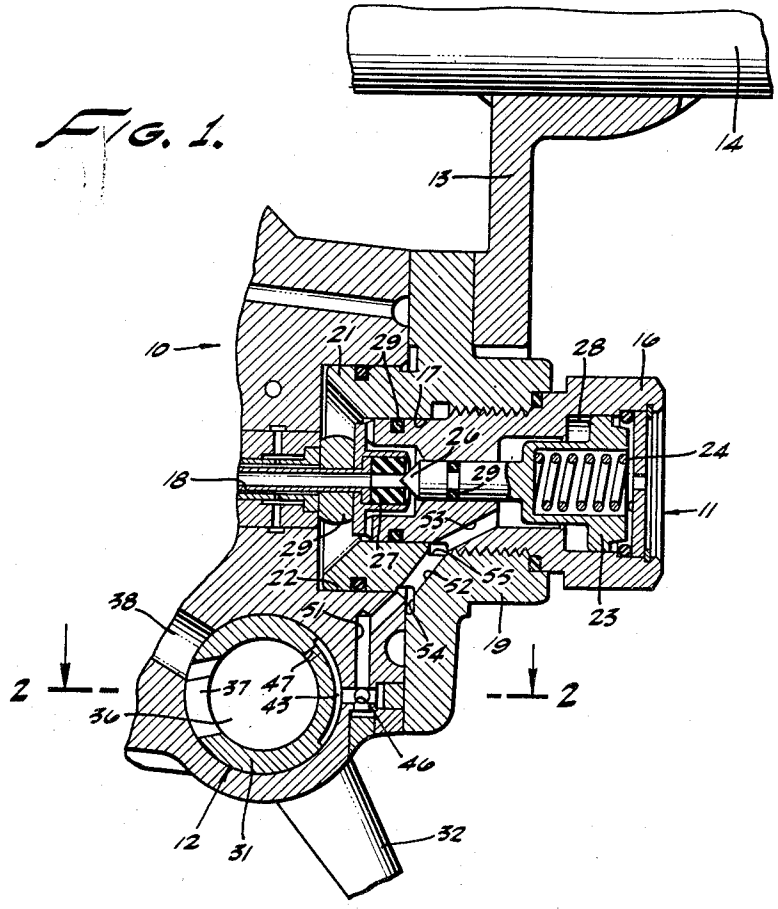
Jan. 15, 1957 G. H. FUEHRER 2,777,424

AUTOMATIC WATER VALVE FOR ROCK DRILLS

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FIG. 1.



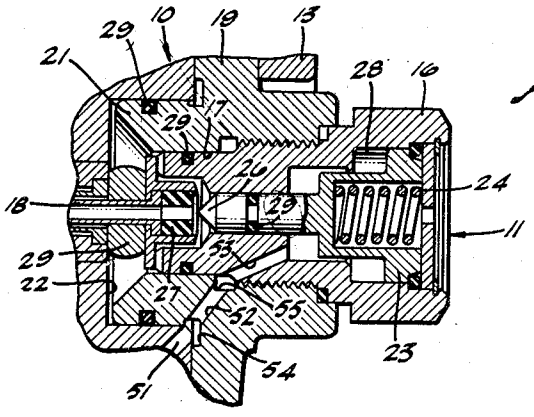


FIG. 3.

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AUTOMATIC WATER VALVE FOR ROCK DRILLS

Filed Nov. 16, 1953 2 Sheets-Sheet 2

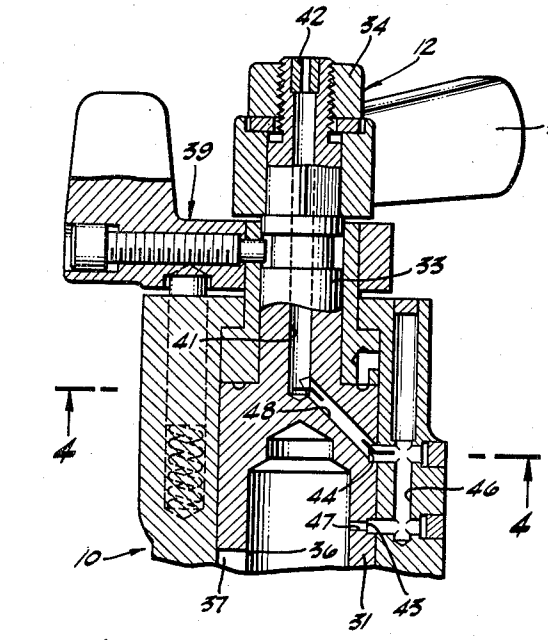


FIG. 2.

