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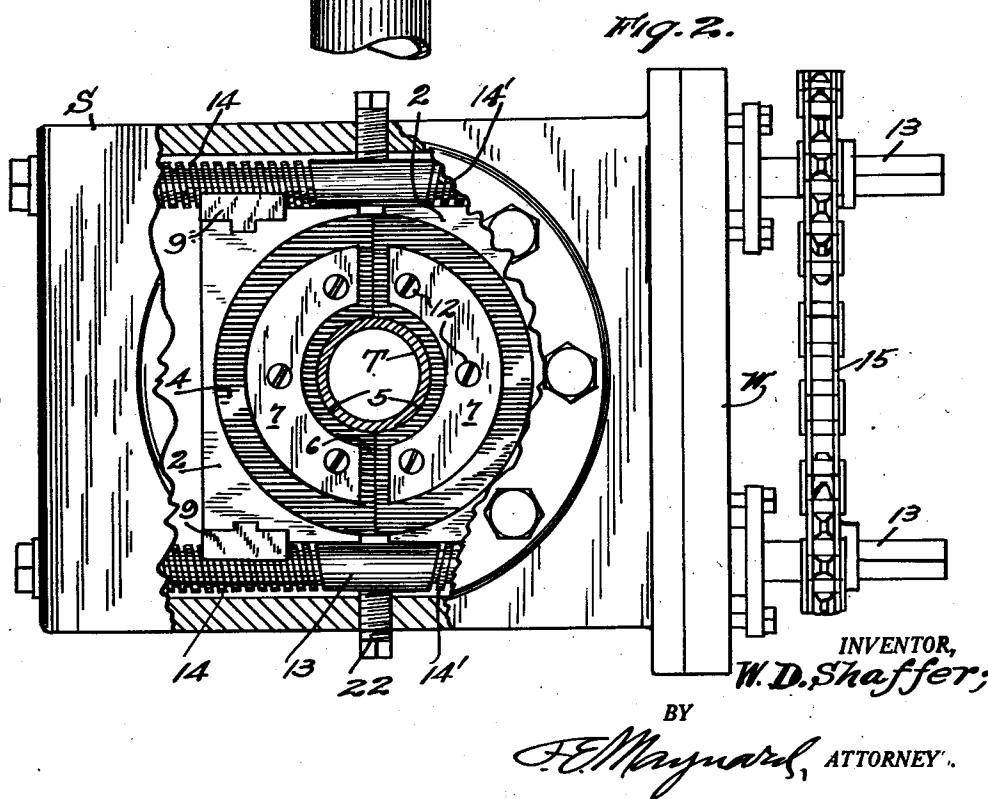
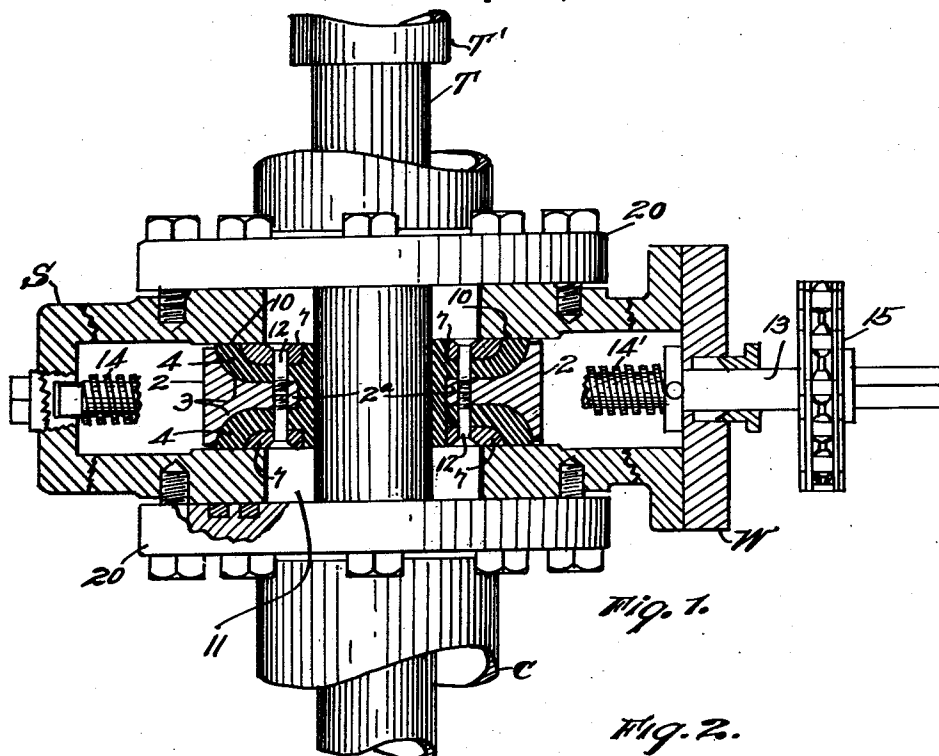
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MEANS FOR CLOSING OFF FLOW BETWEEN WELL CASINGS AND INSIDE TUBINGS

