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PIVOTED FEED LEG TYPE ROCK DRILL

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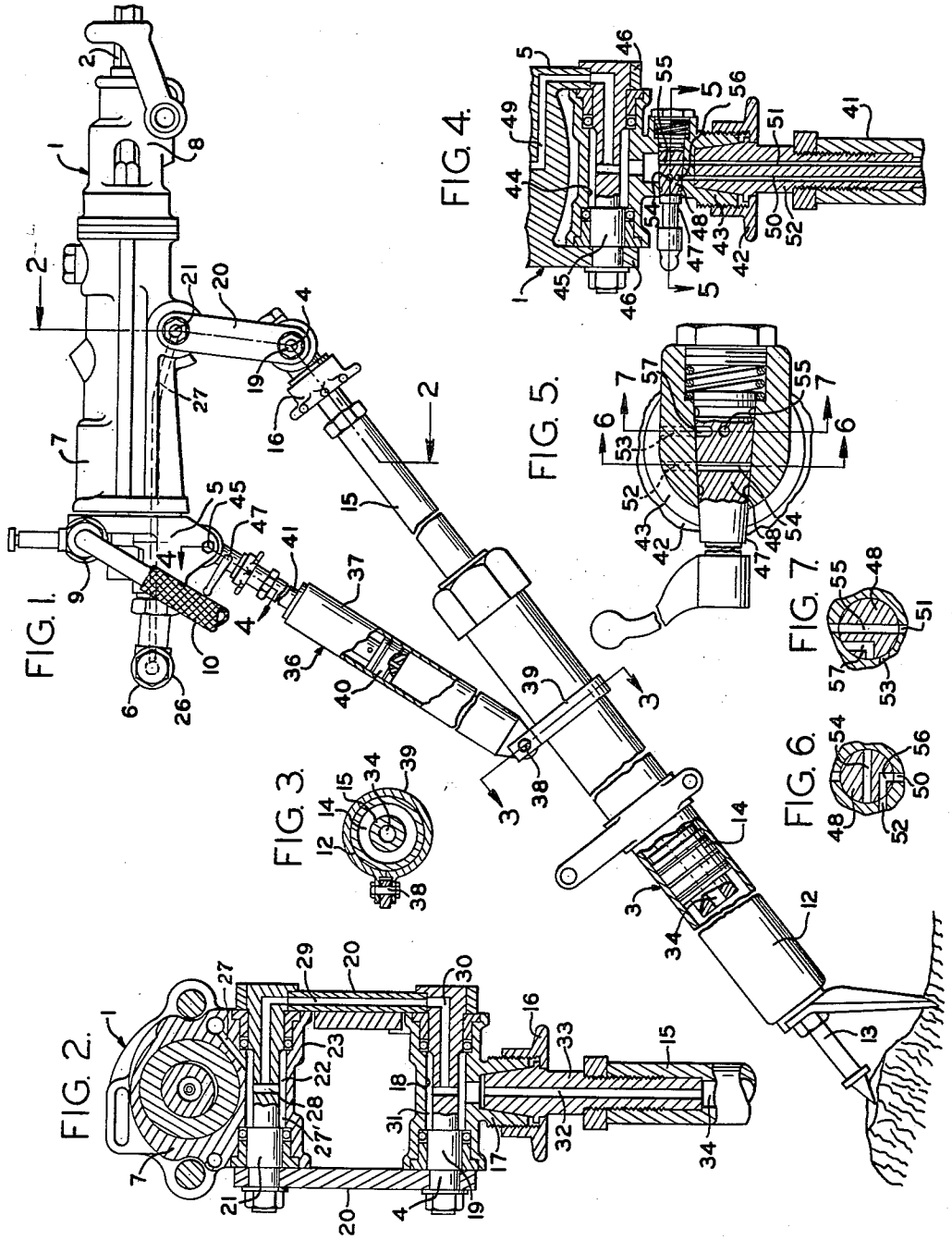


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

INVENTOR:

Charles F. Osgood

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PIVOTED FEED LEG TYPE ROCK DRILL

Charles F. Osgood, Franklin, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

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This invention relates to rock drills and more particularly to hammer rock drills of the pivoted feed leg type.

