April 6, 1954 C. P. HOWE 2,674,200

CASING PUMP DRAIN VALVE

Original Filed Dec. 7, 1951 4 Sheets-Sheet 1

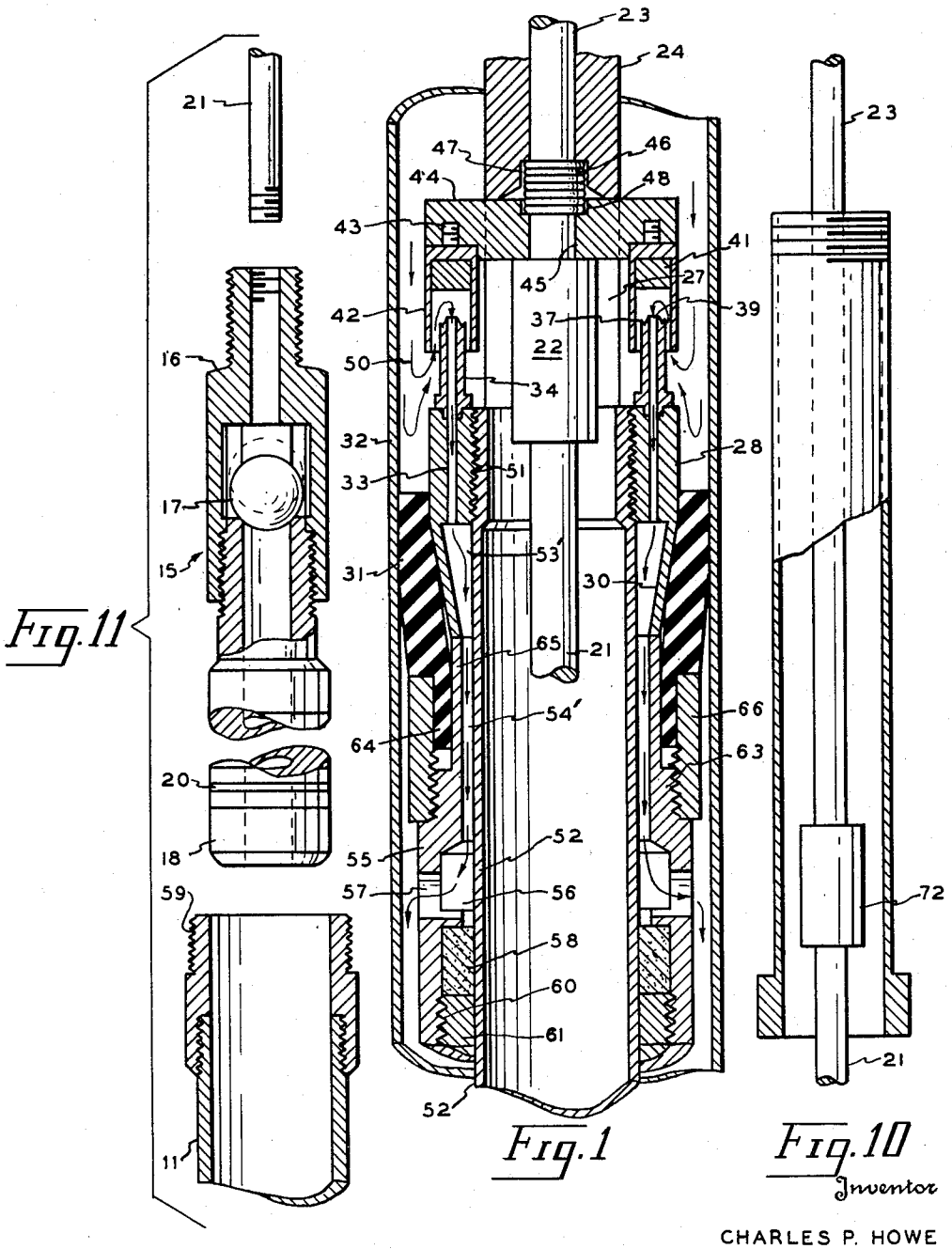


FIG. 11

FIG. 1

FIG. 10

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CASING PUMP DRAIN VALVE

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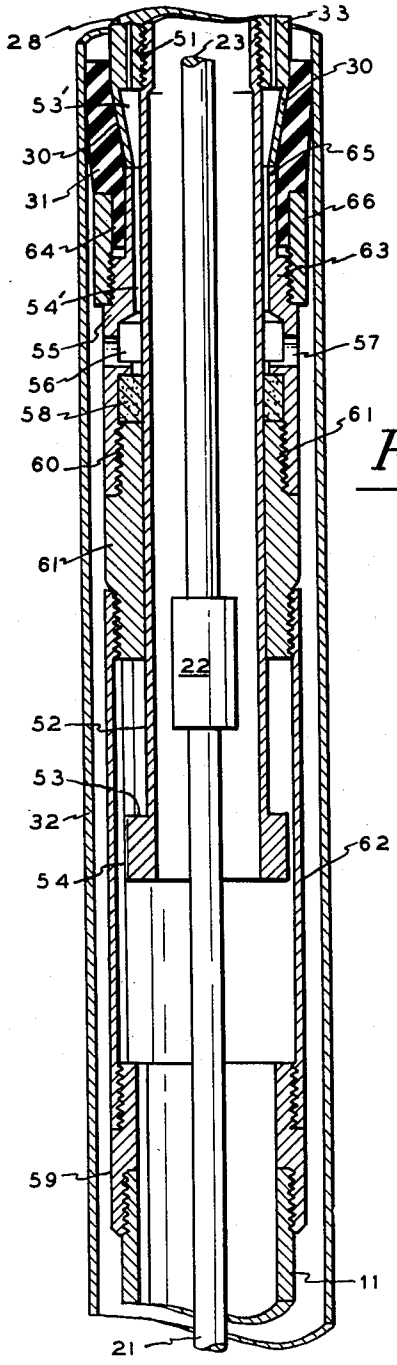


