

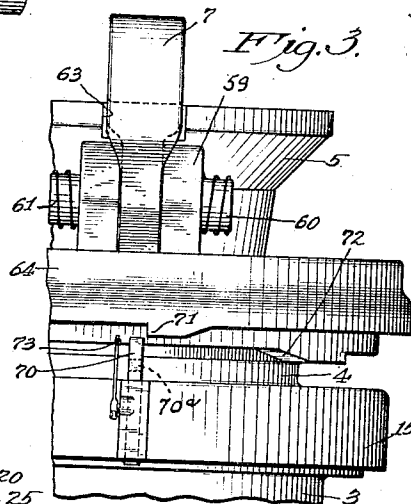
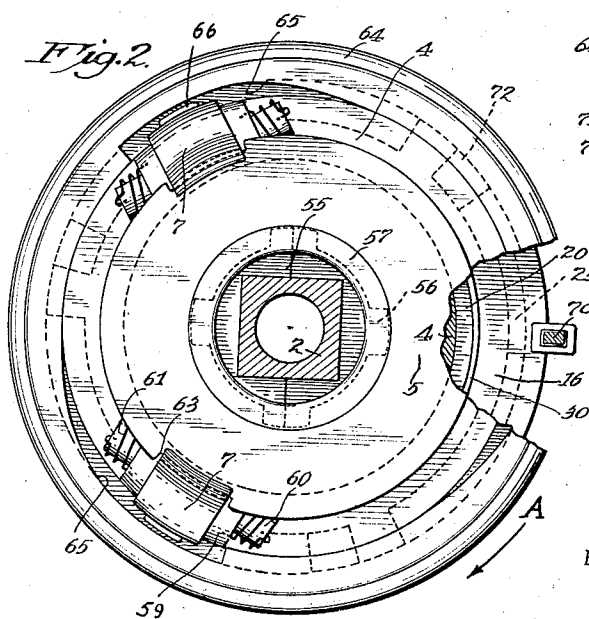
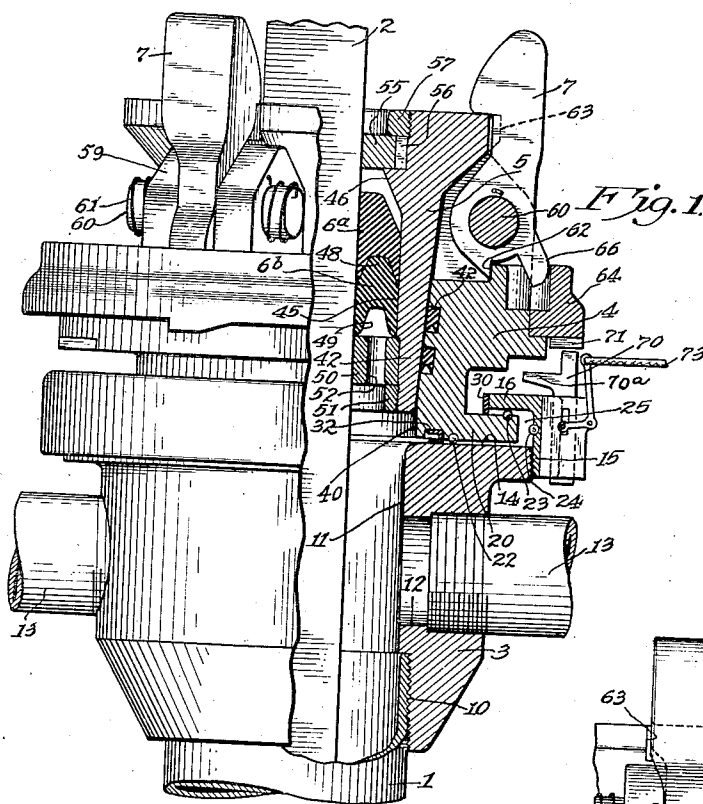
Jan. 24, 1939.

J. W. MacCLATCHIE

2,144,682

BLOW-OUT PREVENTER

Filed Aug. 12, 1936



INVENTOR.
John W. Mac Clatchie,

BY *R. W. Smith*

ATTORNEY.

UNITED STATES PATENT OFFICE

2,144,682

BLOW-OUT PREVENTER

John W. MacClatchie, Los Angeles, Calif., assignor to MacClatchie Manufacturing Company of California, Compton, Calif., a corporation of California

Application August 12, 1936, Serial No. 95,549

10 Claims. (Cl. 255—1)

This invention is a blowout preventer and relates particularly to that type of blowout preventer disclosed in my copending application Ser. No. 96,619, filed August 18, 1936, wherein the packer of the blowout preventer is adapted for automatic alinement with the drill string which is to be packed off, irrespective of any misalinement of the drill string in the well as may result from lateral drift of the drill string or improper alinement or play in the rotary table.

