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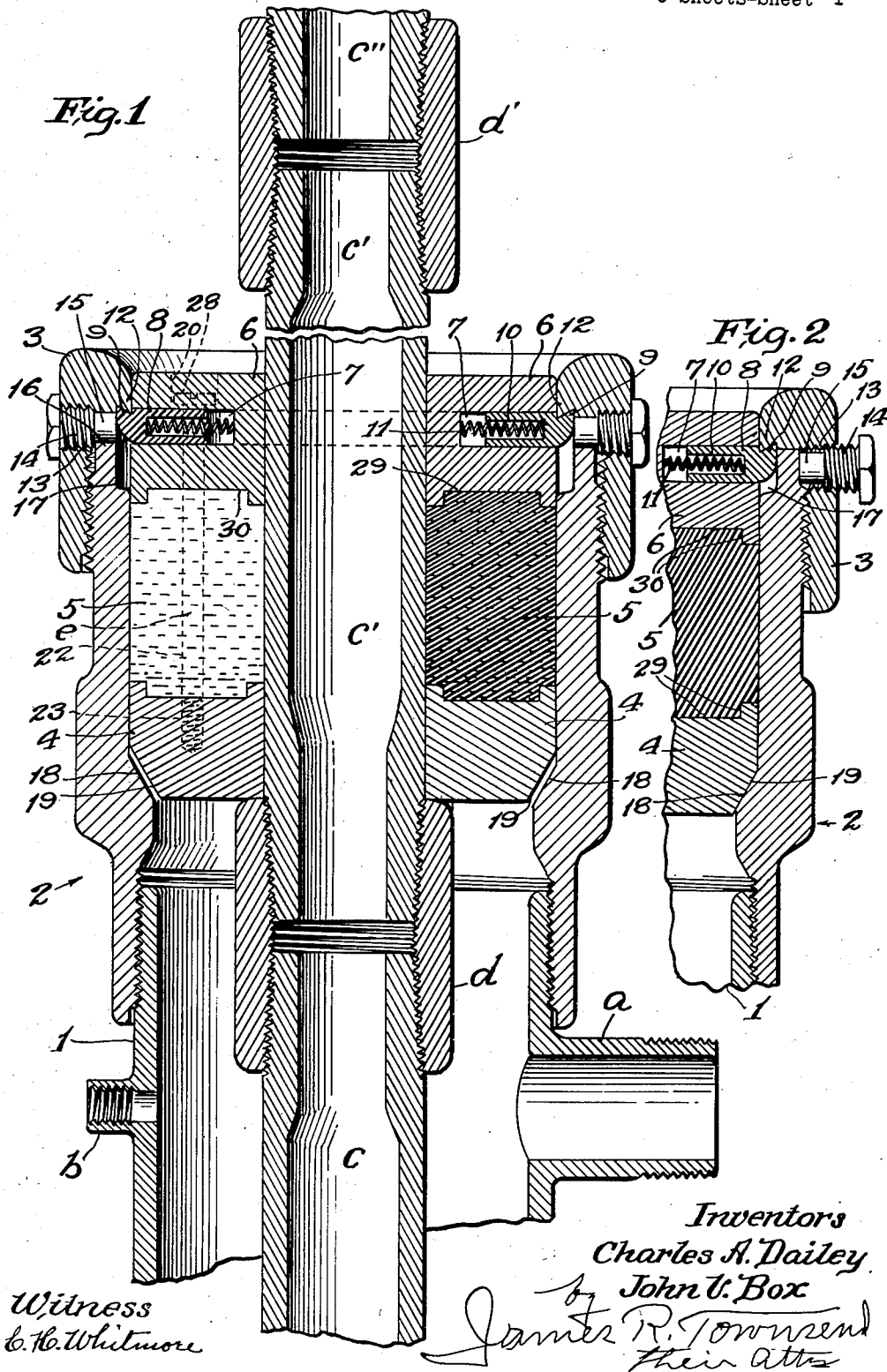
C. A. DAILEY ET AL

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AUTOMATIC DOUBLE ACTING BLOW-OUT PREVENTER FOR USE IN OIL WELL DRILLING

