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2,750,816

FLUID OPERATED DRILLING UNIT

Filed May 18, 1951

2 Sheets-Sheet 1

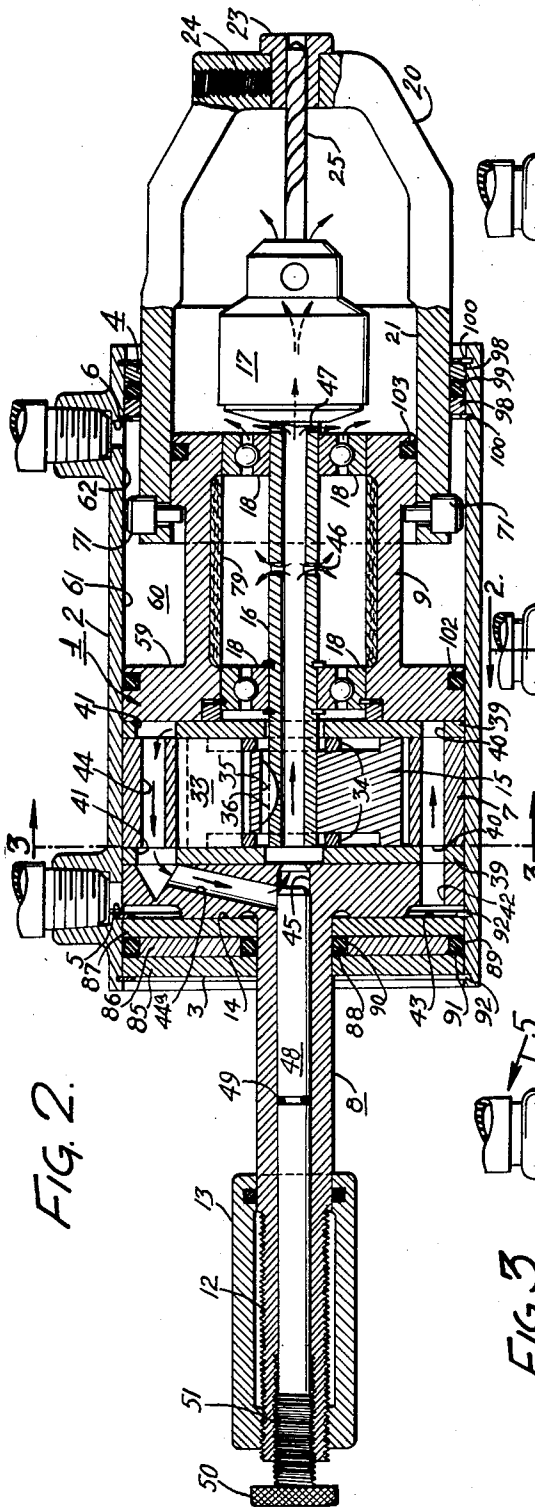


FIG. 2.

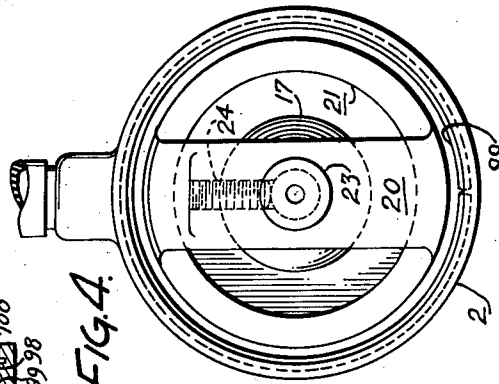
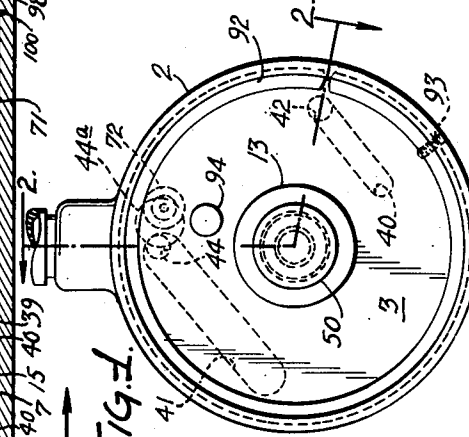


FIG. 4.



