

Feb. 2, 1943.

J. W. HADDOCK

2,310,001

APPARATUS FOR CLEANING HOLES

Filed March 27, 1940

2 Sheets-Sheet 1

Fig. 1.

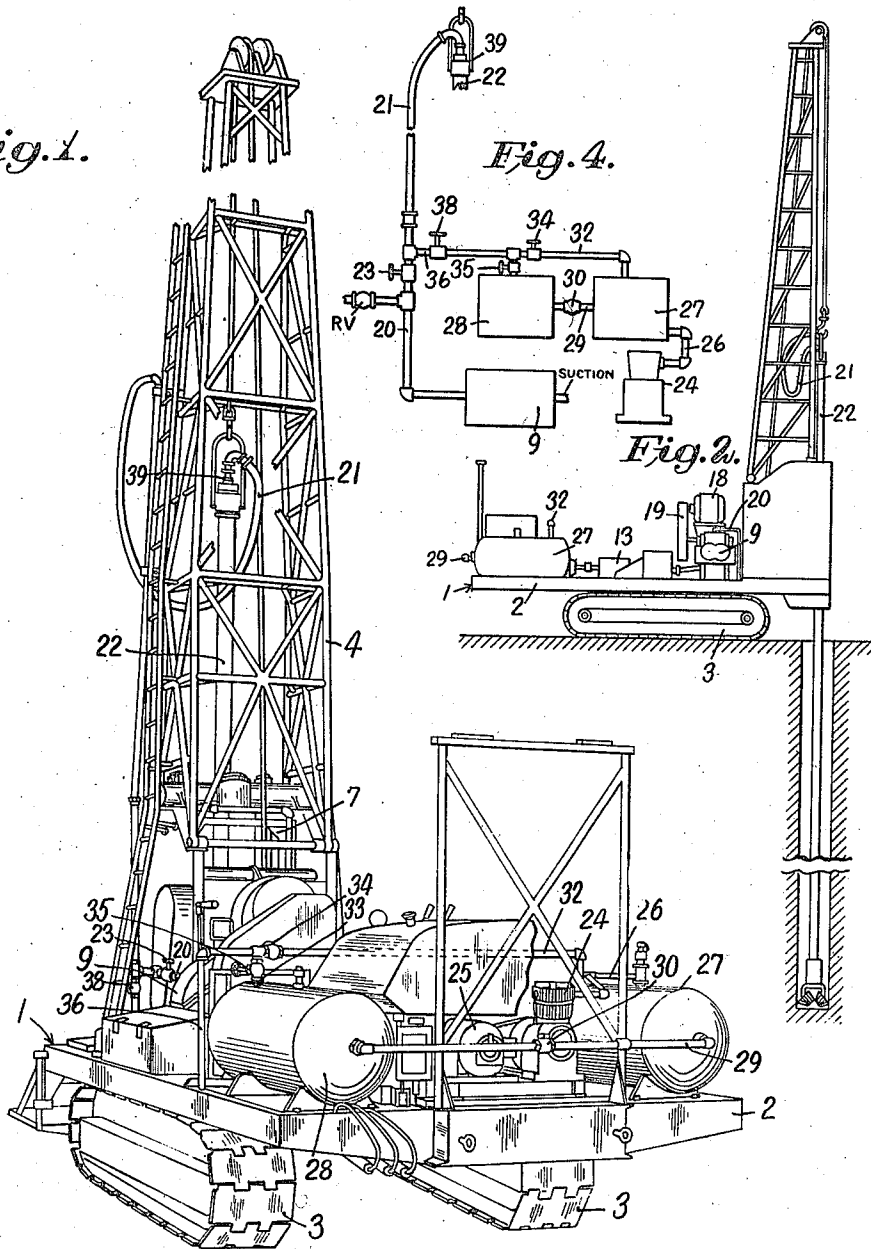


Fig. 4.

Fig. 2.

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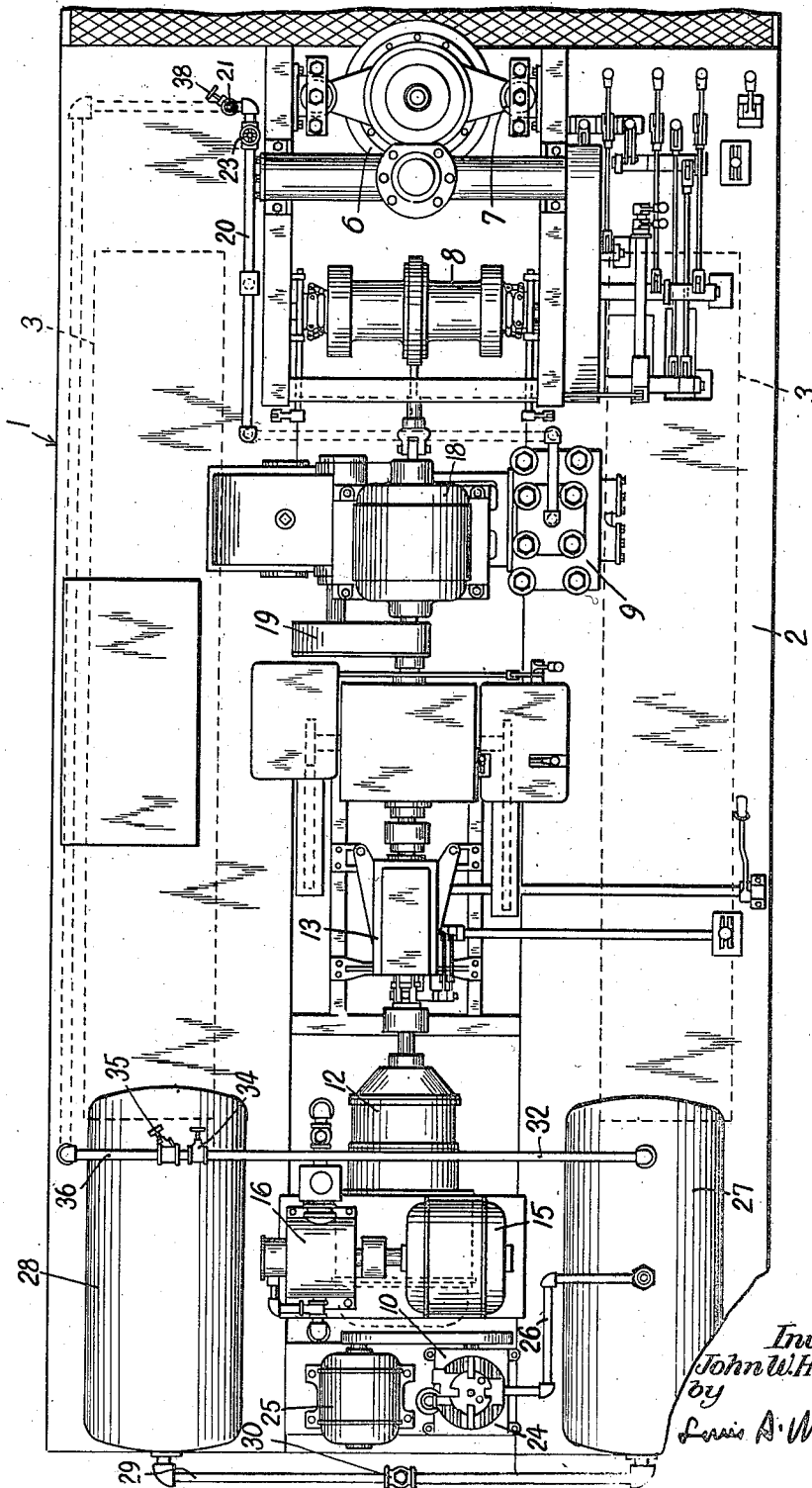
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2 Sheets-Sheet 2

Fig. 3.



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UNITED STATES PATENT OFFICE

2,310,001

APPARATUS FOR CLEANING HOLES

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of Massachusetts

Application March 27, 1940, Serial No. 326,249

1 Claim. (Cl. 255—19)

This invention relates to apparatus for cleaning holes drilled in the earth and more particularly to improved apparatus for removing water and loose material from a substantially vertical blast hole in which the drilling has been completed preparatory for the reception of a blasting charge.

In certain mining operations, such as overburden removal, it is customary procedure to drill relatively vertical holes of substantial depth and to load the same with a suitable charge of explosive, and then to shoot them singly or in groups as may be found best at the particular operation. During the drilling of such holes, cuttings are commonly removed by circulating water, delivered through a passage formed longitudinally through the drill rod, to the bottom of the hole, where it washes away the cuttings from the bit, and carries them upwardly about the drill rod and out of the hole. After the hole has been drilled to the required depth it will, of course, be filled, around the drill rod, with water having cuttings suspended therein, and these cuttings start settling to the bottom of the hole as soon as the circulation of water stops. Before the explosive is placed in the hole it is important that all the cuttings and practically all the water be removed. A bailing process is not satisfactory, because it is difficult to clear out the last several feet at the bottom of the hole, since the cuttings settle out very rapidly once water delivery through the drill rods is discontinued. And bailing is slow and may take almost as much time as drilling. When it is desired to shoot the holes promptly after they are drilled to the required depth some other procedure is highly desirable. I have found that by accumulating a substantial volume of air at considerable pressure and then releasing the air in large volume at the bottom of the hole the air will act much like a plunger and will force the water and loose material ahead of it out of the hole, and effect a relatively complete and very rapid cleaning of the latter. If the air is accumulated during the drilling operation and released very shortly after the liquid circulation is ended and while a large part of the cuttings still in the well are yet in suspension, a most effective job can be done. The results will be entirely different from those which would be secured by discharging an air stream for a substantial period at the bottom of the hole. That procedure would obviously wholly fail to remove the major part of the liquid, and an even larger percent of the cuttings would be left unremoved. My improved apparatus, however, is effective in a single brief operation to place the hole in the desired condition, and if it be de-

sired to bail out any water which may run back down the walls of the hole this is easy and may be done very quickly and there will be no complications due to a semi-solid mass of cuttings filling a substantial part of the bottom of the hole.

It is therefore an object of my invention to provide an improved apparatus for cleaning a hole. It is another object of this invention to provide an improved apparatus for removing water and any loose material that remains in a hole after drilling has been completed. It is still another object of this invention to provide an improved apparatus for removing water and loose material from a drilled hole, utilizing a gaseous fluid under pressure for forcing the water and material from the hole. It is still another object of this invention to provide an improved apparatus for removing water and loose material from a drilled hole by supplying compressed air through the drill rod to the bottom of the hole in such quantities and at such a pressure that the air acts upon the water substantially as a solid plunger, forcing the water and material before it from the hole. Still another object of my invention is to provide an improved apparatus for cleansing substantially vertical drill holes. Yet a further object is to provide an improved apparatus for drilling substantially vertical blast holes and preparing them for loading. Other objects and advantages of the invention will hereinafter more fully appear.

In the accompanying drawings there is shown one form of apparatus which the invention may assume in practice.

In these drawings:

Fig. 1 is a perspective view of a drill rig constituting an illustrative embodiment of the apparatus.

Fig. 2 is a diagrammatic side elevational view on a reduced scale, showing the drill rig of Fig. 1 in drilling position.

Fig. 3 is an enlarged plan view of the drill rig with the derrick removed.

Fig. 4 is a schematic diagram showing the connection of the air tanks and the mud pump to the drill rod.

Referring to the drawings, it will be noted that there is shown a drill rig, generally designated 1, comprising a platform 2 supported by tractor treads 3, 3 and having mounted thereon a derrick mast 4, a drill rod rotation mechanism 6, hydraulic drill rod feeding mechanism 7, a hoist mechanism 8, a mud pump 9 and air blast mechanism generally designated 10. A power unit 12 is connected through transmission mechanism 13, whose mechanism is not illustrated in detail as

per se it does not affect the invention, for driving the tractor treads 3, the drill rod rotation mechanism 6 or the hoist mechanism 8. A power unit 15 drives a hydraulic pump 16 for pumping, through suitable conduit and control means not shown in detail, operating fluid to the drill rod feeding mechanism 7. A power unit 18 is connected through a belt 19 to the mud pump 9 and drives the latter to force water or any other desired drilling fluid through a pipe line 20, a hose connection 21 and the drill rod 22 to the bottom of the hole during drilling. The flow of water from the pipe line 20 to the hose connection 21 is controlled by a manually operated valve 23 located at the forward end of the drill rig where it is close to the other controls and within easy reach of the operator. A suitable safety—or relief—valve closed connection having a relief valve RV therein leads from the line 20 short of the valve 23. The air blast mechanism comprises a small compressor 24 driven by a motor 25 for delivering air through a pipe connection 26 to a receiver tank 27. In this construction there is shown a second receiver tank 28 connected to the tank 27 through a pipe connection 29 having a valve 30 which permits fluid to flow only toward the tank 28. The tanks 27 and 28 are connected through pipes 32 and 33 under the control of manually operated valves 34 and 35 to a conduit 36 which is also connected to the hose 21 leading to the end of the drill rod 22. A manually operated valve 38 located close to the valve 23 controls the supply of air through the conduit 36 to the hose 21. As the structure of the drill rig more in detail does not enter into this invention, further detailed description thereof is herein unnecessary.

During the operation of the drilling apparatus the power unit 12 drives the drill rod rotation mechanism 6 through the transmission mechanism 13, and the feeding of the drill may be controlled by the supply of liquid from the pump 16 to the hydraulic drill rod feeding mechanism 7. The hose connection 21 is connected to the end of the drill rod through a suitable water swivel 39 and when the valve 23 is opened and the motor 18 is started to drive the pump 9 water is forced through the drill rod to the bottom of the hole where it washes away the cuttings and carries them out of the hole. The compressor 24 is driven by the motor 25 while the hole is being drilled to build up a pressure in the tanks 27 and 28. Since there will be material time for building up the pressure in the tanks the size of the compressor may be comparatively small. After the drilling has been completed the mud pump is stopped and the valve 23 is closed and the valves 34 and/or 35 and 38 are opened and an air blast at substantial pressure and of large volume is delivered through the hose 21 and the drill rod to the bottom of the hole for removing water and any loose material therefrom. The air blast may be delivered from one or both of the air tanks to the conduit 36 by manipulating the valves 34 and 35, and is supplied from the conduit 36 to the hose connection 21 under the control of the valve 38. If the hole is of such depth that the discharge from one of the air tanks will be sufficient to blow out the hole, then it will be necessary to open only the valve 34 and supply compressed air to the conduit 36 from the tank 27. The escape of air from the tank 28 will be prevented by the one way valve 30 and by the manually operated valve 35. If a second blast of air should be necessary to clean out the hole the

valve 34 may be closed to prevent the air from passing into the tank 27 and then the valve 35 may be opened to connect the tank 28 with the conduit 36. If a large volume of air is needed to effect a cleaning of the hole the valves 34 and 35 are both opened to connect the tanks to the conduit 36. Air at a pressure of the order of 125 pounds per square inch has been found satisfactory with blast holes of the depth used for ordinary overburden shooting, but it will be noted that the pressure may be varied to suit conditions, and the value mentioned is but illustrative.

The size of the air tanks, the pressure of the air within the tanks and the cross sectional area of the passageways leading from the tanks to the bottom of the drilled hole will best be such that the air will be supplied suddenly in a large volume to act against the contents of the hole at a high and relatively constant pressure until the water ahead of the air blast has been forced from the hole. If the air passages are made of suitable size it will be appreciated that air in such volume can be discharged into the bottom of the hole that it will act virtually as a solid annular plunger and blow all the water and cuttings before it out of the hole. Any water that may drain back from the walls will be in such small quantity that it may be quickly removed with a bailer. Obviously, if desired, the drill bit may be removed before the air blast is to be discharged through the drill rod line, and if desired a separate air discharge line of adequate volume could be used, being inserted after drilling is completed, without departing from the scope of the invention. It may be noted that, without limitation thereto, my invention includes means for delivering to the bottom of a hole of a gaseous fluid in such volume and at such pressure that it is capable of providing at least a momentary flow at a pressure exceeding the static pressure at the bottom of the hole and filling the full volume between the fluid delivery conduit and the wall of the hole. It will be self-evident, however, that this condition is not critical, as aeration of the column of liquid will enable a smaller temporarily maintained flow pressure to clean the hole adequately, and a removal of some liquid by natural flow following aeration, and at least the balance of the remainder by a rushing annular air column, is within the scope of the invention also.

As a result of this invention, it will be noted that an improved apparatus for cleaning a drilled hole is provided. It will further be noted that the cleaning of a hole by this improved apparatus may be effected more quickly, easily and effectively than is possible by any other means of which I am advised. Other advantages of this improved apparatus of cleaning drilled holes will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and embodied in other forms without departing from its spirit or the scope of the appended claim.

What I claim as new and desire to secure by Letters Patent is:

An apparatus for forming vertical or substantially vertical blast holes and preparing them for the reception of a blasting charge comprising, in combination, means including a drilling instrumentality attached to and operated by a tubular rod line for drilling a vertical or substantially vertical hole, means for conducting a cleansing

liquid through the rod line to the bottom of the drill hole to wash away the cuttings from the vicinity of the drilling instrumentality during the drilling operation, means for discontinuing the flow of cleansing liquid through the rod line to the bottom of the drill hole when the drilling operation is completed, and means for suddenly discharging a large volume of compressed gaseous fluid through the rod line, while the drilling

instrumentality remains in the hole and the cuttings and mud are in suspension in the liquid, to the bottom of the hole and at a pressure exceeding the static hydraulic head at the bottom of the hole sufficiently substantially completely to blow out the cleansing liquid, cuttings and mud remaining in the bottom of the hole.

JOHN W. HADDOCK.

CERTIFICATE OF CORRECTION.

Patent No. 2,310,001.

February 2, 1943.

JOHN W. HADDOCK.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 64, before the word "embodied" insert --that the invention may be modified and--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of April, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.