March 17, 1931. C. A. RASMUSSEN 1,796,303

BLOWOUT PREVENTER

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Fig. 2.

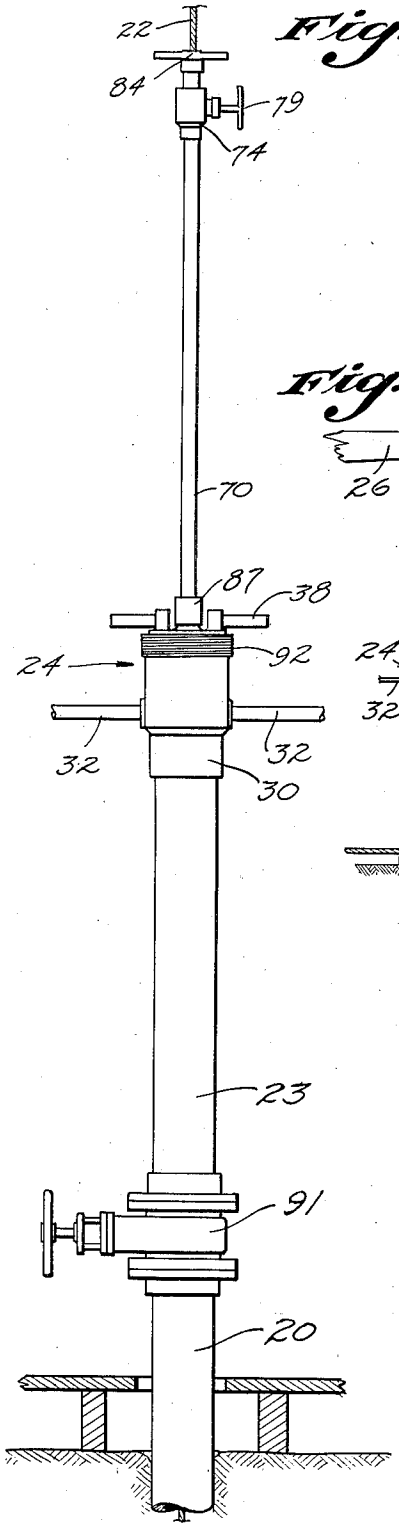



Fig. 1.

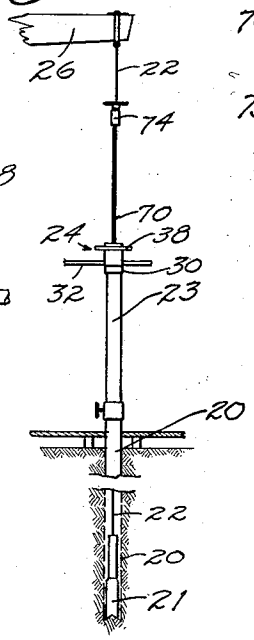



Fig. 3.

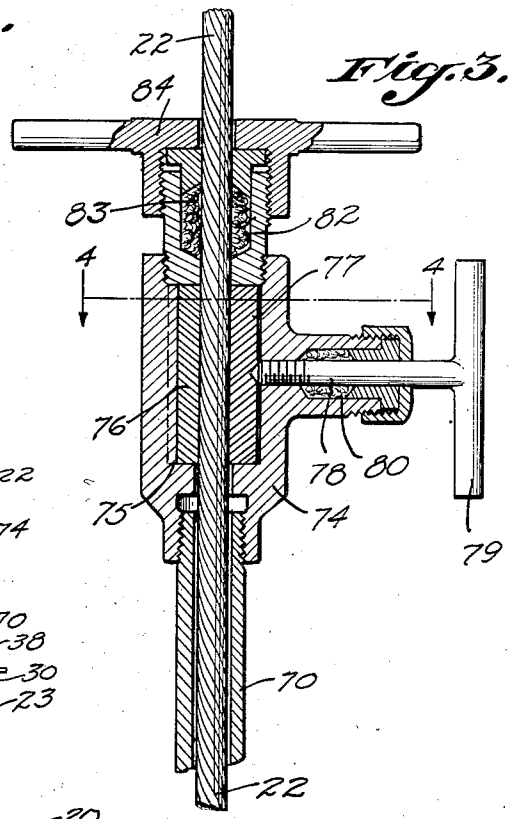
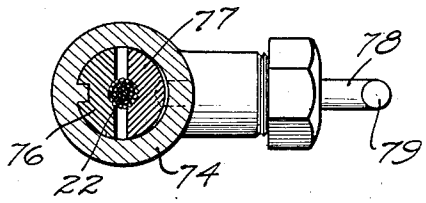