In rock drills of the pivoted feed leg type the hammer drilling tool is hingedly connected to the upper end of an extensible feed leg, and the operator during the drilling operation presses down on a handle secured to the rear end of the drilling tool as the feed leg extends to cause the drilling tool to be fed rectilinearly toward the work. The continuous pressing down by the operator on the rear handle of the drilling tool with one hand while using the other hand to manipulate the control means of the drill is quite a laborious operation, and the present invention contemplates improvements over such a rock drill in that an auxiliary power device is operatively connected between the drilling tool and the feed leg for imparting a downward pressure to the rear end of the drilling tool as the tool it fed toward the work thereby to replace the substantial manual effort heretofore supplied by the operator. Such an auxiliary power device may desirably assume the form of a small fluid cylinder pivotally connected between the rear end of the drilling tool and the upper portion of the feed leg and which may be controlled by valve means located near the other controls on the drilling tool.

It is therefore a primary object of the present invention to provide an improved pivoted feed leg type rock drill wherein the considerable manual effort supplied by the operator during drilling is substantially reduced. Another object is to provide an improved hammer rock drill having its drilling tool hingedly connected to the upper portion of the feed leg and provided with an auxiliary power device whereby a downward pressure may be imparted to the rear end of the drilling tool as the feed leg is operated to effect feed of the drilling tool toward the work. A further object is to provide a hinged feed leg type hammer rock drill, an improved auxiliary power cylinder pivotally connected between the drilling tool and the feed leg and cooperating with the latter in the feeding of the drilling tool along a rectilinear path toward the work during the drilling operation. A still further object is to provide improved detachable means whereby the auxiliary power device may be readily detached from the feed leg. Yet another object is to provide an improved auxiliary power cylinder pivotally connected to the rear end of the drilling tool and to the feed leg and having the pressure fluid supply to the power cylinder passing through the pivotal connection with the drilling tool and controlled by valve means on the drilling tool. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

FIG. 1 is a side elevational view of a hammer rock drill of the hinged feed leg type, showing the auxiliary power cylinder connected between the rear end of the tool and the feed leg, and with parts broken away to show structural details.

FIG. 2 is an enlarged detail section taken on line 2—2 of FIG. 1, showing the hinge connection between the drilling tool and the feed leg, together with a portion of the fluid supply to the feed leg cylinder.

FIG. 3 is a detail cross section taken on line 3—3 of FIG. 2, showing the detachable connection between the auxiliary power cylinder and the feed leg.

FIG. 4 is an enlarged detail section taken on line 4—4 of FIG. 1, showing the pivotal connection between the auxiliary power cylinder and the drilling tool, together with a portion of the fluid supply to the power cylinder.

FIG. 5 is an enlarged cross section taken on line 5—5 of FIG. 4, showing the control valve for the auxiliary power cylinder.

FIGS. 6 and 7 are detailed sections respectively taken on lines 6—6 and 7—7 of FIG. 5, showing certain of the fluid supply passages.

The invention, as shown in the drawings, is embodied in a hammer rock drill of the hinged feed leg type which may be similar to that disclosed in a copending application to one John C. Curtis, Serial No. 590,733, filed June 11, 1956, owned by the same assignee as the present invention. The hammer rock drill generally comprises a fluid operated hammer drilling tool, generally designated 1, for percussively actuating a usual drill steel 2, and an extensible fluid operated feed leg, generally designated 3, is hingedly connected to the drilling tool by a transverse hinge connection 4. The drilling tool has a rear head block 5 supporting a rearwardly located handle 6 whereby the tool may be manually supported and directed in conjunction with the supporting and feeding functions of the feed leg, in manners well known to those skilled in the art. By swinging the drilling tool about its hinge connection with respect to the feed leg blast holes may be drilled in the face of the work at any desired angle. However, during normal horizontal drilling the drilling tool and feed leg assume the relation shown in FIG. 1 and as the feed leg is extended the operator of the drilling tool grasps the handle 6 and as he directs the drilling tool with respect to the work he presses downwardly on the handle thereby to cause the drilling tool to be fed along a rectilinear path toward the work.

The drilling tool has a conventional pressure fluid actuated hammer motor provided with a motor cylinder 7 containing a usual reciprocable hammer piston and carries a front chuck housing 8 within which the chain of the drill steel 2 is suitably supported, and the rear head block 5 and the front chuck housing 8 are suitably attached to the motor cylinder. A usual throttle valve mechanism 9 serves to control the flow of pressure fluid from a supply hose 10 to the hammer motor. Evidently, other known types of drilling tools may be employed if desired.

