Sept. 3, 1963 H. ALLEN 3,102,709

RAM TYPE VALVE APPARATUS

Filed Aug. 26, 1959 3 Sheets-Sheet 1

Fig. 1

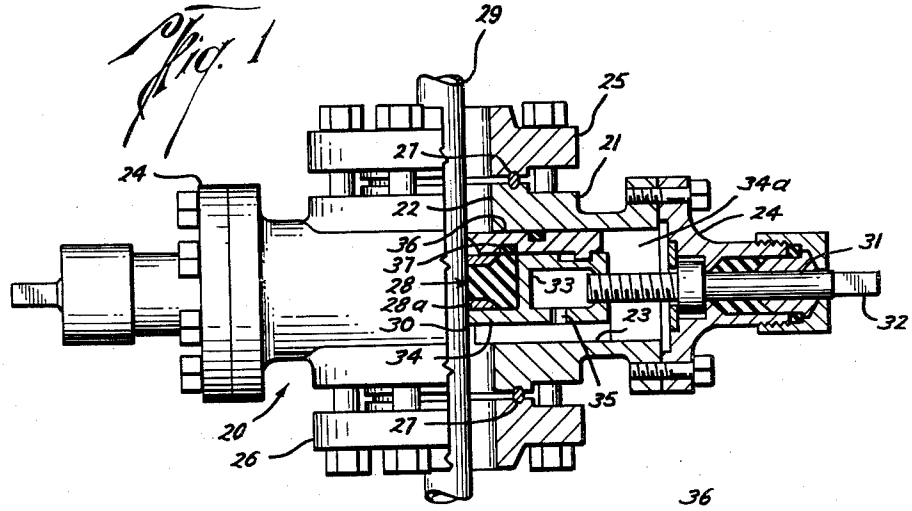


Fig. 2

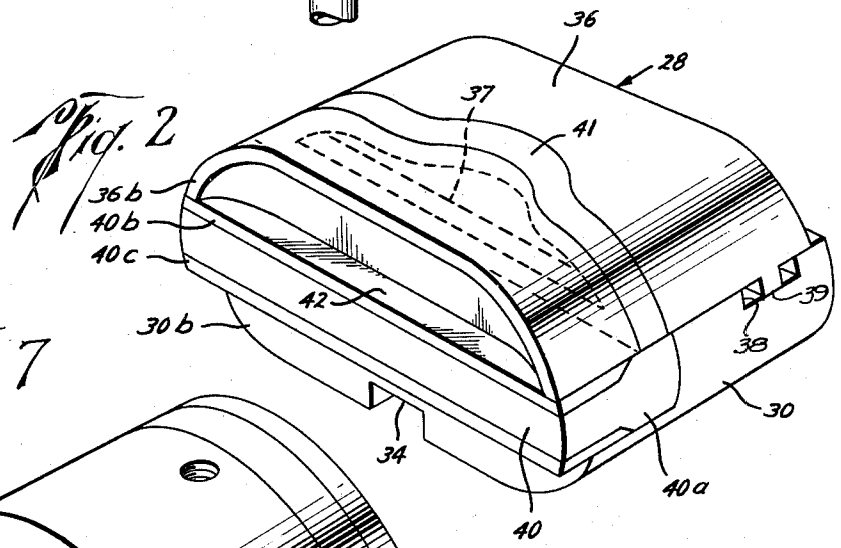
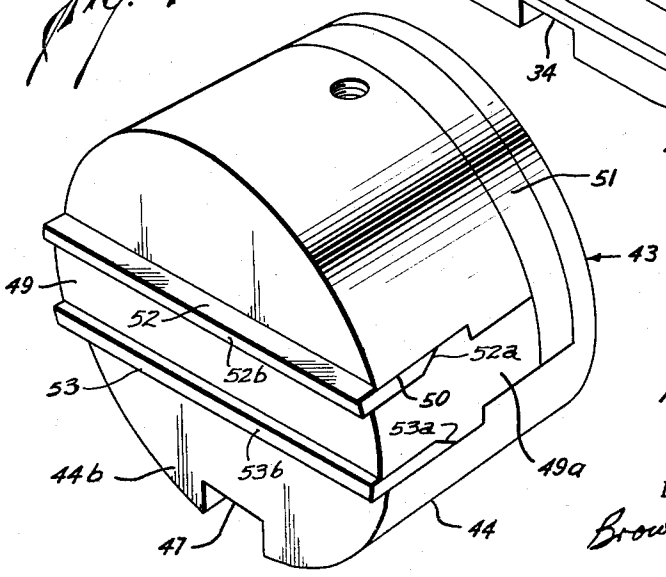


Fig. 7



Herbert Allen
INVENTOR.