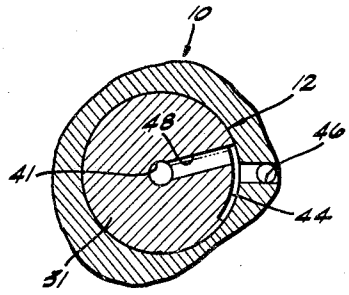


FIG. 4.

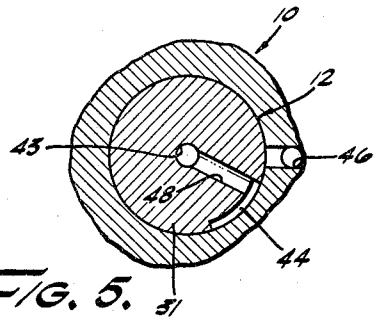


FIG. 5.

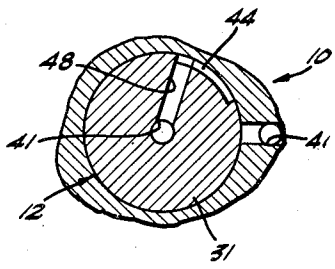


FIG. 6.

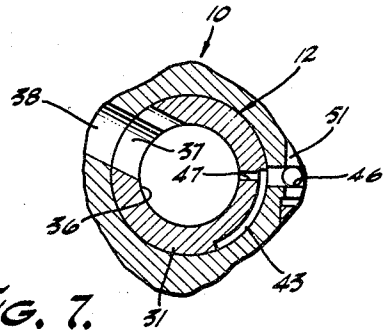


FIG. 7.

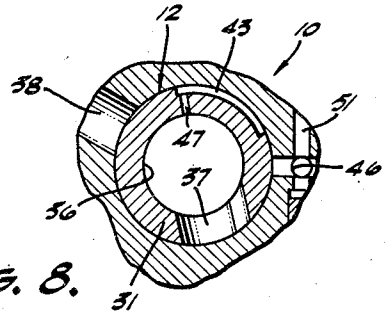


FIG. 8.

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United States Patent Office 2,777,424 Patented Jan. 15, 1957

2,777,424

AUTOMATIC WATER VALVE FOR ROCK DRILLS

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Application November 16, 1953, Serial No. 392,134

6 Claims. (Cl. 121—10)

This invention relates to an automatic water valve which is operable to start or stop the feed of water to the cutting bit of a rock drilling apparatus without the necessity of moving any control knobs, handles, or levers of any sort.

In automatic rock drilling apparatus, for example the stopers, sinkers, and drifters used for mining and tunneling operations, it is conventional practice to feed water to the cutting bit as the drilling progresses The purpose of the water is to effect continuous cleaning or blowing of the hole, so that the drill teeth always engage and act on the hole bottom instead of on chips or fragments previously broken from the main body of the mass being drilled. The feeding of water to the hole bottom has the additional and very important purpose of eliminating the dust which is extremely dangerous and otherwise undesirable in a mine or tunnel.

During the full-speed drilling operation, the water feed works no hardship on a miner since he is then able to stand well away from the hole and is not showered or splattered with the water and muck inherent in the operation. However, the feeding of water during other portions of the drilling operation may result in considerable hardship to the operator who is then drenched with water and muck. This is particularly true when the operator is forming a "collar" or starting hole, at which time the drill motor is operating relatively slowly and the operator must stand close to the drill bit in order to guide it.

In appreciation of the fact that it is often undesirable to feed water to the drill bit during the starting or collaring operation, certain mining companies require that an automatic water valve be so designed that it will shut off the flow of water during collaring but will permit water flow during full-speed drilling. Other companies, on the other hand, require automatic water valves which effect the flow of water at all times when the drill motor is operating, including during the collaring operation. It may be seen, however, that the presence or absence of water flow during collaring and similar operations is not a matter which can be determined for large numbers of operations and all situations, but instead is one which will vary with the type of rock being drilled, the location and angle of the drill, and other factors which can only be determined by the operator. Although this fact is well recognized, the complexity and fragility of automatic water valves which permit the drill operator to selectively start and stop water flow during the collaring operation, or other similar operations, has previously prevented their acceptance and use on commercial drilling apparatus of the type indicated.

In view of the above factors characteristic of the field of automatic water valves for rock drills, it is an object of the present invention to provide an extremely simple and rugged means for selectively starting and stopping the flow of water to the drill bit during one of several types of drilling operations.

