April 16, 1957 J. E. ORTLOFF 2,788,856

PLUNGER ARRANGEMENT FOR CLOSING WELL CASING

Filed May 25, 1955 2 Sheets-Sheet 1

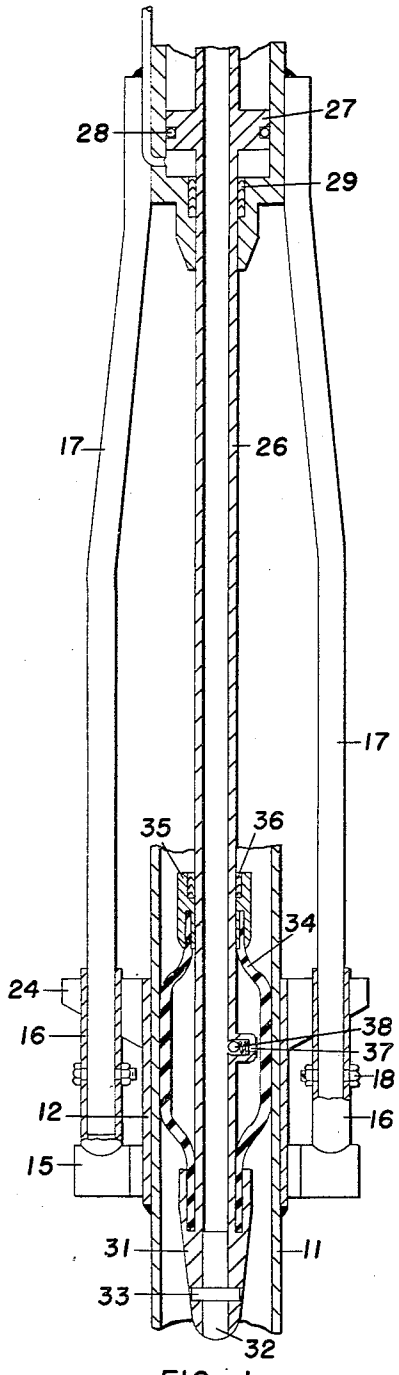


FIG. - 1

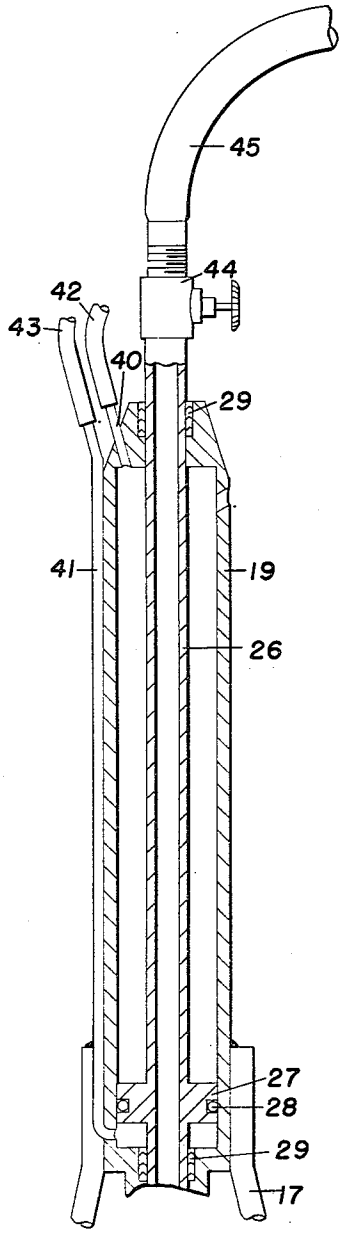


FIG. - 1A

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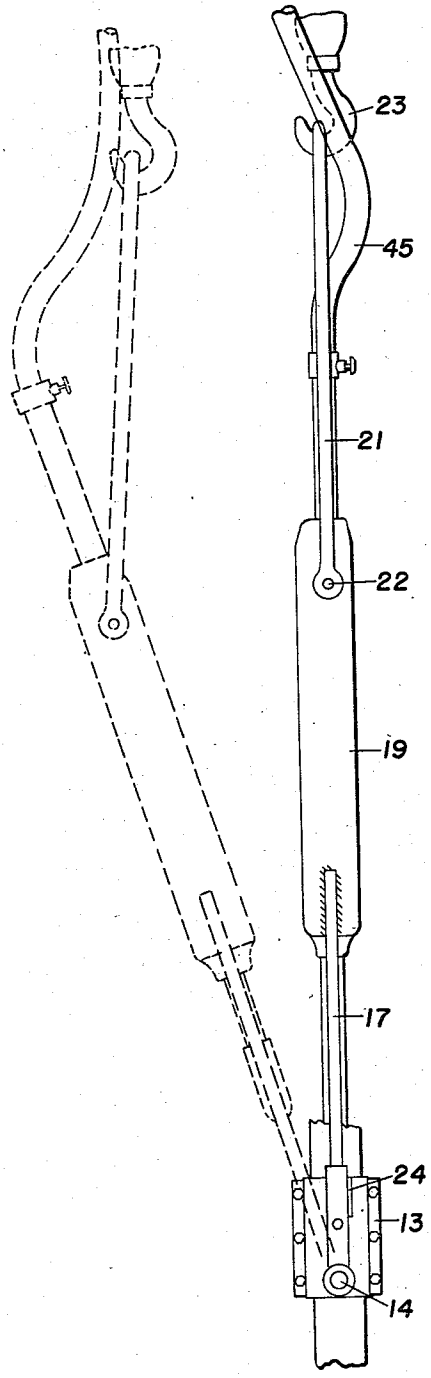


