The present invention relates to the oil industry and more particularly to a sand pump and bailing device.

Sand pumps and bailing devices are used to remove sand and debris from oil wells. The invention described herein is particularly useful in the context of gas well bailing and sand control.

Inventor Paul R. Yates, assignor of twenty-five percent to Claude M. Harris, twenty-five percent to Raymond C. Maness, both of Oklahoma City, Okla., twenty-five percent to John D. Storm and twenty-five percent to George D. Gibson, both of Shawnee, Okla., filed Oct. 15, 1958, Ser. No. 767,034.

The head 14 is formed with a bore 22, diametrically substantially smaller than the bore of the barrel 12, but of sufficient size to freely receive the conventional wire line 26, or the like therethrough. The head is secured to the top of the barrel 12 as by welding. A rope socket 24 is loosely received within the barrel 12. The rope socket 24 is centrally bored through and counter bored at least twice to provide an enlarged bore at its end opposite the rope receiving end and forms a pair of oval shoulders 26 perpendicular to the axis of its bore. The rope 20 is connected to the rope socket 24 by spreading and doubling back the individual strands of the rope and securing the same by molten metal 28 which is conventional.

A relief hole 30 formed in the wall of the socket 24 prevents overfilling the socket with metal. An aperture or window 32 is formed in the wall of the barrel 12 adjacent its connection with the head 14. The window 32 is preferably of such size that the rope socket 24 may be removed from or inserted into the barrel 12 therethrough. Thus it may be seen that the head 14 and barrel 12 need not be separable for connecting or disconnecting a wire line 20 as is conventional for this type of tool, thus eliminating the possibility of the head and barrel separating at this point when in operation within a well bore.

Vertically reciprocable plunger means 34 is placed within the barrel 12. The plunger means 34 includes a tubular section or mandrel 36 which is threadedly connected to, its upper end to the bore of a valve cage 38. The valve cage 38 has an inclined surface defining a reduced upper end portion which is cooperatively engaged within the bore of the downwardsly directed counter bored end of the rope socket 24. The wall of the lower end portion of the rope socket is provided with conventional J-slots, spaced 90°, which cooperatively engage with pins 42 secured to the reduced upper end portion of the valve cage to support the plunger means 34. A screw 44 carried by the reduced upper end portion of the valve cage between opposing vertical walls of one J-slot prevents unauthorized separation of the two members.

A ring 46 having a downwardly facing annular valve seat is secured to the bore of the barrel 12, as by welding adjacent the lower limit of the window 32 for sealing with the inclined surface on the valve cage 38 and closing the bore of the barrel for the purposes which will presently be apparent. The valve cage 38 is provided with a plurality of fluid passageways or apertures 48 permitting communication between the bores of the mandrel and barrel.

The upper end of the mandrel tubular section 36 is provided with a valve seat for sealing with a valve ball 50 upon upward movement of the mandrel.

A plurality of pistons or ring members 52 are secured to the mandrel 36 by pins 54. The bore of each of the pistons 52 is sealed with the periphery of the mandrel 36 and the periphery of each piston is closely received by the wall forming the bore of the barrel 12. Packing or piston rings, indicated at 56, seals the piston fluid tight with the inner wall of the barrel. Each of the pistons 52 has a valve seat 58 formed in its upper surface and a plurality of vertical bores or apertures 60 through each piston provide fluid communication between opposing ends of the piston for the purposes which will readily be apparent. A tubular member 62 having a lower surface adapted to seal with the valve seat 58 is loosely received by the periphery of the mandrel 36 and is reciprocable between an upper position in contact with an upper piston or the valve cage 38, respectively, and a lower position seated on the valve seat 58, which closes the bores 64, by the resistance offered by fluid in the bore of the barrel 12 during reciprocation of the plunger 34, as is more fully described hereinbelow.
3 The sleeve member 16 is threadedly connected to the lowermost end of the barrel 12. The sleeve 16 has a reduced upper end portion 64 which is closely received by and extends upwardly into the bore of the barrel. A valve flap 66 is pivotally connected to the wall of the sleeve member, at one side thereof, and is movable between a horizontal position, shown by solid lines in FIG. 2A, where it rests on an annular shoulder 68 and closes the lower end of the barrel and an upper or open position by the action of the reciprocating plunger means 34 in forcing fluids against the valve flap or reducing the pressure within the bore of the barrel above the valve flap. The inclined wall portion 69 below the shoulder 68 and pivoting connection of the valve flap 66 prevents damage to the valve flap at its connection with the sleeve by rocks, sand or the like under pressure. The wall of the reduced end portion 64 of the sleeve is provided with a port 70 above the valve flap seat 68 which may be moved into and out of register with a co-operating port 72 for forming a path for fluid pressure present more fully described hereinbelow. A fluid chamber 73 is thus formed between the ring 46 and the valve flap 66.

4 The tubular shoe 18 is threadedly connected to the depending end of the sleeve member 16 and is secured by a set screw 74. The shoe is transversely bored, as at 76, for the purposes which will presently be apparent. FIGS. 5 and 6 illustrates a still bit 80 which replaces the shoe 18 for drilling through cement plugs, bridges and the like by a reciprocating action of the entire device by means of the wire line prior to the bowling or sand pumping action.

Operation

In operation, the device, assembled as disclosed hereinafter, is lowered into a well bore, not shown, by the wire line 20. During this lowering operation the inclined surface on the valve cage 38 is seated on the seat formed on the ring 46 and the valve flap 66 is closed thus sealing the fluid chamber 73. After the device has been lowered into fluid which may be present adjacent the bottom of the well bore and the shoe 18 contacts the formation at the bottom of the well the valve cage 38 separates from its seal with the annular ring 46 permitting fluids under pressure present in the well bore to raise the valve flap 66 and enter the chamber 73. If insufficient pressure is present to raise the valve flap 66 and completely fill the chamber 73, the plunger 34 is lowered toward the shoe 18 permitting any fluid in the lower end of the barrel to flow upwardly through the bore of the mandrel 36, through the valve cage 38 and through the bores 60 in the pistons. Upward movement of the plunger lifts the valve flap 66 and seats the valve ball 50 and tubular members 62 and reduces the pressure within the fluid chamber 73 and draws a load of fluid containing sand in suspension or other matter into the chamber. This action may be repeated as desired for loading the tool and pumping sand off of the well bottom. Thus it may be seen that if sufficient pressure is present at the well bottom the same will fill the fluid chamber and as the tool is lifted the inclined surface on the valve cage 38 seals off the upper end of the chamber and traps such pressure therein. After reaching the surface of the earth a pin, not shown, is inserted into the transverse bores 76 in the bottom of the barrel 12. The barrel is then lowered, by the wire line 20, to position the bore of the shoe over a pair of inclined uprights 84 carried by a <000086>drum block 86 (FIG. 7) mounted on the rig floor, not shown, so that the aforementioned pin is nested by co-operating aligned slots 82 formed on the uprights. A wrench, not shown, is applied to the barrel 12 while the drum block holds the shoe stationary for the barrel bore, by the wire line 20, to position the shoe over the valve flap 66. The barrel is then extended upwardly to receive the shoe, in its un-screwing action for mating the sleeve port 70 with the barrel port 72. Bottom hole pressure trapped within the fluid chamber 73 then forces the material out of the chamber.

Obviously the invention is susceptible to some change or alteration without defeating its practicability, and I therefore do not wish to be confined to the preferred embodiment shown in the drawings and described herein, further than I am limited by the scope of the appended claims.

1 claim:

1. A bailer and sand pump, including: an elongated tubular barrel having a rope-receiving head connected to its upper end portion and having a rope-socket-receiving window formed in its wall adjacent the head, said head having a central bore diametrically reduced with respect to the bore of the barrel which latter is substantially uniform in diameter, said upper end portion of the barrel formed with said sand barrel; a rope-socket connected with said rope within said barrel, said rope-socket having a depending counter bored end portion and having a plurality of J-slots formed in the wall of the counter bored end portion, said window having a width and length at least as great as the diameter and length, respectively, of said rope-socket, whereby said rope-socket may be removably connected with said rope exteriorly of said pump without disassembling the latter; an elongated tubular mandrel of reduced diameter reciprocable within said barrel, said mandrel having an annular valve seat formed in its upper end connected with the upper end portion of said mandrel, said valve cage having an annular inclined surface and having a reduced upper end portion closely received by the counter bored end of said rope-socket; pins secured to the reduced upper end portion of said valve cage and engaged by the J-slots in said rope-socket; a screw threadedly connected with the reduced upper end portion of said valve cage between opposing walls forming one said J-slot; an annular ring secured to the inner wall of said barrel below the lower limit of said window, said ring having a valve seat for sealing with the inclined surface of said valve cage; a valve ball within said valve cage adapted for sealing with said valve seat on said mandrel upon the upstream of the latter; a plurality of pistons carried in spaced-apart relation by said mandrel, said pistons each having a valve seat formed on its upper surface, the wall of each said piston having a series of apertures extending vertically downward from said valve seat; a tubular member slidingly carried loosely by said mandrel above each said piston, said tubular members each having a lower surface engageable with the valve seat on each respective said piston for opening and closing the apertures in the latter during its reciprocating action; a sleeve member removably secured to the lowest end of said barrel, said sleeve member having an upper reduced end portion closely received by the bore of said barrel, the reduced end portion of said sleeve having a port through its wall, said barrel having a port in its wall for mating and mismatching with the port in the reduced end portion of said sleeve, said sleeve member having an annular upwardly facing shoulder on its inner wall forming a valve seat below the port; and a valve flap pivotally connected to the wall of said sleeve at one side thereof and movable into and out of sealing position on said annular shoulder to open and close the lower end of said barrel in response to the reciprocating action of said mandrel.

2. A bailer and sand pump, including: an elongated tubular barrel having an upper and a lower end; a rope-receiving head rigidly connected coaxially to the upper end of said barrel, said rope-receiving head having a central bore co-axial with and diametrically smaller than the bore of said barrel; a rope extended through said rope-receiving head; a rope-socket connected with said rope within the upper end portion of said barrel, said rope-socket having a depending tubular end, said barrel having a window laterally extending along said side wall adjacent the rope-receiving head, the dimensions of said window being at least as great as the overall dimensions of said rope-socket, whereby said rope-socket may be removable connected with said rope exteriorly of said barrel without disassem-
bling the latter; an elongated centrally bored mandrel of reduced diameter co-axially disposed within said barrel, said mandrel having a valve seat formed on its upper end; a valve cage secured to the upper end of said mandrel, said valve cage having an upwardly inclined surface defining a reduced upper end portion adapted to be removably connected with the tubular end of said rope-socket for reciprocation therewith within said barrel; a ring secured to the inner wall of said barrel, said ring having a downwardly facing seat co-operating with the inclined surface on said valve cage and closing the bore of the barrel below the window when the device is supported by said rope; a valve ball within said valve cage adapted for seating on said valve seat on said mandrel and closing the upper end of the bore of said mandrel upon the upstroke of the latter; a plurality of pistons carried in spaced-apart relation by said mandrel in contiguous contact with the wall forming the bore of said barrel, said pistons each having a downwardly and inwardly inclined valve seat formed on its upper surface, the wall of each said piston having a series of circumferentially spaced-apart apertures extending vertically downward from said valve seat; a tubular member slidably carried loosely by said mandrel above each said piston, each said tubular member having a downwardly and inwardly tapering surface cooperating with the respective valve seat on said pistons for opening and closing the apertures in the latter during its reciprocating action, each said tubular member being diametrically smaller than the bore of said barrel; a sleeve threadedly secured to the lowermost end of said body, said sleeve having an upwardly projecting reduced end portion closely received by the bore of said barrel, the reduced end portion of said sleeve having a port through its wall, said barrel having a port in its wall for mating and mismating with the port in the reduced end portion of said sleeve, said sleeve having a reduced bore intermediate its ends forming a horizontal valve seat; and a valve flap pivotally connected to the wall of said sleeve at one side thereof above the horizontal valve seat and movable into and out of sealing position on the latter to open and close the lower end of said barrel in response to the reciprocating action of said mandrel and pistons.

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