July 27, 1937. P. CAVINS 2,088,151

BAILER OR CLEAN-OUT TOOL AND METHOD

Filed Feb. 15, 1932

Fig. 1.

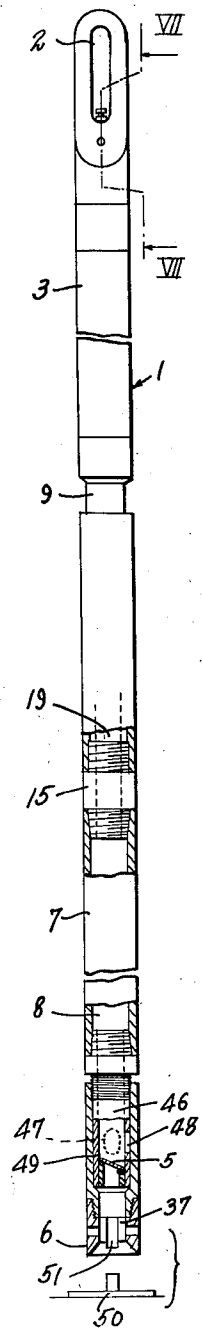


Fig. 2.

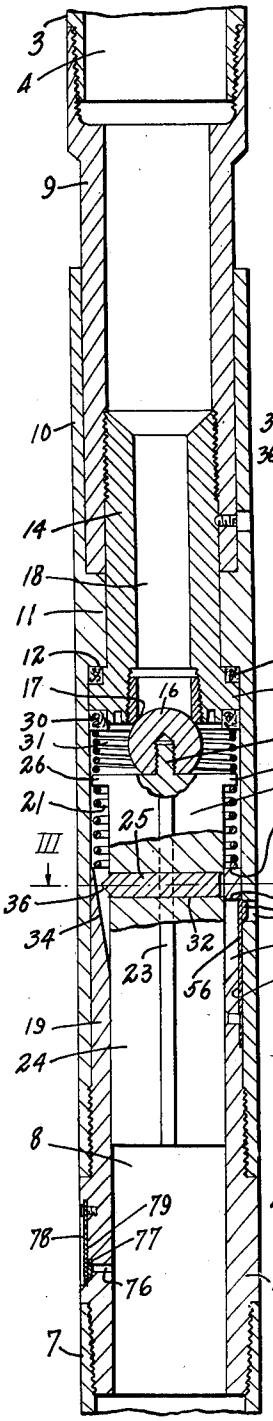


Fig. 7.

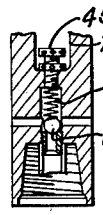


Fig. 3.

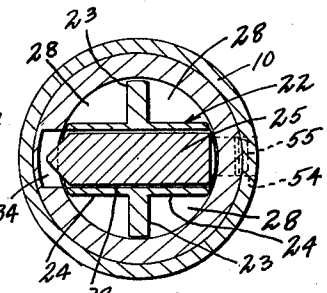


Fig. 6.

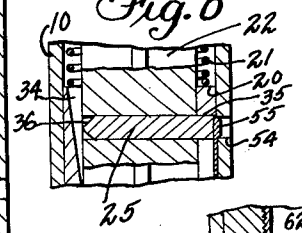


Fig. 5.

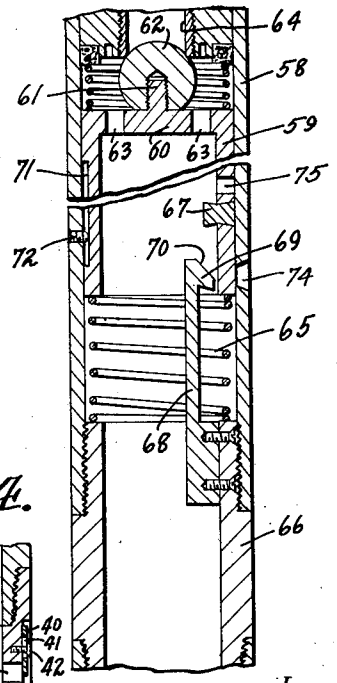
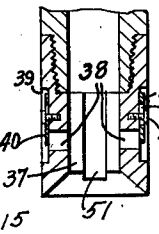


Fig. 4.



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2,088,151

BAILER OR CLEAN-OUT TOOL AND METHOD

Paul Cavins, Long Beach, Calif.