FIG. 2

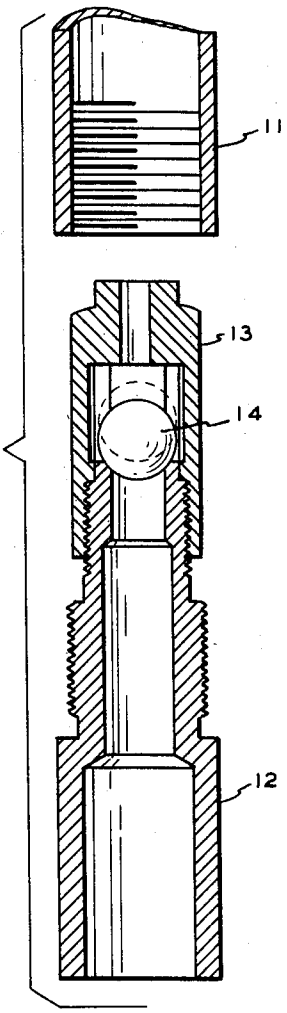


FIG. 12

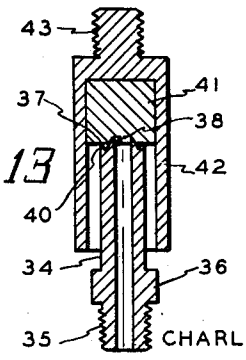


FIG. 13

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CASING PUMP DRAIN VALVE

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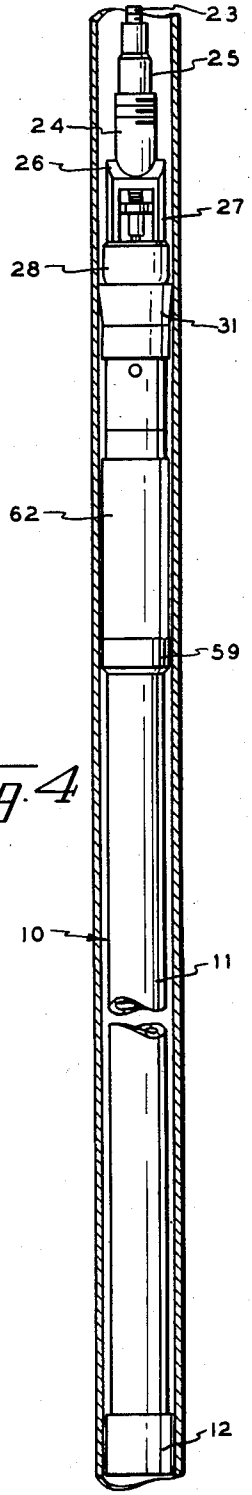


