Nov. 10, 1936. F. J. SCHWEITZER 2,060,248

FLOATING BLOCK GATE RAM

Filed Sept. 26, 1934 2 Sheets-Sheet 1

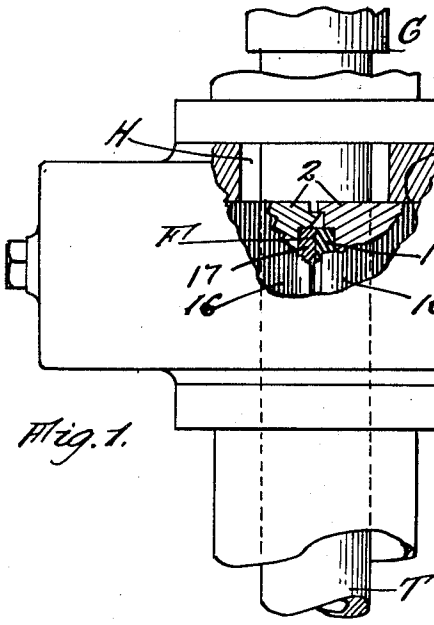


Fig. 1.

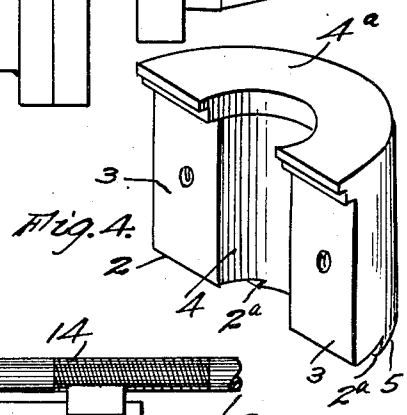


Fig. 4.

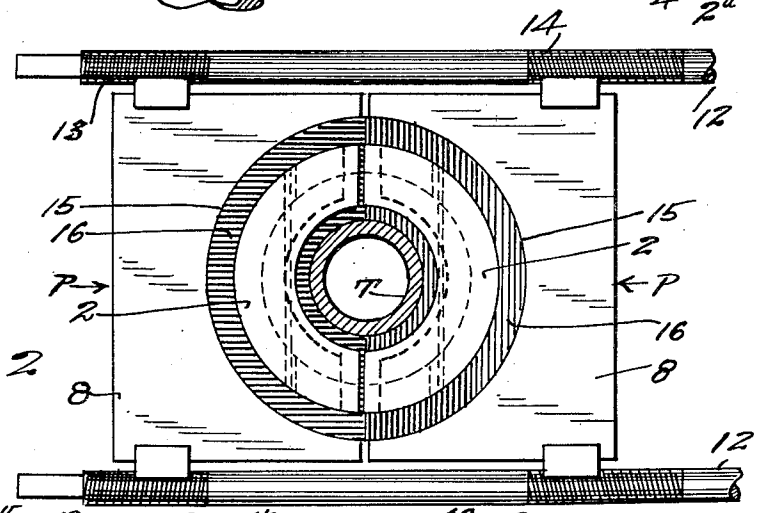


Fig. 2.

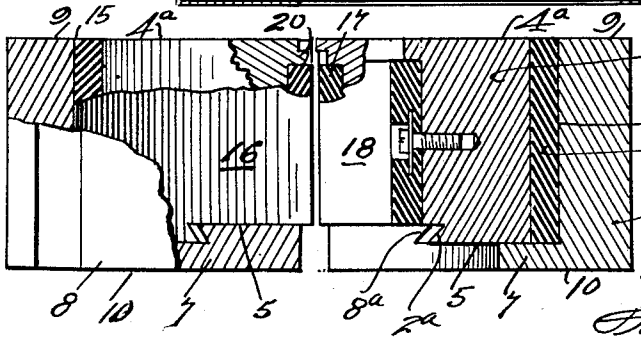


Fig. 3.

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FLOATING BLOCK GATE RAM

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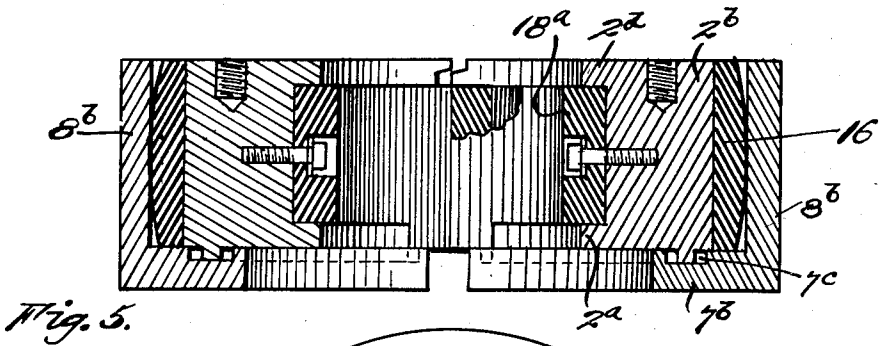


Fig. 5.

