July 18, 1961 P. R. YATES 2,992,682

BAILER AND SAND PUMP

Filed Oct. 13, 1958

3 Sheets-Sheet 1

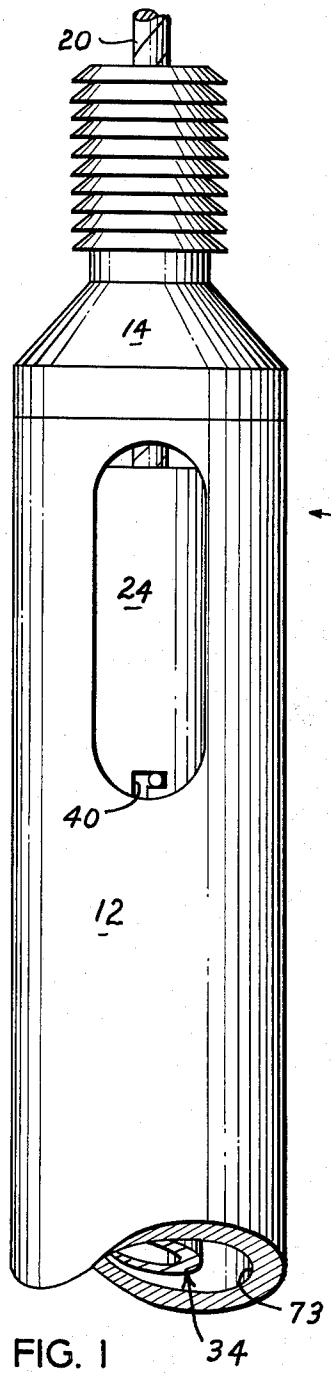


FIG. 1

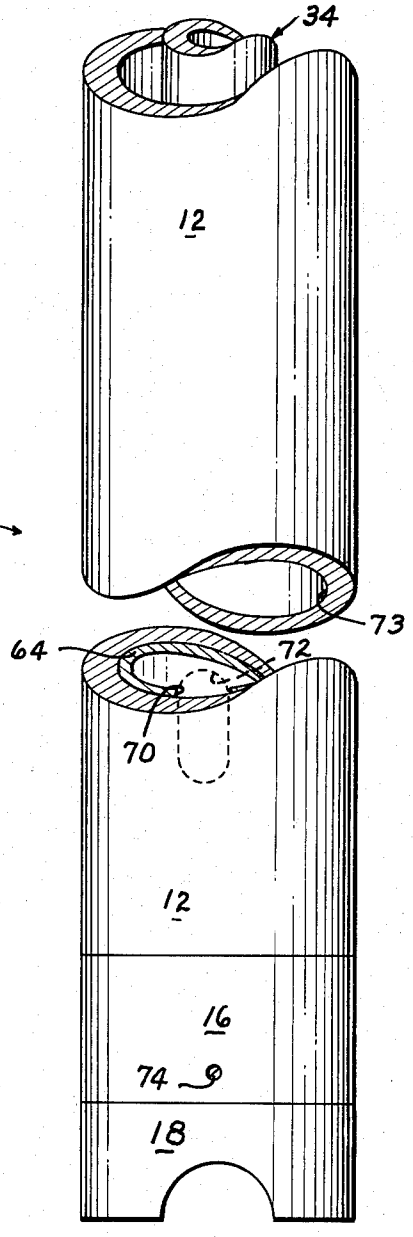


FIG. 1A

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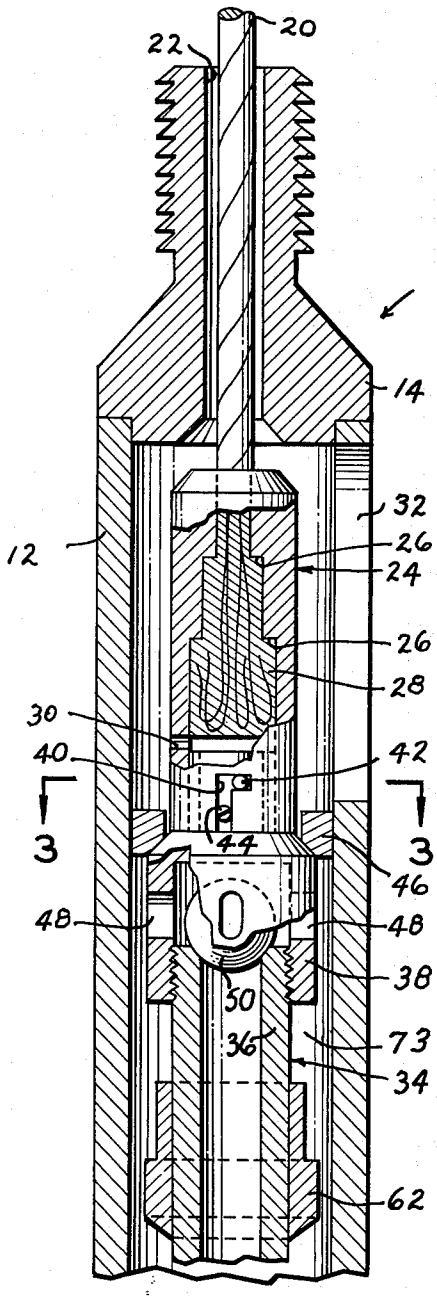


FIG. 2

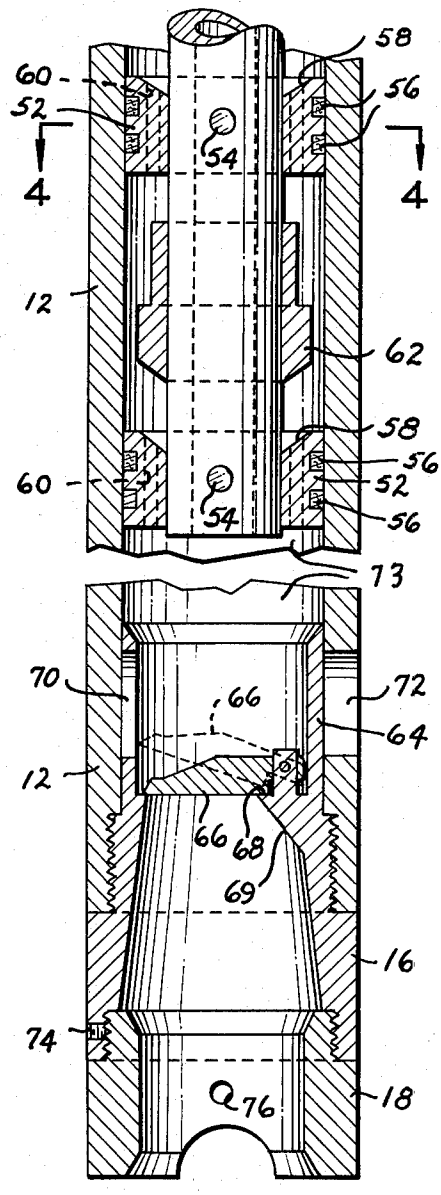


FIG. 2A

