

Description

The present invention relates to an anchor for mooring a floating object to a mooring bed.

A fixed fluke anchor having a cranked shank which is capable of orientating to an upright digging attitude automatically by rolling when dragged inverted over most mooring bed surfaces is known from UK Patents Nos. 1 356 259 and 1 513 453. However, in certain mooring beds of firm clay, the rolling action can be impeded by the flat sides of the shank bearing against the mooring bed surface when the anchor has rolled approximately 45 degrees onto its side.

It is an object of the present invention to obviate or mitigate this problem.

Marine anchors as described above have a fluke angle θ defined by the angle between a line extending from the anchor cable attachment point on the shank to the rear of the fluke and a fluke central line. The fluke central line is in fact constituted by the line intercept of a vertical symmetry plane of the anchor with the upper surface of the fluke, such a line intercept defining a forward direction. If the upper fluke surface is flat then the line intercept is a straight line: however if the fluke upper surface is longitudinally curved giving a curved intercept then the pertinent straight fluke intercept line would be the chord subtended by the « curved » intercept. Also, similar fluke longitudinal intercept lines could be obtained on the fluke by planes parallel to said vertical symmetry plane. The above defines the expression « central fluke line or longitudinal fluke line as hereinbefore defined » used in this specification. The fluke angle θ can be within the range 25 degrees to 55 degrees.

According to one aspect of the present invention there is provided a marine anchor having a vertical plane of symmetry and comprising a main fluke, a shank attached to the main fluke, the main fluke including a pair of upwardly projecting portions which are transversely spaced apart on respective sides of the vertical plane of symmetry of the anchor, trigger elements carried by the upwardly extending portions so as to extend laterally relative thereto said trigger elements serving to orientate the anchor towards a working burial attitude, and support means to position a trigger element for digging in to orientate the anchor on forward motion of the anchor when the anchor lies inverted on a firm sea bed.

According to another aspect of the present invention there is provided an anchor comprising a fluke member arranged transversely to a longitudinal plane of symmetry of the anchor, a shank adapted at one end for attachment to an anchor line and at the other end for attachment to said fluke member, said fluke member including an upstanding lug on each side of said plane of symmetry; auxiliary flukes each attached to a respective lug so as to be remote from the plane of symmetry, each auxiliary fluke extending substantially transversely to said plane of symmetry

and providing a leading surface inclined upwardly at an acute forwardly opening angle β , to a plane at right angles to said plane of symmetry and containing the fluke central line or a fluke longitudinal line as hereinbefore defined; and support means about which the anchor may tilt when inverted on a firm horizontal mooring bed surface to bring a lug and/or an auxiliary fluke into contact with the mooring bed with said leading surface of the auxiliary fluke inclined upwardly at an obtuse forwardly opening angle β_2 to the horizontal mooring bed surface.

Preferably said tilt is sustained under gravity on a firm horizontal mooring bed surface.

Preferably at least a portion of the surface of said lug facing the shank has a forward opening angle γ measured in the forward direction at right angles to the plane of symmetry in the range -2 degrees $+ 20$ degrees, and preferably additionally has an upwards opening angle α relative to the plane of symmetry in the range 0 degrees to 40 degrees measured in a plane orthogonal to the forward direction.

Preferably the said forward opening angle β_1 of the leading surface of the auxiliary fluke is in the range 20 degrees to 80 degrees with 55 degrees to 70 degrees preferred.

Preferably further the leading surface of said auxiliary fluke has a downwardly and forwardly opening angle Δ relative to the plane of symmetry, measured in a plane at right angles to both said leading surface and the plane of symmetry, in the range 60 degrees to 90 degrees with 65 degrees to 75 degrees preferred, and preferably the fluke leading surface area at each side of said plane of symmetry does not exceed 12 per cent of the area of the fluke member viewed at right angles to the forward direction parallel to the plane of symmetry.

Preferably said auxiliary fluke is spaced above the fluke central line.

In a preferred embodiment the support means is located such that, when the anchor is inverted on a firm horizontal planar surface of a mooring bed and tilted thereon with said lug and said auxiliary fluke just buried in the bed, the portion of the fluke surface facing the mooring bed and adjacent the lug is inclined to the horizontal at not less than 45 degrees.

