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ROCK DRILL

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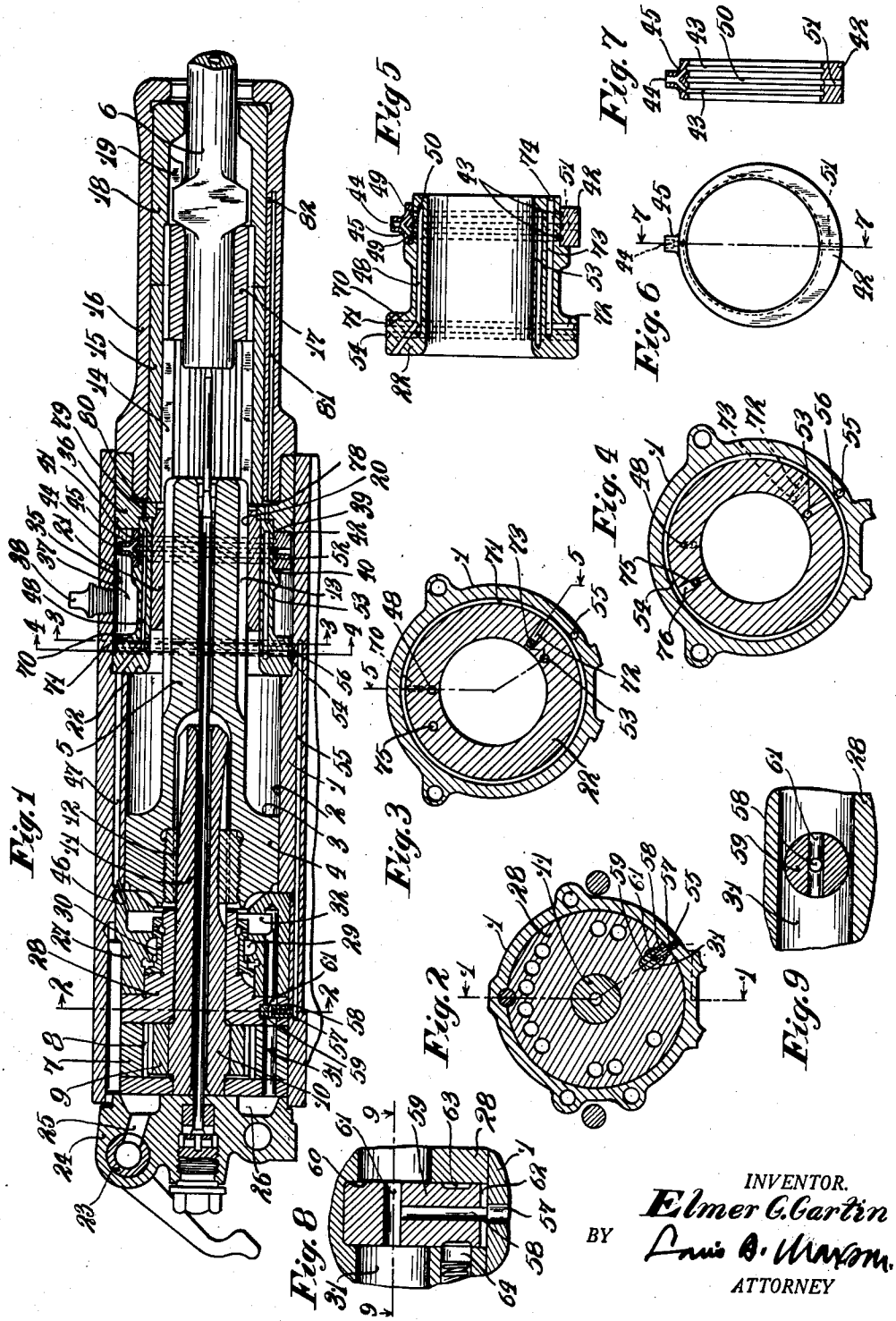


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

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ROCK DRILL

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10 Claims. (Cl. 121—13)

This invention relates to rock drills, and more particularly has reference to improvements in the lubricating means of such drills.

An object of this invention is to provide an improved rock drill lubricating means. Another object is to provide an improved automatic lubricating means for a pressure fluid actuated rock drill. A further object is to provide an improved lubricating means embodied in the rock drill for supplying lubricant to the moving parts of the drill irrespective of the supported position of the drill. Another object is to provide an improved automatic lubricator incorporated in the front head structure of the rock drill. These and other objects will, however, subsequently more fully appear.