Filed April 1, 1929

2 Sheets-Sheet 1



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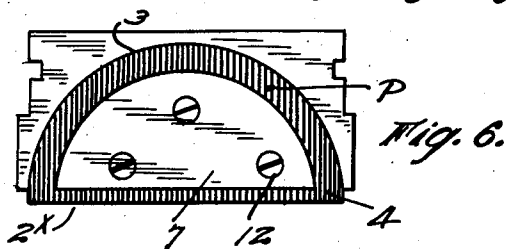
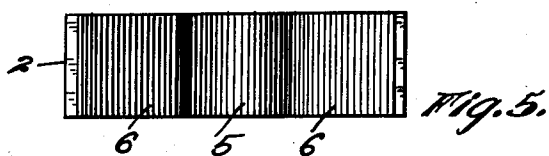
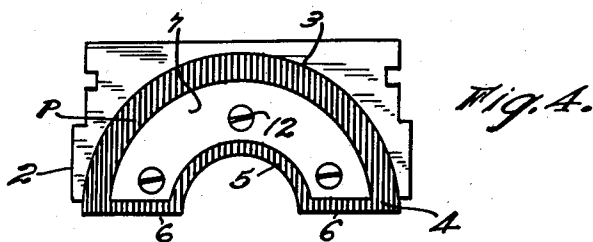
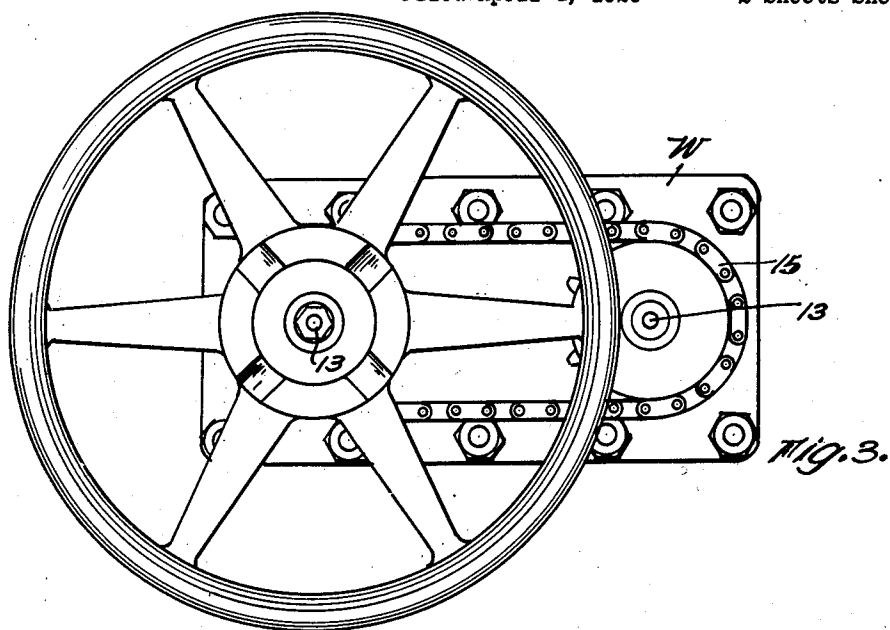
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UNITED STATES PATENT OFFICE

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MEANS FOR CLOSING OFF FLOW BETWEEN
WELL CASINGS AND INSIDE TUBINGS

William D. Shaffer, Brea, Calif.