Application February 15, 1932, Serial No. 593,008

49 Claims. (Cl. 166—19)

This invention relates to a bailer, or clean-out tool, of a type in which the charging of the bailer is effected through the agency of the pressure in the well. In this type of bailer the bailer has a sand chamber below, and an upper chamber, or air chamber, above the sand chamber. These chambers are connected by a passage which is closed by a valve while the bailer is descending in the well. When the bailer reaches the bottom of the well, the sand chamber becomes partially filled with the water or liquid in the well, and when the shoe of the bailer strikes an obstruction in the well, or the well bottom, this valve is automatically opened, and by reason of the pressure in the well the liquid in the sand chamber passes up through the valve of the bailer into the empty air chamber above, while the well pressure charges the sand chamber. Heretofore bailers of this type have been constructed with a valve closure seating on its seat from above.

While it is feasible to construct such bailers in this way, the seating of the valve from above makes it advisable to provide means for balancing the valve, and this complicates the construction of bailers of this type. The general object of this invention is to provide a self-charging bailer having a simple construction enabling the valve to open automatically and latch itself open when the bailer shoe strikes an obstruction in the well or arrives at the well bottom; also to provide a construction for this purpose operating in such a way as to avoid the necessity for balancing the valve.

A further object of the invention is to provide a bailer of this type with a valve closure which comes upon its seat by an upward movement instead of a downward movement as heretofore, and to provide simple means for producing the automatic opening of the valve when the shoe strikes an obstruction or the bottom of the well.

When bailers of this type are operating in wells having relatively high pressure, it is desirable to provide means for regulating the velocity of flow of the same from the well into the sand chamber, and one of the objects of this invention is to provide simple means for attaining this effect.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combinations of parts to be described hereinafter, all of which contribute to produce an efficient bailer or clean-out tool.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawing:

Figure 1 is a side elevation of a bailer embodying my invention, certain parts being broken away and shown in section.

Figure 2 is a vertical section upon an enlarged scale, taken through the bailer, and particularly illustrating the assembly of parts associated with the valve, and showing the latch and other parts for controlling the valve, certain parts being broken away.

Figure 3 is a horizontal section, taken about on the line III—III of Figure 2.

Figure 4 is a fragmentary view illustrating the lower end of the bailer in vertical section, and particularly illustrating means which I may employ for regulating the direction of flow of the sand charge as it passes up into the sand chamber.

Figure 5 is a vertical section similar to Figure 2, but with parts broken away and illustrating another embodiment of the latching means and valve guide.

Figure 6 is a fragmentary view, corresponding to Figure 2, and showing some of the parts illustrated in Figure 2, but with the latch in its operative position, in which it holds the valve open.

Figure 7 is a vertical section, taken at the location of the line VII—VII of Figure 1, and illustrating a release valve which should be employed with this type of bailer.

Before proceeding to a more detailed description of the invention, it should be stated that in bailers of this type, an upper chamber or air chamber is provided located above the valve that separates the air chamber from the sand chamber. When the bailer starts to descend in the well, the air chamber carries air at atmospheric pressure. This chamber is substantially sealed, so that the atmospheric pressure is substantially maintained within it until the bailer arrives at the bottom of the well or at a point in the well where the bailer strikes an obstruction. When this occurs, the valve between the chambers opens automatically and on account of the pressure in the well liquid already partially filling the sand chamber flows past the valve and into the upper chamber which is holding air at substantially atmospheric pressure. In other words, the bailer charges itself automatically due to the relatively low pressure in the air chamber. As the sand chamber fills with the sand the liquid that passes up into the air chamber, of course compresses the air in the upper end of the air chamber.

According to this invention, I employ a valve which comes upon its seat by an upward movement, and I provide automatic means for effecting the opening of this valve when the bailer impinges against the same. In accordance with this invention, I also provide means at the shoe for regulating the velocity of flow of the charge toward and into the receiving chamber of the bailer.

The invention may be practiced by using various specific constructions, but in the present specification I have described merely two forms or embodiments of the invention as regards the controlling means for the valve.

Referring more particularly to the parts, and particularly to Figure 1, 1 indicates a bailer assembly having the usual eye 2 at its upper end for suspending the bailer in the well on a sand line. The upper portion of the bailer includes a casing 3, the interior of which constitutes an upper chamber, or air chamber, 4, and at the lower end of the bailer a bottom valve 5 is provided above the shoe 6.