Fig. 4.




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BLOWOUT PREVENTER

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Fig. 5.

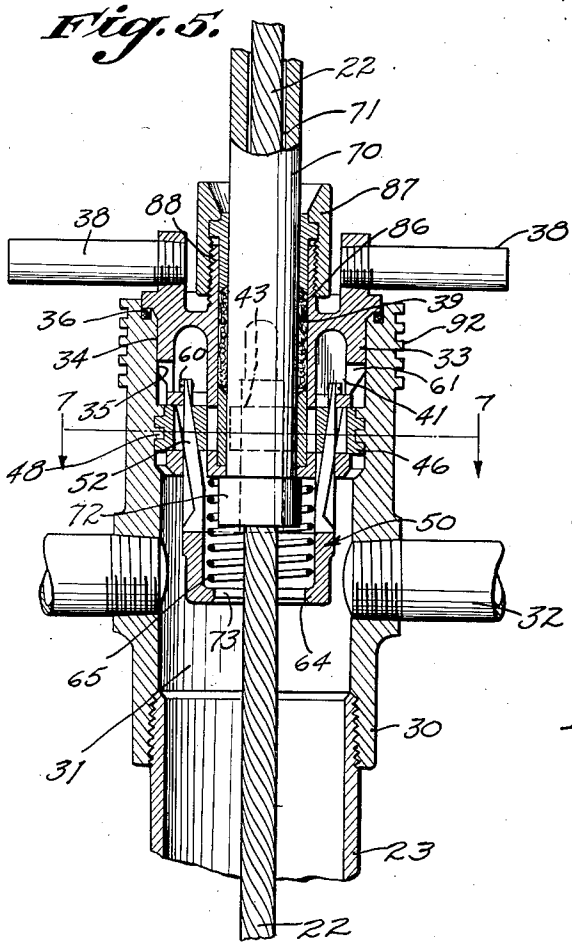



Fig. 9.

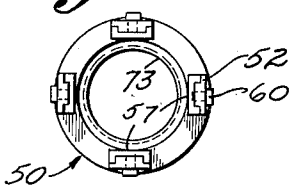



Fig. 10.

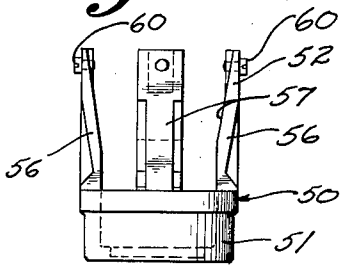



Fig. 11.

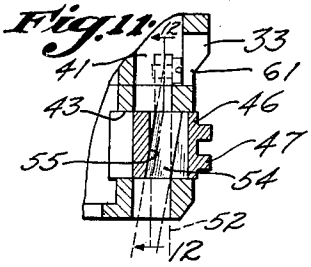



Fig. 7.

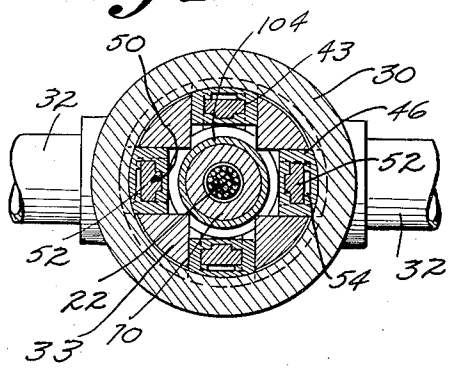
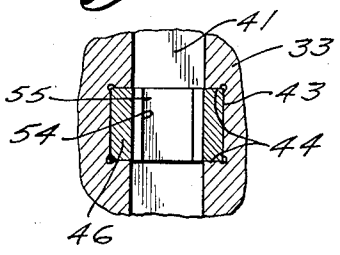



Fig. 12.