FIG. - 2

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PLUNGER ARRANGEMENT FOR CLOSING WELL CASING

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Application May 25, 1955, Serial No. 510,995

7 Claims. (Cl. 166—92)

This invention concerns apparatus for shutting in a wild petroleum well. In particular the invention relates to a device having a movable plunger that can be centered over the open end of a well casing and inserted into the casing after which a packer held by the plunger can be expanded to close the casing.

With any high pressure producing oil well there is always the danger that the well will get out of control and that the well cannot be closed off with the existing equipment. Wells that have blown out as a result of casing failure caused by excessive corrosion present a serious problem since in such cases there will usually be nothing left but the bare casing and therefore no structure such as flanges will be available to use as an anchoring means in attempting to cap the well. Wild wells of this nature present a particularly serious problem in marine installations since corrosion is particularly bad at the water line and the casing may have failed at the water level.

It is an object of the present invention to provide equipment that can be set in place above the well casing and quickly inserted into the casing to seal it off. In accordance with this invention, a split bracket is attached to the casing. The bracket supports a hydraulic cylinder having a piston to which is attached a plunger provided with an expansible packer. The cylinder is swung into place over the casing, the plunger is pushed by the piston into the casing and the packer is expanded preferably by hydraulic pressure. Once the blowout is stopped the well can be killed by pumping in heavy muds so that the necessary repairs can be made to the well.

The nature and objects of the invention will be more readily understood when reference is made to the accompanying drawings in which:

Figure 1 is an elevational view partly in section showing the lower portion of an apparatus of the invention attached to the top of a well casing;

Figure 1A is an upper continuation of the structure of Figure 1, with a portion of the structure repeated; and

Figure 2 is a schematic side elevational view showing the manner in which the apparatus is swung over the casing to insert the plunger.

Referring now particularly to the various figures it will be seen that the apparatus is provided with a split bracket **12** which iis attached to the top of the well casing **11** either by means of the flanges **13** which are clamped together by bolts or by welding the bracket to the casing. Unless the welding can be done underwater it will usually be preferable to attach the bracket by the clamping method when the bracket must be placed below the level of the water. The split bracket is provided with hinge pins **14** which rotatably receive collars **15** to which sleeves **16** are attached. The sleeves **16** are thus pivotally supported by the bracket. After the bracket has been attached to the casing the balance of the apparatus may be attached to the bracket by inserting the elongated rods **17** into the sleeves **16** and fastening them in place with the bolts **18**.

The rods **17** are fastened to and support an elongated

cylinder **19** to the upper end of which is pivotally attached by means of the pins **22** a lifting and positioning bail **21**. Fitting slidably within the cylinder **19** is a piston **27** which in turn is attached to an elongated tubular member **26** which may be referred to as a hollow piston rod or a plunger. An annular seal **28** prevents fluid flow past the piston. The plunger extends out of each end of the cylinder through tight fitting openings provided with packing **29**. The lower end of the piston rod or plunger is provided with a nose **31** holding a plug **32** that closes off the lower end of the bore of the plunger. The plug is held in place by means of a shear pin **33**.

Fixed to the lower exterior of the plunger is an inflatable packer **34** that is held in place at its lower end in an annular groove in the top end of the nose **31** and which is attached at its upper end to a metal sleeve **35** that is slidably positioned on the exterior of the plunger to permit expansion of the packer. Leakage of fluid out of the packer past the sleeve is prevented by the seal **36**. Communicating with the interior of the packer is a port **37** in the wall of the tubular member **26**. A check valve **38** is provided in the port **37** to maintain fluid pressure in the packer when it has ben inflated.

A port **40** in the wall of the cylinder at its upper end permits entry of fluid into the cylinder above the piston, while fluid entry into the cylinder below the piston is provided by a conduit **41**. Fluid for raising or lowering the piston can be supplied through high pressure hoses **42** and **43**. A third high pressure hose **45** is attached to the upper open end of member **26**. This opening can be closed off by a valve **44**, which may be a hand valve, as shown, or a check valve. This valve serves as a means of control if the pumps should fail during the killing of the well and also permits the hose **45** to be disconnected after the well has been killed.

