SAFETY ENCLOSURE FOR OFF-SHORE OIL RIGS

Inventor: Lawrence F. Roy, 27 Rambler Road, Southampton, Pa. 18966

Filed: Feb. 17, 1972

Appl. No.: 227,053

U.S. Cl. 169/2 R, 166/5, 166/75, 175/9

Int. Cl. A62c 3/00

Field of Search 169/1 A, 2 R, 5;
166/5, 75; 175/5-10

References Cited

UNITED STATES PATENTS
3,554,290 1/1971 Verdin.................169/2 R

3,664,429 5/1972 Jones..........................169/2 R
3,685,584 8/1972 Gracia..........................169/2 R

Primary Examiner—Allen N. Knowles
Assistant Examiner—Michael Mar
Attorney—Bacon and Thomas

ABSTRACT

The floatable safety enclosure is formed by a plurality of upwardly extending, floatable wall sections which are adapted to be floated into position around an offshore oil or gas well platform and secured together to form a continuous, dome-like wall around the platform.

16 Claims, 6 Drawing Figures
SAFETY ENCLOSURE FOR OFF-SHORE OIL RIGS

This invention relates to extinguishing off-shore oil and gas well fires and to confining oil escaping from such wells which are not under control.

In the past, off-shore gas and oil well fires have been difficult to extinguish, and the expense involved in extinguishing these fires, which in many instances has been extremely high, adds to the cost of production and thus increases the cost of gas and oil used by the consumer.

Off-shore gas and oil well fires often burn for many days or weeks thereby not only polluting the atmosphere and water in the vicinity, but also needlessly wasting natural resources.

BRIEF SUMMARY OF THE INVENTION

The floatable safety enclosure of this invention obviates many of the difficulties and disadvantages previously encountered in extinguishing gas and oil well off-shore fires and provides an enclosure or dome for enclosing an off-shore platform or rig with a continuous wall which extends above the top of the rig a substantial distance so that a fire within the enclosure is quickly smothered.

It is an object of this invention to provide a floatable safety device or enclosure for off-shore gas or oil well platforms which will prevent combustion supporting air outside of the enclosure from reaching a fire within the enclosure.

Another object of the invention is to provide a safety enclosure which may be floated into position around an off-shore platform.

A further object of the invention is to provide an enclosure formed of a plurality of parts which may be floated into position around an off-shore platform and then secured together to provide a continuous wall or dome around the platform.

It is also an object of the invention to provide an enclosure for off-shore oil rigs which will deny combustion supporting air to a fire within the enclosure and will confine oil escaping from uncontrolled wells discharging within the enclosure.

These and other objects and advantages of the invention will become more apparent from the following specification and claims when taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of one form of the floatable safety enclosure;
FIG. 2 is a cross sectional view taken on the line 2—2 of FIG. 1 showing a layer of crude oil within the enclosure;
FIG. 3 is an enlarged, fragmentary, top plan view showing the ballast chambers of the enclosure secured together;
FIG. 4 is an enlarged, fragmentary, perspective view showing the cooperative ends of the ballast chambers spaced apart;
FIG. 5 is a top plan view of a second form of the floatable safety enclosure; and
FIG. 6 is an elevation view of the enclosure of FIG. 5.

DETAILED DESCRIPTION OF THE DRAWINGS

The form of the invention shown in FIGS. 1–4 comprises an enclosure, formed of two floatable sections designated generally A and B, which provides a continuous wall around an oil or gas off-shore platform designated generally by the reference character C.

The enclosure is of generally circular configuration in plan view and is of generally frusto-conical configuration in transverse section. Since the sections A and B are similar in structure, only section A will be described in detail.

Section A of the floatable safety enclosure includes a lower portion 3 of generally hemispherical configuration which extends upwardly from a hollow float or ballast chamber 5 and converges inwardly toward the off-shore drilling rig platform C. As seen in cross section in FIG. 2, the lower wall portion 3 appears to be of generally frusto-conical configuration.