The invention is particularly applicable to a rotating blowout preventer wherein the packer rotates with the drill string and is mounted in a rotatable element which is journaled on a stationary element fixed to the well casing, and it is an object of the invention to provide improved means for securing the rotatable and stationary elements in assembled relation while permitting free lateral play of the rotatable element with relation to the stationary element.

It is a further object of the invention to provide improved means for securing the packer in the rotatable element and releasing the securing means at will.

Further objects of the invention will be readily understood from the following description of the accompanying drawing, in which:

Fig. 1 is a side elevation of the blowout preventer, partly in axial section.

Fig. 2 is a top plan view.

Fig. 3 is a fragmentary side elevation, looking in a direction at right-angle to that of Fig. 1.

The blowout preventer is adapted for mounting on a casing string 1, with the casing adapted to receive a usual drill string which at its upper end preferably includes a kelly 2. In usual practice the kelly is polygonal in cross-section, preferably square, so that it may be engaged by a usual rotary table (not shown) for normally rotating the drill string in the direction indicated by the arrow A. The blowout preventer includes a stationary element 3 which is mounted on the well casing and an element 4 rotatable relative thereto and having a bore which is adapted for reception of a packer 5 for the kelly.

The element 4 and the packer 5 rotate with the kelly, and means are provided, preferably including anti-frictional bearings, for holding these rotatable parts against longitudinal displacement relative to the stationary element 3 while permitting their free lateral adjustment. Packing is provided between the rotatable and stationary elements and is preferably expanded by well pressure.

The packer 5 is adapted to receive packing

which has a bore corresponding to the cross-section of that portion of the drill string which is to be packed off, said bore being square in the illustrated embodiment of the invention wherein the blowout preventer is adapted to pack off a cross-sectionally square kelly, and the packer is preferably releasably secured in the rotatable element 4 by means of latches 7 which are adapted for positive retraction to inoperative position as a result of rotation of the drill string.

The stationary element 3 may be threaded to the casing string 1 as shown at 10 with its bore 11 forming prolongation of the bore of the casing string, and lateral flow outlets 12 communicate with the bore 11 and have flow lines 13 connected thereto. Above the outlets 12 the element 3 forms a bearing seat 14, and an annulus 15 is threaded onto the outer periphery of this seat and terminates in a flange 16 which overlies the bearing seat in longitudinally spaced relation therefrom.

The rotatable element 4 has a flange 20 which is received on the bearing seat 14, and the flange 16 overlies the flange 20 for holding the element 4 against longitudinal displacement. Anti-frictional bearings are preferably provided between the seat 14 and the flange 20 as shown at 22, between the flanges 16—20 as shown at 23, and at the inner surface of the peripheral wall of the annulus 15 as shown at 24.

The annulus 15 and the flange 20 are of such relative diameter that an appreciable radial space 25 is provided therebetween when the elements 3—4 are concentric, and the inner periphery of the flange 16 is similarly appreciably radially spaced from the element 4 when the elements 3—4 are concentric.

The element 4 is thus adapted for rotation relative to the stationary element 3 while held against longitudinal displacement, but is free for appreciable lateral play relative to the stationary element, and in the event of the element 4 being laterally displaced to its limit of movement as defined by the surrounding annulus 15 the bearing 24 maintains an anti-frictional bearing between the relatively rotatable parts.

The packing which is provided between the elements 3—4 for preventing escape of well pressure, is so arranged as not to obstruct free lateral play of the rotatable element 4 with relation to the stationary element 3, and for this purpose the flange 20 may be recessed for reception of a ring of U-packing 32, which is mounted in the recess with the interior of the ring open to well pressure from the bore 11 so that the packing is

operatively expanded for packing off between the flange 20 and the seat 14. The packing 32 also prevents drainage from the space surrounding the bearings 22, 23 and 24 as defined by the parts 14—15—16, so as to seal against escape of a lubricant which may be supplied to said space for lubricating the bearings, and a packing ring 30 is preferably secured to the inner periphery of the flange 16 and packs off against the flange 20 for similarly sealing the opposite end of this lubricant space.

The bore 40 of the element 4 is preferably of greater diameter than the bore 11 so that even when the element 4 is shifted laterally to its limit of movement with relation to the element 3 the bore 40 offers no obstruction to the bore 11, and the upper end of the bore 40 preferably tapers for wedging reception of the packer 5 which has a corresponding taper. Packing is preferably provided as this tapering seating surface, and is shown as packing rings 42 seated in recesses in the tapering bore of the element 4, with the packing rings preferably annularly grooved at their lower ends so that well pressure seeping upwardly between the cooperating seating surfaces of the parts 4—5 may operatively expand the packing rings.