Preferably the fluke member has a bent up side portion to which said lug is attached.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 shows a plan view of a marine anchor according to the present invention;

Fig. 2 shows a side elevation of the anchor of Fig. 1;

Fig. 3 shows a front view of the anchor of Fig. 1;

Fig. 4 shows an isometric view of the anchor;

Fig. 5 shows the section A-A in Fig. 2;

Figs. 6 to 13 show various stages by the anchor of Fig. 1 orientating from an inverted position on a mooring bed surface to a buried position in the mooring bed, Figs. 6 to 8 being front views while Figs. 9 to 13 are isometric views;

Figs. 14 and 15 are a side view and a partial front view respectively of an anchor according to another embodiment;

Fig. 16 shows a side elevation of an anchor according to another embodiment of the present invention;

Fig. 17 shows a front view of the anchor of Fig. 16;

Fig. 18 shows a front view of an anchor according to yet a further embodiment of the present invention; and

Fig. 19 shows an alternative form of trigger element.

Referring to Figs. 1 to 5, a marine anchor 1 for use in mooring a floating structure such as a floating oil rig, comprises a fluke member 2 and a cranked shank 3 which is in accordance with the Applicant's European Patent 0 020 152 and which includes a longer forwardly extending leg 4 carrying an attachment hole 5 for the anchor line (not shown) and a shorter leg 6 attached to the fluke member 2 by a bolted connection 7 at upstanding flanges 8 on the fluke member 2. The fluke member 2 extends transversely to a vertical plane of symmetry S-S of the anchor.

The shank 3 is of double-leg configuration formed by longitudinal plates 9, 10 and differently inclined strengthening plates 11, 12, 13 extend transversely between the longitudinal plates 9, 10 and provide rearwardly directed diverging passages for unobstructed soil flow through the shank 3. The anchor has a fluke angle θ defined by the angle between a line B-B extending from the cable attachment hole 5 to the rear of the fluke member and the fluke central line C-C (as hereinbefore defined). Since in the present embodiment, the relevant central upper part of the fluke member 2 is flat this intercept will be a straight line. Also other longitudinal fluke intercept lines L-L obtained on the fluke member by vertical planes parallel to the symmetry plane S-S are shown in Fig. 1. In this embodiment the angle θ is approximately 28 degrees.

The fluke member 2 includes a fluke central part 14 of concave form, having a central sole 15 with upwardly bent side portions 16-17 and the sole 15 extends forwardly to two spaced toes 18, 19. The side portions 16, 17 form an angle δ with the symmetry plane S-S (or plane parallel thereto) preferably lying in the range 45 degrees to 90 degrees. The fluke central part 14 is fabricated from steel plate and includes reinforcing ribs 20 extending to the toes 18, 19. As can be seen, the upper surface of the sole 15 is flat. Additionally the fluke member 2 provides upstanding lugs 21, 22 carried by respective fluke portions 16, 17. Each lug 21, 22 has a forwardly opening angle γ measured in the forward direction relative to the plan of symmetry in the range -2 degrees to +20 degrees and preferably 4 degrees to 12

degrees, and an upwardly opening angle α relative to the plane of symmetry in the range 0 degrees to 40 degrees with 8 degrees to 18 degrees preferred. Also, the surface area of each lug 21, 22 facing the shank is in the range 2 per cent to 12 per cent of the area of the fluke member viewed at right angles to the forward direction parallel to the plane of symmetry, preferably this area is in the range 3 per cent to 7 per cent of said fluke member area.

In accordance with the present invention, each lug 21, 22 has attached thereto a respective auxiliary fluke (or trigger element) 23, 24 each of which has a leading surface 25 which is inclined upwardly at an acute angle forwardly opening angle β_1 to the fluke central line C-C (or a fluke longitudinal line L-L). This acute angle β_1 can lie in the range 20 degrees to 80 degrees, and preferably 55 degrees to 70 degrees. Further the area of each surface 25 preferably lies in the range 1 per cent to 7 per cent of the area of the fluke member 2 viewed at right angles to the forward direction parallel to the plane of symmetry (this range will be particularly suitable for clay soils); however for soft mud mooring beds a range up to 12 per cent may be preferable. Further, when the anchor 1 lies in an inverted position as shown in Fig. 6 with an outer edge of the shank longer leg 4 serving to support the anchor on a firm mooring bed M (e.g., clay) but with the anchor tilted so that a lug 21 and an auxiliary fluke 23 engage the bed M, the leading surface 25 forms an obtuse angle β_2 with the mooring bed M as shown in Fig. 2. The upper ends of the plates 11, 12, 13 will also assist in supporting the inverted anchor and in particular will mitigate against sinking of the shank when lying inverted on relatively soft mooring beds. Additionally the leading surface 25 forms an angle Δ (see Fig. 5) relative to the plane of symmetry S-S measured in a plane at right angles to both said leading surface 25 and the symmetry plane S-S: this angle Δ can lie in the range 60 degrees to 90 degrees with 65 degrees to 75 degrees preferred.

