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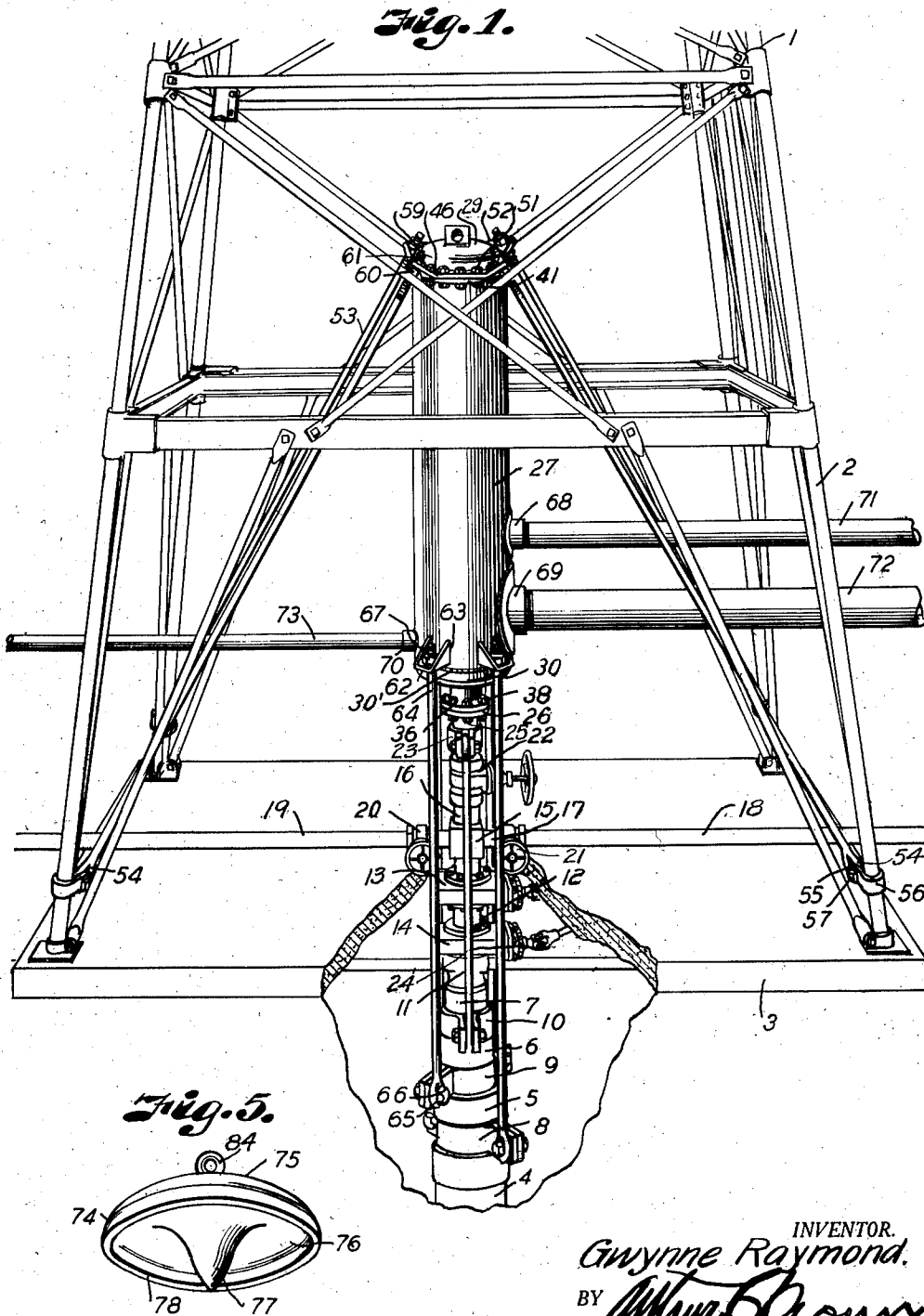
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1,913,041

APPARATUS FOR CONTROLLING FLOW OF FLUID FROM OIL WELLS

Filed Sept. 11, 1930

2 Sheets-Sheet 1



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Fig. 2.