Above the shoe 6, the bailer includes a tube section 7, the interior of which constitutes a receiving chamber 8, or sand chamber, into which the sand passes. The lower end of the casing 3 of the air chamber is secured to a main sleeve 9, and on this sleeve, the shoe and its attached parts are swivelled. In order to accomplish this, I provide an outer sleeve 10 which is telescoped over the main sleeve 9 and this sleeve 10 has an inwardly projecting integral collar 11 with a shoulder 12 on its underside which is supported on an outwardly projecting collar 13 that is carried on the lower end of an inner sleeve 14, said sleeve 14 being threaded into the lower end of the main sleeve 9. The collar 11 is held between the collar 13 and the lower end of the main sleeve 9. The upper end of the main sleeve 9 is secured to the casing 3 of the air chamber.

The lower end of the outer sleeve 10 has a threaded connection to a union 15 that connects it to the upper end of the casing 7 of the sand chamber 8.

The bailer is provided with a cut-off shown as a valve which separates the sand chamber 8 from the air chamber 4, and in the present instance this valve is in the form of a ball 16 which comes upon its seat 17 by an upward movement, said seat being attached at a passage 18, that is, the bore of the inner sleeve 14. The body portion 19 of the union 15 constitutes a sleeve extending up on the interior of the outer sleeve 10 and the end face 20 of this sleeve 19 receives the thrust of a coil spring 21 that normally holds the valve-closure 16 on its seat. In order to accomplish this, and provide for the free flow of liquid past the valve, I provide a valve guide 22 which is formed of two radially disposed wings 23 and 24 (see Figure 3), the former of which is of narrow width, while the latter of which may be of increased width to house a latch bolt 25. The function of this bolt is to latch the valve open during the operation of the bailer.

At their upper ends the wings 23 and 24 have outwardly projecting extensions forming shoulders 26 which receive the thrust of the spring 21 at its upper end.

The valve-closure 16 may be secured to the guide in any suitable manner. In the present instance, the ball is secured by means of a threaded pin 27 that extends upwardly from the upper side of the guide 22. By reason of the use of the wings 23 and 24 four passages 28 are formed in the bailer, (see Figure 3), through which the liquid can pass upwardly in going by the guide.

The underside of the collar 13 of the inner sleeve 14 may be packed, if desired, by means of a packing ring 30 which may be secured in place in any suitable manner. In the present instance, this packing ring is held in place by a coil spring 31 which seats on the upper sides of the shoulders 26. Another packing ring 30a may be provided at the upper end of the collar 13.

In the operation of the bailer, the valve becomes automatically latched open by means of the latch bolt 25, illustrated in Figures 2 and 3, but I do not limit myself to any particular embodiment of the means for controlling the valve-closure 16 to effect its automatic opening and latching.

However, in the embodiment of the invention illustrated in Figure 2, this latch bolt 25 is mounted for horizontal movement in a guide-way 32 that passes through the relatively thick web or wing 24. The side wall of the sleeve 19 of the union 15 is cut away adjacent the rear end of the latch bolt so as to form a slot 33, and opposite this slot an inclined cam face 34 is formed in the sleeve 19. At the upper end of the slot 33 an abrupt shoulder 35 is formed. With this organization of parts, it will be evident that when the shoe strikes an obstruction in the well, or strikes the well bottom, the momentum of the valve-guide will cause it to move on down and open the valve against the force of the spring 21.

As the latch bolt 25 moves downwardly its tapered forward tip 36 will engage the cam face 34 and this will cause a rearward movement of the latch 25 so that its butt end will pass into the slot 33. (See Figure 6.) The recoil of spring 21 will operate to seat the latch 25 under the shoulder 35. This will hold the valve-guide 22 in a depressed position, thereby opening the valve. As this occurs, the liquid now in the sand chamber will pass up through the passage 18 into the release chamber 4. This evacuation of the sand chamber by the liquid in it causes a suction effect, and enables the well pressure to force sand from the well, up through the shoe and into the sand chamber.

In order to regulate the velocity and direction of flow of the charge as it passes into the shoe, and to prevent it from being too violent, I prefer to construct the shoe 6 as illustrated in Figure 4. That is to say, this shoe is provided with the usual central passage 37, but the slide wall of the shoe is provided with a plurality of ports 38 spaced circumferentially around the shoe and having means for regulating the effective area of such port or ports. In the present instance, I provide the shoe with a recess 39 in which an adjustable cover 40 is mounted. This adjustable cover may consist of a saddle plate with a vertical slot 41 in it, to receive a clamping screw 42. By means of this screw, each cover plate 40 may be secured in any position desired so as to obstruct more or less the area of its port 38.

