June 26, 1956 H. ALLEN ET AL 2,752,119

BLOWOUT PREVENTER

Filed March 24, 1952 4 Sheets-Sheet 1

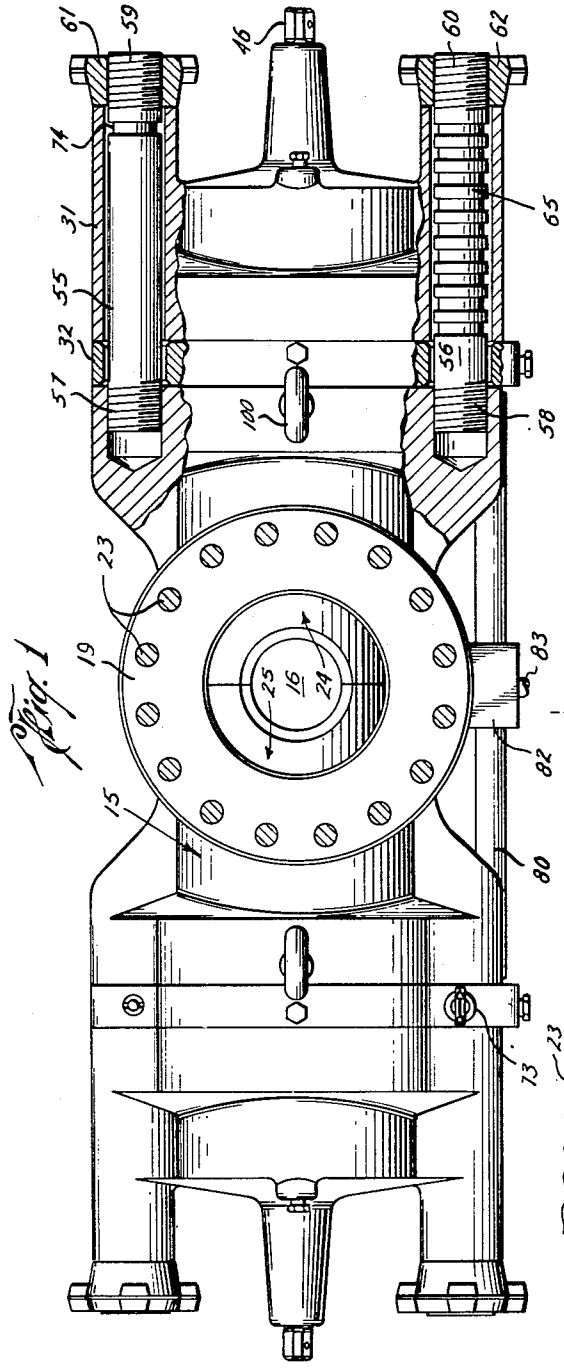

Fig. 1

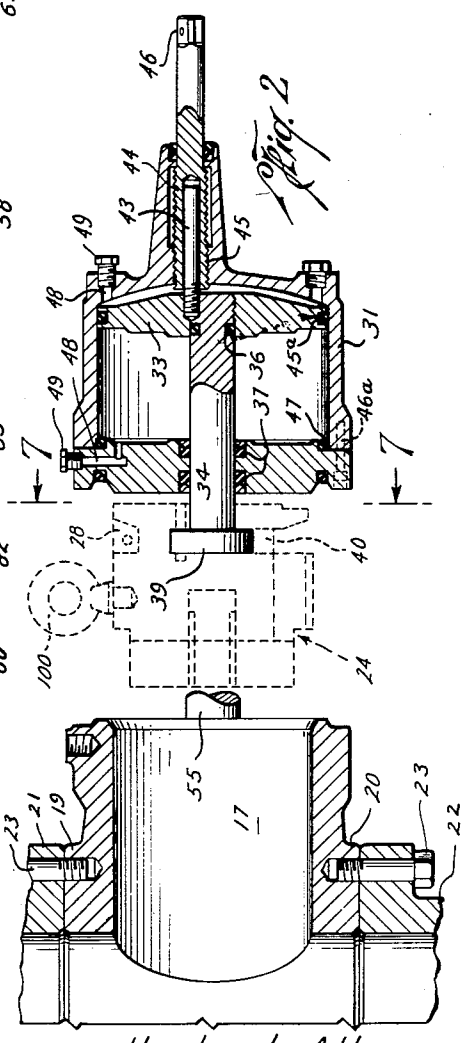