The upper wall portion 7 extends upwardly from the upper edge 9 of the lower wall portion 3 and converges inwardly at a greater angle to the vertical than does the lower wall portion 3. The upper wall portion is also of generally frusto-conical configuration as viewed in cross section in FIG. 2 and the portion of the wall which extends around and is adjacent to the top opening 11 formed in the upper wall portion 7 is curved and is directed downwardly and converges inwardly of the opening to provide a curved deflector portion 13 on the inner surface of the upper wall portion 7.

The lower edge 15 of the lower wall portion 3 is semi-circular and is mounted on the upper surface of the float or ballast chamber 5 which is also of semi-circular configuration.

The float or ballast chamber 5 includes a top wall 17 on which the lower wall portion 3 is mounted, a bottom wall 19, an inner wall 21, and an outer wall 23. The ballast chamber also includes the walls 24 and 25 at either end thereof which complete the ballast chamber 5 and make it air and water tight.

A plurality of rigid feet 26 are fixedly secured to the bottom wall 19 at spaced intervals along the bottom wall from one end to the other end thereof and are adapted to engage the ground for supporting the ballast chamber 5 and the remainder of the section A above the surface of the ground. If desired, instead of a plurality of feet 25, a single, continuous, arcuate foot could be attached to the bottom wall 19 and extend from adjacent one end to adjacent the other end of the ballast chamber.

The ballast chamber 5, which is preferably formed of heavy sheet metal welded together to form a water tight float, is of sufficient size and strength to support the wall portions 3 and 5 in a generally vertical position above the surface of the water. The ballast chamber may be partially filled with water or additional solid ballast may be added to the chamber as found necessary.

The outer surface 27 of the lower wall portion 3 and the outer surface 29 of the upper wall portion 7 is preferably formed of heavy sheet metal and both the lower and the upper wall portions 3 and 7 are provided with a lining of a suitable fire resistant material 31 such as asbestos or a ceramic.

Heavy, metal gusset plates 33 are welded or otherwise fixedly secured to the top wall 17 of the ballast
chamber 5 and to the outer surface 27 of the lower wall portion 3 in order to maintain the wall of section A in an upright position.

A walkway or catwalk 35 extends around the outer periphery of the lower wall portion 3 and is supported above the top wall 17 of the ballast chamber 5 by suitable support members 37. Suitable ladders, not shown, extend from the platform 35 to the top wall 17 of the ballast chamber and a fire-proof closure 39 is mounted in the lower wall portion 3 so that access to the interior of the enclosure may be had from the platform 35.

The ballast chamber 5 carries one or more reversible pumps 41 which are adapted to pump ballast water from the outside of the enclosure into the ballast chamber 5 through a conduit 43 or to pump the ballast water out of the ballast chamber through the conduit 43. A plurality of flood ports 44 controlled by valves 44a permit water from outside the chamber 5 to flow into the chamber when the valves are open. In this manner, the floating section may be lowered or raised in the water. Electric power generating means, not shown, is carried by the section A for supplying the electric power required to operate pumps or other machinery carried by the section.

In order to cool the walls of the section A of the enclosure, a curved spray head or pipe 45 provided with suitable spray orifices 47, is fixedly secured adjacent the top edge of the outer surface 29 of the upper wall portion 7. Water under pressure is adapted to be supplied to the spray head 45 from outside of the enclosure through a conduit 49 and pump 51. The pumps 41 and 51 may be mounted on the top wall 17 of the ballast chamber 5 and a control 52 for these two pumps may be suitably located on the walkway 35.

The sections A and B, after being floated into position around an off-shore gas or oil rig, are adapted to be secured together to provide a continuous wall or dome around the off-shore well platform. In describing section B, the reference numerals employed in describing section A, will be used followed by an 'a' to designate like parts.

The end wall 24 of the ballast chamber 5 of section A and the adjacent end wall 25a of the ballast chamber section B, as best shown FIGS. 1, 3, and 4, are provided with cooperating tongue and groove structure for securing the section A and B together with the ballast chambers 5 and 5a in substantially vertical and horizontal alignment and with the generally vertically extending side edge portions of the lower and upper wall portions of sections A and B contiguous.

