Sept. 17, 1940. H. C. GUSTAFSON 2,215,217

WATER VALVE FOR ROCK DRILLS

Original Filed Dec. 15, 1938 3 Sheets-Sheet 1

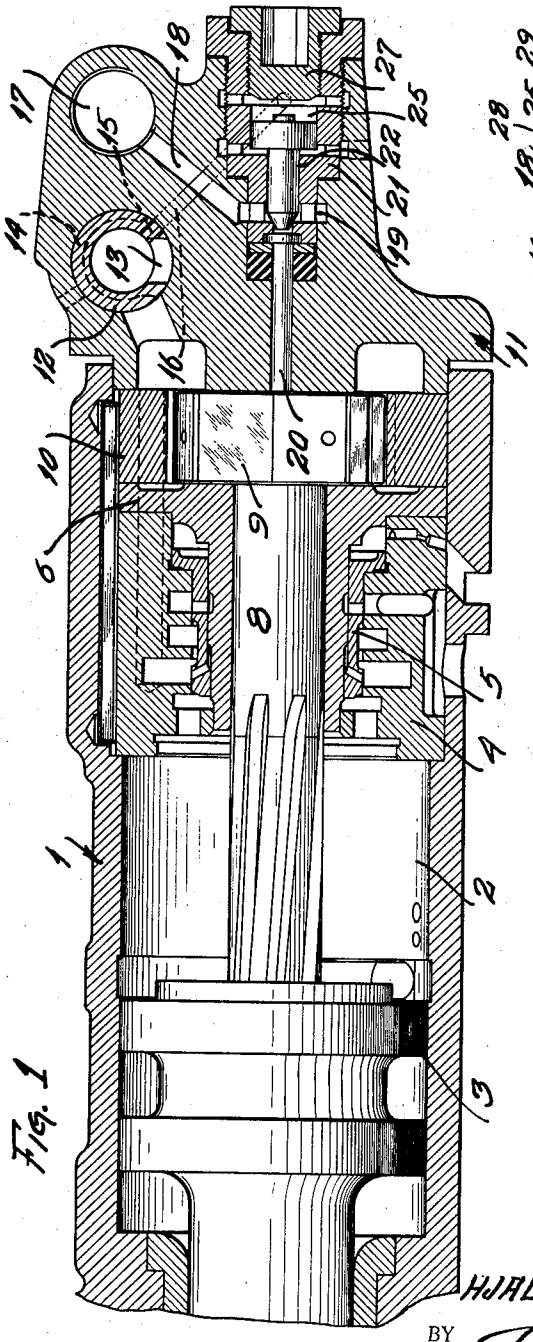


Fig. 1

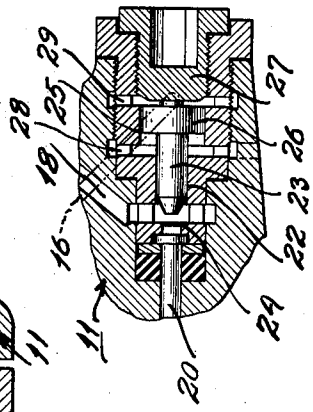


Fig. 3

INVENTOR.
HJALMER C. GUSTAFSON
BY
ATTORNEY.

Sept. 17, 1940. H. C. GUSTAFSON 2,215,217

WATER VALVE FOR ROCK DRILLS

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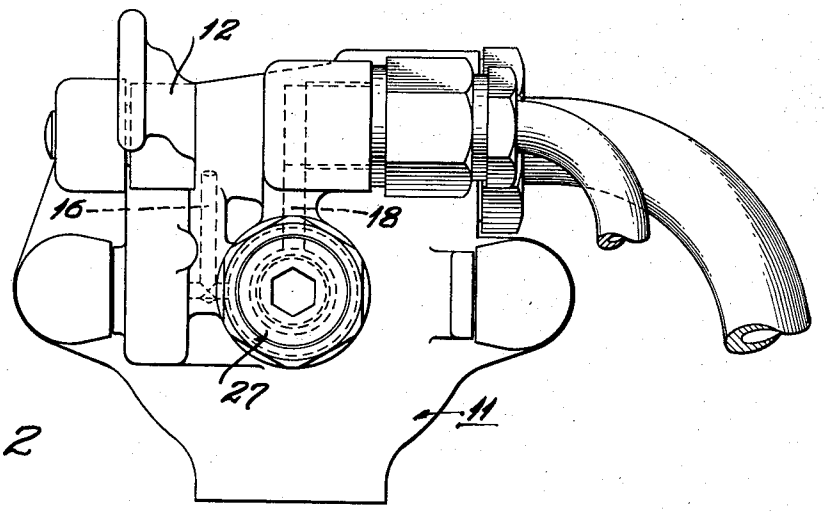