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12 Claims. (Cl. 251—159)

This invention relates to deep well rig apparatus and more especially to the casing string and means for closing off flow therein either in the presence or absence of an inner string of tubing.

Under present day practice in deep well drilling it not infrequently happens that natural pressure of fluids in the hole or well cause a rush by the heads of oil and gas, sometimes with serious injury to operatives, loss of equipment and loss of the well.

It is therefore an object of my present invention to provide means permanently installed in the casing string and preferably in the cellar under the platform of a derrick whereby in event of emergency, or at will as may be desired, the space between the casing and an inner tubing may be closed off to prevent flow.

An object is to provide a gate device which is of extremely simple and sturdy construction, of thoroughly reliable action, of easy operation, and, especially of very compact design so as to occupy the minimum space, vertically, in the string of casing for the conservation of space in the cellar.

It is another object to provide means for the reliable control of flow at will and which enables the circulation of mud of lighter constituency than is possible in rigs which have no reliable safety means for control of suddenly developed pressures in the hole being drilled. This device is designed, also, to eliminate or supplement the usual "blow-out preventers" applied to casing heads.

It is an especial object to provide a control gate incorporating a non-metallic, mobile joint packing media whereby to make a thoroughly reliable seal off when needed.

Numerous additional objects, advantages and features of construction, combination and details, and of mode of operation will be made manifest in the ensuing description of the herewith illustrative apparatus; it being understood that modifications, variations and adaptations may be resorted to within the spirit, scope and principle of the invention as it is hereinafter claimed.

Figure 1 is a sectional elevation of the control gate in a string of casing.

Figure 2 is a sectional plan showing the gate closed on an inner tube part.

Figure 3 is an end view of the control.

Figure 4 is a plan of a detached "tube gate" and Figure 5 is a seal-face view.

Figure 6 is a plan of a "blind gate".

The present control apparatus includes a closure device consisting of a pair of cooperative, opposed, meeting-face ram members hereinafter called "gates" which are of different, interchangeable types according to the function performed. One type of gate 2 is shown in Figs. 4 and 5, as adaptable to close on an inner tube and a type of gate 2^x is for use when it is desired to completely close off the casing when no tube is in place; this being called a "blind gate". These gate members 2 or 2^x are invertible face for face and interchangeable place for place being of duplicate form so that a pair of a kind may be assembled in opposed relation to form a closure.

In Figs. 1 and 2 a pair of tube embracing gates 2 is shown assembled in a generally flat, elongated shell or box S closed by an integral rear end and having a removable end wall W which permits insertion and removal of all interior parts.

A gate 2 consists of a generally rectangular block whose top and bottom faces have semi-circular recesses or channels 3 filled with a mobile or deformable mass or packing medium of rubber (or equivalent) 4 which protrudes extrudable above the top and below the bottom faces of the gate and forms a complete semi-cylindrical gripping arch 5, from top to bottom of the gate preferably and extending diametrically at 6 to form a sealing seam when gates of an installed pair are brought together (as in Fig. 2) about a tube T.

The body or web 2^a of the gate block is curved and set back so that the overbridging rubber arch 5 covers it and may flow up and down under reaction of the engaged tube T.

One of the important features is to provide a rubber or non-metallic material to engage a bearing seat in the shell S to insure a seal-off that is not attainable, practically, in metal to metal joints. By the present apparatus not only is a rubber seal-off obtained but such a seal-off is made more effective by utilization of the reaction of the rubber body against the tubing T to increase the packing pressure against the complementary seat in the shell.