Fig. 4

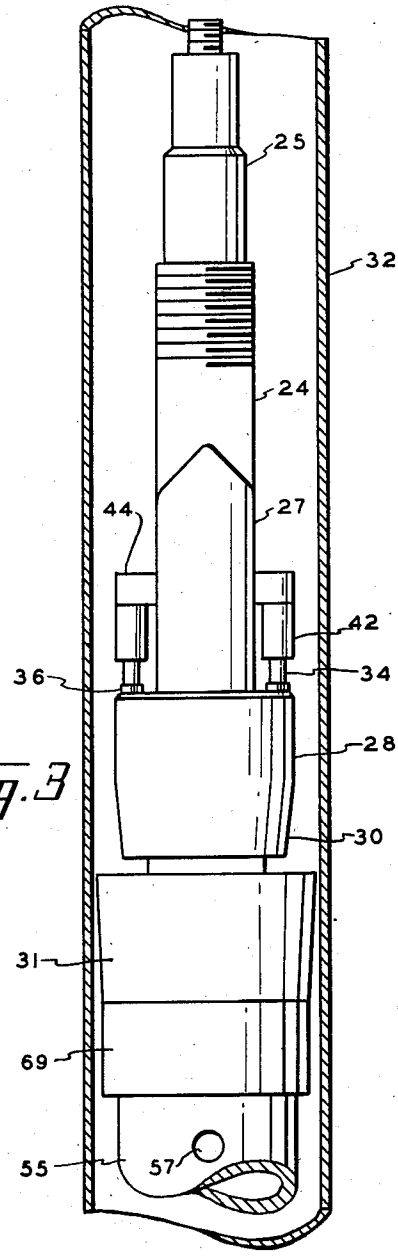


Fig. 3

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CASING PUMP DRAIN VALVE

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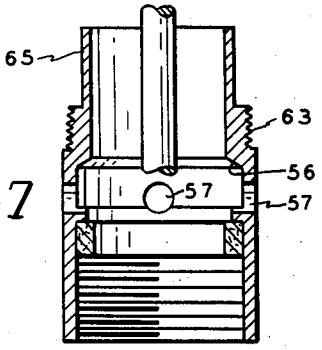


Fig. 7

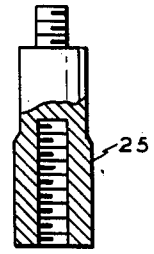


Fig. 14

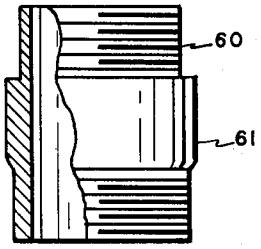


Fig. 8

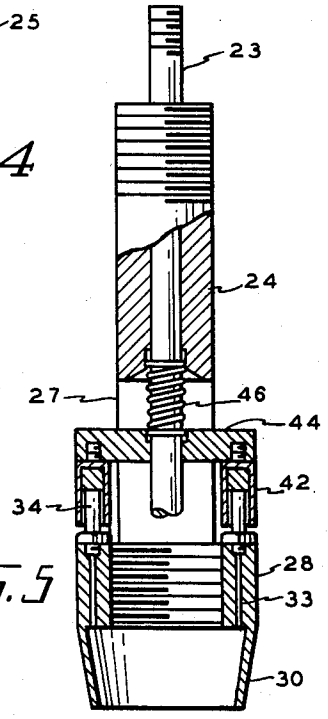


Fig. 5

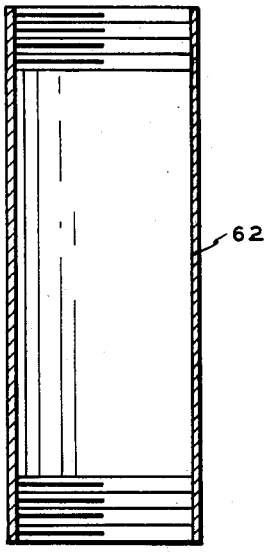


Fig. 9

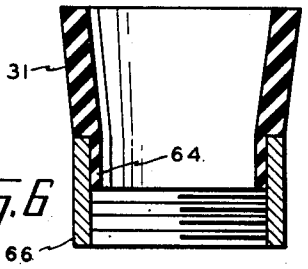


Fig. 6

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UNITED STATES PATENT OFFICE

2,674,200

CASING PUMP DRAIN VALVE

Charles P. Howe, Albion, Ill.