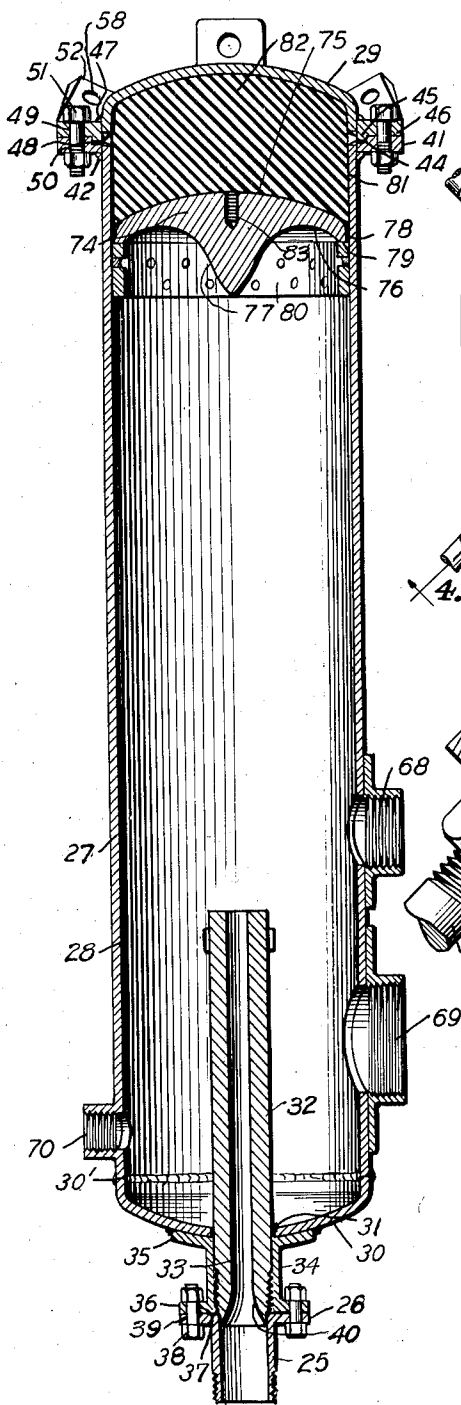


Fig. 3.

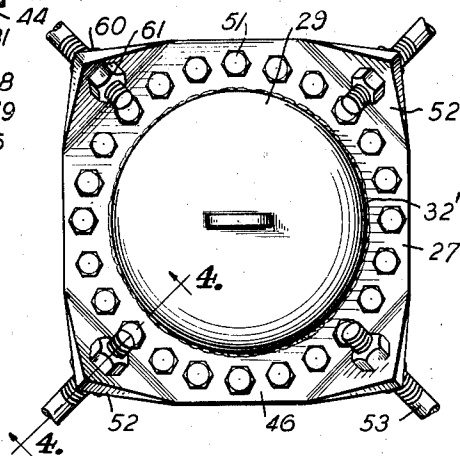
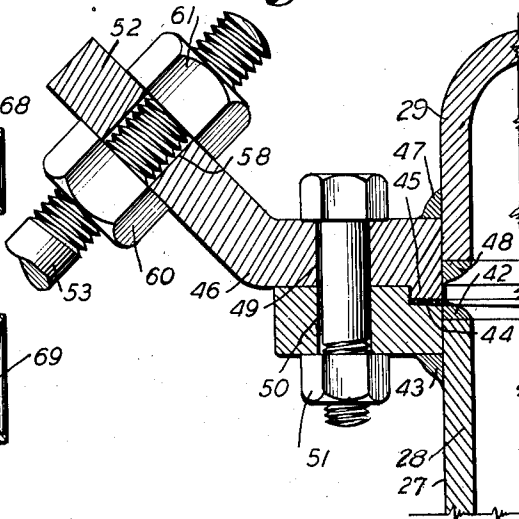


Fig. 4.



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APPARATUS FOR CONTROLLING FLOW OF FLUID FROM OIL WELLS

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My invention relates to apparatus for controlling flow of fluid from oil wells drilled into high pressure strata and has for its principal object to absorb the kinetic energy of flowing oil, gas, sand, etc., violently ejected through the well incidental to the extremely high rock and gas pressures encountered, so that the flow may be kept under control and the fluid may be delivered to the regular oil and gas receivers in substantially quiet state.

It is also an object of the invention to provide for initial separation of the oil, gas and solid matter incidental to controlling flow of fluid from the well.

In accomplishing these and other objects of my invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of an oil well equipped with a flow control apparatus constructed in accordance with my invention.

Fig. 2 is a sectional view through the control drum particularly illustrating the cushion head for absorbing kinetic energy of materials ejected from the well.

Fig. 3 is a plan view of the control drum illustrating connection of its stay rods.

Fig. 4 is an enlarged sectional view through the head of the drum on the line 4-4, Fig. 3.

Fig. 5 is a detail perspective view of the floating head for deflecting flow from the well tubing.

Referring in detail to the drawings:

1 designates an oil well derrick including the usual corner posts 2 supported on a suitable platform 3, and 4, 5, 6 and 7 designate strings of casing extending through the well hole and supported by casing clamps 8, 9 and 10 as in standard oil field practice.

The inner string of casing 7 is preferably provided with a casing head 11 and extending therethrough to the bottom of the well is a string of tubing 12 for conveying fluid from the oil stratum to the surface of the ground. The upper end of the tubing extends above the casing head and is provided

with master valves 13 and 14 respectively for shutting off flow from the well.

