Aug. 27, 1940. P. W. APPLEBY 2,212,491

WELL WASHING DEVICE

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Fig. 1

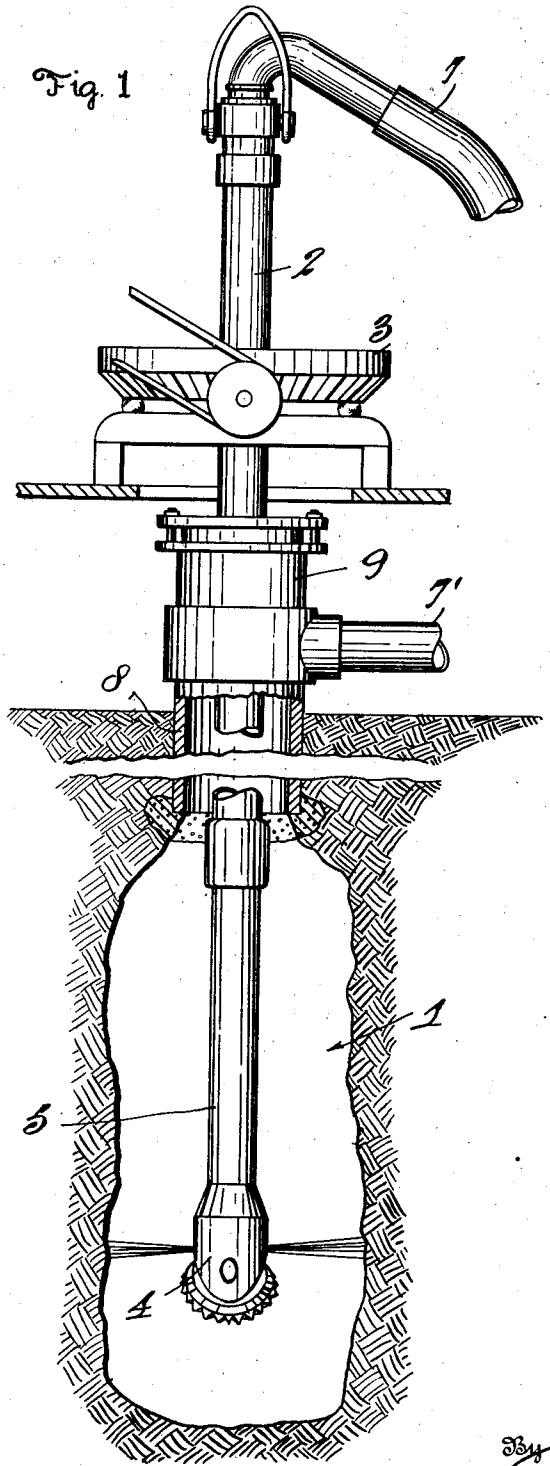
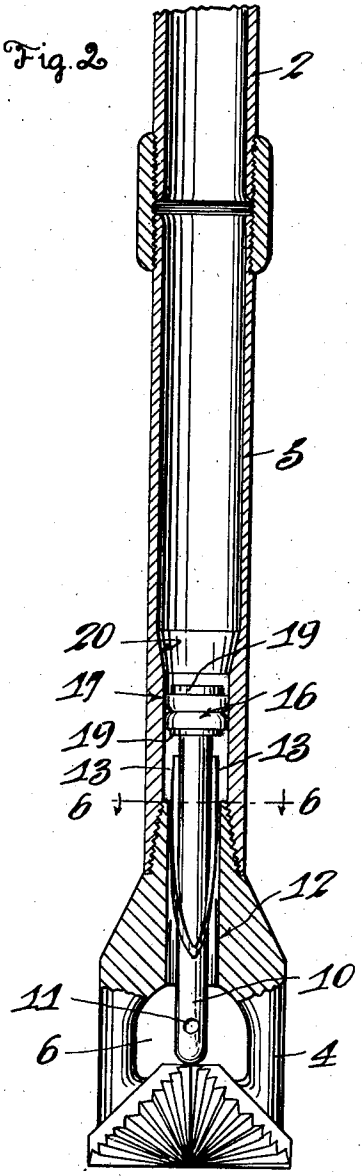


