July 29, 1952 C. R. NEILON 2,604,903

RAM PACKING ELEMENT FOR BLOWOUT PREVENTERS

Filed Sept. 23, 1946 4 Sheets-Sheet 1

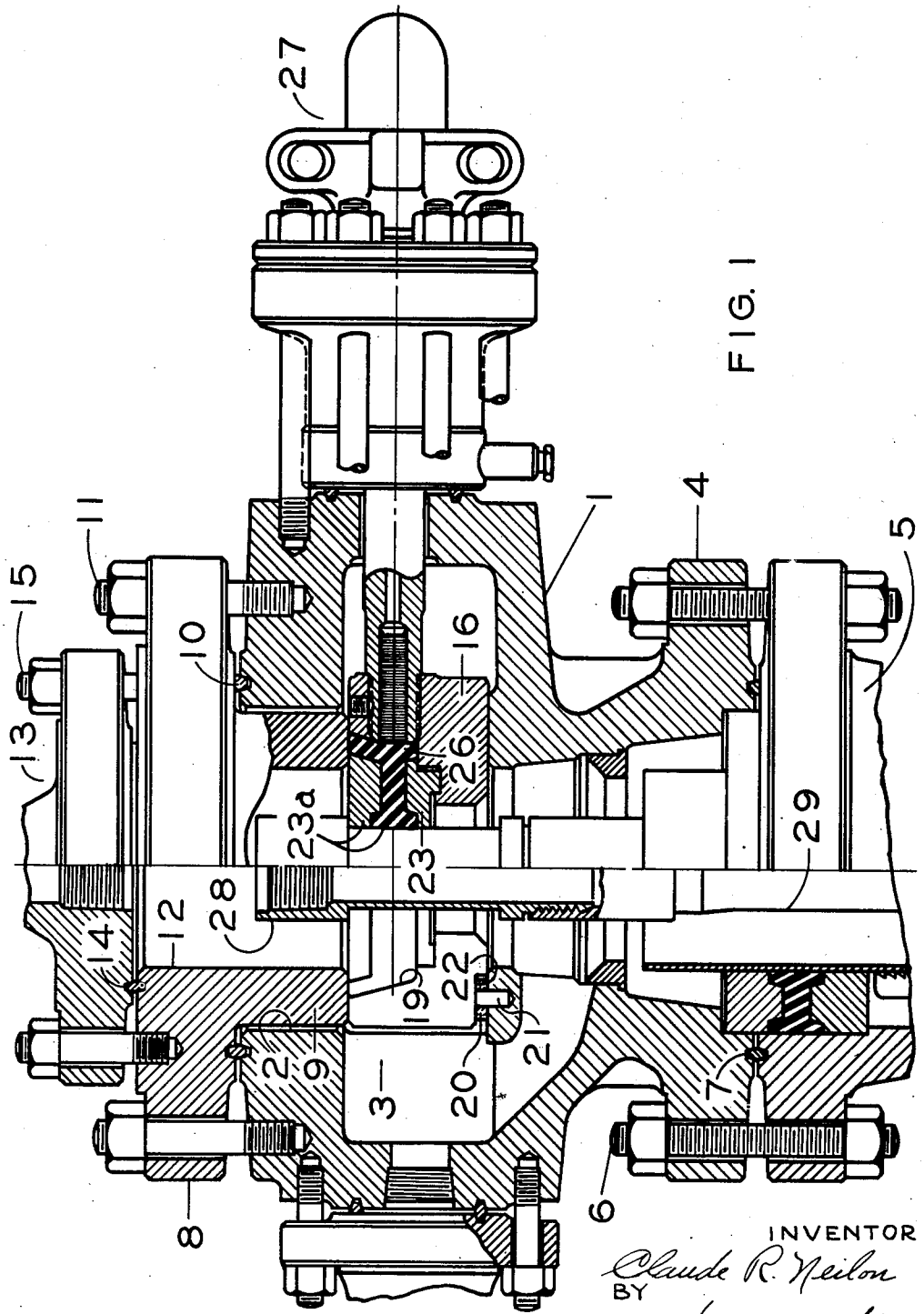


FIG. 1

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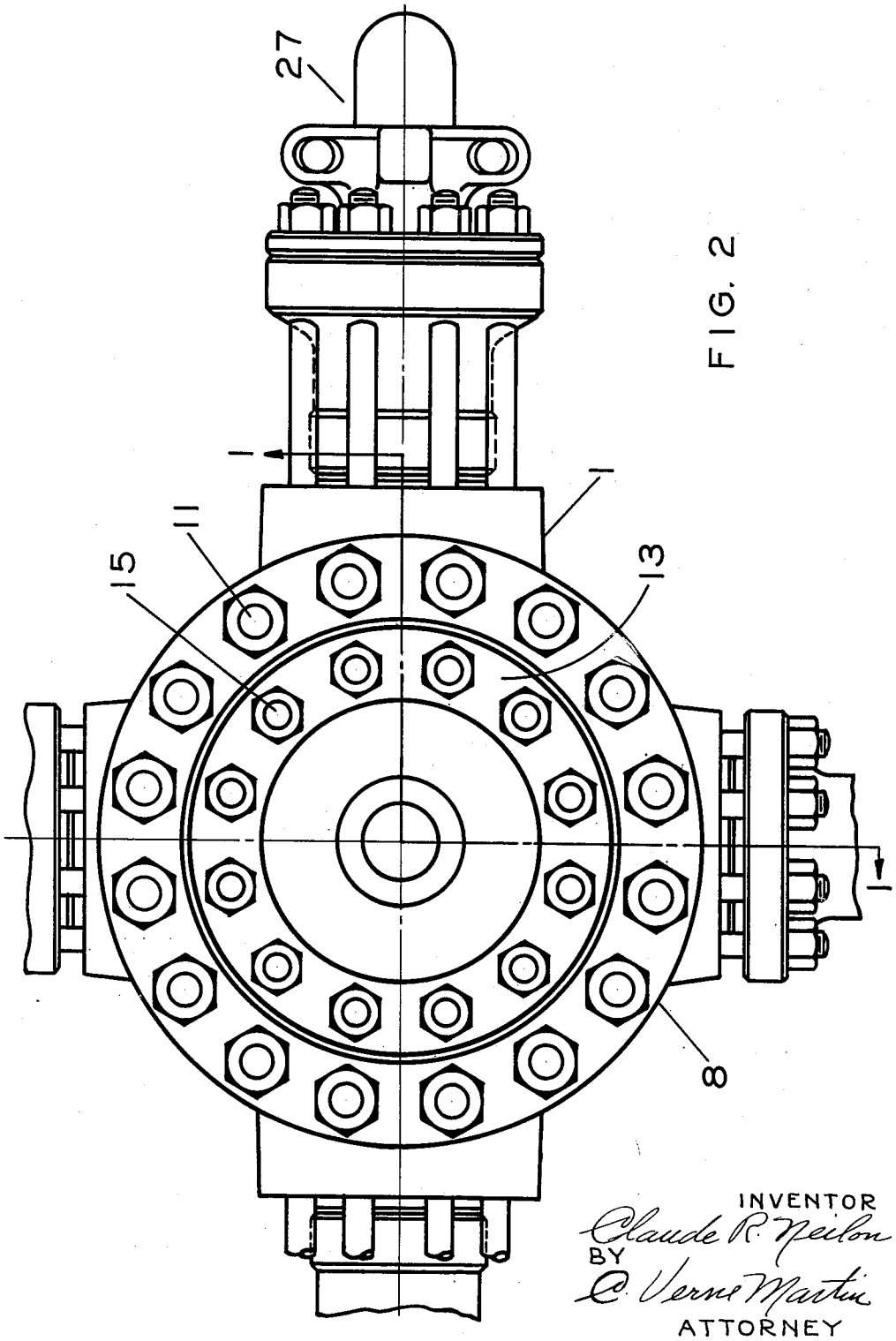


