Jan. 15, 1952 H. O. FOSSUM 2,582,689

OILING SYSTEM FOR ROCK DRILLS

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Fig. 1.

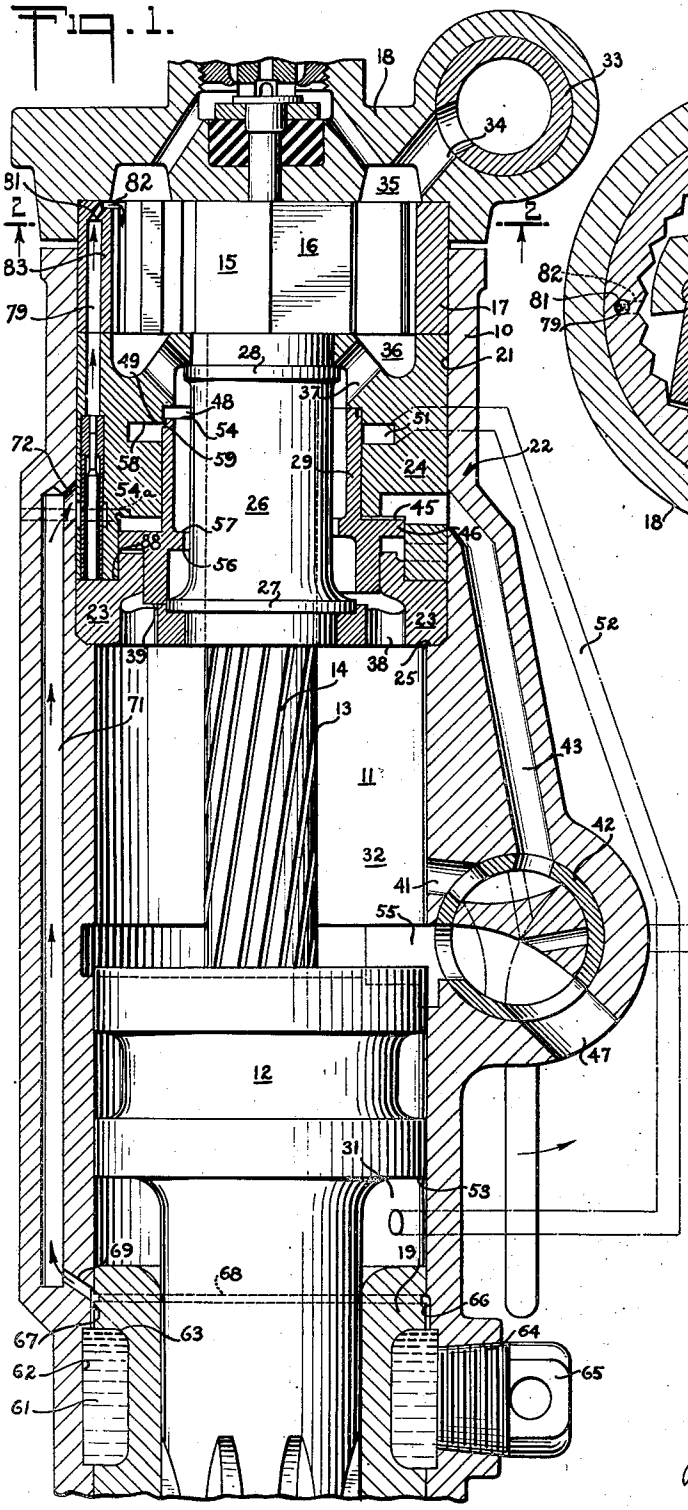


Fig. 2.

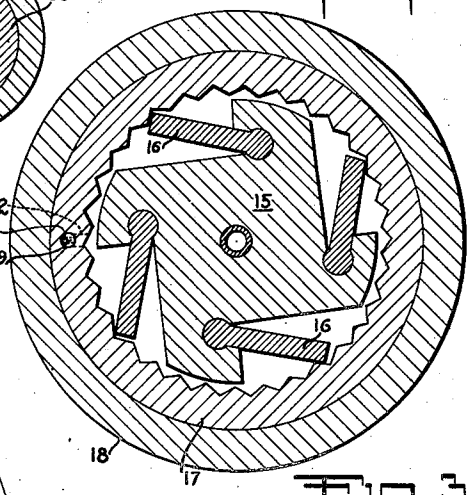
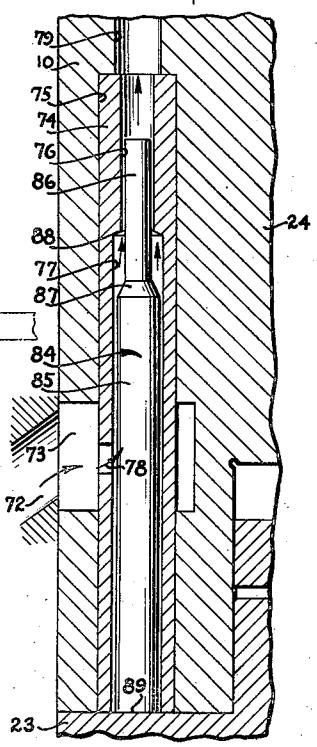


Fig. 3.