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Fig. 6.

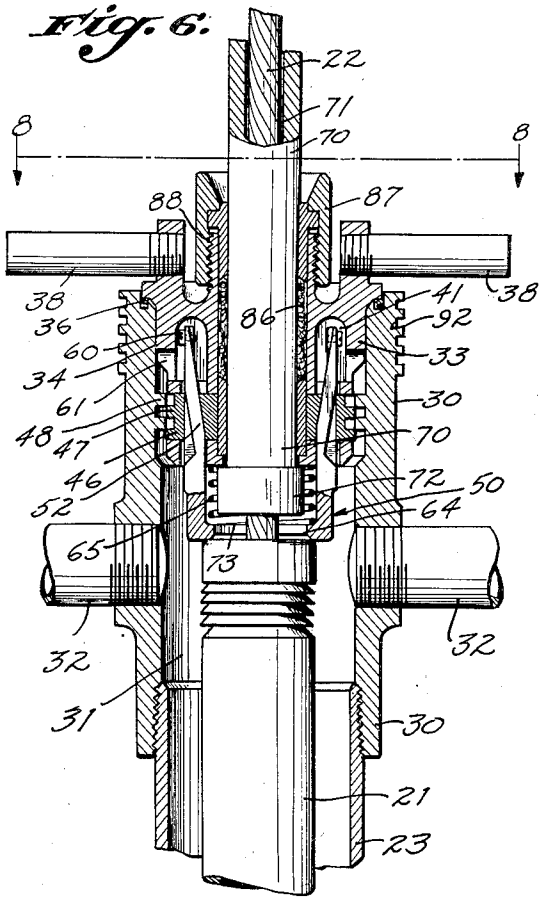



Fig. 13.

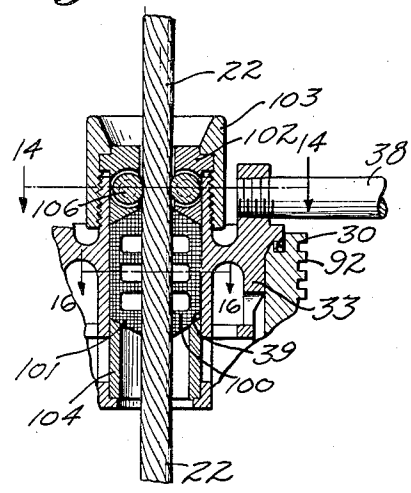



Fig. 14.

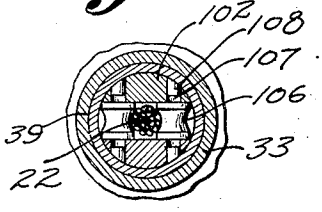



Fig. 15.

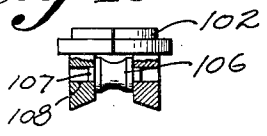



Fig. 8.

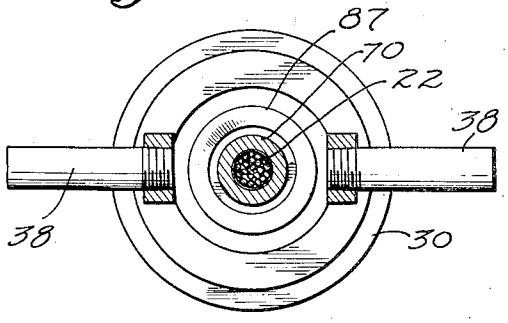
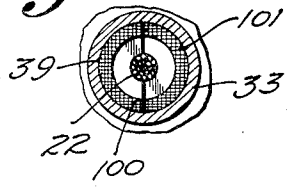



Fig. 16.




