This invention relates to rock drill mountings, and particularly to those equipped with drill feed legs adapted for extension during a drilling operation and for retraction thereafter to remove the drill rod from the bore hole.

Rock drills are usually heavy and unwieldy, requiring some sort of mounting to aid manual manipulation thereof. It is advantageous that the mounting provide powered feed and retraction as well as support.

Pneumatic feed legs of various types are widely used for the purpose. These are elongate cylinder and piston assemblies adapted for extension and retraction by compressed air. While such a feed leg enables an operator to successfully manipulate a drill, the work is still excessively difficult and tiresome.

A principal object of the making of this invention was to significantly aid the maneuvering, manually, of a feed leg-mounted rock drill into drilling position and the holding of the drill in position during the drilling operation.

This has been accomplished by combining with the feed leg an auxiliary leg and counterbalancing device, the latter along with the drill feed leg preferably being of pneumatic type, although capable of being constructed in various ways.

Another object was to balance the drill with respect to the drill feed leg, this being achieved by a unique mount having an off-set connector section providing a depressed cradle which places the longitudinal axis of the drill in line with that of the leg when the drill mounting and the drill are in collaring position. This not only lessens operator fatigue, but makes for easy collaring with a relatively large number of holes and for better drilling control. It is applicable to standard mountings as well as to the counterbalanced mounting here disclosed.

A feature which makes for compactness and working convenience is the interconnection of drill mounting—whether by offset connector or conventional—and drill feed leg by means of a valve which controls supply and exhaust of air to the latter.

The drill feed leg and auxiliary leg are desirably mounted in common on a support by means of a swivel arrangement which enables the drill to be swung horizontally against controlled resistance. The entire assembly will usually be mounted on a work vehicle, such as a rail car.

An outstanding advantage of the invention in addition to the foregoing is the fact that unusually long holes, e.g. ten feet in length, can be easily drilled.

There is shown in the accompanying drawings a specific construction presently regarded as the best mode of carrying out the invention.

In the drawings:

FIG. 1 is a top plan view of a standard rock drill mounted in accordance with the invention on a rail car, only the forward portion of the latter being shown.

FIG. 2, a side elevation, with a raised position being shown in broken lines.

FIG. 2a, a fragmentary section taken on line 2a—2a of FIG. 2.

FIG. 2b, an enlarged vertical central-section taken through pressure regulating valve 4b.

FIG. 3, a fragmentary vertical section taken on the line 3—3 of FIG. 1 and drawn to a considerably larger scale.

FIG. 4, a similar view taken on the line 4—4 of FIG. 1, excluding the drill and showing the offset connector mounting therefor in elevation.

FIG. 5, a fragmentary horizontal section taken on the line 5—5 of FIG. 4.

FIGS. 6, 7, and 8, schematic views showing different settings, respectively, for the feed leg control valve and FIG. 9, a fragmentary view, partially in vertical section, taken on line 9—9 of FIG. 4.

Referring to the drawings:

In the form illustrated, the rock drill mounting of the invention is carried by a rail car 10 for travel over tracks 11 laid progressively during the driving of an underground passageway, such as a tunnel or mine drift, through rock 12.

As illustrated, the mounting comprises a drill feed leg 13 of generally conventional character, pivoted at its rearward end to the lower end of a supporting pedestal 14 as by means of intermediate ears and a pin 15. Such feed leg is made up of a tubular piston rod 16, having a piston 17, FIG. 3, secured to its lower end, and having a fluid-tight cylinder 18, through the closed forward end of which such piston rod slidably extends, see FIG. 4, being free, of course, to rotate about the axis of the feed leg as a center.

In the present instance and as inventive features, a special drill mount 19 having a central section offset from the longitudinal axes of the feed leg and the received drill is rigidly secured to the forward end of piston rod 16 by means of a valve 20 adapted to control telescopic extension and retraction of the piston rod relative to the cylinder. Mount 19 is tubular and serves as a conduit for shunting compressed air from the drill 21 to valve 26 and thence into feed leg 13 in customary manner. The drill 21 may be any of those which are presently available commercially. It is removably attached to mount 19 by a pin 22 in the usual manner. Compressed air is supplied from any normally coincident supply (not shown) by a hose 23, FIG. 1, as is customary and is then passed through bushing 23a to port 22a of pin 22, through passage 22b of pin support 22c and into offset connector 19 to pressurize the feed leg.