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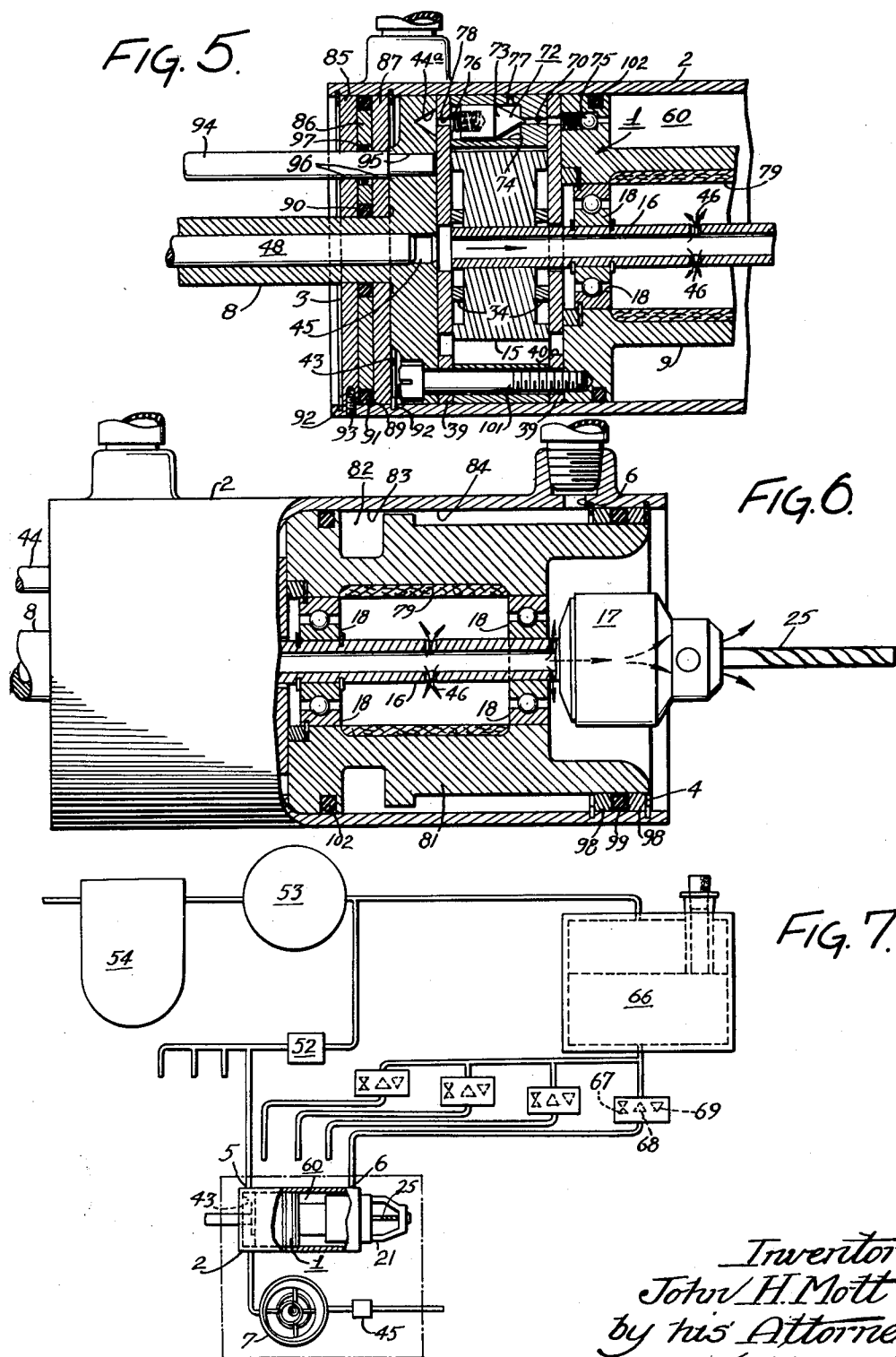
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2 Sheets-Sheet 2



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FLUID OPERATED DRILLING UNIT

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9 Claims. (Cl. 77—6)

The present invention relates primarily to automatic fluid-operated drilling units, and more particularly to units combining a pneumatic motor with a hydraulically controlled pneumatic feed.

