

SPECIFICATION

Apparatus for burning crude oil

5 The present invention relates to apparatus for burning crude oil and has particular application to an apparatus for burning crude oil derived from offshore oil well installations. When oil-well production tests are undertaken at sea, it is necessary to dispose of the crude oil collected during such tests, and which oil is frequently contaminated with water, sand, mud and various kinds of waste from the bottom of the well.

10 Given that production trials generally last from a few hours to a few days, the volume of oil collected, being at most several thousand cubic metres, cannot be dumped into the sea because of the pollution problems caused thereby and does not justify special transport for its evacuation. Further, given that the collecting system for an off-shore oil-well is only installed once the viability of the well has been established, the only economically viable solution is to dispose of the first samples of crude oil collected by on-site combustion.

As stated above this crude oil with its contaminants is a product rich in heavy particles and is far from being easy to burn. Combustion of the oil involves the use of substantial burner means which can handle the combustion of up to 2000m³ of oil per day and such combustion must be undertaken in conditions of absolute security for both the drilling installation and the drilling team.

A serious disadvantage with conventional burners is that whilst such burners can initially be installed to direct the burner flames and the products of combustion in a safe direction there is always a danger that the wind will adversely affect the flame direction to the detriment of the surrounding environment.

The present invention seeks to provide apparatus for burning crude oil, capable of being mounted at a safe location and adjustable at said location to afford additional security to the surrounding environment.

According to the present invention there is provided apparatus for burning crude oil comprising a burner assembly including a plurality of substantially horizontal burners arranged in pairs, means for supplying oil for combustion and compressed air to said burners, and flame control water nozzles, characterised in that the assembly is arranged for pivotal displacement about a substantially vertical axis.

Preferably the burner assembly is pivotally attached to a stand which limits the angular displacement of the assembly about said vertical axis and, more preferably, the apparatus includes means for retaining the burner assembly in any one of a plurality of different locations about said vertical axis.

Preferably the pivotal displacement of the

assembly about said vertical axis is limited to 45° to each side of a mid-position for the assembly.

Preferably the assembly includes pilot burners for igniting the crude oil burners.

In preferred embodiments of the invention the assembly includes valves for controlling the supply of crude oil to the burners and/or valves for controlling the supply of compressed air to the burners and/or valves for controlling the supply of water to said water nozzles.

Preferably each pair of burners is provided with individual valve controls so that each pair of burners can be operated independently of other pairs of burners and conveniently each pair of burners is supplied with oil and compressed air via common valves and whereby the burners of each pair are arranged to operate simultaneously.

In a preferred embodiment the crude oil or the compressed air or the water is delivered to the assembly via a fluid chamber and the vertical pivotal axis of the assembly passes through said chamber. More preferably, more than one fluid is delivered to the assembly via fluid chambers, there being a fluid chamber individual to each fluid, and the said vertical pivotal axis passes through each fluid chamber.

The, or each, fluid chamber is conveniently formed by upper and lower coupling parts, one of which parts has a fixed position relative to the stand whilst the other part has a fixed position relative to the assembly and whereby the part fixed relative to the stand can include the fluid inlet to said chamber and the part fixed relative to the assembly can include the fluid outlet from the chamber.

Preferably the ducts supplying fluids to said assembly pass through said stand with their axes in the same vertical plane.

Preferably the said assembly is contained within a cage and said cage is fixed relative to said assembly. The cage may conveniently comprise tubular members defining upper and lower rectangular frames, connected by front and rear upright members and by inclined members, and said rectangular frames are preferably strengthened by diagonal members.

According to a preferred embodiment of the invention apparatus for burning crude oil comprises a burner assembly within a rectangular box-like cage of tubular material, fixed relative to said burner assembly, the burner assembly including a plurality of burners arranged with their axes substantially horizontal, said burners being arranged in pairs with one burner of each pair above the other and the pairs of burners being horizontally spaced apart, valve means for controlling the supply of crude oil and compressed air to each pair of burners, and flame control water nozzles associated with each pair of burners, and wherein the burner assembly and cage are mounted for

pivotal displacement about a vertical axis and each fluid supply to the assembly includes a chamber through which said vertical axis passes.