The configuration of drill mount 19 is such that the longitudinal axis of the feed leg is substantially coincident with the longitudinal axis of drill feed leg 13 in the collaring position of the drill mounting and drill, as indicated in the full-line showing of FIG. 2. Different makes of drills will ordinarily require the dimensions of the offset mount to be designed especially for this purpose, as respects the particular make concerned.

Extending concentrically within and along tubular piston rod 16 is a tube 24, which is preferably and as another inventive feature, a flexible, rubber hose, so as to withstand the intensive vibration experienced in a drill mounting of this kind without breaking. At its upper end it connects by a nipple 25, FIG. 4, with valve 26, and passes completely through piston 17 by means of a ferrule 26, FIG. 3, to communication with the interior of cylinder 18 forwardly of such piston 17. Tube 24 is of smaller diameter than the interior of piston rod 16 to define therewith an annular passage 27, which is ported at 28 to the interior of cylinder 18 immediately forwardly of piston 17. Port 28 allows pressure fluid entering passage 27 through valve 20 to be supplied and exhausted from the space between the piston rod 16 and cylinder 18 in a manner to be further explained.

Valve 20 is of conventional, dual, two-way, rotary type, as indicated in FIGS. 5—8, having an entirely closed
or neutral position, FIG. 6, and two different open positions—one, FIG. 7, providing for extension of feed leg 13, and the other, FIG. 8, for retraction of piston rod 16 of which piston rod 16 is formed part of cylinder 36.

FIGS. 6, 7, and 8 show the positions of the passages through the rotatable plug 28a of valve 20 in the various positions used during operation of the unit, and FIGS. 5 and 9 show the off-set relationship of the passages 29a, 29b to passages 30a, 30b of the plug.

When the plug is in the position shown in FIGS. 4, 5, 7, and 9, pressure fluid is supplied from hose 23, through drill 21, pin 22, connector 19, port 29 of valve plug 28a and tube 24 to the inside of cylinder 18 where it will act on the forward face of piston 17 and tend to extend piston rod 16. At the same time pressure fluid previously supplied passage 27 will be exhausted through port 28, passage 24, ports 30a and 30b in valve plug 28a, and out exhaust port 31 which passes through valve body 20b.

Forty-five degree clockwise rotation of the valve plug 28a from the position of FIG. 7 will position the ports therein as shown in FIG. 6, and prevent fluid from entering in this position the ports in the rotatable valve plug 28a are out of registration with the ports through the valve body 20b and the pressure at both sides of piston 17 are equal, thus maintaining the piston 17 and piston rod 16 in substantially fixed positions.

Rotation of the valve plug clockwise another forty-five degrees to the position shown in FIG. 8 will align the ports in the plug so that the piston rod will be retracted. Pressure fluid will be applied through connector 19, from hose 23 in the manner previously described, through passage 19a in the valve body 20b, port 30 in valve plug 28a, passage 24 and port 28 to passage 27 where it will act on the rear face of piston 17 and tend to move it and the piston rod further into cylinder 18. At the same time pressure in cylinder 18 that has been acting against the forward face of piston 17 is exhausted through tube 24, ports 29a and 29b of valve plug 28a and the exhaust port 32 through valve housing 20b.

Valve 28 is manually controlled by the drill operator by turning handle 33, FIG. 5.

In accordance with the invention, countervailing means are provided to intermediate the length of the drill feed leg 13 and between it and the support 14. Such means advantageously take the form of an auxiliary leg 34, and countervailing device 35 shown as a pneumatic piston 36 and cylinder 37, FIG. 3.

Auxiliary leg 34 has its forward end pivotally secured on a horizontal axis to the forward end of the stationary part, i.e. cylinder 18, of drill feed leg 13, and by means of interengaging ears and pin 35, FIG. 4, and is a piston rod slidably entering cylinder 37 at the closed forward end thereof and carrying piston 36 at its rearward end within cylinder 37. Such cylinder 37 is pivotally secured to the upper end of support 14 on a horizontal axis, as by means of interengaging ears and a pin 38-1. In this way the countervailing device 35 extends and retractably connects auxiliary leg 34 to support 14.