BY Browning, Bennett, Hyer & Eickenroht
ATTORNEYS

Sept. 3, 1963 H. ALLEN 3,102,709

RAM TYPE VALVE APPARATUS

Filed Aug. 26, 1959 3 Sheets-Sheet 2

Fig. 3

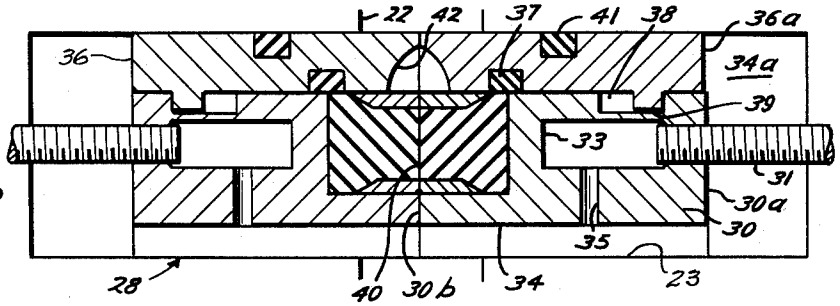


Fig. 4

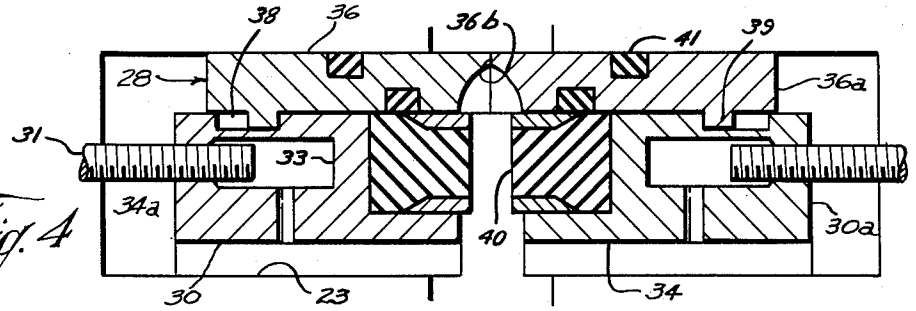


Fig. 5

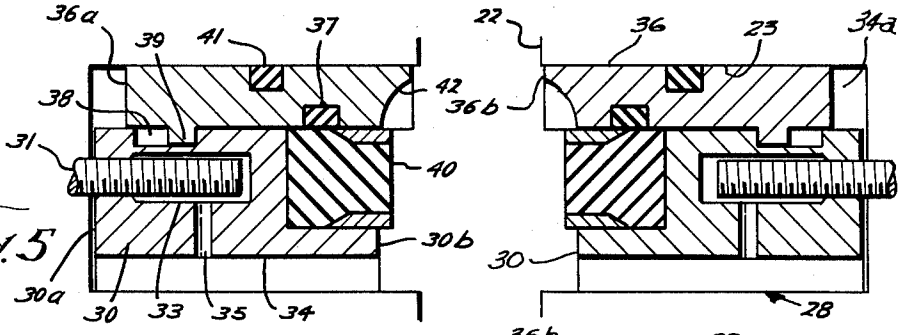
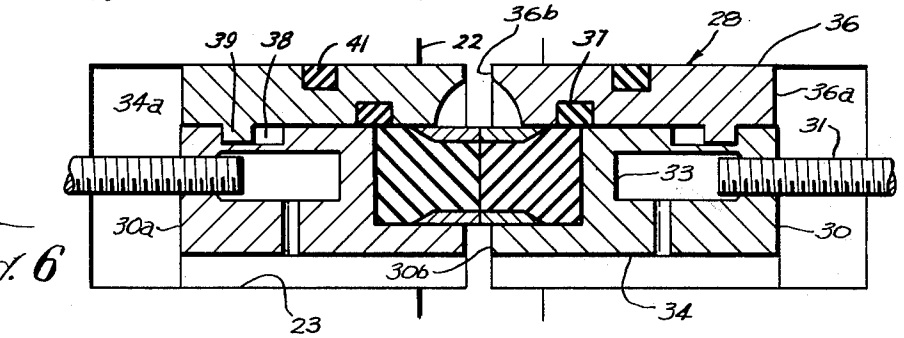


Fig. 6



Herbert Allen
INVENTOR.

