Oct. 25, 1955 G. H. FUEHRER 2,721,540

AUTOMATIC WATER VALVE FOR ROCK DRILLS

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FIG. 1.

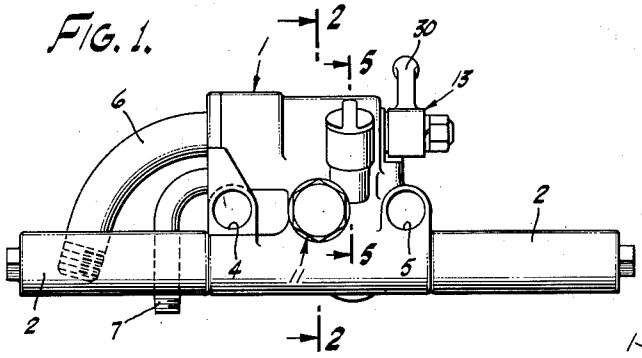
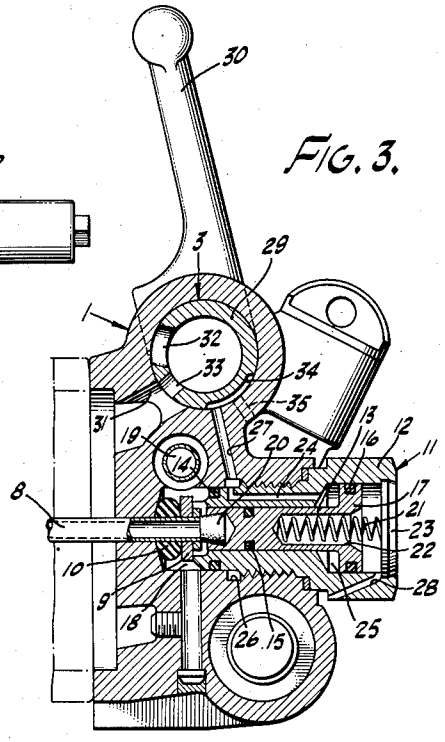


FIG. 3.



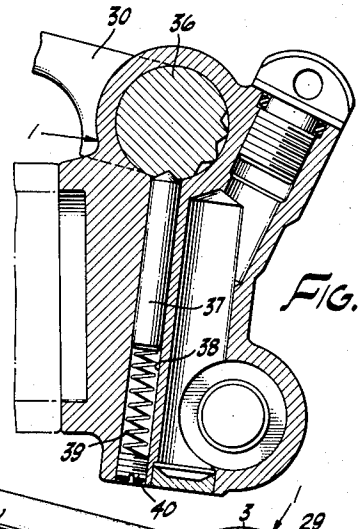


FIG. 5.

FIG. 2.

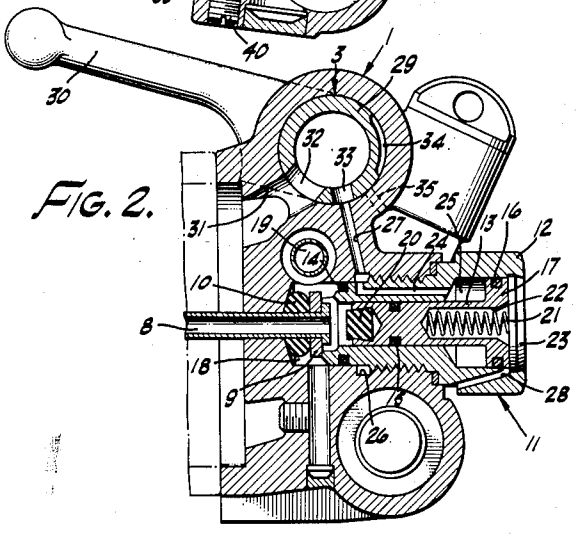
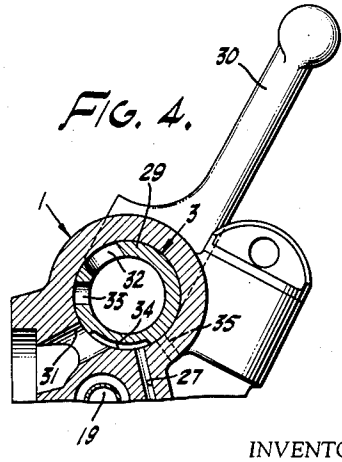


FIG. 4.