Piston 36 includes cup leather 36a, FIG. 3, secured in place in conventional fashion, as illustrated, so as to frictionally engage the inner walls of cylinder 37. Means are provided at that cylinder end which is faced by the inside of the facing 36a, near the forward end, for admitting and for exhausting compressed air, the opposite end portion of the cylinder being bled to atmosphere as by means of exhaust port 37a. Thus, compressed air introduced into cylinder 37 at the leg 34 side of piston 35 acts, in effect, as a countervalue to the weight of drill 21 in the manner of lifting thereof. Moreover, the air pressure exerted against cup leather 36a increases its frictional engagement with the walls of the cylinder and tends to hold the auxiliary leg in any position to which it is moved by manual adjustment of the position of drill 21, it being realized that air entrapped in cylinder 37 backwardly of cup leather 36a is bled out through exhaust port 37a during such repositioning of the drill.

As illustrated, it is convenient to both feed and exhaust air through a single air hose 39, FIGS. 2 and 3, which is flexible and extends from a self-bleeding pressure regulating valve 40. Such valve 40 may be of any standard type provided with a supply passage through inlet 40a, valve seat 40b, and port 40c and an exhaust passage from port 40c, bleed opening 40d, and valve seat 40e. It is connected with a source of compressed air (not shown), as by means of an air hose 41, FIG. 2, and maintains a constant pre-set pressure on the leg 34 side of piston 36. The extent of air pressure permitted to be effective in countervailing device 35 can be adjusted in conventional manner from time to time by manually turning valve handle 42, thereby changing the back pressure required to overcome the biasing effect of spring 43f. Pressure above that required to overcome the biasing spring acts on diaphragm 40g to move it up. This allows valve 40b to close valve seat 40b and moves valve head 40f, allowing excess pressure to exhaust through the valve seat.

With greater pressure, the countervailing effect is greater, and vice versa.

In the illustrated construction, support 14 comprises a standard 43, FIG. 3, having vertically spaced brackets 44 and 45 extending therefrom. An elongate swivel 46 extends between and is mounted for rotation in such brackets. In this instance, the swivel is provided by a non-rotating shaft or spindle 47, serving to rotatably mount by means of bearings 48 and 49 a concentric swivel tube 50 to which the drill feed leg 13 and the countervailing device 35 are pivotally connected as previously described. Such bearings are secured within opposite ends, respectively, of swivel tube 50, and one of such bearings—here bearing 49—and that portion 47a of shaft 47 encompassed thereby are cooperatively tapered to provide for adjustable frictional resistance of the swivel to rotation.

As illustrated, the lower end of shaft 47 is rigidly secured, as by welding, in the lower bracket 45 and the upper end projects through and beyond the upper bracket 44, a vertically free-sliding bushing 51 being interposed between shaft and upper bracket to transmit swivel tube 50 axial thrust from a nut 52, which is threaded on the 35 projecting end of shaft 47 and bears against such bushing.

Adjustment of nut 52 changes the degree of frictional engagement of tapped bearing 49 with the cooperatively tapered portion 47a of shaft 47 in order to attain any desired degree of resistance of swivel 46 to free rotation and, therewith, any desired degree of resistance to swinging of drill feed leg 13 and the drill 21 which it carries about a vertical axis in one direction or the other.

Thus, it can be seen that manual positioning of the drill both vertically (by reason of the countervailing) and horizontally (by reason of the tapped bearing assembly) is facilitated by the apparatus of this invention and is subject to effective control by the operator through the pressure regulating valve 40 and adjusting nut 52, respectively. Because handling of the drill is much easier, drilling performance is improved and considerably longer drills can be used than have been possible to use heretofore.

Whereas there is here illustrated and described a certain preferred construction of apparatus which I presently regard as the best mode of carrying out my invention, it should be understood that various changes may be made without departing from the inventive concepts particularly pointed out and distinctly claimed herebelow.