Another object of the invention is to provide a system by which the operator may start and stop water flow without moving any handle or knob, but instead by merely placing his finger over a vent hole or removing it therefrom.

An additional object is to provide an automatic water valve associated with the drill throttle valve, and which in some throttle valve positions is controlled both by the throttle valve and by an operator-controlled vent, and in other throttle valve positions is controlled by the throttle valve alone.

Other objects and advantages of the invention will be more fully set forth in the following specification and claims considered in connection with the attached drawings to which they relate.

In the drawings:

Figure 1 is a vertical central sectional view of the backhead of an offset telescopic feed leg stoper incorporating the present invention, the throttle valve and automatic water valve being shown as connected by passage means in the backhead;

Figure 2 is a horizontal sectional view taken along line 2—2 of Figure 1 and looking in the direction of the arrows, both it and Figure 1 showing the drill throttle valve in its collar or starting hole position;

Figure 3 illustrates the automatic water valve of Figure 1 as shifted from its closed to its open position;

Figures 4, 5 and 6 are sectional views taken along line 4—4 of Figure 2 and showing the throttle valve in its collar, full throttle and off positions, respectively;

Figures 7 and 8 are sectional views of the throttle valve and as shown in Figure 1, but illustrating, respectively, the throttle valve after shifting from the collaring position of Figure 1 to the full throttle and off positions.

Referring to the drawings, the invention is illustrated as employed in the backhead **10** of an automatic rock drilling apparatus of the offset telescopic feed leg stoper type. Associated with the backhead **10** are the automatic water valve **11** and the throttle valve **12**, the construction and operation of which will be described in detail subsequently. Also associated with the backhead is an arm **13** connected to the offset feed leg which is indicated fragmentarily at **14** in Figure 1.

Water valve **11** preferably comprises a plug-like casing **16** threaded into a recess **17** which communicates with the water tube **18**, the latter extending longitudinally through the drill body, not shown, to the drill steel and cutting bit. In the embodiment illustrated, the recess **17** is formed in a plug or cap member **19** which is suitably mounted on the rear surface of backhead **10** and is shaped with a cylindrical boss **21** sealingly seated in a corresponding backhead recess **22**. The casing **16**, containing the piston and plug components of the water valve as will next be described, is removable to permit replacement of water tube **18** when necessary, and is interchangeable with the conventional water tube plug found on rock drills of the type indicated.

Casing **16** contains a piston plunger **23** which is normally urged forwardly by a compression spring **24** to the position shown in Figure 1, at which its pointed or conical inner end **26** is pressed against a resilient seat washer **27** to close the end of water tube **18**. To shift the piston plunger **23** rearwardly from the closed position shown in Figure 1 to the open position of Figure 2, and thus start the flow of water to the cutting bit, air is admitted to an air chamber **28** the rear walls of which are formed by boss or flange portions of piston plunger **23**. The flow of water is from a water chamber generally in backhead recess **22** and sealed by sealing rings **29**, the chamber being fed with water from a suitable supply source, not shown. For a more complete description of the water valve **11**, particularly with reference to its passage, sealing and vent means, reference is made to my

co-pending application Serial No. 355,679, filed May 18, 1953, for an Automatic Water Valve for Rock Drills, and which is now Patent No. 2,728,328, issued December 27, 1955.

The throttle valve 12 comprises a tubular valve sleeve 31 which is mounted in a corresponding transverse bore in the lower portion of backhead 10 and is adapted with a handle 32 for rotation to its various controlling positions. As shown in Figure 2, one end of valve sleeve 31 is closed and is provided with a relatively small diameter stem 33 on the outer portion of which the handle 32 is mounted as by a lock nut 34. The other end of the valve sleeve is connected to an air supply hose, not shown, to effect a constant feeding of air pressure to the chamber 36 within the sleeve. Referring to Figures 1, 7 and 8, valve sleeve 31 is provided with a port 37 adapted to register with a backhead passage 38 leading to the distributing valve and piston hammer of the drill. When the throttle is in the position shown in Figure 1, port 37 is only partially registered with passage 38 and the drill motor is accordingly operated relatively slowly to form the starting or collar hole. In Figure 7, on the other hand, the port 37 and passage 38 are shown in the fully registered or full-throttle positions, while in Figure 8 these elements are shown in their unregistered or off positions.

