Dec. 2, 1924. 1,517,504

C. C. HANSEN

DRILL ROD PACKING

Filed Sept. 14, 1923

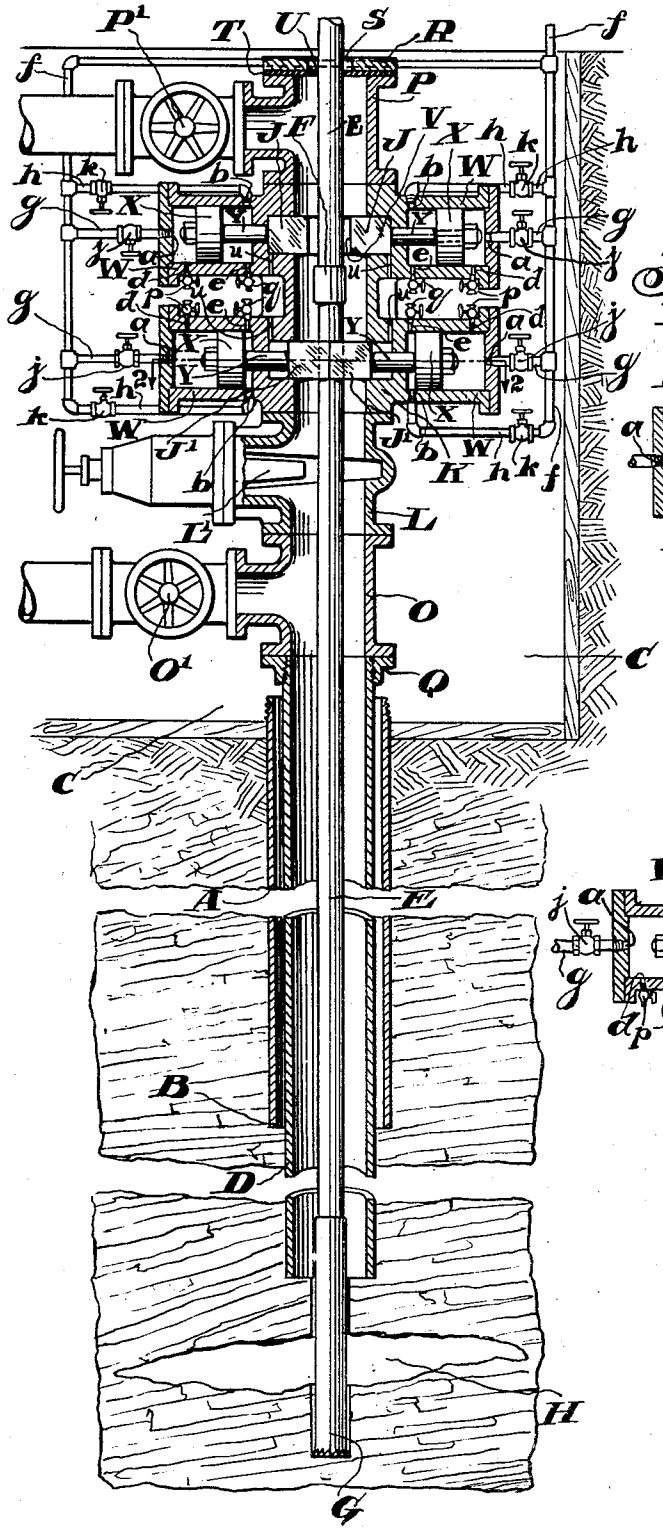


Fig. 1.

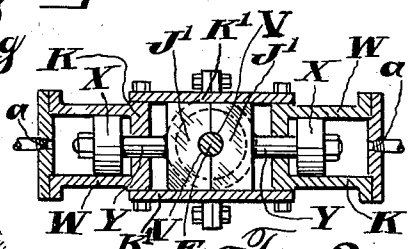


Fig. 2.

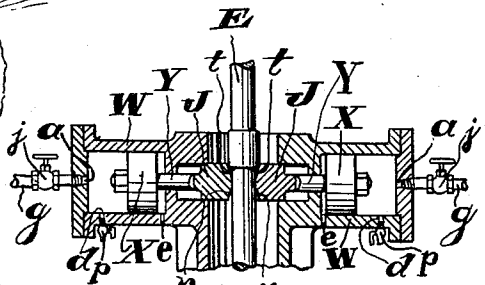


Fig. 3.