Fig. 2



Inventor

Peter W. Appleby

By J. Austin Sweeten

his Attorney

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Fig. 3

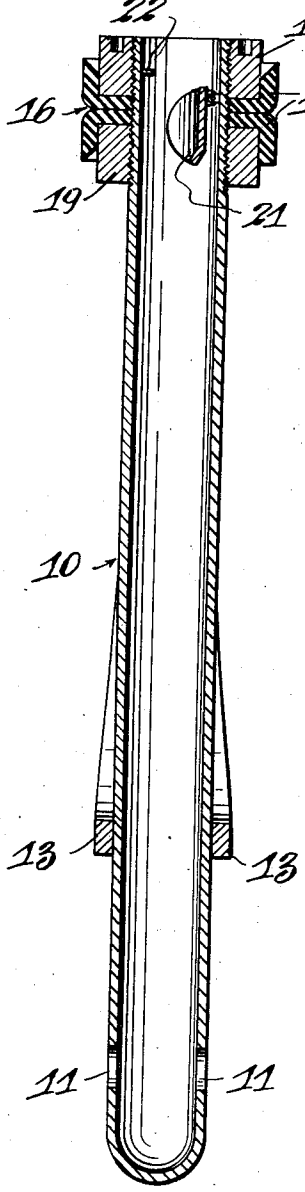


Fig. 4

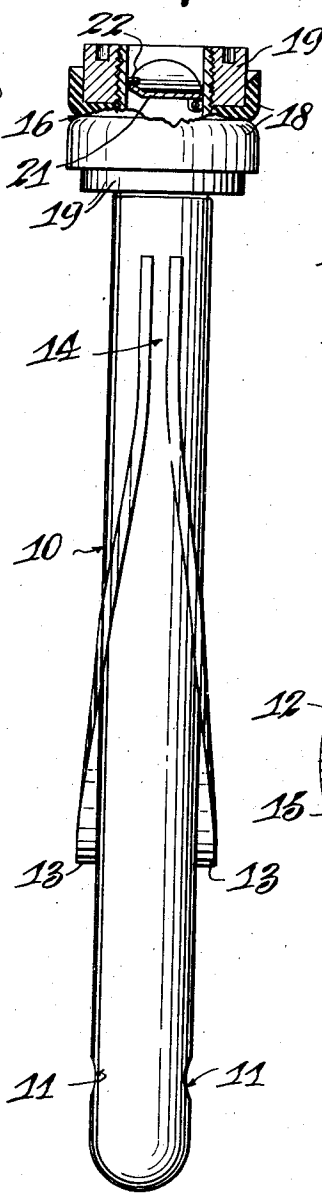


Fig. 5

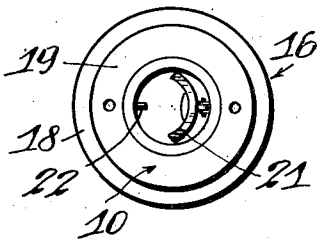
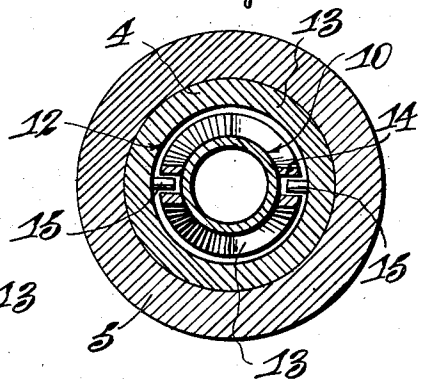


Fig. 6



Inventor

Peter W. Appleby

By J. Preston Smucker

Attorney

Patented Aug. 27, 1940 2,212,491

UNITED STATES PATENT OFFICE

2,212,491

WELL WASHING DEVICE

Peter W. Appleby, Odessa, Tex.

Application August 29, 1939, Serial No. 292,524

15 Claims. (Cl. 255—71)

This invention relates to an improvement in well washing devices, particularly for the cleaning of debris from the walls of deep wells by the forcing of liquid under pressure against the walls to wash down the debris therefrom.