I claim:

1. A mounting for rock drills, including in combination a drill feed leg having an elongate stationary part and an extendible and retractable part telescopically related to...
said stationary part and provided with a drill mount rigidly secured to its forward end; an auxiliary leg, having one of its ends pivoted to said stationary part at a forward location thereof and extending backwardly therealong; a support; means pivotally securing the rearward end of said stationary part to the support; a substantially fluid-tight cylinder pivoted at its rearward end to the support, the auxiliary leg extending sidewise within said cylinder through the forward end thereof; a piston carried by the rearward end of the auxiliary leg and frictionally engaging the inside walls of the cylinder; means for admitting air under pressure to the cylinder forwardly of the piston; means in the cylinder forwardly of the piston for bleeding air from the cylinder on the forward stroke of the piston; means in the cylinder rearwardly of the piston for bleeding air from the cylinder on the rearward stroke of the piston; and means for controlling, respectively, the admission of air to and the bleeding of air from the cylinder forwardly of the piston.

2. The mounting of claim 1, wherein the means for admitting air to and the means for bleeding air from the cylinder forwardly of the piston comprise a self-bleeding pressure regulator valve provided with a connection to a source of compressed air and with an exhaust port, and a conduit connecting said valve with the forward end of the cylinder so that compressed air flows into said conduit and cylinder on one setting of the valve and flows from the cylinder and conduit to exhaust on another setting of the valve.

3. A mounting for rock drills, including in combination, a drill feed leg, having an elongate stationary part, and an extendable and retractable part teleastically related to said stationary part and provided with a drill mount secured to its forward end; a support; means pivotally securing the rearward end of said stationary part to the support; counterbalancing means comprising an auxiliary leg, having one of its ends pivoted to said stationary part at a forward location thereof and extending backwardly therealong, and a counterbalancing device extendibly and retractably connecting said auxiliary leg to the support, whereby the drill is counterbalanced during manual movement vertically from one drilling position to another; and means for extending and retracting said feed leg.

4. The mounting of claim 3, wherein the drill mount has an off-set portion forming a depressed cradle extending along the longitudinal axis of the feed leg and adapted to support a drill with its longitudinal axis substantially in coincidence with the longitudinal axis of the drill feed leg when in collaring position.

5. The mounting of claim 3, wherein the extendible and retractable part of the drill feed leg is a tubular piston rod carrying a piston at its rearward end, and the stationary part is a substantially fluid-tight cylinder within which said piston rod slidably extends, said piston rod being ported to the cylinder forwardly of said piston; and wherein the means for extending and retracting the feed leg comprises a valve interposed between the piston rod and the drill mount, the latter being tubular for conducting compressed air from the drill to said valve, a hose of flexible material extending within the piston rod from the valve through said piston to communication with the cylinder rearwardly of the piston and to define an annular passage interiorly of the piston rod, said valve being of dual, two-way, rotary type providing, in one open setting, for flow of air from the tubular drill mount into said hose and cylinder to extend the piston rod relative to the cylinder, while porting said annular passage to exhaust, and, in another open setting, for flow of air from said tubular drill mount into said annular passage and through said ported piston rod into the cylinder to retract the piston rod relative to the cylinder, while porting said hose to exhaust, and means for controlling said valve.

6. The mounting of claim 3, wherein the support comprises a standard having vertically spaced brackets extending therefrom; an elongate swivel extending between and mounted for rotation in said brackets, the counterbalancing means and the stationary part of the feed leg being pivotally secured to said swivel in mutually spaced relationship along its height on respective horizontal axes; and means resisting free rotation of said swivel.

7. The mounting of claim 6, wherein the swivel includes a shaft extending between said brackets; a swivel end concentric with the shaft and carrying the counterbalancing means and stationary part of the feed leg; bearings rigidly secured to said tube and rotatably mounting the latter on the shaft, one of said bearings and the portion of the shaft encompassed thereby being tapered as part of the means resisting free rotation of the swivel; and adjustable means carried by the shaft and reactive on the swivel tube for changing the degree of frictional engagement of said tapered bearing with the tapered portion of the shaft, said adjustable means constituting part of the means resisting free rotation of the swivel.

8. A mounting for rock drills, including support means; an extendible and retractable leg articulatively attached to said support means and having one end extending as a drill mount; and counterbalancing means, comprising a member pivotally connected to said leg and extending to said support means, and a counterbalancing device, said counterbalancing means holding the leg member in any extended position thereof to which it is manually moved.

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