Fig. 2

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BLOWOUT PREVENTER

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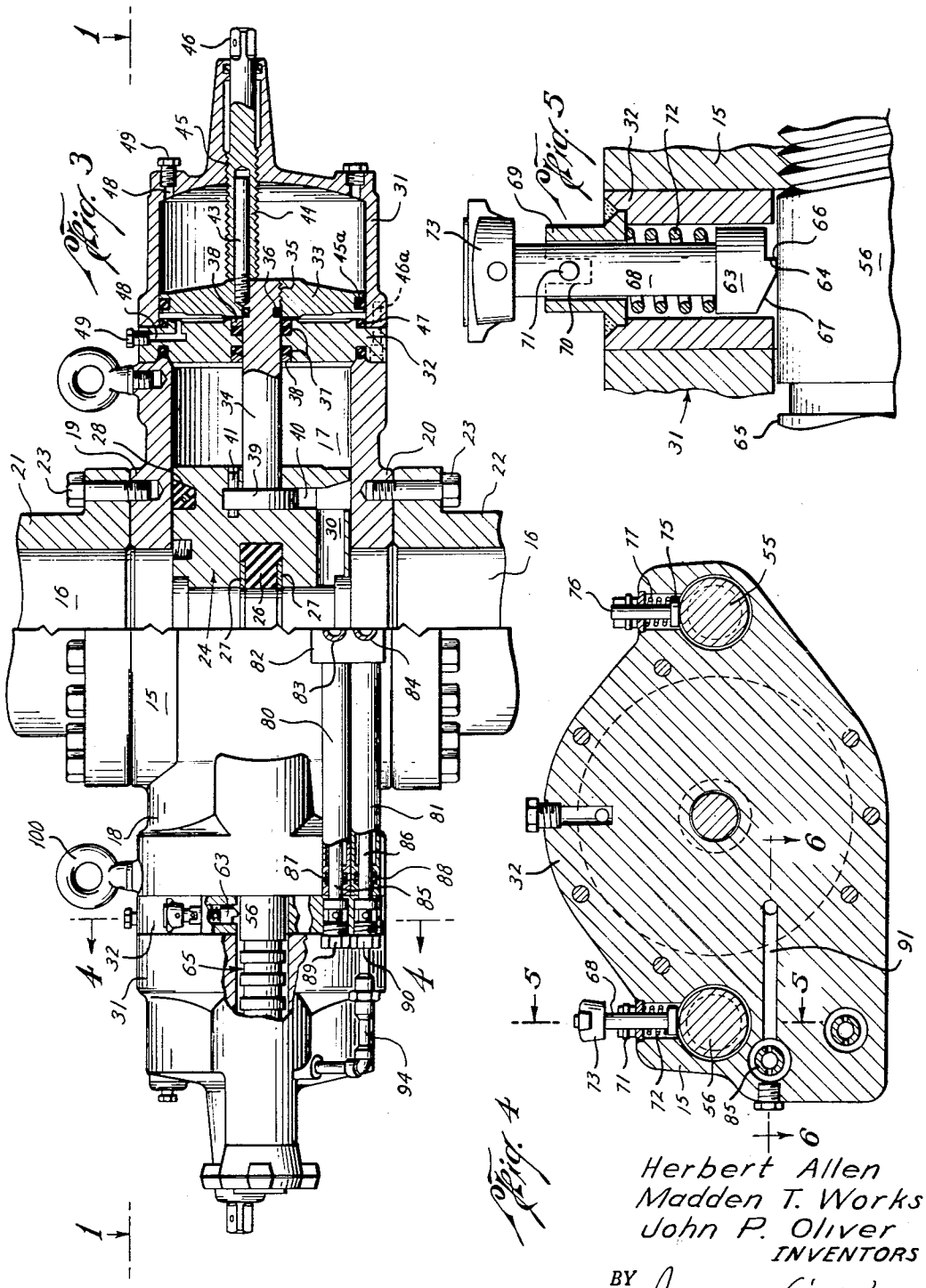

