

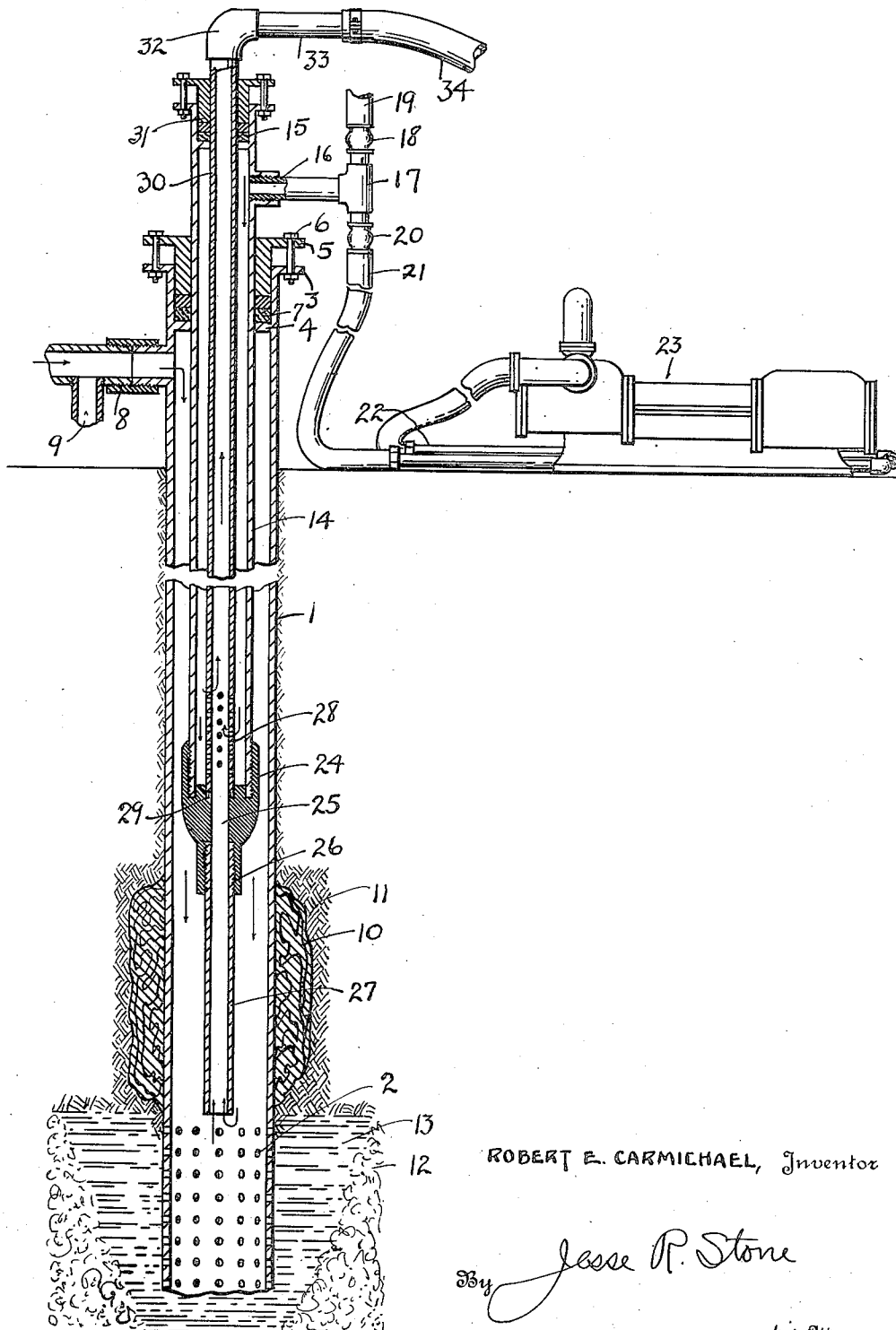
Feb. 19, 1924.