BY
Browning, Simms, Hyer & Eickenroht
ATTORNEYS

Sept. 3, 1963 H. ALLEN 3,102,709

RAM TYPE VALVE APPARATUS

Filed Aug. 26, 1959 3 Sheets-Sheet 3

Fig. 8

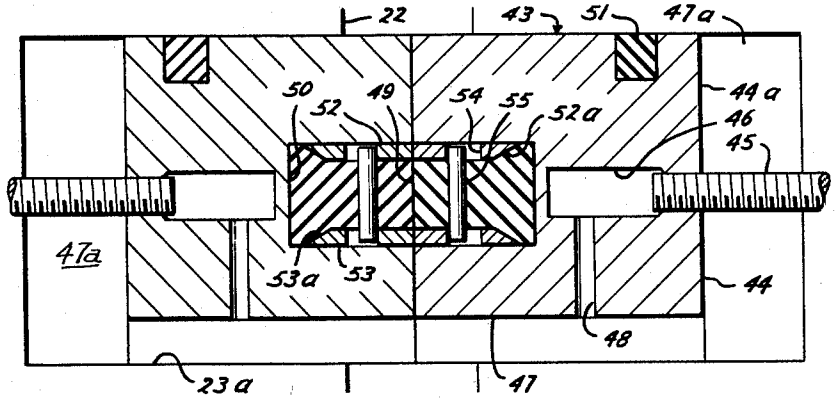


Fig. 9

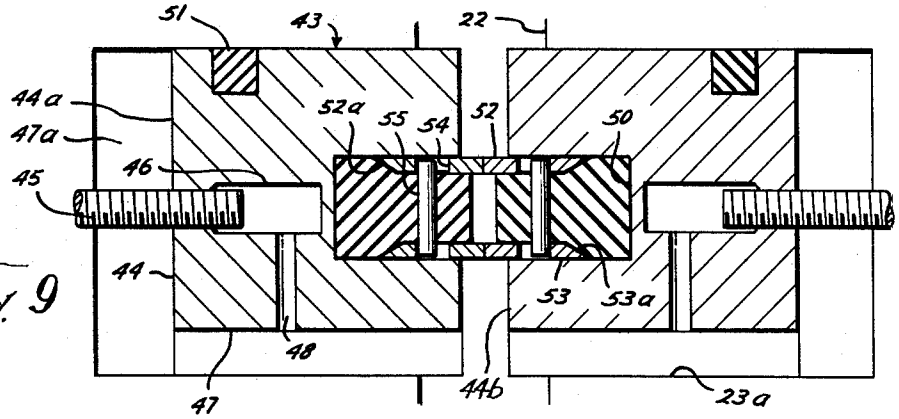
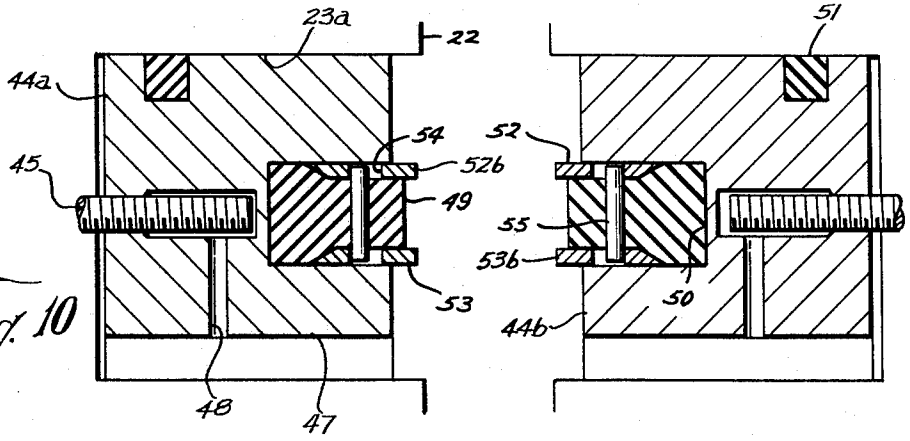


Fig. 10



Herbert Allen
INVENTOR.

BY
Browning, Semmes, Hyer & Eickenroht
ATTORNEYS

United States Patent Office 3,102,709 Patented Sept. 3, 1963

3,102,709

RAM TYPE VALVE APPARATUS

Herbert Allen, Houston, Tex., assignor to Cameron Iron Works, Inc., Houston, Tex.

Filed Aug. 26, 1959, Ser. No. 836,113
12 Claims. (Cl. 251—1)

This invention relates to improvements in valve apparatus. In one of its aspects, it relates to valve apparatus in which upstream line pressure provides a force to assist in holding a closure member closed. In another of its aspects, it relates to such apparatus in which the face of a sealing strip of resilient material normally projects from the inner end of a closure member for sealably engaging an opposing surface in the bore of the valve body to close same.

One example of valve apparatus having both of these characteristics is the conventional blowout preventer which has two or more closure members for fitting about a pipe within the bore of the preventer body to close off the annulus between the pipe and bore, or for abutting with one another to close off an open bore. In a preventer of this type, the rams are adapted, in their closed position, to form a continuous seal with one another across their inner ends and with the guideways in which they are slidable along their sides and across their tops. Well fluid from beneath the closed rams is admitted to an effective pressure area on the outer end of each which is larger than the effective area on the inner end thereof so as to provide a resultant force which supplements the force of the operator to maintain the rams closed. The face of the sealing strip which normally projects from the inner end of each ram provides an excess of resilient material which is extruded upon closing of the rams to activate sealing strip portions along the sides and over the tops of the rams into sealing engagement with the guideways.

