United States Patent

Bishop et al.

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[54] **WIRELINE BLOWOUT PREVENTER**

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[73] Assignee: **Bowen Tools, Inc.**

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[52] **U.S. Cl.** **277/73,** 277/127, 277/199

[51] **Int. Cl.** **B65d 53/00**

[58] **Field of Search**.....277/126, 127, 73, 32, 129, 277/199; 251/159

[56] **References Cited**

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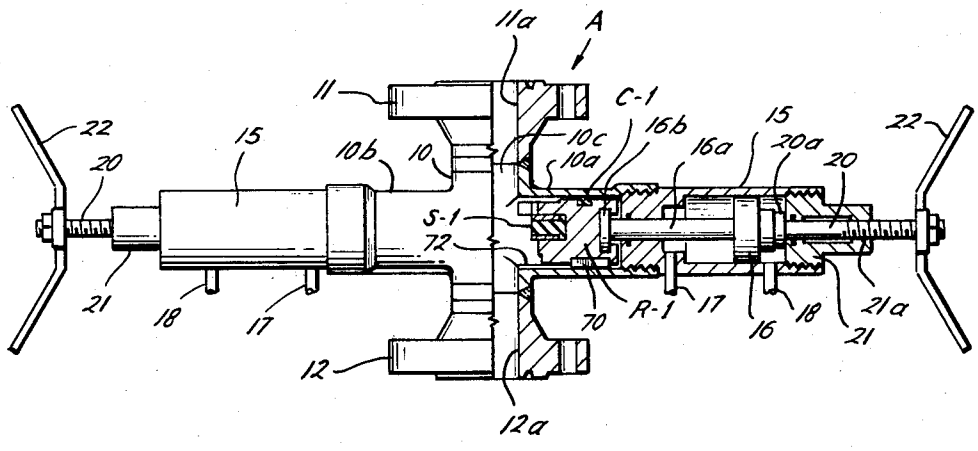
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[57] **ABSTRACT**

A blowout preventer having a pair of preventer rams adapted to seal around a wireline in a well pipe, and having new and improved wireline guide means with each preventer ram which provides positive centering of the wireline as the rams move towards each other. Also, the guide means is strengthened as compared to the prior art and it eliminates inadvertent shearing of the wireline by the guide means as the rams move towards each other to the sealing position.

