From the pocket 74 it will be admitted into the stator chamber 38 through the passageway 75 and the groove 76, thereby acting on the vanes 45 for effecting rotation of the rotor 44 in a counterclockwise direction in Figs. 4 and 5, and the consequential rotation of the pinions 51 around the stationary gear 47 in the same direction, thus resulting in the axial rotation of the pinions 52 in a counterclockwise direction in Fig. 5, which rotation will cause the gear 48 to rotate in a clockwise direction in Fig. 5. The rotation of the gear 48 which forms a part of the rotatable portion 43 of the shaft 40 will of course be transmitted to gear 54 keyed on the portion 43, which rotation will in turn be transmitted to the gear 58 through the idler 55, thereby causing rotation of the feed nut 57 in a clockwise direction in Fig. 6, and the consequential forward feeding motion of the drilling motor 20 due to the operative engagement of the nut 57 with the stationary feed screw 26.

From the stator chamber 38, motive fluid is free to exhaust in the usual manner through the exhaust ports 17 which are diametrically opposed to the contacting point of the rotor 44 with the inner wall of the chamber 38. Any amount of motive fluid remaining within the chamber 38 between the groove 87 and the exhaust ports 17, will be free to exhaust via the groove 87, the port 86, the pocket 85, the passageway 84, the valve groove 83 and exhaust port 88.

Once the drill steel 21 is in contact with the work, the operator will rotate the valve 37 into the position shown in Figs. 8 and 12. In this instance, the motive fluid instead of being directly admitted into the stator chamber 38, will flow therein via the governor 65. As shown in Fig. 8, the port 73 is in communication with the port 78 leading into the bushing 60 through the groove 71 and the port 72. From the inner portion 63 of the bushing 60, the motive fluid will

flow over the head 67 of the governor 65 into the upper portion 64 of the bushing 60 via the ports 62. From the portion 64, the fluid is admitted into the pocket 74, from where it is free to flow into the stator chamber 38 via the passageway 75 and the groove 76 for acting on the vanes 45 to cause rotation of the rotor 44 as above described. In this instance when the rotor 44 is operating under normal load, the motive fluid from the valve 37 will flow freely into the upper portion 64 of the sleeve 60 around the head 67 of the governor 65. However, when the drilling motor 20 is fed to the work at a faster rate of speed than that of the cutting speed of the drill steel 21, the drill steel being forced in contact with the work will subject the rotor 44 to an abnormal load which will cause an increase of the pressure of the motive fluid admitted into the stator chamber 38, which additional pressure will act on the head 67 of the governor 65 for shifting it into the position shown in Fig. 16. In this position of the governor, the free flow of the motive fluid into the upper portion 64 of the bushing 60 is prevented by the governor head 67 engaging the inner wall of the bushing, thereby momentarily preventing actuation of the rotor 44 and enabling the drill steel 21 to penetrate the work sufficiently to remove the additional load to which the rotor 44 was subjected. Thereafter the governor urged by the action of the compression spring 70 will again be shifted into the position shown in Fig. 15 to enable a free flow of the motive fluid into the stator chamber 38, and the consequential normal operation of the feed motor.

During the forward feeding motion of the drilling motor 20 controlled by the governor 65, that is, with the valve 37 in the position shown in Fig. 8, the exhaust of the motive fluid from the stator chamber 38 will take place as above described, namely, through the exhaust ports 17 and through the groove 87, passageway 86, pockets 85, passageway 84, the valve groove 83 and exhaust port 88.

When it is desired to feed the drilling motor away from the work, the valve 37 may be positioned as shown in Figs. 10 and 14. In this instance the motive fluid from the valve center bore 77 will flow into the pocket 85 via the valve port 82 and the passageway 84. From the pocket 85, the motive fluid is free to flow into the stator chamber 38 through the passageway 86 and the groove 87, thereafter acting on the vanes 45 for imparting rotation to the rotor 44 in a clockwise direction in Fig. 4, and the consequential rotation of the pinions 51 around the stationary gear 47 in the same direction resulting in the clockwise axial rotation of the pinions 51 and 52, which last rotation is transmitted to the gears 48 and 54 in a clockwise direction. From the gear 54 rotation in the same direction will be transmitted to the feed nut 57 through the idler 55, causing rearward feeding motion of the drill motor 20 due to the operative engagement of the feed nut 57 with the stationary screw 26. In this instance, the motive fluid after acting on the vanes 45 is free to exhaust through the exhaust ports 17, and finally through the groove 76, the passageway 75, the pocket 74, the passageway 81, the valve groove 79 and the exhaust port 80.

Rotation of the valve 37 may be effected from the rear end of the support 22 by the operator rotating the handle 90 rigidly secured on the rod 89, thereby transmitting rotation to the rod 89 which is in turn transmitted to the valve 37 by

the flexible strip 95. The drilling motor 20 sliding on the shell 22 will carry therewith the sheave 93 and the flexible strip 95, while the rod control handle 90 remains at the rear end of the shell, thereby enabling control of the feed motor from the rear end of the shell irrespective of the position of the drilling and feed motors on the shell.

From the foregoing description, it will be understood that rapid forward feeding motion of the drilling motor 20 may be obtained by positioning the valve 37 as shown in Figs. 9 and 13, in which instance the motive fluid is directly admitted into the feed motor without passing through the governor 65. After the drill steel 21 is in contact with the work, in order to automatically control the feeding speed of the drilling motor in a manner proportional to the drilling speed of the drill steel 21, the valve 37 may be positioned as shown in Figs. 8 and 12, thereby causing admission of the motive fluid to the feed motor to be controlled by the governor 65. When it is desired to feed the drilling motor away from the work, the valve 37 may simply be positioned as shown in Figs. 10 and 14.

In the improved feeding motor above described, the novel transmission mechanism incorporated within the rotor 44 affords an efficient rotation speed reducing mechanism between the rotor and the feed nut 57, through which mechanism rotation is transmitted to the feed nut 57 at a greater rate of power than that of the rotor 44. The speed reduction between the rotor 44 and the drive shaft 43 may be varied at will by changing the pitch diameter of the several gears and pinions involved in this mechanism. For instance, by making the gear 48 larger than the stationary gear 47 and the pinions 52 smaller than the pinions 51, it will be possible to obtain a greater speed reduction than that possible with the gears 47 and 48 having equal pitch diameter.

Although the foregoing description is necessarily of a detailed character, in order to completely set forth the invention, it is to be understood that the specific terminology is not intended to be restrictive or confining and it is to be further understood that various rearrangements of parts and modifications of structural detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In an apparatus of the class described, a support, a reversible fluid actuated rotary motor slidable on said support, a valve carried by said motor capable of rotation for controlling the direction of rotation of said motor, a rotatable rod extending longitudinally of the support, a sheave slidable on said rod against rotation relative thereto, and a flexible strip passing over said valve and sheave for transmitting rotation from said rod to said valve irrespective of the position of said motor on the support.

2. In an apparatus of the class described, a support, a drilling motor slidable on the support, a rotatable member carried by the motor for slidable movement therewith, a rotatable rod extending longitudinally of the support, a sheave slidable on said rod against rotation relative thereto, and a flexible connection between said member and sheave effective for transmitting the rotation of said rod to said member irrespective of the position of said motor on the support.

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