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Patented Mar. 17, 1931 1,796,303

# UNITED STATES PATENT OFFICE

CHESTER A. RASMUSSEN, OF LONG BEACH, CALIFORNIA, ASSIGNOR OF ONE-THIRD TO CHARLES R. BUTLER, OF LONG BEACH, CALIFORNIA, AND ONE-THIRD TO WILLIAM A. TROUT, OF LOS ANGELES, CALIFORNIA

## BLOW-OUT PREVENTER

Application filed May 23, 1927. Serial No. 193,486.

This invention relates to the standard system of drilling wells. In this system a percussion cutter or tool is secured to the lower end of a cable which extends through the well and is attached to a suitable reciprocating means situated on the floor of a derrick. The reciprocating means is generally a walking-beam. The tool is elevated by the reciprocating means and allowed to fall so as to percuss the bottom of the hole and to break the material away so as to produce the well. When the well has been drilled to the stratum immediately above the oil-bearing formation, it is practice to set a well-casing therein, this well-casing being cemented in place. The drilling of the well is recommenced, using a drill which is lowered through the well casing. If the subterranean pressures are sufficient, a well is liable to start to flow at any time after the oil-bearing formation has been penetrated and before the drilling-crew has the well prepared to put on production. Very disastrous results may occur if a flowing well gets out of control. The flow of the well consists primarily of gas, oil and sand. Probably the greatest danger of an uncontrolled well is the fire-hazard from which many damaging fires and explosions have issued, resulting in the loss of life and property. In the case of very high-pressure flows of oil, it is not uncommon to have the derrick or a portion thereof torn away, or to have the well-casing cut and partially destroyed by the abrasive action of the sand.

It is an object of this invention to provide a blowout preventer which may be installed at the upper end of the well-casing before the well has been brought in.

Very often when the stratum adjacent to the oil-bearing formation is reached, there is a gas-pressure in the well. If the gas is allowed to flow to the atmosphere, there is danger of a premature flow of oil and there is also a considerable fire-hazard.

It is an object of this invention to provide a blowout preventer which permits drilling even under considerable pressure.

A further object of the invention is to provide a blowout preventer in which the closure-member is automatically released from the body when the tools are ready to be removed from the well.

A further object of this invention is to provide a blowout preventer having a closure element which may be placed in sealing position, and then further operated so that it will very firmly engage the seat provided in the member which receives it.

Another object of the invention is to provide a blowout preventer having a body designed for attachment to a well casing, a closure member adapted to seat on and close an opening through the body, a string extended through the closure member, and a means for locking the closure member to the body, the means being operable by a rotational movement of the closure member to more tightly clamp the closure member to the body.

Other objects and advantages of the invention will be made evident hereinafter.

This invention may be best understood by referring to the accompanying drawings in which:

Fig. 1 is a small diagrammatic view illustrating the utility of the invention.

Fig. 2 is an elevational view of the invention.

Fig. 3 is an enlarged section taken through the upper end of the polish-rod of the invention.

Fig. 4 is a section taken on the line 4—4 of Fig. 3.

Fig. 5 is an enlarged fragmentary section of the blowout preventer, the head thereof being locked in place.

Fig. 6 is a view similar to Fig. 5 but showing the head released from the body.

Fig. 7 is a section taken on the line 7—7 of Fig. 5.

Fig. 8 is a section taken on the line 8—8 of Fig. 6

Fig. 9 is a plan view of an operating-means of the invention.

Fig. 10 is an elevational view of Fig. 9.

Fig. 11 is an enlarged fragmentary view of the locking-means of the invention.

Fig. 12 is a section taken on the line 12—12 of Fig. 11.

Fig. 13 is a fragmentary view illustrating an alternative form of the invention.

Fig. 14 is a section taken on the line 14—14 of Fig. 13.

Fig. 15 is an elevational view of a portion of the guide means of the invention.

Fig. 16 is a cross section taken on the line 16—16 of Fig. 13.