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Fig. 11

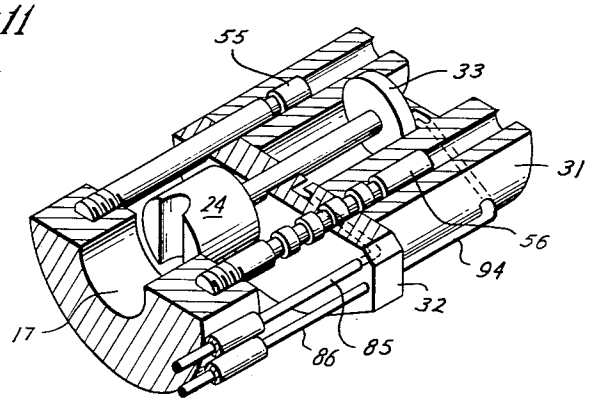


Fig. 6

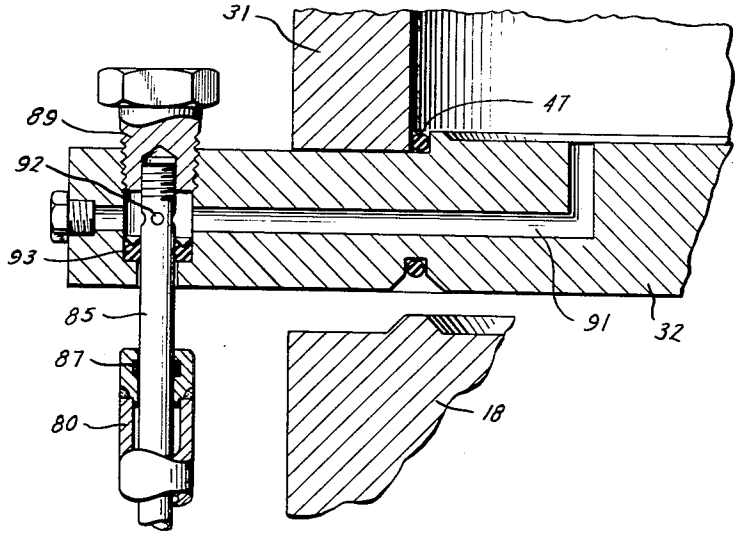
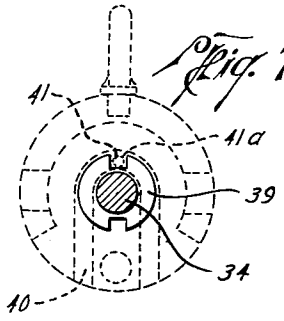


Fig. 7



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BLOWOUT PREVENTER

Filed March 24, 1952 4 Sheets-Sheet 4

Fig. 8

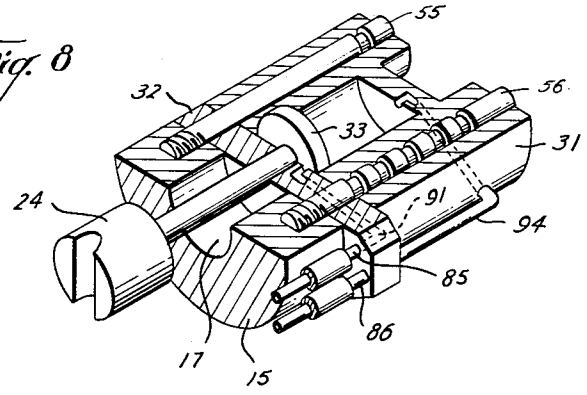
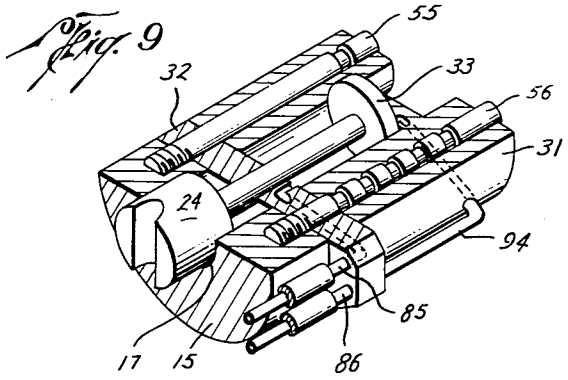


Fig. 9



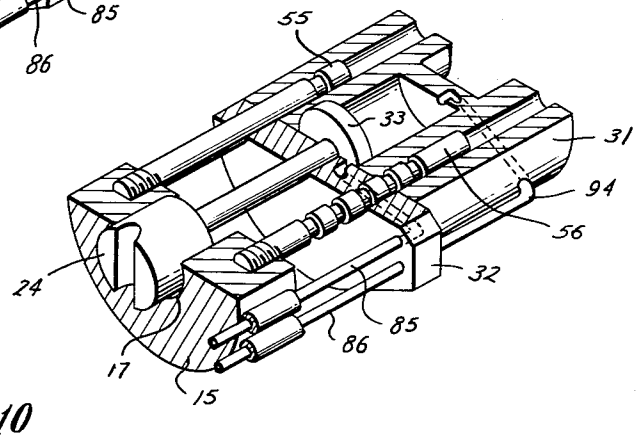


Fig. 10

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United States Patent Office 2,752,119 Patented June 26, 1956

2,752,119

BLOWOUT PREVENTER

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Application March 24, 1952, Serial No. 278,243

19 Claims. (Cl. 251—1)

This invention relates to an improved blowout preventer of the hydraulically actuated ram type.

A blowout preventer, as used in the oil industry, is a device mounted at the surface of a well and having ram members adapted to move into sealing engagement with a pipe extending through the preventer or with each other to prevent the uncontrolled escape of fluids from the well. The ram members are of two general types. One type has mutually engageable faces which can be sealingly engaged when there is no pipe in the well. The other type has concave faces adapted to sealingly engage a pipe to form a seal therewith. During the drilling of a well, it is often necessary to change from one of these types of ram members to the other. Also, since each pipe engaging type of ram member is designed for a particular size of pipe, changes of ram members may be necessitated by a change in the diameter of the pipe passing through the blowout preventer. The changing of the ram members must, for practical purposes, be quickly and easily accomplished.