FIG. 2

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RAM PACKING ELEMENT FOR BLOWOUT PREVENTERS

Filed Sept. 23, 1946 4 Sheets-Sheet 3

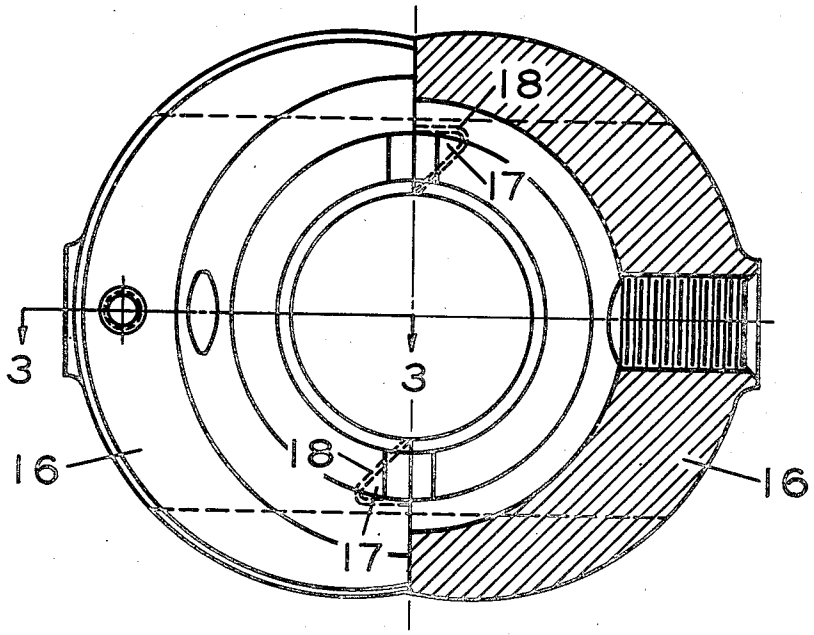


FIG. 4

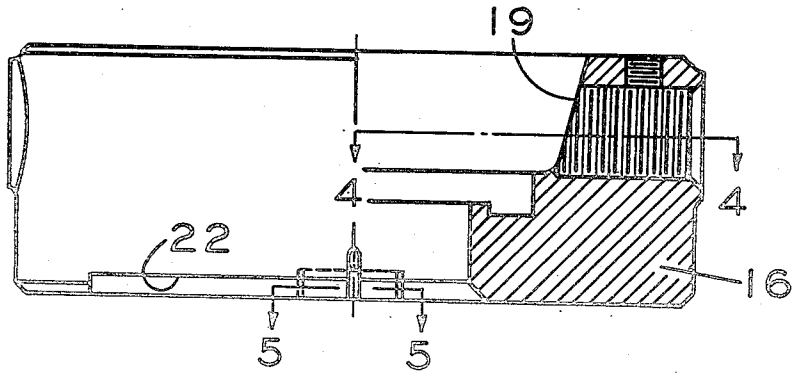


FIG. 3

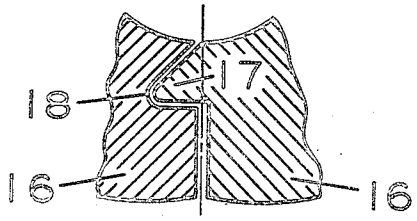


FIG. 5

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RAM PACKING ELEMENT FOR BLOWOUT PREVENTERS

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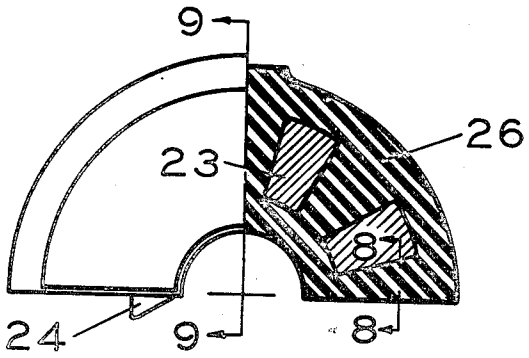