Original application December 7, 1951, Serial No. 260,372. Divided and this application October 21, 1952, Serial No. 315,990

5 Claims. (Cl. 103—221)

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This application is a division of application, Serial No. 260,372, filed December 7, 1951.

This invention relates to a casing pump drain valve and has for an object to provide an improved casing pump having a drain valve which will permit the entrapped sands and solids above the pump head to be washed back and drained through the pump head before the casing pump is pulled for repair or replacement.

A further object of this invention is to provide a drain valve in a casing pump unit which as means for not only automatically releasing the hydrostatic pressure upon the unit before raising the unit from its operating position, but also causes any entrapped sands or solids above the pump head to be washed downwardly from above the pump head through the drain opening to below the same so that the pumping unit may be easily pulled with the regular pulley equipment and without likelihood of breaks occurring by pulling the pump for inspection, repairs or replacement. Although drain valves for oil well casing pumps are old as shown in the patent to D. B. Howe, 2,062,058 of November 24, 1936, and such previous drain valves will permit the hydrostatic pressure above the pump head to drain downwardly through the pump head, such previous type of drain valves do not necessarily cause the sands or solids entrapped above the pump head to be necessarily washed downwardly therethrough, and with such previous drain valves, it is possible that there may be still so great a load of sands or solids left above the pump head after the oil has drained downwardly therethrough that it may be impossible to remove the pumping unit as necessary. With this invention, however, the drain valve insures that any sands or solids will be washed downwardly through the pump head thus relieving the pumping unit from any load of either hydrostatic pressure of oil or of weight of sands or solids, thus leaving the pumping unit free to be readily removed in the usual manner.

The pumping head and drain valve of this invention is also particularly intended in connection with the improved method of pumping oil under pressure without the loss of gas of the invention, set forth in the above mentioned parent application.

With the foregoing and other objects in view, this invention comprises the combination, construction and arrangement of parts hereinafter set forth, claimed and disclosed in the accompanying drawings, wherein:

Fig. 1 is a longitudinal sectional view through an oil well casing pump and drain valves of this invention showing the drain valves in operating position.

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Fig. 2 is a longitudinal sectional view through the working barrel assembly and pump head.

Fig. 3 is a plan view of the pump head and drain valves, in the position of being pulled from the casing.

Fig. 4 is a plan view of the pumping unit in operative position.

Fig. 5 is a sectional view through the pump head and drain valves.

Fig. 6 is a sectional view of the pump head packer.

Fig. 7 is a sectional view of the drain sleeve.

Fig. 8 is a sectional partly elevational view of the drain sleeve support or packing gland.

Fig. 9 is a sectional view through the assembly barrel.

Fig. 10 is a partly broken view of the assembly nipple showing the pump rod extending therethrough.

Fig. 11 is an exploded sectional and partly fragmentary view of the travelling valve.

Fig. 12 is an exploded sectional view of the standing valve.

Fig. 13 is a sectional view through one of the drain valves.

Fig. 14 is a partly sectional view of the upper pump rod coupling.

There is shown at 10 the pumping unit of this invention. This pumping unit 10 includes a valve barrel 11 to the bottom of which is threaded a standing valve 12 including a valve cage 13 and valve ball 14 for permitting oil to travel upwardly therethrough but preventing it from travelling downwardly.

Reciprocably operable within the valve barrel 11 above the standing valve 12 is the travelling valve 15 consisting of the cage 16, the ball valve 17, hollow pump piston 18 and pump packings 20. This travelling valve is reciprocated within the valve barrel 11 by means of the lower pump rod 21 which is secured by a left hand thread to a pump rod coupling 22 to the pump rod 23.