A primary object of the present invention is to provide a drilling unit wherein the rate at which the tool is fed into the work is positively controlled independently of the resistance of the work to the drilling.

A further object is to provide an automatic drilling unit wherein the speed of rotation and the rate of feed are positively regulated independently of one another.

A still further object is to provide a drilling unit adaptable for use in combination with other like units, said units being controllable from a single control valve.

Another object is to provide an inexpensive fluid-operated drilling unit including means for automatically lubricating the moving parts with working fluid.

Yet another object is the provision of a drilling unit comprising a guard member to guide and to regulate the feed of the drill, and to shield the drill when the latter is retracted from the work.

A further object is to provide a drilling or like unit having novel means for clamping the work for operations by the tool and for locating the tool with respect to the work.

Another object is to provide a drilling unit wherein the feed rate of the drill toward the work is automatically reduced when the guard member engages the work.

Still another object is to utilize to advantage exhaust air from the pneumatic motor to cool the unit and to prevent foreign matter from fouling the moving parts of the mechanism.

In the drawings:

Fig. 1 is a rear end elevational view of a drilling unit made in accordance with the present invention;

Fig. 2 is a longitudinal sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 2;

Fig. 4 is a forward end elevational view of the drilling unit;

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary elevational view partially in section illustrating a second embodiment of the present invention; and,

Fig. 7 is a schematic representation of the air and oil systems used in the presently illustrated embodiments of the invention.

Referring to the drawings and more particularly to Fig. 2, the drilling unit comprises a differential piston 1 slidably mounted for longitudinal movement in a cylinder 2, said cylinder having end walls 3 and 4 and being provided with a primary air port 5 and a primary oil port 6. The piston 1 comprises a body 7 having a rearwardly extending hollow stem 8 and a forward reduced portion 9. The stem 8 is externally threaded at 12 to receive a depth

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control nut 13 which is longitudinally adjustable on the stem 8 to determine the forward limit of travel of the piston 1 within the cylinder. Thus, in operation of the unit, advance of the piston carries the nut into engagement with the rear end wall 3 of the cylinder, precluding further advance of the piston. The back limit position of the piston is determined by engagement of the rear face 14 of the piston with the interior surface of the end wall 3.

The body of the piston 7 serves as a housing for an air motor assembly, the rotor 15 of which is adapted to drive a hollow spindle 16 carrying a conventional tool chuck 17. The spindle 16 is freely rotatable in a pair of anti-friction bearings 18, 18 mounted internally of the reduced portion 9 of the differential piston 1.

The forward reduced portion 9 slidably mounts a generally cylindrical guard member 21 which, in turn, is slidably fitted to the forward end wall 4 of the cylinder 2. The external extremity 20 of the guard member 21 is provided with a bushing 23 secured in place by a set screw 24. The bushing not only serves as a work contacting portion for the guard member 21 but also serves as a guide for the drill 25 which is secured in the chuck 17 in the conventional manner. Should a drill of another size required, the bushing may be readily replaced by another having an internal bore dimensioned to snugly embrace the drill. This replacement may be effected by loosening the setscrew 24, removing the bushing 23, replacing the said bushing with a suitable substitute, and retightening the setscrew, so as to securely fasten the substitute bushing in place.

The bushing also functions to clamp the work and to locate the tool accurately with respect to the work at the beginning of and during the operation. It is obvious that a special head may replace the bushing 23 on the guard 20 so that as the latter approaches the work it engages the work to accurately locate the work relative to the tool and thereby control the point of entry of the tool into the work. With such an attachment, the present invention eliminates the necessity for special jigs and like indexing means on the work table. Thus, the work piece may be laid freely on the table, whereby the head of the guard member, as it engages the workpiece, displaces it to the proper position relative to the tool, and because of the pressure on the guard member maintains the workpiece in proper position on the table as the tool advances into it. This feature is especially advantageous, for example, when drilling holes through spherical members. In this instance, the bushing 23 is replaced by a funnel-shaped member having an aperture at its apex affording passage of the tool therethrough. As the guard member approaches the spherical member, the funnel engages the member and guides the same into proper position relative to the tool so that an aperture is drilled precisely through the diameter of the spherical member. Likewise, other heads may be used which engage other types of work to locate them relative to the tool.