Referring first to Fig. 1, 20 represents a well which is being drilled by a reciprocable drill element 21 which is attached to the lower end of a line in the form of a flexible cable 22. Installed in the well is a casing 23 having the blowout preventer 24 of this invention installed at the upper end thereof. The line 22 extends upward through the casing 23 and the blowout preventer 24, and the upper end thereof is attached to a reciprocating-means which is preferably in the form of a walking-beam 26. Referring to Figs. 2 to 12 inclusive the preferred form of the invention will be described.

The blowout preventer, as shown in Figs. 5 and 6, has a body 30 which is screwed onto the upper end of the well-casing 23. The body 30 has a passage 31 formed therethrough, and connected to the passage 31 are gas take-off pipes 32. Adapted to extend into the upper part of the passage 31 is the head 33 of the invention. The head 33 has an upper cylindrical portion 34 which is adapted to fit snugly against the cylindrical face 35 at the upper end of the passage 31. A seating arrangement 36 is provided between the upper end of the body 30 and the head 33 for providing a tight seal. Extending outward from the upper part of the head 33 are the handles 38 whereby the head may be rotated.

The head 33 is provided with a central opening 39, and surrounding the central opening 39 are cavities 41. The cavities 41 extend vertically and are spaced equidistant around the opening 39. I prefer to provide four cavities 41 which are spaced nineteen degrees apart. In alignment with the cavities 41 are recesses 43. The recesses 43 connect to the outside of the head 33 and to the opening 39. As illustrated best in Fig. 12, the recesses 43 are wider than the cavities 41 so that upper and lower guide faces 44 are formed on opposite sides of the cavities. Resting in the recesses 43 are lock-means in the form of jaws 46. The jaws 46 are adapted to slide radially in the recesses 43. The jaws 46 have teeth 47 which are adapted to engage threads 48 formed in the passage 31 below the cylindrical face 35. In Fig. 5 the jaws are shown in engaged position, in which position the head is locked to the body, and in Fig. 6 the jaws are shown in released position, in which position the head is released from the body.

The jaws 46 are moved between engaged and released position by an operating-means in the form of a spider 50. The spider 50 has a lower collar portion 51 from which vertical arms 52 extend in an upward direction. There are four arms 52 spaced apart an angular distance of ninety degrees. The arms 52 extend upward into the cavities 41. As shown best in Figs. 11 and 12, the jaws 46 are provided with openings 54. The openings 54 have pairs of cam faces 55 formed on opposite sides thereof. The cam faces 55 diverge from the axis of the blowout preventer in an upward direction. The arms 52, as shown best in Fig. 10, have cam formations 56 which are adapted to rest between the pairs of cam faces 55. The cam formations 56 diverge from the axis of the blowout preventer in an upward direction. The spider 50 is prevented from falling from place by screws 60 which are installed in the upper ends of the arms 52 after they have been passed through the openings 54 of the jaws 46. The screws 60 are installed through apertures 61 of the body 33. When the spider is in its lowermost position as illustrated in Fig. 5, the cam formations hold the jaws in engaged position, and when the spider is in an uppermost position as illustrated in Fig. 6, the cam formations hold the jaws in released position. Compressed between the lower end of the head 33 and an annular inturned lip 64 which projects inward from the lower end of the collar 51 is a compression-spring 65. The compression-spring 65 yieldably retains the spider in the position shown in Fig. 5.