The upper pump rod 23 extends through a guide sleeve 24 where it is secured by means of the upper pump rod coupling 25 to a sucker rod extending to the top of the well. The guide sleeve 24, which is hollow to permit the upper pump rod 23 to reciprocate therethrough, is integrally supported on the yoke 26 which in turn is an integral part of the yoke legs 27 extending integrally up from the pumping head 28. This pumping head 28 is a substantially cylindrical

member provided with an integral depending cone-shaped skirt 30 arranged when in pumping position to extend into and compress a packing 31 against the sides of the well casing 32 to provide a leak proof seal therewith. Extending vertically through the pump head 28 are a pair of drain openings 33 leading to the inside of the skirt 30. Threaded into the top of the pump head 28 in communication with the drain openings 33 is a drain valve tube 34 having its lower end suitably threaded at 35 and provided adjacent the threads 35 with an integral hex 36 for receiving a wrench. The top end of tube 34 terminates in a pair of concentric spaced apart sharpened lips 37 and 38, the inner lip 38 extending slightly beyond the outer lip 37 and connected thereto by a valley 40.

Cooperating with the valve lips 37 and 38 for sealing or opening the drain openings 33 extending through the tube 34 is a valve seat 41 of soft metal such as Babbitt or lead or the like mounted within an inverted cup 42 having an integrally formed threaded boss 43 for supporting it at one end of a floating bridge 44. The floating bridge 44 with a valve seat cup 42 at each end is provided with a central aperture 45 through which the upper pump rod 23 extends, and is located between the yoke arms 27, being yieldably urged downwardly so as to press the valve seats 41 against the valve lips 37 and 38 by means of a coil spring 46 biased between a recess 47 in the bottom of the guide sleeve 24 and another recess 48 in the top of the bridge 44 counterbored from the pump rod opening 45.

As will be apparent from Fig. 1, when the sucker rod is raised upwardly beyond the normal pumping stroke, it will cause the lower pump rod coupling 22 to abut the bottom of floating bridge 44 and raise it against the coil spring 47 until it abuts the bottom of the guide sleeve 24 and yoke 26, thus raising the valve cups 42 upward and removing the valve seat 41 from contact with the valve lips 37 and 38. As shown in Fig. 1, the cups 42 come to rest with the valve tubes 34 still extending about half way into the cups, hence, any fluid flowing down from above the pumping head unit must swirl about as shown by arrows 50 in order to pass into the inverted cup 42 and reach the opening through the drain tube 34 to the drain openings 33.

Threaded to the inside of the pumping head 28 is the upper threaded end 51 of the assembly nipple 52 whose lower end is provided with a shoulder 53 and enlarged portion 54. The outer surface of nipple 52 cooperating with the inner surface of skirt 30 forms a drain passage 53' therebetween as shown in Fig. 1 leading from the pump head drain openings 33 to a lower drain passage 54' formed between the outside of assembly nipple 52 and the inside of a drain sleeve 55 leading to an internal annular recess 56 and to drain openings 57 to the outside of drain sleeve 55. A packing 58 in the bottom of drain sleeve 55 seals against the outside of assembly nipple 52. The packing 58 is held in position by the upper threaded end 60 of an assembly coupling 61 whose lower end is threaded into the upper end of the assembly sleeve 62, the lower end of assembly sleeve 62 being in turn threaded by a coupling 59 on the upper end of barrel valve 11.

The drain sleeve 55 has a threaded counterbore 63 for securing it in the bottom of the packing sleeve 66, the packing 31, preferably of neoprene rubber or the like having a portion 64 extending therewithin and bounded thereto as by vulcanization or the like. The drain sleeve 55 has an upwardly extending portion 65 above the threaded counterbore 63 and arranged to abut the bottom edge of skirt 30 so as to connect drain passageways 53 and 54 together as shown in Fig. 1, when the pump head skirt is fully depressed within the packing 31 as in normal operation of the pump.