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OILING SYSTEM FOR ROCK DRILLS

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2 Claims. (Cl. 184—55)

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This invention relates to lubricating apparatus for fluid actuated tools such as rock drills.

In rock drills, especially of the sinker type, the use of a line oiler is not expedient, and consequently it is conventional to provide a reservoir within the body of the tool to carry a limited supply of oil for distribution to the working parts by entrainment in the stream of live air which actuates the hammer piston. The oil is conducted through a system of portings from the reservoir to a point adjacent the stream of live air; but in drills of the class wherein the reservoir is remotely located from the point through which the live air is admitted into the oil system, it is well known in the art that there will be no substantial amount of oil conveyed from the reservoir into the live air stream during the normal operation of the drill. During such operation, however, the pulsations in the live air stream incident to the alternate admission and cut-off of the live air supplied to reciprocate the hammer piston, create an oil foam in the reservoir and connecting portings. The air under high pressure mixes with the oil to form such foam. When the operator from time to time cuts off the suply line from the source of live air, the foam will be carried into the body of the tool by the live air returning from the reservoir to the lower pressure zone, and in some cases will cause flooding of the tool at the beginning of a subsequent period of operation. To regulate this return flow is one of the objects of the invention.

Regulating orifices are customarily provided in the portings of the lubricating system to prevent premature dissipation and consequent waste of the lubricant; and since the orifices are necessarily of restricted cross-section, clogging frequently occurs with the result that the tool is not lubricated even though the reservoir is well supplied. In order to remove the clogging detritus, a wire is ordinarily inserted through the restricted orifices; but since the orifices are not accessibles from the outside of the tool, the tool has to be dismantled. Obviously, this is inconvenient and results in the loss of time. Furthermore, when the tool is operated in clogged condition, there is the likelihood of damage to the tool because of lack of lubrication. It is another object of the invention to provide means of preventing the clogging of the lubricating system.

It is a further object of the invention to provide a device arranged in an oiling system which includes a plunger fitting loosely into a sleeve disposed within the portings to act as a check

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valve to prevent an excess of oil from entering the working parts of the tool upon the sudden drop of pressure incident to cutting off the supply of live air to the tool.

Another object of the invention is to provide such a device to limit to predetermined amounts the supply of oil which will advance into the tool at each cutting off of the live air supply.

Still another object is to provide means to prevent the accumulation of detritus in the lubricating system.

Other objects and features will appear more closely from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a longitudinal section of a fragmentary portion of a rock drill embodying the invention, with the piston being illustrated at the start of its return stroke and the distributing valve being shown on the right half of the illustration in rear position, and on the left half of the illustration in forward position;

Fig. 2 is a cross section, taken on line 2—2 of Fig. 1, of the pawl and ratchet mechanism arranged in relation to the terminal port of the lubricating system of the invention; and

Fig. 3 is a longitudinal section, on a larger scale than Fig. 1, of the sleeve and plunger arranged in open position to permit the movement of the oil within the lubricating system.

Referring more particularly to the drawing, the invention is shown embodied in a pressure fluid operated rock drill of the type disclosed in applicant's U. S. Patent 2,448,875, dated September 7, 1948. Such a rock drill comprises a cylinder 10 having a chamber 11 therein in which a hammer piston 12 reciprocates. The drill is provided with conventional rotation mechanism for imparting intermittent rotary movement of the piston, such mechanism comprising a rifle nut (not shown) screwed into a complementary threaded recess in the rear face of the piston, a rifle bar 13 having helical splines 14 slidably engaging the rifle nut, a head 15 (Fig. 2) on the rifle bar, a series of pawls 16 carried on the head, and a ratchet ring 17 surrounding the head and pawls. The ratchet ring is stationary and is supported by the cylinder 10 and by a back head 18, the latter being rigidly secured to the cylinder by conventional means. Back head 18 completes the rear end closure of the cylinder 10, and washer 19 provides a closure for the front end of the cylinder.