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AUTOMATIC WATER VALVE FOR ROCK DRILLS

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3 Claims. (Cl. 121—10)

This invention relates to automatic valves, and particularly to an air-operated valve for controlling the flow of water to the cutting head of a rock drill in accordance with the position of the throttle valve of the drill.

An object of the invention is to provide a compact unitary water valve adapted to be inserted into the backhead of a rock drill in the place conventionally occupied by the water tube plug, thereby eliminating the necessity of providing special orifices and an additional location for the valve.

A further object is to provide an automatic water valve which may be used interchangeably with the water tube plug, depending upon whether it is desired to use manual or automatic water control.

An additional object of the invention is to provide an automatic water valve which does not increase the weight or bulk of the drill on which the same is employed, and which does not necessitate the use of special parts to plug water orifices when the valve is removed from the drill.

A further object is to provide a water valve which is automatically controlled by the throttle of an air-operated rock drill, so that only the single throttle lever need be operated to control both the operation of the cutting head and the flow of water thereto.

Another object is to provide a combination automatic water valve and rock drill throttle valve constructed to effect flow of water to the cutting head when the drill is operating at full speed but to prevent such water flow when the drill is either stopped or operating at partial speed.

The invention, in general, comprises a cylindrical water valve casing threaded into the backhead of a drill in the recess conventionally containing the water tube plug, and a valve disposed axially within the casing and slidable between open and closed positions. The water valve casing and valve are ported to the throttle valve of the drill in such a way that the water valve is actuated to open position when the throttle is set for full speed operation, to that water is supplied to the drill cutting head at the desired time. When, however, the throttle is at its half speed or off position, the water valve member is returned under suitable spring bias to its closed position and the excess air pressure in the water valve is selectively vented through one of two air escape passages.

The invention will be described in connection with the accompanying drawing, in which:

Figure 1 is an elevational view of the backhead of a rock drill, looking longitudinally of the drill in the direction of the cutting head thereof;

Figure 2 is a vertical section taken along line 2—2 of Figure 1 and showing the throttle valve in full speed position and the water valve in open position;

Figure 3 corresponds to Figure 2 but shows the throttle in partial speed position and the water valve closed;

Figure 4 is a fragmentary sectional view corresponding to Figures 2 and 3 and showing the throttle valve in its off position; and

Figure 5 is a vertical section taken along line 5—5 of Figure 1 and illustrating the means for locking the throttle valve in its various drill controlling positions.

Referring to the drawings and particularly to Figure 1 thereof, there is shown the backhead 1 of a rock drill such as may be employed in mining operations. The backhead is provided with a transverse handle 2, a throttle valve 3, and suitable bores 4 and 5 adapted to receive the side bars for the drill. In order to supply the elements necessary for drill operation, an air hose 6 is suitably connected to the upper and outer portion of the backhead 1 and a water hose 7 is also connected to it at a location somewhat beneath the air hose.

In the conventional or standard type of rock drill, a solid water tube plug is threaded into a cylindrical hole or recess located at the center portion of the backhead opposite the end of a water tube 8 which leads through the drill to the cutting head. The water tube plug serves to provide a means which may be easily removed for access to the water tube 8 and related passages, for example to clean the same. Tube 8 is flanged at its inner end and secured to a washer 9 which in turn bears tightly against an encircling packing 10 in such a way that leakage of water along the water tube and into the drill is effectively prevented.