It has been found, however, that although the admission of well fluid to the outer ends of the ram is advantageous in assisting the operator to hold them closed, this additional closing force has necessitated a correspondingly higher force to open the rams. This has in turn necessitated large power operators which are not only costly but extremely inconvenient due to their size and need for a large storage of standby power. It has also been found that when such rams are opened and closed against high well pressures, the restriction of flow which takes place across the projecting faces of their sealing strips will damage the resilient material to the point of making it useless.

An object of this invention is to provide valve apparatus of this type, including blowout preventers and the like, having lower operating requirements for opening each closure member or ram under pressure.

Another object is to provide such valve apparatus which may be opened and, in some cases, closed under high pressure without substantial damage to the resilient material of the sealing strip across the inner end of each closure member or ram.

Still another object is to provide valve apparatus of this type having both of the aforementioned advantages.

The first of these objects is accomplished, in accordance with the present invention, by valve apparatus in which the closure member comprises separate parts extending longitudinally of the guideway in side-by-side relation. One of these parts is a carrier having means thereon for reciprocating it in opposite directions to open and close the bore of the valve body. The other is a plate which is connected to the carrier for limited longitudinal reciprocation with respect to it. The carrier and plate are sealed with respect to one another as well as with respect to

the guideway in closed position to prevent the escape of pressure fluid from the chamber on their outer ends.

Due to the lost motion connection between the carrier and plate, the operator need overcome only the resultant force urging the carrier inwardly to separate the seal means across its inner end from the sealing surface in the body. Then, upon this initial movement of the carrier in an opening direction, the forces on opposite ends of the carrier are substantially balanced and the operator need overcome only the forces on the plate which resist its outward movement as the carrier reaches its limit of reciprocation with respect to the plate. As the carrier continues to move in an opening direction, the plate moves outwardly with it, with the forces across the entire carrier substantially balanced.

In accordance with a preferred form of the invention, by means of which all of the above-mentioned objects are accomplished, the inner end of the plate engages the surface in the body and extends laterally across one side of a sealing strip on the carrier to maintain the bore closed during this initial reciprocation of the carrier in the opening direction. In this manner, the face of the sealing strip is withdrawn from the surface in the body which it engages prior to the time that the bore is choked by the initial withdrawal of the inner end of the plate from said surface. Thus, the greater proportion of wear due to the rush of well fluid past the closure member will occur across the inner end of the plate rather than across the face of the sealing strip.

In this preferred form of the invention, an area on the inner end of the plate adjacent one side of the sealing strip is recessed. Thus, as the face of the sealing strip is separated from the surface in the body, the upstream pressure is effective over such area to reduce the resultant force urging the plate inwardly which must be overcome by the operator during continued opening movement of the carrier.

The second of the above-mentioned objects is also accomplished by another form of the invention in which the plate for maintaining a closure in the bore upon initial opening movement of the carrier and separation of the face of the sealing strip from the surface in the body is yieldably urged toward such lagging position by a portion of the sealing strip which is disposed between the carrier and the outer end of the plate. This plate also serves to extrude the resilient material of the sealing strip for the purpose of activating the remainder of the seal means on the ram. More particularly, in this form of the invention, there may be two such plates, one on each side of the sealing strip portion, thereby enabling a more uniform extrusion of the resilient material.

In the drawings, wherein like reference characters are used throughout to designate like parts.

FIG. 1 is a side view of a blowout preventer construction in accordance with the preferred form of the present invention and with one side thereof in section to show one ram in closed position about a pipe in the bore of the preventer body;

FIG. 2 is a perspective view of an enlarged scale of a ram identical to those on the preventer of FIG. 1, except that, for purposes of illustration, it is a "blind" ram for closing an open hole in the bore;

FIG. 3 is an enlarged sectional view of a pair of blind rams of the type shown in FIG. 2 in closed position within the preventer of FIG. 1;

FIG. 4 is a view similar to FIG. 3, but during the initial opening movement of the rams;

FIG. 5 is another view of the rams in their opened position;

FIG. 6 is still another view of the rams upon initial engagement of the sealing strips thereacross with one another during the final closing movement of the rams;

FIG. 7 is a perspective view of the other form of ram constructed in accordance with the present invention and for use in a preventer body similar to that shown in FIG. 1;

FIG. 8 is a cross-sectional view of the second form of rams in closed position within the body of a preventer;

FIG. 9 is a view similar to FIG. 8, but during the initial opening movement of the rams; and

FIG. 10 is another view in which the rams of FIGS. 8 and 9 have been moved to positions opening the bore of the preventer.

Referring now particularly to the drawings, there is shown in FIG. 1 a blowout preventer **20** having a body **21** of more or less conventional construction in which a bore **22** therethrough is intersected by a pair of oppositely disposed guideways **23**. The opposite ends of the guideways are closed by bonnets **24** bolted or otherwise secured to the flanged ends of the body, and the upper and lower flanged ends of the preventer body are bolted or otherwise connected to flanges **25** and **26**, respectively, to which other wellhead members (not shown) may be connected to provide continuations of the bore **22**. Seal rings **27** are received in corresponding and oppositely disposed grooves in the flanges and the preventer body for sealing the connection therebetween.

In the preferred form of the invention, closure members or rams **28** are disposed within the guideways **23** for movement longitudinally thereof between positions opening the bore **22**, as shown in FIG. 5, and positions closing the bore, as shown in FIGS. 1 and 3. As previously noted, the rams may be "blind," as shown in FIG. 2, wherein they have flat inner ends which abut with one another to close off the bore when it is empty. On the other hand, the rams may be provided with registering recesses **28***a* extending vertically of their inner ends for fitting about a pipe **29**, as shown in FIG. 1, and abutting with one another on opposite sides of the pipe to close off the annulus about the pipe. Obviously, and as well known in the art, the pipe ram of FIG. 1 and "blind" ram of FIG. 2 are interchangeable to suit the particular conditions desired. For purposes of simplicity, the novel features of the present invention will be described in connection with the blind ram which is shown in FIGS. 3 to 6 as well as FIG. 2.

As shown in FIGS. 1 to 6, ram **28** includes a carrier **30** threadedly connected to the inner end of a stem **31** sealably carried in the bonnet **24** for rotation without longitudinal movement. The outer end **32** of the stem is non-circular to accommodate a tool for rotating same to move the carrier toward and away from the bore. The interior of the carrier is recessed at **33** to accommodate the inner end of the stem as the carrier is rotated inwardly and outwardly with respect to it.

The lower side of the carrier **30** is slidable along the lower portion of the correspondingly contoured guideway **23**, and a groove **34** is formed in the carrier longitudinally of the body to admit well fluid within the bore **22** below the ram to a chamber **34***a* in the guideway rearwardly of the carrier. A port **35** in the carrier connects the recess **33** with the groove to permit free movement of the inner end of the stem into and out of the recess.

A plate **36** extends longitudinally between the top side of the carrier **30** and the upper portion of the guideway **23**, and has a top side shaped correspondingly to the upper portion of the guideway for sliding longitudinally with respect thereto. As shown in the drawings, the lower side of this plate carries a seal member **37** of resilient material which extends laterally thereacross to provide a sliding seal between the plate and carrier. A lost motion connection between the carrier and plate includes a laterally extending slot **38** in the top side of the carrier and a rib **39** on the lower side of the plate received within the slot for limiting longitudinal movement of the plate relative to the carrier between a first position in which it abuts the inner end of the slot, as shown in FIGS. 4 and 5, and a second position in which it abuts the outer end of the slot, as shown in FIGS. 2, 3 and 6.

Each ram **28** has means for sealing across its inner end and along its sides, and transversely across the top thereof. This sealing means includes a strip **40** of resilient material extending laterally across the inner end of the carrier as well as additional sealing strip portions **40***a* (FIG. 2) extending from the opposite ends of the strip **40** longitudinally along its opposite sides. Another sealing strip portion **41** is carried by the plate **36** and extends from the portions **40***a* laterally across the top plate **36**. When the rams are closed, the sealing strip **40** will seal about a pipe within the bore as well as with respect to the strip **40** of the opposite ram, portions **40***a* will seal along the sides of the guideway, and the sealing strip portion **41** will seal across the upper portion of the guideway, in a manner to be described below. Also, as will be understood from the drawings, particularly FIG. 2, the seal strip **37** cooperates with sealing strip portions **40***a* and **41** to confine well fluid admitted through groove **34** to the chamber **34***a*.

As previously mentioned, it is conventional in blowout preventer rams of this general type, to provide the sealing strip with an outwardly projecting part for engagement with the object to be sealed about as well as an opposing ram, whereby the sealing strip portions **40***a* and **41** are deformed into sealing engagement with respect to the guideway upon engagement of the rams with one another. Thus, as shown in FIGS. 2 and 4 to 6, the face of the sealing strip portion **40** extends outwardly from the inner end of the carrier prior to engagement with the face of the sealing strip portion on the opposite ram. However, when these rams engage with one another to close the bore of the preventer, the projecting faces on the sealing strip portions are urged inwardly by continued closing movement of the carriers so that, in the closed position of the rams, they substantially conform with the inner end of the carrier, as illustrated in FIGS. 1 and 3. Additional plates **40***b* and **40***c* carried on the upper and lower sides of the strip **40** are useful in confining the resilient material to extrusion in rearward and sidewise directions, as well known in the art.

As previously noted, it has been found that considerable wear will take place across the faces of the sealing strips **40** of this type upon opening of the rams, particularly when the velocity of the fluid being controlled is high. In accordance with the present invention, however, the top plate **36** is made of a relatively rigid material similar to the carrier **30** and its inner end **36***b* projects from the face of the sealing strip portion **40** in its inner limited position, as shown in FIGS. 4 and 5. However, the lost motion connection between the top plate and carrier permits the inner end of the top plate to be moved rearwardly with respect to the carrier so as to substantially conform with the face of the sealing strip portion **40** in the closed position of the ram, as shown in FIGS. 1 and 3. In fact, prior to closing of the rams by engagement of their sealing strips **40** with one another, the inner end of the top plate may actually be disposed rearwardly of the face of the sealing strip and in substantial conformity with the inner end **30***b* of the carrier **30**, as shown in FIG. 6.

From the foregoing, it is apparent that well fluid passing through the slot **34** will enter the chamber **34***a* to act upon the entire outer end of each ram **28**, including the outer ends **30***a* and **36***a* of the carrier and plate, respectively. This provides a force urging the rams toward closed position which equals the pressure of such well fluid times the total area of the ends **30***a* and **36***a*. When each ram is closed, as shown in FIGS. 1 and 3, well fluid is effective over only a portion of the inner end **30***b* of the carrier including a small lower portion of the face of sealing strip **40**. Therefore, the force opposing that previously mentioned is relatively small so that there will

be a resultant inwardly directed force for assisting the operator stem 31 in holding the rams closed.

In conventional ram constructions, it would be necessary for the operator to overcome this entire resultant force in opening the rams. However, due to the lost motion connection between the plate and carrier, the faces of the sealing strips 40 are separated during initial opening movement of the rams, as shown in FIG. 4, prior to movement of the plates 36 with the carriers. As a result, the operator need overcome only the inwardly directed force resulting from the difference in effective pressure area on the inner and outer ends 30*b* and 30*a*, respectively, of the carrier of each ram which, as will be understood, is dependent upon that portion of the face of the sealing strip 40 which sealably engages with the face of the sealing strip 40 of the opposite ram. Then, as the faces of the sealing strips are separated from one another, well fluid is effective over the entire inner end of the carrier so as to at least substantially equalize the forces thereon.

When the carrier reaches its limit of rearward movement with respect to the plate by engagement of the rib 39 with the inner end of the slot 38, as shown in FIG. 4, the operator need overcome a resultant force urging the plate inwardly which is dependent upon the area on the inner end 36*b* of the plate which is engaged with the inner end of the plate of an opposing ram. This latter area is reduced by the provision of recesses 42 extending laterally across the inner ends of the plates adjacent the top side of sealing strip 40. Thus, when the faces of the sealing strips are separated, well fluid is effective over the effective pressure area of the recess 42 to provide a force urging the plate rearwardly, so that the resultant force for maintaining the inner ends of the plates in engagement is merely equal to the well pressure times the small area on the upper portions of the inner ends of the plates. Obviously, therefore, only a small additional amount of power from the operator is required to separate the plates and, when the plates are separated, the forces across the rams are substantially balanced since well fluid is effective over the entire inner end 36*b* of the plate.

When the carrier has reached the position of FIG. 4 during its opening movement, the lost motion connection between the carrier and plate is effective to separate the inner ends of the plate and then move the plate with the carrier to the position of FIG. 5 wherein the entire ram has been withdrawn from the bore 22 to open same.

When the carrier is moved in the closing direction, the slot 38 will normally slide over the rib 39 on the plate so that the rear end of the slot engages the rib to carry the plate inwardly of the carrier. Then, as the faces of the sealing strips 40 engage one another, as shown in FIG. 6, and the carriers are moved further inwardly, the inner ends of the plates will be moved into engagement with one another, as shown in FIG. 3. Alternatively, it may be found that the frictional engagement between the plate and carriers is sufficient to move the plate inwardly with the carrier in their relative positions shown in FIG. 5. In this case, the inner ends 36*b* of the plates on the opposite rams would engage one another prior to engagement of the faces of the sealing strip portions 40 so as to initially choke the bore and reduce damage to said faces. In any case, however, the carriers and plates of the closed rams will return to the relative positions shown in FIG. 3.

In the form of the invention illustrated in FIGS. 7 to 10, the ram 43 comprises a carrier 44 of substantially cylindrical shape which is longitudinally slidable within a similarly shaped guideway 23*a* in a blowout preventer body similar in other respects to the body 21 of FIG. 1. More particularly, the carrier is reciprocated between positions opening the bore 22 in the preventer body, as shown in FIG. 10, and closing same, as shown in FIG. 8, by means of an operator including a stem 45 threadedly connected thereto and carried by the body in a manner shown in FIG. 1. The carrier is also recessed at 46 to accommodate the inner end of the stem as the carrier reciprocates with respect thereto.

Noting further similarities of the ram 43 to the ram 28, the carrier 44 has a longitudinally extending groove 47 along its lower portion for admitting well fluid from the bore beneath the closed rams to a chamber 47*a* on the outer end of 44*a* of the carrier. An opening 48 in the carrier connects the recess 46 with the groove 47 to permit the inner end of the stem to move easily within the carrier.

The seal means for the ram 43 includes a laterally extending strip 49 of resilient material which is received within a groove 50 across the inner end of the carrier 44, sealing strip portions 49*a* extending longitudinally from the opposite ends of strip 49 along the sides of the carrier, and a sealing strip portion 51 extending laterally across the top side of the carrier rearwardly of its inner end and between the outer ends of strip portions 49*a*. As in the case of the sealing strip 40 of the first described form of the invention, the face of sealing strip 49 normally projects from the inner end 44*b* of the carrier 44, as shown in FIGS. 7, 9 and 10, so that, as the carrier is moved to closed position, the faces of the sealing strips 49 of opposite rams are moved into engagement with one another, and then into substantial conformity with the inner end 44*b* of each carrier, as shown in FIG. 8. As previously described, this extrudes the additional sealing strip portions 49*a* and 51 into sealing engagement along the sides and over the upper portion of the guideway 23*a*. Thus, as in the previous form of the invention, well fluid from the bore beneath the closed rams is confined within the chamber 47*a* on the outer end of each ram which, in this form of the invention, is made up in its entirety of the outer end 44*a* of each carrier.

A pair of plates 52 and 53 of relatively rigid material are disposed laterally across the face of the sealing strip 49 along the upper and lower sides thereof, respectively. More particularly, the plates are received between the upper and lower sides of the sealing strip and the upper and lower sides of the slot 50 in the carrier. As shown in each of FIGS. 7 to 10, portions of the sealing strip 49 are received between the outer ends 52*a* and 53*a* of the plates and the back of the slot 50 to urge the plates outwardly to the positions of FIGS. 7, 9 and 10 in which their inner ends 52*b* and 53*b* normally project from the face of the sealing strip 49.

However, as the plates engage one another, during closing movement of the carriers, they will be moved inwardly with respect to the sealing strip 49 so as to extrude the resilient material of the sealing strip portions 49*a* and 51, as previously described. More particularly, the inner ends of the plates 52 and 53 will be moved into substantial conformity with the face of sealing strip 49, whereupon such face and the inner ends of the plates will be further moved into conformity with the inner end 44*a* of the carrier 44, as shown in FIG. 8. Preferably, the plates 52 and 53 are provided with longitudinally extending slots 54 to receive the opposite ends of pin 55 in the sealing strip. As shown in FIGS. 9 and 10, the engagement of the outer ends of the slots 54 with the projecting ends of the pin 55 limit the outward projection of the inner ends of the plates with respect to the face of the sealing strip 49.

From the foregoing, it will be obvious that as the carriers are moved in an opening direction from the closed position of FIG. 8 to the position of FIG. 9, the deformation in the sealing strips will first be relieved by the return of the faces of the strips 49 to their normally projecting positions as the inner ends of the carriers are first separated from one another. Then, upon continued opening of the carriers, the inner ends of the plates 52 and 53 will be urged outwardly by the portion of the sealing strip behind their outer ends so that they continue to engage one another as the faces of the sealing strips 49 are sep-

arated, as shown in FIG. 9. Thus, when the inner ends of the plates are also separated from one another upon continued opening of the carriers, the well fluid rushing through the choked opening between the inner ends of the plates will not severely damage the face of the sealing strips 49 but, to the contrary, the greater proportion of the wear will take place across the inner ends of the plates which are made of relatively rigid material to confine the face of the sealing strip 49 similarly to the relatively rigid plate 36 of the previously described embodiment. Of course, upon closing of the rams, the bore will be choked by the inner ends of the plate as they approach the FIG. 9 position. At this time, the faces of sealing strips are, as in opening, spaced outwardly of such inner ends.

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 apparatus.

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. Valve apparatus, comprising a body having a bore therethrough and a guideway therein intersecting the bore, a closure member longitudinally slidable within the guideway to open and close the bore, and comprising a carrier and a plate extending longitudinally of the guideway in side-by-side relaion, means for reciprocating the carrier to move the closure member between bore opening and closing positions, means operative to seal, in the closed position of the closure member, between the inner end of the carrier and a surface in the bore opposite the guideway and between the guideway and closure member along the sides and laterally across the closure member, means sealing between the carrier and plate to form with said first-mentioned seal means a pressure chamber in the guideway comprising in part pressure responsive surfaces on the outer ends of the carrier and plate, means for admitting fluid pressure on the side of the carrier opposite the plate into the chamber from the bore for urging each of the carrier and plate toward said surface in the bore, and means connecting the plate and carrier for limited longitudinal reciprocation with respect to one another upon initial reciprocation of the carrier in a direction to open the bore, whereby the seal means between the inner end of the carrier and said surface is separated prior to movement of the plate with the carrier.

