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[73] Assignee **Esso Production Research Company**

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[54] **PIPE ALIGNMENT APPARATUS**
10 Claims, 9 Drawing Figs.

[52] U.S. Cl..... **166/85,**
277/11, 251/1

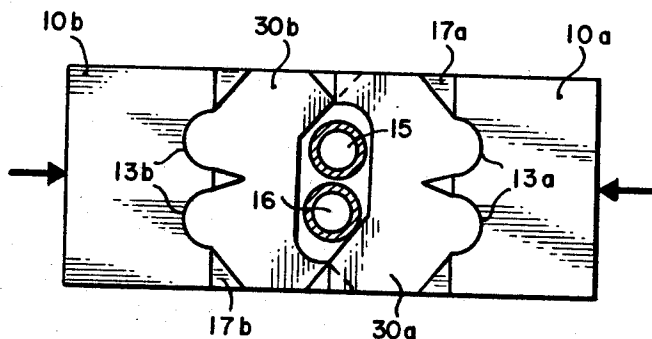
[51] Int. Cl..... **E21b 33/06**

[50] Field of Search..... 138/103;
277/11; 251/1; 166/75, 85, 82, 86, 89, 93, 189

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ABSTRACT: Pipe alignment apparatus for use with ram type blowout preventers used when running dual pipe strings into underwater wells from a floating vessel. A housing contains two alignment rams facing each other. The front face of each alignment ram is configured such that when the alignment rams close about two pipe strings, proper positioning of the pipe strings for engagement with grooves formed in each ram gate front face of a ram-type blowout preventer is ensured.



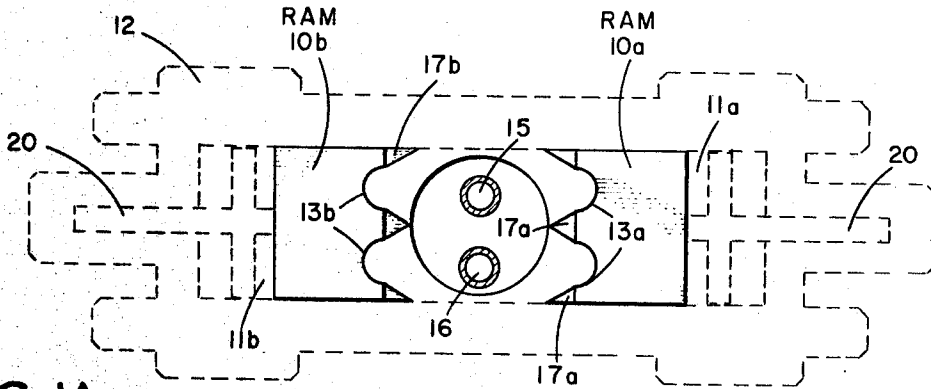


FIG. 1A.

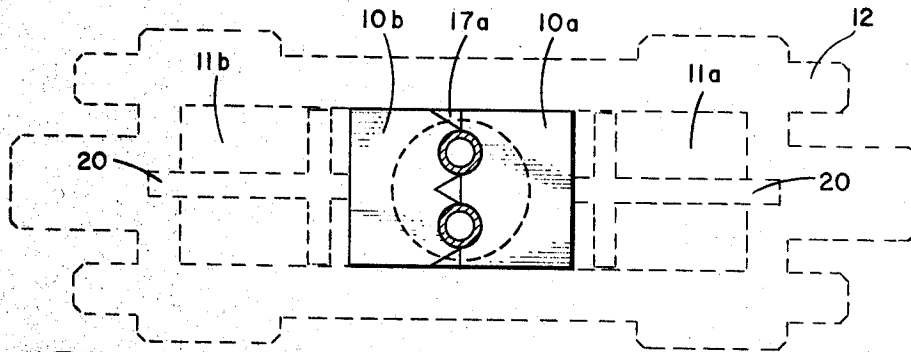


FIG. 1B.