With reference to Fig. 3, the body portion 7 of the piston is hollow and serves as a rotor chamber 30 for the rotor 15. The body of the rotor 15 is radially slotted at 32 for the reception of vanes 33 disposed to bear against the inner eccentric wall of the chamber. The rotor 15 is recessed at its axial ends, as seen in Fig. 2, for reception of vane rings 34, 34 which bear against the inner radial extremities of the vanes 33 and maintaining the vanes in close contact with the inner wall of housing 30. Rotation of the rotor 15 within the chamber 30 carries the vanes 33 about the inner wall of the rotor chamber. The vane rings 34, 34 float in the recessed ends of the rotor, interiorly of the vane extremities and rotate with the said rotor about a center concentric with the

eccentric chamber 30. It is apparent that the rings 34, 34 will retain the vanes in continuous operative engagement with the peripheral wall of the rotor chamber. It should be noted, however, by reason of the changing angular relations between the end edges of the vanes and the surfaces of the pump chamber and vane rings engaged by said end edges, that the edges must describe arcs of a common cylinder whose diameter is equal to one-half of the difference between the diameter of the bore of the pump chamber and the outside diameter of the vane ring, since only in these conditions will uniform contact be maintained between the vanes and the opposed surfaces of the said bore and rings.

The rotor 15 is further provided with a keyway 35 which receives a key 36 engaged also with the rotary spindle 16. The vanes 33 define the respective inlet and exhaust chambers 37 and 38 of the motor 10. High pressure air is admitted, as more fully described herein-after, into the intake chamber 37, driving the rotor in a clockwise direction as viewed in Fig. 3 so as to carry the expanding air around with the rotor to the discharge chamber 38. Thus, when the intake chamber is open to a constant source of high pressure air, and the exhaust chamber is open to the atmosphere as described below, the rotor will rotate continuously at a rate determined by the differential in pressure between the incoming air and the exhaust air. It is noted that when the rotor is stopped, the vanes will be maintained in their extended position by the vane rings 34, 34. Thus, the intake and exhaust chambers are separated even when the rotor is stopped, and the motor is thereby capable of being started without the application of external starting torque.

The motor assembly includes a pair of face plates 39, 39 each having elongated intake and exhaust slots, 40 and 41 respectively, disposed so as to lie transversely of the radius at opposite sides of the plate 39. The slots 40 connect the intake chamber 37 with an intake passage 42 in the body of the piston 1. This passage, in turn, is open to the rear end cylinder chamber 43 between the rear face 14 and the end wall 3, which communicates directly with the primary air port 5 in the cylinder 2. The slots 41 in the motor face plates 39, 39 connect the exhaust chamber 38 of the motor with an exhaust passage 44 in the body of the cylinder. The exhaust air is directed through a radial discharge passage 44a and a valve 45 into the interior of the rotary spindle 16 and thence into the atmosphere through ports 46 and 47 and through the tool chuck 17. It is apparent that the air exhausted from the port 46 will be discharged into the interior of the reduced portion 9 of the piston, and the air will escape to the atmosphere through the forward anti-friction bearing 18, thereby excluding dirt and foreign materials generally from the bearing. Similarly, the air exhausted through the port 47 and the chuck 17 will drive the dirt and other foreign material away from the moving parts of the drilling unit.

The valve 45 is adjustable by actuation of a valve stem 48 mounted in the piston stem 8, an O-ring 49 being provided on the valve stem to preclude leakage of exhaust air past the stem to the atmosphere. The left-hand extremity of the valve stem is provided with a speed adjusting knob 50 and is threaded at 51 for engagement with the stem 8 whereby rotation of the knob 50 will advance or retract the stem so as to regulate the escape of exhaust air from the motor assembly and thereby the exhaust pressure which, in turn, controls the speed of the motor. It should be noted that the rear end cylinder chamber 43 is open to high-pressure air so that the piston will be urged to the right when the air is introduced to the drilling unit. It will be apparent, therefore, that the high pressure air controls both the advance of the piston and the rotation of the spindle 16. With reference to Fig. 7, it will be noted that the air is introduced to the rear cylinder chamber by way of the primary air port 5 and a control valve 52 which will thus control both the advance of the

piston 1 and the rotation of the motor. The valve 52 is connected to a primary air source (not shown) through a conventional pressure regulator 53 and filter 54.