R. E. CARMICHAEL

1,484,601

WELL CLEANER

Filed Nov. 6, 1922



Patented Feb. 19, 1924.

1,484,601

UNITED STATES PATENT OFFICE.

ROBERT E. CARMICHAEL, OF HOUSTON, TEXAS.

WELL CLEANER.

Application filed November 6, 1922. Serial No. 599,274.

To all whom it may concern:

Be it known that I, ROBERT E. CARMICHAEL, a citizen of the United States, residing at Houston, Harris County, Texas, have
5 invented a certain new and useful Improvement in Well Cleaners, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the
10 same.

My invention relates to an improvement in the apparatus for and the process of cleaning wells of sand, shale and other material which tend to clog the pump during
15 the pumping operations, and prevent the oil from entering the apparatus.

It is frequently the case that when a well has been drilled into the pay strata, the oil is found to be contained within a fine sand
20 or a heaving shale which tends to cave or flow in toward the strainer or perforated pipe and to fill the pipe with the mixture of oil and shale and to clog the lower end of the pumping apparatus.

It is the object of my invention to provide a device which, when properly operated, will serve to remove the sand and shale from about the lower end of the casing or
25 pipe and to form a cavity adjacent the pipe into which the oil may flow and thus be pumped from the ground without the usual difficulty of clogging.

Another object is to provide an apparatus which may be readily installed and cheaply
30 operated so as to perform the functions stated.

Another object is to provide a process of removing the sand and shale from about the perforated pipe or strainer in the well so
40 that there will be no further tendency to clog the same while the pump is being operated.

Other objects and advantages of my improvement will be more fully set forth in the specification which follows, and will be set forth with particularity in connection with the claims appended hereto.

The figure of the drawings is a view in vertical section of the apparatus installed
50 in a well.

In carrying out my process I have formed an outer casing 1 which is perforated at 2 adjacent the lower end to allow the entrance thereto of the oil or water which is to be
55 pumped. The upper end of this casing is formed with a lateral flange 3 at the upper

end and a lower inwardly projecting flange 4 spaced somewhat below the upper end to form a stuffing box. A sleeve of the usual construction is adapted to fit within the casing and is adjustable vertically against the
60 packing 7 by means of a bolt 6 extending through a flange 5 upon the sleeve and through the adjacent flange 3 on the casing in the usual manner.

The casing has, below the stuffing box, a laterally extending inlet pipe secured to the casing by means of the coupling 8 and serving as an entrance for flushing fluid. This
65 pipe may have a laterally branching pipe 9 thereon through which air may be forced.

Extending through the stuffing box formed at 7 is an air-conducting pipe 14. This pipe is slidable through the stuffing
70 box 7 and extends downwardly into the well and is secured within a threaded nipple 24. The upper end of the pipe has a branching inlet 16 connected to a T 17 to allow the entrance of either air or water. Upon one
75 side of the T an inlet pipe 19 is connected, in which is formed a check valve 18 allowing the entrance of air under pressure, but adapted to prevent its escape outwardly. The pipe 19 is preferably made flexible so
80 as to allow the raising and lowering of the pipe 14 through the stuffing box, as desired.

On the other side of the T 17 is connected a pipe 21 having therein a check valve 20 allowing the passage of fluid inwardly but
85 not outwardly. The pipe 21 is preferably a flexible hose connected to a length of pipe 22 adjacent the device and at the other end of said pipe 22 to a pump 23. The pipe 22 is of sufficient length to prevent a rapid flow of fluid therein, as will be later described.

Within the air pipe 14 is an interior outlet pipe 30. This pipe is perforated at 28 adjacent the lower end and is seated within the swedged coupling 24 previously described, and fits within a central seat 29
90 therein. The lower end of the compound coupling 24 is reduced in diameter and threaded internally at 26 to receive a short length of pipe 27, said pipe being preferably of the same diameter as the pipe 30. Above
95 the coupling 24 the pipe 30 is perforated at 28 to allow air to enter the same from the inside of the pipe 14. This allows a passage 25 through the outlet pipe for the fluid pumped into the well. The upper end of
100 the pipe 30 is made fluid-tight with the outer air pipe 14 by means of a stuffing box 31

having packing 15 therein. The upper end of the pipe is connected by means of an L 32 to an outlet pipe 33, connected by means of a flexible hose 34 to a pit or other receptacle not shown, for the fluid coming from the well.

This device, when used, is ordinarily extended downwardly to the sand or shale in which the pay is located. It is ordinarily the case in oil and water wells that the oil will be found directly below a more or less impervious stratum of rock or stiff gumbo. Such a stratum is designated at 11 in the drawing. When the device is extended downwardly so that the perforations 2 come within the pay strata composed of sand or shale 12, a packer 10 may be expanded in the impervious stratum 11 so as to shut off the entrance of water or other liquid from above the pay strata.

When it is desired to start the apparatus, it is usual to find the casing either wholly or partially filled with water and mud standing therein, and it is desired to pump water through the pipe 8 into the space outside of the pipe 14 and upwardly through the passage 25 to the surface, and thereby carry from the bottom of the well sand and shale which may be mixed with the liquid. It is found, however, that unless the current of flushing fluid is assisted by means of the lifting effect of air this sort of device will be very quickly clogged. Therefore, air is pumped into the air-conducting pipe 14 through the pipes 19 and 16 from some compressor, not shown. If this is attempted with the apparatus filled with liquid it will be found that the air can not be forced downwardly in the pipe 14 to the point adjacent the openings 28 where it finds entrance to the outlet pipe. I have found, however, that if water is pumped in with the current of air, this may be accomplished. Therefore, when the device is first started I pump, by means of the pump 23, a current of water or mud through the pipes 22, 21 and 16, into the pipe 14, and thence downwardly to the perforations 28, and then upwardly therein. While this pump is operating I force air through the pipe 19 into the apparatus and this air will be carried in bubbles with the current of water from the pump and will be forced downwardly with the water and through the perforations 28 into the outlet pipe. This will be carried on for a period long enough to obtain a flow of air with the water through the pipe 14, and the outlet pipe 30. When this has been accomplished the pump connected with the inlet pipe 8 will be started and the current of water through this pipe to the bottom of the well will find an outlet through the pipes 27 and 30 to the surface. As it passes the openings 28 it will be mixed with air and will be assisted to the surface by the

lifting effect of the air. Gradually the water from the pump 23 may be cut off and the apparatus will be found to work with air alone being discharged through the pipe 14 and the openings 28 into the outlet pipe where it will serve to assist in raising the liquid to the surface. It will create in the liquid a suction effect which will draw in water, sand and shale from the lower end of the pipe 27 and carry it upwardly and discharge it through the pipes 33 and 34 with some force.

If the casing 1 is found to be partially filled with sand or shale it will be necessary to raise the pipe 14 and the outlet pipe 30 through the stuffing box at the upper end of the casing until the lower end of the suction pipe 27 is on a level with the top of the shale. The apparatus will then be started, and as the shale or sand is pumped with the liquid from the casing the device may be gradually lowered downwardly until the shale is entirely removed from the casing. The further operation of the device will draw the shale or sand through the perforations in the casing and discharge it at the surface until a cavity is formed below the stratum 11. This cavity will be constantly filled with water during the operation of the device, so that the water will tend to support this stratum from the lower side. The shale or sand will cave inwardly and form the funnel-shaped cavity 13, which will be thus filled with fluid.

When it is found that a cavity has been formed and that oil is flowing into the said cavity in some volume sufficient to assist in clearing the shale, it is best to use for the flushing fluid a current of oil instead of water. The reason for this is that the oil will not tend to wash away the formation and will tend to carry away the shale and sand coming into the casing just as efficiently as the water. In a short time it will be found that the cavity is sufficiently large so that no further sand or shale comes out of the discharge pipe but that oil alone is being pumped from the well. It is then possible to remove the pipes 14 and 30, together with the connecting pipes thereon, and to then use the ordinary type of pump in pumping the oil from the well.

I find that, in forcing water and air both through the pipe 16, the pressure of the air in the T 17 is sometimes great enough to interfere with the action of the water pump 23. If the line 22 is short the air escapes past the valve 20 and passes through the hose 21 to the pump. By the use of several lengths of pipe 22 in the line between the pump 23 and the valve 20, the inertia of the water filling such pipe will prevent the sudden escape of air past the check valve to the pump and the device will work smoothly.

The advantages of this process will be apparent to one skilled in the art. When the oil is found in strata which ordinarily tend to clog the pump and to prevent the obtaining of production from the well this device may be employed to clean away a cavity at the lower end of the perforated casing so that there will be no further danger or difficulty due to the caving in of the sand or shale. A well thus operated will produce for long periods without the usual difficulty with the caving formation.

Having thus described my invention, what I claim is new and desire to protect by Letters Patent is:

1. In a device for cleaning wells, an outer casing perforated at the lower end, a stuffing box at the upper end, an air-conducting pipe slidable through said stuffing box and extending downwardly in said casing, an outlet pipe fitting fluid-tight through the upper end of said air pipe and connected with said air pipe adjacent the lower end of said air pipe, said outlet pipe being perforated above said connection with said air pipe, means to circulate liquid downwardly in said casing, means to force air downwardly in said air pipe whereby the flow of fluid in said outlet pipe is accomplished.

2. In a device for cleaning wells, an outer casing perforated at the lower end, a central outlet pipe, an intermediate air pipe secured to said outlet pipe adjacent the lower end of said outlet pipe, said outlet pipe being perforated to allow entrance of air thereto, a stuffing box on the upper end of said casing through which said air and outlet pipes are slidable, means to pump liquid into said casing and means to force air into said outlet pipe.

3. In a device for cleaning wells, a well casing, an outlet pipe, an air inlet pipe between said casing and outlet pipe, means to force air and water from said air pipe into said outlet pipe adjacent the lower end thereof, and means to force liquid down outside said air inlet pipe and out said outlet pipe.

4. In a device for cleaning wells, a well casing, an inner outlet pipe, an air inlet pipe outside said outlet pipe, said air pipe and

outlet pipe being vertically slidable in said casing, means to pump air and water through said air inlet pipe into said outlet pipe adjacent the lower end, means to cut off the said water from the air and means to pump flushing fluid down through said casing and out said outlet pipe.

5. In a device for cleaning wells, means to pump water into the well to the bottom thereof, a pipe to conduct said water from the well, means to pump water and air into the pipe toward the lower end thereof, and means to adjust said pipe vertically in the well.

6. A process of clearing wells of sand, shale and the like, comprising forcing a mixed stream of water and air into a well to a point spaced upwardly from the bottom, gradually cutting off the water until a stream of air alone is used, forcing a stream of flushing liquid to the bottom and mixing the return streams of air and water.

7. A process of cleaning wells of sand, shale and the like comprising, forcing a stream of mixed air and water into a well, providing an outlet therefor, then gradually cutting off the water from the air stream, then forcing to the bottom of the well a separate stream of flushing fluid and providing for its outlet with the air from the well.

8. A process of clearing wells of sand, shale and the like comprising, forcing a stream of air into a well at a point adjacent the lower end thereof, forcing a separate stream of water to the bottom thereof and providing an outlet for both water and air from the well.

9. A process of clearing wells of sand, shale and the like comprising, forcing a stream of water down to the level of the sand or shale to wash the same from the well, forcing a stream of air into the outlet current of liquid and adjusting the height of the outlet fluid currents as the material is washed out from the well.

In testimony whereof, I hereunto affix my signature this the 2nd day of November, A. D. 1922.

ROBERT E. CARMICHAEL.