Filed Jan. 3, 1929

3 Sheets-Sheet 1



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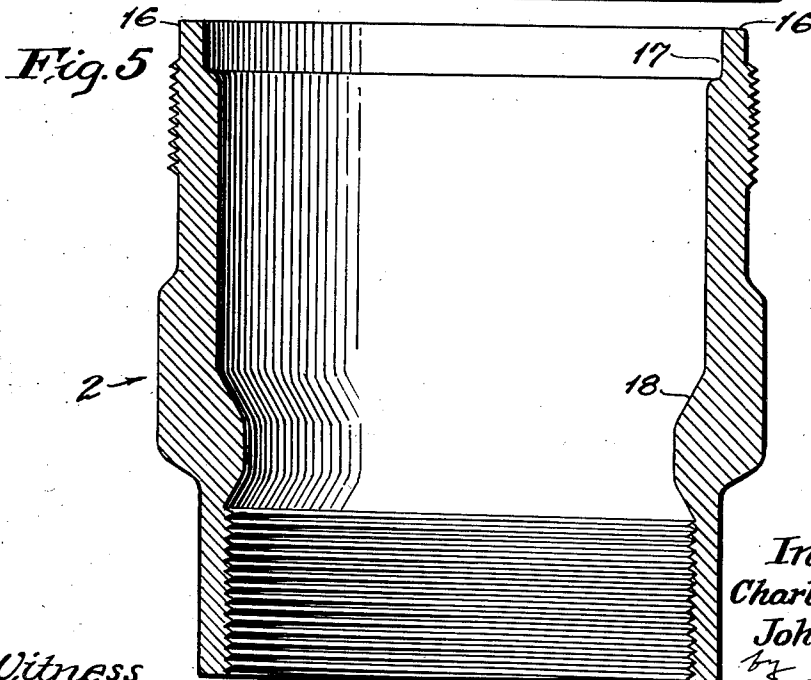
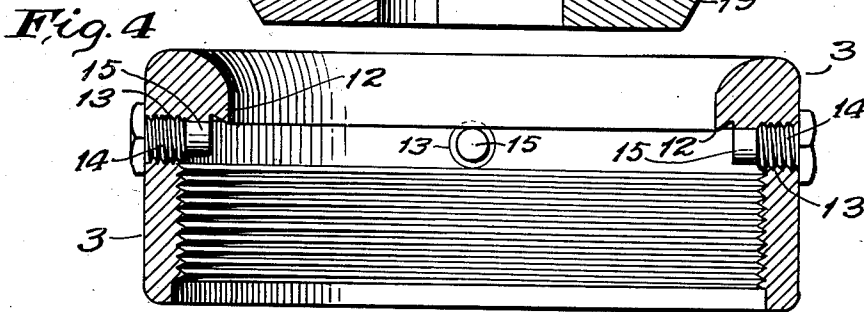
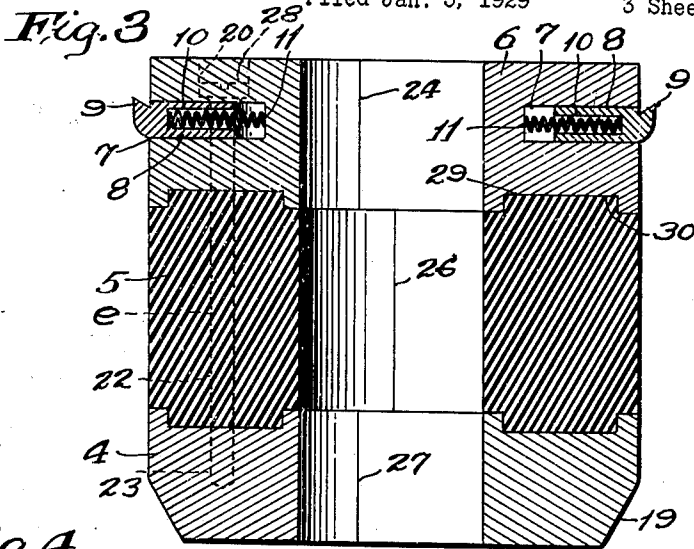
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 6