5 The invention will now be described further by way of example with reference to the accompanying drawings in which:

10 Fig. 1 shows, diagrammatically, a plan view of a burner apparatus in accordance with the invention

Fig. 2 shows, diagrammatically, a side view of the burner apparatus of Fig. 1 and

Fig. 3 shows, diagrammatically, a front view of the device.

15 In the drawings certain elements have been omitted for clarity but such omitted elements as are important in the operation of the device have been clearly identified and described hereunder.

20 As will be seen from the illustrations the burner assembly is contained within a substantially rectangular protective cage 1 and the burner assembly and cage are pivotally displaceable about a vertical axis $X-X'$ relative to a fixed upright stand 2.

25 The cage 1, conveniently made from square tubing, is formed by upper and lower rectangular frames 3 and 4 respectively interconnected by front and rear uprights 5 and 6 respectively and the cage is strengthened by diagonal members 7 in frames 3 and 4 and by diagonal members 8 which extend between the frames 3 and 4.

30 The stand 2, includes a base flange g with plates 10 upstanding therefrom. A duct 11, for supplying oil to the assembly, passes through the stand 2 and presents a coupling 12 to which a duct (not shown) supplying oil to the burner can be attached. A duct 13, parallel to duct 11 and with its axis in the same vertical plane as duct 11, passes through the stand 2 and presents a coupling 14 for attachment of a compressed air supply duct (not shown). A duct (not shown) with a coupling thereon, for connection with a water supply duct, will also pass through the stand 2, in identical manner to ducts 11 and 13, between and parallel to the ducts 11 and 13 and with its axis in the same vertical plane as that passing through the axis of ducts 11 and 13. This water duct through stand 2, and its connections with the water supply ducting of the assembly to be described hereafter, has been omitted only for clarity in the drawings.

55 The duct 11, discharges into an elbow 15 the horizontal limb of which is fixed on duct 11 and the vertical limb of which opens upwardly. A coupling part 16 receives the upper open end of the vertical limb of part 15 with a fluid tight seal and part 16 is rotatable relative to part 15.

60 The duct 13 discharges into an elbow 17, the vertical limb of which opens downwardly, and a coupling part 18 receives the lower open end of the vertical limb of elbow 17

with a fluid tight seal and part 18 is rotatable relative to part 17.

70 In similar manner the water supply duct (not shown) will discharge into an elbow (not shown) the vertical limb of which may open upwardly or downwardly and a coupling part (not shown) will receive the open end of the vertical limb of the elbow with a fluid tight seal, and the coupling will be rotatable relative to the vertical limb of the elbow.

75 It will now be seen that the vertical limb of elbow 15 and the coupling 16 define an oil chamber, the duct 11 discharges into the elbow 15 and the outlet to the oil chamber is via the coupling 16. The elbow 17 and coupling 18 define a compressed air chamber into which duct 13 discharges and from which air exhausts via coupling 18.

80 The axes of the fluid chambers defined by elbow 15 and coupling 16 and elbow 17 and coupling 18 and the chamber (not shown) defined by the water supply elbow and coupling, all lie concentric with the vertical axis $X-X'$, the rotation of couplings 16, 18 and the water coupling is effected concentric with the axis $X-X'$ and thus the supply of oil, compressed air, and water, to the assembly will be maintained for all positions of the cage 1 and the burner assembly about the vertical axis $X-X'$.