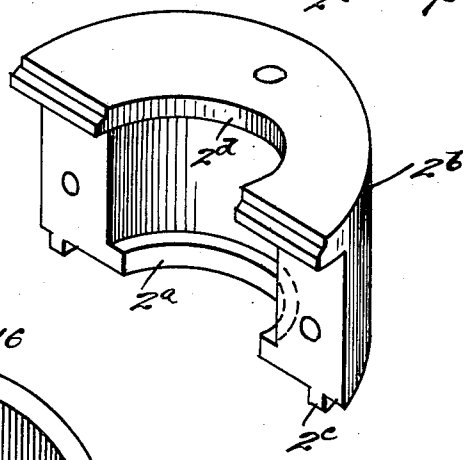


Fig. 6.

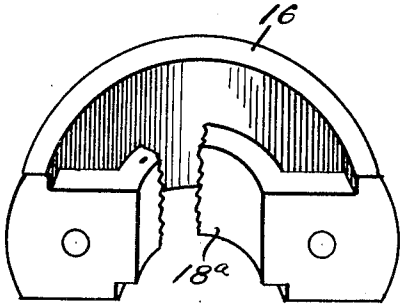


Fig. 7.

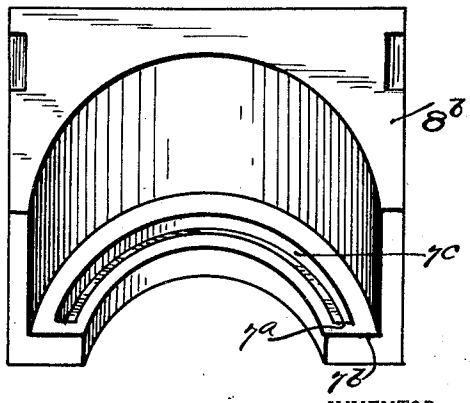


Fig. 8.

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Patented Nov. 10, 1936 2,060,248

UNITED STATES PATENT OFFICE

2,060,248

FLOATING BLOCK GATE RAM

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Application September 26, 1934, Serial No. 745,603

13 Claims. (Cl. 251—55)

The instant invention is an improvement in the class of casing control gates shown in the Shaffer-Schweitzer patent issued June 7, 1932, No. 1,861,614.

Such patent shows a solid main ram body 2 with a rigidly connected body part 7 which is surrounded by a small strip of packing 4 laid in a half-ring groove 3 in the top of the ram body 2. A feature of that patent is that the ring strip 4 is provided with a fulled portion 6' for the purpose of effecting a reactive, compressing effort on the mass of ring 4 in the groove 3 so that this will tend to extrude out toward the rear bearing face 10 of the gate housing or shell S. It will be apparent that such extrusive pressure occurs when a pair of opposed gate rams forcibly meet at the fulled corners 6' and in the absence of these corners the extrusive reaction is proportionately reduced.

Intensive study of the problem of obtaining a tight seal around a string section in the gate and a tight seal around the gate string pole has led to the discovery that a larger mass of packing subject to extrudable pressure against the shell wall will produce a far more effective seal at the shell or housing bearing surface and it is to secure this function that the instant invention has an object.

A further purpose is to provide a control or shut-off gate and blow-out preventer having a main ram body device universal to all sizes of string section within its range adapted for use of any pair of a system of interchangeable abutment blocks which are sized to fit respective string sections according to the diameter of string present in the housing. By such provision it will not be necessary to remove the whole ram set merely to adapt the control to changes of size of strings being run in a well casing. It will only be necessary to change the abutment blocks with their packing medium.

And further, it is an object to provide a composite gate ram in which the main ram body relatively slidably supports the abutment block and includes a body of packing medium compacted between the body and the block and whereby when the block sets up hard against the string part the intruded packing in the ram will be compressively extruded against the near bearing surface of and in the housing and effect a highly reliable seal.

The invention consists in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages, and whose construction, combination and details of means, and the manner of operation will be made manifest in the description of the herewith illustrative apparatus; it being understood that modifications, variations, and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more directly claimed hereinafter.