FIG. 7

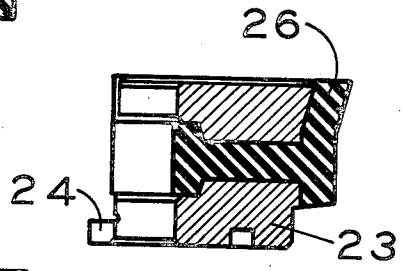


FIG 9

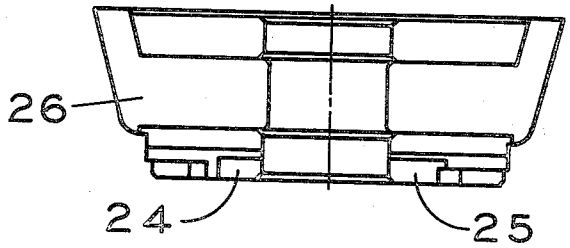


FIG. 6

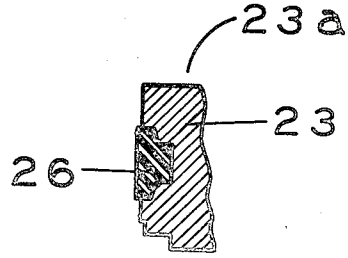


FIG. 8

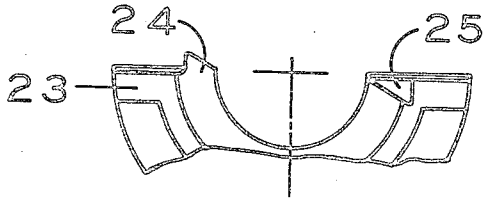


FIG. 10

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UNITED STATES PATENT OFFICE

2,604,903

RAM PACKING ELEMENT FOR BLOWOUT PREVENTERS

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Application September 23, 1946, Serial No. 698,721

9 Claims. (Cl. 137—618)

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This invention relates to blowout preventers of the ram type and has particular reference to a packing element for the ram that may be inserted or removed vertically from the upper portion of the body of the blowout preventer.

In the drilling of deep wells, say 10,000 feet or deeper, extremely high well pressures are usually encountered and the equipment necessary for controlling such high pressures must naturally be very sturdy and heavy. This heavy equipment is difficult to handle and requires much time consuming labor.

Ram type blowout preventers designed to close and seal about a string of tubing passing through the vertical bore thereof are usually provided with ram chambers within the bore, such that a pair of ram members or packing elements cooperate together to fit snugly about the tubing or tubing hanger and form a seal against the well pressure existing between the inner wall of the casing and the exterior of the tubing string.

At times it is necessary to renew the packing element due to wear and sometimes it is necessary to change the diameter of the tubing string due to well conditions. When this emergency arises it is imperative that the operation be expeditiously completed for the well must be temporarily killed by introducing heavy mud to completely subdue the well pressure at the well head to permit such changes as are necessary to be made.

At other times during the completion of the well and at still other times during the flowing life of the well, it is necessary to manipulate the ram of the head to permit the tubing string to be raised or lowered. This movement of the tubing is necessary to actuate the various bottom hole equipment and to permit the various necessary testing procedures.

It is a well known fact that the corrosive action within the well and the gummy nature of the fluid produced attacks all exposed surfaces and often renders them in such condition that operation is difficult if not impossible. This particularly is true of valves and the rams of blowout preventers and the like.

To eliminate such difficulty and facilitate the changing of the packing element and enhance the mobility of the ram elements after long exposure to this corrosive action all close fitting openings were eliminated. The ram carrier, with its packing element mounted therein, is designed to move freely on a pair of guides. The housing in which the ram carrier moves is designed to provide ample clearance around the ram carrier and in fact the ram carrier moves into a free

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area the moment the sealing pressure on the packing element is broken. There are no exposed corrosive surfaces upon or within which the ram carrier and its attendant ram packing elements travel in close fitting relationship in my improved design.

Further my sectional interlocking ram insert or packing element may be readily changed or renewed by simply breaking the seal about the tubing and the lower surface of the crown and placing a new packing element in its place in the tapered bore of the ram carrier through the vertical bore or open end of the blowout preventer. My new and improved replaceable packing element is very effective and has proven its utility and merit by its ready acceptance by the oil field trade.

It is one of the objects of my invention to provide a ram construction for a blowout preventer that can be changed readily and with as little loss of time as possible.

Another object of my invention is to provide a sectional interlocking ram insert or packing element that may be easily inserted into place in the recess of a blowout preventer through the vertical opening or bore in the upper open end of the blowout preventer body.

Another object of my invention is to provide an improved replaceable packing element for a ram type blowout preventer that may be inserted or withdrawn from the blowout preventer through the open upper bore of the blowout preventer.

Another object of my invention is to provide a packing assembly for blowout preventer rams which can be readily inserted into the rams and removed therefrom and which will form a seal about the upper portion of the ram to exclude well pressure therefrom.

Another object of my invention is to provide a simple and effective replaceable ram packing element for a blowout preventer that may be speedily set in place in the ram and held in operative position without the aid of bolts or other fastening devices.

Another object of my invention is to provide a pair of segmental interlocking ram inserts so constructed that transverse movement of the rams may be translated into displacement of the ram inserts and this displacement of the ram inserts to be normal to the transverse movement of the rams.

Other objects and advantages of my invention will become apparent during the course of the following description and appended claims in

connection with the accompanying drawings illustrating the preferred constructional embodiments of my invention wherein like parts are designated by like numerals.

Fig. 1 is a side elevation, partly in section of a blowout preventer incorporating my invention, the section being taken along the line 1—1 of Fig. 2.

Fig. 2 is a top plan view of the assembled blowout preventer.

Fig. 3 is a side elevation, partly in section, of the two part ram carrier, the section being taken along the line 3—3 of Fig. 4.

Fig. 4 is a top plan view, partly in section, of the two part ram carrier, the section being taken along the line 4—4 of Fig. 3.

Fig. 5 is a section taken on the line 5—5 of Fig. 3 showing the details of the interlocking construction.

Fig. 6 is a side elevation of the sectional packing element.

Fig. 7 is a top plan view of the sectional packing element, partly in section showing one of the interlocking lugs.

Fig. 8 is a section on the line 8—8 of Fig. 7 showing the resilient packing molded to the metal insert.

Fig. 9 is a section of the interlocking segmental resilient packing element taken along the line 9—9 of Fig. 7.

Fig. 10 is a bottom plan view of the packing element showing the two interlocking elements to hold the two identical halves in unit relation when placed in the bore of the ram.

Figures 3, 4 and 5 clearly show the interlocking feature as applied to the two identical halves forming the complete ram carrier unit. The same type of interlocking construction is used in forming the complete resilient packing element unit shown in Figures 6, 7, 8, 9 and 10.

In the drawing the numeral 1 indicates a blowout preventer body provided with a bore or vertical passage 2 having ram chambers 3 extending laterally therefrom. The body 1 is further provided with a lower flange 4 by which it is connected to a well head 5 by means of double end bolts 6. A ring joint gasket 7 inserted in an annular groove provided at the junction of the body and the well head forms a seal to seal off well pressure at this connection.

A studded flanged crown 8, with a depending annular skirt 9 is adapted to loosely fit within the vertical passage 2. A well fluid seal is provided between the upper end surface of the body 1 and the flange of the crown 8 by a ring joint gasket 10 secured in place by studs 11 and their accompanying nuts. The crown is also provided with a bore 12 for well fluid to pass through on its way to the well head equipment or Christmas tree, generally indicated at 13 and mounted on the crown 8 and sealed against leakage of well pressure by the ring joint gasket 14. Suitable studs 15 and their accompanying nuts are provided to firmly secure the upper well head equipment 13, to the crown 8.

A ram carrier 16, composed of two identical interlocking segmental sections, having interlocking lugs 17 and sockets 18, is adapted to be inserted through the vertical passage 2 into the ram chambers 3 in the body 1 of the blowout preventer. These sections are inserted individually and formed into a unit after insertion. They are machined as a unit to provide a downwardly tapering bore 19. Ram guides 20 are held in place on the bottom surface of the ram chambers 3 by dowel pins 21. The ram carriers are so designed that a shouldered bottom surface 22 is adapted to slide on the ram guides 20 when the ram is advanced or retracted to close or open the vertical passage through the blowout preventer.

A pair of identical interlocking segmental ram inserts 23, are provided with interlocking lugs 24 and sockets 25, as well as with radial disposed passages having resilient packing 26 molded therein and thereto to form unitary resilient packing elements 23*a*. These are adapted to be inserted, individually and formed into a single unit after insertion, to seat within the tapered bore 19. These packing elements are so constructed that they may be removed through the vertical passage 2 when worn or when the size of the well tubing must be changed.

When initially installing a ram type blowout preventer using my improved packing element, the body 1 is secured to the well head 5 as described above. The two part ram carrier 16 is inserted into the ram chambers 3 and operatively secured to the actuating mechanism, generally indicated at 27. The resilient packing elements 23*a* are seated in the tapered bore 19 of the ram carrier 16. The crown 8 is then secured to the body 1 and the balance of the upper well head equipment 13 is secured in place. The resilient packing elements 23*a*, being thus lightly confined, may be moved transversely in the ram chambers to close about or retract from a tubing hanger nipple 28 supporting a well tubing string 29.