A blowout preventer is quite often situated beneath the floor of a drilling rig and is usually operated in very close quarters so that the preventer must be as compact as possible. Such compactness is measured not only by the height of the preventer but also by its length and by the space required to change the ram members. One important factor in determining the compactness of a preventer is the well pressure against which the rams must operate. With the drilling of deeper and deeper wells, higher and higher pressures are encountered and it is necessary that the blowout preventer be constructed to close its rams against these higher pressures. This demands either that a larger hydraulic actuating piston be employed or that the pressure of the hydraulic operating fluid be increased. As a matter of practical importance, it is desired to increase the ratio of the well pressure to the pressure of the hydraulic fluid required to close the rams and not to increase the pressure of the hydraulic fluid in order that the preventer can be operated with low pressure sources of fluid commonly found on drilling rigs. On the other hand, increasing the piston area of the hydraulically actuated preventers heretofore known greatly increases their bulk.

An object of this invention is to provide a blowout preventer which is very compact and relatively lightweight, and yet which can have a very high well pressure to closing pressure ratio.

Another object of this invention is to provide a blowout preventer which can have a very high well to closing pressure ratio by increasing the effective area of the hydraulic pistons operating the rams, the preventer nevertheless being very compact.

Another object of this invention is to provide a blowout preventer wherein a fluid actuated ram having a path of normal operation within a preventer body can be moved out of and into such path by a hydraulic piston having a stroke just long enough to operate the ram along said normal path, the movement of the ram being accomplished without lengthening the stroke of said piston.

Another object of this invention is to provide a blowout preventer having a piston with a stroke sufficient for normal operation of the ram connected thereto, wherein the withdrawal of the ram from the preventer body, such as for changing it, is accomplished by moving the cylinder in which the piston operates to a position such that the piston can withdraw the ram.

Another object of this invention is to provide a blowout preventer having an in-line arrangement of a ram and a fluid actuated piston for operating the ram, the ram being removable from and insertable into the preventer body by said piston without lengthening the stroke of said piston from that required for normal operation of the ram within the preventer body.

Another object of this invention is to provide a blowout preventer having a ram operated by a fluid actuated piston with a stroke which is merely long enough to normally operate the ram and yet in which the piston can be employed to move the ram into and out of the preventer body by moving the path of travel of the piston in a direction in which it is desired to move the ram, the moving of such path of travel being effected by fluid pressure applied to the piston.

Another object of this invention is to provide in a blowout preventer having a fluid actuated piston for operating a ram and a cylinder for the piston which is movable with respect to the preventer body, a means for supplying fluid to the piston which permits the cylinder to move while said fluid is being supplied thereto.

Another object of this invention is to provide in such a blowout preventer a means for preventing rotation of a ram with respect to the preventer body, the ram being connected to a piston disposed coaxially therewith.

Other objects, advantages and features of this invention will be apparent to one skilled in the art upon the consideration of the written specification, the appended claims, and the attached drawings wherein:

Fig. 1 is a plan view, partially in section, of a preferred embodiment of the blowout preventer of this invention;

Fig. 2 illustrates a potrion of the apparatus positioned for changing a ram;

Fig. 3 is an elevational view, partially in cross-section, of the apparatus illustrated in Fig. 1;

Fig. 4 is a cross-sectional elevation taken on line 4—4 of Fig. 3;

Fig. 5 is a view taken on the line 5—5 of Fig. 4;

Fig. 6 is a view taken on line 6—6 of Fig. 4;

Fig. 7 is a view taken on line 7—7 of Fig. 2 and further illustrates the connection between the ram and the piston rod; and

Figs. 8, 9, 10 and 11 are schematic views illustrating the operation of this apparatus during a ram changing cycle.

Like characters of reference are used throughout the several views to designate like parts.

Referring now to the drawings, there is illustrated a blowout preventer body 15 having a well passage 16 therethrough and a pair of ram chambers extending laterally from the well passage, one of such chambers being shown at 17 and the other being disposed within preventer body portion 18. The preventer body has oppositely disposed bosses 19 and 20 surrounding well passage 16 and adapted to be connected to pipes, conduits, or other pieces of equipment 21 and 22 by a plurality of studs 23.

Disposed within the ram chambers are ram members 24 and 25 which are adapted to be reciprocated within the chambers and to move at least a portion of their faces into abutment with each other within well passage 16. The rams are provided with a packing 26 (see Fig. 3)

disposed in a semicircular manner across cutaway portions of their endwise faces and adapted to sealingly engage a pipe extending through the well passage. Packing **26** can be backed up with metal members **27** if desired. Packing **26** extends horizontally across the entire face of the ram members including the abutting face portions and thence back along the sides of the ram members approximately midway of their height to finally pass over the top of the ram member as at **28**. In this manner, packing **26** not only forms a seal with a pipe extending through the well passage and between the abutting faces of the ram members but also between the sides of the ram members and the walls of chamber **17** as well as between the upper portion of the ram member and the walls of chamber **17**. The packing and the ram members preferably employed in the apparatus of this invention are more fully disclosed in Patent No. 2,387,106 issued October 16, 1945 and in Patent No. 2,527,068 dated October 24, 1950.

Each ram member has a passage **30** therethrough along its lower portion providing communication between that portion of well passage **16** below seal **26** and chamber **17** at the rear of the ram member. This communication permits a substantial balancing of the pressure of well fluids on each side of the ram members until the latter effect an initial seal with each other or with a pipe after which the well pressure serves to urge the ram members into an even tighter sealing contact.