Referring again to Fig. 2, the guard member 21, as described above, is mounted on the reduced portion 9 of the piston 1 and is slidably supported within the end wall 4 for a longitudinal movement with the piston 1. The end wall 4, the cylinder 2, the reduced portion of the piston 9, and the generally cylindrical guard member 21 define the forward cylinder chamber 60. The chamber 60 comprises two integral parts: the major chamber 61 including that portion of the chamber 60 that is bounded by the reduced portion 9 of the piston and the cylinder 2; and the minor chamber 62 including that part of the chamber 60 that lies between the guard member 21 and the cylinder wall 2.

The chamber 60 is adapted to receive pressure oil at approximately the same pressure as the aforementioned high pressure air. It will be noted that the forward face 59 of the piston 1 is substantially smaller than the rear face 14 which is exposed to high pressure air. Consequently, the two pressures being approximately equal, the piston 1 will be urged to the right against the oil pressure in chamber 60. The guard member 21, encountering no resistance, will be carried to the right along with the piston 1, thereby displacing oil from the minor chamber 62, and this movement will continue until the guard member contacts the work, at which time the piston alone will continue its advance movement, feeding the drill 25 into the work. During this feeding operation, the minor chamber 62 will remain constant in size and the volume of the major chamber 61 will diminish, the oil contained in said chamber being discharged by way of the minor chamber 62 into the oil system through primary port 6. Prior to the guard member's engagement with the work, and by reason of the fact that the minor chamber 62 is relatively small in cross section as compared with the chamber 61, a relatively small quantity of oil will be discharged from the drilling unit. After the guard member 21 contacts the work, and during the subsequent contraction of the chamber 61, a relatively large amount of oil must be discharged from the drilling unit.

As illustrated diagrammatically in Fig. 7, the oil source comprises an oil reservoir 66 open to high pressure air coming from the pressure regulator 53. The oil is introduced to the drilling unit through a valve means which includes a needle valve 67, a check valve 68, and a pressure relief valve 69, all arranged in parallel. The pressure relief valve 69 is provided to afford a relatively rapid advance movement of the guard by opening under a given pressure to provide a second path for oil flow back to the reservoir supplementing the path through needle valve 67. The check valve 68 allows a uni-directional flow of oil under pressure of the air from the oil reservoir 66 to the primary oil port 6 of the drilling unit; and the needle valve 67 is adjustable to limit the rate of flow of oil from the drilling unit back to the reservoir 66. It is by this latter adjustment that the rate of advance of the piston is regulated. Regulation is such that until the guard member 21 contacts the work, the advance is relatively fast, but upon said contact the advance is slowed to a rate determined by the setting of the needle valve 67. This differential speed is made possible by the difference in the cross sections of chambers 61 and 62 whereby, the oil discharged from the minor chamber 62, being relatively limited in volume for each unit advance of the piston is not impeded by the needle valve 67, but the oil discharged from the major chamber 61, being of greater volume for each unit of piston advance is impeded by the needle valve, thereby reducing the feed of the drill into the work. It will be apparent that the needle valve setting controls the rate of advance irrespective of the resistance of the work, so that upon "break through" of the drill, when the drill encounters no further resistance, the rate of advance will be the same, as determined by the setting of the needle valve.

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In the operation of the drilling unit the control valve 52 is opened to admit air to the rear cylinder chamber 43 thus effecting an advance of the piston 1 against the back-pressure of the oil in the forward cylinder chamber 60. The high pressure air is also directed from the rear cylinder chamber 43 through the motor assembly to effect clockwise rotation of the spindle 16. The piston advance is relatively rapid until the guard member 21 contacts the work, at which point the advance is slowed to a rate determined by the setting of the needle valve 67. This slow advance continues at a constant rate until the depth control nut 13 engages the exterior face of the end wall 3 at which point the advance will be halted, the clockwise rotation of the motor continuing at the rate determined by the speed control knob 50.