The description of the actuating mechanism 27 will be found in detail in my co-pending application Serial Number 698,691, now abandoned, filed simultaneously with the subject application.

When initially setting the packing elements 23*a* into sealing engagement about the hanger nipple 28 the weight of the tubing string 29 is suspended by overhead hoisting equipment (not shown). During this operation it is important that only the weight of the tubing string be relieved and that the string itself be not lifted from its position in the well. This permits freedom of movement of the rams so they may be readily advanced to close and seal about the tubing hanger.

It is apparent when the rams of my device are closed about the tubing that the ram inserts will be forced upward out of the tapered bowl of the carriers into intimate contact with the face of the skirt 9 of the crown 8. This is true because as the rams are brought together around the tubing string, the excess resilient packing material moulded into the ram inserts is further compressed within the directed taper of the bowl of the carriers. It is important to note that any compression set up in the resilient packing material at any extremity of the ram insert is directed by my construction to the opposite extremity because of the radially disposed packing passages. After this latter operation has been completed the overhead hoisting means is released and the full weight of the tubing string rests upon the packing elements 23*a* through the intimate contact of the shouldered surface of the hanger nipple 28 with the top surface of the packing elements, further forcing the resilient packing into the tapered bore 19 and about the hanger nipple 28.

During the normal producing life of a well the pressure of both the fluid within the tubing and the pressure of the fluid within the annulus between the tubing and the next casing will vary.

This pressure variance will exert a force upon any member or members, effectively separating the two pressure areas and this force will act in the direction of the greater pressure.

Therefore, when the direction of the differential pressure is upward it will only tend to urge the resilient packing material **26** of the ram inserts into further sealing engagement for this material is directly subjected to pressure in this direction.

Further, when the direction of the differential pressure is downward it acts upon the upper surface of the segmental ram inserts **23** forcing these metal cores downward into the tapered bore of the carriers and thereby forces the interposed resilient packing material **26** into further sealing engagement, for the surface area of the metal core of the insert is many times greater than the circumferential area of the resilient packing that is exposed to pressure in this direction.

When it becomes necessary to repack the ram due to a worn-out packing **26** the following procedure is followed. As is the custom with all types of blowout preventers when repacking is necessary, the well must be killed as explained above before the seal excluding the well pressure from the atmosphere is released. When this is accomplished the Christmas tree **13** is removed and swung to one side. The crown **8** is next removed and a length of tubing (not shown) is secured in the upper threaded end of the hanger nipple **28**. Overhead hoisting equipment (not shown) is then used to support the hanger nipple **28** with the tubing string **29** attached thereto while the worn-out packing element **23***a* is removed and replaced with a new one.

When it is necessary to change the size of the tubing string, the same procedure is followed with the exception that the new resilient packing element **23***a* is of a size to properly seal about the tubing used. Reassembly procedure is the same as described above for initially setting up of the blowout preventer to seal against well pressure.

It is apparent from the foregoing that my improved replaceable packing element possesses merit and utility not found in other blowout preventers on the market today. While only the preferred form of my invention has been disclosed and described herein, I do not wish to be limited or restricted to the specific details set forth and wish to reserve to myself any further embodiments, modifications and variations that may appear to those skilled in the art or come within the scope of the appended claims.

Having fully described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. A blowout preventer including a body having a vertical passage therethrough with a shoulder therein, a pair of ram assemblies disposed within said passage on opposite sides of a tubing hanger nipple supporting a string of well tubing passing through said passage, said ram assemblies insertable through said vertical passage and movable transversely to open and close said passage about the hanger nipple, said ram assemblies comprising a plurality of segmental ram carriers provided with a tapered bore and a plurality of segmental ram packing elements, all of said segments being insertable and removable through said vertical passage, said carriers seating on said shoulder, a crown engaging the upper end surface of said packing elements through the vertical passage in said body and exerting axial pressure on said elements in opposition to said ram carriers, sealing means between said crown and body, and means to secure said crown to said body and simultaneously apply axial pressure on said packing elements in opposition to the tapered bore of said ram carriers to urge the former to have inward radial movement.