85 The coupling 16 discharges oil from elbow 15 into a manifold 19 which supplies oil via three valves 20, 21 and 22 to three generally upright manifolds 23, 24 and 25 respectively. Upper and lower outlets 26 and 27 respectively from manifold 23 supply crude oil to a first pair of burners 32 and 35 respectively, arranged with their axes substantially horizontal and in the same vertical plane, upper and lower outlets 28 and 29 respectively from manifold 24 supply crude oil to burners 33 and 36 respectively, arranged in like manner to burners 32 and 35, and upper and lower outlets 30 and 31 respectively from manifold 25 supply crude oil to burners 34 and 37 respectively arranged in like manner to burners 33 and 36. The burners 32, 33 and 34 lie in a common horizontal plane, the burners 35, 36 and 37 lie in a horizontal plane and, as burner pairs 32, 35 and 33, 36 and 34, 37 are controlled by valves 20, 21 and 22 respectively, each burner pair can be operated independently of the other pairs of burners.

90 The coupling 18 discharges into a manifold 38 which supplies compressed air through valves 39, 40 and 41 to generally upright manifolds 42, 43 and 44 respectively. Manifolds 42 and 43 are omitted from Fig. 3 for clarity in Fig. 3. The manifold 42 discharges compressed air to burners 35 and 32 via outlets 45 and 48 respectively, manifold 43 discharges compressed air to burners 36 and 33 via outlets 46 and 49 respectively and manifold 44 discharges compressed air to burners 37 and 34 via outlets 47 and 50

respectively. Outlets 45, 46 and 48 and 49 have been omitted from Fig. 3.

Thus valves 39, 40 and 41 individually control the air supply to burner pairs 32, 35 and 33, 36 and 34, 37 respectively.

In similar manner to couplings 16 and 18 the coupling for the water duct discharges into a manifold which supplies water to three ducts 51, 52 and 53 (the ducts 51 and 52 are not shown in Fig. 3) which discharge to generally upright manifolds 54, 55 and 56 respectively (manifolds 54 and 55 and their attachments are not shown in Fig. 3). The manifolds 54, 55 and 56 each have two outlets to water nozzles, the manifold 56 supplies water to upper and lower nozzles 59 and 58 respectively, manifold 55 supplies water to upper and lower nozzles 60 and 60a respectively and manifold 54 supplies water to upper and lower nozzles 61 and 61a respectively.

Thus, with the above described arrangement, nozzles 61, 60, 59, 61a, 60a and 58, are located adjacent burners 32, 33, 34, 35, 36 and 37, respectively and, in like manner to the oil and air supplies, the water supply to the water nozzles associated with each pair of burners can be controlled by a single valve (not shown for clarity in the drawings) independently of the other nozzles.

The nozzles 61, 60, 59, 61a, 60a and 58 are so directed relative to their respective burners 32 to 37 respectively that, when operable, the water jet from each nozzle can regulate the flame, and reduce smoke, from its respective burner.

It will now be seen that with the arrangement described above the burner can be operable with one, two or three pairs of burners so that the burner assembly can accommodate wide variations in the supply of oil thereto and, by adjusting the angular position of the burner assembly and cage relative to the stand, the most advantageous direction for the burner assembly can be obtained.

Whilst the present invention has been described by way of example with reference to a specific embodiment many variations and modifications will be apparent to persons skilled in the art within the scope of the appended claims and, by way of example, the cage may be of different construction, the valves and fluid supply ducts may be differently arranged from that illustrated and the burner assembly can be readily made vertically adjustable and, with the valves, made adjustable under the control of servomotors.

CLAIMS

1. Apparatus for burning crude oil comprising a burner assembly including a plurality of substantially horizontal burners arranged in pairs, means for supplying oil for combustion and compressed air to said burners, and flame control water nozzles characterised in that the

assembly is arranged for pivotal displacement about a substantially vertical axis.

2. Apparatus as claimed in claim 1 in which the burner assembly is pivotally attached to a stand which limits the angular displacement of the assembly about said vertical axis.

3. Apparatus as claimed in claim 1 or 2 including means for retaining the burner assembly in any one of a plurality of different locations about said vertical axis.