Therefore, the rubber mass is confined between upper and lower jamb-segments 7—7 sunk in the rubber and forming channels which open at the top and bottom to present a large area of rubber surface P (Fig. 4) to form packing against contiguous parallel seats 10 on inner faces of the shell S and surrounding a central hole 11 therein,

and through which the tubing string may pass up or down.

The confining segments 7 may be combined with the block 2 in any suitable manner and as shown here are mounted on holding screws 12 so as to slide down under the load of an imposed string collar and thus tend to express the rubber from the confining channel and cause it to flow in toward and grip an interposed tubing, and to flow outward and upward to jamb on the seats 10.

The gates 2 are set in opposed relation in the shell S on opposite sides of its casing axis and have half-nuts 9 at opposite sides which mesh with contiguous screw-rods 13 each having right-hand and left-hand screw threads 14-14' which are of reverse pitch so that while the rods are turned at the same rate the two gates 2-2 will move toward or from each other according to direction of rotation of the rods; the gates sliding on their bearings 10. The screw-rods are inter-gearred by any suitable transmission, as a sprocket mechanism 15 secured on the rods, either of which may have an operating device, a hand wheel being shown here.

The compact, flat shell S is adapted to be installed in the casing string C whose near ends are screwed into flanges 20 bolted to the top and bottom of the shell. The inside works of the shell can be pulled out at will by removing the end wall W and renewal made or if desired "blind gates" 2x may be inserted when it is desired to pull the tube string and close off the hole when no tubing is in place.

If desired control shells S may be installed at suitable distance apart in the casing so that one control may have "tube gates" 2 to close on a tube in the casing, while the other may be open and in reserve to close off when the tubing string is pulled.

When the tube gates are closed on a tube the faces 6 jam together firmly and the cylindrical faces 5 close hard against the tubing T. Under such conditions the rubber mass flows back into the recesses 3 and thence out toward the bearing faces 10 and packs hard thereon. The rubber parts 4 exposed in the top and bottom channels about the bearing bodies 7 constitute loops or border bars and are lateral limbs leading from the extremities of the diametrical, meeting packing 6-6. It will be seen that each gate has top and bottom channels defined by the coplanar surfaces of the main bodies 2 and the jamb-segments or elements 7.

The collar T of a tubing string can be lowered to rest on the closed gates 2 if so desired and the load will increase the packing efficiency of the rubber on the faces 10.

The distal walls of the recesses are flared outward so as to deflect the fluent rubber to packing position.

By using a set of the controls adapted to shut off on tubing it will be understood that the drill pipe can be run in or out while circulation is kept up since the controls can be alternately opened or shut to allow the collars at the joints to pass without escape of fluid from gas pressure.

The gates are adapted to be retracted to the outer ends of the shell space so as to be out of the way and allow the insertion and removal, and the operation of various tool equipment. When the shut off is to be made the screw rods are returned by the hand wheel or an attachment which may be operated from a remote position. If desired the tubing in the casing can be moved up or down in the closed gates, and rotated.

It will be seen that the rubber confining segments are of such size that they will not pass in clear of the relative guide faces or bearing in the shell and these therefore not only reinforce the holding screw 12, but prevent the segments from being bulged out of sliding plane and insure retraction of the gates.

While the coating screw rods are desirable and very efficient as the operating means for the gates, it is understood that various practical means may be substituted.

What is claimed is:

1. Means for shutting off flow in a casing line including a two-part gate device with jamb-segments and a shell for the same having bearing faces for said segments, and a mobile packing medium embedded under the segments and having top and bottom margins, which surround the segments, expressible under reaction pressure to make a tight seat on the said faces.

2. Means for shutting off flow in a well casing line including a pair of opposed gate members each having a deformable packing medium which, when said packing is subject to abutment resistance, is expressible to jam against contiguous guide faces, and top and bottom jamb-segments which have plane bearing faces opposed to contiguous guide faces and are surrounded by said packing medium.