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

In this drawing—

Fig. 1 is a longitudinal sectional view of a rock drill in which the illustrative form of the improved lubricating means is embodied, the view being taken in the plane of line 1—1 of Fig. 2.

Fig. 2 is a cross sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 1.

Fig. 5 is a detail sectional view taken in the plane of line 5—5 of Fig. 3, showing parts of the improved lubricating means.

Fig. 6 is an elevational view of the lubricator control pendulum.

Fig. 7 is a cross sectional view taken on line 7—7 of Fig. 6.

Fig. 8 is an enlarged detail sectional view of the lubricant discharge control element.

Fig. 9 is a detail sectional view taken on line 9—9 of Fig. 8.

In this illustrative embodiment of the invention, the improved lubricating means is shown embodied in a hammer rock drill having a pressure fluid actuated hammer motor comprising a cylinder 1 having a bore 2 containing a reciprocatory hammer piston 3. The hammer piston has a head 4 fitting the bore 2 and a forwardly projecting striking bar 5 adapted to deliver impact blows to the shank of the usual lugged rock drill steel 6.

As is usual in rock drills of the type disclosed, rotation means operated by the hammer piston is provided for rotating the drill steel and comprising a ratchet ring 7 having formed internally therein ratchet teeth 8 with which usual pawls 9 are engageable, these pawls being carried by a pawl carrier 10 with which there is integrally formed a rifle bar 11. This rifle bar has spiral grooves interlocked with spiral ribs formed on a rifle nut 12 secured within the hammer piston. As the hammer piston moves forwardly, the pawls of the pawl carrier slip over the ratchet teeth so that the piston delivers an unimpeded blow to the drill steel shank, and upon reversal of the piston the pawls hold the rifle bar against rotation, and due to the spiral interlocking connection between the rifle bar and rifle nut, rotative movement is imparted to the piston. This rotary piston motion is transmitted to the drill steel through straight grooves 13 formed on the striking bar 5 and interlocked with straight ribs 14 formed on a chuck sleeve 15 rotatably mounted within a front chuck housing 16. Secured to this chuck sleeve is a chuck bushing 17 within which the drill steel shank is supported, and this bushing connects to the chuck sleeve a driver member 18 which has lugs 19 engaging in driving relation the drill steel lugs. It will thus be seen that as the drill steel is percussively actuated by the hammer piston, it is at the same time rotated. The piston striking bar is guided in a bore 20 formed in a bushing 21 secured within the front motor head 22.

The fluid distribution means for effecting reciprocation of the hammer piston comprises a throttle valve 23 carried within a rear head block 24, and this valve controls the flow of pressure fluid through a passage 25 to a fluid supply chamber 26 formed in the head block. Arranged between the ratchet ring and the rear end of the cylinder bore are cooperating valve chest elements 27 and 28 having formed therein a valve chamber 29 in which is arranged an automatic fluid actuated fluid distributing valve 30, herein preferably of the well known sleeve type. Pressure fluid is supplied to the valve chamber through a passage 31 communicating with the chamber 26 for conducting pressure fluid to an annular fluid supply recess 32 communicating with the valve chamber, and the distributing valve controls the flow of pressure fluid from recess 32 through usual ports and passages to the opposite ends of the motor cylinder. The cylinder is provided with usual fluid exhaust means. As the particular structure of the hammer motor and its associated rotation means does not enter into this invention other than its particular association therewith,

further description thereof is considered unnecessary.