4. Apparatus as claimed in claim 1, 2 or 3 in which the pivotal displacement of the assembly about said vertical axis is limited to 45° to each side of a mid-position for the assembly.

5. Apparatus as claimed in claim 1, 2 or 3 or 4 in which the assembly includes pilot burners for igniting the crude oil burners.

6. Apparatus as claimed in claim 1, 2, 3, 4 or 5 in which the assembly includes valves for controlling the supply of crude oil to the burners.

7. Apparatus as claimed in any preceding claim in which the assembly includes valves for controlling the supply of compressed air to the burners.

8. Apparatus as claimed in any preceding claim in which the assembly includes valves for controlling the supply of water to said water nozzles.

9. Apparatus as claimed in any preceding claim in which each pair of burners is provided with individual valve controls so that each pair of burners can be operated independently of other pairs of burners.

10. Apparatus as claimed in any preceding claim in which each pair of burners is supplied with oil and compressed air via common valves and whereby the burners of each pair are arranged to operate simultaneously.

11. Apparatus as claimed in any preceding claim in which said crude oil or said compressed air or said water is delivered to the assembly via a fluid chamber and the vertical pivotal axis of the assembly passed through said chamber.

12. Apparatus as claimed in claim 11 in which more than one fluid is delivered to the assembly via fluid chambers, there being a fluid chamber individual to each fluid, and wherein the said vertical pivotal axis passes through each fluid chamber.

13. Apparatus as claimed in claim 11 or 12 in which the, or each, fluid chamber is formed by upper and lower coupling parts, one of which parts has a fixed position relative to the stand whilst the other part has a fixed position relative to the assembly and wherein the part fixed relative to the stand includes the fluid inlet to said chamber and the part fixed relative to the assembly includes the fluid outlet from the chamber.

14. Apparatus as claimed in any preceding claim in which ducts supplying fluids to



respectively. Outlets 45, 46 and 48 and 49 have been omitted from Fig. 3.

Thus valves 39, 40 and 41 individually control the air supply to burner pairs 32, 35 and 33, 36 and 34, 37 respectively.

In similar manner to couplings 16 and 18 the coupling for the water duct discharges into a manifold which supplies water to three ducts 51, 52 and 53 (the ducts 51 and 52 are not shown in Fig. 3) which discharge to generally upright manifolds 54, 55 and 56 respectively (manifolds 54 and 55 and their attachments are not shown in Fig. 3). The manifolds 54, 55 and 56 each have two outlets to water nozzles, the manifold 56 supplies water to upper and lower nozzles 59 and 58 respectively, manifold 55 supplies water to upper and lower nozzles 60 and 60a respectively and manifold 54 supplies water to upper and lower nozzles 61 and 61a respectively.

Thus, with the above described arrangement, nozzles 61, 60, 59, 61a, 60a and 58, are located adjacent burners 32, 33, 34, 35, 36 and 37, respectively and, in like manner to the oil and air supplies, the water supply to the water nozzles associated with each pair of burners can be controlled by a single valve (not shown for clarity in the drawings) independently of the other nozzles.

The nozzles 61, 60, 59, 61a, 60a and 58 are so directed relative to their respective burners 32 to 37 respectively that, when operable, the water jet from each nozzle can regulate the flame, and reduce smoke, from its respective burner.

It will now be seen that with the arrangement described above the burner can be operable with one, two or three pairs of burners so that the burner assembly can accommodate wide variations in the supply of oil thereto and, by adjusting the angular position of the burner assembly and cage relative to the stand, the most advantageous direction for the burner assembly can be obtained.

Whilst the present invention has been described by way of example with reference to a specific embodiment many variations and modifications will be apparent to persons skilled in the art within the scope of the appended claims and, by way of example, the cage may be of different construction, the valves and fluid supply ducts may be differently arranged from that illustrated and the burner assembly can be readily made vertically adjustable and, with the valves, made adjustable under the control of servomotors.