Supported at the projecting end of the tubing and preferably above the derrick floor is a Christmas tree connection comprising a cross fitting 15 having its vertical outlets 16 connected in series with the tubing and its side outlets 17 connected with lateral pipes 18 and 19 for conveying oil emitted from the well to the usual storage tanks after the well has been brought under control, the flow through the pipes 18 and 19 being controlled by suitable valves 20 and 21.

Received in the tubing above the cross fitting is a valve 22 for shutting off flow from the upper end of the tubing and fixed to the tubing above the valve 22 is a clamp 23 for anchoring the tubing to one of the strings of casing, here illustrated as the casing 6, the clamp 23 being connected with the clamp 10 by suitable tie rods 24.

The assembly of the flow lines thus far described is the usual apparatus for controlling flow of oil from a well and is satisfactory for controlling low pressure wells, but in certain oil fields wells produce under extremely high pressures which may vary from 2000 to 2500 pounds per square inch, and when the well is opened to start flow of fluid, the initial uprush of fluid is so violent that the valve 22 is opened to release the initial flow to atmosphere and rocks, drilling mud, sand and oil are thrown over the crown block or top of the derrick. Oftentimes these particles of rock and sand strike sparks and set the well on fire, making it very hard to extinguish and bring the well under control for normal flow through the flow lines.

It is therefore becoming the practice not to release the initial flow from the well to atmosphere, but to extend the flow through an expansion chamber wherein the initial flow is checked and allowed to expand before its release to atmosphere through suitable flow lines. However, even with the expansion chambers as now employed, the uprush of the fluids is so violent that the anchors for securing the expansion chambers

are sometimes torn from their moorings and blown from the derrick.

It is therefore a purpose of the present invention, as above mentioned, to provide means for absorbing the kinetic energy of the flowing fluid and divert the flow for expansion and quiet release through the flow lines as now described.

Threadedly mounted on the upper end of the well tubing is an extension pipe 25 having a collar 26 at its upper end for supporting an expansion and control chamber 27 constructed in accordance with my invention, and preferably comprising an elongated drum of substantially larger diameter than the well tubing to provide expansion of the fluid flowing from the well. The drum is positioned vertically on the tubing and its side walls 28 and its upper and lower heads 29 and 30 are preferably constructed of boiler plate.

The lower head 30 is preferably welded to walls of the drum as indicated at 30' and is crowned outwardly and provided with an opening 31 to receive a nipple 32 having a bore 33 which may be of smaller diameter than the tubing to provide a choke for reducing velocity of fluid through the master valves and controlling the output of the well. Fixed to the bottom of the head in alignment with the opening is a spool 34 having a peripheral collar 35 at its upper end shaped in conformity with the crown of the head and a collar 36 at its lower end complementary to the collar 26 on the tubing extension.

The upper collar 35 is preferably welded to the head of the drum and the lower collar 36 is provided with openings 37 for receiving bolts 38 which project through aligning openings 39 in the collar 26 as shown in Fig. 2 to anchor the drum to the tubing.

The nipple 32 is preferably threaded into the spool and may be provided with a bell shaped mouth 40 having hardened wearing surfaces.

The upper end of the drum is provided with an outwardly extending flange 41 consisting of a ring welded to the rim of the drum as at 42.

The ring 41 is provided on its upper face adjacent the wall of the drum with a peripheral recess 44 for receiving a peripheral tongue 45 formed on a ring 46 similar to the ring 41 and secured to the head 29 by welding as indicated at 47 and 48. The rings thus described are provided with aligning openings 49 and 50 for receiving bolts 51 whereby the head may be secured to the drum.

The upper ring 46 may comprise a rectangular plate having its corners bent upwardly at an angle to provide ears 52 for

securing stay rods 53 for anchoring the drum to the derrick as now described.

The lower ends of the rods 53 are preferably provided with eyes 54 whereby they may be moored to the derrick legs, for example the eyes may be received between ears 55 on leg clamps 56 and bolts 57 may be projected through the ears and eyes of the rods as shown in Fig. 1.

The upper ends of the rods are threaded and extend through openings 58 in the ears 52 for receiving a lock nut 60 and a nut 61 for securing the rods to the ears.

Channel shaped lugs 62 are welded to the lower end of the drum as at 63 and are provided with openings for receiving threaded ends of tie rods 64 extending parallel with the well tubing and having eyes 65 at their lower ends for anchorage by bolts 66 to respective casing clamps 8 and 9 as shown in Fig. 1, nuts 67 being threaded on the ends of the rods to engage the lugs for additionally anchoring the lower end of the drum.

The lower end of the drum is also provided with suitable outlet connections 68, 69 and 70 for flow lines 71, 72 and 73, the lines 71 and 72 being connected to suitable separators or flow tanks and the line 73 to the slush pit not shown.