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Patented Dec. 2, 1924. 1,517,504

UNITED STATES PATENT OFFICE.

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DRILL-ROD PACKING.

Application filed September 14, 1923. Serial No. 662,748.

To all whom it may concern:

Be it known that I, CHARLES C. HANSEN, a citizen of the United States, and a resident of Easton, county of Northampton, State of Pennsylvania, have invented a certain Drill-Rod Packing, of which the following is a specification, accompanied by drawings.

This invention relates to well drills and more particularly to drills of the rotary type having a cutting bit attached to a rotary spindle or drill rod, such, for instance, as a core drill. In drilling oil and other wells, gas pressure of considerable magnitude are frequently encountered when a certain depth has been reached. Uncontrolled escape of such gas presents a danger on account of the damage likely to be done to persons and the equipment, as well as because of the impossibility of carrying on the drilling operation. Various means have therefore been employed to pack the well against unintentional escape of the gas during the drilling, as well as during the raising and lowering of the drill rods and drilling tools, but it has heretofore been difficult to satisfactorily prevent the escape of gas from a well in which a core drill of the type mentioned above was being used. This is partly due to the fact that outside coupled drill rods are usually employed, the couplings being of larger diameter than the rods, so that any satisfactory packing for such drill rods must provide for a tight closure at all times in spite of the difference in the diameter of the drill rod.

The primary object of the present invention is to effect substantially pressure tight sealing of the well around the drill rod and to tightly pack the drill rod during the operation of the drill, and to facilitate passage of portions of the drill rod of different diameter past the seal in either direction without permitting any appreciable amount of the gas under pressure to escape. A further object is to effect automatic adjustment of the packing members to permit passage of the portions of the drill rod of larger diameter during the lowering and raising thereof.

A still further object is to enable the packing members to reciprocate in a direction at right angles to the drill rod; to operate the packing members by fluid pressure; and to impart fluid pressure resistance to the passage of the portions of the drill rods of larger diameter during the hoisting and lowering of the drilling tools. Still further objects will hereinafter appear, and to he ends set forth the invention consists in the several features of construction and operation set forth in the following specification and shown in one preferred embodiment in the annexed drawing, forming a part hereof, in which

Figure 1 is a vertical sectional view partly broken away, of a typical core drill outfit in place in a well being drilled, showing the invention applied thereto;

Figure 2 is a transverse sectional view taken on the line 2—2 of Figure 1, showing one pair of reciprocating packing members in operative position; and

Figure 3 is a detail sectional view of the reciprocating packing members as seen in Figure 1, illustrating the operation thereof.

The drawings show diagrammatically, an oil well of considerable depth, which may be from 1000 to 2500 feet or more. The first or outer casing A usually extends to a depth of from 800 to 2000 feet and is tightly embedded at its lower end B. The top of the casing A is also suitably secured as by being screw threaded at the bottom of the working chamber C, which is cased into a suitable depth below the surface. The inner casing D extends below the outer casing A substantially to the bottom of the well. The rotary drill rod or spindle composed of the rod sections E connected by outside couplings F extends through the casing A, and the core barrel and bit G is connected to the lowermost rod section E. The drill spindle is rotated in the usual manner and the drilling is continued with the bit G until he gas strata H has been reached where the gas encountered may be under any pressure up to from 1500 to 2000 pounds per square inch. Means are provided in the working chamber C for sealing the inner casing D and preventing unintentional escape of the gas. In this instance two pairs of oppositely acting reciprocatory packing members J and J′ are suitably mounted within a packing box K around the drill rod in position to reciprocate and alter-

nately embrace the drill rod upon opposite sides and constitute an effective seal. The packing members J and J′ are designed to pack the drill rod and substantially prevent leakage during the operation of the drill and to facilitate the passage of either the rod sections E of smaller diameter or couplings F of larger diameter between the members J and J′ during the lowering and hoisting of the drilling tools.