The extensible feed leg 3 may assume various forms but herein comprises a feed cylinder 12 provided with a bottom foot piece 13 engageable with the floor, and reciprocable with this cylinder is a feed piston 14 having an upwardly extending piston rod 15. The upper end of the piston rod is detachably coupled at 16 to an end member 17. This end member has a transverse bore 18 (see FIG. 2) receiving a transverse pivot pin 19. Parallel connector links 20 are connected at one end to this pin and the other ends of the links are connected to a parallel pivot pin 21 passing through a transverse bore 22 in a depending lug 23 on the motor cylinder 7 of the drilling tool. The transverse pins provide parallel pivotal or hinge connections between the drilling tool and the feed leg although evidently if desired but a single transverse hinge connection may be provided between the feed leg and the drilling tool.

Pressure fluid may flow from the supply hose 10 to the feed leg in various manners herein desirably through suitable fluid passage means including a passage in the rear head block 5 leading to passage means in the handle which carries a control valve mechanism 26 whereby the

operator grasps the handle 6 may also regulate the flow of pressure fluid to the feed leg cylinder in the manner fully disclosed in the copending application above referred to. This control valve mechanism may be similar to that disclosed in a copending application Serial No. 279,014, filed March 28, 1952, also owned by the assignee of the present invention. Leading from the control valve mechanism 26 on the tool handle is a passage 27 (FIG. 1) connecting with an annular chamber 27' surrounding the pivot pin 21, and a fluid passage 28 in the pivot pin 21 is connected to the chamber 27' (FIG. 2) which in turn communicates with a fluid passage 29 in one of the connector links 20, and the passage 29 communicates with a passage 30 in the other pivot pin 19. Passage 30 is connected through a port with an annular chamber 31 surrounding the pivot pin and this chamber is connected by a passage 32 in a member 33 threadedly attached to the upper end of the piston rod 15. A passage 34 connects the interior of the piston rod to the cylinder beneath the feed piston FIG. 1).

In order to substantially reduce the effort supplied by the operator during the drilling operation there is provided an auxiliary power device such as a power cylinder, generally designated 36, which is in the form of an extensible strut or jack operatively connected between the rear end of the drilling tool and the upper portion of the feed leg cylinder so that the downward pressure heretofore imparted by the operator to the tool handle during drilling is herein supplied by the auxiliary power cylinder. In this improved construction the fluid cylinder 37 is pivotally connected by a transverse pivot pin 38 to a suitable clamp member 39 surrounding an upper portion of the feed cylinder. As shown, the pivot pin 38 is in the form of a clamping bolt whereby the clamp 39 may be tightened to attach the auxiliary power cylinder to the feed leg. Evidently various other suitable forms of attachment may be provided in lieu of that shown. Reciprocable with the cylinder 37 is a piston 40 having an upwardly extending piston rod 41 secured by a suitable detachable coupling 42 to an upper member 43. A member 43 has a transverse bore 44 for receiving a transverse pivot pin 45 for connecting the upper end of the piston rod to depending lugs 46 herein secured to the rear head block 5 of the drilling tool. The power cylinder is herein desirably of the double acting type and carried by the upper member 43 is a control valve mechanism 47 whereby the flow of pressure fluid to the power cylinder may be regulated as desired. Evidently, the valve mechanism 47 may be mounted on the rear head block 5, if desired. This control valve mechanism comprises manually operable rotary valve member 48 which may control the flow of pressure fluid from a supply passage 49 in the rear head block 5 to parallel passages 50 and 51 formed in a member 52 threadedly secured to the upper portion of the piston rod 41 (FIG. 4). The upper member 43 also has suitable vent ports 52 and 53 communicating with the valve receiving bore and the valve has formed therein passages 54 and 55 for connecting the supply passages with the passages 50 and 51 respectively, whereby pressure fluid may be supplied separately or simultaneously to the opposite ends of the bore of the power cylinder at opposite sides of the piston 44. Also formed in the valve member 48 are passages 56 and 57 for respectively connecting the cylinder passages 50 and 51 to the vent passages 52 and 53. Thus by suitable control of the valve member 48 pressure fluid may be supplied to the opposite ends of the bore of the auxiliary power cylinder, as desired. Also the valve member 48 may be positioned to trap pressure fluid within the auxiliary power cylinder at the opposite sides of the piston, as desired.