2. A blowout preventer including a body having a vertical passage therethrough, a pair of ram assemblies disposed within said passage on opposite sides of a tubing hanger nipple supporting a string of well tubing passing through said passage and movable transversely to open and close said passage about the hanger nipple, said ram assemblies comprising a pair of interlocking segmental ram carriers provided with a tapered bore and a pair of interlocking segmental molded resilient packing elements separately insertable and removable through said vertical passage and seating in said bore, a shoulder on said body in said passage, said ram carriers seating on said shoulder and opposing axial thrust of the packing elements, closure sealing means to seal off said vertical passage against well pressure and simultaneously to apply axial pressure on said packing elements in opposition to the tapered bore of said ram carriers to urge inward radial movement of said packing elements.

3. In combination with a ram-type blowout preventer having a vertical passage through its body, a pair of ram assemblies disposed within said passage on opposite sides of a tubing hanger nipple supporting a string of well tubing passing through said passage, said ram assemblies insertable through said vertical passage and movable transversely to open and close said passage about the hanger nipple, and comprising a pair of identical interlocking segmental ram carriers provided with a vertically downwardly extending tapered bore and seating in the body passage and also a pair of identical interlocking segmental molded resilient packing elements, each of said carrier segment and elements being insertable and removable through said passage, said elements when inserted seating in the tapered bore of said carriers, a shoulder on said hanger nipple resting on the upper end surface of said packing elements whereby the weight of said tubing string bears upon the resilient packing elements to force them downwardly against the tapered bore of said ram carriers, and closure sealing means to seal off said vertical passage against well pressure while simultaneously urging said resilient packing elements into intimate sealing engagement with said tapered bore by downward pressure thereon in opposition to the ram carriers.

4. In combination with a ram-type blowout preventer having a vertical passage through its body, a pair of ram assemblies disposed within said passage and on opposite sides of a tubing hanger nipple supporting a string of well tubing passing through said passage, said ram assemblies being insertable through said passage and movable transversely to open or close said passage about said hanger nipple and comprising a pair of identical interlocking segmental ram carriers provided with a vertically downwardly extended tapered bore and seating in said body passage, said ram assemblies also including a pair of identical interlocking segmental molded resilient packing elements, said elements when inserted seating in the tapered bore of said ram carriers, a shoulder on said hanger nipple resting on the upper end surface of said packing elements whereby the weight of said tubing string bears upon the resilient packing elements to force

them into the tapered bore of said ram carriers, a crown engaging the upper end surface of said packing elements through said vertical passage, sealing means between said crown and body, and means to secure said crown to said body while simultaneously urging said packing elements into the bore of said ram carriers to effect a tightening pressure of the packing elements against said nipple.

5. A blowout preventer including a body having a vertical passage for receiving a tubing string, said passage having a restriction therein forming an upwardly facing seat, a ram carrier in said passage on said seat, a sectional ram packing element resting on said carrier and radially contractible around a tubing hanger nipple in the passage, said carrier and element having cooperating surfaces urging contraction of said packing element under vertical pressure on said cooperating surfaces, and a passage closing means removably mounted on said body and sealing off said passage against well pressure.

6. A combination as called for in claim 5 wherein each of said ram carrier and packing element is composed of radially separable sections for separate insertion into and removal from the vertical body passage upon removal of said passage closing means.

7. A combination as called for in claim 5 wherein the passage closing means when attached to said body serves to apply downward pressure to said ram carrier and packing element in opposition to said seat.

8. A blowout preventer including a body having a vertical passage therethrough with an upwardly facing seat therein, rams in said passage on opposite sides of a tubing hanger nipple passing through said passage, said rams being movable transversely to open or close said passage about said hanger nipple and comprising a carrier annulus and a packing annulus one above the other in said passage and one resting on said seat, said annuli each including a plurality of separable segments for separate insertion into and removal from the passage, and said packing annulus, at least, being radially contractible, said two annuli having tapered coacting surfaces causing radial contraction of the packing annulus when downward pressure is applied to said annuli in opposition to said seat, and removable means closing the upper end of said passage against well pressure therein.

9. A combination as called for in claim 8 wherein said closing means also contacts the upper side of said packing annulus to apply downward axial pressure thereto.

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