When the pumping unit is being lowered into the well or is being raised therefrom, it will be supported on the sucker rod and upper pump rod 23 holding the coupling 22 against the bottom of floating bridge 44 and thus against the bottom of the yoke guide sleeve 24 and yoke 26. The pump barrel assembly will be supported in turn by shoulder 53 of assembly nipple 52 abutting the bottom end of assembly coupling 61. In this position, the skirt 30 is disengaged from the outside of packing 31 as shown in Fig. 3 and the maximum external diameter of packing 31 is less than the internal diameter of casing 32, thus permitting the pumping unit to pass freely up and down within the casing 32. When being placed in the well, the bottom ends of the working barrel 12 or any suitable extension tube thereon will hit against the bottom of the well, thus preventing further descent of the pumping unit. The weight of the assembly nipple 52 and attached spots and the pumping head will cause the skirt 30 of pumping head 28 to enter within and expand the packing 31 tightly against the inside of casing 32 while simultaneously the spring 46 urges floating bridge 44 downwardly and thus seals the valve seat 41 against the tube lips 37 and 38. The pump is now ready to be operated, as the sucker rod drops down further to the normal pumping position, in which position, the travelling valve 15 may be reciprocated up and down by means of the lower pumping rod 21 with its coupling 22 remaining well below the floating bridge 44 on which the valve cups 42 are supported. After an extended period of pumping, it may be necessary to remove the pumping unit for inspection, repair or replacement. To do so, the sucker rod is raised upwardly beyond its normal zone of operation until coupling 22 comes into contact with the bottom of floating bridge 44 and raises against the coil spring 46 to abut the bottom of guide sleeve 24 and yoke 26. Should the pump sand up and the travelling rod 15 freeze or stick so that it will not travel either way, the sucker rod may be rotated in the direction to unthread the left hand thread between the bottom of coupling 22 and the top of lower pumping rod 21, thus freeing coupling 22 for upward movement. This opens the drain valves 42 from the drain valve tube 34 without having to do any work against the hydrostatic pressure of the column of oil and entrained sands or solids therewithin, while the pumping head skirt 30 still remains within packing 31 compressed against the inside of casing 32. The column of oil immediately starts to drain down through the drain openings 33 and passageways 53', 54', recess 56 and drain openings 57 to below the packing 31 to the bottom of the well.

As the oil drains downwardly, it is forced to reverse its direction in order to enter under the cups 42 to reach the opening through tube 34, thus causing a swirling motion in the bottom of the oil column thoroughly washing out any entrapped sand through the opening so that by the time the column of oil has drained from above to below, every bit of sand will have been washed therethrough, leaving the pumping unit free of both the weight of the oil column and of the weight of any sand that might otherwise be left thereabove.

The sucker rod is then pulled somewhat additionally, thereby pulling the skirt 30 out of the packing 31 and allowing it to contract to the condition shown in Fig. 3 whereupon the pumping unit may be pulled easily from the well by means of the sucker rod for replacement or repair, the column of oil that has drained therebelow thus serving to seal the bottom of the well.

While the device has been shown and the structure described in detail, it is obvious that this invention is not to be considered as being limited to the exact form disclosed, and that changes in detail and construction may be made therein within the scope of what is claimed, without departing from the spirit of this invention.

Having thus set forth and disclosed the nature of this invention, what is claimed is:

1. In a well casing pump having a pumping unit having a pump head, a packing normally sealing the pump head to the casing during pumping operation, an operating rod normally reciprocable through the head in pumping operation and raisable beyond the normal pumping zone to unseal the packing and lift the pumping unit from the casing, the pump head having a drain opening providing communication above and below the packing sealed pump head; drain valve means for normally keeping the drain opening closed during pumping operation comprising an open ended tube mounted on said pump head in communication with the drain opening, an inverted cupped cylinder mounted over said tube end of greater internal diameter than the external diameter of said tube, yieldable means normally holding said cupped cylinder against said tube end to close the drain opening during pumping operation, and means engaging with the operating rod to lift said cupped cylinder against said yieldable means to open said tube end with the cup still about the tube when the operating rod is raised above its normal zone of reciprocation in advance of raising the pump head and unsealing the packer when pulling the unit from the casing, thereby opening the drain opening with the cupped cylinder extending partially about said tube and causing the fluid draining therethrough downwardly in the casing from above the pump head to reverse its direction before entering said valve tube and thus swirl about and wash back any trapped sands or solids from above the pump head.

2. In a well casing pump having a pumping unit having a pump head, a packing normally sealing the pump head to the casing during pumping operation, an operating rod normally reciprocable through the head in pumping operation and raisable beyond the normal pumping zone to unseal the packing and lift the pumping unit from the casing, the pump head having a drain opening providing communication above and below the packing sealed pump head; drain valve means for normally keeping the drain opening closed during pumping operation comprising an open ended tube mounted on said pump head in communication with the drain opening, an inverted cupped cylinder mounted over said tube end of greater internal diameter than the external diameter of said tube, a soft metal valve seat in the cup of said inverted cylinder, said tube having sharpened valve seat engaging lip means at its top open end, yieldable means normally holding said cupped cylinder against said tube end to close the drain opening during pumping operation, and means engaging with the operating rod to lift said cupped cylinder against said yieldable means to open said tube end with the cup still about the tube when the operating rod is raised above its normal zone of reciprocation in advance of raising the pump head and unsealing the packer when pulling the unit from the casing, thereby opening the drain opening with the cupped cylinder extending partially about said tube and causing the fluid draining therethrough downwardly in the casing from above the pump head to reverse its direction before entering said valve tube and thus swirl about and wash back any trapped sands or solids from above the pump head.

3. In a well casing pump having a pumping unit having a pump head, a packing normally sealing the pump head to the casing during pumping operation, an operating rod normally reciprocable through the head in pumping operation and raisable beyond the normal pumping zone to unseal the packing and lift the pumping unit from the casing, the pump head having a drain opening providing communication above and below the packing sealed pump head; drain valve means for normally keeping the drain opening closed during pumping operation comprising an open ended tube mounted on said pump head in communication with the drain opening, an inverted cupped cylinder mounted over said tube end of greater internal diameter than the external diameter of said tube, a soft metal valve seat in the cup of said inverted cylinder, said tube having sharpened valve seat engaging lip means at its top open end, said lip means comprising a pair of concentric spaced apart annular lips having a valley therebetween, yieldable means normally holding said cupped cylinder against said tube end to close the drain opening during pumping operation, and means engaging with the operating rod to lift said cupped cylinder against said yieldable means to open said tube end with the cup still about the tube when the operating rod is raised above its normal zone of reciprocation in advance of raising the pump head and unsealing the packer when pulling the unit from the casing, thereby opening the drain opening with the cupped cylinder extending partially about said tube and causing the fluid draining therethrough downwardly in the casing from above the pump head to reverse its direction before entering said valve tube and thus swirl about and wash back any trapped sands or solids from above the pump head.

4. In a well casing pump having a pumping unit having a pump head, a packing normally sealing the pump head to the casing during pumping operation, an operating rod normally reciprocable through the head in pumping operation and raisable beyond the normal pumping zone to unseal the packing and lift the pumping unit from the casing, the pump head having a drain opening providing communication above and below the packing sealed pump head; drain valve means for normally keeping the drain opening closed during pumping operation comprising an open ended tube mounted on said pump head in communication with the drain opening, an inverted cupped cylinder mounted over said tube end of greater internal diameter than the external diameter of said tube, a soft metal valve seat in the cup of said inverted cylinder, said tube having sharpened valve seat engaging lip means at its top open end, said lip means comprising a pair of concentric spaced apart annular

lips having a valley therebetween, said inner lip extending beyond said outer lip, yieldable means normally holding said cupped cylinder against said tube end to close the drain opening during pumping operation, and means engaging with the operating rod to lift said cupped cylinder against said yieldable means to open said tube end with the cup still about the tube when the operating rod is raised above its normal zone of reciprocation in advance of raising the pump head and unsealing the packer when pulling the unit from the casing, thereby opening the drain opening with the cupped cylinder extending partially about said tube and causing the fluid draining therethrough downwardly in the casing from above the pump head to reverse its direction before entering said valve tube and thus swirl about and wash back any trapped sands or solids from above the pump head.

5. In a pumping unit of the class described having a pump head having a drain opening providing communication above and below the head and an operating rod normally reciprocable through the head in pumping operation; drain valve means for closing said opening comprising tube secured on said pump head, the drain opening extending through the top end of said tube, an inverted cupped cylinder of greater internal diameter than the external diameter of said tube and having a soft metal valve seat in its cup, said tube having a pair of sharpened concentric lips at its open end, said cupped cylinder metal seat being adapted to be closed against said tube end lips to close said drain opening, yieldable means normally urging said cupped seat toward closed position during pumping operation, and means engaging with the operating rod to lift said cup against said yieldable means to drain open position when the operating rod is raised above its normal zone of reciprocation in advance of lifting the unit from operative position, thereby causing the fluid draining downwardly therethrough from above the pump head to reverse its direction before passing through said valve tube and thus swirl about and wash back any entrained sands or solids.

No references cited.