Bailers of this type are preferably provided with means for relieving the pressure in the air chamber when the bailer is taken out of the well. If such means were not provided, the casing of the bailer might burst from the high internal pressure. For this purpose, I provide the upper end of the air chamber with a relief valve. This valve may be in the form of a ball 43, (see Figure 7), that is normally held on

its seat by a coil spring 44, regulated by an adjusting screw 45.

When the bailer has been taken from the well, its load can be discharged by rotating a discharge valve 46 which is in the form of a sleeve rotatably mounted on the lower end of the bailer. This sleeve 46 carries an outlet port 47 which can be rotated into register with a discharge port 48 formed in the bottom valve housing 49 at this point. This rotation can be accomplished by means of a fixed key-plate 50, the key of which engages in two diametrically opposite slots 51 in the shoe 6.

In order to enable the latch bolt 25 to be released when desired, I provide a small opening 54 in the side of the casing 10 opposite the shoulder 35 and in this opening a push button 55 is mounted, said button being formed as a head on a small leaf spring 56 that is mounted in a recess 57 between the sleeve 19 and sleeve 10. This spring may be riveted in place, as indicated.

By shoving in on the push button 55, it is evident that the bolt can be released from the shoulder 35.

Other types of latching means for the valve may be employed, for example, I may employ the construction illustrated in Figure 5. In this view, 58 indicates the outer sleeve that corresponds to the sleeve 10, and within this sleeve a piston head 59 is guided to slide freely, said head being in the form of a sleeve with an integral disc 60 at one end. This disc has a threaded pin 61 to which the valve 62 is attached, and the disc is provided with a plurality of perforations 63 to permit the liquid to flow up past the valve-closure 62 and through the valve passage 64. The valve is normally held closed by a coil spring 65, the upper end of which thrusts against the lower end of the head 59, and the lower end of which rests against the upper end of a union 66, corresponding to the union 15. The side wall of the head 59 is provided with a catch 67 which may be in the form of a rivet with its head projecting on the inner side of the wall of the head. This rivet is in line with a spring 68 that extends upwardly from the union 66 to which it is attached. This spring has a hook 69 at its upper end with an inclined upper face 70 which is engaged by the rivet when the head comes down.

The head 59 should be provided with means to prevent it from rotation so as to insure that the catch 67 will always be maintained in line with the hook 69. For this purpose, a longitudinal slot 71 may be provided in the side wall of the head which receives the tip of a set screw 72 mounted in the wall of the sleeve 58.

The mode of operation of this valve is substantially the same as that of the valve illustrated in Figure 2, that is, when the shoe strikes an obstruction, or the bottom of the well, the head 59 moves on by its own momentum. This movement is sufficient to enable the catch 67 to engage under the hook 69 and hold the valve open. The liquid in the sand chamber will then flow up through the tubular head 59 through the openings 63, past the valve-closure 62, and up the valve passage 64.

In order to enable the hook to be released, I provide a small opening 74 in the wall of the sleeve 58 opposite the hook, and in the latched open position of the valve, this opening will be in alignment with a corresponding opening 75 formed in the wall of the sleeve of the head 59. This will enable an instrument to be inserted through the aligned openings to shove the hook back off of the catch.

The wall of the sand chamber is preferably provided with a relief port 76, (see Figure 2), which is closed on its outer side by a disc 77 carried on the inner side of a spring 78. This spring is mounted in a recess 79 on the outer wall of the union 15 which carries the port 76.

The mode of operation of the bailer will now be briefly described:

Referring particularly to Figure 2, as the bailer descends in the well, the valve is held closed by the spring 21 which presses upwardly against the guide 22, thereby holding the closure 16 on its seat. When the bailer reaches the liquid in the well, the sand chamber partially fills with the liquid or water in the well. When the bailer strikes the sand in the well, it will be falling at a considerable velocity, and when the movement of the shoe 6 is arrested, the momentum of the valve guide 22 causes it to continue on downward. As the valve-guide 22 moves on downwardly, the tip of the latch bolt 25 engages the cam face 34 which gives the bolt a sliding movement toward the right. The cam face 34 is designed so that this movement does not begin until the upper face of the latch 25 is well below the shoulder 35. When the butt end of the latch has moved under the shoulder 35, the valve is held or locked in open position. The pressure in the well then causes the water in the sand chamber to flow up through the passages 28, (see Figure 3), around the valve guide, and thence up through the valve passage 18 into the release chamber 4 of the bailer, and forces a charge of sand into the evacuated sand chamber 8.

As the water flows up into the air chamber, it compresses the air caught in the upper end of the air chamber.

The bottom check valve 5 of the bailer permits this upward flow, and when the bailer starts upwardly this valve closes and traps the charge in the sand chamber 8.