Now referring to the improved lubricating means, it will be noted that the front motor head 22 is arranged in a bore 35 in the forward portion of the motor cylinder, and the forward end of this bore is closed by a head member 36 having an inwardly directed flange engaging a reduced portion on the striking bar guide bushing 21, and this front motor head is annularly grooved and cooperates with the walls of the bore 35 to form an annular lubricant reservoir 37. Threaded within the wall of the cylinder is a filler plug 38 whereby the reservoir 37 may be readily filled with lubricant. Rotatably mounted at 39 on the cylindrical portion of the front motor head 22 and arranged between the inner face of the head member 36 and an annular flange 40 on the head member 22, is a pendulum 41, herein generally annular in form and having a weighted lower portion 42; and formed in the inner walls of this pendulum are annular grooves 43, 43 connected through passages to a port 44 opening through a boss-like projection 45 formed on the upper portion of the pendulum, and this port 44 communicates with the reservoir 37 in the manner shown. Pressure fluid is supplied to the pendulum grooves 43, 43 from the annular supply recess 32 through a passage 46 in the valve chest member 27 communicating through a passage 47 in the cylinder with a passage 48 in the front motor head 22, the passage 48 being connected through ports 49, 49 with the grooves 43, 43. Formed in the inner wall of the pendulum, midway between the grooves 43, 43, is a similar groove 50 connected through a passage 51 in the lower weighted portion 42 of the pendulum with the lubricant reservoir 37. Lubricant is discharged from the reservoir through the passage 51 to the air supply passage for the distributing valve chamber; and this passage 51 communicates as shown in Fig. 1, through the groove 50 and a port 52 in the front head, with a passage 53, also formed in the front head, the latter communicating with an annular groove 54 surrounding the exterior periphery of the larger portion of the head. A passage 55 in the cylinder communicates at its forward end through a port 56 with the groove 54, and at its rearward end through a port 57 with a passage 58 formed centrally in a rotatable lubricant discharge plug 59, and this plug is traversed by a right angle passage 61 communicating with the central passage 58 and with the fluid supply passage 31 at the opposite sides of the plug. The outer end of the plug 59 is provided with a screw driver slot 62 for adjusting the plug when the valve chest is removed from the rear bore of the cylinder, and the exterior of the plug is serrated at 63, and a spring pressed plunger lock 64 is provided for engaging these serrations for locking the plug in its different adjusted positions.

The operation of the lubricating means thus far described is as follows: When the drill is in the horizontal drilling position shown in Fig. 1 and the throttle valve is open to supply pressure fluid to the valve chamber for distribution to the motor cylinder, thereby to effect reciprocation of the motor piston, pressure fluid at the same time flows from recess 32 through passages 46, 47 and 48, and thence through ports 49, 49, grooves 43, 43 and port 44 to the upper portion of the lubricant reservoir 37 so that the pressure fluid thus flowing to the reservoir acts on the upper surface of the lubricant contained therein. As the pressure fluid flows through passage 31 to the valve chamber, fluid also flows through passage 61 in the adjustable plug 59, thereby creating with a cupping or Pitot tube action a suction within the passage 58, port 57, passage 55, port 56, passage 53, port 52 and passage 51 so that lubricant is drawn through these last named passages into the air stream flowing through the supply passage 31 to the valve chamber, and the lubricant entrained in this flowing fluid is carried to all the moving parts of the motor effectively to lubricate the same. If the drill is turned into any position about its longitudinal axis when in the horizontal position shown in Fig. 1, lubricant is at all times supplied from the reservoir to the moving motor parts, since when the drill is so moved about its longitudinal axis the pendulum merely swings about its bearing on the front motor head, thereby maintaining the discharge passage 51 at all times immersed in the lubricant while the air port 44 is at all times at the upper portion of the reservoir. When it is desired to move the drill into a vertical "down-hole" drilling position, the flow of pressure fluid to the reservoir and the discharge of lubricant therefrom are maintained, since the air supply port 44 and the lubricant discharge passage 51 at that time occupy a position within the lower portion of the reservoir so that the lubricant discharge passage is maintained immersed in the lubricant. It will thus be seen that the improved lubricating means thus far described at all times maintains a flow of lubricant to the drill parts when the drill is in any horizontal drilling position about its longitudinal axis or in a vertical "down-hole" drilling position.

Now referring to the improved means for supplying lubricant to the moving drill parts when the drill is in a vertical "up-hole" drilling position, it will be noted that communicating with the rear end of the lubricant reservoir 37 is a passage 70, in turn communicating with an annular groove 71 formed about the exterior periphery of the enlarged portion of the front motor head 22. This groove 71 is connected through a passage 72 with a longitudinal passage 73 formed in the front motor head, and this passage in turn communicates at its forward end with an annular groove 74 formed in the forward face of the front motor head. The groove 74 is connected through a longitudinal passage 75 to a radial passage 76 communicating with the groove 54 of the lubricant discharge passage means. It will thus be seen that when the rock drill is in a vertical "up-hole" drilling position pressure fluid flows from the supply recess 32 through passages 46, 47, 48, ports 49 and fluid discharge port 44 communicating with the upper portion of the lubricant reservoir 37 for maintaining a pressure on the upper surface of the lubricant. Lubricant is then discharged from the reservoir through passage 70, groove 71, passage 73, groove 74, passages 75, 76, groove 54, port 56, passage 55, port 57 and passages 58 and 61 in the adjustable plug 59.

The arrangement described to provide for lubrication during "up-hole" drilling can not prevent satisfactory lubrication during horizontal and "down-hole" drilling, for the passages 73, 75 etc. are longer, and may be more restricted, if desired, than the oil connection from the pendulum inlet to the groove 54; and moreover the oil during drilling tends to emulsify and pass readily through any available opening into the reservoir to the point of communication with the main air supply passage.