For a more complete description of the elements operated by the air passing through port 37 and passage 38, reference is made to my co-pending application Serial No. 379,207, filed September 9, 1953, for a Pneumatic Rock Drill with Selective Drill Steel Rotation, and which is now Patent No. 2,726,640, issued December 13, 1955. That application also contains a complete description of the rotation release valve 39 (Figure 2) which is mounted on valve stem 33 but is movable independently of it. The valve 39 is operable to selectively start and stop drill steel rotation as may be desired by the operator of the apparatus.

According to the present invention, means are provided to associate the throttle valve 12 and water valve 11 in such a way that the latter is always closed when the throttle valve is in the off position shown in Figure 8, and is always open when the throttle valve is in the full-throttle position shown in Figure 7. However, in the collar or any other intermediate throttle valve position, the operator may selectively open and close the water valve 11 by merely placing his finger over the end of a vent or bleed passage 41 which preferably terminates in a replaceable restrictor means 42 at the outer end of valve stem 33. The location of the end of vent passage 41 at the end of valve stem 33 is very desirable since the drill operator may, with one hand, turn the throttle valve handle 32 and the rotation release valve 39, and selectively block or open the bleed passage.

The specific air passages and ports for connecting the water and throttle valves 11 and 12 and vent or bleed passage 41, in order to accomplish the above results, comprise first and second arcuate grooves 43 and 44 on the external surface of valve sleeve 31, and a generally U-shaped backhead passage 46 the ends of which are adapted to register with the grooves 43 and 44 when sleeve 31 is in predetermined rotated positions. Groove 43 communicates through a passage or port 47 with valve chamber 36, and groove 44 communicates with an obliquely extending portion 48 of bleed passage 41. The U-shaped passage 46, which lies in a horizontal plane, communicates through an upwardly extending passage 51 in backhead 10, a passage 52 in plug or cap member 19, and a passage 53 in water valve casing 16 with the air chamber 28 inwardly adjacent the flange portions of piston plunger 23. The connections between passages 51, 52 and 53 include annular grooves 54 and 55 which cause the passages to be in communication regardless of the relative rotated positions of the abutting elements.

The lengths and locations of arcuate grooves 43 and 44 are such that both will be out of registry with U-shaped passage 46 when throttle valve 12 is in the off position shown in Figures 6 and 8. The water valve 11 will then be in the closed position shown in Figure 1, since the flow of air pressure from valve chamber 36 to air chamber 28 is effectively blocked and the compression spring 24 is operative to seat plunger end 26 on seat washer 27. When, however, the handle 32 is turned to rotate throttle valve 12 to the full-throttle position shown in Figures 5 and 7, groove 43 is registered with U-shaped passage 46, but groove 44 is still out of registry therewith. It follows that air then flows from valve chamber 36 through port 47, groove 43, U-shaped passage 46, and passages 51, 52 and 53 to air chamber 28. The air pressure in the air chamber 28 is thus increased to force piston plunger 23 rearwardly against the bias of spring 24 and to the unseated position shown in Figure 3, so that flow of water through water tube 18 to the drill bit is permitted. It will be noted that the air pressure in air chamber 28 is allowed to build up since there is no vent or bleed from U-shaped passage 46 to vent passage 41, the groove 44 and passage 46 being out of registry at this time as previously indicated.

At all or substantially all intermediate throttle valve positions, for example the collar position shown in Figures 1 and 4, both of the grooves 43 and 44 are registered with U-shaped passage 46, and a path is created from valve chamber 36 both to the air chamber 28 and to the vent or bleed passage 41. While the bleed passage 41 is open, air will bleed off and the air pressure in chamber 28 will not build up to a value sufficient to shift piston plunger 23 rearwardly. The blocking of bleed passage 41 by an operator pressing his finger against restriction means 42 will, however, prevent further bleeding and will cause the air pressure in chamber 28 to build up and effect rearward piston shifting until the water valve is open as shown in Figure 3. It follows that the operator may selectively open and close the water valve, during collaring or any other intermediate throttle valve position, by merely pressing his finger against restrictor 42 or removing it therefrom. The diameter of the bore in restrictor 42 is substantially the same as the diameter of port 47. It follows that the rate of bleed is approximately equal to the rate of air feed to the water valve, so that air pressure in the water valve will not build up until the bleed passage is blocked.