The packing which is mounted in the packer 5 for packing off the drill string, is preferably expanded by well pressure and may be of the type disclosed in my prior U. S. Patent No. 2,051,261, granted August 18, 1936. As an instance of this arrangement the lower end of the bore of the packer 5 may be cylindrical as shown at 45, with the upper end of this cylindrical bore preferably merging into a tapering bore 46, and packing is received in the bores 45—46 and has a bore conforming to the cross-section of that portion of the drill string which is to be packed off, the bore of the packing being square in the illustrated embodiment of the invention so as to fit the square kelly 2.

The packing preferably comprises superimposed packing rings 6a—6b, the upper ring 6a tapering at its upper end for wedging reception in the tapering bore 46 when well pressure operatively expands the packing, and being annularly grooved at its lower end for reception of a corresponding tapering tongue 48 at the upper end of the lower packing ring 6b. The lower end of the lower packing ring is also annularly grooved as shown at 49, so that well pressure directed into the groove 49 may operatively expand the packing. The superimposed packing rings may be held in assembled relation by a collar 50 which fits in the bore 45 around the kelly 2 and below the packing 6a—6b, and which is held in place by a threaded ring 51, the collar 50 having ports 52 opening therethrough so that well pressure is communicated to the groove 49 for operatively expanding the packing and wedging it in the tapering bore 46.

The upper end of the bore 46 is preferably closed by a split annulus 55 which is adapted for longitudinal reception in the upper end of the bore of the packer 5 above the tapering bore 46 and which may form means for positively rotating the packer 5 with the kelly 2. For this purpose the annulus 55 has a bore fitting the cross-section of the kelly 2, with its outer periphery forming a splined engagement 56 with the upper end of the bore of the packer 5, and the annulus 55 may be held in place by a collar 57 which is threaded into the bore of the packer.

The latches 7 which releasably secure the pack-

er 5 in the rotatable element 4 may be of the general type disclosed in my prior U. S. Patent No. 1,708,316, granted April 9, 1929, except that they are mounted on the rotatable element 4 and not on a stationary part of the blowout preventer. As an instance of this arrangement the latches may be pivoted between lugs 59 which project upwardly from the element 4, the pivotal mountings being shown at 60, and the latches are normally projected to operative position by springs 61 so that the heads of the latches overlie and engage the packer 5. Projection of the latches to operative position may be limited by stops 62, and the latches preferably provide means for positively rotating the member 4 with the rotating packer 5. For this purpose the packer 5 may be notched as shown at 63 for reception of the latches 7 when the latter are swung to operative position.

Means are preferably provided whereby rotation of the drill string positively retracts the latches 7 so as to disengage and permit removal of the packer 5. As an instance of this arrangement a ring 64 may be journaled on the element 4 and the bore of this ring forms cam surfaces 65 which cooperate with fingers 66 of the latches 7. The ring 64 is normally turned relative to the element 4 in the opposite direction to that indicated by arrow A, until the cams 65 are clear of the fingers 66 as shown at Fig. 2, with the ring 64 then permitted to rotate with the element 4 as a result of frictional binding engagement thereon, and since the cams 65 thus remain clear of the fingers 66 the latches 7 are operatively projected by their springs 61 so as to lock the packer 5 in the element 4.

When the packer is to be released the ring 64 is held against turning, so that continued rotation of the element 4 in the direction of arrow A, causes the fingers 66 to engage the cams 65 for positively swinging the latches 7 to their released position.

Rotation of the ring 64 may be arrested for thus positively retracting the latches, by means of a normally retracted latch 70 which is mounted on the stationary member 3, preferably at the annulus 15, and which is adapted for manual projection by a cable 73 so as to engage any one of a plurality of stops 71 on the rotatable element 4; and a plurality of releasing cams 72 are preferably provided on the element 4 so that when the latch 70 has stopped rotation of the ring 64 and continued rotation of the element 4 has thus engaged the fingers 66 with the cams 65 for retracting the latches 7, one or the other of the cams 72 engages an extension 70a of the latch 70 for retracting the latch. The ring 64 is thus again free for frictionally binding rotation with the element 4 after having been turned to a position relative to said element where the cams 65 retain the latches 7 in their released position. The packer 5 is thus free for removal and replacement, and to again lock the packer in assembled relation it is only necessary to turn the ring 64 relative to the member 4 in the opposite direction to that of arrow A, until the cams 65 again clear the fingers 66 as shown at Fig. 2. The latches 7 being then operatively projected by their springs 61 so as to engage the packer 5, the ring 64 frictionally binds on the element 4 and rotates therewith until the latch 70 is again manually projected for stopping rotation of the ring 64 and thus positively retracting the latches 7 as previously described.

