June 20, 1939. H. C. OTIS 2,163,178

WELL HEAD

Filed June 18, 1936 2 Sheets-Sheet 1

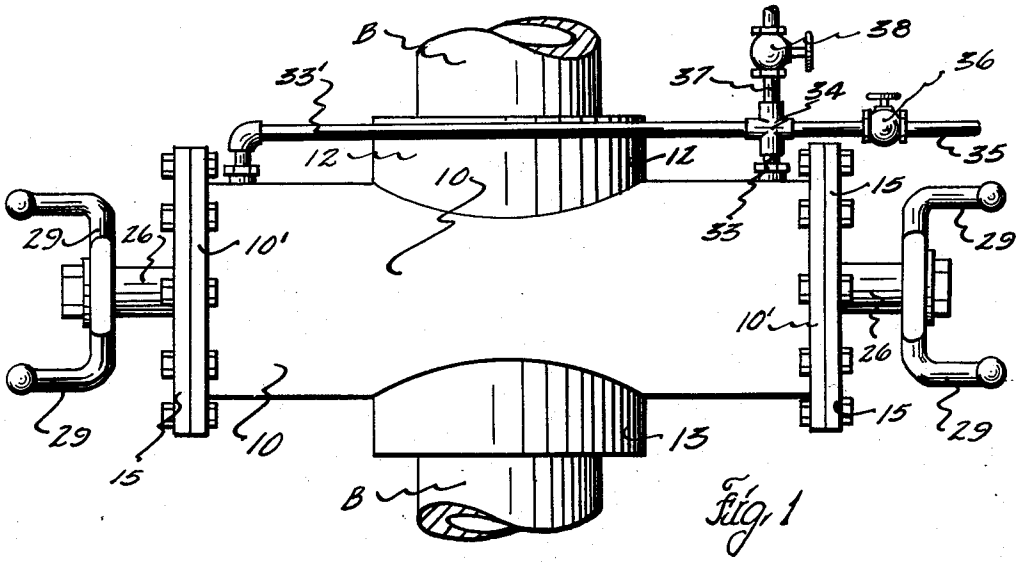


Fig. 1

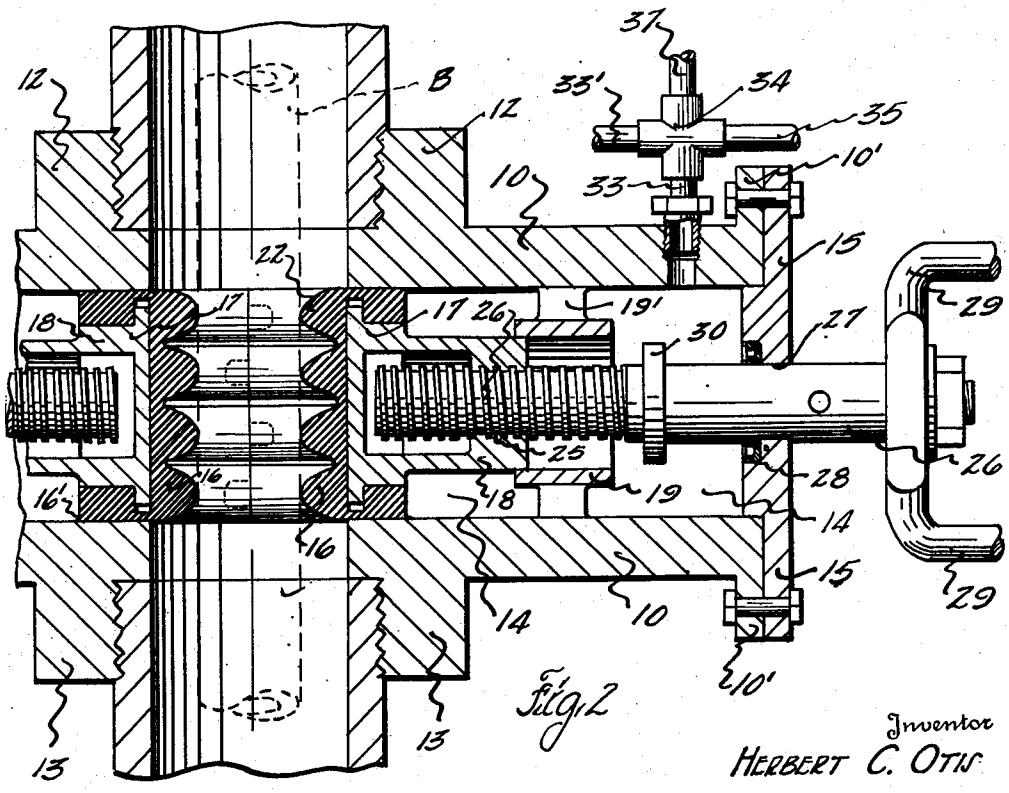


Fig. 2

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WELL HEAD

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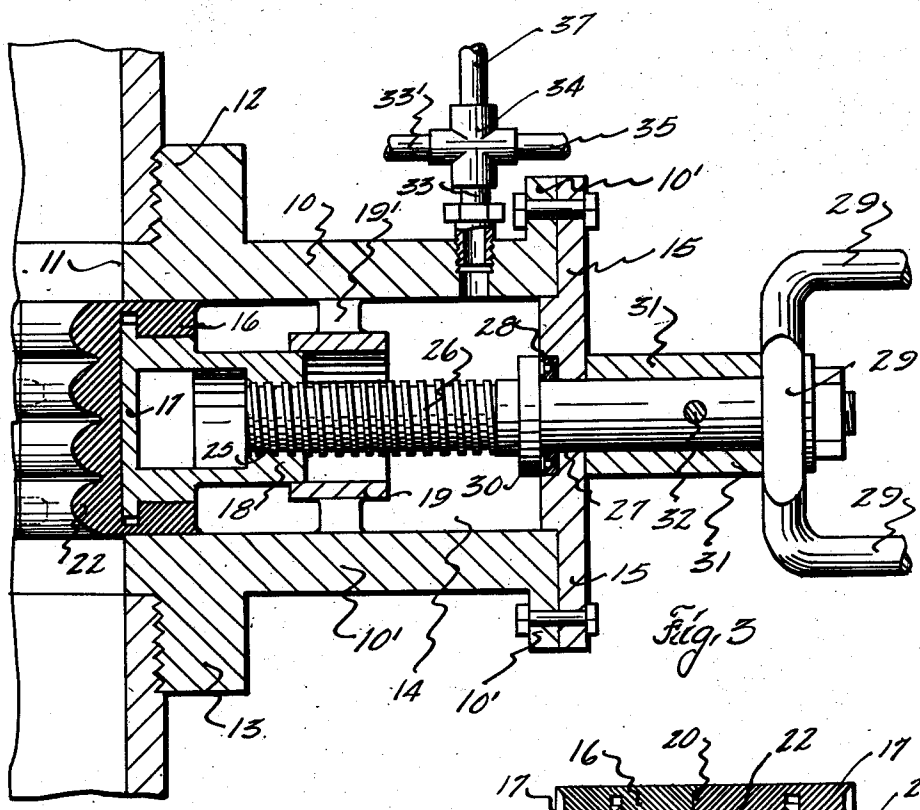


Fig. 3

