

SPECIFICATION

Pipe shearing ram assembly for blowout preventer

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This invention relates to a shear ram assembly for a blowout preventer.

10 Prior art blowout preventer shear rams include a type in which a seal is provided for the face or faces of the shear blades to seal against (U.S. Patent No. 3,651,526 to L. E. Williams, Jr. et al) and another type in which the seal for the blades is contained in a recess in one of the blades to seal against the other 15 shear blade along the shear plane (U.S. Patent Specification Nos. 3 817 326 and 3 736 982). For each time these rams are operated to shear, they are operated a great number of times to act as blind rams. The 20 service life of such shear rams is limited by excessive ram packing forces which result from limited packing area and the excessively wide crack between confronting blade surfaces which is bridged by packing. Also with 25 the prior art pipe shear rams for blowout preventers little attention is given to assure that the pieces of the sheared pipe do not interfere with the sealing.

30 According to one aspect of the present invention there is provided a blowout preventer comprising a body having a pipe opening therethrough, ram guideways extending laterally from opposite sides of the pipe opening, a ram assembly comprising a pair of rams 35 located one in each of the ram guideways, and means for moving the rams together to close off the pipe opening and for moving the rams apart to open the pipe opening, each ram having a shear blade so located that the 40 shearing edge of the blade on one ram can pass just below the shearing edge of the blade on the other ram to shear any pipe positioned in the pipe opening when the rams are moved together to close off the opening, 45 seal means on one of said rams including a seal positioned to be engaged and compressed by the shear blade of the other ram when the rams are extended to form a seal, and characterised by a shoulder on the ram having the lower shear blade, a recess below 50 said upper shear blade, said seal means being positioned above the upper surface of said lower shear blade and below said shoulder, pipe forcing means including a wedge shape 55 on the leading edge of the upper shear blade which coacts with said shoulder on said lower shear blade to raise the sheared pipe above the lower shear blade out of the path between said upper shear blade and said seal means.

60 According to another aspect of the present invention there is provided a shear ram assembly for a ram type blowout preventer having a pair of rams, each ram having a shear blade attached thereto and so located 65 that the shearing edge of the blade on one

ram can pass just below the shearing edge of the blade on the other ram to shear any pipe positioned in the pipe opening when the rams are moved together to close off the opening, 70 seal means on one of said rams positioned to be engaged and compressed by the shear blade of the other ram when the rams are extended to form a seal, and characterised by a shoulder on the ram having the lower shear 75 blade, a recess above said upper shear blade, said seal means being positioned above the upper surface of said lower shear blade, and pipe forcing means including a wedge shape on the leading edge of the upper shear blade 80 which coacts with said shoulder to raise the sheared pipe above the lower shear blade out of the path between said upper shear blade and said seal means.

A drain may be provided through the lower 85 shear blade to allow debris and metal particles to fall therethrough and thus not interfere with the face seal.

This structure minimises wear on the seal and avoids having to seal around pipe ends 90 and metal debris.

The invention will be described now by way of example only with particular reference to the accompanying drawings. In the drawings:

95 *Figure 1* is a side view partially in section of a blowout preventer having a ram assembly in accordance with the present invention in retracted position;

100 *Figure 2* is a detailed sectional view of the shear blades in sealed position following the shearing of a pipe;

105 *Figure 3* is a partial detailed sectional view of the shear blades following the pipe shearing to show the movement of the sheared pipe section out of the path of the shear blade sealing face, and

Figure 4 is an isometric view of the ram assembly.

A blowout preventer 10 shown in Fig. 1 is generally of the usual design including a body 110 12 having a pipe bore 14 through which pipes such as 16 are adapted to extend, a shear ram assembly 18 and pressure responsive means 20 and 22 for moving rams 24 and 26 toward each other into a sealed position in which they close the pipe bore 14, and 115 for retracting the rams 24 and 26 from such position.

The rams 24 and 26 are slidable in the guideways 28 and 30 within body 12 and are provided with suitable sealing means 32 and 34. The ram 24 has shear blade 36 projecting toward ram 26 which has the projecting shear blade 38. Both shear blades 36 and 38 are of the well known design with the central portion of at least one blade 36 recessed and the side portions extending toward the other ram to provide some centering of the pipe 16 as the rams close thereon. This blade contour is shown in Fig. 4 and is similar to the blades 125 130 disclosed in the aforementioned Meynier Pa-

tent No. 3,817,326. Blade 36 coacts with blade 38 to shear pipe 16, as shown in Fig. 2 along the shearing plane which is established along the upper surface of blade 36 and along the lower surface of blade 38. The blade 38 has a leading edge which is wedge shaped, the shear blade forming an angle with the shearing plane of not more than 45°. The shearing plane may actually allow a small gap between the upper and lower blades to avoid interference thereof.