Cylinders **31**, including closure flanges **32**, are mounted so as to be movable with respect to chambers **17** and **18** in a direction parallel to that of ram members **24** and **25**, respectively, as will be more fully explained hereinafter. Only one of cylinders **31** has been sectioned in the drawings and it will be understood that the other cylinder **31** is constructed in a like manner with corresponding parts. Hence, the following detailed description applies to both cylinders.

Disposed within cylinder **31** is a piston **33** which is reciprocal back and forth within the cylinder and which has a connection with ram member **24**. This connection comprises a connecting rod **34** non-rotatively connected to piston **33**, as by threads **35** which are sealed against fluid flow by seal ring **36**. Piston rod **34** extends through flange **32** and has a sliding seal therewith provided by seal members **37** which are expandable by fluid pressure applied thereto and retained in place by retainer rings **38**. It will be noted that these sealing means are oppositely facing so as to seal rod **34** against flow caused by pressure applied from either direction. The other end of rod **34** is connected to a ram member by means of flange portion **39** of the rod fitting into a corresponding groove **40** of the ram. Rotation between the ram and the rod is prevented by pin **41** carried by the ram and fitting into slot **41***a* in flange **39**. It will be noted that with this construction, the ram member can be removed from the connecting rod by simply lifting it upward and a new ram member can be placed on the rod by simply mating groove **40** down with flange **39** and making sure that pin **41** engages in slot **41***a*. Also there can be no rotation between the ram member and the piston rod.

With the foregoing construction, it will be clear that upon the application of fluid pressure to one of the endwise faces of piston **33**, the piston, piston rod and ram will be moved together in a direction depending upon which side of the piston has pressure applied thereto. In this manner ram **24** can be moved into and out of well passage **16** by reciprocation within chamber **17**.

Means are provided for preventing rotation of the ram with respect to its chamber. This means includes not only the non-rotative connection between the ram and piston rod in the form of pin **41** and slot **41***a* but also includes pin **43** disposed parallel to and eccentrically of the axis of piston **33** and having a sliding fit with a portion of cylinder **31**. It will be noted that pin **43** is tapped into both piston **33** and rod **34** thereby providing a key

to prevent rod **34** from turning with respect to piston **33**. Therefore, since piston **33** is prevented from rotating with respect to cylinder **31** by pin **43** and since rod **34** has a non-rotatable connection with both piston **33** and ram **24**, the latter is prevented from rotating in chamber **17**.

The sliding fit of pin **43** with cylinder **31** can be provided by a stud **44** which has a threaded connection **45** with cylinder **31** and bears a wrench hold **46** at its outer end permitting it to be screwed into and outwardly from cylinder **31**.

The effective pressure area of piston **33** can be made quite large without substantially decreasing the overall compactness of the blowout preventer. Preferably, its area is such that the ratio of (*a*) the well fluid pressure acting across the area of rod **34** to open the rams to (*b*) the closing pressure applied to the piston and acting to close the rams, is within the range of 25:1 to 30:1 thereby providing a very high ratio blowout preventer.

A piston ring such as O-ring **45***a* can be provided around the periphery of piston **33** to prevent leakage thereby.

As stated above, cylinder **31** includes a closure flange **32**. This flange can be bolted to the remaining portion of the cylinder by means of studs **46***a* and has a seal ring **47** sealing the joint between the flange and the remainder of the cylinder. Passages **48** can be tapped through the upper part of the flange to permit bleeding of gases from the cylinder when the same is being filled with hydraulic fluid. Plugs **49** normally close these passages.

Means are provided for supporting cylinder **31**, preferably coaxially with chamber **17**, and to permit its movement with respect to body **15** in a direction parallel to the movement of ram member **24**. This means can comprise a pair of shafts **55** and **56** screwed into the body **15** as at **57** and **58**, respectively, and extending to have a sliding fit with cylinder **31**. The outer ends of the shafts can be threaded as at **59** and **60** to receive lug nuts **61** and **62**. Normally these lug nuts are tightened against cylinder **31** to maintain it snugly against body **15** in the position shown in Fig. 1. However, the nuts are removable to permit the cylinder to slide away from the body **15** along shafts **55** and **56**.

Means are provided, including mutually engageable parts, to permit the cylinder to move in one direction with respect to body **15** and to limit its movement in an opposite direction. As shown in the drawings, this means comprises a pawl **63** having a tooth **64** adapted to engage one of the plurality of recesses which comprise ratchet **65**. This ratchet can be formed integrally with or it can be carried by shaft **56**. It will be noted that pawl tooth **64** has a ratchet engaging face **66** and an oppositely disposed sloping face **67** which will cause the ratchet tooth to retract from a ratchet recess upon relative movement therebetween in the direction of the sloping surface. Pawl **63** is carried by a shaft **68** received in a part **69** of flange **32**. A laterally extending pin **71** on shaft **68** is adapted to engage slot **70** and prevent unintentional turning of pawl **63**. Spring **72** is provided between part **69** and pawl **63** to urge the latter toward the ratchet. A handle **73** can be provided for reversing pawl **63** for a purpose to be made more fully apparent hereafter. Shaft **55** is provided with a single ratchet recess **74** near its outer end. Adapted to engage this recess and to prevent further outward movement of cylinder **31** is a pawl **75** carried on shaft **76** and pressed towards shaft **55** by spring **77**. It will be understood that both flanges **32** have pawls **63** and **75** and that both have shafts **55** and **56** arranged as above described.