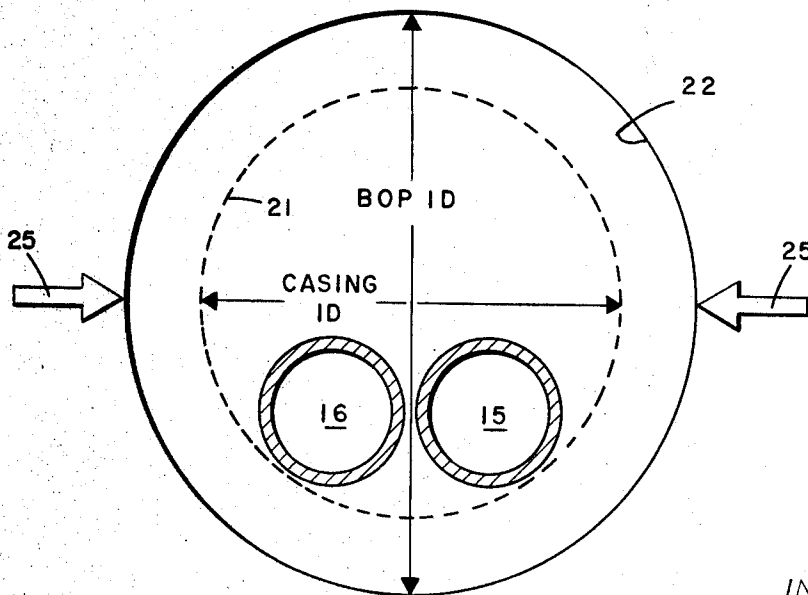


FIG. 2.

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FIG. 3A.

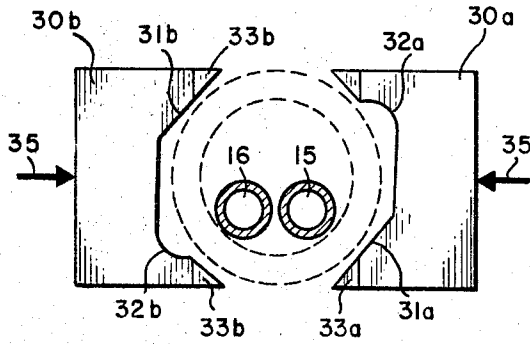


FIG. 3B.

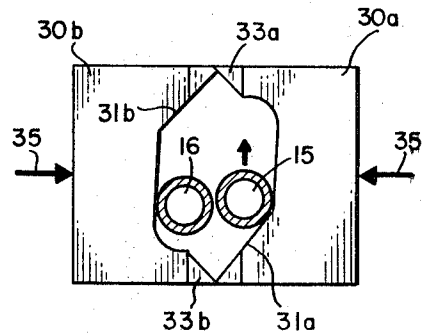


FIG. 3C.

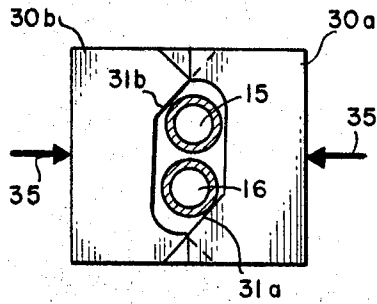


FIG. 4.

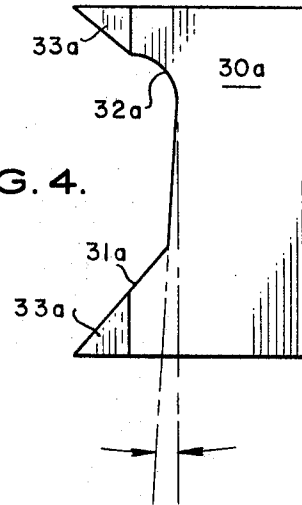


FIG. 3D.