According to the present invention, the conventional water tube plug is removed and its location occupied by an automatic water valve 11 (Figures 1–3) adapted to control the flow of water in water tube 8 in accordance with the position of throttle valve 3. The valve 11 comprises a cylindrical casing 12 threaded into backhead 1 longitudinally of water tube 8, and a valve member 13 mounted within casing 12 and slidable longitudinally thereof. Both the casing 12 and the slidable valve member 13 are provided with suitable sealing means, preferably O-rings 14 and 15 disposed, respectively, in annular grooves at the inner ends of the casing and valve, and a third O-ring 16 located at the outer and enlarged or flanged portion 17 of the valve member 13.

As shown in Figures 2 and 3, the O-ring 14 at the end of valve casing 12 creates a fluid tight water chamber 18 which surrounds the end of water tube 8 and communicates through a transverse bore 19 in the backhead with the water hose 7 and thus with a suitable source of water supply. In order to block the flow of water from water hose 7 through chamber 18 and into water tube 8, a resilient plug member 20 is mounted in a suitably tapered recess at the inner end of the slidable valve member 13. Plug 20, which is preferably formed of rubber, is shaped to fit tightly over the flanged end of water tube 8 and thus effectively block the flow of water therethrough.

The plug member 20 is normally urged toward its inner or water blocking position by means of a helical compression spring 21 which bears between the end of a central bore 22 in the valve member 13 and an end disc or cap 23 secured in valve casing 12 as by spinning.

Referring now to Figure 2, the means for moving valve member 13 outwardly off its seat and against the bias of spring 21 will next be described. These means comprise a passage 24 disposed longitudinally in casing 12 and terminating at its outer end in an enlarged chamber 25 in which the flanged portion 17 of valve 13 slides. At its inner end passage 24 connects to an annular groove 26 in the water tube plug recess in backhead 1. Annular groove 26 also constitutes an air chamber and communicates with passage 24 regardless of the rotated position of casing 12, and also with a passage 27 extending through backhead 1 to the throttle valve 3. Accordingly, the admission of air from the throttle valve and into passage 27 operates through annular groove 26 and passage 24 to increase the pressure in chamber 25 adjacent the inner

face of flange 17 to a point sufficient to actuate valve member 13 outwardly to the open position illustrated in Figure 2. During such outward movement, the air compressed between flange 17 and end cap 23 is vented through a port 28 in casing 13.

The throttle valve 3, which controls both the operation of the cutting head and of the automatic water valve 11, comprises a hollow cylinder 29 mounted in the upper portion of backhead 1 and rotatable by a hand lever 30 to various controlling positions. The hollow cylinder 29 is connected at one end to the air hose 6 and serves as the means to transmit air to a port 31 in the backhead 1 and thus to the body of the drill in order to operate the cutting head thereof. In order to determine whether this flow of air is such as to cause either full or partial speed operation of the drill, a relatively large aperture or port 32 is provided in the throttle cylinder 29 and disposed to register with the port 31 when the throttle is in the full-speed position illustrated in Figure 2, and a second smaller and arcuately spaced aperture or port 33 in cylinder 29 is located so as to register with port 31 and provide a restricted flow of air into the drill when the throttle is in the partial speed position shown in Figure 3. The relationship between ports 32 and 33 is such that small port 33 is in registry with passage 27 when large port 32 is registered with port 31, so that air actuation of the water valve to open position always occurs during full speed drill operation. In addition to the large and small ports 32 and 33 in cylinder 29, an arcuate recess or groove 34 is provided in the outer surface of the cylinder in order to provide for venting of compressed air in water valve casing 12 as will next be described.