From the foregoing, it will be apparent that when pawl **63** is turned so that sloping surface **67** thereof faces outwardly along shaft **56**, cylinder **31** and flange **32** can move away from body **15** until pawl **75** engages ratchet **74**. During such movement, pawl **63** will ride over the teeth of ratchet **65** and thus will permit movement of the

cylinder in one direction with respect to body 15. However, if a force should be exerted to move cylinder 31 towards body 15, pawl 63 will engage a tooth of ratchet 65 thereby limiting movement of cylinder 31 towards the body member to be not more than the distance between adjacent ratchet teeth. On the other hand, when handle 63 is pulled upwardly sufficiently that pin 71 can clear slot 70, pawl 63 can be rotated 180° so that its sloping surface 67 faces toward body 15. When in this position, the ratchet and pawl permit movement of cylinder 31 towards body 15 but limit movement away from the body. Of course, lugs 61 and 62 will be removed before cylinder 31 is moved with respect to body 15.

Means are provided for selectively introducing fluid to opposite sides of each of the ram actuating pistons so that they can be reciprocated back and forth within their cylinders. Such means include a pair of parallel conduits 80 and 81 carried by body 15 by means of a clip 82 and having, respectively, fluid connections 83 and 84. A second pair of parallel conduits 85 and 86 are provided to telescope with conduits 80 and 81 with a sliding seal therebetween provided by seal members 87 and 88. It will be noted conduits 85 and 86 have a straight portion extending between conduits 80 and 81 and flange 32. With such an arrangement, and since the ends of conduits 85 and 86 are directly connected to flange 32 by means of plugs 89 and 90, it will be apparent that the endwise thrust caused by fluid pressure within conduits 80 and 81 acting over the area of conduits 85 and 86 will be applied directly to flange 32.

Conduit 85 is placed in communication with the inner side of piston 33 by means of a passage 91 through flange 32 and by ports 92. A packing 93 of the pressure seal type is disposed to effect a seal between flange 32 and conduit 85 upon the application of pressure through the conduit. Pressure to the opposite or outer side of piston 33 is applied through conduit 94 which opens into the outer portion of cylinder 31 through a tap in the wall thereof and which is in communication with conduit 86 through plug 90. Except for the arrangement of conduit 94 by which it communicates through plug 90, it will be understood that the construction of plug 90 and its engagement with conduit 86 is the same as illustrated for plug 89 and conduit 85 in Fig. 6. A similar seal is provided between flange 32 and conduit 86 as is illustrated in Fig. 6.

It will be understood that each of cylinders 31 and pistons 33 are provided with conduits 85 and 86 as above described although, for the sake of simplicity, only the left-hand cylinder of Fig. 1 is illustrated in detail with respect to the fluid introducing means. However, conduits 80 and 81 can each be a single conduit extending to either side of clip 82 towards each of the cylinders so that the endwise thrust on these conduits occasioned by operation of the respective pistons 33 will be counterbalanced.

As an important feature of this invention, the ram members 24 and 25 have a sufficiently tight fit within chambers 17 and 18 that the force required for the movement of each of them is greater than the force required for movement of the respective cylinder connected thereto along shafts 55 and 56. Such tight fit can be provided by using suitably sized packing 26 on the ram members and by making the latter fit very snugly within chamber 17. With this construction, it will be possible, after lug nuts 61 and 62 have been removed, to apply pressure to the outside face of piston 33, after the latter has been positioned toward the outer end of cylinder 31, and cause the cylinder to move away from body 15. Alternatively, the application of fluid pressure to the inside face of piston 33 will cause cylinder 31 to move toward preventer body 15. By such movements and with the aid of the ratchet arrangement, ram 24 can be moved from the preventer body to permit its change by merely removing lug nuts 61 and 62 and then employing the proper sequence of fluid pressures on piston 33. This operation will become more apparent upon a description thereof with particular reference to schematic diagrams in Figs. 8 through 11.

Referring to Fig. 8, ram 24 is shown in the position it occupies when extended into well passage 16. Fluid pressure is applied through conduit 85 and passage 91 to the inner side of piston 33. Such pressure causes piston 33 to move ram 24 to its rearmost position in chamber 17. Lug nuts 61 and 62 are then removed, or removed prior to this ram movement, and pawl 63 turned so that its sloping surface 67 faces outwardly towards the end of shaft 56. The apparatus will then be in the position shown in Fig. 9. Upon the application of fluid pressure through conduits 86 and 94 to the outer face of piston 33, cylinder 31 including flange 32 will move outwardly of body 15 while ram 24 and piston 33 will remain in a substantially fixed position with respect to body 15 or will move inwardly a lesser distance than the cylinder moves outwardly. The reason for this relatively greater movement of cylinder 31 is that, as explained above, ram 24 has a sufficiently tight fit with the walls of chamber 17 that the force required to move it is greater than that required to move cylinder 31 outwardly along shafts 55 and 56.