Various attempts have been made heretofore to provide for such washing action, but these have utilized complicated valve arrangements, and due to their complexity of structure and to the springs usually associated therewith, they become inoperative and impractical for use in a conduit system through which the foreign matter and debris must pass in being discharged from the well.

The object of this invention is to provide for the washing of the walls of the well and the removal of the washing device without the removal of the tubing from the well, whereby the washing unit may be introduced in the tubing while it is in the well to accomplish the washing action and then removed therefrom readily and simply without removing the tubing.

Another object of the invention is to improve the construction of the well washing device, to render it free of complicated mechanism, simple in construction and operation, and capable of relatively low cost of manufacture.

In carrying out these objects, the invention utilizes a well washing tool adapted to be introduced into the upper end of the drill stem or tubing to be forced downward therein to the lower portion of the well in such position as to provide for the radial discharge of the washing fluid outwardly against the walls of the well to wash the debris therefrom. Provision is made in the tool for its removal automatically at the completion of the washing operation by the introduction of fluid pressure from a point exterior to and below the tool, causing the latter to be moved upward in and discharged from the drill stem or tubing.

These features are embodied in a preferred form of the invention which is shown in the accompanying drawings in which:

Fig. 1 is a side elevation of a rotary drilling unit in position in a well, parts being in section;

Fig. 2 is a vertical sectional view through the lower portion of the drilling apparatus, with parts shown in elevation;

Fig. 3 is a vertical sectional view through the tool;

Fig. 4 is a side elevation thereof partly in section;

Fig. 5 is a top plan view of the tool; and

Fig. 6 is a horizontal sectional view through the drill collar and tool, on the line 6—6 of Fig. 2.

The invention is shown in connection with rotary drilling apparatus of more or less conventional form, shown as used in a well designated generally by the numeral 1. The drilling apparatus utilizes a drill stem or tubing 2 operatively connected with a rotary table 3 of a conventional rotary rig. The rotary table 3 is designed for rotating the tubing 2 to accomplish the drilling action, for which purpose the tubing 2 carries the drill bit 4 on the lower end thereof through the medium of a drill collar 5. The drill bit 4 is provided with cutting teeth of the usual character and has openings 6 laterally thereof for the discharge of fluid that is forced downward through the drill stem 2 from a conduit 7 connected with the upper end thereof during the drilling operation.

The drill stem 2 operates in a casing 8 which lines the well 1 to a point spaced above the lower end thereof and which casing 8 is closed at its upper end around the drill stem 2 by means of a packing gland 9 of conventional construction. A pipe 7' is shown as connected with one side of the packing gland 9 for the discharge of fluid from the well or for the introduction of fluid around the drill stem within the casing.

Normally the drilling operation progresses in the well by the rotation of the drill stem 2 and its drill bit 4 which are fed downward in the casing 8. During the drilling operation, it is frequently desirable to wash down debris from the side walls of the well, and heretofore this has usually required the pulling of the drill stem from the well to introduce the washing device thereto, but this invention has provision for the introduction of a washing unit into the drill stem to accomplish the washing action without the removal of the drill stem from the well, and thereafter the washing unit may be removed.

For this purpose, I utilize a tubular tool designated generally by the numeral 10 which is substantially elongated and preferably has a closed lower end but is provided with lateral openings 11 in opposite sides thereof. The tool 10 is adapted to be introduced into a passageway 12 through the upper portion of the drill bit 4 that communicates with the drill collar 5 and drill stem 2 thereabove. The sides of the tool 10 are provided with substantially spiral or longitudinal curved ribs 13 on opposite sides thereof, the upper ends of which ribs are brought relatively close together to form a guideway 14, as shown in Figs. 4 and 6 to receive therebetween a pin 15 project-

ing inward from each opposite side of the axial bore 12 in the drill bit 4.