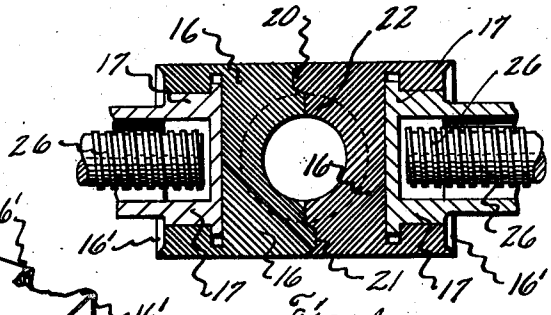


Fig. 4

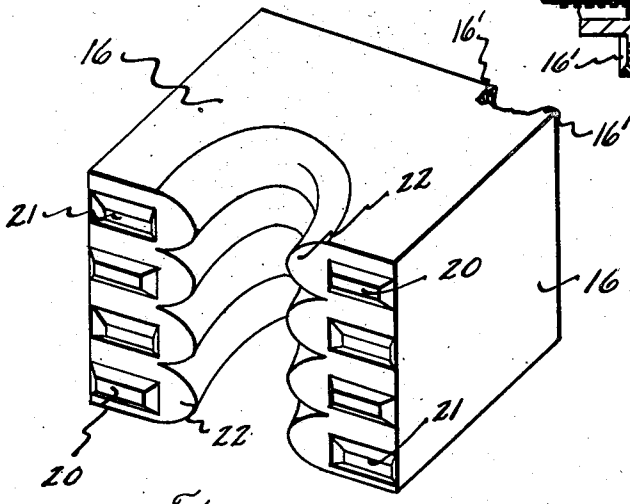


Fig. 5

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2,163,178

WELL HEAD

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Application June 18, 1936, Serial No. 85,827

4 Claims. (Cl. 137—139)

This invention relates to new and useful improvements in well heads.