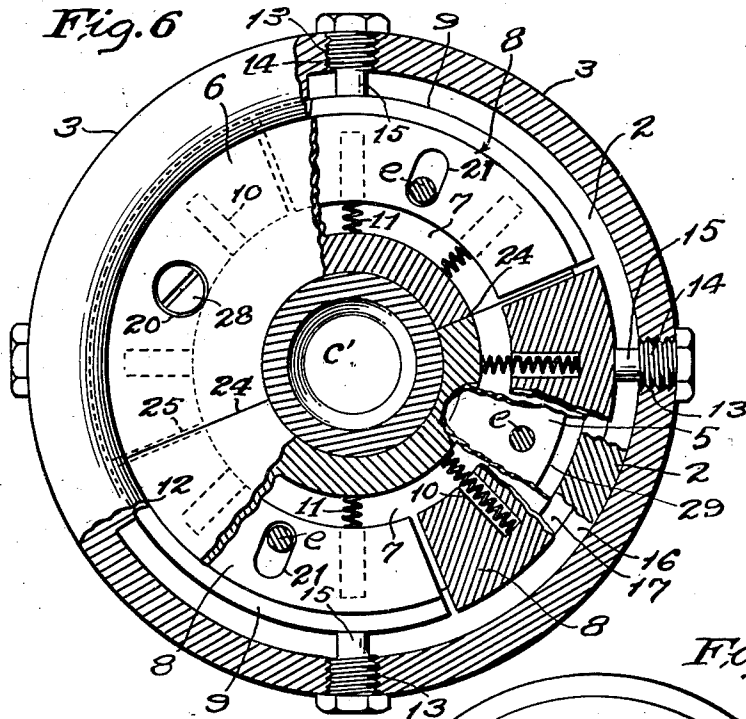


Fig. 8

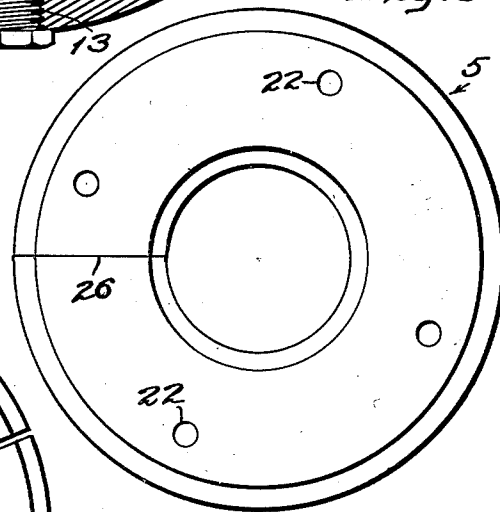
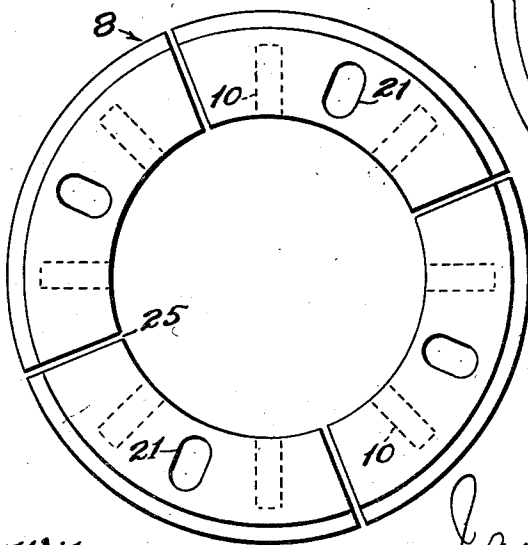


Fig. 7



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UNITED STATES PATENT OFFICE

1,978,991

AUTOMATIC DOUBLE ACTING BLOW-OUT
PREVENTER FOR USE IN OIL WELL
DRILLINGCharles A. Dailey, Torrence, and John V. Box,
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Application January 3, 1929, Serial No. 330,053

10 Claims. (Cl. 286—16)

In the drilling of oil wells by the rotary drill method emergencies often arise requiring that the fluid in the well shall be prevented from having an unrestrained flow from the top of the well, thus making it possible to control the flow and at the same time prevent disastrous results which might occur if the fluid from the well should become ignited or flow with such rapidity as to cause a cave-in of the well. It is the principal object of the present invention to provide a well blowout preventer which may be quickly applied to the rotary drill stem and positioned within a casing seat in a manner to pack the well casing, said packing operation being accomplished by the pressure exerted by the weight of the drill string in a downward direction or the pressure exerted by the fluid of the well in an upward direction.

The present invention contemplates the provision of a pair of articulately connecting packing members adapted to be fitted around a drill tube and provided at opposite ends with a pair of compression rings adapted to deliver pressure to the packing element when pressure is exerted either by the weight of the drill stem or the fluid pressure within the well, said packing structure including a seat carried by the upper end of a well casing and within which the packing unit may be automatically locked.