The invention thus provides a blowout preventer including simple means for holding the packer in assembled relation with the holding

means operable by rotation of the drill string for positively releasing the same, and the invention also provides improved means for mounting a packer assembly on a stationary element which is fixed to well casing, so that the packer assembly is held against longitudinal displacement but is free for lateral adjustment with relation to the stationary element and is preferably also free for rotation with the drill string relative to the stationary element.

I claim:

1. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, one of said elements including a flange, the other of said elements having bearing surfaces engaging the opposite faces of the flange for securing the cooperating elements against relative longitudinal displacement but permitting relative rotation and relative lateral adjustment of said elements, anti-frictional bearings at each of said bearing surfaces, packing at said bearing surfaces for sealing the space around the anti-frictional bearings, one of said packings being exposed to pressure from the well casing for packing off between the cooperating elements, a packer in the bore of the rotatable element adapted to pack off around a kelly, latches pivoted on the rotatable element and adapted for projection to engage the packer and prevent its longitudinal displacement, a driving connection for rotating the packer with the kelly, a driving connection, rendered operative by projection of the latches, for turning the rotatable element with the packer, a cam normally turning with the rotatable element, means for arresting rotation of the cam so that continued turning of the rotatable element engages the latches with the cam for retracting the latches to release the packer, and means for rendering the arresting means inoperative after retraction of the latches so as to again permit turning of the cam with the rotatable element.

2. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against relative longitudinal displacement but permitting rotation of said rotatable element with respect to said stationary element, and latches on the rotatable element adapted for projection to engage the packer and prevent its longitudinal displacement.

3. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against longitudinal displacement but permitting rotation and relative lateral adjustment of said rotatable element with respect to said stationary element, and latches on the rotatable element adapted for projection to engage the packer and prevent its longitudinal displacement.

4. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well

casing, means for securing the cooperating elements against relative longitudinal displacement but permitting rotation of said rotatable element with respect to said stationary element, latches on the rotatable element adapted for projection to engage the packer and prevent its longitudinal displacement, a driving connection for rotating the packer with the well string which extends therethrough, and a driving connection for turning the rotatable element with the packer.

5. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against relative longitudinal displacement but permitting rotation and lateral adjustment of said rotatable element with respect to said stationary element, latches on the rotatable element adapted for projection to engage the packer and prevent its longitudinal displacement, a driving connection for rotating the packer with the well string which extends therethrough, and a driving connection for turning the rotatable element with the packer.

6. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against relative longitudinal displacement but permitting rotation of said rotatable element with respect to said stationary element, latches on the rotatable element adapted for projection to engage the packer and prevent its longitudinal displacement, means actuated by rotation of the rotatable element for retracting the latches, and means for controlling operation of said last mentioned means.

7. In combination, cooperating elements one of which is a stationary element adapted for mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against relative longitudinal displacement but permitting rotation and lateral adjustment of said rotatable element with respect to said stationary element, latches on the rotatable element adapted for projection to engage the packer and prevent its longitudinal displacement, means actuated by rotation of the rotatable element for retracting the latches, and means for controlling operation of said last mentioned means.

8. In combination, cooperating elements one of which is adapted for mounting on well casing, a packer in the other of said elements adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against longitudinal displacement but permitting lateral adjustment of said rotatable element with respect to said stationary element, latches adapted for projection to engage the packer and prevent its longitudinal displacement, means actuated by rotation of the well string for retracting the latches, and means for controlling operation of said last mentioned means.

9. In combination, cooperating elements one of which is a stationary element adapted for

mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperating elements against relative longitudinal displacement but permitting rotation of said rotatable element with respect to said stationary element, latches adapted for projection to engage the packer and prevent its longitudinal displacement, means actuated by rotation of the well string for retracting the latches, and means for controlling operation of said last mentioned means.

10. In combination, cooperating elements one of which is a stationary element adapted for

mounting on well casing and the other of which is a rotatable element, a packer in the rotatable element adapted to pack off around a well string which extends through the packer into the well casing, means for securing the cooperative elements against relative longitudinal displacement but permitting rotation and lateral adjustment of the rotatable element with respect to the stationary element, latches adapted for projection to engage the packer and prevent its longitudinal displacement, means actuated by rotation of the well string for retracting the latches, and means for controlling operation of said last mentioned means.

JOHN W. MACCLATCHIE. 15