Fig. 2

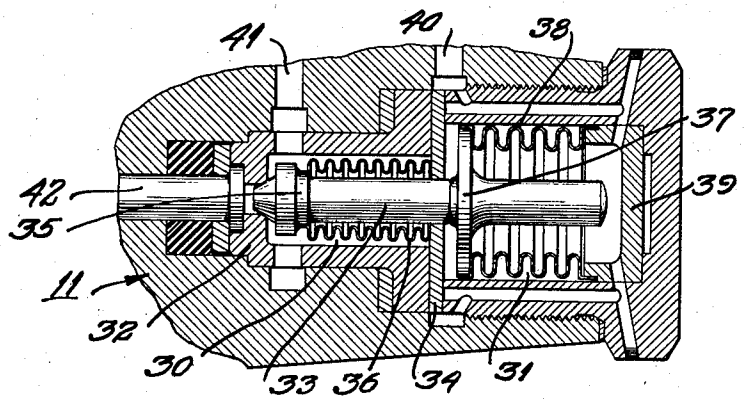


Fig. 4

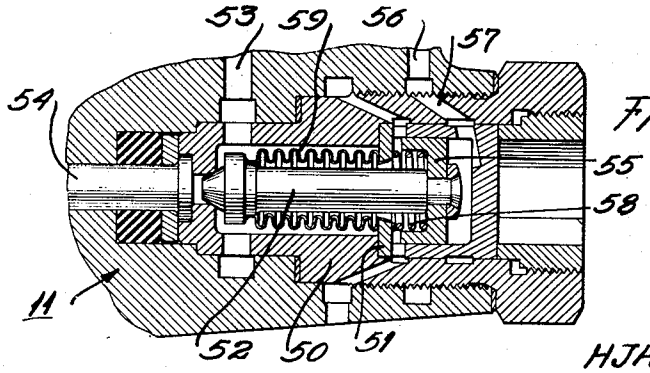


Fig. 5

INVENTOR.
HJALMER C. GUSTAFSON

BY

ATTORNEY.

Sept. 17, 1940. H. C. GUSTAFSON 2,215,217

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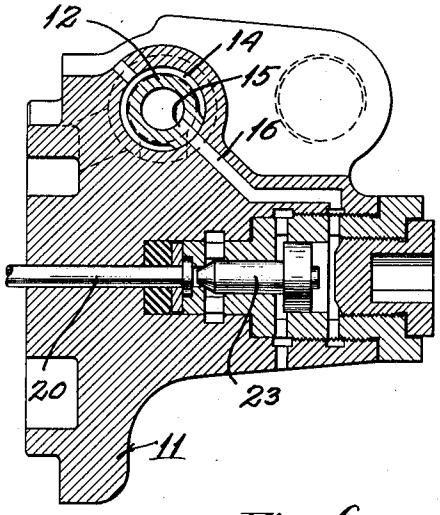


Fig. 6.

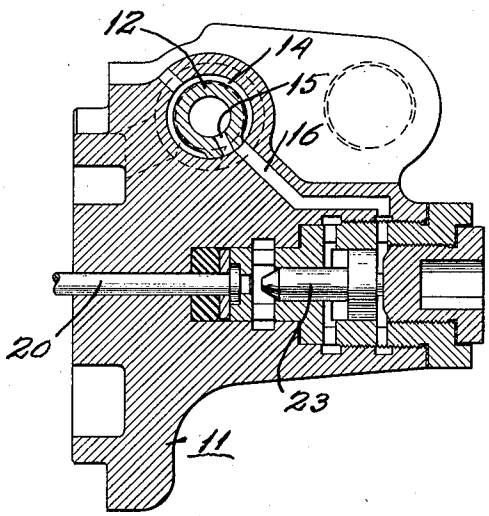


Fig. 7.