One object of the invention is to provide an improved well head, particularly adapted for drilling and well operations, and arranged to pack off around a drill stem or tubing so as to permit the vertical passage of couplings without the loss of pressure; as well as being provided with pressure operating means and manual ram operating and fastening means.

An important object of the invention is to provide an improved well head including packing members yieldable to permit the passage of objects therebetween without the loss of pressure, together with fluid pressure operating means arranged to be active in closing the rams, but inactive in the opening of the rams, whereby the rams may be closed by fluid pressure and opened either by the well pressure or by tools passing between said rams.

Another object of the invention is to provide an improved well head which is arranged to be operated either manually or by pressure fluid and including yieldable packings on the rams permitting the passage of objects without the loss of pressure, whereby the rams may be quickly moved into packing position by the pressure fluid, and held or fixed in closed position by the manually operated means, thus not depending upon the fluid pressure to maintain said rams in their closed positions.

A further object of the invention is to provide an improved well head wherein the rams are closed by fluid pressure, which pressure is inactive in the opening of said rams, whereby well pressure or tool is utilized to open the rams, and the fluid pressure may be reduced to act as a cushioning or shock absorbing means during the opening operation, which makes for smooth retraction of the rams.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a side elevation of a well head constructed in accordance with the invention,

Figure 2 is an enlarged, transverse, vertical, sectional view of a portion of the device and showing the rams moved to their closed position by fluid pressure,

Figure 3 is a view similar to Figure 2, and showing the ram operating means in position for manual operation,

Figure 4 is a horizontal, cross-sectional view taken on the line 4—4 of Figure 2, and

Figure 5 is an isometric view of one of the packing members.

In the drawings, the numeral 10 designates an elongate metallic housing having a vertical bore 11 at its central portion. An upwardly extending collar 12 surrounds the upper end of the bore, while a similar, depending collar 13 surrounds the lower end of the bore. The collars are preferably made integral with the housing and are internally screw-threaded as shown. The lower collar 13 may be screwed onto the well casing, or other support, whereby the housing is readily mounted in working position.

The housing is formed with a pair of opposed packing chambers 14, rectangular in cross-section, and located in horizontal alignment with each other. The inner end of each chamber is open to the vertical bore 11, while the outer end of said chamber is closed by a plate or cap 15, which is bolted, or otherwise secured to a peripheral flange 10' provided at the outer end of the housing. Although each chamber is shown as rectangular in cross-section, it is obvious that its shape may vary.

An elastic packing member 16 is slidable or reciprocable in each chamber and this member is formed of rubber, rubber compound, or other suitable material. The packing member is molded, or otherwise secured to a follower 17, which follower is preferably constructed of suitable metal. The elastic packing member has a sliding fit within the housing, while the follower is formed with an extended shank 18 which slides within a guide ring 19 located centrally within the chamber. The ring is supported by suitable webs 19'. With this arrangement it is obvious that the follower and packing member form a ram which may be reciprocated within the chamber, whereby the face of the packing member may be moved into the vertical bore 11 of the housing.

The construction of the face of each packing member is a feature of the invention and is clearly shown in Figure 5, this inner face has a general semi-circular shape in cross-section, whereby when the member is moved into the bore 11, said face will snugly engage the outer surface of the drill stem, tubing, or other element B extending through said bore. The members are so constructed that when both members engage the element B, they provide an annular packing

member which encircles said element. The members are formed with complementary projections 20 and grooves 21 on their vertical engaging edges (Figure 4), whereby when said members encircle the element, the projections 20 engage the grooves 21 to lock the members in alignment with each other.