Figure 1 is a side elevation, partly in section, of the control gate. Figure 2 is a plan of the closed gate rams. Figure 3 is a vertical longitudinal section and partial elevation of the nearly closed gate rams. Figure 4 is a perspective of a dismounted interchangeable abutment block of a ram.

Figure 5 is a longitudinal section of a variant form of the gate assembly, and

Figures 6, 7, and 8 are respectively perspective views of the relative gate block, the modified packing girdle and the modified ram body.

A prominent characteristic of the present invention and one which is distinctive over various other types of deep well casing gates and blow-off preventers comprises what might be called a floating abutment block 2, Fig. 4, of which a number may be provided and differentiated only in that each has in its diametrical face 3 a semi-circular bore or recess 4 of a diameter determined by the diameter of a section T as of a string of tool stem parts or of casing or pipe passing through the gate housing or shell S. The abutment block 2 is preferably of semi-circular form in plan and of suitable depth between its plane top and bottom surfaces 4a and 5, Fig. 3.

In some cases to make a complete shut-off in the housing S the recess 4 may be omitted from the diametrical face 2 of the block so that the through hole H of the shell may be entirely closed in the absence of a string part T.

A pair of the floating blocks is shown in slightly spaced opposition in Fig. 3 as being supported at their bottom surfaces 5 on inwardly projecting seats or bearing flanges 7 of a pair of opposed co-acting ram bodies 8—8 having top and bottom plane faces 9 and 10 contiguous to and slidable inwardly and outwardly between complementary bearing surfaces 11 provided in the housing S and practically surrounding the through hole H.

The ram bodies 8—8 are concurrently oppositely actuated as by means of a pair of shafts 12 each having oppositely screw threaded portions 13 and 14, Fig. 2, and being cross connected by suitable transmission mechanism of any preferred type to the end that the shafts 12—12 can be concurrently rotated with the result that the opposed ram bodies 8—8 are concurrently

closed toward the string section T or are moved away from it concurrently.

The top plane 4 of the pair of abutment blocks 2 is substantially coplanar with the top plane 9 of the associated ram bodies 8 and the bodies are provided each with a semi-circular recess 15 sufficiently greater than the diameter of the periphery of the applied blocks 2 to form a space for the reception of the girdle of packing medium 16 which, as shown in Fig. 3, extends from the top plane 9 of the ram structure to the upper bearing surface of its flange 7 on which the applied block 2 is adapted to have a desired degree of sliding movement as to the ram body.

The packing girdle 16 not only fills the space 15 of each ram body around the applied abutment block 2, but also extends transversely across the diametrical face 3 of the block and into the bore or recess 4; the inner face of the diametrical portion 17 of the packing being recessed at 18 complementary to a given string section T.

From the above it will be seen that the pair of ram bodies 8—8 are adapted to receive on the flanges 7 any pair of the abutment blocks 2 fittable within the recesses 15 so that different sizes of pipe, casing, or drill stem extending through the housing S can be closely fitted by the application to the ram bodies of abutment blocks 2 whose diametrical packing face 17 has a recess of a size complementary to the size of the section T in the gate housing S.

In operation of the present shut-off gate after an appropriately dimensioned pair of abutment blocks 2 has been mounted in the ram bodies in the housing S in order to close the gate elements the screw shafts 12 are concurrently turned with the result that the diametrical faces of the abutment blocks bring their packing layer 17 firmly against the interposed string section T and with their plane diametrical faces F, Fig. 1, coming together.

Then on continued inward movement of the ram bodies 8 whilst the abutment blocks 2 are at rest against the string section T it will be seen that the mass of rubber 16 extending from the flange 7 up to the top plane 9 of the ram body will be subjected to extrusive pressure and a material upward sealing thrust is produced at the upper margin of the semi-circular packing medium 16 making a tight seal against the contiguous inner surface 11 of the gate housing S. This material extrusion is enhanced by reason of the relative movement inwardly or toward the stopped blocks 2, of the main ram bodies 8 on which the blocks are, as above stated, slidably mounted for the purpose of effecting extrusive compression of the packing material interposed between the adjacent surfaces of the recess 15 and the blocks 2.

It may sometimes happen that because of the character of the materials or because of the great pressure with which the packing layer 17 is pressed against the string section T the packing may tend to stick to the string section and in order to provide for the positive retraction of the abutment blocks 2 with the opening ram bodies 8 means are provided to connect the blocks to the bodies to insure retraction. In the present case such connecting means is shown as comprising hooking ledges 8^a formed on the flanges 7 and arranged in opposition to complementary shoulder 2^a formed on the bottom of the abutment members 2.