The general mode of operation of the improved rock drill is as follows: When the drilling tool is positioned to drill substantially horizontal holes in the work, as shown in FIG. 1, the operator may support and direct the drilling tool during starting of a hole by grasping the rear tool handle 6 and in cooperation with the feed leg the drilling tool may be supported, guided and fed rectilinearly toward the work. As the operator grasps the handle 6 with one hand he may also manipulate the control valve mechanism 26 on the handle to regulate the flow of pressure fluid to the feed leg cylinder and with the other hand he may manipulate the control valve mechanism 9 of the drilling tool. Prior to this invention, the operator with his hand which grasps the rear tool handle 6 pressed down the rear end of the drilling tool and thus in conjunction with the feed leg directed the drilling tool along a rectilinear path toward the work. The improved auxiliary power cylinder 36 now provides the substantial effort heretofore supplied by the operator, and by suitable manipulation of the control valve mechanism 47, the auxiliary power cylinder 36 pulls the rear end of the drilling tool downwardly and holds the tool in the proper position and may be operated to direct the tool as the feed leg is extended thereby to cause the drilling tool to move along the desired rectilinear path toward the work. During other drilling operations or during transporting of the drill, the auxiliary power cylinder 36 may be readily detached from the feed leg simply by releasing the clamping bolt and removing the same from the clamp. By proper positioning of the valve member 48 of the auxiliary power cylinder pressure fluid may be supplied through either or both of the fluid passages 50 and 51, the latter may be connected if desired to the vent ports 52 and 53 and also, if desired, pressure fluid may be trapped in the auxiliary power cylinder at the opposite sides of the piston 40 to lock the drilling tool and feed leg against relative tilting movement.

As a result of this invention an improved hammer rock drill of the pivoted feed leg type is provided having improved auxiliary power means whereby ease of operation of the rock drill is substantially enhanced. By the provision of the auxiliary power cylinder connected between the drilling tool and the feed leg, the manual effort heretofore supplied by the drill operator during the drilling operation is substantially reduced thereby enabling the use of heavier drilling equipment, and also enabling the operator to control the drilling tool from a remote point, as for example, when the drilling tool is located at a relatively high point with respect to the working face. The improved fluid supply passage arrangement embodied in the pivotal connection of the auxiliary cylinder with the drilling tool results in simplicity and compactness, eliminating an additional external hose connection. These and other advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice it will be understood that this form is shown for purposes of illustration and that the invention may be embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a self-contained portable hammer rock drill, the combination with a drilling tool hingedly connected to an extensible feed leg with the latter having one end engageable with an extraneous abutment such as the ground, the tool having a rear handle adapted to be grasped by the operator in the supporting and positioning of the tool, of an auxiliary power device connected to the drilling tool at a point spaced from the hinged connection to the feed leg for tilting the tool about its hinged connection relative to the feed leg and to apply a downward pressure to the rear end of the drilling tool as the latter is advanced toward the work during drilling upon extension of the feed leg, the extension of said feed leg and concurrent downward pressure on the rear end of said tool in cooperation effecting feed of the tool toward the work and the position of said tool relative to said feed leg during the drilling operation, and control means carried by said drilling tool for said feed leg and said auxiliary power device for permitting the operator to coordinate the action of said

feed leg and said auxiliary power device by the regulation of said control means by the operator.

2. In combination, a drilling tool, an extensible supporting and feeding leg for the tool having its bottom end engaging an extraneous abutment such as the ground, a transverse hinge connection between said tool and the upper portion of said feeding leg, an auxiliary power cylinder connected between said tool and said feeding leg at points spaced from said hinge connection for controlling the pivotal movement of said drilling tool about said hinge connection relative to said feeding leg as the latter is extended to effect feed, the extension of said feeding leg and concurrent operation of said auxiliary power cylinder effecting forward feed of said tool toward the work and the position of said tool relative to said feeding leg during drilling, and control means carried by said drilling tool for said feeding leg and said auxiliary power cylinder for permitting the operator to coordinate the action of said feeding leg and said power cylinder by the regulation of said control means by the operator to regulate the flow of power medium separately to said feeding leg and said power cylinder.

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