After cylinder 31 has moved to the fullest extent permitted by the travel of piston 33, the apparatus will be in the Fig. 10 position. Since ram 24 is not sufficiently removed from body 15 to permit its changing, pressure to piston 33 is reversed and applied to its inner face. This causes the piston to move with respect to the cylinder and complete the withdrawal of the ram. During this additional withdrawal of the ram, the cylinder is prevented from moving toward the preventer body by the action of pawl 63 engaging one of the teeth of ratchet 65.

The ram member can be readily lifted from its position on rod 34 by merely unscrewing eye bolt 100 from body 15 and screwing it into the ram member as shown in Fig. 2 and then using this eye bolt as a lifting handle. After a new ram has been placed on the end of rod 34, handle 73 of pawl 63 is lifted to clear pin 71 of slot 70 and pawl 63 is then rotated 180°. In such position, its sloping face 67 faces inwardly toward body 15 so that cylinder 31 can move in that direction but is prevented from moving away from the body. The apparatus will then be in the Fig. 11 position and fluid can be applied to the outside face of piston 33 to move the ram into engagement with chamber 17. Upon reversal of fluid pressure to apply it to the inner face of piston 33, cylinder 31 will be forced inwardly toward body 15. Thus it will move from the Fig. 10 to the Fig. 9 position. Then, upon replacement of stud nuts 61 and 62, the ram can be operated in the normal manner.

It may be necessary, in some instances, to move cylinder 31 and ram member 24 several times before the Fig. 11 position can be reached. Thus there may be some slippage between ram member 24 and body 15 while piston 31 is being moved outwardly which slippage will prevent the cylinder from being moved a distance equal to the stroke of the piston. Also the stroke of the piston may be only a fraction of that required to move the ram from its normal path of operation within body 15 to the Fig. 11 position. In such instances, it is merely necessary to continue alternating the application of fluid pressure to opposite sides of the piston to completely withdraw the ram member from the body. In such operation, the cylinder is moved alternately with the ram member in a stepwise fashion. The same stepwise movement may be employed in moving the cylinder into abutment with the preventer body.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages

which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A blowout preventer which comprises, in combination, a body having a passage therethrough and chambers extending laterally from said passage, rams reciprocally received in said chambers, closed power cylinders mounted for movement toward and away from said body chambers in a direction parallel to that of said rams, a piston reciprocally mounted in each cylinder and having a connection with a ram to reciprocate the latter, means for selectively introducing fluid to opposite sides of said pistons, and means limiting movement of the cylinders in one direction with respect to said body including mutually engageable parts carried by the cylinders and the body, each of said rams having a sufficiently tight fit within its chamber that the force required for its movement is greater than that required to move the corresponding cylinder with respect to said body in a direction opposite to said one direction.

2. The apparatus of claim 1 wherein the mounting for each cylinder includes a shaft extending between said body and said cylinder for supporting said cylinder during movement thereof toward and away from said body, and wherein said mutually engageable parts comprise a ratchet and pawl.

3. The apparatus of claim 1 in combination with means for preventing rotation of said rams with respect to said body.

4. The apparatus of claim 3 wherein said means for preventing rotation comprises a pin providing a sliding connection between each of the pistons and its respective cylinder, said pin being disposed eccentrically of the axis of said piston, and a non-rotatable connection between each piston and its respective ram.

5. An apparatus which comprises, in combination, a body having a passage therethrough and a chamber extending laterally of said passage, a ram reciprocally received in said chamber, a closed power cylinder for movement in a direction parallel to that of said ram and away from said body a sufficient distance to withdraw said ram from said chamber, a piston in said cylinder with a connection to said ram for reciprocation of the latter, and means for selectively introducing fluid to one side of said piston comprising a first conduit, a second conduit telescoping with said first conduit and having a sliding seal therewith, said second conduit being in communication with one side of said piston and movable with respect to said first conduit in a direction parallel to that of said cylinder.

6. The apparatus of claim 5 in combination with means limiting movement of said cylinder in one direction with respect to said chamber including mutually engageable parts one of which is carried by said cylinder and another being fixed in location with respect to said body.

7. The apparatus of claim 5 wherein said second conduit has a straight portion extending from said cylinder to said first conduit, the second conduit being fastened to said cylinder at a point on said straight portion whereby endwise thrust of said second conduit is transmitted directly to said cylinder.