The inner face of each elastic packing member is provided with a plurality of arcuate or semi-circular blunt-nosed, flexible lips 22. The lips have their upper and lower ends rounded and are disposed through the entire vertical length of the inner face of the member, and it is obvious that when both the packing members are moved into engagement with the element B extending through the bore 11, said lips engage the surface of said element to pack off therearound. It will be obvious that the lips may be distorted either upwardly or downwardly to permit passage of couplings, or other enlargements on the element B without breaking the packing seal. The lips may also be deflected in any radial direction due to such movement of the element, while still maintaining the seal.

For manually operating the packing members 16 to move them into and out of engagement with the element B, the shank 18 of each follower is provided with a central, horizontally extending bore 25. This bore has the inner end of an elongate operating rod 26 threaded therein. The outer end of the rod extends through an opening 27 in the plate 15 which closes the outer end of the chamber 14. A pressure packing ring 28 surrounds the rod, being located within the plate, and serves to prevent escape of pressure around the rod from within the housing 14. The extreme outer end of the rod has a suitable operating handle 29 fastened thereon, whereby the rod may be readily rotated.

The rod is formed with an integral collar 30 which is located at substantially its mid-portion. This collar is adapted to engage the inner wall of the plate 15, as shown in Figure 3, and when said collar is engaging the plate the handle 29 is spaced some distance from the plate. A yoke 31 is arranged to be placed over the outer end of the rod between the handle 29 and plate 15. A pin 32 passes through the yoke and handle and holds said yoke in place. It is obvious that when said yoke is in position, the rod 26 is immovable with relation to the housing, although it may be rotated. Such rotation will cause the follower and packing member molded thereto, which form a ram, to be reciprocated or slid within the housing, and thus, a manual control of the rams is had.

For operating the rams by fluid, or other pressure, a pressure fluid line 33 is connected into the outer end of one chamber 14, whereby fluid under pressure may be admitted behind each ram to move the same into engagement with the element B. The line 33 has a four way T 34 connected to its upper end and a fluid inlet pipe 35 leading from a source of supply is attached to one side of the T. A suitable control valve 36 is connected in the pipe. A pipe 33' leads from the T to the other chamber 14. A fluid outlet pipe 37 is also connected to the T and is provided with a control valve 38.

When it is desired to operate the rams by fluid pressure, the yoke 31 is removed from the rod 26, whereby the rod becomes movable with relation to the housing 10. The outlet valve 38 is closed and the inlet valve 36 is opened which directs fluid under pressure into each chamber 14 through the pipes 33 and 33' behind the ram therein. The inner edge of each packing member 16 is formed with lips 16' whereby pressure within the chamber cannot by-pass the ram. As the fluid pressure is entered into each chamber, the ram is moved against the well pressure into engagement with the element B. The rod 26, being fastened in the follower, of course, moves with the ram, sliding through the opening 27 in the plate 15. Leakage of pressure through this opening is prevented by the pressure ring 28.

It is especially desirable to employ the fluid pressure for operating the rams when the head is used in operating a well under pressure, for it is obvious that since the rams must be moved against the well pressure, it would be difficult to reciprocate them manually. After the faces of the packing members have engaged the element B, the packing seal is affected. Due to the blunt-nose lips 23 which are capable of distortion and deflection in any direction, couplings, or other enlargements on the element B may be passed therethrough without losing the well pressure.

After the packing members have engaged the element B, they may remain in their packing position for some time, and it is not desirable to maintain them in such position by the fluid pressure from the lines 33 and 33'. Therefore, it is possible to replace the yoke 31 on the rod and properly adjust said rod to hold the members in engagement with the element. The fluid pressure in the chamber may then be depleted and the rams are locked in their engaged position.

In retracting the rams, it is advantageous to do so without the manually operable rod 26, and therefore, the yoke 31 is not used. Assuming that pressure from the lines 33 and 33' is holding the rams in position, the valve 36 is closed and the valve 38 opened. This latter valve is opened in accordance with the amount of the well pressure so that as the well pressure forces the rams inwardly, the fluid pressure is allowed to escape through the outlet pipe 37. In some instances, an enlargement, such as a conical coupling collar (not shown), on the element B will force the rams inwardly to move them to an open position. In either case, by properly adjusting the valve 38, the pressure fluid acts as a cushion or shock absorber, and smooth retraction of the rams is assured.