A gate valve casing L and a pressure bleeder valve connection O are preferably interposed between the packing box K and the inner well casing D, and a relief valve connection P is preferably superposed above the packing box K having covers K′. The valve connection P, packing box K and valve casing L and connections O are concentrically arranged about the drill rod within the working chamber C and secured together. The pressure bleeder valve connection O is suitably secured to the top of the inner casing D, as by the screw threaded flange Q. The top of the relief valve connection P is closed by a circular end plate R having a central aperture S, the diameter of which aperture S is such as to enable the drill rod couplings F to pass through. A disk T of rubber or other suitable compressible material is interposed between the plate R and connections P. This disk T has an opening U concentric with the aperture S but of slightly less diameter, so that a relatively tight fit is provided about the larger and smaller diameter portions of the drill rod during their movement into and out of the well casing.

The pressure bleeder valve O′ is designed to permit a controlled flow of gas to escape from the well when desired. The gate valve L′ enables the well casing to be tightly sealed up after removal of the drill rods and other tools from the well. The compressible disk T tends to prevent the escape of any gas which may leak past the seal formed by the packing members J and J′ and the relief valve P′ permits the safe controlled removal of such gas.

The packing members J and J′ are in the form of opposite substantially rectangular blocks adapted to reciprocate in the packing box K and having grooves V adapted to embrace the drill rod when the blocks meet.

Fluid pressure means are preferably provided for effecting reciprocation of the packing blocks toward and away from each other, into and out of engagement with the drill rod E. In the present instance parts of fluid pressure cylinders W are located on opposite sides of the packing box K. The cylinders W are provided with pistons X having rods Y to the extremities of which the packing blocks J, J′ are secured. Pressure fluid is admitted to the cylinders W to actuate the pistons of the packing members through inlet ports *a* and *b* and exhausted through ports *d* and *e* located at opposite ends of the cylinder.

A pressure fluid supply conduit *f* leading from a suitable source of supply (not shown) is adapted to convey the pressure fluid which may be steam, compressed air or gas, to the cylinders through branch pipes *g* and *h*.

In the present instance two pairs of fluid pressure operated packing blocks are employed, one pair being located in the upper portion of the packing box and another pair in the lower portion. The respective pairs of blocks are adapted to act alternately, the former during the lowering of the drill tools and the latter when the drilling tools are being hoisted out of the hole. The branch pipes *g* and *h* are provided with valves *j* and *k* for controlling the fluid admission to opposite ends of the cylinders W and similar valves or pet cocks *p* and *q* for controlling the exhaust from the cylinders. The valves *j*, *k*, *p* and *q* are independently manually operable so that one pair of packing blocks J or J′ may be actuated independently of the other pair, or the regulation may be coordinated so that one pair will come into operation while the other is rendered inoperative.

In the operation of the device, assuming the parts to be in the position shown in Figure 1, the packing members J′ are held in place about the drill rod E by the pistons X, under pressure supplied through the inlet ports *a*, and the exhaust ports *e* are open. The packing members J are retracted from the drill rod, pressure fluid having been supplied through the inlet ports *b*, the exhaust ports *d* being open. The drill rod is now packed for hoisting and suitable means are provided for raising the drilling tools. In the upward movement of the drill rod the portions F of larger diameter engage the under sides of the packing members J′ and move the members J′ backward in the cylinders sufficiently to allow the couplings F of larger diameter to pass by. Flexible resistance to such movement is imparted by the fluid pressure in the cylinders, so that as soon as the coupling has left the packing members the fluid pressure in the cylinders will act on the pistons and cause the packing members to return to their normal position. The opening movement of the packing members is sufficient to enable the core barrel G to also pass through the packing box K, after which the gate valve L may be closed to completely seal the well casing.