The location of the venting groove 34 is such that venting is effected through one of two selected passages depending on whether the throttle valve 3 is in partial speed position (Figure 3) or in off position (Figure 4). When the throttle is in partial speed position the venting groove interconnects passage 27 in backhead 1 with a port 35 bored therethrough and to the atmosphere. On the other hand, when the throttle is in its off or clockwise rotated position, shown in Figure 4, the venting groove interconnects passage 27 with the port 31 normally serving to admit air to the body of the drill. In the former case venting is direct to the atmosphere, whereas in the latter case the venting is accomplished through the drill. In either case, however, venting groove 34 serves as a means to permit escape of air from the chamber 25 and through passages 24 and 27 when the throttle 3 is turned to either partial speed or off position, thereby permitting spring 21 to slide valve member 13 to its closed position.

In order to guide throttle valve 3 and lock the same in the exact desired position, such as full speed, partial speed, and off, a solid end portion 36 of hollow throttle cylinder 29 is provided adjacent hand lever 30 with suitably spaced notches as shown in Figure 5. The notches in cylinder end 36 selectively receive, depending upon the rotated position of the throttle, the pointed end of a detent 37 located in a bore 38 in the backhead. Detent 37 is urged into each notch by a helical compression spring 39 bearing against an end cap 40 at the outer end of bore 38. With this construction, pointed detent 37 rides along end portion 36 as the throttle is manually rotated by manipulation of its hand lever 30, so that the throttle tends to stop rotating at the precise desired position corresponding to the locations of the notches.

In the operation of the automatic water valve let it be assumed that the drill is set for full speed operation by moving the throttle valve 3 counterclockwise to its full-speed position. Large port 32 in throttle valve cylinder 29 then registers with the port 31 in the backhead, and compressed air is admitted from air hose 6 through valve cylinder 29, port 32 and port 31 and into the body of the drill to effect full-speed operation thereof. At the same time, the smaller valve cylinder port 33 is in position to register with vertical air passage 27 in the backhead 1, permitting compressed air to pass therethrough into annular groove 26, thence through longitudinal passage 24 in the valve casing 12 and into the chamber 25 inwardly adjacent the flanged portion 17 of slidable valve member 13. The pressure thus created in chamber 25 effects longitudinal sliding of the valve member 13 to the right as viewed in Figure 1, against the bias of spring 21 to cause the resilient plug member 20 to be moved off the flanged inner end of water tube 8 to its position in Figure 2 and thus permit the flow of water therethrough. Such flow of water comes from water hose 7, through bore 19 in backhead 1, and into the water chamber 18 surrounding the inner end of the water tube. As the flanged valve member end 17 is shifted by the air pressure in chamber 25, any air outwardly of flange 17 escapes through the vent 28 in valve casing 12.

The drill is set for partial speed operation and flow of water to the cutting head is stopped by rotating the throttle 3 clockwise from the position shown in Figure 2 to that shown in Figure 3. When the throttle is in this position, the large port 32 in throttle cylinder 29 serves no purpose, but the restricted or smaller port 33 is registered with the port 31 in the backhead, so that a restricted or partial flow of compressed air travels into the body of the drill to effect reduced speed operation. Since neither port 32 nor 33 in throttle cylinder 29 is at this time registered with the air passage 27, and accordingly no air pressure is present within the valve, valve member 13 is slid longitudinally to its closed position under the bias of spring 21, thereby cutting off the flow of water through water tube 8 by engaging the resilient plug member 20 with the inner end of the water tube. Prior to and during this spring return of valve member 13 to its inner or closed position shown in Figure 3, the air under pressure in chamber 25 is vented through passage 24 in valve casing 12, passage 27 in the backhead, groove 34 in the outer portion of throttle cylinder 29, and outwardly through port 35 to atmosphere. In this manner, the flow of water to the cutting head is terminated when the drill is operating at partial speed.

Upon the clockwise rotation of throttle lever 30 from the partial speed position of Figure 3 to the off position of Figure 4, there is no additional venting and no actuation of the automatic water valve since the compressed air in the valve has already been vented while throttle was at partial speed position. When, however, the throttle lever 30 is suddenly rotated clockwise from its full speed position of Figure 2 to the off position of Figure 4, the venting described in connection with Figure 3 is no longer operative and additional venting means must be available. In the latter case the venting is from chamber 25 through passages 24 and 27, circumferential groove 34 to port 31, and thence through the body of the machine to the atmosphere. In this way adequate venting of the compressed air in the automatic valve is provided whether the throttle is moved from full speed to off position in a rapid or in a step-by-step manner.