The line 22 extends centrally through the opening 39. Carried on the line 39 is a polish-rod 70 having an opening 71 through which the line 22 extends. The lower end of the polish-rod 70 rests below the head 33 and has an enlarged portion 72 which prevents it from being pulled through the opening 39. The enlarged portion 72 is small enough, however, to pass through the opening 73 defined by the inturned lip 64. The polish-rod 70 is secured to the line 22 at its upper end by the means shown in detail in Fig. 3. The upper end of the polish-rod 70 has a casting 74 secured thereto, this casting 74 having a cavity 75 in which jaws 76 and 77 are located. The jaw 77 is a movable jaw and is moved toward the line 22 by means of a screw 78 having a handle 79, this screw 78 passing through a stuffing-box 80. Screwed into the upper end of the cavity 75 is a stuffing-box body 82 which carries a stuffing-box 83, this stuffing-box 83 surrounding the line 22. The nut 84 of the stuffing-box 83 may be screwed downward in order to provide a tight seal so that there will be no leakage of gas or oil through the opening 71 and around the line 22. The opening 39 receives packing 86 which is compressed by means of a nut 87 screwed onto a projection 88 of the head 33. This arrangement permits the polish-rod to slide vertically with the line 22 without a leakage of gas therearound.

In operating the invention, the line 22 is first threaded through the polish-rod 70 which is in place in the head 33. The drill element 21 is attached to the lower end of the line 22 and is lowered into the upper end of the well-casing 23. The head 33 may at this time be placed in the upper end of the passage 31 of the body 30. The jaws at this time are retained in released position. This may be done by pulling the drill element upward into the position shown in Fig. 6 so that the lower part of the spider is engaged and moved upward to such a position that the jaws are moved radially inward into released position. After the head has been set in place, as shown in Fig. 6, the line is lowered so that the spider is disengaged and is moved downward by the action of the spring 65 into the position shown in Fig. 5, in which position the jaws are moved into locking position. If there is any difficulty in the meshing of the teeth 47 of the jaws with the threads 48, the head may be rotated by engaging the handles 38. After a proper engagement of the teeth and threads, the head is rotated so that it is screwed downward in order that the seating arrangement 36 may form a tight seal so that there will be no leakage at this point. The line 22 is then lowered until the drill element 21 reaches the bottom of the hole. At this time the lowering is arrested and the screw 78 is advanced inward so that the jaws 76 and 77 firmly grip the line 22 so that the line 22 and the polish-rod 70 are locked together. The nut 84 may at this time be screwed downward so that the packer will form a tight seal at this point. The apparatus is then ready for drilling operation which is effected by oscillating the walking-beam 26. The polish-rod, as will be understood, reciprocates with the line 22. There will be no leakage because of the fact that a tight seal is provided; first, between the body 30 and the head 33; second, between the polish-rod 70 and the head 33; and third, between the polish-rod 70 and the line 22. The polish-rod 70 is of sufficient length to allow the proper stroke of the drill element. The invention permits drilling under pressure and when the oil-bearing formation is penetrated and the well brought in, the well will be absolutely under control.

When the well has been brought in, the jaws 76 and 77 are released so that the line 22 and the drill element 21 may be pulled upward. The drill element is then moved against the spider which is raised and the jaws are moved into released position. The head 33 is then completely removed from the body 30. The gate-valve is then closed so that the upper end of the well is closed. The stem of the gate-valve is usually made quite long so that it may be operated at a safe distance from the well. A suitable flow-head may thereafter be installed on the body, external threads 92 being provided for this purpose. After the flow-head has been installed, the gate-valve 91 may be opened.

In Figs. 13 to 16 inclusive I illustrate an alternative form of the invention. In this form of the invention a rubber packer 100 is placed in the opening 39, this rubber packer 100 being formed of halves 101. Placed in the upper end of the opening 39 are sections 102 which are held in place by a nut 103. The lower ends of the sections 102 project into the opening 39 and engage the upper end of the packer 100. The packer 100 is compressed between the sections 102 and a sleeve spacer 104 located in the lower end of the opening 39. In this manner the packer is caused to form a seal between the head 33 and the line 22. For the purpose of preventing side wear on the packer 100, I provide centralizing or guide rollers 106 which have trunnions 107 carried in depressions 108 of the sections 102. This is clearly shown in Figs. 14 and 15. The rollers 106 permit the line shaft to move up and down relative to the head 33 but prevent side travel which would necessarily injure the packer 100 to such an extent that it would not be effective in providing a seal.