The upper end portion of the tool 10 is provided with a surrounding piston or packing designated generally by the numeral 16 which may be of any suitable construction designed to fit closely within the bore 17 of the drill collar 5. In the form shown, this packing structure 16 is formed by opposed packing cups 18 surrounding the upper end portion of the tool 1 and is held in place by locking rings 19 threaded thereon. To guide the tool 10 into the bores of the drill collar 5 and drill bit 4, the upper end of the bore 17 is beveled off or flared at 20, which tends to compress the packing rings 18, or other packing means to provide a fluid tight fit of the piston structure 16 within the bore 17 of the drill collar.

The upper end portion of the tool 10 is provided with a downwardly opening check-valve 21 pivotally mounted within the tool in position to close against a stop pin 22 which limits the closing movement of the check-valve.

In the operation of the device, when it is desired to wash the walls of the well, a suitable washing fluid, preferably oil, may be used for the purpose. The tool 10 is first introduced into the upper end of the drill stem 2 and dropped through the drill stem where it continues downward until its lower end passes through the bore 12 in the drill bit 4, substantially in the position shown in Fig. 2. Its downward travel will be cushioned when it nears its lower position by the compressing means 16, so that the lower end of the tool 10 will not strike the cutters of the drill bit with sufficient force to cause damage thereto. The curved ribs 13 and trackway 14 will coact with the pins 15 to turn the tool 10 to its proper position for registry of the openings 11 with the openings 6 in the drill bit for the proper lateral discharge of fluid therethrough.

After the tool 10 is in place in the lower portion of the drilling apparatus, the cleaning fluid is pumped downward through the drill stem from the conduit stem 7, and it will be directed through the tool 10 and discharged through the openings 11 thereof and laterally through the openings 6 in the drill bit, against the side walls of the well, substantially as illustrated in Fig. 1. This may continue until the desired washing action has been accomplished.

Thereafter, the pumping of fluid downward through the casing 8 from the pipe 7' will create sufficient pressure in the bottom of the well to force fluid upward through the bore 12 in the drill bit and the bore 17 in the drill collar 5 to act against the under side of the packing 16, which will force the tool 10 upward in the drill stem for removal in the upper part thereof, if desired. During this action, the fluid pressure in the tool 10 causes the check-valve 21 to close against the pin 22 to prevent the leakage of fluid therethrough and to direct the full force of the fluid against the packing 16.

I claim:

1. In a well drilling unit, the combination of a string of pipe having a lateral discharge opening in the lower portion thereof, a tool in said string of pipe adapted to be dropped down from the upper end thereof to the lower end portion thereof in the well and having a passageway therethrough with a lateral opening in position to register with the opening in the string of pipe and to direct fluid therethrough against the side wall of the well, and means for applying fluid pressure to said tool to eject the same from said string of pipe.

2. In a well drilling unit, the combination of a string of pipe having a lateral discharge opening at the lower portion thereof, a tool slidably mounted in the string of pipe for introduction thereto and having a passageway therein with a lateral discharge opening in position for communication with the opening in the string of pipe and to direct fluid therethrough against the side wall of the well, means for directing fluid through the passageway in the tool for lateral discharge, and means for applying pressure to the under portion of the tool for ejecting the same from the string of pipe.

3. In a well drilling apparatus, the combination of a string of pipe having a drill bit on the lower end portion thereof, a tool slidably mounted in the string of pipe adapted to be dropped down from the upper end thereof to the lower end portion thereof in the well and having a passageway therein with a lateral discharge opening above the cutting edges of the drill bit in the lower position thereof in position to direct fluid laterally of the string of pipe against the side wall of the well, and means for forcing fluid downwardly through the tool for lateral discharge.

4. In a well drilling apparatus, the combination of a string of pipe having a drill bit on the lower end portion thereof, said drill bit having cutting elements, a tool slidably mounted in the string of pipe adapted to be dropped down from the upper end thereof to the lower end portion thereof in the well and having a passageway therein with a lateral discharge opening above the cutting elements in the lower position thereof in position to direct fluid laterally of the string of pipe, means for forcing fluid downwardly through the tool for lateral discharge, and a packing surrounding the tool between the same and the string of pipe.

