Oct. 23, 1962 R. W. BEAUMONT 3,059,619

ROCK DRILL

Filed March 14, 1961 2 Sheets-Sheet 1

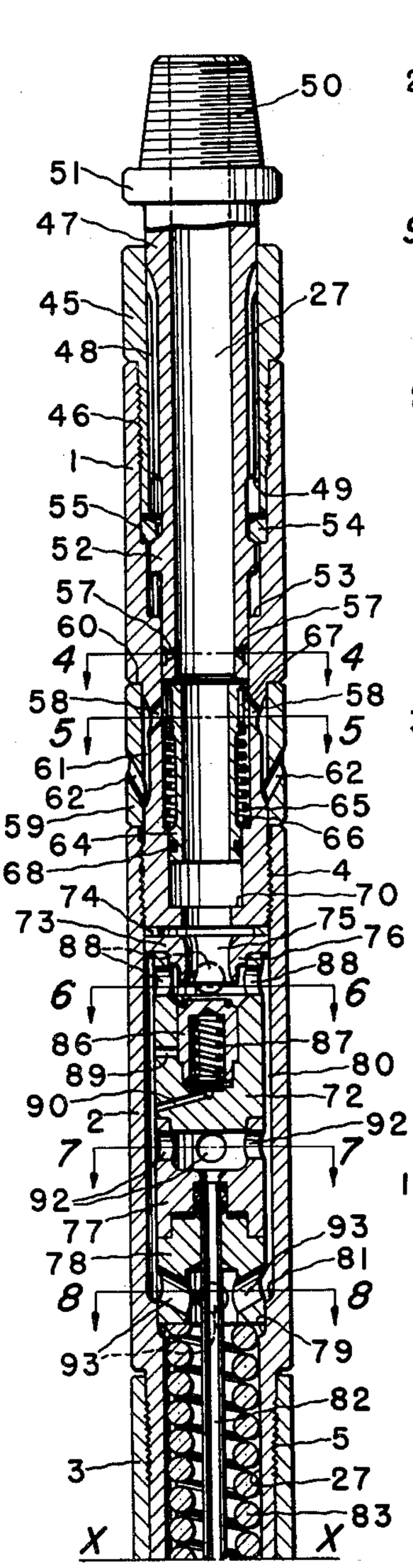

FIG. 1

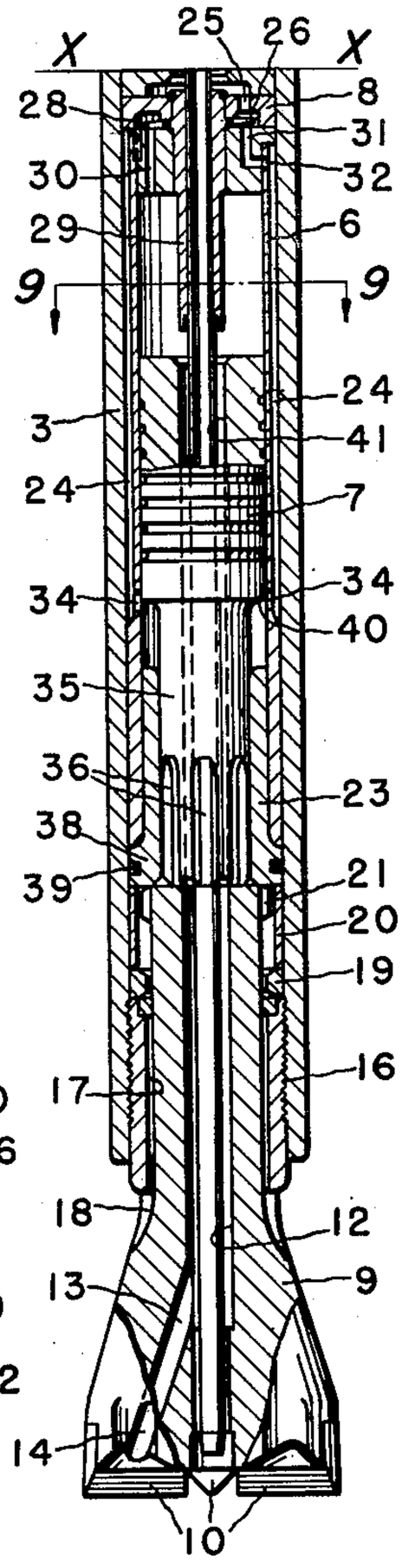

FIG. 2

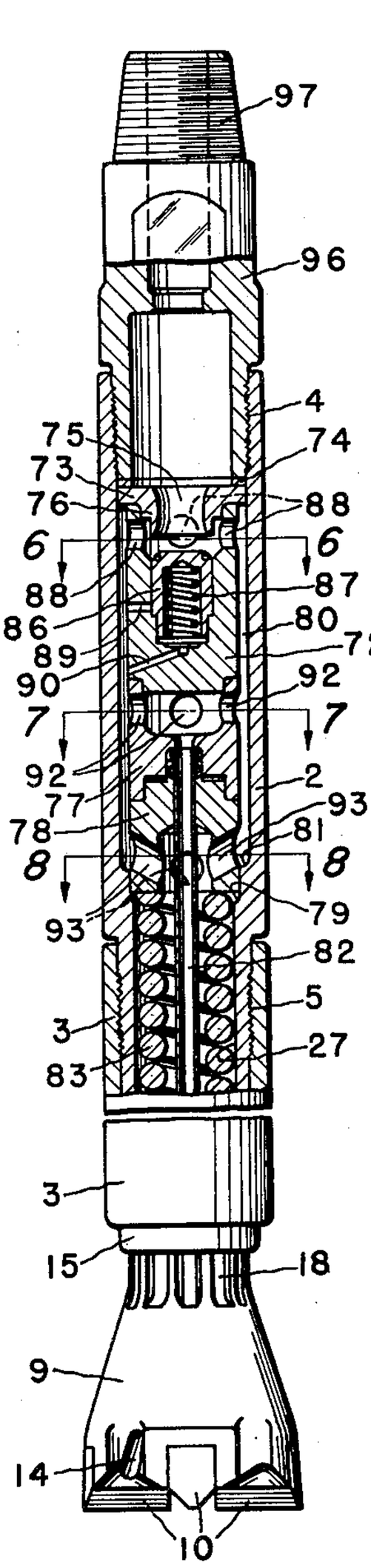

FIG. 3

INVENTOR
RICHARD W. BEAUMONT
BY
HIS ATTORNEY

Oct. 23, 1962

R. W. BEAUMONT

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2 Sheets-Sheet 2

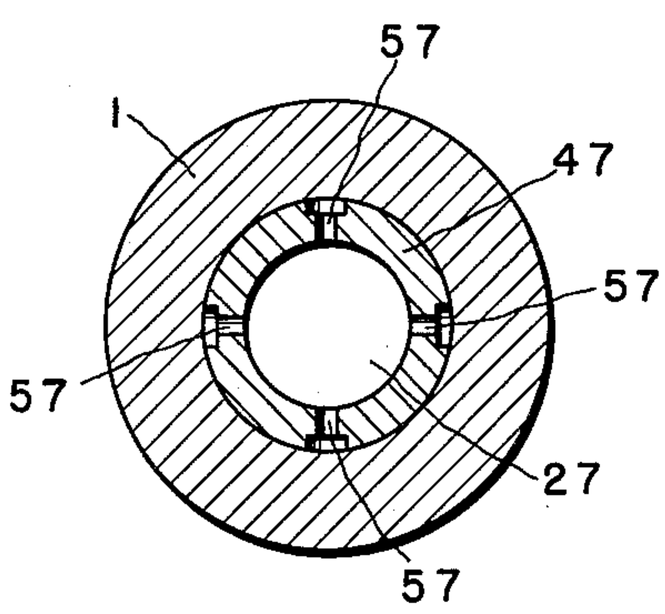

FIG. 4

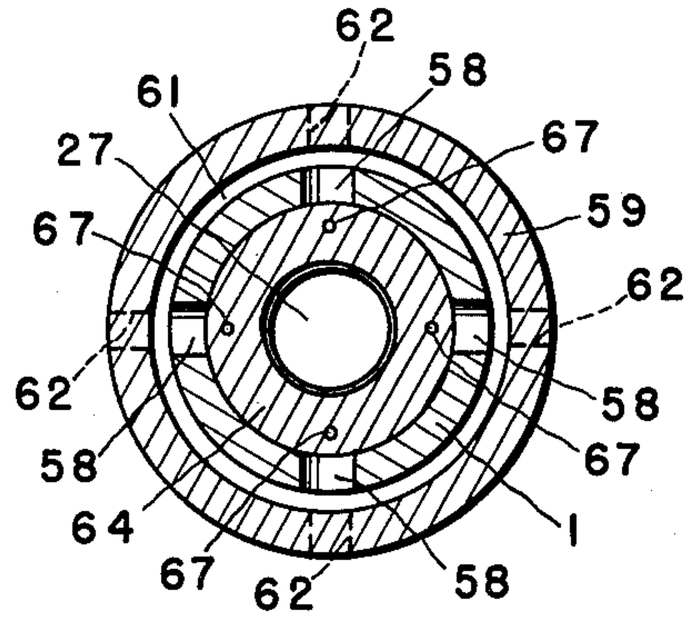

FIG. 5

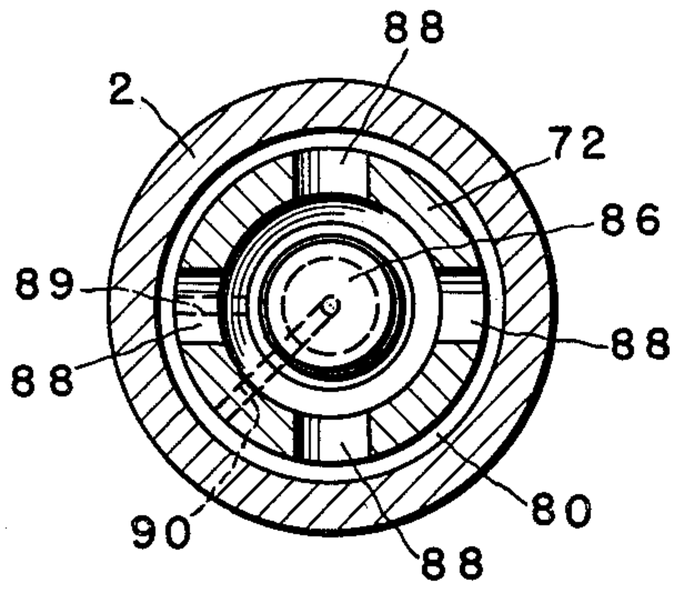

FIG. 6

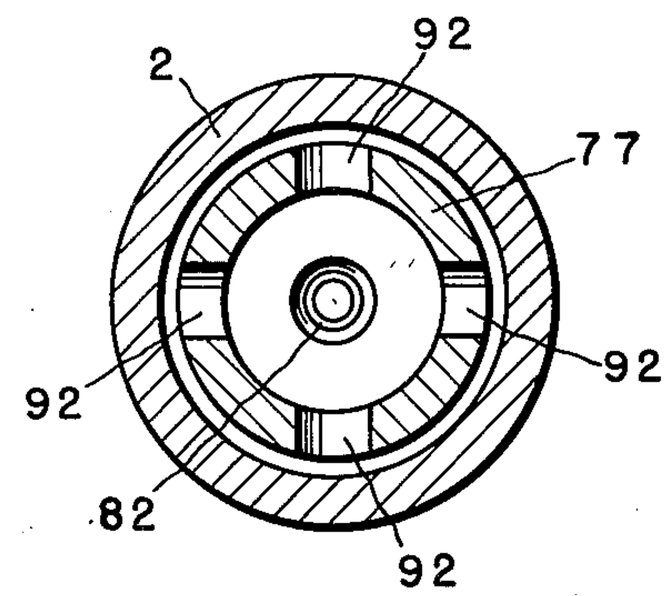

FIG. 7

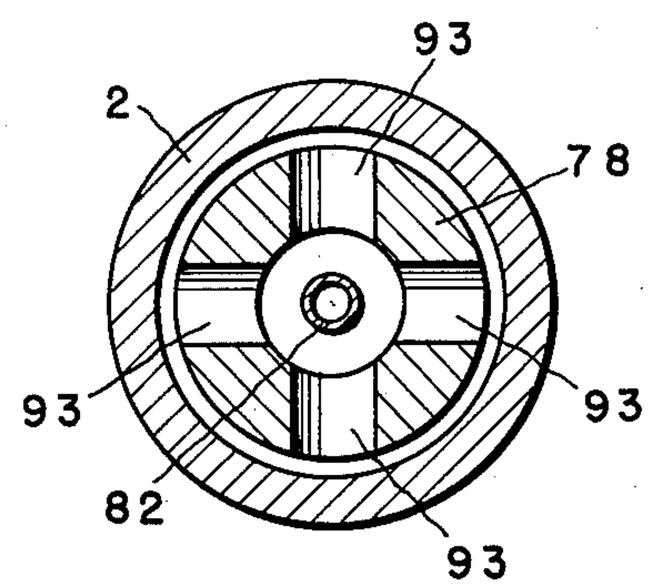

FIG. 8

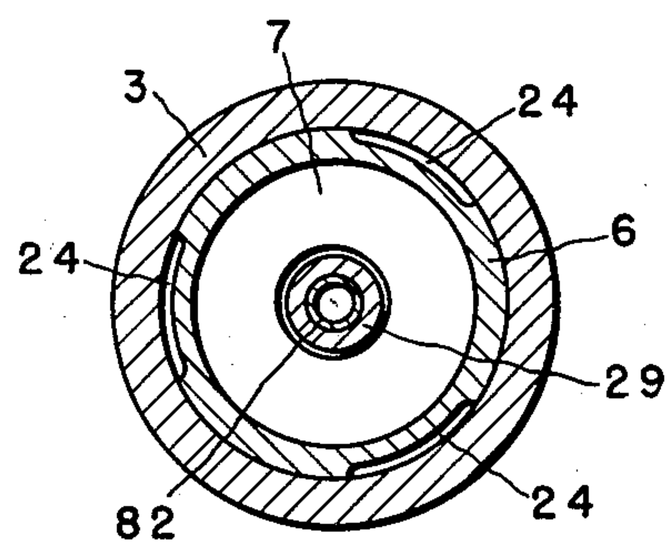

FIG. 9

INVENTOR
RICHARD W. BEAUMONT
BY
HIS ATTORNEY

United States Patent Office

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ROCK DRILL

Richard W. Beaumont, Asbury, N.J., assignor to Ingersoll-Rand Company, New York, N.Y., a corporation of New Jersey

Substituted for abandoned application Ser. No. 777,353, Dec. 1, 1958. This application Mar. 14, 1961, Ser. No. 96,069

12 Claims. (Cl. 121—16)

This application is a substitution for abandoned application Serial No. 777,353, filed on December 1, 1958.

This invention relates to down-the-hole pneumatically operated percussive rock drills, so called because they are adapted to be inserted into the hole being drilled, and it has for its object to provide a novel and improved drill of this type.

Another object of the invention is to provide a down-the-hole rock drill with means for more effectively cleaning the hole being drilled than has been possible in the past.

Another object is to provide a drill of the type specified with means for automatically keeping water, mud and cuttings out of the drill while adding or removing drill pipe, or when drilling is interrupted for other reasons.

Still another object is to provide improved means for blowing hole-cleaning air, in addition to the normal drill exhaust, out through the bit of the down-the-hole rock drill.

A further object is to provide a drill of the above type with a blower valve controlling the discharge of air through the valve casing to assist in removing cuttings from the hole being drilled.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Down-the-hole rock drills often work in very deep holes, as in drilling oil wells, and, as the hole advances, the drilling is interrupted from time to time to permit additional drill pipe to be added. The percussive mechanism which actuates the drill bit is located in the drill casing down in the hole, and while the drill is working a rotating mechanism located above ground rotates the drill pipe and the drill connected to the forward end of the drill pipe so that the cutting edges of the drill bit keep changing their position as they bite into the strata being drilled. At the same time the drill pipe conveys compressed air to the drill, not only to actuate the pneumatic drill piston in the casing but also to blow air through the drill bit to clean out the hole which is being drilled.

In the preferred embodiment of the present invention hereinafter described, the rock drill comprises three major components: the forward or bottom section containing the drill bit, the pneumatic piston which actuates same, and the valve mechanism controlling operation of the piston; an intermediate section or back head containing a blower tube support, a check valve and associated mechanisms; and a rear or top section constituting a circulating sub body and associated parts including a blower valve controlling the discharge of air from this section of the casing to assist in removing drill cuttings.

The circulating sub section of the drill has a slip joint which allows one set of ports to be opened while drilling, and another set of ports to be opened for blowing while not drilling. A sliding blower valve in the sub closes these ports to keep out dirt and water when the air pressure in the sub drops to zero. The check valve in the back head section of the drill casing controls the flow of air to the piston to operate the drill bit, and to a blower tube which extends through the casing and drill bit to discharge cleansing air directly into the bottom of the hole to supplement the normal exhaust through the

piston grooves and the bore in the shank of the drill bit. This check valve is normally open during drilling, but when not drilling the valve closes to keep water, mud and cuttings out of the drill.

The invention is described more in detail in connection with a preferred embodiment illustrated in the accompanying drawing, in which:

FIGS. 1 and 2, when joined end to end with FIG. 1 at the top, constitute a vertical sectional view of a down-the-hole rock drill embodying the invention;

FIG. 3 is a partial vertical sectional view showing a modification of a down-the-hole drill with the omission of the circulating sub and associated mechanisms, but is otherwise similar to the drill shown in FIGS. 1 and 2;

FIG. 4 is an enlarger transverse section taken on line 4—4 of FIG. 1;

FIG. 5 is an enlarger transverse section taken on line 5—5 of FIG. 1;

FIG. 6 is an enlarger transverse section taken on line 6—6 of FIGS. 1 and 3;

FIG. 7 is an enlarged transverse section taken on line 7—7 of FIGS. 1 and 3;

FIG. 8 is an enlarged transverse section taken on line 8—8 of FIGS. 1 and 3; and

FIG. 9 is an enlarged transverse section taken on line 9—9 of FIG. 2.

The rock drill shown in FIGS. 1 and 2 comprises a tubular outer casing composed of the following parts: section 1 which constitutes the circulating sub body; section 2 which is threaded at 4 to the reduced forward end of section 1 and constitutes the back head housing the check valve and the blower tube inlet; and section 3 which is threaded at 5 to the reduced forward end of section 2 and contains a tubular piston sleeve 6 in which a piston 7 is reciprocated by fluid under pressure valved alternately to opposite ends of the piston by valve 8, as shown at the top of FIG. 2.

A working implement 9, shown in the form of a drill bit, is mounted in the forward end of the drill casing with its inner end positioned to be struck by the piston 7, as shown in FIG. 2. The drill bit includes a head having cutters 10 arranged to cut a hole of slightly greater diameter than the diameter of the drill casing so that the drill may be lowered into the hole being drilled. An axial bore 12 in the shank of the drill bit, serving to conduct cleansing fluid to the bottom of the hole being drilled, communicates with ducts 13 terminating in openings 14 in the cutting end of the drill bit, as shown in FIG. 2.

The bit 9 is retained in the drill casing and is engaged for rotation therewith by a chuck which includes an end member 15 threaded at 16 in the forward end of the drill casing and having internal longitudinal splines 17 slidably engaging complementary grooves 18 in the shank of bit 9. The chuck also includes a split ring 19 and a sleeve 20 clamped between the end member 15 of the chuck and a tubular guide piece 23 in the forward end of piston sleeve 6. Split ring 19 serves to cooperate with the outwardly projecting spline sections 21 on the rear end portion of the shank for limiting longitudinal movement of the drill bit relative to the drill casing.

Still referring to FIG. 2, it will be noted that the upper portion of piston sleeve 6 has its outer cylindrical surface cut or machined to form arcuate air chambers 24 between said sleeve 6 and the outer casing section 3. The valve 8, shown herein by way of illustration, is slidably fitted in the casing section 3 and partly positioned in the rear end portion of piston sleeve 6, as shown at the top of FIG. 2. The said valve 8 is provided with ports 25 for the passage of pressure fluid to the valve chamber 26 from the fluid supply passage 27 in the drill casing at the bottom of FIG. 1.

The flow of pressure fluid from valve chamber 26 for actuating the piston 7 is controlled by a conventional type flapper valve 28 mounted for rocking movement about a central tube 29 which is mounted in valve 8, as shown at the top of FIG. 2. The lower body portion of valve 8 is provided with a port 30 for the conductance of fluid from valve chamber 26 to the space rearward of the piston 7, port 30 being adapted to be covered by the flapper valve 28 when the latter is rocked to the position shown in FIG. 2. Positioned on the opposite side of the lower body portion of valve 8 (top of FIG. 2) is a port 31 arranged to be covered by the flapper valve 28 when rocked to its opposite position. This port 31 communicates with ports 32 adjacent the top of piston sleeve 6 which, in turn, communicate with the air chambers 24 between said sleeve 6 and the outer casing section 3. Ports 34 in piston sleeve 6 adjacent the bottom of chambers 24, communicate said chambers 24 with the interior of sleeve 6 when said ports are uncovered by the piston 7.

The reduced extension 35 of piston 7 is provided with longitudinal grooves 36 through which air is exhausted to the bore 12 of drill bit 9, as hereinafter described. In this type of piston construction the afore-mentioned tubular guide piece 23 mounted at the forward end of piston sleeve 6 has a flange 38 clamped between the sleeve 20 and the forward end of piston sleeve 6. A sealing ring 39 is mounted in said flange 38 to prevent the escape of pressure fluid leaking from the chambers 24 between sleeve 6 and the casing section 3.

Assuming the parts of the drill illustrated in FIG. 2 to be in the position shown therein, air from the supply passage 27 at the bottom of FIG. 1 is conducted to the valve 8 and thence through ports 25, valve chamber 26, ports 31 and 32, chambers 24, and ports 34 to the portion of the interior of piston sleeve 6 forwardly of the forward pressure surface 40 of piston 7. This fluid acts on said pressure surface 40 to actuate the piston 7 rearwardly, causing the fluid rearwardly of the piston to be exhausted through the central bore 41 of the piston until bore 41 is closed by slidably receiving the central tube 29 of valve 8. When piston 7 has moved rearwardly a sufficiently great distance to uncover the rearward ends of its longitudinal grooves 36, pressure fluid from ports 34 is exhausted through said grooves 36 and thence through bore 12 of drill bit 9. The compressive action of the piston moving rearwardly increases the pressure in the rearward portion of piston sleeve 6 and valve port 30, causing the flapper valve 28 to be thrown into its other limiting position in which it closes port 31. The supply of pressure fluid to the forward end of the piston is cut off, whereupon pressure fluid is supplied to the rear pressure surface of the piston.

This reversal in supply of the pressure fluid actuates the piston 7 forwardly whereby the piston moves clear of the tube 29 and cuts off the exhaust through longitudinal grooves 36 in the reduced extension 35 of the piston. Accordingly, the pressure forwardly of pressure surface 40 of the piston increases, causing the flapper valve 28 to be thrown into the position shown in FIG. 2.

The rear section 1 of the tubular outer casing constitutes the circulating sub body. A chuck 45 is threaded at 46 into the rear end of said circulating sub body, as shown at the top of FIG. 1. A tubular circulating sub driver 47 is slidably mounted in the chuck 45, sub driver 47 having splines 48 engaging cooperating internal splines 49 in said chuck which enable the driver 47 to rotate the chuck 45 as well as the entire tubular outer casing of the drill. The rear end of the driver is threaded at 50 for connection to the drill piping. It also has a flange or shoulder 51 adapted to engage the rear annular edge of chuck 45 to limit the forward movement of driver 47 with respect to the tubular outer casing during drilling operations. The driver 47 includes an internal flange 52 longitudinally movable between an internal annular step 53 in the tubular casing section 1 and a ring 54 mounted

between the forward end of chuck 45 and a second annular step 55 in the casing section 1. Ring 54 being mounted rearwardly spaced from step 53 cooperates with step 53 to limit longitudinal movement of driver 47.

The driver 47 has four equally spaced ports 57 disposed about its forward end portion, as shown in FIGS. 1 and 4. When the circulating sub driver 47 moves forward until its shoulder 51 engages the rear annular edge of chuck 45, and/or its internal flange 52 engages the internal annular step 53 in casing section 1, the ports 57 of the driver register with ports 58 in casing section 1. Forwardly of ports 58, a portion of the outer diameter of casing 1 is reduced and surrounded by a collar 59 clamped between the rear end of casing section 2 and an annular step 60 in casing section 1, forming an annular chamber 61 with which ports 58 are in constant communication. Blower ports 62 in collar 59 communicating chamber 61 with the atmosphere are positioned to conduct the fluid flowing therethrough in an upward direction towards the open end of the hole being drilled. It will be noted that the downwardly directed ports 58 and the upwardly directed ports 62 are positioned adjacent the top and bottom, respectively, of annular chamber 61, hence dirt and cuttings falling back into ports 62 will collect in chamber 61 from which they will subsequently be blown out.

The escape of air through blower ports 62 to assist in removing cuttings from the hole being drilled is not only controlled by movement of sub driver 47, but also by a blower valve 64 slidably mounted in the casing section 1 of the rock drill. The said blower valve 64 is generally spool-shaped, as shown in FIG. 1, and the reduced annulus between its two end flanges contains a coil spring 65 which is compressed between an annular ledge 66 formed in the inner tubular surface of casing section 1 and pins 67 in the rear or upper flange of said valve. The forward or lower flange of said valve, which has a smaller outside diameter than the rear or upper flange, contains a suitable O ring 68 sealing the juncture with the inner tubular surface of casing section 1. When the valve 64 is closed, as shown in FIG. 1, coil spring 65 holds the rear or upper flange of the valve against the forward annular end of the circulating sub driver 47. When in this position, the valve seals the ports 58 thus preventing dirt and water from entering the drill through ports 58.

When actually drilling, however, the circulating sub driver 47 moves forward in casing section 1 until its shoulder 51 engages the rear annular edge of chuck 45. Thereupon the forward annular end of driver 47 forces the valve 64 forwardly until the forward flange of the valve engages the inner annular end 70 of casing section 1. At this time the ports 57 of driver 47 register with ports 58 in casing section 1, and compressed air flowing through driver 47 from the connected air line (not shown) enters annular chamber 61 and passes out through the blower ports 62 in casing section 1 and assists in removing the cuttings from the hole being drilled. Approximately half the air continues straight through the casing section 1 and enters a check valve arrangement which will now be described.

This arrangement includes a check valve body 72 and the following parts located in the back head section 2 of the drill casing: a check valve body cover 73 positioned rearwardly of valve body 72 and provided with a central air passage 75 and an annular flange 76 of reduced diameter in which the rear annulus of check valve body 72 is seated; a blower tube inlet piece 77 positioned forwardly of valve body 72 and having an annular edge seated in the forward end of valve body 72; and a blower tube retainer 78 positioned forwardly of blower tube inlet piece 77 and having a stepped tubular rear end seated in the mating forward end of inlet piece 77 and an annular forward end seated on the reduced annular ledge 79 on the inner cylindrical surface of casing section 2.

The check valve body **72**, blower tube inlet piece **77** and blower tube retainer **78** all have an external diameter which is less than the internal diameter of casing section **2** to form an annular air chamber **80**. The rear terminus of air chamber **80** is formed by the valve body cover **73** while the forward terminus of air chamber **80** is formed by the annular ledge **81** on the inner cylindrical surface of casing section **2**. The blower tube retainer **78** supports a blower tube **82** which extends forwardly through the forward end portion of the fluid supply passage **27** in casing section **2** (FIG. 1), tube **29** of valve **8** (FIG. 2), central bore **41** of piston **7**, and the axial bore **12** in the shank of drill bit **9**, to a point adjacent the cutters **10** of the drill bit. A coil spring **83** shown at the bottom of FIG. 1 is compressed between the forward end of retainer **78** and the cover of valve **8** shown at the top of FIG. 2.

The check valve body **72** (FIG. 1) has a valve **86** which is constantly urged upwardly by spring **87** into a closed position in engagement with the forward end of valve body cover **73**, and, when said valve **86** is closed, it cuts off the supply of air flowing downwardly to the portion of the rock drill forwardly of valve **86**. This arrangement is provided to trap air in the portion of the rock drill forwardly of the valve **86** to prevent water, mud and cuttings from entering the forward end of the rock drill when drilling operations are interrupted. However, when the drill is operating said valve **86** is held open (as shown in FIG. 1) by the velocity impact of the air on the valve, and the pressure drop across the valve. Air flowing through air passage **75** in cover **73** is forced to make an **S** turn in order to pass through radially positioned ports **88** in valve body **72** and into the annular chamber **80** (FIGS. 1 and 6). The air is forced to make this **S** turn to prevent the pulsating air flow to the drill to cause the valve to flutter, as is the case with certain types of check valves. The valve body **72** also has ducts **89** and **90** leading from the valve cylinder to the annular air chamber **80**, as shown in FIGS. 1 and 6. The purpose of duct **89** is to provide an air cushion to prevent valve **86** from impacting on the associated shoulder of valve body **72** when the valve is driven forward. The purpose of duct **90** is to insure that, when valve **86** is closed and in engagement with valve body cover **73**, any increase of pressure forwardly of said valve aids in holding the valve closed.

The supply of air travelling downward in annular chamber **80** around the check valve body **72** divides again, some of it passing through ports **92** in blower tube inlet piece **77** (FIGS. 1 and 7) into the blower tube **82**, while the remainder passes through ports **93** in blower tube retainer **78** (FIGS. 1 and 8) and enters the fluid supply passage **27** in casing section **2** to be conducted to valve **8** to actuate the piston **7** as previously described.

When the rock drill of FIGS. 1 and 2 is operating, and the drill bit **9** is raised off the hole bottom approximately six inches, the following happens: The circulating sub body section **1** extends to its maximum length, sub driver **47** extending rearwardly from chuck **45**. The blower valve **64** moves downward, compressing spring **65** and uncovering ports **58** to permit pressure fluid flowing through supply passage **27** to flow through annular chamber **61** and blower ports **62** to atmosphere for full blowing. The valve **64** moves forward against spring **65** because the area of the pressure surface of the lower end of valve **64** is smaller than the area of the pressure surface of the upper end of the valve. Since almost all of the air flowing through supply passage **27** is used for full blowing, the piston and the drill bit remain inoperative during full blowing. When the drill is fed down against the bottom of the hole sub driver **47** moves forwardly to provide for ports **57** to register with ports **58** so that a portion of the pressure fluid flowing through passage **27** to operate the drill is conducted through ports **57**, **58** and blower ports **62** to assist in cleaning the hole during operation of the drill.

In the embodiment of the invention illustrated in FIG. 3, the rear or upper threaded end portion **4** of the back head section **2** is connected directly to a head **96** which is threaded at **97** for connection to the drill piping. In this drill the circulating sub body, the circulating sub driver, and the blower valve and associated parts illustrated in the upper half of FIG. 1 are omitted. Hence, all the air entering the head **96** from the air line passes downwardly through the central air passage **75** in the check valve body cover **73**. From this point on, the operation of the rock drill is the same as that previously described.

Although certain embodiments have been shown and described herein for purposes of illustration, it will be evident to those skilled in the art that the invention is capable of various modifications and adaptations within the scope of the appended claims.

I claim:

1. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, a passage within the casing in communication with said source of air under pressure to direct a portion of the air therein to said control means and another portion of said air directly into said drill bit, a check valve operatively associated with said passage to control the flow of air through said passage, and a second passage within said casing for blowing a portion of the initial incoming air out through said casing in advance of said valve.

2. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, of means in said casing controlling the flow of air to said control means comprising a generally tubular member having a portion of its outer surface spaced from the inner surface of said casing and forming an annular air chamber, ports in said member connecting the interior of said casing to said chamber to supply air to the latter, a check valve in said member biased to close said ports and actuated by the pressure of air in said casing to open said ports, a blower tube carried by said member and extending through said casing and the aligned bores in said piston and said drill bit to a point adjacent the working edge of the latter, and means in said member for supplying air from said chamber partly to said blower tube and partly to the interior of said casing in advance of said control means.

3. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, of means in said casing controlling the flow of air to said control means com-

prising a generally tubular member having a portion of its outer surface spaced from the inner surface of said casing and forming an annular air chamber, ports in said member connecting the rear of said chamber with the interior of said casing, a check valve in said member biased to close said ports and actuated by the pressure of air in said casing to open said ports, a blower tube carried by said member and extending through said casing and the aligned bores in said piston and said drill bit to a point adjacent the working edge of the latter, and ports in said member connecting said chamber to said blower tube and to the interior of said casing in advance of said control means.

4. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, of means in said casing controlling the flow of air to said control means comprising a generally tubular member having a portion of its outer surface spaced from the inner surface of said casing and forming an annular air chamber, ports in said member connecting the rear of said chamber with the interior of said casing, a check valve in said member biased to close said ports and actuated by the pressure of air in said casing to open said ports, a blower tube carried by said member and extending through said casing and the aligned bores in said piston and said drill bit to a point adjacent the working edge of the latter, ports in said member connecting an intermediate portion of said chamber to said blower tube, and additional ports in said member connecting the forward portion of said chamber to the interior of said casing in advance of said control means.

5. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing adjacent said piston for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, of means in said casing controlling the flow of air to said control means comprising a generally tubular member having a portion of its outer surface spaced from the inner surface of said casing and forming an annular air chamber, ports in said member connecting the rear of said chamber with the interior of said casing, a check valve in said member biased to close said ports and actuated by the pressure of air in said casing to open said ports, ducts in said member beneath said valve and connected to said chamber to air cushion said valve, a blower tube carried by said member and extending through said casing and the aligned bores in said piston and said drill bit to a point adjacent the working edge of the latter, ports in said member connecting an intermediate portion of said chamber to said blower tube, and additional ports in said member connecting the forward portion of said chamber to the interior of said casing in advance of said control means.

6. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore

therein aligned with the bore in said piston, and means in said casing including a valve for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, of means in said casing controlling the flow of air to said valve comprising a generally tubular member having an elongated portion of its outer surface intermediate its ends spaced from the inner surface of said casing and forming an annular air chamber, ports in said member connecting the rear of said chamber with the interior of said casing, a check valve in said member spring-biased to close said ports and actuated by the pressure of air in said casing to open said ports, ducts in said member beneath said check valve and connected to said chamber to air cushion said check valve, a blower tube carried by said member and extending through said casing and the aligned bores in said piston and said drill bit to a point adjacent the working edge of the latter, ports in said member connecting an intermediate portion of said chamber to said blower tube, and additional ports in said member connecting the forward portion of said chamber to the interior of said casing in advance of said first-mentionted valve.

7. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, a sub casing secured to the rear end of said outer casing as a rearward extension of the latter, an annular air blower chamber outside said sub casing, blower ports connecting said blower chamber to atmosphere, air ports in said subcasing leading into said blower chamber, a driver rotatably and slidably secured within the rear end of said sub casing and adapted to be connected to a source of air under pressure, a blower valve slidably mounted in said sub casing forwardly of said driver and adapted to close the air ports in said sub casing, said blower valve being biased to close said air ports in said sub casing and being exposed to the air pressure within said driver and said sub casing to open said air ports and being exposed to the compressive action of said driver, and ports in said driver registrable with the air ports in said sub casing for blowing air from said driver through said blower chamber and said blower ports to atmosphere.

8. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, a tubular sub casing secured to the rear end of said outer casing as a rearward extension of the latter, and in which an annular portion of said sub casing adjacent said outer casing has its outer diameter reduced, a collar surrounding said reduced annular portion of said sub casing and forming therewith an annular air blower chamber, blower ports in said collar connecting said blower chamber to atmosphere, air ports in said sub casing leading into said blower chamber, a tubular driver rotatably and slidably secured within the rear end of said sub casing and adapted to be connected to a source of air under pressure, a blower valve slidably mounted in said sub casing forwardly of said driver and adapted to close the air ports in said sub casing, said blower valve being biased to close said air

ports in said sub casing and being exposed to the air pressure within said driver and said sub casing to open said air ports and being exposed to the compressive action of said driver, and ports in said driver adjacent the forward end thereof registrable with the air ports in said sub casing for blowing air from said driver through said blower chamber and said blower ports to atmosphere.

9. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, a tubular sub casing secured to the rear end of said outer casing as a rearward extension of the latter, and in which an annular portion of said sub casing adjacent said outer casing has its outer diameter reduced, a collar surrounding said reduced annular portion of said sub casing and forming therewith an annular air blower chamber, blower ports in said collar adjacent the forward end of said blower chamber connecting the latter to atmosphere, air ports in said sub casing leading into the rear end of said blower chamber, a tubular driver rotatably and slidably secured within the rear end of said sub casing and adapted to be connected to a source of air under pressure, a blower valve slidably mounted in said sub casing forwardly of said driver and adapted to close the air ports in said sub casing, said blower valve being spring-biased to close said air ports in said sub casing and being exposed to the air pressure within said driver and said sub casing to open said air ports and being exposed to the compressive action of said driver, and ports in said driver adjacent the forward end thereof registrable with the air ports in said sub casing for blowing air from said driver through said blower chamber and said blower ports to atmosphere.

10. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, a tubular sub casing secured to the rear end of said outer casing as a rearward extension of the latter, and in which an annular portion of said sub casing adjacent said outer casing has its outer diameter reduced, a collar surrounding said reduced annular portion of said sub casing and forming therewith an annular air blower chamber, blower ports in said collar adjacent the forward end of said blower chamber connecting the latter to atmosphere, air ports in said sub casing leading into the rear end of said blower chamber, a tubular driver rotatably and slidably secured within the rear end of said sub casing and adapted to be connected to a source of air under pressure, a blower valve slidably mounted in said sub casing forwardly of said driver and adapted to close the air ports in said sub casing, said blower valve being spring-biased to close said air ports in said sub casing and having a relatively small forward annular edge and a relatively large rear annular edge exposed to the air pressure within said driver and said sub casing and having said rear annular edge exposed to the compressive action of said driver, and ports in said driver adjacent the forward end thereof registrable with the air ports in said sub casing for blowing air from said driver through said blower chamber and said blower ports to atmosphere.

11. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, a tubular sub casing secured to the rear end of said outer casing as a rearward extension of the latter, and in which an annular portion of said sub casing adjacent said outer casing has its outer diameter reduced, a collar surrounding said reduced annular portion of said sub casing and forming therewith an annular air blower chamber, rearwardly slanted blower ports in said collar adjacent the forward end of said blower chamber connecting the latter to atmosphere, air ports in said sub casing slanted forwardly into the rear end of said blower chamber, a tubular driver rotatably and slidably secured within the rear end of said sub casing and adapted to be connected to a source of air under pressure, a blower valve slidably mounted in said sub casing forwardly of said driver and adapted to close the air ports in said sub casing, said blower valve being spring-biased to close said air ports in said sub casing and having a relatively small forward annular edge and a relatively large rear annular edge exposed to the air pressure within said driver and said sub casing and having said rear annular edge exposed to the compressive action of said driver, and ports in said driver adjacent the forward end thereof registrable with the air ports in said sub casing for blowing air from said driver through said blower chamber and said blower ports to atmosphere.

12. The combination with a down-the-hole rock drill having a tubular outer casing adapted to be connected to a source of air under pressure, a piston reciprocably mounted in said casing and having an axial bore and forward and rear pressure surfaces, a drill bit in said casing actuated by said piston and having an axial bore therein aligned with the bore in said piston, and control means in said casing for directing air under pressure alternately to the forward and rear pressure surfaces of said piston to actuate said drill bit and to exhaust said air through the bore in said drill bit, of a passage in said casing in communication with said source of air under pressure to direct a portion of air in the passage to said control means and another portion of such air directly into said drill bit, a check valve operatively associated with said passage to control the flow of air through said passage, and a passage in said casing for blowing a portion of the initial incoming air out through said casing in advance of said valve, a sleeve longitudinally movable in said casing, a valve actuated by said sleeve to control said passage.

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