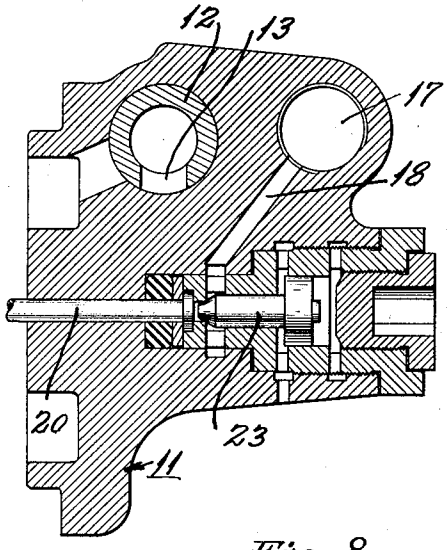


Fig. 8.

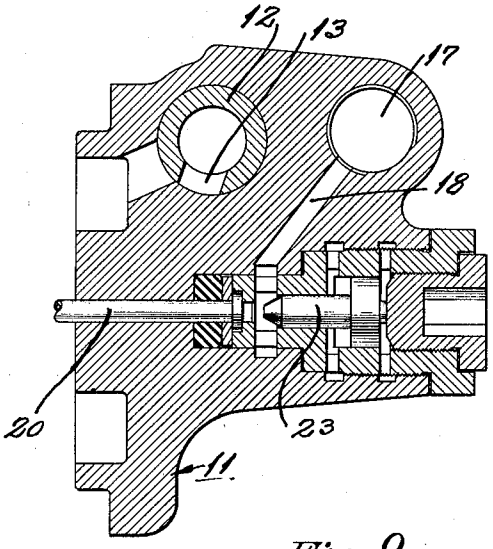


Fig. 9.

INVENTOR.
HJALMER C. GUSTAFSON
BY
A. S. Carpenter
ATTORNEY

Patented Sept. 17, 1940 2,215,217

UNITED STATES PATENT OFFICE

2,215,217

WATER VALVE FOR ROCK DRILLS

Hjalmer C. Gustafson, Denver, Colo., assignor to Gardner-Denver Company, Quincy, Ill., a corporation of Delaware

Application December 15, 1938, Serial No. 245,897
Renewed October 9, 1939

8 Claims. (Cl. 121—10)

My invention relates to improvements in rock drills and is more particularly directed to means for admitting cleansing fluid to the point of contact of the drill steel with the work.

The present object of the invention is to provide novel and efficient means for controlling the flow of cleansing fluid to the drill bit.

Another object of the invention is to provide a control mechanism whereby the flow of cleansing fluid is regulated by the operation of the usual throttle valve of a drill.

Still another object of the invention is to provide a control means in the water line of a rock drill which will permit the flow of water to the drill bit prior to the starting of the drilling motor and a continuation of the flow until the throttle valve has been moved to a point slightly beyond its closed position.

Further objects of the invention will hereinafter appear, and to all of these ends the invention consists of the features of construction, arrangement of parts, and combination of elements, substantially as hereinafter fully described and claimed in the specification and shown in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view through the rear portion of a drilling unit showing the means controlling the flow of water through the water tube and ultimately to the drill bit, said means being illustrated in a closed position.

Figure 2 is a rear end view of the backhead of the drilling motor showing the various connections for the water and operating fluid together with the throttle valve arrangement controlling both.

Figure 3 is a sectional view showing the control valve illustrated in Figure 1 when moved to an open position permitting the flow of water through the water tube.

Figure 4 is a modification of the valve shown in Figures 1 and 2.

Figure 5 is a further modification of the control valve.

Figure 6 is a sectional view of the backhead showing the position occupied by the throttle valve when admitting operating fluid to the water valve holding the same closed.

Figure 7 is a view similar to Figure 6 but shows the throttle valve occupying a position when the holding fluid to the valve is starting to escape. It also discloses the relation of the supply port for holding fluid with respect to the passageway leading to the water valve.