8. An apparatus which comprises, in combination, a body having a passage therethrough and a chamber extending laterally of said passage, a ram reciprocally received in said chamber, a closed power cylinder mounted for movement in a direction parallel to that of said ram, a piston in said cylinder with a connection to said ram for reciprocation of the latter, and means for selectively introducing fluid to opposite sides of said piston comprising a pair of parallel first conduits, a pair of parallel second conduits telescoping respectively with said first conduits and having a sliding seal therewith, each of said conduits being disposed parallel to the direction of movement of said cylinder and said second conduits being fastened to said cylinder for movement therewith, one of the second conduits being in communication with one side of said piston and the other with the opposite side of said piston.

9. The apparatus of claim 8 in combination with a shaft mounting said cylinder for movement toward and away from said ram chamber and in alignment with the end of said chamber, and a pawl and ratchet connection between said cylinder and body limiting movement of said cylinder in one direction, said ram having a sufficiently tight fit within its chamber that the force required for its movement in the chamber is greater than that required for movement of said cylinder with respect to said body.

10. The apparatus of claim 9 in combination with means for preventing rotation of said ram with respect to said body comprising a connecting rod between the piston and ram having a non-rotatable connection with each, and a pin providing a sliding connection between the piston and cylinder, said pin being eccentrically disposed of the axis of said piston.

11. A blowout preventer which comprises, in combination, a body having a passage therethrough and lateral chambers extending from said passage, a reciprocal ram in each of said chambers, closed power cylinders coaxial with said chambers, shafts carried by said body and mounting said cylinders for axial movement thereof toward and away from said chambers, a piston in each cylinder, connecting rods between each piston and a ram, means for selectively introducing fluid to opposite sides of said pistons, and a pawl and ratchet connection between said body and said cylinders limiting movement of the latter in one direction but providing for movement in an opposite direction, said rams each having a sufficiently tight fit with the respective chambers that the force required to move a ram is greater than that required to move a respective cylinder in said opposite direction.

12. The apparatus of claim 11 wherein said ratchets are each mounted on a shaft, each shaft having a sliding fit with a cylinder and said pawl is carried by said cylinder.

13. The apparatus of claim 11 wherein said means for introducing fluid comprises a pair of first conduits carried by said body, a pair of second conduits carried by each of said cylinders parallel to the axis of said cylinders and telescoping with said first conduits with a sliding seal therebetween, said second conduits respectively being in communication with said opposite sides of said piston.

14. An apparatus which comprises, in combination, a body having a passage therethrough and a lateral chamber extending from said passage, a ram reciprocally mounted in said chamber, a closed power cylinder, a shaft carried by said body and mounting said cylinder for movement thereof toward and away from said chamber, a piston reciprocally disposed in said cylinder, means connecting said piston and ram for movement together, means for selectively introducing power fluid into said cylinder on opposite sides of said piston, and a pawl and ratchet connection between said body and said cylinder limiting movement of the latter in one direction, said ram having a sufficiently tight fit with said chamber that the force required to move the ram is greater than that required to move said cylinder.

15. In an apparatus having a body and a ram disposed

therein for reciprocal movement into a passage through said body, the combination therewith of a closed power cylinder disposed outwardly of both the body and ram, means mounting and supporting said cylinder for movement away from said body a sufficient distance to permit said ram to be withdrawn from said body and then toward the body to reinsert said ram in said body, said movement being in a direction parallel to that of said ram, a piston reciprocally mounted in said cylinder and having a connection with the ram for reciprocating the latter, means for selectively introducing fluid into said cylinder on opposite sides of said piston, and means limiting movement of the cylinder in one direction on said mounting and supporting means so that upon alternately introducing fluid on opposite sides of said piston and upon limiting movement of the piston with respect to said body in said one direction, the cylinder is moved stepwise in an opposite direction, said means limiting movement including mutually engageable parts, one of which is carried by said cylinder and another fixed in location with respect to said body.

16. The apparatus of claim 15 wherein said another part is carried by said body.

17. The apparatus of claim 15 in combination with means for preventing rotation of said ram with respect to said body.

18. In a ram-type blowout preventer having a body with rams reciprocally mounted therein for movement into a passage through said body, the combination therewith of closed power cylinders disposed outwardly of both the body and the respective rams, means mounting and supporting said cylinders for movement away from said body a sufficient distance to permit said rams to be withdrawn from said body and then toward the body to reinsert said rams in said body, said movement being in a direction parallel to that of said rams, a piston reciprocally mounted in each cylinder and having a connection to a respective ram for reciprocation of the latter, means for selectively introducing fluid to opposite sides of said pistons, and means for limiting movement of said cylinders on said mounting and supporting means in one direction with respect to said body while permitting movement in another direction so that upon alternately introducing fluid on opposite sides of said pistons and upon limiting movement of the pistons with respect to said body in said one direction, the cylinders are moved stepwise in said another direction, said limiting means comprising pawl and ratchet parts carried by the body and cylinder.

19. The apparatus of claim 18 wherein the mounting and supporting means for said cylinders comprise shafts extending from said body and supporting said cylinders for movement thereof in a direction toward and away from said body, said ratchet parts being carried by one of said shafts.

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