From the above, it will be seen that the rams may be actuated either by fluid pressure, or by the manually rotatable rod. The rod is utilized to lock the rams in their engaged or packing position, and the change from manual to fluid operation may be accomplished quickly and easily. The provision of the blunt-nosed flexible lips 23 permits couplings on the element B to readily pass through the packing members without any loss of well pressure. The projections 20 and grooves 21 on the vertical engaging edges of the members 16 lock the members together in horizontal alignment and give the effect of a solid, annular ring.

What I claim and desire to secure by Letters Patent, is:

1. A well head including, a head member arranged to be attached to a well casing and provided with a vertical passage therethrough ample to permit the passage of a well drill, opposed chambers angular in cross-section on each side of the passage of said head, a pair of elastic packing members angular in cross-section each having a sliding fit in said chambers and held

against rotation by their angular shape, said packing members having elastic faces arranged to engage and pack off a drill stem extending through the passage of said head member, but being amply yieldable to permit the passage of a drill collar therebetween with substantially no loss of well pressure thereacross, followers extending outwardly from the packing members and having internal screw threads, stationary guides for said followers in the head member, operating rods slidable in the head and having screw-threaded engagement in the threads of the followers, projections on the rods engaging fixed portions of the head member for limiting the outward sliding movement of said rods, whereby rotation of said rods causes the packing members to slide inwardly to embrace a drill stem, and fluid pressure means for sliding said packing members inwardly against well pressure and into contact with a drill stem, said fluid pressure acting against the outer sides of said packing members to seal them in the chambers against the escape of well pressure.

2. A well head including, a head member arranged to be attached to a well casing and provided with a vertical passage therethrough ample to permit the passage of a well drill, opposed chambers angular in cross-section on each side of the passage of said head, a pair of elastic packing members angular in cross-section each having a sliding fit in said chambers and held against rotation by their angular shape, said packing members having elastic faces arranged to engage and pack off a drill stem extending through the passage of said head member, but being amply yieldable to permit the passage of a drill collar therebetween with substantially no loss of well pressure thereacross, followers extending outwardly from the packing members and having internal screw threads, stationary guides for said followers in the head member, operating rods slidable in the head and having screw-threaded engagement in the threads of the followers, projections on the rods engaging fixed portions of the head member for limiting the outward sliding movement of said rods, whereby rotation of said rods causes the packing members to slide inwardly to embrace a drill stem, fluid pressure means for sliding said packing members inwardly against well pressure and into contact with a drill stem, said fluid pressure acting against the outer sides of said packing members to seal them in the chambers against the escape of well pressure, and means manually operated for locking the rods and packing members against sliding.

3. A well head including, a head member arranged to be attached to a well casing and provided with a vertical passage therethrough ample to permit the passage of a well drill, opposed chambers on each side of the passage of said head, a pair of elastic packing members held against rotation and each having a sliding fit in one of the chambers and a continuous elastic contact with the surrounding walls of the chamber, said packing members having elastic faces arranged to engage and pack off a drill stem extending through the passage of said head member, but being amply yieldable to permit the passage of a drill collar therebetween with substantially no loss of well pressure thereacross, fluid pressure means for supplying a fluid pressure to the rear sides of said packing members to displace them into sealing contact with a drill stem and for expanding the rear edges of the elastic packing members into sealing contact with the walls of the chambers, manually operated means for sliding the elastic packing members in the chambers, and means for positively holding the rods against sliding inwardly when manually operated.

4. A well head including, a head member arranged to be attached to a well casing and provided with a vertical passage therethrough ample to permit the passage of a well drill, opposed chambers on each side of the passage of said head, a pair of elastic packing members held against rotation and each having a sliding fit in one of the chambers and a continuous elastic contact with the surrounding walls of the chamber, said packing members having elastic faces arranged to engage and pack off a drill stem extending through the passage of said head member, but being amply yieldable to permit the passage of a drill collar therebetween with substantially no loss of well pressure thereacross, fluid pressure means for supplying a fluid pressure to the rear sides of said packing members to displace them into sealing contact with a drill stem and for expanding the rear edges of the elastic packing members into sealing contact with the walls of the chambers, manually operated means for sliding the elastic packing members in the chambers, mechanical means manually operated for locking the packing members and their manual operating means against sliding, and means for positively holding the rods against sliding inwardly when manually operated.

HERBERT C. OTIS.