When this point is reached the operator closes the control valve 52 thereby cutting off the supply of high pressure air to the drilling unit. The rear face 59 of the piston 1 being exposed to the pressure oil in the chamber 60, the piston will be moved to the left as viewed in Fig. 2 thereby returning the major chamber 61 to its original dimensions, the oil flowing into this chamber through the check valve 68. The head of air trapped in the rear cylinder chamber will be discharged through the motor assembly, thereby effecting a continuing clockwise rotation of the motor during retraction of the piston. This continuing rotation makes possible the formation of a clean cut hole free from internal burrs and the like.

The guard member will be retained against the work until the reduced portion 9 of the piston engages limit pins 71, 71 located near the rear extremity of the guard member. At this point the piston will carry the guard member to the left until the back limit position of the piston is reached. By retaining the guard member against the work, the drill 25 is retracted into the guard member 21 directly upon disengaging the work, so as to substantially eliminate the possibility of injury to the operator by contact with the rotating drill and to facilitate and insure withdrawal of the tool from the work.

It will be noted that the limit pins 71, 71 extend beyond the outer periphery of the generally cylindrical guard member 21 to limit the advance of the guard member by engaging the interior surface of the forward end wall 4 of the cylinder 2.

Automatic lubrication of the moving parts of the drilling unit is provided by a lubricator 72 best shown in Fig. 5. The lubricator comprises primarily a conical valve piston 73 slidably mounted in a valve chamber 74. The forward end of the valve chamber communicates with the forward cylinder chamber 60 through a passage 70 containing a ball valve 75 arranged to permit unidirectional flow from the chamber 60 into the valve chamber 74. The valve piston 73 is spring loaded as indicated at 76 to urge the valve piston to the right within the valve chamber 74, and the rear face of the piston is open to exhaust air pressure in the channel 44a by way of an aperture 78 in the motor face plate 39 (see Fig. 1). The valve chamber 74 is also provided with a port which extends from the valve chamber to the cylinder wall as indicated at 77.

In the operation of the lubricator 72, pressure air in the chamber 43 working back between the piston and cylinder wall will enter the valve chamber 74 by way of port 77 and will force the spring pressed valve piston 73 to the left, thereby uncovering port 70. Pressure oil in chamber 60 will then unset ball valve 75, and oil will flow in limited quantities past the closely fitted ball to the port 70 to chamber 74. Subsequently, this oil will pass through the port 77 to the wall of the cylinder. This interrelated action of pressure air and pressure oil is made possible by the differential between the areas of the valve piston exposed to the air and oil when the piston is seated.

Oil from the cylinder wall will be entrained in the high pressure air and will be carried through the motor,

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thereby lubricating the working parts of the motor. The oil-laden air is exhausted from the motor through the valve 45 into the hollow spindle 16 where it is ejected into the atmosphere through the ports 46 and 47 and the chuck 17 as indicated by the arrows in Fig. 2. The rotation of the spindle 16 will throw the oil carried by the air stream out of port 46 into a felt liner 79 thereby saturating the liner with the oil. This saturated liner will convey the oil to the anti-friction bearings 18, 18 thereby lubricating the bearings, insuring against functional deterioration. Should the lubricating system dissipate the oil in the reservoir 66 to an extent that the fluid system is inoperative, the advance of the drill will become erratic, thereby warning the operator that the oil level is dangerously low.

Another embodiment of the invention is illustrated in Fig. 6 wherein a piston, represented by the reference numeral 81, is formed at its forward extremity for slidable mounting in the end wall 4 of the cylinder 2, thus eliminating necessity for a guard member 21. The operational characteristics of this embodiment are identical to those of the previously described embodiment with the exception that the advance of the piston is positively regulated throughout the entire stroke. It will be appreciated that the formation illustrated therein forms a forward cylinder chamber 82 comprising a major chamber 83 and a minor chamber 84. In the present embodiment the chamber 83 will retain the illustrated dimensions and only the chamber 84 will be diminished by the advance of the piston 81. A suitable setting of the needle valve 67 will limit the rate of advance of the piston 81 to a predetermined speed so that the drill is possessed of a constant rate of feed.

According to the present invention certain structural features are incorporated to provide efficiencies in manufacture and to permit ready disassembly and reassembly for cleaning and repair of the unit. To this end, the primary air and oil inlets 5 and 6 respectively, are formed along one side of the said cylinder near the forward and back extremities thereof.