The form of the invention, just described, is useful during actual drilling and is also of utility during bailing. The bailing operation of the well consists in removing the water from the well after the oil-bearing formation has been penetrated. When the water level in the well is lowered, the point is reached where the gas-pressure overcomes the hydrostatic head of the water, and at this time the well tends to flow. It is highly desirable to retain a seal at the upper end of the well during this time so that there will be no possibility of the well getting out of control. The form of the invention shown in Figs. 13 to 16 inclusive provides a means for forming a seal around the line 22 and at the same time allowing almost any length of stroke. It will be seen that the line 22 may be pulled upward and lowered its entire length.

I claim as my invention:

1. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported by said body; means for rotating said head; screw-threads formed on said body; lock-means radially movable in said head for locking said head in said body, said lock-means having teeth adapted to engage with said screw-threads, said lock-means causing said head to tightly engage said body when said head is rotated; and actuating means for radially moving said lock-means from engagement with said screw-threads so that said head may be removed from said body.

2. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported

by said body; means for rotating said head; screw-threads formed on said body; lock-means radially movable in said head for locking said head to said body, said lock-means being operable upon a rotation of said head, to increase the tightness of engagement between said head and said body; and actuating means for radially releasing said lock-means so that said head may be removed from said body.

3. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported by said body; means for rotating said head; screw-threads formed on the interior of said body; lock-means for locking said head in said body, said lock-means having teeth adapted to engage with said screw-threads, said lock-means causing said head to tightly engage said body when said head is rotated; and actuating means for radially releasing said lock-means from said screw-threads so that said head may be removed from said body.

4. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported by said body; means for rotating said head: screw-threads formed on said body; lock-means radially movable in said head for locking said head in said body, said lock-means having teeth adapted to engage with said screw-threads, said lock-means causing said head to tightly engage said body when said head is rotated; and actuating means adapted to be engaged and operated by a device in said well for radially releasing said lock-means from said screw-threads so that said head may be removed from said body.

5. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported by said body; means for rotating said head; screw-threads formed on said body; lock-means radially movable in said head for locking said head in said body, said lock-means having teeth adapted to engage with said screw-threads, said lock-means causing said head to tightly engage said body when said head is rotated; actuating means for radially releasing said lock-means from said screw-threads so that said head may be removed from said body; a string extending through said head; and a device supported by said string, said device being adapted to operate said actuating means.

6. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported by said body; means for rotating said head; screw-threads formed on said body; a plurality of toothed jaws carried by said head, the teeth on said jaws being adapted to engage said screw threads, said jaws moving said head axially when said head is rotated, said jaws having cam faces; and an actuating means having cam formations adapted to move said jaws from and into engagement with said screw threads.

7. A blowout preventer for a well comprising: a body adapted to be placed at the top of the well; a removable head supported by said body; means for rotating said head; internal screw-threads formed on said body; a plurality of toothed jaws having external teeth carried by said head, the teeth on said jaws being adapted to engage said screw threads, said jaws moving said head axially when said head is rotated, said jaws having cam faces; and an actuating means having cam formations adapted to move said jaws from and into engagement with said screw threads.

8. A blowout preventer of the character described, including: a body adapted to be placed at the top of a well, said body having a valve seat near its upper end and internal threads below said valve seat; a removable head supported by said body and being adapted to engage said valve seat, said head having radial recesses substantially aligned with said internal threads; lock-means received in said recesses and being provided with external threads for engagement with said internal threads; and means for moving said lock-means between engaging and non-engaging relationship with said internal threads.

9. A blowout preventer of the character described, including: a body adapted to be placed at the top of a well, said body having a valve seat near its upper end and internal threads below said valve seat; a removable head supported by said body and being adapted to engage said valve seat, said head having radial recesses substantially aligned with said internal threads; lock-means received in said recesses and being provided with external threads for engagement with said internal threads; and a lock-means releasing device projecting below said head whereby to be engaged by a body moved upwardly in said well.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 10th day of May, 1927.

CHESTER A. RASMUSSEN.