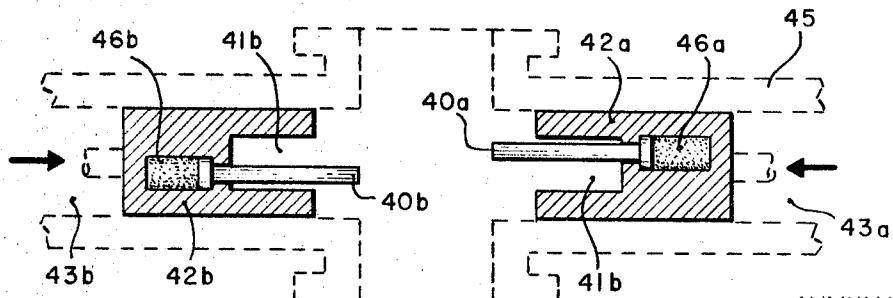
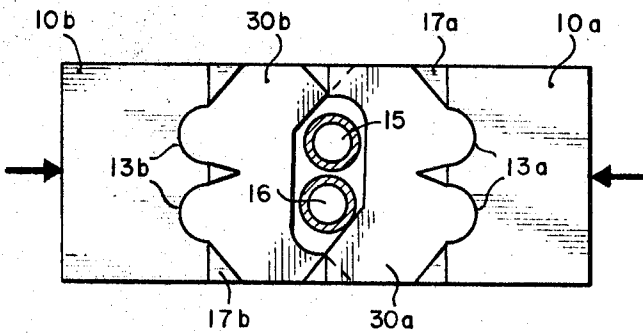


FIG. 5.

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PIPE ALIGNMENT APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention concerns apparatus for aligning pipes for ram type blowout preventers which are used in conjunction with running multiple tubing or casing strings from a floating rig.

When performing well work from a floating vessel where a submerged wellhead is utilized, underwater blowout preventers are employed. A mating conductor pipe connects the underwater blowout preventer (BOP) stack to the floating vessel. The individual BOP's in the stack are remotely operated from the floating vessel. When dual (parallel) tubing or casing strings are to be run, dual-string rams would be required to be placed in the BOP's; however, in order to utilize conventional pipe rams, provision must be made for general pipe orientation with respect to the ram gate faces. On land-type drilling rigs when the BOP's are close to the drilling floor, orientation is achieved by placing a crowbar between the pipe strings which would be hanging in the elevators and manually orienting the strings in the proper general direction or by some other manual means. Pipe guides built into the face of the ram gates complete the alignment and permit proper closing and pack-off. Where remote, underwater wellheads are used, the dual strings may spiral around each other in a marine riser, especially if the rig floor on the vessel is several hundred feet above the BOP stack on the ocean floor. These strings may be situated at the BOP level in a manner to prevent conventional dual-string rams from aligning the pipe strings for proper BOP functioning. The present invention uses alignment apparatus for properly aligning dual strings for underwater BOPs automatically.

SUMMARY OF THE INVENTION

Pipe alignment apparatus for use with BOP's used when running dual pipe strings into wells including a housing having two spaced-apart alignment ram chambers. An alignment ram is arranged in each alignment chamber. The alignment rams are movable toward each other to a closed position and away from each other to an open position. Each alignment ram front face is configured such that when the alignment rams are moved to the closed position thereof, proper positioning of dual pipe strings for engagement with grooves formed in each ram gate front face of a ram-type BOP is ensured. When incorporated in the BOP housing, the alignment chambers are arranged in the BOP ram gates and means are provided in each alignment chamber for urging the alignment ram to protrude from the face of the ram gate but permitting retraction of the alignment ram into the alignment chamber as the front face thereof engages and aligns the two pipes into proper position for engagement in ram gate semicircular grooves formed in each ram gate front face. Means are provided for remotely closing and opening the ram gates and alignment rams.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A, 1B illustrate typical conventional dual-string rams in their opened and closed positions, respectively;