The end wall 24 of section A is formed with a vertically extending, tapered groove 53 while the end wall 25 of section A is formed with a tapered tongue 55. In like manner, the end wall 25a of the ballast chamber 5a of section B is provided with a tongue 55a which cooperates with the groove 53 of section A while the other end of the ballast chamber 5a of section B is provided with a groove 53a into which the tongue 55 of section A extends.

As shown in FIG. 4, the groove 53 of section A includes a pair of side walls 57 and 59 which converge inwardly from the end wall 24 to an inner end wall 61 while the tongue 55a of section B includes the side walls 63a and 65a which extend outwardly from the end wall 25a and converge to an outer end wall 67a.

A ledge 69a is positioned below the tongue 55a at one end of the ballast chamber 5a of section B and extends outwardly and upwardly to provide a male bottom rest which is adapted to be seated in a socket 71 formed in one end of the ballast chamber 5 of section A. The ledge 69a and socket 71 cooperate to assist in maintaining the sections A and B in vertical alignment while the tongue 55a and groove 53 hold the sections in horizontal alignment. The other end of the ballast chamber 5 of section A is provided with a ledge similar to the ledge 69a of section B while the other end of the ballast chamber 5a is provided with a socket similar to the socket 71 of section A.

The side edge portions of the walls 3 and 7 are provided with sealing members 73 which cooperate with the adjacent side edge portions of the walls of section B and form a tight joint between the walls of sections A and B for preventing the air outside of the enclosure for entering the interior thereof between the side edges of the side walls of the dome.

The cooperating ends of the ballast chambers 5 and 5a are drawn together by means of power driven winches 75 and 75a mounted on the top wall of ballast chambers 5 and 5a. As best shown in FIG. 4, the winch 75a fixed on ballast chamber 5a includes a rotatable drum 77a on which a steel cable 79a is wound. The free end of the cable 79a carries a hook 81a adapted to be detachably connected to an l-bolt 83 fixed to the lower portion of the adjacent gusset plate 33 carried by ballast chamber 5.

After the cooperating ends of the sections A and B are drawn into proximity by the winches 75 and 75a, hydraulic chain jacks 85 and 85a are employed for holding the cooperating ends of the ballast chambers in engagement with the tongues 55 and 55a seated in the grooves 53 and 53a. The chains 87 and 87a carried by the hydraulic chain jacks 85 and 85a are connected to upstanding hooks 89 and 89a carried by the top wall of the ballast chamber of the adjacent section.

After the sections A and B are moved into position around an off-shore platform and attached together by the chains 87 a77a, the ballast chambers 5 and 5a form a continuous enclosure which will serve to confine any oil which escapes from the enclosed wall heads. The ballast chambers 5 and 5a are quite large and the inner walls 21 and 21a extend downwardly below the surface of the water for a substantial distance so that a layer of oil may accumulate within the enclosure to a depth of many feet before the lower surface of the oil would reach the bottom edge of the inner walls 21 and 21a. Any oil accumulating within the enclosure may be pumped into a barge or other storage vessel by means of a pump 91 connected with a conduit 93 which extends through the lower wall portion 3 and then downwardly into the liquid confined within the enclosure.

A fire within the enclosure would be extinguished as soon as the oxygen in the air within the enclosure was consumed. Since the ballast chambers and the lower and upper wall portions of the sections completely enclose the rig, and hot gases of combustion would flow outwardly through the relatively small top opening 11, air for supporting combustion could not enter the enclosure and therefore the fire would be quickly extinguished for lack of oxygen.
In order to more quickly extinguish a blaze or fire within the enclosure, fire extinguishing chemicals or the like may be discharged into the interior of the enclosure through the top opening 11 from the semi-circular spray pipes 95 and 95a carried by the sections A and B. The spray pipes 95 and 95a are disposed above and immediately adjacent to the inner periphery of the top opening 11 so that material being discharged from the orifices 97 of the spray pipes will be directed into the top opening above the enclosed platform.

