Aug. 28, 1956 A. E. WILDE 2,760,751

COMPENSATING GATE RAM PACKER

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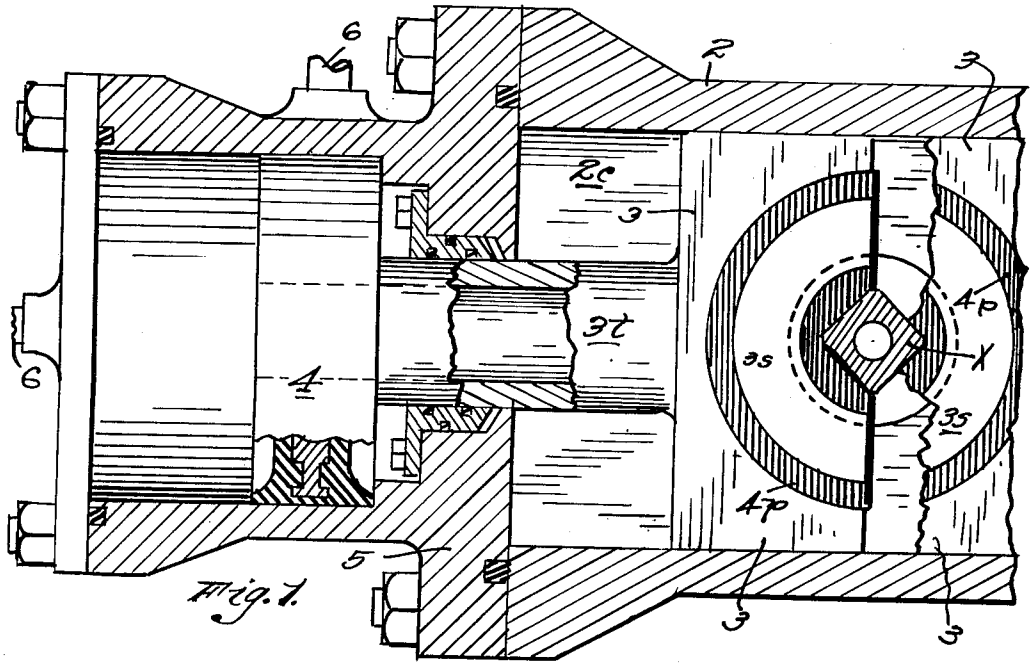


Fig. 1.

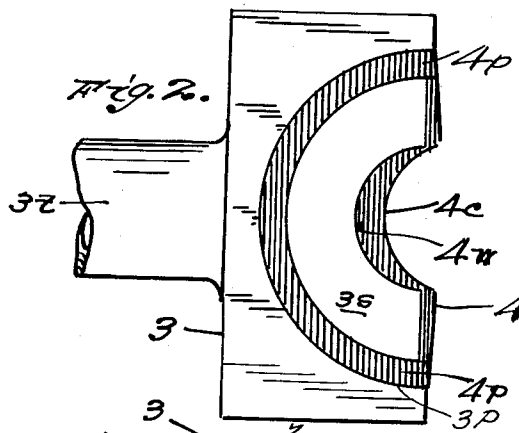


Fig. 2.

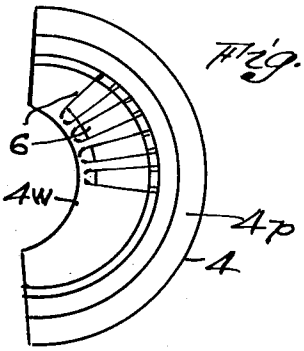


Fig. 3.

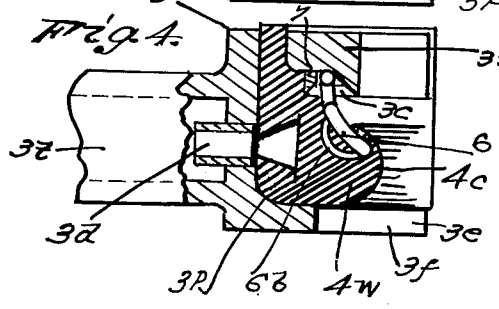


Fig. 4.

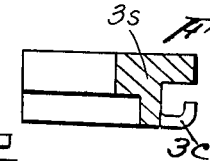


Fig. 5.

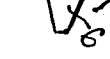


Fig. 6.

A. E. Wilde, INVENTOR;

Frederick E. Maynard Atty.

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COMPENSATING GATE RAM PACKER

Arthur E. Wilde, Yorba Linda, Calif., assignor to Shaffer Tool Works, a corporation of California

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3 Claims. (Cl. 251—2)

This invention is a sliding-ram type heavy duty gate valve assembly of the class commonly used in deep well operations, particularly drilling operations.

It is an object of this invention to provide a ram, for such assemblies, that embodies a novel packer having the capacity, in cooperation with a companion ram, of making a "complete shut off," that is, meet face to face with the opposite ram to close the tool string passageway that extends from top to bottom of the assembly shell; or to make a shut off by abutting against and sealing on an incidentally interposed section of well working apparatus passing through the said passageway and be effective on a circular or other cross-sectional part of the apparatus. The purpose of the gate assembly, as is well known, is to safely, quickly and effectively stop flow of liquid or gas along the outside of the interposed apparatus, or in the absence of said apparatus, from said well or hole.

Further, an intent of the invention is to provide an elastic-material packer and a carrying ram therefor and in which the inner or passageway face of the packer is adapted to be forcibly compacted centripetally to meet face to face with a like, opposed packer either to make a diametrical "complete" type shut off or to conform itself to the sectional contour of an interposed tool string or other apparatus in the assembly. And in this connection an aim is to provide a packer subject to compacting movement to make the shut off following a closing movement of its carrying ram, and especially to provide a hydraulically shifted ram in which the packer is mounted and is compacted by hydraulic pressure, preferably from the same source line supply fluid to shift the ram.

