

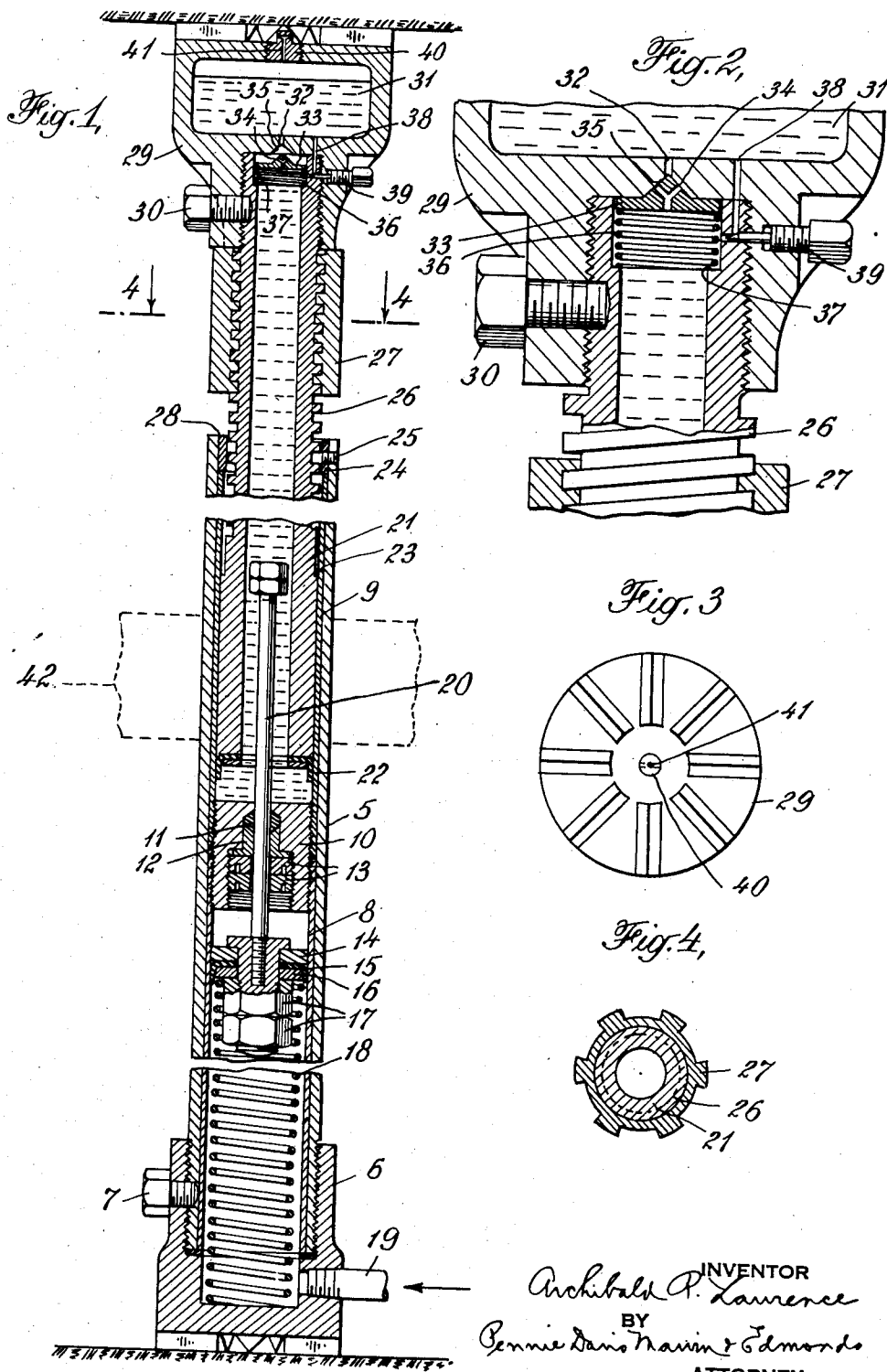
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HYDRAULIC DRILL COLUMN

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HYDRAULIC DRILL COLUMN

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This invention relates to a column adapted to serve as a support for a drill, and particularly to such a column which may be adjusted readily and when adjusted will afford a secure support.