CLAIMS

1. Apparatus for burning crude oil comprising a burner assembly including a plurality of substantially horizontal burners arranged in pairs, means for supplying oil for combustion and compressed air to said burners, and flame control water nozzles characterised in that the

assembly is arranged for pivotal displacement about a substantially vertical axis.

2. Apparatus as claimed in claim 1 in which the burner assembly is pivotally attached to a stand which limits the angular displacement of the assembly about said vertical axis.

3. Apparatus as claimed in claim 1 or 2 including means for retaining the burner assembly in any one of a plurality of different locations about said vertical axis.

4. Apparatus as claimed in claim 1, 2 or 3 in which the pivotal displacement of the assembly about said vertical axis is limited to 45° to each side of a mid-position for the assembly.

5. Apparatus as claimed in claim 1, 2 or 3 or 4 in which the assembly includes pilot burners for igniting the crude oil burners.

6. Apparatus as claimed in claim 1, 2, 3, 4 or 5 in which the assembly includes valves for controlling the supply of crude oil to the burners.

7. Apparatus as claimed in any preceding claim in which the assembly includes valves for controlling the supply of compressed air to the burners.

8. Apparatus as claimed in any preceding claim in which the assembly includes valves for controlling the supply of water to said water nozzles.

9. Apparatus as claimed in any preceding claim in which each pair of burners is provided with individual valve controls so that each pair of burners can be operated independently of other pairs of burners.

10. Apparatus as claimed in any preceding claim in which each pair of burners is supplied with oil and compressed air via common valves and whereby the burners of each pair are arranged to operate simultaneously.

11. Apparatus as claimed in any preceding claim in which said crude oil or said compressed air or said water is delivered to the assembly via a fluid chamber and the vertical pivotal axis of the assembly passed through said chamber.

12. Apparatus as claimed in claim 11 in which more than one fluid is delivered to the assembly via fluid chambers, there being a fluid chamber individual to each fluid, and wherein the said vertical pivotal axis passes through each fluid chamber.

13. Apparatus as claimed in claim 11 or 12 in which the, or each, fluid chamber is formed by upper and lower coupling parts, one of which parts has a fixed position relative to the stand whilst the other part has a fixed position relative to the assembly and wherein the part fixed relative to the stand includes the fluid inlet to said chamber and the part fixed relative to the assembly includes the fluid outlet from the chamber.

14. Apparatus as claimed in any preceding claim in which ducts supplying fluids to



said assembly pass through said stand with their axes in the same vertical plane.

15. Apparatus as claimed in any preceding claim in which the said assembly is contained within a cage and said cage is fixed relative to said assembly.

16. Apparatus as claimed in claim 15 in which said cage comprises tubular members defining upper and lower rectangular frames connected by front and rear upright members and by inclined members, and wherein said rectangular frames are strengthened by diagonal members.

17. Apparatus for burning crude oil comprising a burner assembly within a rectangular box-like cage of tubular material, fixed relative to said burner assembly, the burner assembly including a plurality of burners arranged with their axes substantially horizontal, said burners being arranged in pairs with one burner of each pair above the other and the pairs of burners being horizontally spaced apart, valve means for controlling the supply of crude oil and compressed air to each pair of burners, and flame control water nozzles associated with each pair of burners, and wherein the burner assembly and cage are mounted for pivotal displacement about a vertical axis and each fluid supply to the assembly includes a chamber through which said vertical axis passes.

18. Apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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The nozzles 61, 60, 59, 61a, 60a and 58 are so directed relative to their respective burners 32 to 37 respectively that, when operable, the water jet from each nozzle can regulate the flame, and reduce smoke, from its respective burner.

It will now be seen that with the arrangement described above the burner can be operable with one, two or three pairs of burners so that the burner assembly can accommodate wide variations in the supply of oil thereto and, by adjusting the angular position of the burner assembly and cage relative to the stand, the most advantageous direction for the burner assembly can be obtained.