During normal operation of the motor the lubricant entrained in the pressure fluid flowing to the motor cylinder flows through the flutes 13 in the piston striking bar to a recess 78 formed between the forward end of the guide bushing 21 and the rear end of the chuck sleeve 15, the lubricant flowing from this recess past the adjacent surfaces of the members 36 and 15 to the bearing surfaces between the rotating elements 15 and 18 and the chuck housing, lubricant also flowing from the longitudinal flutes 13 to the straight ribs 14 on the rotatable chuck sleeve 15. A supplemental supply of lubricant is conducted to the bearing surfaces between the elements 15 and 18 and the chuck housing by means comprising passages 79 communicating with an annular recess 80 formed between the forward face of the member 36 and the rear end flange surface of the chuck housing 16; and this recess 80 is connected through a longitudinal passage 81 in the chuck housing and port 82 with the chuck housing bore. During operation of the drill in a horizontal or vertical "down-hole" drilling position, lubricant may flow through the passages 79, recess 80 and passage 81 to the chuck housing bore from the discharge groove 54, passages 76, 75 communicating with the groove 74 with which the passages 79 also communicate.

Lubricant is discharged from the reservoir 37 by combined action of the pressure on the surface of the lubricant and the suction created in the passage 55 by the passages in the adjustable plug 59. By the insertion of a screw driver in the slot 62, the plug 59 may be rotated to vary the angular position of the passage 61 with respect to the fluid supply passage 31 so that the suction created in the mouth of the passage 61 may be varied, the pressure fluid flowing through the passage 31 creating the suction in the passage 55 by the cupping or Pitot tube action at the mouth of the passage 61, which is varied by such change in the angular relation of the passage 61 with respect to the supply passage 31.

As a result of this invention, it will be noted that an improved automatic lubricating means is provided for a rock drill, wherein lubricant is automatically supplied to the moving parts of the drill irrespective of the supported position of the drill. It will further be noted that by embodying the improved lubricator directly within the front head structure of the drill, an improved lubricating action is attained, it being possible to regulate the flow of lubricant to the drill in an improved and more effective manner by direct lubricant discharge to the air supply passage of the drill. It will further be evident that the improved lubricator is of an extremely simple and compact structure which may be embodied in a standard form of rock drill with a minimum of change.

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 modified and 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 rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and having moving motor parts, and lubricator means embodied in the rock drill for supplying lubricant to the moving motor parts irrespective of the supported position of the drill and comprising a lubricant reservoir, passage means for supplying pressure fluid to said reservoir and for discharging lubricant from said reservoir to said motor irrespective of the angular or endwise tilted positions of the drill, said supply and discharge passage means including a weighted member swingably mounted in said reservoir and having a fluid supply passage and a lubricant discharge passage both communicating with said reservoir in all positions of the weighted member about its pivot.

2. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and having moving motor parts, and lubricator means embodied in the rock drill for supplying lubricant to the moving motor parts irrespective of the supported position of the drill and comprising a lubricant reservoir, passage means for supplying pressure fluid to said reservoir and for discharging lubricant from said reservoir to said motor irrespective of the angular or endwise tilted positions of the drill, said supply and discharge passage means including a weighted member swingably mounted in said reservoir and having a fluid supply passage and a lubricant discharge passage both communicating with said reservoir in all positions of the weighted member about its pivot, and separate lubricant discharge passage means for discharging lubricant from said reservoir to said motor independently of said discharge passage when the drill is in "up-hole" vertical drilling position.

3. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and having moving motor parts, and lubricator means embodied in the rock drill and operative upon flow of pressure fluid to said motor and including a lubricant reservoir, a passageway for the flow of pressure fluid and means for supplying pressure fluid to and for discharging lubricant from said reservoir including means movably mounted in said reservoir and having passage means for delivering lubricant from the reservoir for delivery to said passageway, said movably mounted means being automatically movable into different lubricant discharging positions with respect to the reservoir so that lubricant may be discharged from the reservoir to the motor in different supported positions of the rock drill.