Cylinder 10 has a counterbore 21 within which is arranged a valve chest, generally indicated at

22, comprising a valve block 23 and a valve cap 24. Axial movement of the valve chest is prevented since the valve cap abuts forwardly against shoulder 25 formed in the cylinder by the counterbore and the valve block abuts rearwardly against the rigidly secured ratchet ring 17. Within the valve chest 22 is mounted a bushing 26 which has locating flanges 27 and 28 arranged to maintain the bushing against axial movement within the valve chest. Such bushing forms a bearing for the rotating rifle bar 13.

Surrounding the bushing 26 is an annular distributing valve 29 which is mounted for limited axial reciprocation to direct live air alternately into the front piston chamber 31 and rear piston chamber 32 to reciprocate the piston. Such valve may be any of several types well known in the art. The valve illustrated has been found effective in a rock drill of the type shown in which live air from a source of supply (not shown) is controlled by a throttle valve 33. Valve 33 is shown in open or working position and live air enters therethrough to passage 34, reservoir 35, and the interior ratchet ring 17 (Fig. 2) to front reservoir 36, thence through ports 37 to the interior of valve 29 and out through radially arranged ports 38 to rear piston chamber 32, driving piston 12 on its forward stroke. During the forward stroke of the piston, valve 29 is held in its rearward position (shown on the right in Fig. 1) by pressure of the live air on forward face 39 as the air advances through ports 37. When piston 12 on its forward stroke uncovers kicker port 41, live air is admitted by way of blower valve 42, slot 43, and port 44 to impinge against the rear face 45 of distributing valve flange 46, thereby to trip the valve forward to shut off the live air from the rear piston chamber 32. Upon the completion of the forward stroke of the piston, as shown in Fig. 1, rear piston chamber 32 is evacuated through the main exhaust port 47 in valve 41.

The piston is now in position to be driven rearwardly by the admission of live air through annular passage 48, annular recess 49 formed on the rear portion of the valve, annular groove 51, passageway 52 (diagrammatically represented in Fig. 1) into the front piston chamber 31 where it will impinge against the front face 53 of piston 12. The valve 29, during the first portion of the rearward travel of the piston, is held in its forward position by the pressure of the live air on its rear face 54. As piston 12 travels rearwardly, it closes exhaust port 55. Pressure of the residual air in the rear chamber 32 will then be built up until, at a predetermined position of the piston, it will be sufficiently high on face 39 of the valve to overcome the forward pressure on face 54 and to trip the valve to rearward position, thus completing the cycle. While the valve is in forward position, there is, in addition to the differential pressure just described, a constant pressure against face 56 exerted by the live air within the valve which exceeds the pressure on face 57, and this differential also assists in tripping of the valve in the rearward direction. The last described differential, it should be observed, does not exist when the valve is in rear position. In that case, the live air moving forward at high speed will exert a higher pressure on the face 57 than on face 56 even though its area is the smaller. The piston in its rearward travel also closes kicker port 41, further communication between the valve chamber and the rising pressure in the cylinder chamber being thereby cut off. A bleeder port 54a (not shown but diagrammatically represented in Fig. 1 permits the escape to atmosphere of the entrapped air in the portion of the valve chamber exterior to the valve thereby to assist in the rearward shifting of the valve.

Turning now to the oil lubricating system, reservoir 61 is provided at the front end of the cylinder by the mating of annular recess 62 in the cylinder 10 and annular recess 63 in the washer 19. Oil is supplied thereto by the operator from time to time, as required, through the aperture 64 which is threaded for the reception of filler plug 65. Adjacent to the reservoir and in the interior face of the cylinder are two longitudinally extending grooves or slots 66 and 67 formed on diametrically opposed portions of the chamber. Such grooves or slots are connected by an annular groove 68, and by means of ports 69 they establish communication between the reservoir 61 and longitudinal passage 71 in the cylinder 10. At its rear end, passage 71 is connected by a port 72 (Fig. 3) to the annular recess 73 in the valve block 24 encompassing sleeve 74. Such sleeve is arranged within a limited bore 75 in the valve block 24 and is formed with a longitudinal bore 76 in its rear portion and a counterbore 77 in its forward portion. Port 78 connects the annular recess 73 to the counterbore 77; and by means of bore 76 communication is established between counterbore 77 and the longitudinal passage 79 extending through the valve block 24 and ratchet ring 17 in offset relation to the longitudinal passage 71. Passage 79 leads rearwardly through the ratchet ring 17 to the inwardly inclined port 81 which terminates in a restricted aperture 82 formed in the wall 83 of the ratchet ring to serve as an outlet for the lubricating system to the interior of the ratchet ring. Continuous communication is thereby established from the reservoir 61 to the interior of the ratchet ring through the latter of which the stream of live air flows into the piston chambers 31 and 32 as previously described.