8 Claims, 6 Drawing Figures

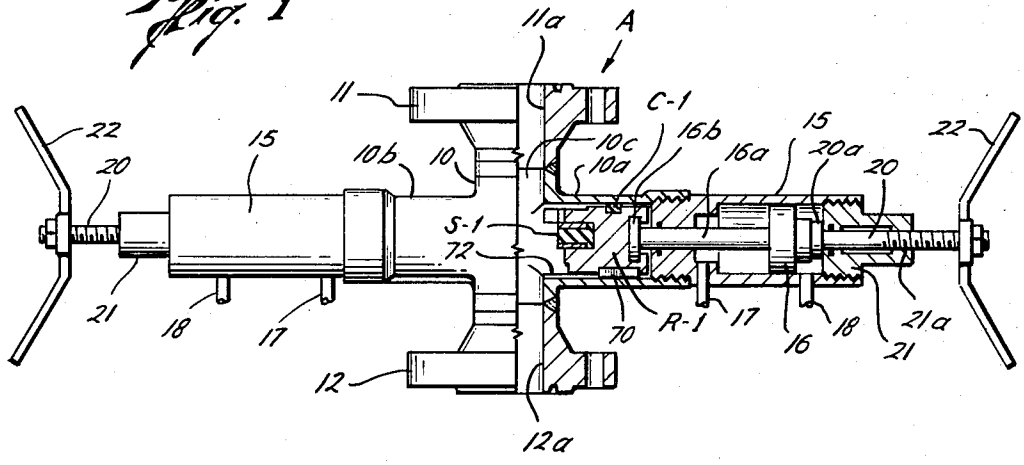


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SHEET 1 OF 2

Fig. 1



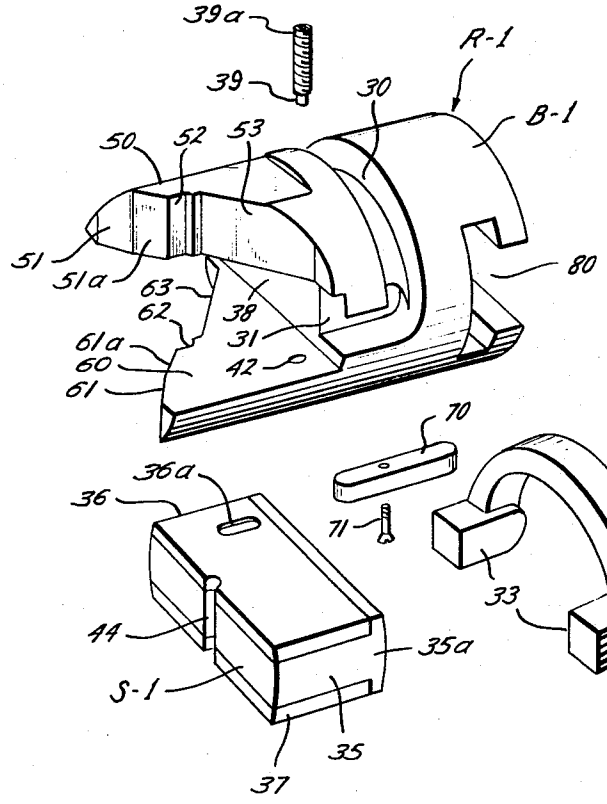


Fig. 2

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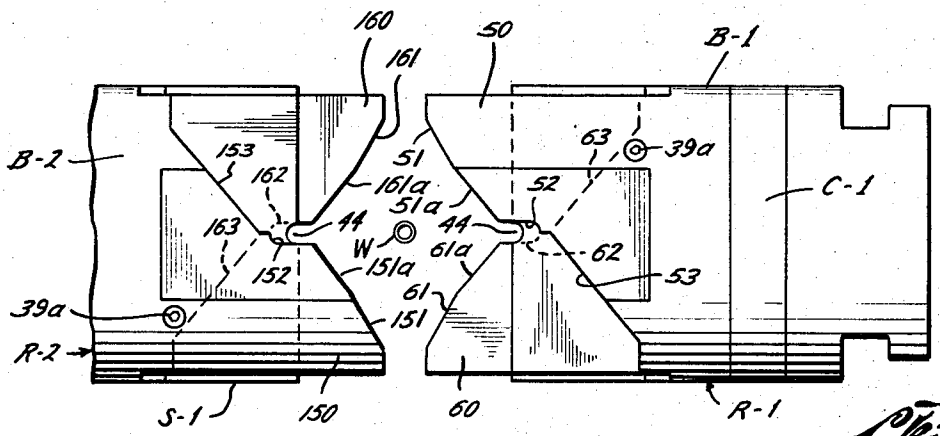