In order to check flow of the fluid and absorb its kinetic energy, I provide the drum with a supplemental head 74 preferably comprising a steel casting having a convex upper face 75 complementary in contour with the fixed head, and a concave lower face 76 provided with a substantially cone-shaped depending deflector portion 77 for deflecting the flow of fluid toward the wall of the drum.

The head 74 is loosely mounted in the drum and provided with a peripheral flange 78 for normally seating on a shoulder 79 formed by a ring 80 welded to the inner walls of the drum at a point below its upper end to provide a space 81 between the upper face of the member 74 and the detachable head of the drum to receive a flexible material 82 such as rubber or the like to provide a cushion for absorbing the blow of the mud and other masses striking the head 74 as later described.

The cushion may be formed of a plurality of layers of rubber gasket material or the like to form a flexible mass which may be compressed between the head 75 and the outer removable head 29. The head 74 is thus loosely mounted in the drum and is free to move to allow the cushioning material to absorb impact of the blows of the heavy material blown from the well. In some instances it may be desirable to dispense with the metal deflector head, particularly in wells flowing large quantities of sand, since the sand has very abrasive action on metal parts. In this instance the

sand will directly contact the yieldable material which will withstand the abrasive action much longer than the metal head. The movable head 74 may be provided with a threaded socket 83 to receive a threaded eye 84 to aid in the removal of the head when the well is to be bailed.

In bringing in a well with a flow control apparatus constructed and assembled as described, the well tubing including the master valves, Christmas tree connections and the extension 25 are assembled in the well as shown. The expansion drum 27 with its upper end open and with the nipple 32 removed, is secured to the extension 27. The tie rods 64 are projected through the lugs 62 and their lower ends are anchored to the casing clamps 8 and 9. The nuts 67 are then applied to the threaded ends of the rods to anchor the drum to the strings of casing 5 and 6. Flow of the well has thus far been prevented by the drilling mud which has been pumped into the casing during the drilling operations, the weight of the mud in the casing preponderating over the pressure in the oil stratum.

When it is desired to bring in the well the final drilling operation may be carried on through the opened end of the drum and a substantial portion of the mud holding back flow from the oil sand may be bailed by running a bailer through a pipe (not shown) of substantially the diameter of the tubing which is threaded into the spool 34 in place of the nipple and is of sufficient length to project above the open end of the drum to serve as a guide for the bailer and prevent damaging impact of the bailer with the bottom of the drum. The bailing operation will continue until the static head has been reduced sufficiently to establish an initial flow through the tubing after which the master valves 13 and 14 and the valve 22 are closed and the nipple 32 is replaced.

The floating deflector head 77 is then inserted into the upper end of the drum to rest on its seat 79. The cushioning material 82 is then inserted in the drum after which the head 29 is applied and the bolts 51 inserted to draw the head downwardly onto the drum to compress the cushioning material.

The stay rods 53 are then secured to the head and tensioned by the nuts 60 and 61.

After the head 29 has been applied to the drum the valves 13, 14 and 22 are again opened. The pressure in the oil sand will break through the liquid in the tubing and the mud, rocks and sand will be thrown upwardly through the tubing and be discharged against the cone-shaped deflector 77 which parts the flow and deflects it outwardly against the walls of the expansion drum to allow the flow to expand and drop to the lower end of the drum.

The force of the flow and blows from solid materials lift the deflector head to compress the cushioning material so that the kinetic energy of the flowing material is absorbed thereby and the drum head is relieved from direct impacts of the heavy masses blown from the well. Attention is also directed to the fact that the point of the deflector tends to break up the solid masses discharged with the fluid.

When excessive pressure of initial flow has subsided and the rocks, mud, sand and the like have been blown from the well, the valve 22 may be closed and the milder flow continued through the lines 18 and 19. The control drum may then be removed and used in bringing in other wells or it may be left on the well and the flow to the storage tanks may be discharged through the lines 71 and 72.

It is thus apparent that I have provided means for checking the flow and absorbing its kinetic energy before it is discharged to the receiving tank or separators and that undue pressures and impacts are prevented from damaging the expansion drum.

What I claim and desire to secure by Letters Patent is:

1. In a well trap, an upright tank, a nipple extending upwardly from the bottom of the tank, a choke nozzle detachably mounted on the upper end of the nipple, and a discharge pipe leading from the tank at a point below the nozzle.

2. In a well trap, an upright tank mounted directly over the well pipe for receiving the discharge of fluids therefrom without changing their direction of flow, a nipple extending axially from the bottom of the tank and connected to the well pipe, a discharge pipe leading from the side of the tank below the top of the nipple, and a removable plug in the top of the tank directly over the nipple.

In testimony whereof I affix my signature.
GWYNNE RAYMOND.