The sections A and B are each provided with means to anchor them in position, not shown, and each section would carry a supply of various types of fire fighting chemicals as well as the tools and equipment necessary to repair a well and its platform after a fire has been extinguished.

While the enclosure is illustrated and described as being formed of two sections A and B, it could obviously be formed of more than two sections. The dimensions of the sections of the enclosure are determined to some extent by the number of well heads connected with an off-shore platform and with the size and height of the rig.

A great advantage of the floatable safety enclosure is that the sections can be moved into position close to a burning off-shore rig or platform by being pushed by a tug or like vessel. The tub would be protected from the fire by the wall of the section which would constitute a barrier or heat shield for the tug.

The concept of this invention includes a floatable safety enclosure of any suitable configuration, such as for example triangular or square formed of a plurality of sections secured together in abutting relationship so as to trap oil within the enclosure and to provide a continuous wall around an shore platform for preventing combustion supporting air from reaching a fire within the enclosure.

In the form of the invention illustrated in FIGS. 5 and 6, the safety enclosure is of generally square configuration and is formed by a pair of similar sections 102 and 104. Section 102 includes vertically extending walls 106, 108, and 110 fixedly mounted on a water and air tight ballast chamber 112 which may be flooded with water or pumped out in a manner similar to that already described in connection with the form of the invention shown in FIGS. 1-4.

Support blocks or feet 114 for engaging the ground and the section are fixed to the lower surface of the ballast chamber 112, and a walkway 116 extends around the outside of the walls 106, 108, and 110 a short distance above the upper surface of the ballast chamber 112.

The section 112 includes a top wall 118 which abuts against the top wall 120 of the section 104. A semi-circular opening 126, formed in the edge of the top wall 118 midway between the opposite edges of the edge of the wall, cooperates with a semi-circular opening 128 formed in the edge of the top wall 120, to form a circular opening 130 when the section 102 and 104 are secured together.

In order to assist in bringing the sections 102 and 104 into alignment, an aligning tongue 122 is provided on the edge of the top wall 118 at one side of the circular opening 130 and a cooperating recess 124 is formed in the edge of the top wall 120 for receiving the tongue 122. A like arrangement is provided on the other side of the circular opening 130 where an aligning tongue 132 is formed on the edge of the top wall 120 and a cooperating recess 134 is formed in the edge of the top wall 118 to receive the aligning tongue 132. The sections 102 and 104 may be further maintained in alignment and secured together by providing the ballast chambers of the sections with alignment and securing means similar to those shown in FIGS. 1-4 and employed in connection with the form of the invention previously described. In like manner, the walls of the sections 102 may be line with fire resistant material and the walls may be cooled by spraying water on the outer surface thereof. A ladder 136 extends from the walkway 116 to the top of section 102.

A closure 138 provided for the circular opening 130, is pivotally mounted at 140 on the top wall 118 and is adapted to be moved from the closed position shown in solid lines to the open position shown in broken lines by a hydraulic motor 142. The cylinder of the hydraulic motor 142 is pivoted at 144 to the upper wall 118 of section 102 and the projecting end of the piston rod 146 is pivoted at 148 to the closure 138. By actuating the hydraulic motor 142, the closure 138 may be moved to selectively cover or uncover the circular opening 130.

The floatable safety enclosure shown in FIGS. 5 and 6 is similar to the one previously described and is adapted to extinguish fires within the enclosure by preventing combustion supporting air from reaching the interior of the enclosure. Oil escaping from a well within the enclosure is trapped and confined by the ballast chambers and may be pumped out of the enclosure to a barge or storage facility in a manner similar to that described above.

While preferred forms of the invention have been described and disclosed herein, such changes and modifications as may occurred to those skilled in the art are to be considered within the perview of this invention as fall within the scope of the appended claims.