Fig. 3

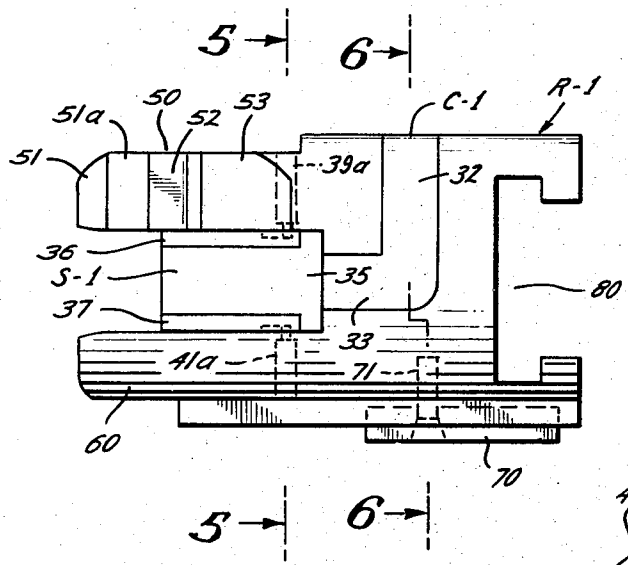


Fig. 4

Fig. 5

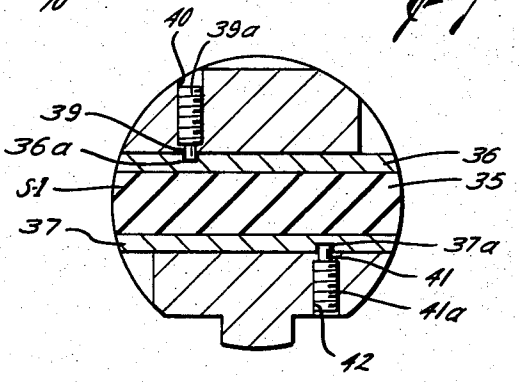
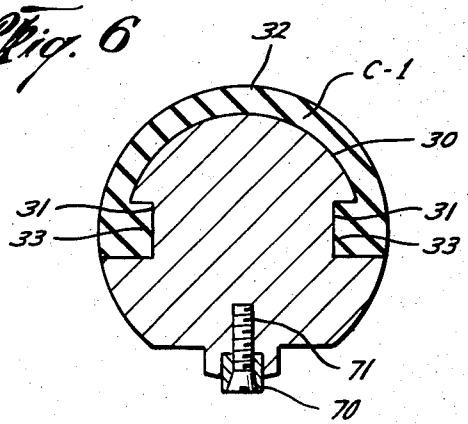


Fig. 6



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WIRELINE BLOWOUT PREVENTER

BACKGROUND OF THE INVENTION

The field of this invention is blowout preventers having rams for sealing around a wireline in a well pipe.

In the past, blowout preventers having rams for sealing off around a wireline had an upper V-shaped guide-member on one of the rams and a lower V-shaped guide member on the other of the rams A slot was provided in each ram opposite each V-shaped guide member for receiving same when the rams were in the sealing position around the wireline. The slots weakened the ram bodies, and the co-action between the guide members and the slots sometimes resulted in a shearing of the wireline.

SUMMARY OF THE INVENTION

The present invention relates to a blowout preventer having preventer rams for sealing around a wireline, wherein new and improved wireline guide means is provided for positively guiding a wireline into a centered position as the rams are moved towards each other, and wherein such guide means is stronger than the prior art and is constructed so that it eliminates inadvertent shearing of a wireline by such guide means as the rams move towards each other to the sealing position.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevation, partly in section, illustrating the blowout preventer construction of this invention;

FIG. 2 is an exploded view of one of the ram bodies and ram seals for the blowout preventer of this invention;

FIG. 3 is a plan view of one of the ram bodies and a portion of the other ram body to illustrate the coaction therebetween in the guiding of a wireline into sealing engagement with the ram seals with each ram body;

FIG. 4 is an elevation of the ram body shown in FIG. 2, but illustrating same in the assembled condition with the ram seals in position with the ram body;

FIG. 5 is a vertical sectional view taken on line 5—5 of FIG. 4 to illustrate further details thereof; and

FIG. 6 is a vertical sectional view taken on line 6—6 of FIG. 4 to further illustrate the construction details of the ram body and seal illustrated in FIG. 4. DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, the letter A designates generally the blowout preventer of this invention which includes a conventional blowout preventer body **10** having cylindrical portions **10***a* and **10***b* therewith for receiving rams R–1 and R–2. The blowout preventer body **10** has a longitudinal passage or bore **10***c* therethrough for the normal passage of a wireline and well tools, as well as well fluids and other fluids used in connection with the well. The body **10** preferably has an upper flange **11** and a lower flange **12** welded thereto for connection in a Christmas tree or other well head assembly in the known manner. The flanges **11** have longitudinal passages or bores **11***a* and **12***a*, respectively, which are in alignment with the longitudinal passage **10***c* in the body **10** and which are also in alignment with the well pipe connected above and below the blowout preventer A by means of such flanges **11** and **12**, as will be well understood by those skilled in the art.

The rams R–1 and R–2 may be manually actuated or hydraulically actuated, but as illustrated in FIG. 1 of the drawings, hydraulic actuating means are provided, together with an emergency manual actuating means. Thus, the body **10** is formed with an operating cylinder **15** at each end thereof, each of which has a piston **16** therein and suitable hydraulic fluid lines **17** and **18**. The piston **16** has a piston stem **16***a* with a connector button **16***b* of conventional construction at its inward end for releasable attachment to its respective ram R–1 or R–2. The rams R–1 and R–2 may thus be moved inwardly and outwardly by the action of hydraulic fluid on the pistons **16** and the cylinders **15**, as will be well understood.

In the event it is desired to move the rams by manual means rather than the hydraulic fluid means, manually actuated operating stems **20** are provided which are threaded into an end cap **21** which is secured to the hydraulic cylinder **15**. A handle **22** is preferably provided on each of the stems **20** for rotating the stems **20** to threadedly move them inwardly and outwardly in coacting threads **21***a* on each end cap **21**. The inward end of each stem **20** has a head **20***a* which engages the piston **16**, but does not normally move therewith. However, when the stem **20** is moved inwardly, or towards the longitudinal opening **10***c*, and the hydraulic fluid is relieved inwardly of the piston **16**, the piston **16** may be moved mechanically inwardly to thereby move the ram attached thereto inwardly towards the central opening **10***c*. After the stems **20** have been rotated for mechanical movement of the rams inwardly, the stems **20** can thereafter be moved outwardly to the position shown in FIG. **1**, but since they are not directly connected to the piston **16**, the pistons **16** do not move therewith. Therefore, it is necessary to either move the pistons **16** outwardly by the introduction of hydraulic fluid into the cylinder **15** inwardly of the piston **16**, or some other means must be provided to move the rams to their retracted position shown in FIG. **1**. Normally, of course, the manually operated stems **20** are not actuated except to close the rams in an emergency situation wherein the hydraulic system fails to function. It will be appreciated, however, that the hydraulic system can be completely eliminated and the stems **20** can be directly connected to the rams R–1 and R–2, in which event, the rams are moved mechanically in both directions with respect to the central longitudinal opening **10***c*.

Considering now the details of the preferred form of the ram R–1 as best seen in FIGS. **2–6**, such ram R–1 has a ram body B–1, an outer substantially semi-circular seal C–1, and an inner substantially flat seal S–1.

The body B–1 is formed with a semi-circular slot **30** having terminating end recesses **31** which receive the outer seal C–1. The seal C–1 is formed of rubber or other similar sealing material and it has a central curved portion **32** which fits within the slot or recess **30**, and it also has terminating end portions **33** which fit within the terminating end recesses **31** of the slot **30** in the conventional manner.

The inner seal S–1 is preferably formed with a central seal member **35** formed of rubber or other suitable sealing material, with an upper metal plate **36** and a lower metal plate **37** confining the rubber **35** therebetween. The rubber **35** has a substantially T-shape since its outer end **35***a* extends behind the plates

36 and 37 for sealing contact with surface 38 of the body B–1 and the end portions 33 of the outer seal C–1. The upper plate 36 has a slot 36*a* formed therein (FIGS. 2 and 5) for receiving a pin 39 on the end of a retaining screw 39*a* which is threaded into a suitable opening 40 in the body B–1.

The ram body B–1 has an upper guide member 50 which is preferably integral with the rest of the body B–1. A lower guide member 60 is also formed, preferably integrally, with the body B–1, and they are spaced apart from each other so as to form a lateral slot into which the ram seal S–1 is positioned. As previously explained, the ram seal S–1 is removably held in such slot between the upper guide member 50 and the lower guide member 60 by retaining pin 30 having a threaded screw 39*a* therewith in the opening 40. It should also be noted that an additional retaining pin 41 having a threaded screw 41*a* therewith may be threaded into a threaded opening 42 in the body B–1 (FIG. 5) for engagement in a slot 37*a* which corresponds with the slot 36*a* in shape, but it is positioned off center as illustrated in FIG. 5. By unthreading the pins 39 and 41 from the slots 36*a* and 37*a*, the entire ram seals S– 1 may be removed from the body B–1. The body B–1 is formed of metal or other relatively high strength material, and since the guide members 50 and 60 are preferably integral with the body B–1, they are formed of the same material.

For maintaining the body B–1 in proper alignment during movements thereof inwardly and outwardly within the blowout preventer body 10, a key 70 which is preferably secured to the body B–1 by a connection screw 71 is utilized and it fits within a suitable slot 72 (FIG. 1) formed in the body 10 inwardly of the cylindrical portion 10*a* for the ram R–1. A similar slot (not shown) is formed in the cylindrical portion 10*b* for the ram R–2.

The upper guide member 50 has a guide surface 51 which preferably is formed with an increasing inclination or taper at its portion 51*a* in the vicinity of its central portion which has a recess or notch 52 formed therein. The upper guide member 50 is cut away or is inclined in a substantial continuation of the inclined guide surface 51 at surface 53 so as to receive a corresponding inclined surface 151 on an upper guide member 150 of the ram R–2, as will be more fully explained. It is to be noted that the recess or notch 52 extends outwardly or further from the center of the longitudinal bore 10*c* than does a semi-circular notch or recess 44 which extends through the central portion of the ram seal S–1 (FIGS. 2 and 3).

The lower guide member 60 is formed with an inclined guide surface 61 which also has an increased inclination at the central portion 61*a* which is in the vicinity of a notch or recess 62. The inclined surface of the lower guide member 60 continues on at substantially the same angle as indicated at the surface 63 to provide a cutaway portion for receiving the inclined surface portion 161 of the lower guide member 160 of the ram R–2, as will be more fully explained.

It should be noted that the angles of inclination of the surfaces 51 and 61 of the upper guide member 50 and the lower guide member 60 of the ram R–1, respectively, are opposite to each other so that when viewed from above as in the plan view (FIG. 3) they form a substantially V-shape with the point of the V terminating at the vertical notch 44 in the seal S–1 so as to serve as a guide means for guiding a wireline W (FIG. 3) which is extending through the blowout preventer A to such notch 44 for sealing engagement with the Seal S–1.

The ram R–2 is identical with the ram R–1 and therefore, like parts have like designations in connection with both of the rams R–1 and R–2. However, the upper guide member 150 is disposed in a complementary position to that of the upper guide member 50. This makes it possible for the upper guide members 50 and 150 to be disposed in substantially the same plane and to interfit with each other. Likewise, the lower guide member 160 of the ram R–2 is formed in a complementary position to that of the lower guide member 60 of the ram R–1 so as to lie in substantially the same plane and so as to interfit with each other for the guiding action, as will be explained. It should be noted that the upper guide member 150 has corresponding inclined surfaces 151 and 151*a* to the inclined surfaces 51 and 51*a*, but at opposite angles of inclination. Also, the upper guide member 50 has a notch 152 which together with the notch 52 forms a pocket or enclosure surrounding the wireline W when the rams are in the closed sealing position with the ram seals S–1 for both of the rams in contact with the wireline W. The upper guide member 150 also has a cutaway portion formed by an inclined surface 153 which is complementary to the upper guide member surface 51 to facilitate and permit the interfitting between the guide members 50 and 150 in the closed sealing position with the wireline W.

The lower guide member 160 has corresponding inclined surfaces 161 and 161*a* which are at opposite angles to the inclined surfaces 61 and 61*a*. Also, the lower guide member 160 has a recess or notch 162 which together with the notch 62 forms an enclosure for confining wireline W when the rams R–1 and R–2 are in the closed sealing position with the wireline W. Also, the lower guide member 160 has a cutaway portion defined by the inclined surface 163 to permit the interfitting between the guide members 60 and 160 in the closed sealing position.

The opening 80 formed in the ram R–1 and also similarly formed in the ram R–2 (not shown) are conventional in shape and are for releasably engaging the piston button or head 16*b* connected to the piston rod 16*a* in the known manner.

In the operation or use of the blowout preventer apparatus A of this invention, the rams R–1 and R–2 are normally in the retracted or open position illustrated in FIG. 1. When it is desired to close off the longitudinal passage 10*c* to prevent fluid flow therethrough, when a wireline W is in such blowout preventer A, the rams R–1 and R–2 are moved towards each other, utilizing the hydraulically actuated pistons 16, or the mechanically actuated stems 20. Since the wireline W is not normally exactly centered within the longitudinal opening 10*c*, it must be guided to a central position so that it ends up in the notches 44 of the ram seals S–1 on the rams R–1 and R–2 in order to seal around the wireline W and to completely seal off the opening 10*c* with the ram seals S–1 and the outer seals C–1. Thus, regardless of the position of the wireline W within the longitudinal opening 10*c* when it is desired to close off such opening

10*c*, one of the surfaces **51**, **61**, **151**, or **161** will engage the wireline W and will cause it to move inwardly towards the central recesses **44** in the ram seals S–1. The greater inclination or taper of the inclined portions **51***a*, **61***a*, **151***a* and **161***a* is not necessary, but it does increase the speed at which the wireline W moves towards the central portion of the ram bodies and thus to the recesses **44** as the rams R–1 and R–2 move towards each other for finally sealing around the wireline W.

Since the guide members **50**, **60**, **150** and **160** do not enter slots, there is no danger of shearing the wireline W by such guide members as they move towards their closed position. The full mass of each guide member **50**, **60**, **150** and **160** is obtained above and below the ram seals S–1, and the integral connection with the ram bodies B–1 and B–2 provide greater strength in such guide members than was heretofore obtained.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape, and materials as well as in the details of the illustrated construction may be made without departing from the spirit of the invention.

We claim:

1. A blowout preventer ram adapted to sealingly engage a wireline in a well pipe, comprising;

a first ram body;

an upper guide member on said first ram body;

a lower guide member on said first ram body below said upper guide member and spaced therefrom to form a lateral slot therebetween which has an outer slot surface;

said body having a semi-circular slot in its upper portion only and terminating in end recesses which communicate with said lateral slot;

a resilient seal strip disposed in said semi-circular slot and said end recesses;

an inner ram seal assembly disposed in said lateral slot and including a resilient central seal member having a substantially T-shape, and a metal back-up plate above and below said seal member alongside the leg of said T-shape;

the head of said T-shape being disposed in contact with said outer surface of said lateral slot and said seal strip at said end recesses;

the inner surface of said central seal member and said metal back-up plates being in the same plane;

means to secure said inner seal assembly in said lateral slot;

said upper guide member having an inclined surface for guiding engagement of said wireline towards contact with said ram seal;

said lower guide member having an inclined surface for guiding engagement of said wireline towards contact with said ram seal; and

said inclined surface of said upper and lower guide members being at opposite angles of inclination with respect to each other.

2. The structure set forth in claim **1**, wherein said blowout preventer ram has a second ram body with a semi-circular slot in its upper portion only and terminating in end recesses, and including:

an upper guide member on said second ram body having an inclined surface for guiding engagement with a wireline and adapted to interfit with said upper guide member on said first ram body for guiding a wireline as the rams are moved towards each other;

a lower guide member on said second ram body below said upper guide member on said second ram body and spaced therefrom to form a lateral slot which has an outer slot surface, and said lower guide member also having an inclined surface for guiding engagement with a wireline and adapted to interfit with said lower guide member on said first ram body for guiding a wireline as the rams are moved towards each other;

said end recesses and said lateral slot in said second ram body being in communication with each other;

a second resilient seal strip disposed in said semi-circular slot and said end recesses of said second ram body;

a second inner ram seal assembly disposed in said lateral slot of said second ram body and including a central seal member having a substantially T-shape, and a metal back-up plate above and below said seal member alongside the leg of said T-shape; the head of said T-shape being disposed in contact with said outer surface of said lateral slot in said second ram body and said seal strip at said end recesses;

the inner surface of said central seal member and said metal back-up plates of said second seal assembly being in the same plane; and

means to secure said second seal assembly in said lateral slot of said second ram body.

3. The structure set forth in claim **2**, wherein:

said upper guide members on said first and second ram bodies are in substantially the same plane; and

said lower guide members on said first and second ram bodies are in substantially the same plane.

4. The structure set forth in claim **3**, wherein:

said inclined surfaces on said upper guide members are at substantially the same angle of inclination; and

said inclined surfaces on said lower guide members are at substantially the same angle of inclination.

5. The structure set forth in claim **4**, wherein:

each of inclined surfaces on said upper guide members has a notch which is complementary to the notch on the other upper guide member and which notches are of a size to form an opening for a wireline to extend therethrough when said ram seals are in sealing engagement with the wireline.

6. The structure set forth in claim **4**, wherein:

each of inclined surfaces on said lower guide members has a notch which is complementary to the notch on the other lower guide member and which notches are of a size to form an opening for a wireline to extend therethrough when said ram seals are in sealing engagement with the wireline.

7. The structure set forth in claim **4**, wherein:

each of inclined surfaces on said upper guide members has a notch which is complementary to the notch on the other upper guide member and which notches are of a size to form an opening for a wireline to extend therethrough when said central seal members are in sealing engagement with the wireline; and

each of inclined surfaces on said lower guide members has a notch which is complementary to the notch on the other lower guide member and which notches are of a size to form an opening for a wireline to extend therethrough when said central seal members are in sealing engagement with the wireline.

8. The structure set forth in claim 2, wherein:

each of said inclined surfaces on said guide members has an increased taper in proximity to the central portion thereof to facilitate the guiding action of a wireline towards such central portion.

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