Figure 8 is a sectional view of the backhead taken slightly in advance of the showing made in Figure 6, disclosing clearly the position occupied by the operating fluid supply port of the throttle valve when in the position shown in Figure 6, and

Figure 9 is a view similar to Figure 8 but discloses the position of the supply fluid port of the throttle valve when the valve is in a position such as that disclosed in Figure 7.

Briefly, the invention about to be described relates to a valve positioned within the backhead of a drill and designed for the purpose of controlling the flow of water through the water tube of the drill and ultimately through the drill steel to its point of contact with the work. With such an arrangement it is obvious that the cuttings made by the drill bit during its operation are consistently removed from the hole, thus increasing the amount of work performed by the unit and at the same time removing the dust hazards that commonly occur. The water valve as shown is one operated by air and its structure permits the valve to be closed when the throttle valve is in a closed position with the drilling unit idle, and held in a closed position by air taken from the interior of the throttle valve when the latter is closed. However, when it is desired to operate the drilling unit the throttle valve is turned to its open position permitting the flow of fluid through the throttle valve to the valve chest of the drilling motor but prior to the opening of this throttle valve the holding air for the water valve is released to atmosphere, thus insuring the flow of water through the water tube and the steel prior to the starting of the drilling motor. The advantages obtained by a structure of this nature are obvious. However, the most principal feature being that water enters the hole prior to the operation of the drill steel and continues to do so until the drill is cut off, thus destroying completely any dust that might occur.

Referring now to the drawings in detail, the numeral 1 indicates a drilling motor having a cylinder 2 within which is a reciprocating piston 3. As is customary in a structure of this type the piston 3 strikes the end of the drill steel during its reciprocations.

The rear end of the cylinder 2 is provided with a valve chest 4 having therein a sleeve valve 5 supported by a valve plug 6 through which passes the usual rifle bar 8 having at its rear end the ratchet head 9 provided with pawls engageable with a ratchet ring 10 keyed to the cylinder 2. The rear end of the cylinder 2 is closed by a

backhead 11 provided with suitable connections for both water and air, a throttle valve 12 controlling the flow of air to the sleeve valve 5. The backhead as shown in Figure 1 has positioned axially of the cylinder 2 a water tube 20 extending through the rifle bar 8 to the front portion of the drill where it communicates with the drill steel supported by the drill. Also positioned within the backhead 11 and arranged in line with the water tube 20 is the control valve forming my invention.

As shown in Figure 1, the throttle valve 12 is provided with a port 13 which permits the passage of fluid from the interior of the valve to a passageway leading to the reciprocating valve 5. The throttle valve is also provided exteriorly with a circumferential groove 14 extending part way around the body of the valve and a small port 15 which when the valve is closed is adapted to communicate with a passage 16 leading to the valve controlling the flow of water through the drill.

As previously stated, the backhead 11 is provided with a suitable water connection the same being indicated at 17 and leading from this is a passageway 18 terminating in a bore 19 formed within the backhead and axially of the cylinder 2. Leading from this bore 19 through the interior of the drill is the conventional water tube 20.

Positioned within the bore 19 and abutting the flanged end of the water tube 20 is a valve casing 21 having at its front portion a bore 22 closed by a pin valve 23, the end of the valve being tapered and engageable with a tapered opening 24 formed in the end wall of the plug. Communicating with the bore 22 of the plug are radial ports which permit the flow of water from the passageway 18 into the bore 22.

The rear end of the valve casing 21 is provided with an enlarged bore 25 within which is receivable a piston 26 affixed to the pin valve 23. The rear end of the bore 25 is threaded and closed by a removable plug 27, thus forming in reality a cylinder 25 within the casing 21. At each end of the cylinder 25 are openings 28 and 29, the former, 28, being open to atmosphere as indicated by dotted lines, while the latter 29 is in communication with the passageway 16 leading from the throttle valve.