Whilst the present invention has been described by way of example with reference to a specific embodiment many variations and modifications will be apparent to persons skilled in the art within the scope of the appended claims and, by way of example, the cage may be of different construction, the valves and fluid supply ducts may be differently arranged from that illustrated and the burner assembly can be readily made vertically adjustable and, with the valves, made adjustable under the control of servomotors.

CLAIMS

1. Apparatus for burning crude oil comprising a burner assembly including a plurality of substantially horizontal burners arranged in pairs, means for supplying oil for combustion and compressed air to said burners, and flame control water nozzles characterised in that the

assembly is arranged for pivotal displacement about a substantially vertical axis.

2. Apparatus as claimed in claim 1 in which the burner assembly is pivotally attached to a stand which limits the angular displacement of the assembly about said vertical axis.

3. Apparatus as claimed in claim 1 or 2 including means for retaining the burner assembly in any one of a plurality of different locations about said vertical axis.

4. Apparatus as claimed in claim 1, 2 or 3 in which the pivotal displacement of the assembly about said vertical axis is limited to 45° to each side of a mid-position for the assembly.

5. Apparatus as claimed in claim 1, 2 or 3 in which the assembly includes pilot burners for igniting the crude oil burners.

6. Apparatus as claimed in claim 1, 2, 3, 4 or 5 in which the assembly includes valves for controlling the supply of crude oil to the burners.

7. Apparatus as claimed in any preceding claim in which the assembly includes valves for controlling the supply of compressed air to the burners.

8. Apparatus as claimed in any preceding claim in which the assembly includes valves for controlling the supply of water to said water nozzles.

9. Apparatus as claimed in any preceding claim in which each pair of burners is provided with individual valve controls so that each pair of burners can be operated independently of other pairs of burners.

10. Apparatus as claimed in any preceding claim in which each pair of burners is supplied with oil and compressed air via common valves and whereby the burners of each pair are arranged to operate simultaneously.

11. Apparatus as claimed in any preceding claim in which said crude oil or said compressed air or said water is delivered to the assembly via a fluid chamber and the vertical pivotal axis of the assembly passed through said chamber.

12. Apparatus as claimed in claim 11 in which more than one fluid is delivered to the assembly via fluid chambers, there being a fluid chamber individual to each fluid, and wherein the said vertical pivotal axis passes through each fluid chamber.

13. Apparatus as claimed in claim 11 or 12 in which the, or each, fluid chamber is formed by upper and lower coupling parts, one of which parts has a fixed position relative to the stand whilst the other part has a fixed position relative to the assembly and wherein the part fixed relative to the stand includes the fluid inlet to said chamber and the part fixed relative to the assembly includes the fluid outlet from the chamber.

14. Apparatus as claimed in any preceding claim in which ducts supplying fluids to

said assembly pass through said stand with their axes in the same vertical plane.

15. Apparatus as claimed in any preceding claim in which the said assembly is contained within a cage and said cage is fixed relative to said assembly.

16. Apparatus as claimed in claim 15 in which said cage comprises tubular members defining upper and lower rectangular frames connected by front and rear upright members and by inclined members, and wherein said rectangular frames are strengthened by diagonal members.

17. Apparatus for burning crude oil comprising a burner assembly within a rectangular box-like cage of tubular material, fixed relative to said burner assembly, the burner assembly including a plurality of burners arranged with their axes substantially horizontal, said burners being arranged in pairs with one burner of each pair above the other and the pairs of burners being horizontally spaced apart, valve means for controlling the supply of crude oil and compressed air to each pair of burners, and flame control water nozzles associated with each pair of burners, and wherein the burner assembly and cage are mounted for pivotal displacement about a vertical axis and each fluid supply to the assembly includes a chamber through which said vertical axis passes.

18. Apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.