To briefly summarize the operation of the automatic water valve, let it be assumed that throttle valve 12 is in the off position shown in Figures 6 and 8, at which time the flow of air from valve chamber 36 to water valve 11 and to bleed passage 41 is blocked. The spring 24 is then operative to hold the piston plunger 23 against seat washer 27 and block the flow of water through tube 18 to the drill bit. Should the operator then desire to form a starting or collar hole, he stands relatively close to the drill bit and turns throttle valve handle 32 to rotate valve sleeve 31 to the collar position shown in Figures 1 and 4. Chamber 36 then communicates through U-shaped passage 46 both with air chamber 28 and vent passage 41, so that the operator may effect shifting of water valve plunger 23 rearwardly to its open or Figure 3 position merely by placing his finger on restrictor 42 at the end of the vent passage. In normal operation, the operator will only cause water flow to the extent necessary to eliminate dust, since a continuous flow of water is undesirable at this time due to the location of the operator close to the drill steel where he is subject to being showered with water and muck. After the collar hole has been formed, the operator turns throttle valve 12 to the full-throttle position shown in Figures 5 and 7, and steps back away from the drill steel where he is not likely to be contacted by the water and muck inherent in the operation. The flow of water at this time is continuous since a path is formed from valve chamber 36 to air chamber 28 but the vent through bleed passage 41 is

blocked, the groove 44 and U-shaped passage 46 being out of registry as shown in Figure 5.

Throughout the application the structure 11 has been referred to as the water valve since it contains the valve plunger, etc. It will be apparent, however, that the entire water valve comprises not only the structure 11 but the bleed passage 41 and all of the passages interconnecting throttle valve 12 and the structure 11.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. In a water valve for pneumatic drilling apparatus, a valve element including an actuating piston movable between a position permitting the flow of water to the drill steel of said drilling apparatus and a position blocking water flow thereto, means to admit air under pressure to a chamber adjacent said valve element and housing said actuating piston to effect shifting of said piston and valve element to one of said positions, and means to vent said air pressure to the atmosphere during the period of its admission to said chamber, said vent means having a cross-sectional area sufficiently large to prevent said air pressure from building up to a value sufficient to effect valve element shifting to said one position, the discharge end of said vent means being disposed to facilitate blocking thereof by the operator's finger to effect shifting of said valve element to said one position, said vent means being operatively associated with said throttle valve of said drilling apparatus, and means associated with said throttle valve to block said vent means continuously when said throttle valve is in a predetermined controlling position.

2. In a water valve for a pneumatic rock drilling apparatus having a water passage leading to the drill steel of the apparatus, means forming a piston chamber, a valve piston mounted in said piston chamber and movable between opened and closed positions at which water flow through said passage is respectively permitted and blocked, means to bias said piston to said closed position, conduit means to conduct air pressure to said piston chamber to move the piston and open said valve against the action of said bias means, and vent means to bleed air from said conduit means and from said piston chamber, said vent means being sufficiently large to prevent building up of a pressure adequate to shift said piston to said open position, said vent means having a discharge end disposed to permit blocking thereof by the operator's finger, and means associated with the throttle valve of said drilling apparatus also operable to block said vent means at a point intermediate said piston chamber and said discharge end when said throttle valve is in full throttle position.

3. An automatic water valve system for a pneumatic rock drilling apparatus having a water tube adapted to deliver water to the drill steel of said apparatus, which comprises a piston plunger mounted at the backhead of said apparatus and adjacent the end of said water tube, said piston plunger being movable between open and closed positions respectively permitting and blocking the flow of water through said water tube, a compression spring mounted on one side of said piston plunger and adapted to bias the same toward said closed position, means to define an air chamber one wall of which comprises the other side of said piston plunger, a throttle valve mounted in said backhead to control the flow of air from a source of air pressure to the distributing valve and piston hammer of said apparatus, a vent passage terminating in an outlet orifice to the atmosphere; and means in said throttle valve and backhead to interconnect said air chamber, said vent passage and said air pressure source when said throttle valve is in collar position, and to connect said air pressure source and air chamber but to block the flow of air through said vent passage when said throttle valve is in full-throttle position.

4. The invention as claimed in claim 3, wherein the last-named means comprise a throttle valve sleeve having first and second grooves therein and forming a valve chamber connected to said air pressure source, a port in said sleeve and connecting said valve chamber and said first groove, passage means adapted to selectively register with said first and second grooves and connected to said air chamber, and means to connect said second groove and said vent passage, said grooves being so related that both register with said passage means when the throttle valve is in collar position, but only said first groove registers with said passage means when that throttle valve is in full-throttle position.

5. The invention as claimed in claim 4, wherein said port and said outlet orifice are relatively small and of approximately the same diameter.

6. The invention as claimed in claim 3, wherein said throttle valve is formed with a stem terminating in a control handle, said vent passage is through said stem, and said outlet orifice is adjacent said control handle.

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