Ram 24 includes the face seal 40 positioned within recess 42 and the shoulder 44 immediately above face seal 40. Shoulder 44 is positioned to coact with the forward or leading face 46 of shear blade 38 to lift or wedge the cut section 47 of pipe 16 upward out of the path of shear blade 38 so that its face 46 can seal against the face seal 40.

In shearing pipe small pieces of metal may break loose from the pipe section 47 and collect on the upper surface of shear blade 36. Such debris if not properly handled could interfere with the blade face sealing. It has been suggested that the upper surface of blade 36 includes a groove 48. With such groove 48 these small pieces of metal fall therein and are out of the path of blade 38 toward seal 40. We provide at least one drain hole 50 (preferably a plurality of drain holes) extending through blade 36 to drain debris collecting in groove 48 downward into the bore 14 to assure that excess debris does not fill and overflow groove 48 and thus interfere with the face sealing.

The shear blade 38 projects outward from ram 26 to provide a recess below the upper shear blade 38 so that the lower section of cut pipe has a recess in which it may be positioned after shearing. It is also preferred that the ram 26 provide a recess above the upper shear blade 38 in which the upper cut section of pipe may be positioned if it is not raised after shearing by the tension in pipe 16.

The blowout preventer of the present invention thus provides improved ram assemblies with a face seal which avoids the problem of rams moving across seals and also eliminates the interference of the cut pipe section and debris with the face seal.

CLAIMS

1. A blowout preventer comprising a body having a pipe opening therethrough, ram guideways extending laterally from opposite sides of the pipe opening, a ram assembly comprising a pair of rams located one in each of the ram guideways, and means for moving the rams together to close off the pipe opening and for moving the rams apart to open the pipe opening, each ram having a shear blade so located that the shearing edge of the blade on one ram can pass just below the shearing edge of the blade on the other ram to shear

any pipe positioned in the pipe opening when the rams are moved together to close off the opening, seal means on one of said rams including a seal positioned to be engaged and compressed by the shear blade of the other ram when the rams are extended to form a seal, and characterised by a shoulder on the ram having the lower shear blade, a recess below said upper shear blade, said seal means being positioned above the upper surface of said lower shear blade and below said shoulder, pipe forcing means including a wedge shape on the leading edge of the upper shear blade which coacts with said shoulder on said lower shear blade to raise the sheared pipe above the lower shear blade out of the path between said upper shear blade and said seal means.

2. A blowout preventer according to claim 1 wherein the wedge shape on the leading edge of the upper shear blade forms an angle with the shear plane of not more than 45°.

3. A blowout preventer according to either of claims 1 or 2 including a transverse groove in the upper surface of said lower shear blade whereby debris is received therein to clear the path of the upper shear blade for sealing with said seal means, and drain means communicating with said groove and extending through said lower shear blade whereby debris collecting in said groove may pass through said drain holes into the pipe opening below said lower shear blade.

4. A blowout preventer according to claim 1, including a recess above said upper shear blade.

5. A shear ram assembly for a ram type blowout preventer having a pair of rams, each ram having a shear blade attached thereto and so located that the shearing edge of the blade on one ram can pass just below the shearing edge of the blade on the other ram to shear any pipe positioned in the pipe opening when the rams are moved together to close off the opening, seal means on one of said rams positioned to be engaged and compressed by the shear blade of the other ram when the rams are extended to form a seal, and characterised by a shoulder on the ram having the lower lower shear blade, a recess above said upper shear blade, said seal means being positioned above the upper surface of said lower shear blade, and pipe forcing means including a wedge shape on the leading edge of the upper shear blade which coacts with said shoulder to raise the sheared pipe above the lower shear blade out of the path between said upper shear blade and said seal means.

6. A shear ram assembly according to claim 5 wherein the wedge shape on the leading edge of the upper shear blade forms an angle with the shear plane of not more than 45°.

7. A shear ram assembly according to



tent No. 3,817,326. Blade 36 coacts with blade 38 to shear pipe 16, as shown in Fig. 2 along the shearing plane which is established along the upper surface of blade 36 and along the lower surface of blade 38. The blade 38 has a leading edge which is wedge shaped, the shear blade forming an angle with the shearing plane of not more than 45°. The shearing plane may actually allow a small gap between the upper and lower blades to avoid interference thereof.

Ram 24 includes the face seal 40 positioned within recess 42 and the shoulder 44 immediately above face seal 40. Shoulder 44 is positioned to coact with the forward or leading face 46 of shear blade 38 to lift or wedge the cut section 47 of pipe 16 upward out of the path of shear blade 38 so that its face 46 can seal against the face seal 40.

In shearing pipe small pieces of metal may break loose from the pipe section 47 and collect on the upper surface of shear blade 36. Such debris if not properly handled could interfere with the blade face sealing. It has been suggested that the upper surface of blade 36 includes a groove 48. With such groove 48 these small pieces of metal fall therein and are out of the path of blade 38 toward seal 40. We provide at least one drain hole 50 (preferably a plurality of drain holes) extending through blade 36 to drain debris collecting in groove 48 downward into the bore 14 to assure that excess debris does not fill and overflow groove 48 and thus interfere with the face sealing.

The shear blade 38 projects outward from ram 26 to provide a recess below the upper shear blade 38 so that the lower section of cut pipe has a recess in which it may be positioned after shearing. It is also preferred that the ram 26 provide a recess above the upper shear blade 38 in which the upper cut section of pipe may be positioned if it is not raised after shearing by the tension in pipe 16.

The blowout preventer of the present invention thus provides improved ram assemblies with a face seal which avoids the problem of rams moving across seals and also eliminates the interference of the cut pipe section and debris with the face seal.

CLAIMS

1. A blowout preventer comprising a body having a pipe opening therethrough, ram guideways extending laterally from opposite sides of the pipe opening, a ram assembly comprising a pair of rams located one in each of the ram guideways, and means for moving the rams together to close off the pipe opening and for moving the rams apart to open the pipe opening, each ram having a shear blade so located that the shearing edge of the blade on one ram can pass just below the shearing edge of the blade on the other ram to shear

any pipe positioned in the pipe opening when the rams are moved together to close off the opening, seal means on one of said rams including a seal positioned to be engaged and compressed by the shear blade of the other ram when the rams are extended to form a seal, and characterised by a shoulder on the ram having the lower shear blade, a recess below said upper shear blade, said seal means being positioned above the upper surface of said lower shear blade and below said shoulder, pipe forcing means including a wedge shape on the leading edge of the upper shear blade which coacts with said shoulder on said lower shear blade to raise the sheared pipe above the lower shear blade out of the path between said upper shear blade and said seal means.

2. A blowout preventer according to claim 1 wherein the wedge shape on the leading edge of the upper shear blade forms an angle with the shear plane of not more than 45°.

3. A blowout preventer according to either of claims 1 or 2 including a transverse groove in the upper surface of said lower shear blade whereby debris is received therein to clear the path of the upper shear blade for sealing with said seal means, and drain means communicating with said groove and extending through said lower shear blade whereby debris collecting in said groove may pass through said drain holes into the pipe opening below said lower shear blade.

4. A blowout preventer according to claim 1, including a recess above said upper shear blade.

5. A shear ram assembly for a ram type blowout preventer having a pair of rams, each ram having a shear blade attached thereto and so located that the shearing edge of the blade on one ram can pass just below the shearing edge of the blade on the other ram to shear any pipe positioned in the pipe opening when the rams are moved together to close off the opening, seal means on one of said rams positioned to be engaged and compressed by the shear blade of the other ram when the rams are extended to form a seal, and characterised by a shoulder on the ram having the lower lower shear blade, a recess above said upper shear blade, said seal means being positioned above the upper surface of said lower shear blade, and pipe forcing means including a wedge shape on the leading edge of the upper shear blade which coacts with said shoulder to raise the sheared pipe above the lower shear blade out of the path between said upper shear blade and said seal means.

6. A shear ram assembly according to claim 5 wherein the wedge shape on the leading edge of the upper shear blade forms an angle with the shear plane of not more than 45°.

7. A shear ram assembly according to



- claim 6 including a transverse groove in the upper surface of said lower shear blade whereby debris is received therein to clear the path of the upper shear blade for sealing with
- 5 said seal means, and drain means communicating with said groove and extending through said lower shear blade whereby debris collecting in said groove may pass through said drain holes into said pipe opening below said lower shear blade.
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8. A blowout preventer substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

9. A shear ram assembly substantially as
- 15 hereinbefore described with reference to and as shown in the accompanying drawings.

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