FIG. 2 illustrates conventional dual-string rams and showing misalignment of the pipe strings with respect to the dual-string BOP;

FIGS. 3A—D illustrate the alignment apparatus of the invention and underwater BOP apparatus used therewith;

FIG. 4 illustrates one part of the alignment apparatus in greater detail; and

FIG. 5 illustrates combined dual-string alignment and BOP apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1A and 1B, the face of each BOP ram gate 10a, 10b arranged in chambers 11a, 11b in BOP housing

12 housing 12 has dual, semicircular grooves 14a, 13b to fit around the two pipe strings 15, 16. Each ram gate also has beveled pipe guides 17a, 17b built into the face of each ram gate 10a, 10b, respectively. These triangularly shaped guides 17a, 17b overlap each other as the ram gates are closed, as illustrated in FIG. 1B. Such pipe guides provide final adjustment in pipe alignment to funnel each pipe string into the BOP grooves 13a, 13b. Suitable piston-cylinder mechanisms 20 are incorporated into BOP housing 12 for moving ram gates 10a, 10b to open and closed positions by remote hydraulic operation.

Referring to FIG. 2, there is shown pipe strings 15, 16 in misalignment position. These pipe strings are within a large casing pipe 21 which, in turn, is surrounded by the larger BOP stack 22. Assuming pipe strings 15, 16 were positioned in the manner shown in FIG. 2 at the BOP level, the conventional dual-string rams shown in FIGS. 1A and 1B could not align the pipe strings for proper BOP functioning. The arrows 25 indicate BOP closing direction. Pipe guides 17a, 17b would funnel both pipe strings into one side of the ram and the pipe strings would be partially crushed, leaving neither pipe string in the opening on the other side of the BOP ram.

In FIGS. 3A—D alignment apparatus for aligning dual strings in accordance with the teachings of the present invention is shown. Such apparatus includes two alignment rams 30a, 30b facing each other. The front face of each alignment ram is formed with a surface 31a, 31b which slants from one end thereof in a horizontal direction away from the opposing ram front face and then extends to the other end thereof in a horizontal direction toward the opposing ram front face. The latter slanted surface preferably contains a curved portion 32a, 32b. Each of the end surfaces on each alignment ram is also provided with overlapping guide members 33a, 33b. The direction of the slanted surfaces of one alignment ram face and the location of the curved surface are opposite to the direction of the slanted surfaces and the location of the curved surface of the other alignment ram face. The degree or amount of curvature of the curved surfaces is substantially the same as the curvature of the pipe strings. The angle of each slanted surface which slants away from the opposing ram front face is at least sufficient to permit pipe members to move relative to each other and be properly aligned with each other in a plane perpendicular to the direction of closure of the alignment rams and thereby prevent crushing of the pipe members when the alignment rams close. Such slanted surfaces preferably slant initially sharply and then more gradually as shown. Alternatively, such surfaces could extend at a uniform slope to the curved surfaces. Hydraulic means are preferably used for closing and opening the alignment rams. The arrows 35 indicate the direction for BOP closure. FIG. 4 shows the alignment ram 30a in greater detail. FIG. 3A is a plan view of the alignment apparatus in open position. The two pipe strings 15, 16 are shown in the same misaligned position as they were shown in FIG. 2. FIG. 3B is a similar view showing alignment rams 30a, 30b being closed and kicking pipe strings 15, 16 into rough alignment. FIG. 3C is a similar view showing alignment rams 30a, 30b being closed and pipe strings 15, 16 in proper alignment. FIG. 3D is a similar view showing the dual-string ram gates 10a, 10b ready to close to the aligned pipe strings which are held in position by alignment rams 30a and 30b. Thus, the configuration is compatible with conventional dual-string rams which are now capable of closing properly around the two pipe strings.