As clearly illustrated in Fig. 5 the rear end wall 3 is laminated in structure comprising three annular discs 85, 86 and 87. The outer discs 85 and 87 are dimensioned to snugly embrace the outer periphery of the stem 8 and to fit neatly interiorly of the cylinder 2. The central disc 86 is dimensionally reduced relative to the outer discs to provide interior and exterior peripheral recesses 88 and 89 adapted to receive under compression O-rings 90 and 91, respectively, thus providing a seal against escape of high pressure air from the rear cylinder chamber 43.

The end wall 3 is immobilized against longitudinal movement within the cylinder by a pair of snap rings 92, 92, and against rotary motion by a torque set screw 93. The piston 1 is likewise immobilized against rotary motion by a torque pin 94 imbedded in the piston at 95 and slidable within the end wall 3 at 96. It will be noted that leakage through the end wall 3 about the torque pin 94 is precluded by an O-ring 97 held in compression between the discs 85 and 87 in a manner described above in connection with the O-rings 90 and 91.

The end wall 4 is likewise laminated in structure comprising a pair of annular rings 98, 98 retaining between them an O-ring 9. The forward end wall 4 is immobilized against axial movement relative to the cylinder by a pair of snap rings 100, 100.

The piston 1 is formed in three sections joined together by bolts 101 best seen in Figs. 3 and 5. As clearly illustrated in Fig. 2, the forward section comprises the reduced end portion 9 and the forward face 59 of the piston. The central section comprises the body 7 which constitutes the housing for the motor assembly, and the motor face plates 39, 39. The rear portion comprises the rear face 14 of the piston and the stem 8.

In the assembly of the drilling unit the forward end wall

4 is fixed in position within the cylinder; the piston 1 is then assembled and the guard member 21 is slipped over the forward extremity of the reduced portion 9 and held in place by the insertion of the limit pins 71, 71; the piston assembly is then inserted into the cylinder, the stem 8 being stripped of the depth control nut 13 and the speed control knob 50 to permit insertion of the end wall 3 in the cylinder, the depth control nut and the speed control knob are then attached to the stem 8 to put the unit in operating condition.

Leakage of high pressure air from the rear cylinder chamber 43 is precluded by the rear end wall 3 and by an O-ring 102 held in compression in a circumferential groove near the forward face 59 of the piston 1. The leakage of oil from the unit is precluded by the same O-ring 102 and the O-ring 99 in the end wall 4. An O-ring 103 is held in compression between the outer extremity of the reduced portion 9 of the piston and the guard member 21, substantially eliminating leakage of oil between those last mentioned members.

The drilling unit has been described above as a unitary installation, but it is within the scope of the invention to attach a plurality of like units to the same fluid control system, as indicated by the extra leadlines from the control valve 52 and the oil valves 67, 68 and 69 in Fig. 7. When thus attached it is apparent that all the drilling units are actuatable from a single control valve and are controlled as to the rate of advance by individual needle valves. The speed of rotation for each unit would be susceptible to regulation independently of the other units by means of the individual speed control valve 45.

Modifications in the arrangement of the fluid control system and in the structural details of the unit are possible within the scope of the present invention as defined in the appended claims.

I claim:

1. An automatic tool unit comprising a rotatable spindle, a differential piston having a reduced forward end portion and mounting means for said spindle, chuck means for releasably mounting the tool on said spindle, a cylinder closed at one end to form a rear pressure chamber between the said closed end and the piston and supporting the piston for extension and retraction of the reduced end portion at the other end, sealing means at the last-named end of the cylinder forming a forward pressure chamber between the peripheral surface of the reduced end portion of the piston and the confronting wall of the cylinder, a tool-guiding guard member slidably mounted for relative axial movement in both said cylinder and on the said reduced portion of the piston, said guard embracing the chuck means and operable to house the tool, means for introducing pressure oil to the forward chamber and for permitting discharge of oil from said chamber when the piston is advanced in the cylinder, means for rotating said spindle, means for introducing pressure fluid to said rear chamber to advance the piston, and valve means to regulate the flow of oil from said forward chamber during advance of the piston thereby regulating the rate of advance of the piston and the guard member.