The standard practice in rock drilling with mounted drills includes the use of a column serving as a support for a cross-arm which is adjustable to any height. The drill machine is held rigid on the cross-arm by means of a clamp. The columns vary in length according to the size of the opening which is being drilled in the rock face. Usually the length is about six feet. Such columns are made generally from a piece of three-inch pipe which is fitted with a pack-screw for tightening the column against the floor and roof of the opening close to the working face of the rock. Such columns are subject to numerous disadvantages. It is difficult to secure enough pressure by means of the jack-screw to ensure security, that is to say, to avoid possible loosening of the column while the drill machine is in operation. The vibration to which the column is subjected frequently loosens the jack-screw, creating a dangerous condition unless the looseness is promptly rectified. Constant attention to the jack-screw is necessary to avoid such danger.

It is the object of the present invention to afford a column of simple construction which permits the application of much greater pressure than is otherwise possible and which automatically will take up any looseness and maintain sufficient pressure to ensure security of the column and of the operations conducted therewith.

Another object of the invention is the provision of a column which may be readily removed from any position in which it is being operated for readjustment in another position where the drill is to be used.

Other objects and advantages of the invention will be apparent as it is better understood by reference to the following specification and the accompanying drawing, in which:

Fig. 1 is an elevation in section of a column embodying the invention;

Fig. 2 is an enlarged sectional view of a portion of the head of the column;

Fig. 3 is a plan view of the head of the column; and

Fig. 4 is a section on the line 4—4 of Fig. 1.

In carrying out the invention, I provide a column which may, if desired, be constructed of pipe similar to that used in columns heretofore, that is to say, three-inch iron pipe having an outside diameter of three and one half inches. Any

suitable tubing having the requisite strength may, however, be employed. The pipe or tubing is provided with a foot of any suitable material such as cast steel, and embodies at its base a cylinder and piston adapted to be actuated by pneumatic pressure, for example air at a pressure of about 85 pounds per square inch, as normally supplied in mine work. The piston carries a piston rod operating through a gland, and under the action of the air pressure, when applied, the piston rod is advanced into a chamber which is filled with a hydraulic medium, preferably oil. In displacing the oil, the piston rod causes a plunger to advance, carrying with it a suitable head which is adapted to engage the roof of the tunnel or stope in which the column is used. When the plunger has advanced as far as possible in consequence of a single movement of the piston rod, a nut carried by the plunger is moved into engagement with the shoulder to prevent retraction of the plunger. The head includes a reservoir for the hydraulic medium such as oil, and when the piston rod is retracted under the influence of a spring provided for that purpose, the hydraulic medium flows from the reservoir into the interior of the plunger in an amount equivalent to that displaced by the piston rod.

When air is again admitted to the cylinder at the base of the column, the valve leading to the reservoir is closed, and displacement of the hydraulic medium, as the piston rod rises again, causes the plunger and head to advance. Repeated operations cause the head to engage with the roof of the tunnel or stope under the relatively enormous pressure developed, the pressure being maintained by retaining pneumatic pressure in the cylinder at the base of the column, so that if any looseness develops it is immediately taken up by corresponding movement of the plunger.

A by-pass is provided between the reservoir in the head of the column and the interior of the plunger, and is controlled by a suitable valve, preferably a simple screw device. When the column is to be released, the nut is moved backwardly from the shoulder with which it is engaged, the valve is opened manually, and the pneumatic pressure is released. The plunger will sink as the hydraulic medium moves upwardly through the by-pass into the reservoir. The valve controlling the by-pass is then again closed, and the column is ready for use again in its new position.

With this preliminary description of the structure and its function, reference is made to the

drawing, in which 5 indicates the body of the column consisting of any metal tubing having the necessary strength. A foot 6 of cast steel or similar material is threadedly secured to the base of the column 5 and is securely held thereto by a screw 7. Although the tubular body 5 may be machined internally to a smooth finish, I prefer to employ sleeves 8 and 9 of brass or other suitable material connected by a bushing 10, including a gland which consists of packing 11, a packing ring 12 and nuts 13.

In the lower cylinder afforded by the sleeve 8, I provide a piston 14 having a cup 15 of leather or other suitable material secured by a washer 16 and nuts 17. A retractile spring 18 is secured to the lower side of the piston and to the bottom of the foot 6 so that the piston is normally disposed at the lower end of the cylinder. The nipple 19 is adapted to be connected by a hose to the source of pneumatic pressure normally maintained in the mine, suitable valves being provided to control the introduction and release of the pneumatic pressure. A so-called "three-way" valve (not shown) is usually employed for this purpose, permitting the introduction of the pneumatic medium to the cylinder and the release of this medium as may be desired.

A piston rod 20 is connected to the piston 14 and extends through the gland in the bushing 10 into the interior of the upper chamber formed by the sleeve 9. In this chamber a hollow plunger 21 is provided with a cup 22 of leather or other suitable material secured to its lower end so as to afford a tight fit. Movement of the plunger is limited by engagement of a shoulder 23 with the lower edge of a ring 24 which is held by a screw 25 at the upper end of the sleeve 9. The plunger is provided near its upper end with a heavy thread 26 and a nut 27, the size of the thread being such that the nut can be turned manually. The nut 27 is adapted to be brought into engagement with a shoulder 28 at the upper end of the column 5 after the plunger has been moved up by the operation of the piston rod 20 as hereinafter described.

The interior of the plunger 21 and the space above the bushing 10 is filled with a hydraulic medium, preferably oil. A head 29 of cast steel or other suitable material is threadedly secured to the upper end of the plunger 21 and is held against movement relative thereto by a screw 30. The head includes a reservoir 31 for the hydraulic medium which is adapted to drain through an opening 32 into the interior of the hollow plunger 21 under control of a valve 33 having passages 34 therethrough. The valve is normally held against the conical seat 35 by a spring 36 resting on a shoulder 37. During the upward movement of the plunger 21, the valve remains closed and is held closely against the seat by the pressure of the hydraulic medium beneath the valve. A bypass 38 extends from the reservoir 31 to a point beneath the valve 33 and is controlled by a valve consisting of a manually operable screw 39. This valve is opened only when the column is to be released to permit the flow of the hydraulic medium upwardly into the reservoir. A filling plug 40 with an air vent 41 is provided in the top of the reservoir to permit the introduction of the hydraulic medium and to afford connection with the atmosphere, so that the hydraulic medium may flow from and to the reservoir during the operation of the device.

Such operation should be readily apparent from the foregoing description. When the column is

to be used, it is set up in the desired position and connected to the source of air pressure. Air is permitted to enter the lower cylinder, thus advancing the piston rod 20 and displacing the hydraulic medium within the plunger 21. This causes the plunger to move upwardly, the valve 33 being closed at this phase of the operation, as indicated in Fig. 2. When the piston 14 has reached the upper limit of its travel, the nut 27 is moved downwardly into engagement with the shoulder 28, thus preventing retraction of the plunger. The pneumatic pressure is then released, and the piston 14 is retracted by means of the spring 18. The withdrawal of the piston rod 20 results in reduced pressure within the plunger 21, and the valve 33 opens to the position indicated in Fig. 1, so that the hydraulic medium is permitted to flow from the reservoir into the hollow plunger in an amount equivalent to the displacement of the piston rod 20. Pneumatic pressure is again applied, forcing the piston 14 upwardly, the valve 33 being again closed as in Fig. 2, and the plunger 21 is again advanced. The operation may be repeated until such time as the head 29 is firmly in engagement with the roof and sufficient pressure is afforded so as to maintain the column in its desired position.

With the apparatus as described, it is possible to multiply the available pneumatic pressure, usually of about 85 pounds per square inch, into an effective pressure of 4,000 pounds or more per square inch, thus ensuring rigidity of the column. It will be noted, moreover, that while the column is in use, the pneumatic pressure is maintained, and consequently if there is any tendency to loosen, the plunger 21 is immediately forced upwardly, so as to continuously maintain the desired pressure against the roof of the tunnel or stope.

When the column is to be released, the nut 27 is first moved backwardly to the position indicated in Fig. 1, and the valve 39 is opened so as to permit the hydraulic medium to flow backwardly into the reservoir. The pneumatic pressure is then released, and the plunger 21 sinks to its lowermost position, displacing the hydraulic medium which returns to the reservoir. The valve 39 may then be closed and the column is ready for use in its new position.

When the column is in position, the drilling machine indicated generally in dotted lines as 42 may be secured to the usual cross-arm (not shown). The details of the cross-arm and clamp and of the drilling machine form no part of the present invention. Such devices are well known in the art, and those adapted for use with columns as heretofore known may be used similarly with the improved hydraulic column as herein described.

Among the particular advantages of the invention are greater rigidity, security and safety, and greater facility in setting up and taking down the column, with consequent reduction in the labor and energy required in the operation of the drilling machine. The column as described, which employs principles of both pneumatic and hydraulic mechanisms, avoids the disadvantages of apparatus in which attempts have been made to use either of these principles separately. The improved column is adapted for practical mine conditions and has been successfully used for its intended purpose without any necessity for supplemental and unusual equipment which is not ordinarily available in mine operation.

Various changes may be made in the details of

construction and arrangement of the parts of the apparatus without modifying the invention or sacrificing any of the advantages thereof.

I claim:

5 1. A portable column for supporting a drilling device comprising a cylinder having an unob-
 10 structed exterior portion of substantial length along which the mounting of a drilling machine may slide, a plunger movable therein, a mem-
 15 ber extending across said cylinder and at least in part movable longitudinally thereof, a hy-
 20 draulic medium within said cylinder at one side of said member, means for admitting fluid to the
 25 side of said member opposite the hydraulic medium for moving at least a part of said member
 longitudinally of the cylinder in one direction, said member substantially preventing flow of the
 actuating medium therepast, reciprocation of said member causing a displacement of at least a
 portion of the hydraulic medium and an advance-
 ment of the plunger, means for holding the
 plunger in its advanced position, a reservoir
 for hydraulic medium formed within the column,
 and means actuated by return movement of said
 member for supplying hydraulic medium from
 said reservoir to the cylinder.

2. A portable column for supporting drilling
 devices comprising separated cylinders, a piston
 in one cylinder having a rod projecting into the
 30 second, a plunger in the second cylinder, liquid
 means in the second cylinder adapted to be dis-
 placed by the rod whereby the plunger is ad-
 vanced, adjustable means to limit return move-
 35 ment of the plunger, reservoir means carried by
 the plunger from which additional liquid is sup-
 plied to the second cylinder when the rod is with-
 drawn, and valve means controlling the flow of
 40 liquid to and from the reservoir, said valve means
 being actuated to open position by the with-
 drawal of the rod from said second cylinder.

3. A column for supporting drilling devices
 comprising separated cylinders, a piston in one
 cylinder having a rod projecting into the second,
 a plunger in the second cylinder, liquid means
 45 in the second cylinder adapted to be displaced by
 the rod whereby the plunger is advanced, adjust-
 able means to limit return movement of the
 plunger, and reservoir means independent of the
 first cylinder consisting of a hollow head secured
 50 to the plunger to supply additional liquid to the
 second cylinder when the rod is withdrawn.

4. A column for supporting drilling devices
 comprising separated cylinders, a piston in one
 cylinder having a rod projecting into the sec-
 ond, a plunger in the second cylinder, liquid
 5 means in the second cylinder adapted to be dis-
 placed by the rod whereby the plunger is ad-
 vanced, adjustable means to limit return move-
 ment of the plunger, reservoir means independ-
 ent of the first cylinder consisting of a hollow
 10 head secured to the plunger to supply additional
 liquid to the second cylinder when the rod is
 withdrawn, and valve means controlling the
 flow of liquid to and from the reservoir.

5. A portable column for supporting a drilling
 device comprising a cylinder having an unob-
 15 structed exterior portion of substantial length
 along which the mounting of a drilling machine
 may slide, a plunger movable therein, an hy-
 draulic medium within said cylinder, pneumati-
 20 cally actuated means for displacing the hydraulic
 medium and thereby advancing the plunger,
 means for holding the plunger in its advanced
 position, a reservoir for a supply of additional
 hydraulic medium, a conduit for supplying hy-
 25 draulic medium from said reservoir to the hy-
 draulic cylinder, when the displacing means is
 withdrawn, a by-pass around said conduit from
 said reservoir to the hydraulic cylinder, and
 valve means for controlling passage of the hy-
 30 draulic medium through said by-pass.

6. A portable column for supporting a drilling
 device comprising a cylinder having an unob-
 structed exterior portion of substantial length
 along which the mounting of a drilling machine
 may slide, a plunger movable therein, an hy-
 35 draulic medium within said cylinder, pneumati-
 cally actuated means for displacing the hydraulic
 medium and thereby advancing the plunger in
 its advanced position, a reservoir for a supply
 of additional hydraulic medium, a conduit for
 40 supplying hydraulic medium from said reservoir
 to the hydraulic cylinder, a valve normally pre-
 venting the flow of hydraulic medium through
 said conduit, said valve being actuated to open
 position by withdrawal of the displacing means,
 45 a by-pass around said conduit from said reservoir
 to the hydraulic cylinder, and valve means for
 controlling passage of the hydraulic medium
 through said by-pass.

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