The accompanying drawings illustrate the invention.

Figure 1 is a fragmental axial section of an assembly embodying this invention applied to a well casing and surrounding a drill pipe in position for locking the upper packing ring onto the well pipe and against upward movement of the drill pipe, and with the automatic parts in position to be operated by descent of the drill pipe.

Fig. 2 is a fragmental sectional detail showing one side of the assembly when the stop pins have been retracted and the bonnet has been screwed down to compress the packing.

Fig. 3 is an axial section of the packing sleeve detached.

Fig. 4 is an axial section of the bonnet detached adapted to be screwed onto the housing.

Fig. 5 is an axial section of the housing detached.

Fig. 6 is a plan in section on various planes of the bonnet and the compressor and locking rings shown in Fig. 1.

Fig. 7 is a plan view of the segments of the locking ring.

Fig. 8 is a plan of the packing ring.

The head 1 of the casing is externally threaded at the upper end and is provided with the usual

overflow mud line *a* and auxiliary mud pipe *b*, through which latter, fluid mud may be pumped into the casing below the head, when desired.

The packing sleeve housing or body steel 2 is internally threaded at its lower end, is externally threaded and internally recessed or cut away as at 17, at its upper end, and its lower end is screwed onto the upper end of the casing head.

A steel bonnet 3 is threaded onto the upper end of the housing 2, and is provided with a detent that overhangs the recess 17.

The pipe sections as at *c*, *c'* and *c''* are connected by couplings *d*, *d'* that form tappets projecting from the joints and arranged to contact with the compression rings 4 and 5 of the packing sleeve.

The rings 4 and 6 are the packing compressing rings and are of steel. They are adapted and arranged respectively to apply to the rubber packing ring 5, upward pressure from the lower coupling *d*, as indicated in Fig. 1, when the drill pipe is drawn up by machinery, or downward pressure from the drill pipe coupling *d'*, when the drill pipe is lowered.

The lower packing compressing ring 4 is made of steel in two semi-circular pieces; the packing ring 5 is made of rubber in one piece, split on one side so that the ring may be opened and put onto the drill pipe at one side thereof to encircle the drill pipe; the top packing compressing ring 6 is made of steel in two semi-circular pieces and is provided with an outwardly open annular channel 7 in which is mounted the lock ring made up of four segmental dogs 8, radially slidable in the channel and provided at their outer ends with arcuate upwardly projecting detents 9, and also provided with radial slots 10, which extend part way across the dogs to allow radial movement of the dogs relative to the compression ring 6, without interference with the assembly screws *e* that serve to guide the dogs that are normally held in extended position by springs 11.

The bonnet 3 has an inner annular overhang 12 forming a circular detent seat with which the outer arcuate edges or detents 9 of the segmental dogs 8 engage. The upturned edges of the detents are in a horizontal plane and are arcuate so as to register with, and catch under the overhang 12 with a perfect hold to prevent upward movement of the upper steel ring 6 and to prevent any inward movement of the dogs that might release the engagement between the ring and the bonnet.

The bonnet 3 is provided with threaded radial holes 13 to receive screw-threaded bodies 14 of stop pins 15 that are held in place by the screws

to hold the bonnet spaced from the rim 16 of the housing. The housing is internally cut away to form a cylindrical recess as at 17, to allow the upper ring 6 to be moved downward without retracting the dogs from the retaining position so that the upper ring 6 may be depressed inside the housing without moving the dogs.

The housing is provided with an upwardly expanded lower steel ring seat 18 in the form of an annular shoulder, and the lower end of the lower ring 4 is tapered as at 19 to seat on such shoulder when the lower coupling *d* is not up-lifting the lower ring 4 to compress the rubber packing ring 5 as shown in Fig. 1. The packing compression indicated in Fig. 1 is effected by pulling up the drill pipe by the powerful rig machinery not shown, so that the tappet formed by the lower coupling, lifts the lower coupling ring 19.

It will be seen by reference to said Fig. 1 that if the drill pipe were lowered from the position there shown, the coupling *d* would no longer support the lower ring 4, and that by lowering the drill pipe until the upper coupling *d'* strikes the upper compressing ring 6 and forces down the packing sleeve, and seats the lower ring 4 on seat 18 and compresses the packing ring without any other adjustment of the parts; and by reference to Fig. 2 it will be seen that in case the ring 6 is thus depressed, the stop or spacing pins 15 may be unscrewed and thus outdrawn, and the bonnet screwed down to hold whatever compression may have been effected.