Arranged within the sleeve 74 is a plunger, generally indicated at 84, which comprises a main body 85 and a rearwardly reduced extension 86 joined by a tapered portion 87. The main body 85 of the plunger is supported in the counterbore 77 and is of somewhat shorter length than the length of the counterbore. The diameter of the main body 85 of the plunger is slightly less than the diameter of the counterbore 77, and the plunger extension 86, which projects into the bore 76 is of slightly less diameter than that of said bore. The plunger is thus loosely supported in the sleeve and is free for limited movement in relation to the enclosing structure of the tool considered as a unit. In operation, as the entire tool vibrates longitudinally in response to the impacts of the hammer piston, the plunger will, by its own inertia, remain substantially stationary within the longitudinal limits permitted by the counterbore 77. As the entire tool jumps forwardly when the hammer piston strikes the front head air cushion or the drill steel (not shown), as the case may be, the plunger will remain stationary until its tapered portion 87 is stricken by the correspondingly tapered seat 88 formed between the bore 76 and counterbore 77. When the entire tool jumps rearwardly as the hammer piston reverses and meets the air cushion in rear chamber 32, the plunger 84 will again remain stationary by inertia until encountered by the wall 89 of the valve cap 23 which serves as a forward closure for the counterbore 77. Such alternate

impacts of the plunger against seat 88 and the wall 89 cause the plunger to disintegrate any small particles of foreign matter that may have become introduced into the oil in which the plunger is submersed and which may "hang up" or stick in this restricted zone.

Whenever the operator shuts off the supply of live air and the pressure of the live air within the body of the tool drops, the oil or oil foam in the lubricating system will rush toward the zone of low pressure. This sudden movement of the oil will force the plunger 84 rearwardly so that the tapered portion 87 will seat at 88 and cut off further flow of the oil toward the outlet aperture 82. Obviously, only a limited amount of oil will have passed from the counterbore 77 to the bore 76 by the time the valve seats.

The length and diameters of the plunger may be varied to provide for the different viscosities of oil. Obviously, if a rod of smaller diameters is provided, the space between the bores of the sleeve and the diameters of the rod will increase and the oil will pass more freely therethrough. With oils of greater viscosity, the substitution of a plunger of smaller diameters has been found advantageous. A similar effect is produced by the use of a shorter rod. The space taken up by the rod, and accordingly the resistance to the passage of oil through the sleeve bores, is diminished and an oil of greater viscosity is more free to pass therethrough.

It is to be understood that although a single embodiment of the invention has been shown in the drawing and described in the specification, the invention is not limited to such embodiment but is capable of modification and substitution of parts and general reorganization within the scope of the appended claims.

What is claimed is:

1. In a percussive tool of the class wherein a hammer piston, reciprocated by live air from a conducting passage, imparts longitudinal jars to the entire tool as a unit, a lubricating system comprising a reservoir, an oil transmission passage leading from the reservoir to a point adjacent the live air conducting passage within the tool and connecting with said passage, a sleeve in the transmission passage having a bore, a counterbore, and a tapered connecting portion, said transmission passage intersecting the sleeve at the side thereof in the region of the counterbore, a cylindrical plunger arranged within the sleeve having a main body, an extension thereto, and a tapered connecting portion, said main body and extension being arranged within the counterbore and bore of the sleeve respectively in a manner to provide a continuous clearance space between the periphery of the plunger and the sleeve for the passage of oil about the plunger, the tapered portion of the plunger being adapted to seat upon the tapered portion of the sleeve, the plunger being adapted to remain immovable by inertia in relation to the entire tool thereby to reciprocate in the oil in the transmission passage to prevent the accumulation of foreign matter therein, said plunger being further adapted to seat upon the tapered portion of the sleeve to act as a check valve to prevent the flow of oil toward the live air conducting passage upon the sudden drop in air pressure incident to shutting off the supply to live air to the tool.

2. In a percussive tool of the class wherein the motor is actuated by pressure fluid from a conducting passage, a lubricating system comprising a supply reservoir, enclosed oil transmission means leading from the reservoir to a point adjacent to the pressure fluid conducting passage within the tool, a sleeve in the transmission means having a tapered portion adapted to serve as a valve seat, said transmission means including a passageway which at one point intersects the sleeve at the side thereof, and a cylindrical plunger in the sleeve having a tapered portion to cooperate with the valve seat, the plunger being mounted in the sleeve in a manner to provide a continuous clearance space between the periphery of the plunger and the sleeve for the passage of oil about the plunger when the plunger is not in a seated position, said plunger being adapted in response to the sudden drop of pressure incident to the shutting off of the supply of pressure fluid to the motor, to act as a check valve to prevent the further passage of oil from the reservoir to the pressure fluid conducting passage.

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