The operation of the device can be described with the aid of Figure 2, the dotted outline showing the apparatus as it approaches the vertical position and the solid lines showing the apparatus in the vertical position. The split bracket has been clamped or welded to the casing and the rods **17** have been inserted into the sleeve **16** from one side of the well. The assembled apparatus can be raised to a vertical position by suitable means such as a crane operating from a barge. The crane hook **23** lifts the bail **21** which then moves the assembly toward its vertical position. The entire assembly pivots about the bracket hinge pin as the bail is raised. The stops **24** fastened to the bracket **12** prevent the assembly from going past center once it is in a vertical position.

As the assembly approaches a vertical position fluid pressure may be applied through hose **42** to drive the piston downward and thus extend the plunger toward the open casing. Once the apparatus is in the vertical position full pressure is applied behind the piston and the plunger inserts the packer into the casing. When the piston reaches the end of its down stroke, pressure is applied to inflate the packer by pumping fluid through the hose **45** into the tubular piston rod. Once the packer has been fully expanded the well will be shut in. The purpose of the pressure hose **43** and conduit **41** is to provide for upward travel of the piston in case it is necessary to raise the plunger if the plunger has been moved too far downwardly before the apparatus has been placed in a vertical position. No provision is made for deflating the packer, as it is considered that the packer is expendable.

Once the well blowout has been stopped heavy mud can be pumped into the well by raising the pressure within the tubular member **26** sufficiently to shear the pin **33**. Conveniently the pin can be designed to shear at approximately double the pressure required to fully inflate the packer.

It is to be understood that this invention is not limited to the specific structures hereinbefore described and that modifications and variations thereof that do not depart from the spirit and scope of the invention will occur to those skilled in the art. The scope of the invention is defined in the appended claims.

What is claimed is:

1. An apparatus for closing off fluid flow from an open cased well which comprises a cylinder, a piston movable within said cylinder, a plunger attached to said piston and extending through one end of said cylinder, supporting means attachable to the well casing and said cylinder and adapted to support said cylinder in longitudinal alignment with the well casing and with the plunger extending toward said casing, an expansible packer mounted to the free end of said plunger, means to apply fluid pressure to said piston and thereby drive said packer into said casing, and means to expand said packer within the casing.

2. An apparatus for closing off fluid flow from an open cased well which comprises an enclosed hollow cylinder attachable to the well casing and adapted to be supported above and in longitudinal alignment with said casing, a piston movable within said cylinder, a plunger attached to said piston and extending through the lower end of said cylinder in a movable fluid-tight relation, an expansible packer mounted on the lower end of said plunger, means to apply fluid pressure to said piston and thereby insert said packer into said casing, and means to expand said packer after its insertion in the casing.

3. An apparatus for closing off fluid flow from an open cased well having casing extending upward out of the well which comprises a piston an elongated cylinder adapted to receive said piston, supporting means pivotally attached to said casing and to said cylinder and adaptable to support said cylinder above said casing with the longitudinal axis of the cylinder in substantial alignment with the longitudinal axis of the casing, a plunger attached to said piston and extending through the lower end of said cylinder in a movable fluid-tight relation, an expansible packer mounted on the lower end of said plunger, means for applying fluid pressure to said piston to insert said packer within said casing, and means to expand said packer following its insertion within said casing.

4. An apparatus for closing off fluid flow from an open cased well having casing extending upward out of said well which comprises a hollow fluid-tight cylinder, supporting means pivotally attached to said casing and to said cylinder and adapted to support said cylinder above said casing with the longitudinal axes of the cylinder and the casing in substantial alignment, a piston positioned within and movable along the length of said cylinder, a rod attached to said piston and extending out the lower end of said cylinder, said rod being slidably movable relative to said cylinder in a fluid-tight manner, a fluid passageway extending through said piston and the length of said rod, an expansible packer attached to the outer surface of the lower end of said rod, means to apply fluid pressure within said cylinder and above said piston so as to insert said packer into said casing, means to apply fluid pressure within said passageway to expand said packer, a releasable plug within the lower end of said passageway to prevent fluid flow therethrough until said packer has been expanded.

5. An apparatus as defined in claim 4 in which said plug is releasable in response to a predetermined fluid pressure within said passageway.

6. An apparatus for closing off fluid flow from an open cased well having casing extending upward out of the well which comprises a piston, a fluid-tight cylinder adapted to receive said piston, supporting means pivotally attached to said casing and to said cylinder and adaptable to support said cylinder above the casing with the longitudinal axes of the cylinder and the casing in substantial alignment, a piston rod attached to and piercing said piston and extending out of the lower end of said cylinder in a slidable fluid-tight relation therewith, a packer expansible in response to fluid pressure attached to the lower portion of said rod, a fluid passageway within said rod, means to apply fluid pressure against said piston so as to insert said packer into said casing, and means to apply fluid pressure within said passageway to expand said packer after the insertion of the packer into the casing.

7. An apparatus as defined in claim 4 including a fluid check valve positioned between the fluid passageway and the packer to retain said packer in an expanded condition once the packer has been so expanded.

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