After the bailer has been pulled from the well, it can be lowered down onto the key-plate 50 to rotate the rotary sleeve 46 and bring its port 47 into register with the port 48, thereby discharging the sand from the sand chamber 8 through the expansive power of the air compressed to relatively high pressure in the upper end of the release chamber. In this connection, it should be understood that the upper end of the air chamber is sealed from the atmosphere, except for the relief valve 43 which may act to relieve pressure in the interior of the bailer if this is dangerously high. In this way the bailer can be unloaded at a sufficiently high pressure to discharge it effectively, but without any danger to the men working with the bailer.

The cover plates 40 may be adjusted more or less across the ports 48 in the side wall of the shoe 6 so as to regulate the velocity of flow of the sand into the sand chamber 8 of the bailer, and also to bring in part of the sand load from the side and to prevent merely coring into the sand.

The mode of operation of the valve illustrated in Figure 5, is substantially the same as that of the valve 16. That is to say, when the bailer strikes an obstruction, or the bottom of the well, the momentum of the head 59 moves it down until the catch 67 becomes engaged by the hook 69; this holds the valve open.

In the case of the bailer shown in Figure 2,

the latch is released by pressing in on the push button 55.

In the hook type of latch shown in Figure 5, the hook may be disengaged by a pin inserted through the openings 75 and 74, which will be in alignment with each other when the catch 67 is in engagement with the hook.

The valve-guide 22, and the piston head 59, carrying valve 62, should be made long enough to give them sufficient weight to insure their having sufficient momentum to effect the latching of the valves in their open position.

The radial flow of sand in through the side inlet ports 38 of the shoe has the effect of drawing sand in the well laterally toward the shoe, and prevents mere coring action of the bailer.

If there is danger of having the bailer stick in the well, it is advisable to spud the bailer lightly, thereby effecting successive slight opening of the valve-closure 16. Each time the valve 16 is opened in this way some liquid would pass up through the valve opening and permit some sand to pass into the sand chamber. In this way, the bailer will take successive "bites", and the sand chamber can be partially filled with sand. Just before pulling the bailer, it will be dropped far enough to give the weighted valve sufficient momentum to latch it open and completely fill the sand chamber. In using this spudding method, if it should happen that the valve 16 fails to latch itself open the relief valve would relieve the high pressure in the sand chamber as the bailer is withdrawn from the well.

It is understood that the embodiments of the invention described herein are only two of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiments set forth.

What I claim is:—

1. A bailer having a sand chamber at its lower end and an air chamber above the sand chamber with a passage connecting the same, a valve seat for said passage, a valve closure, a member carrying the valve closure having substantial weight and guided in the bailer, a spring thrusting against said member and normally holding the valve closure on its seat, a catch carried by said member, and a relatively fixed spring hook mounted in the bailer below the said catch, said parts cooperating when the downward movement of the bailer is arrested, to enable the momentum of said member to open the valve and enable the catch to engage the hook to maintain the valve in its open position.

2. A bailer having a sand chamber at its lower end and an air chamber above the sand chamber with a passage connecting the same, a valve seat for said passage, a valve closure, a member carrying the valve closure having substantial weight and guided in the bailer, a spring thrusting against said member and normally holding the valve closure on its seat, a catch carried by said member and a relatively fixed spring hook mounted in the bailer below the said catch, said parts cooperating when the downward movement of the bailer is arrested, to enable the momentum of said member to open the valve and enable the catch to engage the hook to maintain the valve in its open position, the wall of said bailer having an opening in the same through which the hook can be reached from the exterior of the bailer to release the same.

3. A bailer having a sand chamber at its lower end and an air chamber above the sand chamber with a passage connecting the same, a valve seat for said passage, a valve closure received on said seat from below, a valve guide carrying the valve closure, said valve guide consisting of a piston having a sleeve guided within the bailer and having a disk at its upper end connected with the valve closure and having openings for passing fluid upwardly through the valve passage when the valve closure is off its seat, a spring engaging the lower end of the valve guide and normally holding the valve closure on its seat, a catch mounted on the wall of the valve guide, a relatively fixed spring hook carried below the catch in the bailer, said parts cooperating when the downward movement of the bailer is arrested to open the valve by the momentum of the valve carrier and enable the catch to engage the hook to maintain the valve in an open position, the wall of said valve guide and the wall of the bailer having openings registering with each other when the valve is in its open position, said registering openings being located opposite the end of the hook to enable the same to be released from the exterior of the bailer.