Also the invention provides a conformative packer in which there is embedded a flexible type of armor to protect the compactive wall portion of the packer from being destructively torn out by fluid pressure in the gate or by movement of engaged, passing equipment, that is, tools or pipe.

The invention resides in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose constructions, combinations and details of means and manner of operation will be made manifest in the following description of the herewith illustrative embodiment; it being understood that modifications, variations, adaptations and equivalents may be resorted to within the scope, spirit and principles of the invention as it is claimed in conclusion hereof.

Figure 1 is a horizontal, axial section of the gate (partly broken away) showing the rams making a shut off on a square-section tool string part. Figure 2 is a top plan of a ram per se with its packer. Figure 3 is a top plan of an isolated packer with some of the armor plates in place thereon. Figure 4 is a vertical, axial section of a ram and its packer. Figure 5 is a vertical, axial section of the top segment of the ram to illustrate its armor

plate, hanging hooks. Fig. 6 is an inside face elevation of one of the plates.

The gate shell here includes a central box-shaped body 2 in which there is a ram chamber 2*c* in which is slidably fitted and guided a pair of like and oppositely moving, block-shaped rams 3—3. The rams are preferably hydraulically motivated and have tail tubes 3*t* respectively attached to double action pistons 4 arranged outwardly from heads 5 of the shell and in which the tubes reciprocate.

Motive liquid is supplied to opposite sides of the pistons as by hydraulic pipes 6 so that the pistons and their rams are forced inward or outward in the shell at will and in a desired rapid manner when necessary. Fig. 1 shows the rams as closed on a kelly bar X extending downward in the shell. If the bar were not in the shell the rams would meet face to face diametrically by reason of the packers now to be described.

Each ram has a generally semicircular pocket 3*p*, Fig. 4, from its top face down to a bottom flange 3*f* which has a semicircular inner edge 3*e*. The novel packer consists of a substantially half-circle segment of rubber or a suitable substitute conforming in plan, Fig. 3, to the pocket 3*p* and rests on the flange 3*f*. The packer 4 has around its top a relatively narrow lip 4*p*, Figs. 1 and 2, for sealing upward against the adjacent inner face of the top (not shown) of the shell body 2, and this lip is sustained by a complementary floating crown or ram part 3*s* of half-ring form in plan, Fig. 2. The floating crown sealingly accommodates whatever is in the gate, such as, for example, a well pipe, and the inwardly overhanging packer makes a full shut-off when compacted inwardly relative to the floating crown by which pipe shut-off is made. The packer is solidly lodged between the part 3*s* and the flange 3*f* and has an inwardly overhanging wall body 4*w* which is concaved as shown in Fig. 3, to a suitable degree and is capable of being compacted centripetally so as to be closed flat against the opposed and like wall 4*w* of the opposed gate when both are closed and make a complete shut off if no tool or string part (X) is interposed in the shell passageway.

As stated above the ram is operated by liquid pressure and it is desirable to inwardly compact the packer wall 4*w* by hydraulic pressure also; though other means are within the principle of the invention to secure this function. Therefore, liquid in the outer end of the piston chamber of the shell is led through the piston tail tube 3*t* by way of a duct 3*d* leading to the contiguous portion (body 4) of the wall 4*w*, Fig. 4.

From this it will be clear that after the ram has been forced to its inward limit as arrested by an opposing ram or by a string section X in the shell then the concave wall face 4*c*, will, under the liquid pressure in the tail tube be solidly compacted diametrically from side to side of the ram if no part X is in the shell and between the rams, or will be forcibly conformed to part X if present, Fig. 1.

It is very desirable that means be provided in the packer 4 to protect it against being blown upwardly out of the shell in event of high pressure of gas or liquid from the well or well hole at which the shell may be installed, and at the same time permit the compacting function of the packer. This protection is secured here by an arcuate arrangement of relatively free tooth-like plates 6, Fig. 6, having top-end T-heads 6*t* which hook onto and are pivotally suspended by suitably spaced claws 3*c* formed on the bottom face of the crown part 3*s* of the ram. A collar 7 retains the T-heads in landed position of their respective claws. The top ends of the plates are shown in Fig. 3 in their embedded position in the packer, and Fig. 4 shows at the outer face of one of the plates

a bow 6*b* of the plate forming a window into which the rubber of the packer is molded and forms an interlock between the plate and the rubber packer; each plate having such a bow.

It is understood that the inner seal-making surface of the packer is clear of adjacent metal parts so that rubber meets the opposed ram or the interposed part X whenever the rams are closed to make a shut off in the shell.

What is claimed is:

1. A compensating valve gate structure for well equipment, including: a shell with a bore for vertical passage of apparatus and laterally opposite chambers leading therefrom, rams operative in said chambers and each having a bottom flange and a semicircular pocket thereabove open to the top of the ram, an elastic body packer resting on said flange and having an inner wall inwardly overhanging the flange for conformably engaging and sealing on well working apparatus when presented in said bore or on the opposite ram packer, and a semicircular crown embedded in the top of the packer and entirely supported by the packer to provide a floating mounting for the crown, said inner wall projecting under the crown for free deformation when in sealing function, and means for compacting said overhanging portions inwardly relative to the crown whereby to make a complete shut-off by the elastic packers.

2. The structure of claim 1 including flexible, reinforcing armor members mounted on the top of the packer and pivotally attached to the bottom face of the floating crown.

3. The structure of claim 1 wherein said means for compacting said overhanging portions is located on the ram and supplies fluid pressure to the back of said wall to force said overhanging portion inwardly relative to the floating crown to effect said complete shut-off by the elastic packer.

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