When the housing and bonnet are in place, as shown in Fig. 1, dropping of the drill pipe by reason of weakening of the floor of the hole, will cause the upper coupling *d'* to force the upper compressing ring 6 and the packing sleeve down in the housing to the position shown in Fig. 2, and thereupon, the screws may be unscrewed; and when the stop pins are thus outdrawn, and the bonnet screwed down into position shown in Fig. 2, it is made sure that the compression of the packing ring 5 will remain irrespective of any change in the position of the drill pipe that may occur.

The rings of the packing sleeve are secured together by the assembly screws *e* inserted through the counter-sunk hole 20 of the upper compressing ring 6, recesses 21 in the dogs of the locking ring, and, through the bolt holes 22 in the packing ring 5, and are screwed into sockets 23 in the lower compressing ring 4.

One of the gaps 24 between the segments of the upper compressing ring 6, one of the gaps 25 between two dogs 8, of the locking ring, the gap 26 of the packing ring 5 and one of the gaps 27 of the lower compressing ring 4 sufficiently coincide to allow the packing sleeve to be opened at one side in the usual way, to receive the drill pipe; and in practice after the sleeve is brought into position around the drill pipe, it is slipped down through the bonnet 3 into the housing; and as the dogs strike the overhang, the springs allow them to move in, and when the overhang has been passed, force the dogs to move out, below the overhang 12, thus securing the sleeve in position to be acted upon by the collars of the drill pipe, either from above or from below as hereinbefore explained.

The assembly screws are provided with heads 28 kerfed to receive a screw-driver, not shown, by which they may be screwed down so as to be sunk out of the way.

The packing ring 5 and its compressing rings

4 and 6 are provided with annular tongue and groove engaging faces 29, 30, so that when the parts are assembled, and the screws are screwed home the packing sleeve is a unit.

It is to be understood that the usual gates and valves, not shown, for controlling the outlets of the drill pipe and casing are employed as usual in drilling rigs.

We claim:—

1. The combination with a well casing head of a drill pipe, joints and couplings that are adapted to form tappets at the ends of the joints, of a packing sleeve housing fixed to the top of the well casing head, of a bonnet having detent receiving means adapted to allow the downward passage of a sleeve; a packing sleeve for the housing; a packing compressing ring adapted to pass the detent receiving means downwardly; a locking ring carrying detents to engage the detent receiving means of the bonnet to prevent upward return of the compressing ring, said tappets being adapted and arranged to operate the rings respectively to compress the sleeve on the up and also on the down movement of the drill pipe under abnormal movement thereof by either gas pressure from the interior of the casing, or from weight of the drill pipe, or from machinery.

2. In a rotary well drilling rig, a housing adapted to be connected to the top of a well casing; a bonnet connected to the housing and provided with an annular detent; and a locking ring made up of sections forming dogs adapted to pass the detent on the descent of the ring and to engage the detent to prevent movement upward past the detent.

3. For use in drilling a well with a rotary drill and drill pipe inside a well casing; a housing connected to the top of the casing and surrounding the drill pipe; a packing sleeve adapted to encircle the drill pipe and to be inserted into the housing between the drill pipe and the housing and comprising a packing ring and lower and upper packing compressing rings adapted to be driven by the drill pipe collars, and automatic retaining means cooperating with the housing and carried by the upper compressing ring to admit the packing sleeve and to prevent withdrawal of said sleeve from the housing.

4. In a device of the character set forth, a housing, externally screw-threaded and annularly recessed within at its upper portion; an internally threaded sleeve adjustably threaded onto the top of the housing and having an annular projection overhanging the top of the housing and the annular recess; and pins screwed through the sleeve and adapted when screwed in, to space the overhang from the top of the housing, and when screwed out, to allow the overhang to rest on top of the housing so that in each position of the pins, there will be a solid support for the overhang, on the rim of the housing.

5. In combination with a drill pipe formed of joints and couplings at the joint ends to form stops projecting from the joint ends; a casing head through which the drill pipe operates; a packing sleeve housing fixed to the casing head and having an annular shoulder at the lower end and a circular recess at the top, and being internally threaded at the lower end for connection to the casing head and externally threaded at the upper end; a sleeve compressing ring seated on the shoulder and slidable in the housing; a packing sleeve seated on the compressing ring and fitting the housing; a top ring on the

sleeve and slidably fitting the housing, a bonnet having detent receiving means adapted to allow downward movement of the top ring outwardly movable detents carried by said top ring and engaging said detent receiving means; and a rotary drill pipe extending through the packing sleeve and provided with a tappet above the upper compression ring and with a tappet below the lower compression ring to force such rings respectively to compress the packing.