The invention provides a small, light and compact automatic water valve usable interchangeably with the conventional water tube plug and which may be easily removed for cleaning purposes. When the drill is employed with a conventional water tube plug instead of with automatic water valve of the invention, the inner end of the plug serves to effectively block the annular groove 26 so that no compressed air is admitted into the water chamber 18 and no water permitted to escape through passage 27 and port 33 during location of the throttle in full speed position.

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. A combination water valve and throttle valve mechanism for use in the backhead of an air operated rock drill, said rock drill having a water tube adapted to transmit water from a chamber in said backhead and to the cutting bit of the drill; which comprises a valve casing inserted in said chamber, a flanged valve element mounted in said casing and movable between an outer open position and an inner closed position blocking the flow of water through said water tube, spring means to bias said valve element to said inner closed position, a hollow throttle valve cylinder connected to an air supply hose and manually rotatable to various drill controlling positions, said throttle valve cylinder having large and small ports therethrough and a venting recess in the outer surface thereof, said large and small ports being located, respectively, to register when the throttle valve cylinder is in full speed position with a port leading to the body of the drill and with a passage leading to a chamber inwardly adjacent the flange on said movable valve element, said small port and said venting recess being disposed, respectively, to register when the throttle valve cylinder is in a partial speed position with said port leading to the body of the drill and with said passage and a vent hole to the atmosphere, and said venting recess being disposed to register when the throttle valve cylinder is in off position with said passage and said port to the drill body.

2. A combination water valve and throttle valve mechanism for use in the backhead of an air operated rock drill, said rock drill having a water tube adapted to transmit water from a chamber in said backhead and to the cutting bit of said drill; which comprises a valve casing threaded into said chamber, a cylindrically flanged valve element mounted in said casing and movable between an outer open position and an inner closed position blocking the flow of water through said water tube, a spring disposed to bias said valve element toward said inner closed position, a hollow throttle valve cylinder connected to an air supply hose and manually rotatable to various drill controlling positions, said throttle valve cylinder having large and small ports therethrough and a venting groove in the outer surface thereof, said large and small ports being located, respectively, to register when the

throttle valve cylinder is in a full speed position with a port leading to the body of the drill and with a passage leading to a chamber inwardly adjacent the flange on said movable valve element, said small port and said venting groove being disposed, respectively to register when the throttle valve cylinder is in partial speed position with said port to the body of the drill and with said passage and a vent hole to the atmosphere, said venting groove being disposed to register when the throttle valve cylinder is in off position with said passage and said port to the drill body, and detent means to locate said throttle valve cylinder in said full speed, partial speed, and off positions.

3. A combination water valve and throttle valve mechanism for use in the backhead of a pneumatic drill, said backhead having a chamber therein, said drill having a water tube extending from said chamber to the cutting bit of a drill steel associated with said drill; which mechanism comprises a valve casing mounted in said chamber; a valve piston mounted in said casing and movable between an outer open position and an inner closed position blocking the flow of water through said water tube; spring means to bias said valve piston to said inner closed position; a throttle valve cylinder rotatable between a full speed position and a part speed position, said throttle valve cylinder being adapted when in full speed position to admit from an air pressure source a large volume of air per unit of time into said drill to effect full speed operation thereof, and when in part speed position to admit from said air pressure source a lesser volume of air per unit of time into said drill to effect part speed operation thereof; and passage means associating said throttle valve cylinder, said valve casing and a vent, said passage means connecting said air pressure source to a chamber in said valve casing inwardly adjacent said valve piston when said valve cylinder is in full speed position, and connecting said chamber in said valve casing to said vent when said valve cylinder is in part speed position.

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