When the drilling tools are to be lowered into the well, the valves are manipulated so that the inlet ports *a* and exhaust ports *e* of the cylinders W containing the pistons X for operating the packing members J

are open and the inlet ports *b* and exhaust ports *d* of the lower opposite pair of cylinders also open, the inlet ports *b* and exhaust ports *d* of the upper pair of cylinders being closed and the inlet ports *a* and exhaust ports *e* of the lower pair of cylinders also being closed. The drill rod will then be packed by the upper packing members J and the lower packing members J′ will be inoperative. During the lowering of the drilling tools the packing members J will act in the same manner as the members J′ during the hoisting operation. The grooved ends of the packing members J and J′ are chamfered as shown at *r* to facilitate the passage of the couplings F of larger diameter and bit G. The grooves may also be chamfered on the opposite sides as shown at *t* to make the fit between the packing members and drill rod as light as possible so that the interval of opening of the packing members will be as brief as possible during the passage of the larger diameter portions through the packing members.

Leak ports *u* are provided behind the packing members J and J′ to prevent fluid pressure from building up and impeding the movement of the packing members.

I claim:

1. In combination with a well casing and a drill rod composed of portions of different diameter, oppositely acting pairs of reciprocating members having grooves adapted to alternately embrace a portion of the drill rod of smaller diameter, and fluid pressure operated means for normally maintaining one pair of packing members in engagement with the drill rod and permitting movement of a portion of the drill rod of larger diameter past said engaging pair of packing members and acting to restore said members to normal position as said portion of the drill rod of larger diameter passes out of engagement with said members.

2. A packing device for drill rods, comprising a well casing and a drill rod adapted to operate therein, said drill rod being composed of a plurality of separate sections with joints between the sections of larger diameter, pairs of oppositely acting reciprocating packing members having grooves adapted to embrace the drill rods to substantially seal the well casing and fluid pressure operated means for normally maintaining one of said pairs of packing members in engagement with the drill rod and another pair out of engagement therewith.

3. A packing device for drill rods, comprising a well casing and a drill rod adapted to operate therein, said drill rod being composed of a plurality of separate sections with joints between the sections of larger diameter, and pairs of oppositely acting reciprocating packing members having grooves adapted to embrace the drill rods to substantially seal the well casing, and fluid pressure operated means for normally maintaining one of said pairs of packing members in engagement with the drill rod and another pair out of engagement therewith, said packing members being adapted to permit passage of the portions of the drill rod of larger diameter and to return to normal position.

4. A packing device for drill rods, comprising a well casing and a drill rod adapted to operate therein, said drill rod being composed of a plurality of separate sections with joints between the sections of different diameter, pairs of oppositely acting grooved reciprocating packing members and fluid pressure operated means for causing one of said pairs to engage the drill rods to substantially seal the well casing, while the other pair remains inoperative, and permitting limited movement of said engaging pair of members as the portions of larger diameter pass the seal.

5. A packing device for drill rods comprising a well casing and a drill rod adapted to operate therein, said drill rod being composed of a plurality of separate sections with joints of larger diameter between the sections, fluid pressure cylinders at opposite sides of said casing, pistons in said cylinders, a pair of grooved packing members adapted to embrace opposite sides of said drill rod, said packing members being connected to said pistons, and means for maintaining said packing members in engagement with the drill rod to effect substantial sealing of the well casing, said packing members being adapted to permit passage of the joints of larger diameter and said means interposing resistance to such passage tending to return the members to operative position.

6. A packing device for drill rods, comprising a well casing and a drill rod adapted to operate therein, said drill rod being composed of a plurality of separate sections with joints of larger diameter between the sections and pairs of cooperating reciprocating packing members having grooves adapted to embrace opposite sides of said drill rod to effect substantial sealing of the well casing during passage of the drill rod between said members, and fluid operated means for effecting movement of the packing members to cause one pair to engage the drill rod while another pair remains out of engagement, and permitting passage of the joints of larger diameter past the seal formed by the engaging pair of packing members.

7. In combination with a well casing and a drill rod having portions of different diameter, packing members adapted to reciprocate toward and away from the drill rod to embrace the portion of the drill rod

of smaller diameter, fluid pressure operated means for holding the packing members in substantially fluid tight engagement with the drill rod, said packing members being adapted to reciprocate to permit passage of the portions of the drill rod of larger diameter, and said holding means being adapted to impart resistance to the reciprocation of the packing members and effect return of the members to normal position.

In testimony whereof I have signed this specification.

CHARLES C. HANSEN.