From the structure just described it is obvious that when the throttle valve is in the position shown in Figure 1, motive fluid flowing through the port 15 of the throttle valve and the passageway 16 engages the rear face of the piston 26, holding the tapered end of the pin valve 23 in engagement with its seat 24, thus interrupting the flow of water from the passage 18 to the water tube 20. However, when the operator starts the drill, the throttle valve is moved to such a position as where the port 13 will permit the passage of motive fluid from the interior of the throttle valve to the passageway leading to the sleeve valve 5. Prior to the establishment of this communication the passageway 16 is open to atmosphere through the groove 14 to atmosphere through a suitable port indicated by dotted lines, thus the holding air engaging the rear face of the piston 26 is permitted to escape and at the same time water under pressure acting upon the tapered face of the valve stem 23 moves the valve back to its open position, as shown in Figure 3, so that the flow of water from the passageway 18 to the tube 20 might be fully established.

Figures 4 and 5 show modifications of the valve illustrated in Figures 1 and 3 and it will be observed that the structures disclosed in these modifications are controlled by holding fluid passing from the throttle valve in a manner similar to that previously described and illustrated in Figures 1 and 3. A difference in structure is of course present and such structures include mechanical means for returning the valve to its open position and at the same time preventing leakage through the valve proper.

In Figure 4 the valve casing is made in two parts including a front portion having a chamber 30 and a rear portion having a chamber 31. The front chamber being provided with an end wall 32 having an opening closed by the tapered portion of a stem 33. This stem is supported by a wall 34 positioned between the two sections of the valve casing. The front end of the stem 33 is enlarged as indicated at 35 and affixed thereto in any suitable manner is one end of a flexible bellows 36, the other end being secured in a like manner to the dividing wall 34. Thus with its structure movement of the pin 33 is permitted and at the same time leakage of water around the pin into the chamber 31 is prohibited.

To move the stem 33 to its closed position as illustrated, the rear chamber 31 has therein a piston 37 and affixed to this piston in any desired manner is one end of a second flexible bellows 38, the other end being affixed to the end of a plug 39 positioned within the chamber 31. Motive fluid controlled by the throttle valve enters through the passageway 40 and is communicated to the interior of a chamber formed by the bellows 38, the piston 37 and the plug 39, thus acting upon the piston 37 moving the same forward and at the same time moving the stem 33 to such a position whereby the flow of water from the passageway 41 to the water tube 42 is interrupted. With this structure when the throttle valve is moved to its opening position initial to the operation of the drill, holding air contained within the chamber formed by the bellows 38 and acting upon the piston 37 is permitted to pass to atmosphere as previously described, the flexible bellows 38 tending to return the piston to its rearmost position and likewise the bellows 36 will return the stem 33 to its rearmost position permitting the flow of water from the passageway 41 to the water tube 42. With this structure it is evident that leakage of water or air from one chamber to the other is prevented and at the same time the means preventing this serving to return the valve and piston to one of their operating positions.

In Figure 5 a further modification of the structure is shown and it comprises a casing 50 divided into two compartments by a wall 51, on one side of which is positioned a stem 52 very similar in structure to the stem 33 shown in Figure 4 and serving to interrupt the flow of water from the passageway 53 to the water tube 54.

The stem 52 in this structure extends through the wall 51 and is provided at its rear end with a piston 55 against which motive fluid entering from the passage 56 through the ports 57 is active, tending to hold the tapered end of the stem 52 in a closed position. When this pressure active upon the rear face of the piston 55 is relieved in a manner hereinbefore described, a coiled spring 58 returns the piston to its rearmost position within its cylinder and at the same time moving the stem 52 rearwardly so that the flow of water from the passageway 53 to the wa-

ter tube 54 might be established. Here again the resilient bellows 59 prevent leakage and the intermittingly of air with the water.

In the preferred embodiment of this invention and the several modifications thereof the principal features lies in the provision of means whereby the flow of water to the drill steel might be effected without the possibility of air intermingling with the water. In the preferred embodiment, shown in Figures 1 and 3, the water control valve, while operated by air, is so arranged that none of the operating air can reach the water chamber, while in the modifications definite means, such as the bellows, has been provided to seal the water chamber from the air chamber. The advantages obtained by such a structure are apparent. However, it might be pointed out that ordinarily in control means of a nature similar to that described it frequently happens that particles of air pass directly to the drill steel. Naturally that air has to escape and when it escapes it carries with it particles of dust. This has been definitely eliminated.