In FIG. 5, the dual-string alignment and BOP apparatus is arranged in a BOP housing. Each dual string alignment ram 40a, 40b is arranged in a chamber 41a, 41b in each ram gate 42a, 42b which is, in turn, arranged in a chamber 43a, 43b formed in BOP housing 45. Each chamber 43a, 43b is provided with a resilient rubber or spring cushion 46a, 46b in the rear thereof to urge alignment rams 40a, 40b to protrude from the face of each ram gate but permitting retraction of the alignment rams into the alignment chamber as the front face thereof engages and aligns the two pipe strings into proper position for engagement in the ram gate grooves.

We claim:

1. Pipe alignment apparatus for use with blowout preventers used when running dual pipe strings into wells comprising:

a housing having two spaced-apart pipe alignment ram chambers;

an alignment ram arranged in each alignment chamber;

said alignment rams being movable toward each other to a closed position and away from each other to an open position; and

each alignment ram front face being configured such that when said alignment rams are moved to the closed position thereof proper positioning of said dual pipe strings for engagement with grooves formed in each ram gate front face of a ram-type blowout preventer is ensured.

2. Apparatus as recited in claim 1 including means for remotely closing and opening said alignment rams.

3. Apparatus as recited in claim 1 in which each alignment ram front face is formed with a surface which slants from one end thereof in a horizontal direction away from the opposing alignment ram front face and then extends to the other end thereof in a horizontal direction toward the opposing ram front face, the angle of each slanted surface which slants away from the opposing alignment ram front face is at least sufficient to permit said pipes to move relative to each other and be properly aligned with each other in a plane perpendicular to the direction of closure of the alignment rams to thereby prevent crushing of the pipe members when the alignment rams close.

4. Apparatus as recited in claim 3 in which the slanted surface extending toward the opposing ram surface contains a curved portion the degree of which is substantially the same as the curvature of said pipes.

5. Apparatus as recited in claim 4 in which each of the ends of said slanted surfaces on each alignment ram is provided with pipe guide members adapted to overlap when said alignment rams close.

6. Blowout control apparatus used when running dual pipe strings into wells comprising:

a BOP housing having two ram gate chambers therein;

a ram gate arranged in each chamber and having two grooves formed in the front face thereof;

a pipe alignment chamber arranged in each ram gate;

a pipe alignment ram arranged in each alignment chamber;

means in each alignment chamber for urging said alignment ram to protrude from the face of said ram gate but permitting retraction of said alignment ram into said alignment chamber as the front face of said alignment ram engages and aligns said dual pipes into proper position for engagement in said ram gate grooves;

each alignment ram front face being configured such that when said alignment rams are moved to the closed position thereof proper positioning of said dual pipe for engagement with said grooves formed in each ram gate front face is ensured.

7. Apparatus as recited in claim 6 including means for remotely closing and opening said alignment rams.

8. Apparatus as recited in claim 6 in which each alignment ram front face is formed with a surface which slants from one end thereof in a horizontal direction away from the opposing alignment ram front face and then extends to the other end thereof in a horizontal direction toward the opposing ram front face, the angle of each slanted surface which slants away from the opposing alignment ram front face is at least sufficient to permit said pipes to move relative to each other and be properly aligned with each other in a plane perpendicular to the direction of closure of the alignment rams to thereby prevent crushing of the pipe members when the alignment rams close.

9. Apparatus as recited in claim 8 in which the slanted surface extending toward the opposing ram surface contains a curved portion the degree of which is substantially the same as the curvature of said pipes.

10. Apparatus as recited in claim 9 in which each of the ends of said slanted surfaces on each alignment ram is provided with pipe guide members adapted to overlap when said alignment rams close.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,554,278 Dated January 12, 1971

Inventor(s) Carl E. Reistle, III, et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the bibliographical data:

Delete "[45] Patented Dec. 22, 1970" and insert
--[45] Patented Jan. 12, 1971--

Signed and sealed this 6th day of March 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents