July 18, 1939. P. G. GATES 2,166,489

PUMP TYPE BAILER

Filed June 1, 1937

Fig. 1.

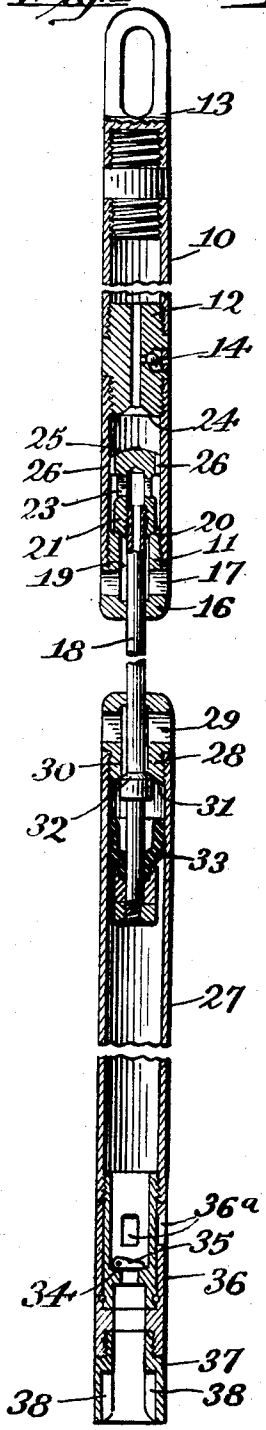



Fig. 2.

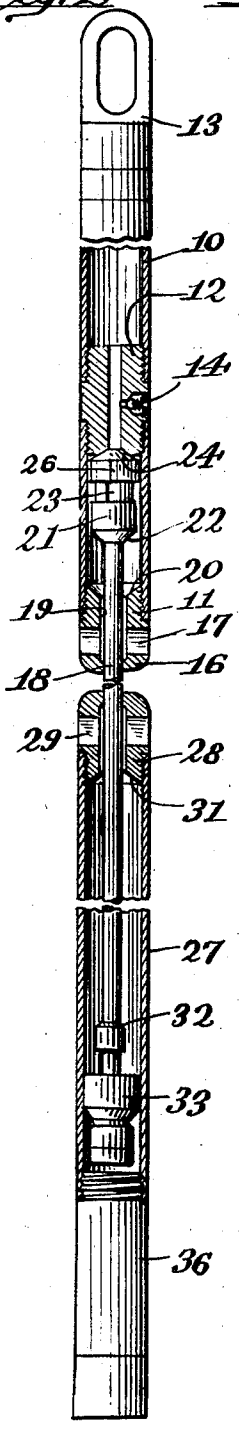



Fig. 3.

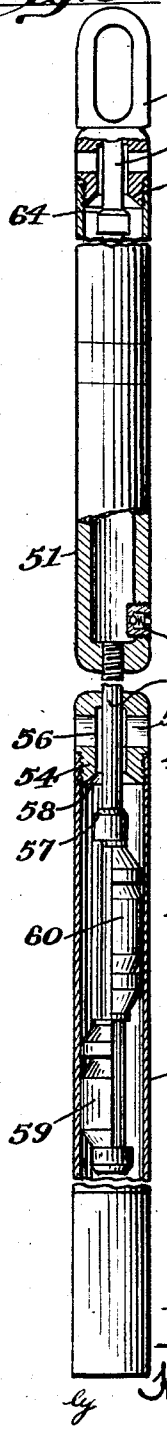



Fig. 4.

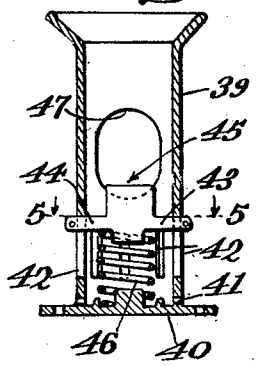
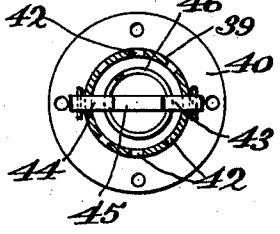



Fig. 5.




Inventor.
Paul G. Gates.
Hazard & Miller
Attorneys.

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# UNITED STATES PATENT OFFICE

2,166,489

## PUMP TYPE BAILER

Paul G. Gates, Long Beach, Calif.

Application June 1, 1937, Serial No. 145,799

14 Claims. (Cl. 166—19)

This invention relates to improvements in pump type bailers and may be considered as an improvement over the form of construction disclosed in my copending application Serial No. 98,889, filed September 1, 1936.

An object of the invention is to provide an improved form of pump type bailer wherein the construction is somewhat simplified and wherein parts may be made from conventional devices now on the market. The improved construction is not only simplified but the number of parts is somewhat reduced, facilitating manufacture and contributing to the durability of the bailer.

Another object of the invention is to provide a construction which will facilitate the emptying or unloading of the bailer wherein precautions are taken to increase the safety with which the tool may be emptied or unloaded when it has been recovered from a well.

With the foregoing and other objects in view, which will be made manifest in the following detailed description, and specifically pointed out in the appended claims, reference is had to the accompanying drawing for an illustrative embodiment of the invention, wherein:

Figure 1 is a sectional view through one form of the improved bailer illustrating the bailer in that position wherein it is suspended and is being lowered into a well;

Fig. 2 is a view similar to Fig. 1, illustrating the position of the bailer after it has landed at the bottom of the well;

Fig. 3 is a sectional view through an alternative form of bailer embodying the invention;

Fig. 4 is a sectional view through the device which may be employed to facilitate unloading or emptying of the bailer; and

Fig. 5 is a horizontal section taken substantially on the line 5—5 upon Fig. 4.

Referring to the accompanying drawing wherein similar reference characters designate similar parts throughout, the form as illustrated in Figs. 1 and 2 consists of an upper chamber constituting an air chamber 10 which may be formed of sections of pipe and subs 11 and 12, respectively. The top of the air chamber is closed by a cap 13 which may be provided with a suitable construction for connection of the bailer with a sand line. Suitably located in a wall of the air chamber is a relief valve 14 which is outwardly opening so as to enable the escape or relief of excess pressures in the air chamber when the bailer is withdrawn from the bottom of a well. The bottom of the air chamber is provided with a cap 16 having lateral ports 17, and through which extends a tube 18. The bottom of the cap 16 fits snugly around the tube but from the ports 17 upwardly there is formed a clearance 19 which provides a passage from seat 20 down to ports 17. On the top of the tube there is provided cap 21 having a seat 22 adapted to engage seat 20. This cap has lateral ports 23 and its top surface is adapted to engage the bottom of sub 12.

In the preferred form of construction complementary seats 24 and 25 are formed on the sub and cap, respectively. The sides of the cap above apertures 23 may fit the interior of the air chamber and vertical slots or openings 26 are formed in the sides of the cap to enable passage of fluid from tube 18 up through sub 12 into the air chamber.

Tube 18 is designed to suspend an entrapping chamber 27 which may be formed of pipe, the top of which is closed by a cap 28 which may be a counterpart of cap 16. Cap 28 has its top snugly fitting around tube 18 and has lateral ports 29 with a clearance 30 around the tube from ports 29 down to the beveled seat 31. The tube 18 is provided with a beveled shoulder 32 adapted to engage the beveled seat 31. Below the shoulder 32 the tube 18 carries a swab 33 and while the construction of the swab may vary, I prefer to use in this form of construction that type of swab generally known on the market as a Guiberson swab. This swab forms a plunger mounted on the bottom of the tube which is reciprocable within the entrapping chamber or sand chamebr 27. The bottom of the sand or entrapping chamber 27 is provided with an entrapping valve seat 34 on which is mounted an entrapping valve 35. Around this seat there is rotatably disposed a sleeve 36. Ports are formed in the body of the entrapping valve seat and in the sleeve 36 so that upon rotation of the sleeve, these ports can be aligned above valve 35 to empty the entrapping chamber. The sleeve preferably carries shoe 37 which has vertical slots 38 formed on its interior.

The operation of this form of bailer is as follows: When the bailer is suspended and is lowered into a well, the entrapping chamber and the air chamber are both initially filled with air. As the bailer descends into the liquid in a well, the external hydrostatic pressure causes fluid to enter the entrapping chamber 27 past valve 35, compressing the air and forcing the compressed air to collect in the top of air chamber 10. When the shoe 37 encounters an obstruction in the well or lands at the bottom of the well, downward movement of the entrapping chamber 27

is arrested. As the downwardly exposed surface of swab 33 is greater than the upwardly exposed surface of shoulder 32, the tube 18 will tend to temporarily remain in the uppermost position shown in Fig. 1. The air chamber 10 telescopes downwardly with respect to tube 18 with the result that seat 22 on cap 21 disengages seat 20. This opens the interior of tube 18 through ports 23, clearance 19, and ports 17 to the exterior of the bailer. Continued downward movement of the air chamber causes the tube 18 to be forced downwardly and liquid that has entered the entrapping chamber 27 during the descent of the bailer can thus escape through the outlet from the top of the entrapping chamber thus opened. When the cap 21 engages the sub 12 the tube 18 is forced downwardly and the swab 33 starts on its initial downward stroke in the sand chamber during which stroke the liquid in the sand chamber 27 may pass up above the plunger into the space in the top of the entrapping or sand chamber which is around tube 18 to be expelled on the succeeding upward stroke through the outlet afforded by passages 29 and 30. Liquid may freely enter the top of the sand chamber above the swab through ports 29 so that there is no tendency for any vacuum to form above the swab during its downward strokes.

At the end of the downward stroke of the swab the air chamber 10 is lifted which causes seats 22 and 20 to engage, closing the outlet previously afforded by ports 17. During the upward stroke of the swab 33 liquid and debris or sand in the well is induced to enter the sand chamber past the entrapping valve 35. Continued up and down strokes may be imparted to the swab 33 until the operator is convinced that the sand chamber has been fully loaded.

It will be noted that there is a limited telescopic connection formed between the air chamber 10 and the top of the tube 18. This limited connection forms a type of jar which may be used to loosen the sand chamber 27 if the sand chamber had become stuck or badly embedded in the sand at the bottom of the well. When the bailer is withdrawn from the well it assumes the position as shown in Fig. 1 wherein all outlets from the sand chamber and the air chamber to the exterior of the bailer are closed with the exception of the relief valve 14. As the bailer approaches the surface the hydrostatic pressure entrapped within the bailer becoming greatly in excess of the surface pressure, there is some escape past the relief valve 14 reducing the entrapped pressure to only the pressure required to unload the bailer.

The device illustrated in Fig. 4 is designed to facilitate and safeguard unloading of the bailer. It consists of a tube 39 having a base 40 which may be secured to the derrick floor. In the bottom of this tube there are formed apertures or ports 41 through which any sand that may collect in the bottom of the tube may be washed out. This tube has a plurality of vertical slots 42 formed therein adapted to receive the arms 43 and 44 of a key 45. This key is designed to enter the slots 38 formed in the shoe 37. It is urged into uppermost position by means of a spring 46. In the wall of the tube there is formed a port 47 adapted to be aligned with the ports formed in sleeve 36 and in the seat for the entrapping valve 35 when these ports are aligned.

On recovering the bailer from the well its lower end is inserted in tube 39 and is lowered into engagement with the key 45 which cushions the bottom of the bailer. The bailer can be rotated until key 45 enters the slots 38 in which position the aperture or port in the entrapping valve seat is disposed in registration with port 47. When key 45 has engaged in slots 38 the bailer is then rotated relatively to the sleeve to align and open ports 36a so that the retained pressure that has not been entirely released by relief valve 14 may be utilized to expel the liquid and solid contents of the entrapping chamber 27. As the retained pressure is sufficient to discharge the contents with considerable velocity there is frequently a reactionary force of considerable magnitude set up on the bailer and where no holder or guide is used such as illustrated in Fig. 4, this reactionary force developed sometimes causes the bailer to get out of control. However, with the bottom of the bailer disposed in the device illustrated in Fig. 4 the bailer can be kept under control in spite of these reactionary forces.

The purpose of having a large number of circumferentially arranged slots 42 is to enable the key 45 to be rotationally adjusted within tube 39 with relation to port 47. By tipping the key 45 its arms 43 and 44 can be withdrawn from any pair of diametrically opposed slots and selectively introduced into any other pair of slots. The purpose of being able to rotationally adjust the key is to enable the key to accommodate itself to whatever position is required when it engages slots 38 so that port 36a in the sleeve will be in registration with ports 47. As the shoe 37 is threadedly connected to sleeve 36, on tightening up the shoe the position of slot 38 with respect to port 36a in the sleeve cannot be accurately anticipated. Consequently, rotational adjustment of key 45 compensates for this enabling port 36a in sleeve 36 to register with port 47 when the key and slots are in engagement.

While I have illustrated the bailer as being equipped with a cylindrical shoe as shown, slotted at 38 for the reception of key 45, it will be understood that other forms of shoes on bailer bottoms may be employed. For example, if a chisel-shaped shoe or bailer bottom is used, the construction or shape of key 45 is altered to fit and receive the chisel point. The key not only serves to properly position port 36a in the sleeve in alignment with port 47 but holds the sleeve while the bailer is being rotated relatively to it to open the ports 36a.

In the construction shown in Fig. 3, the general construction and formation of the sand or entrapping chamber 50 is substantially the same as that previously described.

The chamber corresponding to the air chamber is indicated at 51 and may be provided with a relief valve indicated at 52. In this form the tube 53 has its upper end threaded into the bottom of chamber 51. It slidably extends through the cap 54 having ports 55 and clearance 56. It is provided with a beveled shoulder 57 adapted to seat on seat 58 on the bottom of the cap. Tube 53 carries a swab of the type now generally known on the market as a Mission swab. The details of construction of that form of swab forms no part of the present invention but by way of explanation, this type of swab is longitudinally divided into two parts 59 and 60. Part 59 is rigid with respect to tube 53 whereas part 60 is longitudinally slidable relatively thereto. The conventional Mission swab has the two parts 59 and 60 mounted on a solid body. If the body is used along with the parts 59 and 60 the body should be drilled so as to form a hollow

continuation of tube 53. On the other hand I prefer to make the tube 53 of such a form as to provide the body on which parts 59 and 60 can be mounted and to apply these parts of the swab thereto. In either form there is a continuous passage formed which establishes constant communication between the entrapping chamber 50 and the upper chamber 51. During downward strokes of the swab the slidable part 60 slides into the upper position shown enabling fluid in the entrapping chamber 50 to pass up between the parts of the swab. On up strokes, part 60 occupies a position horizontally opposite part 59 and the swab then acts as a plunger or piston expelling the fluid from the top of the entrapping chamber through ports 55 and at the same time inducing an inward flow through the bottom of the entrapping chamber past the entrapping valve therein.

When the bailer is pulled from the well, shoulder 57 seats on seat 58 closing the outlet from the top of the entrapping chamber. Chamber 51 may constitute an air chamber wherein the top of the chamber is closed and the air therein retained at hydrostatic pressure except for the pressure released through relief valve 52.

As an alternative construction, instead of using chamber 51 as an air chamber to retain air under pressure to be utilized for dumping, a valve seat 61 may be formed in the top of the chamber and a stem 62 is provided attached to the bail 63. This stem has a beveled shoulder 64 adapted to seat upon seat 61. On pumping strokes of the bailer the valve thus formed in the top of chamber 51 may open and close. However, when the bailer is withdrawn from the well the valve closes but the air which was initially in chamber 51 has been expelled and replaced by liquid. On reaching the surface excess pressure is released by relief valve 52. When the bailer is opened at the surface the column of liquid inside of the bailer develops a sufficient hydrostatic head to expel the contents of the sand chamber. Of course, if the hydrostatic head of liquid in the chamber 51 is thought to be insufficient to expel the load in the entrapping or sand chamber, valve 64 can be kept closed so as to retain all of the hydrostatic pressure in chamber 51 which is not released by relief valve 52. In that event the liquid which is in the chamber 51 is maintained at a pressure above that created by the weight of the liquid and as the liquid usually has gas incorporated in it the gas which tends to separate and collect in the top of the chamber 51 is also effective at this retained pressure to expel the liquid and solid content of the bailer. The valve in the top of chamber 51 opens to allow air to enter this chamber breaking any vacuum tending to form therein and allowing this column of liquid in the bailer to wash out the contents of the sand chamber.

In all of the above forms of construction it will be appreciated that while the bailer is open at both ends during pumping so as to enable fluid and debris to be drawn into the sand chamber and expelled from the top thereof in loading the bailer when the bailer is withdrawn from the well it is closed so that the retained hydrostatic pressure keeps the parts of the bailer expanded or extended. Then when the bailer is opened any retained pressure may be utilized to facilitate dumping or emptying the bailer.

In the form shown in Fig. 3, the pressure of the column of liquid in the bailer alone may be sufficient to expel the contents of the sand chamber.

It will also be noted that in these forms of bailers a type of jar is incorporated in the bailer construction itself so that in the event that the sand chamber becomes embedded it is possible on reciprocation of the air chamber to effectively jar it loose.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve at its bottom, means providing a plunger reciprocable in the top of the entrapping chamber, a tube extending into the top of the entrapping chamber on which the plunger is mounted, and means by which the tube may be suspended, mounted for limited telescoping movement upon the tube.

2. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve at its bottom, means providing a plunger reciprocable in the top of the entrapping chamber, a tube extending into the top of the entrapping chamber on which the plunger is mounted, and means providing an air chamber mounted for limited telescoping movement upon the tube.

3. A pump type bailer comprising means providing an air chamber, means providing an entrapping chamber, a tube connecting the chambers, a cap on the tube reciprocable between limits in the air chamber, there being an outlet from the entrapping chamber openable by said cap and adapted to be closed thereby when the bailer is suspended and a plunger on said tube reciprocable within the entrapping chamber.

4. A pump type bailer comprising means providing an entrapping chamber, a single tube reciprocable in the top of the entrapping chamber, a plunger on the tube disposed within the entrapping chamber, there being an outlet from the top of the entrapping chamber, said plunger being so constructed that on downward strokes fluid in the entrapping chamber may pass from below the plunger to above the plunger into the space around said tube and upon upward strokes the fluid above the plunger may be expelled through the outlet and additional fluid drawn into the entrapping chamber, and means for closing said outlet against egress from the entrapping chamber.

5. A pump type bailer comprising means providing an entrapping chamber, a single tube reciprocable in the top of the entrapped chamber, a plunger on the tube disposed within the entrapping chamber, there being an outlet from the top of the entrapping chamber, said plunger being so constructed that on downward strokes fluid in the entrapping chamber may pass from below the plunger to above the plunger into the space around said tube and upon upward strokes the fluid above the plunger may be expelled through the outlet and additional fluid drawn into the entrapping chamber, and means for closing said outlet against egress from the entrapping chamber, said means being asociated with the tube.

6. A pump type bailer comprising means providing an entrapping chamber, a single tube reciprocable in the top of the entrapping chamber, a plunger on the tube disposed within the entrapping chamber, there being an outlet from the

top of the entrapping chamber, said plunger being so constructed that on downward strokes fluid in the entrapping chamber may pass from below the plunger to above the plunger into the space around said tube and upon upward strokes the fluid above the plunger may be expelled through the outlet and additional fluid drawn into the entrapping chamber, and means for closing said outlet against egress from the entrapping chamber, and means for optionally opening and closing the top of the tube whereby upon closing the tube a portion at least of the hydrostatic pressure may be retained therein to be utilized to unload the entrapping chamber.

7. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve adjacent its bottom, a plunger reciprocable therein so constructed as to permit upflow therepast upon downward strokes but to prevent downward flow therepast upon upward strokes, there being an outlet adjacent the top of the entrapping chamber through which fluid may be expelled by the plunger on upward strokes whereby on reciprocation of the plunger the entrapping chamber may be loaded, means extending through the top of the entrapping chamber by which the plunger may be reciprocated, and means carried by said means above the plunger for closing said outlet to prevent egress therethrough from the entrapping chamber.

8. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve adjacent its bottom, a plunger reciprocable therein, so designed as to permit upward flow therepast upon downward strokes but to prevent downward flow therepast upon upward strokes, there being an outlet in the top of the entrapping chamber through which fluid may be expelled by the plunger on upward strokes whereby on reciprocation of the plunger, the entrapping chamber may be loaded, tubular means on which the plunger is mounted, and valve means above the plunger carried by the tubular means adapted to close the outlet against egress from the entrapping chamber.

9. A pump type bailer comprising means providing an entrapping chamber, a plunger reciprocable therein, so designed as to permit upward flow therepast upon downward strokes but to prevent downward flow therepast upon upward strokes, there being an outlet in the top of the entrapping chamber through which fluid may be expelled by the plunger on upward strokes whereby on reciprocation of the plunger, the entrapping chamber may be loaded, tubular means on which the plunger is mounted, and valve means carried by the tubular means adapted to close the outlet against egress from the entrapping chamber, and means by which the bailer may be suspended for closing the top of the tubular means when the bailer is suspended and opening the tubular means when the bailer is supported.

10. A pump type bailer comprising means providing an entrapping chamber, a plunger reciprocable therein, so designed as to permit upward flow therepast upon downward strokes but to prevent downward flow therepast upon upward strokes, there being an outlet in the top of the entrapping chamber through which fluid may be expelled by the plunger on upward strokes whereby on reciprocation of the plunger the entrapping chamber may be loaded, tubular means on which the plunger is mounted, valve means carried by the tubular means adapted to close the outlet against egress from the entrapping chamber, and means for optionally opening and closing the top of the tubular means operable by the suspending means for the bailer.

11. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve adjacent its bottom, a plunger reciprocable therein so constructed as to permit upflow therepast upon downward strokes but to prevent downward flow therepast upon upward strokes, there being an outlet in the top of the entrapping chamber through which fluid may be expelled by the plunger on upward strokes whereby on reciprocation of the plunger the entrapping chamber may be loaded, means extending through the top of the entrapping chamber by which the plunger may be reciprocated, and means carried by said means above the plunger adapted to seat in the outlet for closing the outlet against egress.

12. A pump type bailer comprising means providing an entrapping chamber, a plunger reciprocable therein so constructed as to permit upflow therepast upon downward strokes but to prevent downward flow therepast upon upward strokes, there being an outlet in the top of the entrapping chamber through which fluid may be expelled by the plunger on upward strokes whereby on reciprocation of the plunger the entrapping chamber may be loaded, means extending through the top of the entrapping chamber by which the plunger may be reciprocated, means above the plunger operable by the plunger reciprocating means for closing the outlet against egress from the entrapping chamber, and means providing an air or gas chamber in which air or gas may be retained under at least a part of the hydrostatic pressure to be utilized to unload the bailer.

13. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve, tubular means reciprocable in the top of the entrapping chamber adapted upon reciprocation to induce upward flow through the entrapping chamber, and valve means in the tubular means for opening and closing the tubular means by which the bailer may be suspended, said valve means being adapted to open when the bailer is supported and upon downward strokes of the tubular means and to close upon the tubular means being lifted thereby so as to entrap at least a portion of the pressure at the depth to which the bailer is lowered so that the entrapped pressure may be utilized to assist in unloading the bailer.

14. A pump type bailer comprising means providing an entrapping chamber having an entrapping valve, tubular means reciprocable in the top of the entrapping chamber adapted upon reciprocation to induce upward flow through the entrapping chamber, and valve means in the tubular means by which the tubular means may be lifted and reciprocated, said valve means being adapted to close the tubular means against escape of pressure therethrough when lifted so as to entrap at least a portion of the pressure at the depth to which the bailer is lowered so that the entrapped pressure may be utilized to assist in unloading the bailer.

PAUL G. GATES.