From the foregoing it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

What I claim is:

1. In a rock drill, a steel actuated thereby, a backhead forming a part of the drill, a water tube supported by said head serving to convey water to the steel, a throttle valve controlling the flow of operating fluid for the drill, a valve controlling the passage of water from a supply to the tube, passageways leading from the throttle valve to the water valve and atmosphere, and said throttle valve introducing operating fluid into said passageways for holding the water valve closed after the closing of the throttle valve and then permitting said holding fluid to escape to atmosphere for the opening of the water valve prior to the introduction of operating fluid to the drill.

2. In a rock drill, a steel actuated thereby, a backhead forming a part of the drill, a water tube supported by said head serving to convey water to the steel, a throttle valve controlling the flow of operating fluid for the drill, a water valve controlling the passage of water from a supply to the tube, said valve having a portion engageable by operating fluid controlled by the throttle valve, and said throttle valve introducing fluid to hold the water valve closed after the closing of the throttle valve and permitting the escape of the holding fluid to open the water valve prior to the opening of the throttle valve.

3. In a rock drill, a steel actuated thereby, a backhead forming a part of the drill, a water tube supported by said head serving to convey water to the steel, a throttle valve controlling the flow of operating fluid for the drill, a valve controlling the passage of water from a supply to the tube, said valve having two portions, one constituting the water valve and the other its operating means, a passageway extending from the throttle valve to the operating portion of the valve, said throttle valve introducing fluid into said passageway to hold the water valve closed subsequent to its closing action and during its closed period and relieving said holding fluid to atmosphere prior to the opening of said throttle valve, means serving to return the several portions of the water valve to their inoperative position, and said means constituting a seal to prevent the intermingling of water and air.

4. In a rock drill, a steel actuated thereby, a backhead forming a part of the drill, a water tube supported by said head serving to convey water to the steel, a throttle valve controlling the flow of operating fluid for the drill, a pin valve positioned adjacent said water tube controlling the flow of water therethrough, said pin valve being moved to a closed position by operating fluid controlled by the throttle valve, and said operating fluid being introduced to the valve to hold the same closed subsequent to the closing action of the throttle valve and during its closed period and relieving said holding fluid to atmosphere prior to the opening of the throttle valve.

5. In a rock drill, a steel actuated thereby, a backhead forming a part of the drill, a water tube supported by said head serving to convey water to the steel, a throttle valve controlling the flow of operating fluid for the drill, a valve casing positioned in the backhead and in line with the water tube, a valve in the casing controlling the flow of water through the tube, a passageway leading from the throttle valve to the water valve, and said throttle valve introducing operating fluid to the water valve to hold the same closed subsequent to the closing action of the throttle valve and permitting the escape of said holding fluid prior to the opening of the throttle valve.

6. In a rock drill, a steel actuated thereby, a conduit conveying cleansing fluid to the steel, a throttle valve controlling the flow of operating fluid to the drill, a valve controlling the flow of cleansing fluid through the conduit, said valve having a portion engageable by operating fluid controlled by the throttle valve, and said throttle valve introducing fluid to close the valve and hold the same closed after the closing of the throttle valve and permitting the escape of holding fluid to open the valve prior to the opening of the throttle valve.

7. In a rock drill, a steel actuated thereby, a tube conveying water to the steel, a throttle valve controlling the flow of operating fluid to the steel, a valve controlling the flow of water to the tube, a passageway leading from the throttle valve to the second valve, and said throttle valve introducing operating fluid through the passageway to close the second valve and hold the same closed subsequent to the closing action of the throttle valve and permitting the escape of holding fluid to atmosphere prior to the opening of the throttle valve.

8. In a rock drill, a steel actuated thereby, a tube conveying water to the steel, a throttle valve controlling the flow of operating fluid to the steel, a valve controlling the flow of water to the tube, a passageway leading from the throttle valve to the second valve, and said throttle valve introducing operating fluid through the passageway to the second valve closing the same subsequent to the closing action of the throttle valve holding the same closed thereafter and permitting the escape of holding fluid to atmosphere prior to the opening of the throttle valve.

HJALMER C. GUSTAFSON.