What I claim is:

1. A floatable safety enclosure for off-shore oil rigs comprising: a wall of fire resistant material completely surrounding an off-shore oil rig and extending from the surface of the water upwardly to a height substantially above the upper end of the rig, said wall comprising a plurality of upwardly extending adjacent sections each having generally vertically extending, side edge portions; float means rigid with the lower edge portion of each section of the wall and extending along the length thereof for supporting the wall sections in a generally vertical attitude above the surface of the water; and means for detachably securing adjacent sections together with the side edge portions of adjacent sections in abutment whereby said sections form a continuous wall around the oil rig.

2. A floatable safety enclosure according to claim 1 in which the walls of the sections converge upwardly and the upper edge portions of the wall sections form a top opening over the rig, the distance around the periphery of the top opening being substantially less than the distance around the periphery of the lower edge of the wall.

3. A floatable safety enclosure according to claim 2 in which the wall formed by said sections is of generally frusto-conical shape and includes upper and lower...
3,730,278

frusto-conical portion, the upper frusto-conical portion extending upwardly from the upper edge of the lower frusto-conical portion, the wall of the upper frusto-conical portion converging upwardly at a greater angle to the vertical than the wall of the lower frusto-conical portion.

4. A floatable safety enclosure according to claim 2 in which the portion of the wall extending around and adjacent to the top opening is directed downwardly and converges inwardly of the opening providing a curved deflector for directing smoke and flame rising with the enclosure back into the interior thereof.

5. A floatable safety enclosure according to claim 2 which includes means carried by said enclosure for discharging fire extinguishing substance into the interior of said enclosure through said top opening.

6. A floatable safety enclosure according to claim 5 in which said means for discharging the fire extinguishing substance comprises, spray discharge means positioned around the periphery of the top opening and pump means operably connected with said spray discharge means and with a source of said substance.

7. A floatable safety enclosure according to claim 1 in which the upwardly extending walls of each section are generally planar, and the enclosure includes a top wall of fire resistant material which extends inwardly over the oil rig from the planar walls of said sections.

8. A floatable safety enclosure according to claim 7 in which said top wall is provided with an opening, a closure for said opening is movably mounted on said top wall, and power operated means is operably connected with said closure for moving it between a position covering said opening and a position remote from said opening.

9. A floatable safety enclosure according to claim 7 in which a portion of said top wall extends inwardly from each of said sections with the free edges thereof in abutment, and opposed, cooperating, aligning means is provided on the free edge of the inwardly extending top portion of said sections.

10. A floatable safety enclosure according to claim 1 in which the side edge portions of the floats of adjacent sections are in abutment when the sections are attached together, and the opposed edge portions of adjacent floats have cooperating means carried thereby for bringing adjacent floats and the sections carried thereby into alignment.

11. A floatable safety enclosure according to claim 10 in which the cooperating means carried by adjacent floats comprises a tongue carried by one float seated with a close sliding fit in a cooperating recess formed in the opposed edge portion of the adjacent float.

12. A floatable safety enclosure according to claim 10 in which the means for detachably securing adjacent sections together includes a substantially non-extensible, flexible strand fixedly connected at one end to one float, and power operated pulling means mounted on the other float and connected to the other end of the strand for pulling the opposed edge portions of the floats and the cooperating means carried thereby into abutment.

13. A floatable safety enclosure according to claim 1 in which each of said float means comprises a tank providing a water ballast chamber, valve means for controlling the flow of water into the ballast chamber, and pump means for removing water from the ballast chamber.

14. A floatable safety enclosure according to claim 13 in which each tank carries foot means engageable with the ground for supporting the ballast chamber above the surface of the ground.

15. A floatable safety enclosure according to claim 13 in which at least one of the tanks includes conduit means connecting the interior of the enclosure with the exterior thereof and oil pump means connected with said conduit means for pumping oil on the surface of the water within the enclosure to the exterior thereof.

16. A floatable safety enclosure according to claim 13 in which each of the sections includes pipe means having outlet means for discharging water over the exterior of the section and inlet means disposed in the water adjacent the enclosure and water pump means operably connected with said pipe means for pumping water therethrough.