5. In a well drilling apparatus, the combination of a string of pipe having a drill bit on the lower end portion thereof, a tool slidably mounted in the string of pipe and having a passageway therein with a lateral discharge opening in position to direct fluid laterally of the string of pipe, means for forcing fluid downwardly through the tool for lateral discharge, a packing surrounding the tool between the same and the string of pipe, a check-valve within the tool passageway to close the same against upward movement of fluid therethrough, and means for directing fluid upwardly against the packing to eject the tool from the string of pipe.

6. In a well drilling apparatus, the combination of a drill bit, a tool slidably mounted in the drill bit and having a passageway therein with a lateral discharge opening in position to direct fluid laterally of the drill bit, said tool having a guideway on the periphery thereof, and means in position to engage in said guideway for turning the tool to its proper position relative to the drill bit.

7. In a well drilling apparatus, the combination of a string of pipe having a drill bit on the lower end portion thereof, a tool slidably mounted in the string of pipe and having a passageway therein with a lateral discharge opening in position to direct fluid laterally of the string of pipe, means for forcing fluid downwardly through the tool for lateral discharge, said tool having a guideway on the periphery thereof, and means in position to engage in said guideway for turning

the tool to its proper position relative to the string of pipe.

8. In a well washing device, the combination of a tubular structure adapted to be introduced into a well, a tool slidably mounted in the tubular structure and having a passageway therein provided with a discharge opening arranged to direct liquid laterally against the side walls of the well, means for forcing liquid downwardly through the passageway for discharge, and means for applying fluid pressure to the under side of the tool to eject the same from the tubular structure.

9. A well washing tool adapted to be introduced into a pipe in a well, comprising a tubular body having one or more lateral discharge openings in the lower portion thereof arranged approximately at right angles to the axis of the body, an external packing structure about the body above said discharge openings adapted to seal the opening in the pipe and cause the fluid to be directed through the tool, and means for closing the passageway through the body from below whereby the tool may be ejected from the pipe in the well by fluid pressure from below.

10. A well washing tool adapted to be introduced into a pipe in a well, comprising a tubular body having one or more lateral discharge openings in the periphery thereof arranged at an angle to the axis of the body in position to direct fluid therefrom against the side walls of the well, sealing means on the body above the one or more openings adapted to seal the opening in the pipe and cause the fluid to be directed through the tool, and means for closing the passageway through the body from below whereby the tool may be ejected from the pipe in the well by fluid pressure from below.

11. In a well washing device, the combination of a tubular structure adapted to be introduced into a well, and a tool slidably mounted in the tubular structure and adapted to be dropped from the upper portion thereof to the lower portion thereof in the well and having a passageway therein provided with a discharge opening arranged to direct washing fluid laterally against the side wall of the well, and means for ejecting the tool by fluid pressure from below from said lower position to the upper position in the tubular structure.

12. In a well washing device, the combination of a string of pipe, and a tool slidably mounted therein and adapted to be dropped from the upper portion thereof to the lower portion thereof in the well and having a passageway therein provided with a discharge opening below the string of pipe arranged for discharge of washing fluid toward the side wall of the well, and means for ejecting the tool by fluid pressure from below from said lower position to the upper position in the pipe.

13. In a well washing device, the combination of a string of pipe, and a tool slidably mounted therein and adapted to be dropped from the upper portion thereof to the lower portion thereof in the well and having a passageway therein provided with a discharge opening below the string of pipe arranged for discharge of washing fluid substantially in a horizontal direction toward the side wall of the well, and means for ejecting the tool by fluid pressure from below from said lower position to the upper position in the pipe.

14. In a well washing device, the combination of a string of pipe including a drill bit having cutting elements, and a tool slidably mounted in said string of pipe adapted to be dropped from the upper portion thereof to the lower portion thereof in the well and having a passageway therein provided with a lateral discharge opening above the cutting elements in the lower position thereof and arranged for discharge of washing fluid laterally against the side wall of the well.

15. In a well washing device, the combination of a string of pipe including a drill bit, said drill bit having cutters thereon, and a tool slidably mounted in the string of pipe with the lower end thereof resting on the cutters, said tool having a passageway therein communicating with the string of pipe and having a lateral discharge opening through the drill bit in position to direct washing fluid against the side wall of the well.

PETER W. APPLEBY.