4. A bailer having a receiving chamber at its lower end and an empty chamber above the receiving chamber with a passage connecting the same and having a valve-seat, a weighted valve-closure mounted to come upon the valve-seat from below, a shoe on the bailer, means for holding the valve-closure on its seat while the bailer is descending in the well, means for controlling the valve-closure to open the said passage through the agency of the momentum of the weighted valve closure when the shoe strikes an obstruction in descending in the well and thereby effecting the filling of the said chamber by the action of the pressure in the well, said shoe having a port in the side wall thereof with means for regulating the effective opening of the same to draw sand laterally toward the shoe.

5. A bailer having means for effecting the charging of the same by the action of the well pressure, said bailer having a shoe with a central passage through which the charge passes upwardly and having a side wall with a port therein with means for regulating the effective opening of the port to control the flow of sand in the well radially inward toward the shoe.

6. A bailer having a sand chamber below and an air chamber above, with a valve between said chambers, means for suddenly opening the valve to effect the charging of the sand chamber by the action of the well pressure, said bailer having a shoe with a central passage, a check valve in said central passage through which the charge passes upwardly, said shoe having a side wall with a port therein below the check valve, with means for regulating the effective opening of the port to control the flow of sand in the well radially inward toward the shoe, and to regulate the velocity of flow of the charge passing up through the central passage of the shoe.

7. In a bailer, a casing having an upper chamber and a seat therein below the chamber, a cut-off provided at the lower side of said seat, means below the cut-off for effecting an opening thereof to charge the bailer when its downward movement is arrested, and a valve operable to retain the charge.

8. In a bailer, a casing having an upper chamber and a shoe, a shoulder formed in the casing between said upper chamber and shoe, a cut-off seated on the lower side of said shoulder, means

below the cut-off for effecting an opening thereof to charge the bailer when its downward movement is arrested, and a valve operable to retain the charge.

9. In a bailer, a casing having an upper chamber and a shoe, a shoulder formed in the casing between said upper chamber and shoe, a cut-off seated on the lower side of said shoulder, means below the cut-off for effecting an opening thereof to charge the bailer when its downward movement is arrested, a valve operable to retain the charge, and a plurality of ports in the wall of the shoe.

10. In a bailer, a casing having an upper chamber and a shoe, a shoulder formed in the casing between said upper chamber and shoe, a cut-off seated on the lower side of said shoulder, means below the cut-off for effecting an opening thereof to charge the bailer when its downward movement is arrested, a valve operable to retain the charge, a plurality of ports in the wall of said shoe, and means for opening and closing said ports.

11. In a well tool, a casing having an upper chamber and a lower chamber, a valve closure therebetween, and means below the valve operable by momentum to open the same when the downward movement of the tool is arrested.

12. In a well tool, a casing having an upper chamber and a lower chamber, a valve closure therebetween, means below the valve operable by momentum to open the same when the downward movement of the tool is arrested, and means to lock the valve in open position.

13. In a bailer, a casing having an upper chamber and a lower chamber, a valve closure therebetween, a weighted member below and connected with said valve, and means to maintain the valve normally closed, said valve being adapted to be opened by the momentum of the weighted member when the bailer is arrested in its downward movement.

14. In a bailer, a casing having an upper chamber and a lower chamber, a valve closure therebetween, a weighted member below and connected with said valve, means to maintain the valve normally closed, said valve being adapted to be opened by the momentum of the weighted member when the bailer is arrested in its downward movement, and locking means to hold the valve in its open position.

15. In a bailer, a casing having an upper chamber and a lower chamber, a ball valve therebetween, a valve guide below and connected with said valve, means to maintain the valve normally closed, said valve being adapted to be opened by the momentum of the valve guide when the bailer is arrested in its downward movement, and locking means to hold the valve in open position.

16. In a bailer, a casing having an upper chamber and a lower chamber, a restricted passage connecting the chambers, a ball valve seating at the lower end of said passage, a valve guide below and connected with said valve, a spring to maintain the valve normally closed, said valve being adapted to be opened by the momentum of the valve guide when the bailer is arrested in its downward movement, and locking means to hold the valve in open position.

17. In a bailer, a casing having an upper chamber and a lower chamber, a restricted passage connecting the chambers, a valve seat at the lower end of said passage, a ball valve, a valve guide having passages therethrough disposed below and connected with said valve, a spring to maintain the valve normally closed, said valve being adapted to be opened by the momentum of the valve guide when the bailer is arrested in its downward movement, and locking means to lock the valve in its open position.

18. In a bailer, a casing having an upper chamber and a lower chamber, a restricted passage connecting the chambers, a valve seat at the lower end of said passage, a ball valve, a valve guide having passages therethrough disposed below and connected with said valve, locking means carried by the valve guide, a spring to maintain the valve normally closed, said valve being adapted to be opened by the momentum of the valve guide when the bailer is arrested in its downward movement, said locking means being adapted to lock the valve in open position.

19. In a well tool, a casing having upper and lower chambers, a valve closure therebetween, and means in the lower chamber to exert a downward pull on the valve closure to effect opening thereof.

20. In a well tool, a casing having upper and lower chambers, a valve closure therebetween, means in the lower chamber to exert a downward pull on the valve closure to effect opening thereof, and intake ports at the lower end of the casing.

21. In a bailer having upper and lower chambers, a valve closure therebetween, means in the lower chamber to exert a downward pull on the valve closure to effect opening thereof, intake ports at the lower end of the bailer, and means to vary the intake area of said ports.

22. In a cleaning device for wells, a casing having an inlet port in the side wall thereof, said inlet port providing a side passage to said casing, and means for varying the area of said side passage to the casing.

23. In a cleaning device for wells, a casing having a plurality of inlet ports in the side wall thereof, said inlet ports providing side passages to said casing, and means for varying the total area of said side passages to the casing.

24. In a cleaning device for wells, a casing having a bottom inlet and an inlet port in the side wall thereof adjacent said bottom inlet, said bottom inlet providing a bottom passage to said casing, and said inlet port providing a side passage to said casing, and means for varying the area of said side passage to the casing.

25. In a cleaning device for wells, a casing having a bottom inlet and inlet ports in the side wall thereof adjacent said bottom inlet, said bottom inlet providing a bottom passage to said casing, and said inlet ports providing side passages to said casing, and means for varying the total area of said side passages to the casing.

26. In a cleaning device for wells, a casing, a shoe attached to said casing, said shoe having an inlet port in the side wall thereof, said inlet port providing a side passage to said casing, and means for varying the area of said side passage to the casing.

27. In a cleaning device for wells, a casing, a shoe attached to said casing, said shoe having inlet ports in the side wall thereof, said inlet ports providing side passages to said casing, and means for varying the total area of said side passages to the casing.

28. In a cleaning device for wells, a casing, a shoe attached to said casing, said shoe having a bottom inlet and an inlet port in the side wall thereof adjacent said bottom inlet, said bottom inlet providing a bottom passage to said casing,

and said inlet port providing a side passage to said casing, and means for varying the area of said side passage to the casing.

29. In a cleaning device for wells, a casing, a shoe attached to said casing, said shoe having a bottom inlet and inlet ports in the side wall thereof adjacent said bottom inlet, said bottom inlet providing a bottom passage to said casing, and said inlet ports providing side passages to said casing, and means for varying the total area of said side passages to the casing.

30. In a cleaning device for wells, a casing having an inlet port in the side wall thereof, said inlet port providing a side passage to said casing, and means for closing said side passage.

31. In a cleaning device for wells, a casing having inlet ports in the side wall thereof, said ports providing side passages to said casing, and means for closing said side passages.

32. In a cleaning device for wells, a casing having a plurality of inlet ports in the side wall thereof, said ports providing side passages to said casing, and means for closing certain of said ports to vary the total area of said side passages to the casing.

33. In a suction bailer, a casing including a sand chamber and a suction chamber, a fluid-way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer is arrested in its descent in the well, and an inlet port to said sand chamber in the side wall of said casing.

34. In a suction bailer, a casing including a sand chamber and a suction chamber, a fluid-way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer is arrested in its descent in the well, and inlet ports to said sand chamber in the side wall of said casing.

35. In a suction bailer, a casing including a sand chamber and a suction chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer is arrested in its descent in the well, an inlet port in the side wall of said casing providing a side passage to said sand chamber, and means for varying the area of said side passage to the sand chamber.

36. In a suction bailer, a casing including a sand chamber and a suction chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer is arrested in its descent in the well, inlet ports in the side wall of said casing, said ports providing side passages to said sand chamber, and means for varying the total area of said side passages to the sand chamber.

37. The method of bailing sand and the like material from well bottom which comprises applying suction to simultaneously draw such material vertically through the bottom inlet of a bailer casing and laterally through the side wall of the bailer casing adjacent the bottom inlet from the well area surrounding the lower end of the bailer casing, to prevent the same from becoming embedded in the sand or the like at well bottom, and regulating the area of lateral flow of material through the side wall of the bailer casing to accommodate the bailer to the type of well bottom encountered.