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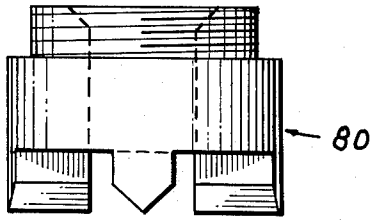


FIG. 5

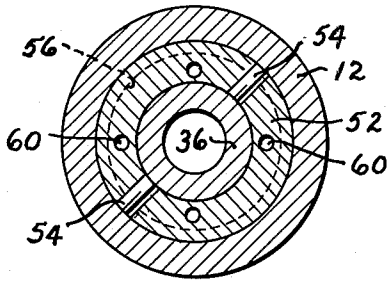


FIG. 4

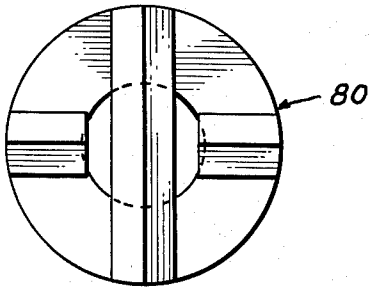


FIG. 6

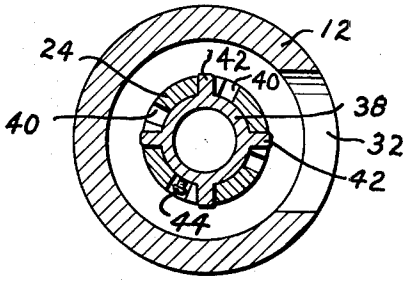


FIG. 3

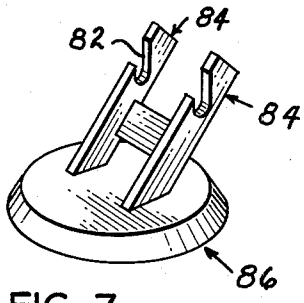


FIG. 7

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United States Patent Office 2,992,682 Patented July 18, 1961