2. A tool unit according to claim 1 wherein stop means is provided between the rear end of said guard member and the forward end of the reduced portion of the differential piston to limit the advance movement of the guard member relative to the piston.

3. A tool unit according to claim 2 wherein the rear end portion of the guard member is cylindrical and forms with the cylinder wall a minor section of the forward pressure chamber smaller in cross sectional area than the major section of said chamber which lies between the said reduced portion of the differential piston and the wall of the cylinder, and wherein further the pressure oil admission and discharge means is at the forward end of the said forward chamber, whereby during the initial advance of the guard member with the piston, oil is discharged from said minor section and during the latter part of the said

advance movement of the guard member oil is discharged from the major section of the chamber.

4. A unit according to claim 3 wherein a detachable bushing is mounted in the forward extremity of the guard member to snugly embrace the tool and to serve as a work contacting portion for said guard member.

5. A hydraulically controlled mechanical movement for feeding a tool into the work, said movement including a cylinder, a tool-carrying piston slidably mounted for axial movement in said cylinder, said piston having a reduced forward end portion; a generally cylindrical guard member slidably mounted on said reduced end portion and in the forward end of said cylinder, a forward pressure chamber in the cylinder comprising two adjoining sections, the major section lying between the reduced end portion of the piston and the confronting cylinder wall and being of relatively great cross sectional area, and the minor section lying between the guard member and the said wall and being of lesser cross sectional area; means for exerting pressure on the rear end of said piston; means for maintaining the said forward pressure chamber in constant communication with a hydraulic pressure fluid source, said means including a port at the forward end of the chamber and valve means for limiting the flow of said hydraulic pressure fluid from said port, whereby upon advance of the piston due to the pressure at the rear end of the piston, the hydraulic fluid will be discharged from said minor section until the guard member is immobilized by contact with the said work, and thereafter from the said major section, said valve means providing a positive control for the rate of feed of the said tool into the work.

6. A hydraulically controlled mechanical movement for feeding a tool into work, said movement including a cylinder; a tool-carrying piston slidably mounted for axial movement in said cylinder, said piston having a reduced end portion; a generally cylindrical control member slidably mounted on said end portion and in the forward end of said cylinder and having an elongated extension projecting axially from said forward end and terminating in a work-engaging portion normally disposed forward of the working tip of said tool; a forward pressure chamber in the cylinder comprising two adjoining sections, the major section lying between the reduced end portion of the piston and the confronting cylinder wall and being of relatively great cross sectional area, and the minor section lying between the control member and the said wall and being of the lesser cross sectional area; means for exerting pressure on the rear end of said piston, means for maintaining the said forward pressure chamber in constant communication with a hydraulic pressure fluid source, said means including a port at the forward end of the chamber; and valve means for limiting the flow of said hydraulic pressure fluid from said port, whereby upon advance of the piston due to the pressure at the rear end of the piston, the hydraulic fluid will be discharged from said minor section until the control member is immobilized by contact of said extension with the said work, and thereafter from the major section, said valve means providing a positive control for the rate of fluid of said tool into the work.

7. An automatic tool unit comprising a rotatable spindle, a piston having mounting means for said spindle, means for mounting the tool on said spindle, a cylinder supporting the piston for extension and retraction, sealing means at the end of the cylinder forming a forward pressure chamber, a tool-guiding guard member slidably mounted for relatively axial movement in said cylinder, said guard being operable to house the tool, means for introducing pressure oil to the forward chamber and permitting discharge of oil from said chamber when the piston is advanced in the cylinder, means for rotating said spindle, means to advance the piston, and valve means to regulate the flow of oil from said forward chamber during advance of the piston, thereby regulating the rate of advance of the piston and the guard member.

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8. A device according to claim 7 wherein advance of said piston and said guard member reduces said forward chamber at a given rate, and arrest of said guard and advance of said piston reduces said forward chamber at a greater rate, whereby upon arrest of said guard member, said valve means slows the advance of said piston.

9. A device according to claim 8 wherein said tool mounting means comprises a reduced end portion of said piston projecting outwardly of said cylinder through said forward chamber, and wherein further said guard member is slidably mounted between said peripheral surface of the reduce end portion and the confronting wall of the cylinder.

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