38. The method of bailing sand and the like material from well bottom in successive charges which comprises lowering a bailer to well bottom and applying suction to simultaneously draw such material vertically through the bottom inlet of the bailer casing and laterally through the side wall of the bailer casing adjacent the bottom inlet from the well area surrounding the lower end of the bailer casing, to prevent the same from becoming embedded in the sand or the like at well bottom, elevating the bailer to the surface of the well with the charge retained therein, removing the charge, and regulating the area of lateral flow of material through the side wall of the bailer casing for succeeding charges to accommodate the bailer to the type of well bottom encountered.

39. In a cleaning device for wells, a casing having a bottom inlet providing a bottom inlet passage into said casing, a charge retaining valve in said casing above said bottom inlet, an inlet port in the side wall of said casing adjacent said bottom inlet and between said bottom inlet and said valve providing a side inlet passage into said casing, and means for varying the area of said side inlet passage into said casing.

40. In a cleaning device for wells, a casing having a bottom inlet providing a bottom inlet passage into said casing, a charge retaining valve in said casing above said bottom inlet, a discharge port in said casing above said valve, closure means for controlling said discharge port, an inlet port in the side wall of said casing adjacent said bottom inlet and between said bottom inlet and said valve providing a side inlet passage into said casing, and means for varying the area of said side inlet passage into said casing.

41. In a cleaning device for wells, a casing having a bottom inlet providing a bottom inlet passage into said casing, a charge retaining valve in said casing above said bottom inlet, a plurality of inlet ports in the side wall of said casing adjacent said bottom inlet and below said valve providing side inlet passages into said casing, and means for varying the total area of said side inlet passages into said casing.

42. In a cleaning device for wells, a casing having a bottom inlet providing a bottom inlet passage into said casing, a charge retaining valve in said casing above said bottom inlet, a plurality of inlet ports in the side wall of said casing adjacent said bottom inlet and below said valve providing side inlet passages into said casing, and closure means for said ports on said casing for varying the total area of said side inlet passages into said casing.

43. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, said casing having a bottom inlet providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, and an inlet port in the side wall of said casing adjacent said bottom inlet and below said valve, said side inlet port being spaced from the lower end of said casing and providing a side inlet passage into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom.

44. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said cham-

bers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, said casing having a bottom inlet providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, a discharge port in said casing above said valve, closure means for controlling said discharge port, and an inlet port in the side wall of said casing adjacent said bottom inlet and below said valve, said side inlet port being spaced from the lower end of said casing and providing a side inlet passage into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom.

45. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, a bottom inlet in said casing providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, and a plurality of inlet ports in the side wall of said casing adjacent said bottom inlet and below said valve, said inlet ports being spaced from the lower end of said casing and providing side inlet passages into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom.

46. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, said casing being provided with a bottom inlet providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, an inlet port in the side wall of said casing adjacent said bottom inlet and below said valve, said inlet port providing a side inlet passage into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom, and means for varying the area of said side inlet passage into said casing to accommodate the bailer to well bottoms having different characteristics.

47. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, said casing being provided with a bottom inlet providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, a discharge port in said casing above said valve, closure means for controlling said discharge port, an inlet port in the side wall of said casing adjacent said bottom inlet and below said valve, said inlet port providing a side inlet passage into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom, and means for varying the area of said side inlet passage into said casing to accommodate the bailer to well bottoms having different characteristics.

48. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, a bottom inlet in said casing providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, a plurality of inlet ports in the side wall of said casing adjacent said bottom inlet and below said valve, said inlet ports providing side inlet passages into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom, and means for varying the total area of said side inlet passages into said casing to accommodate the bailer to well bottoms having different characteristics.

49. In a suction bailer, a casing including a substantially air tight suction chamber and a sand chamber, a fluid way between said chambers, means for closing said way when the bailer is descending in the well, means for opening said way when the bailer encounters the well bottom, a bottom inlet in said casing providing a bottom inlet passage into said sand chamber, a charge retaining valve in said casing below said sand chamber, a plurality of inlet ports in the side wall of said casing adjacent said bottom inlet and below said valve, said inlet ports providing side inlet passages into said sand chamber to draw well sand and the like encountered at the well bottom from around the lower end of said casing and into said casing to prevent the same from becoming embedded in the sand at the well bottom, and closure means for said ports on said casing for varying the total area of said side inlet passages into said casing to accommodate the bailer to well bottoms having different characteristics.

PAUL CAVINS.