2,992,682

BAILER AND SAND PUMP

Paul R. Yates, Shawnee, Okla., assignor of twenty-five percent to Claude M. Harris, twenty-five percent to Raymond C. Manees, 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. 13, 1958, Ser. No. 767,034
2 Claims. (Cl. 166—105)

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

Sand pumps and bailers are by no means new but none of them, as shown by the prior art as far as I know, utilize hydrostatic, hydraulic and vacuum action.

It is, therefore, the principal object of this invention to provide a combination bailer and sand pump which utilizes hydrostatic and hydraulic pressure followed by a reduction of pressure or vacuum action for loading the device under well pressure at the bottom of a well bore and conserving such pressure for discharging such load at the surface of the earth.

Another object is to provide a device of this class which may be connected to a wire line after the tool has been assembled.

Another object is to provide a bailer of this class having a reciprocable plunger means for affecting a pumping action adjacent the bottom of a well bore.

Another object is to provide a device of this character having a valve flap for opening and closing its lower end, and an annular valve seat for sealing with means carried by the upper end of the plunger means, thus providing a fluid entrapping chamber filled with atmospheric pressure as the device is lowered into a well bore.

A further object is to provide a device for securing a sample of the fluid and sand or other loose formation from the bottom of a well bore, which sample is sealed within a fluid tight chamber contained by the device against mixture with other matter or fluids while being removed from the well.

Yet another object is to provide a tool of this class which may be used for removing bridges, cement plugs, or the like.

Another object is to provide a device of this class having tubular reciprocating plunger means connected to a wire line for moving fluids into and out of the device under pressure.

Other objects will be apparent from the following description when taken in conjunction with the accompanying three sheets of drawings, wherein:

FIGURE 1 is a fragmentary side elevational view of the upper end portion of the device;

FIGURE 1A is a fragmentary side elevational view of the lower end portion of the device;

FIGURES 2 and 2A are vertical cross-sectional views taken through FIGS. 1 and 1A, respectively;

FIGURES 3 and 4 are horizontal cross-section views taken substantially along lines 3—3 and 4—4, respectively;

FIGURE 5 is a side elevational view of a star bit;

FIGURE 6 is a bottom view of the bit seen in FIG. 5; and,

FIGURE 7 is a perspective view of a dumping block tool.

Like characters of reference designate like parts in those figures of the drawings in which they occur.

In the drawings:

The reference numeral 10 indicates the device, as a whole, comprising an elongated tubular body or barrel 12, a head 14, a sleeve member 16 and a shoe 18 adapted to be lowered into a well bore, not shown, by a wire line

20. 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 20, 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 annular 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 at 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 co-operatingly received within the bore of the downwardly 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 co-operatingly 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 reasons 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 60, by the resistance offered by fluid in the bore of the barrel during reciprocation of the plunger 34, as is more fully described hereinbelow.

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 seats 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** formed in the wall of the barrel in a manner more fully described hereinbelow. A fluid chamber **73** is thus formed between the ring **46** and the valve flap **66**.

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 star 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 bailing or sand pumping action.

Operation

In operation, the device, assembled as disclosed hereinabove, 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 shoe. The bailer is lowered, by the wire line **20**, to position the bore of the shoe over a pair of inclined uprights **84** carried by a dump 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 dump block holds the shoe stationary for turning the barrel 90° relative to the shoe, in an unscrewing 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.

I 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; a rope extended through the bore in said head; 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 on its upper end; a valve cage 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 on said valve cage; a valve ball within said valve cage adapted for sealing with said valve seat on said mandrel upon the upstroke 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 slidably 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 threadedly secured to the lowermost 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 mismating 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 co-axially 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 through its 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 removably 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 verically 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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