4. In a rock drill, a pressure fluid actuated hammer motor for moving a drill steel and having moving motor parts, and lubricator means embodied in the rock drill and operative upon flow of pressure fluid to said motor for supplying lubricant automatically to the moving motor parts and including a lubricant reservoir, a passageway for the flow of pressure fluid and means for supplying pressure fluid to and for discharging lubricant from said reservoir including a pendulum member swingably mounted in said reservoir and having passage means for supplying pressure fluid to said reservoir and for delivering lubricant from said reservoir for delivery into said passageway, said pendulum being automatically swingable into different pressure fluid supplying and lubricant discharging positions with respect to the reservoir so that pressure fluid may be supplied to and lubricant discharged from said reservoir in different supported positions of the rock drill.

5. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and having moving motor parts, and lubricator means embodied in the rock drill and operative upon flow of pressure fluid to said motor for supplying lubricant automatically to the moving motor

parts and including a lubricant reservoir, a passageway for the flow of pressure fluid and means for supplying pressure fluid to and for discharging lubricant from said reservoir including a pendulum member swingably mounted in said reservoir on an axis alined with the longitudinal axis of the rock drill and having a passage communicating with the reservoir and a passage for delivering lubricant from the reservoir for delivery into said passageway, said pendulum being automatically swingable into different lubricant discharging positions with respect to the reservoir so that lubricant may be discharged from the reservoir in any position of the rock drill about its longitudinal axis.

6. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and having moving motor parts, and lubricator means embodied in the rock drill and operative upon flow of pressure fluid to said motor for supplying lubricant automatically to the moving motor parts and including a lubricant reservoir, a passageway for the flow of pressure fluid and means for supplying pressure fluid to and for discharging lubricant from said reservoir including means movably mounted in said reservoir for delivering lubricant from the lower portion of the reservoir for delivery to said passageway irrespective of which portion becomes the lower portion due to turning of the drill about its longitudinal axis.

7. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and including a cylinder containing a reciprocable piston and a front head having an opening through which a portion of the piston moves, and automatic lubricating means for the rock drill operative upon flow of pressure fluid to said motor for supplying automatically lubricant to the motor cylinder irrespective of the supported position of the drill, said lubricating means including a lubricant reservoir formed by the cylinder and front head, a pressure fluid passageway, and means for supplying pressure fluid to and for discharging lubricant from said reservoir including means movably mounted in said reservoir for delivering lubricant from the reservoir for delivery to said fluid passageway in different supported positions of the drill.

8. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel including a cylinder containing a reciprocable piston and a front head having an opening through which a portion of the piston moves, and automatic lubricating means for the rock drill operative upon flow of pressure fluid to said motor for automatically supplying lubricant to the motor cylinder in any supported position of the rock drill, said lubricating means including a lubricant reservoir formed by the cylinder and front head, a pressure fluid passageway, and means for supplying pressure fluid to and for discharging lubricant from said reservoir including means for delivering lubricant from said reservoir to said fluid passageway, said front head providing an annular bearing surrounding the opening through which the piston extends and said lubricant delivering means including a pendulum swingably mounted on said bearing in said reservoir and having a lubricant discharge passageway communicating with the lower portion of said reservoir in different supported positions of the rock drill, said lubricant discharge passageway discharging into said fluid passageway.

9. In a rock drill, a pressure fluid actuated hammer motor for actuating a drill steel and having moving motor parts, and lubricator means embodied in the rock drill and operative only upon flow of pressure fluid to said motor for automatically supplying a continuous controlled flow of lubricant to the moving motor parts irrespective of the drilling position of the rock drill and the level of the lubricant in said lubricator means, said lubricator means including a lubricant reservoir and means for supplying pressure fluid to said reservoir and for discharging lubricant therefrom including a movably mounted control element in said reservoir having passage means for supplying pressure fluid to said reservoir and discharging lubricant from said reservoir and movable into different controlling positions with respect to the reservoir in different drilling positions of the rock drill.

10. In a rock drill, a pressure fluid actuated hammer motor having a front head structure and moving motor parts and a pressure fluid supply, and lubricator means embodied in said front head structure at the forward end of the rock drill and operative only upon flow of pressure fluid to said motor for automatically supplying a continuous, positive, controlled flow of lubricant to the moving motor parts irrespective of the drilling position of the rock drill and the level of the lubricant in said lubricator means, said lubricator means including a lubricant reservoir and means for supplying pressure fluid to said reservoir and for discharging lubricant therefrom including a movably mounted control element in said reservoir having passage means for supplying pressure fluid to said reservoir and discharging lubricant from said reservoir and movable into different controlling positions with respect to the reservoir in different drilling positions of the rock drill, said supply and discharge means having pressure fluid delivery and lubricant egress passages communicating with said reservoir and so arranged as to prevent flow of lubricant from said reservoir to the motor when the supply of pressure fluid to the motor is discontinued.

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