6. In a rotary well drilling apparatus for use in drilling wells, likely to open up high rock pressure in the course of drilling; means for effecting a quick closure for the space between the drill pipe and the top of the well casing which consists in a housing screwed on top of the well casing and surrounding the drill pipe and provided at its lower end with a shoulder, and at its upper end with an annular cut-away recess; a bonnet screwed onto the upper end of the housing and having an annular detent overhanging the cut-away recess; a packing sleeve adapted to fit in and close the space between the housing and drill pipe, and comprising a bottom compression ring resting on said shoulder, a compressible packing ring to fit in and closing the packing chamber above the compressible ring; a channelled locking ring adapted to fit the drill pipe and having an annular channel open to the cut-away recess inside the housing; an annular locking dog made up of sections arranged flatwise in the annular channel and up-turned at the ends to hook under the annular detent of the bonnet and provided with bores radial to the locking ring; springs in the bores to hold the dog sections out into position in the cut-away, to hook under the annular detent, the under faces of the outer ends of the dogs being rounded up and the inner face of the rim of the bonnet being rounded down to cooperate with the rounded ends of the dogs to allow the dogs to be pushed in simultaneously by the overhang and into position for being returned outwardly to latch the locking ring and the bonnet together; said dogs being provided between their spring bores with radial slots; and guide pins fixed to the locking ring and extending into the radial slots.

7. A blowout preventer for use in oil well drilling operations comprising in combination with a well casing down through which a drill tube extends a body sleeve mounted upon the upper end of the casing, said sleeve being formed with a central bore in longitudinal alignment with the casing, said bore having a packing shoulder near its lower end and a counterbore at its mouth, a bonnet threaded onto the upper end of the body sleeve and having an inturned lip overhanging the counterbore of said sleeve, a packing structure adapted to be positioned upon the drill tube at a point between its couplings and to be disposed within the body sleeve, said packing unit comprising a deformable packing ring adapted to circumscribe the drill tube

and to fit within the bore of the body sleeve, a lower packing plate and an upper packing plate assembled therewith and fitting within the bore of the body sleeve for reciprocal movement, the lower plate being adapted to rest against the lower shoulder of the body sleeve and radially movable lock members carried by the upper packing plate and adapted to interlock therewith when moved to a seated position therebeyond whereby alternate pressure exerted against either of the packing plates will cause the deformable packing ring to be compressed and radially expanded to seal the body sleeve.

8. A blowout preventer for use in oil well drilling operations comprising in combination with a well casing down through which a drill tube extends a body sleeve mounted upon the upper end of the casing, said sleeve being formed with a central bore in longitudinal alignment with the casing, said bore having a packing shoulder near its lower end and a counterbore at its mouth, a bonnet threaded onto the upper end of the body sleeve and having an inturned lip overhanging the counterbore of said sleeve, and a packing structure adapted to fit around the drill stem and within the bore of the body sleeve comprising a deformable packing ring, a pair of packing plates one disposed on each side of said ring, said rings and plates being severed radially along a side of the device and articulately assembled whereby their severed edges may be separated to permit the assembled structure to be placed in an embracing position around the drill stem and readily yieldable catch members carried by the upper packing plate and adapted to interlock with the overhanging lip occurring at the top of the body sleeve whereby to prevent removal of the packing structure after it has been placed in its operative position around the drill stem and within the body sleeve.

9. In a device of the character described, a casing head having a downwardly tapered seat therein through which the drill stem may pass, the combination of a pressure head shaped to fit said seat and close about said drill stem, said pressure head including upper and lower plates, a flexible packing member between said plates, and means on said upper plate slidable laterally in said pressure head to engage said casing head in a plurality of adjusted positions and hold said pressure head from upward movement.

10. A casing head having a passage there-through for a pipe, a downwardly tapered seat in said passage, a pressure head shaped to fit said seat and close about said pipe, latching dogs in said pressure head, means holding said dogs resiliently outward, and means on said casing head to be automatically engaged by said dogs, to prevent upward movement of said pressure head.

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