This device provides for the relative inward movement of a ram body as to its stopped abutment block and provides for interlock and pulling co-action of the ram body on the block 2 during opening action.

If desired, the upper, inner corners of the abutment block may be mortised and tenoned at 20 to close together when the abutments are in closed position so as to prevent upward blow-out of the rubber under high well pressure.

The bore diameter 4 of the complementary abutments 2 is of such that when the abutments are closed on the string section T a collar C or other string shoulder will rest on the top plane 4^a of the closed abutments so as to hang the string by the gate if desired.

It is understood that the packing medium girdling the abutments may be of any desired character; rubber of suitable density and mobility being very effective.

Lines of force of the closing ram bodies 8—8 are indicated by the arrow lines P, Fig. 2.

There is shown in Figures 5 to 8, inclusive, a form of the ram body assembly in which the bodies 8^b have flanges 7^b which are provided with substantially semi-circular grooves 7^c, Figure 8, ending at stop shoulders 7^a near the diametrical faces of the ram bodies. The complementary ram blocks 2^b have on their bottom surfaces, which rest on the flanges 7^b, downwardly extending semi-circular beads 2^c matching the grooves 7^c and being slightly shorter in their length so that if it should happen that the bodies 8^b should not set true in the housing or shell S (Fig. 1) then the semi-circular blocks 2^b may automatically shift themselves to assume a concentric relation as to the string part T (Fig. 2). In the blocks 2^b of Figure 5, more clearly shown in Figure 6, are provided bottom ledges 2^a on which the semi-circular portion 18^a of the relative packing girdle may rest as is clearly shown: the top of each block having an overhanging ledge 2^d thus confining the top and bottom surfaces of the applied packing girdle and limiting the same from upward or downward shifting movement.

An important advantage of the present gate apparatus is that it is only necessary to withdraw the assembled ram device including the parts 8—8, and the applied packing girdles 16 with their filling blocks 2, to such a position just clear of the shell S as will enable the blocks and their applied packing girdles to be withdrawn or lifted from the ram bodies 8—8 (8^b—8^b) so that a removal of worn parts may be readily facilitated or a change of parts as may be required to close upon different sizes of string parts T may be made.

A further advantage of the invention is in the ability of the floating ram blocks to relatively twist as to their ram bodies so that the abutting rubber packing faces of the blocks can come flat together even though the ram bodies should happen to be out of proper alignment in the shell for any reason; as by improper assembly on the screws.

What is claimed is:

1. A valve structure comprising a gate ram body and a block slidably mounted in said body and presenting an inner diametrical face to move with the body toward an opposed object, said block being arrestable by the object and permitting further inward movement of the ram body toward the object, and a deformable, resilient packing element lying across the said face of the said block to engage said object, and including a girdle part lying between the block and the

contiguous wall face of the ram body, whereby upon relative inward movement of the body as to the stopped block the girdle part will be extruded under pressure by the body against a contiguous surface of the valve structure; said block being unattached to the body and adapted for ready dismounting therefrom, and a seat in the body on which the ram block slides and which has means engageable with the block to retract it with the ram body.

2. A shut-off and blow-out preventer including a housing, a ram body slidably operative in said housing, an abutment block freely operatively mounted on said body and having a packing face engageable with an opposed obstacle in the housing, and a deformable, resilient packing interposed between said block and contiguous wall surface of said body and extrudable, under pressure of said body, when the block is forced against the obstacle, to seal on a contiguous surface of the housing; said body disposed wholly within the said housing and having a seat area, and said block having a part slidably bearing on said area and said part having means to engage with the body for retraction of the block from the closed position.

3. A shut-off and blow-out preventer including a housing, an abutment block having a packing face movable against an obstacle in the housing, a ram body movable in the housing, and a resilient packing medium interposed between said block and said body, the latter having a pocket in its inner face and against the near wall of which said packing medium reacts under pressure so that its top and bottom edges flow outward and seal on contiguous surfaces between which the top and the bottom of the block are slidably mounted, and means extending in from said wall for slidably supporting and for positively retracting the block.

4. Means, in a gate valve and blow-out preventer, to form a seal in a valve housing, including a ram having a relatively floating abutment-engaging block having between its top and bottom a girdle of resilient packing medium, which for a portion of its length lies substantially in the plane of a plane face of the block which is contiguous to an inner bearing face of the housing and which also extends across the abutment engaging face of the block; that portion of the packing contiguous to said surface being extrudable thereagainst upon inward movement of the ram whilst the block is arrested by an obstacle in the valve; said ram having an inwardly projecting part on which the block is slidable and which provides a surface against which an edge of the said girdle is extrudable under pressure.