2. Valve apparatus of the character defined in claim 1, wherein said first-mentioned seal means includes a sealing strip of resilient material extending laterally across the inner end of the carrier and having a face normally projecting from said inner end to engage said surface, and at least a portion of the inner end of the plate extends laterally across one side of the sealing strip, in the closed position of the closure member, and is longitudinally reciprocal with respect to the carrier between a first position in which said portion of the inner end of the plate is substantially flush with the seal means on the inner end of the carrier, and a second position in which said portion of the inner end of the plate projects from said seal means in a direction toward said surface in the bore, so as to maintain the bore closed during said initial reciprocation of the carrier.

3. Valve apparatus of the characer defined in claim 2, wherein there is a recessed area on the side of the inner end of the plate adjacent the face of the sealing strip which is held out of engagement with said surface during engagement of the remaining area therewith for exposure to the fluid pressure in the bore upon the separation of the face of the sealing strip from said surface.

4. A valve closure member, comprising a longitudinally extending carrier, a sealing strip of resilient material extending laterally across the inner end of the carrier, a plate extending longitudinally of the carrier in side-by-side relation thereto, means for moving the carrier in opposite longitudinal directions, said carrier and plate having smooth portions intermediate their inner and outer ends for sliding longitudinally within a guideway in sealed relation thereto and said outer ends having surfaces responsive to fluid pressure acting in a longitudinal direction over the cross sectional area of the intermediate smooth portions of said closure member, a lost motion connection between the plate and carrier to permit limited longitudinal reciprocation therebetween, and means sealing between the adjacent surfaces of the plate and carrier so that the plate may be held against movement with the carrier, during limited movement by the carrier in an outward direction, by a force due to fluid pressure on the fluid pressure responsive surface on its outer end.

5. A valve closure member of the character defined in claim 4, including additional sealing strip portions extending longitudinally from opposite ends of the first-mentioned strip along opposie sides of the carrier and then laterally across the plate rearwardly of the inner end thereof, said additional portions forming a continuation of the sealing means between the plate and carrier.

6. A valve closure member of the character defined in claim 4, wherein the face of the first-mentioned sealing strip normally extends beyond the inner end of the carrier, and the plate is reciprocable with respect to the carrier between a first position in which at least a portion of its inner end is substantially flush with and a second position in which such portion of its inner end extends beyond said face in its normal position.

7. A valve closure member of the character defined in claim 6, wherein the inner end of the plate is recessed along an area on the side thereof adjacent the face of the sealing strip across the inner end of the carrier.

8. Valve apparatus, comprising a body having a bore therethrough and a guideway therein intersecting the bore, a closure member longitudinally slidable within the guideway to open and close the bore, said closure member comprising a carrier having a sealing strip of resilient material extending laterally across the inner end thereof with its face normally projecting therefrom, and a plate of relatively rigid material carried by the carrier for limited reciprocation longitudinally with respect thereto and having its inner end extending laterally across one side of the sealing strip, means for reciprocating the carrier between a first position in which the face of the sealing strip and the inner end of the plate are engaged with a surface in the bore opposite the guideway to close same and a second position withdrawn from said surface to open the bore, and means for yieldably urging the plate inwardly with respect to the carrier toward one limited position during the initial opening movement of the carrier so that the face of the sealing strip is disengaged from said surface prior to disengagement therefrom of the inner end of said plate.

9. A valve closure member of the character defined in claim 8, wherein the plate and carrier extend longitudinally of one another in side-by-side relation to dispose their inner and outer ends laterally adjacent one another and including means sealing between the adjacent faces of the carrier and plate.

10. A valve closure member of the character defined in claim 8, wherein said means for yieldingly urging the plate inwardly includes a portion of said sealing strip, said por-

tion being of resilient material and disposed between the carrier and the outer end of the plate.

11. A valve closure member of the character defined in claim 10, including another plate of relatively rigid material carried by the carrier with its inner end extending laterally across the other side of the sealing strip, and wherein said means for yieldably urging the other plate inwardly includes another portion of said sealing strip, said other portion being of resilient material and disposed between the carrier and the outer end of the other plate.

12. A valve closure member of the character defined in claim 8, including additional sealing strip portions of resilient material extending from opposite ends of said first-

mentioned sealing strip along the sides of the closure member and then laterally thereacross.

References Cited in the file of this patent

UNITED STATES PATENTS

1,863,252	Pierce	June 14, 1932
2,218,093	Penick	Oct. 15, 1940
2,593,793	Rector	Apr. 22, 1952
2,912,000	Green	Nov. 10, 1959

FOREIGN PATENTS

195,692	Great Britain	of 1923