3. Means for shutting off flow in a casing string including a pair of gate members provided with meeting faces of deformable packing material, a shell in which said members are operative and having opposed bearing faces therefor, said members each having top and bottom jamb-segments presenting bearing faces to opposed faces of the shell; said material being expressible, under reaction, to seat on the adjacent shell faces and form a seal thereon around said segments.

4. A shut-off control device comprising a shell attachable in a line of casing and having a passageway for a through element and a pair of gate members each with top and bottom channels of loop-shape in plan and bordering top and bottom metal jamb-elements, the channels having a filling of mobile packing material which includes a body extending transversely from side to side of the effective closing end of the relative member and from top to bottom thereof; said shell having bearing faces against which said channel filling packing is forced when the transverse packer bodies of the members are in closing off position.

5. A shut-off control apparatus for well casing including a shell having a passageway for a tubing string, and a pair of opposed gates operative therein and provided with packing bodies to jam against interposed tubing, and said gates having top and bottom jamb-elements forming open channels in which are sunk lateral loop-like limbs from the said packing bodies, said shell having upper and lower bearing faces opposed to said jamb-elements and against which the packing limbs in said channels react under pressure.

6. In a casing shut-off control, a shell provided with a passageway for a tubing string from top to bottom, a pair of opposed, co-acting gate members, said shell having inner, upper and lower bearing faces between which the said members are guided, fluent packing bodies sunk in said gates and forming meeting sealing faces, and confining means imposed on said bodies and forming bordering flow chambers from which the bodies may be partly expressed out, up and down against the said bearing faces; said means being

opposed to the relative bearing faces of the shell irrespective of the position of the gates and the shell.

7. In a casing shut-off control, a pair of opposed sliding ram bodies each having diametrical meeting faces of rubber packing and having top and bottom jamb portions about which are provided channels in which lie border bars of rubber extending therinto from respective diametrical packing; whereby when said bodies are forced together said bars are partly extruded from said channels to seal against adjacent faces in a shell therefor.

8. In a casing shut-off control, a shell having opposite inner bearing faces and provided with a through hole for passage of parts, and a gate device including a pair of opposed ram elements each having a top and a bottom packing portion to ride on said faces during full range of ram movement, and bodies surrounding said packing portions and extending across opposed side faces thereof; whereby when the diametrical portions of the packing are compressed by the closing of the gate rams the said surrounding packing bodies are partly extruded against said inner bearing faces.

9. In a casing shut-off control, a ram element whose body has channeled top and bottom faces and whose diametrical face is covered by a packing medium which has laterally extending portions exposed in the top and bottom channels of the element, so as to be extruded when the diametrical portion is placed under compression by closing action of the ram element.

10. A device of the character described including, a housing adapted to be mounted on a well casing and having an opening to register with the well casing and a chamber intersecting the opening, two valve members in the chamber operable between positions free of the opening and positions in sealing engagement with an object extending through the opening, a valve seat on

the wall of the chamber around the opening, means for operating the members, and expansible packing carried in recesses in the members adapted to cooperate and to seal with the object and to be compressed into sealing engagement with the seat when in cooperative engagement.

11. A device of the character described including, a housing adapted to be mounted on a well casing and having an opening to register with the well casing and a chamber intersecting the opening, two valve members in the chamber operable between positions free of the opening and positions in sealing engagement with an object extending through the opening, a valve seat on the wall of the chamber around the opening, means for operating the members, and expansible packing carried in recesses in the members adapted to cooperate and to seal with the object and to be compressed into sealing engagement with the seat when in cooperative engagement, the surfaces of the packing in cooperative engagement and sealing with the object being greater than the surfaces in engagement with the seat.

12. A control of the character described including, a housing adapted to be applied to a well casing and having an opening to register with the casing and a chamber intersecting the opening, valve means operable to close the opening including two valve members in the chamber operable between positions clear of the opening and positions where they cooperate to close the opening, an annular seat on the wall of the chamber around the opening, and bodies of packing carried in recesses in the members and adapted to cooperate at the inner edges of the members to close the opening and adapted to be compressed through arcuate openings in the walls of the recesses to seal with the seat, and means for operating the members.

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