5. Means, in a gate valve and blow-out preventer, to form a seal in the valve housing, including a ram having a relatively floating abutment block having between its top and bottom and across its abutment engaging face a girdle of resilient packing medium, which for a portion of its length lies substantially in the plane of a plane face of the block which is contiguous to an inner face of the housing; said ram having means to effect positive retraction of the block from an arresting obstacle, and the ram having a lateral pocket in which the block is arranged and which provides for relative inward movement of the ram whilst the block is arrested; whereby to extrude the compressed packing against said inner face and having a surface against which said portion of the girdle is extrusively pressed to make a seal.

6. Means, in a gate valve and blow-out preventer, to form a seal in the valve housing, including a ram having a relatively inwardly movable abutment engaging block having between its top and bottom and across its abutment engaging face a girdle of resilient packing medium, which for a portion of its length lies substantially in the plane of a plane face of the block which is contiguous to an inner face of the housing; said ram having means extending inwardly and normal to the axis of the girdle to effect positive retraction of the block from an arresting obstacle and having a backing face supporting and to place said medium portion under extrusive pressure when the block is arrested by the obstacle.

7. In a casing gate structure, a housing having a through hole for a tool or pipe string, and means for sealing off around the string and around the said hole and comprising a pair of gate blocks each girdled by a band of packing medium extending across adjacent faces of the blocks, and ram devices on which said blocks freely float and by which they are pressed toward said string and by which the girdling bands are extruded, under pressure between the stopped blocks and the pressure applying rams in a complete circle around said hole, against a near surface of the housing to effect a housing seal; the ram devices having ledges on which the blocks are slidable and which have means to engage with the bottoms of the blocks to retract them and providing for ready upward removal of the blocks, from the ledges, when exposed from the housing.

8. In a well casing gate structure, a housing with a through hole, a pair of ram bodies cooperative to close around said hole and sliding between upper and lower bearing faces in the housing, a pair of blocks cooperative to close around a string section centering in the hole, a packing band extending across the closing face of and girdling each block; said bodies having flanges on which the blocks are supported for free floating action and means for the retraction of the blocks from closing position on the string; said packing bands coacting to form a circle of packing extrudable between the rams and the blocks to seal on area about said hole, and said retractive means operative to separate the bands following initial opening movement of the rams.

9. In a casing gate ram structure, a gate block entirely girdled by a deformable packing medium which extends in part from a top bearing face to a bottom bearing face of the block, and means for subjecting the peripheral portion of the girdle to extrusive pressure; said block having a diametrical face across which the packing extends and having a telescoping portion complementary to an opposed gate block.

10. In a casing gate valve, a set of closeable abutment elements each having a girdle of packing to seal around a string part in the valve, and said elements having telescoping portions to prevent blow-out of the packing closed on the string part.

11. A valve structure comprising a movable ram body provided with a pocket having a supporting surface parallel to the direction of movement of the ram, and a block floating on the surface as to the body and being readily dismountable therefrom; said block being provided with a packing medium seating against a wall of the pocket and extending as a girdle around the block to engage and seal on an obstacle, and a valve housing having a bearing surface for the

ram and against which the packing is extrudable from the pocket between the ram and the block when the latter is arrested by the obstacle; the block and its girdle constituting a packing unit bodily insertable into, and removable from, said pocket to form the inner wall of the ram.

12. A gate and blow-out preventer having opposite ram bodies with floating blocks girdled by packing medium which lies across opposite faces of the blocks and a part of each girdle being extrudable edgewise toward upper and lower block bearing surfaces and including telescopic means for preventing blow-out of the packing on the blocks when they are in closed position; said packed blocks forming the inner walls of the ram bodies.

13. A blow-out preventer having, in combination, a through-hole shell, and a ram or gate element reciprocatively guided therein to open or closed positions and provided with a unitary, bodily removable packing device having upper and lower bearing faces and being axially slidable as to the gate element, said device including packing which presents a sealing area at its inner face to engage and seal on an opposing part and also presents packing bordering the outer rims of the said bearing faces and seating against the adjacent, inner surface of the said element and which bordering packing is extrudable edgewise; means forming guide area on which the said packing unit is slidable and against which the extruded border packing seals when compacted as the gate element is moved inward after said packing device is arrested by said part as the gate is closed, and means retractively connecting the packing unit or device with the gate element; the latter having a frontal or inner pocket in which said packing device is disposed.

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