As can be seen in Fig. 2, each auxiliary fluke 23, 24 lies above the level of the fluke sole portion 15 and more particularly above the level of the fluke central line C-C. More especially each auxiliary fluke is positioned such that it lies above the line I-I (Fig. 2) extending from the front end of the bottom edge of the shank longer leg 4 to the point P on the fluke central line C-C spaced 0.66L from the front end of the fluke member 2, where L is the length of the fluke member, and indeed the flukes 23, 24 lie substantially above this line even when the line extends to the rear of the fluke. The effect of this is that when the anchor 1 is burying normally, the major portion of the fluke member 2 will be buried before the negatively acting auxiliary flukes 23, 24 engage the mooring bed, and this combined with the fact that the area of leading surfaces 25 is much smaller than the positive "burying" area of the fluke member facilitates deep burial of the anchor. The lugs 21, 22 and the flukes 23, 24 are also fabricated from

steel plate.

A significant feature of the above described anchor is that the leading edges of the fluke 2 on each side of the plane of symmetry are of indented form, that is to say the leading edges are cut back at 1 in plan view with respect to a straight line drawn from a front point 19 (or 18) of the fluke to a point B at the outer edge of the fluke 2, ie. at the joining edge of the plates 16, 17 and lugs 21, 22 as shown in Fig. 1. The provision of adequate such indentation of the fluke greatly assists the rolling action of the anchor to the vertical working burial attitude.

Operation

Figs. 6 to 13 show anchor orientation in firm clay. The anchor 1 is unstable when dragged inverted and quickly topples about the longer leg 4 of the shank 3 until one lug (e.g. 22) and an auxiliary fluke 24 bears on the mooring bed surface M and is held there by the moment of the weight W of the anchor 1 acting about one edge of the longer leg 4 of the shank as shown in Fig. 6. Further dragging causes the lug 22 and auxiliary fluke 24 to penetrate the mooring bed surface M progressively as shown in Figs. 7, 8 and 9 with the anchor rotating substantially about the top edge of the long leg 4 of the shank in contact with the mooring bed. When an appreciable portion of the fluke member 2 has been pulled into the soil by the lug 22 and auxiliary fluke 24 as the anchor is pulled over the mooring bed surface, forces F_1 , F_2 are generated producing a turning moment, or couple, as shown in Fig. 10. This couple acts to lift the shank 3 off the surface of the mooring bed M as the anchor rolls further (Fig. 11) until, in Fig. 12 enough of the fluke 2 is buried to pull the shorter leg 6 of the shank 3 into the soil. In Fig. 13, the rolling force F_1 from the buried auxiliary fluke 24 is counteracted by an opposing force F_2 from the other auxiliary fluke 23 with the result that the anchor 1 adopts an upright burial attitude (Fig. 13). This roll mechanism prevents the mooring bed surface reaching the position shown dashed in Fig. 8 whereby a side face of the shank 3 bears against the surface of the mooring bed and impedes rolling. Finally, the anchor proceeds to bury deeper into the mooring bed soil in the attitude shown in Fig. 13 when pulled further by the anchor cable since the upwards forces from the auxiliary flukes are much less than the downwards force produced by the main fluke due to the fact that the «negative» burial area of the auxiliary flukes 23, 24 is very much less than the «positive» burial area of the fluke member 2.

It is preferred in Fig. 1 that the height H of the centre of area of the fluke member 2 above the mooring bed M is not less than 40 per cent of the width K of the fluke member 2, and preferably not less 50 per cent of K. Also as seen in Fig. 7, when the auxiliary fluke 24 and lug 22 are just buried it is preferable that the fluke portion 17 is inclined to the horizontal at an angle E not less than about

45 degrees. When the anchor is in the position shown in Fig. 8, it will be noted that the fluke side portion 17 is substantially vertical and in a minimum resistant position to penetration so encouraging rolling to the positions in Figs. 9 and 10. These features encourage the above described rolling mechanism. Additionally the flukes 23, 24 will function in combination with the lugs 21, 22 and the upwardly bent fluke portions 16, 17 to produce dynamic stability in the anchor 1.

The flukes 23, 24 are shown at the rear of the outer surface of the lugs 21, 22 and this arrangement could provide benefits with regard to soil deflection. However the flukes 23, 24 could very well be located at other positions on the lugs, and it is felt that a substantial mid-position would be advantageous.

Figs. 14 and 15 show the present invention applied in an anchor as described in UK Patents 1 356 259 and 1 513 453. Thus the anchor of Figs. 14, 15 comprise a fluke 2A carried by single-leg cranked shank 3A with upward side lugs 30, 40 extending from the sides of the fluke 2A. The side lugs 30, 40 carry auxiliary flukes 23A, 24A generally corresponding to the lugs 23, 24 of the Figs. 1 to 5 embodiment, and the flukes 23A, 24A will operate in a similar manner. UK Patent 1 356 259 teaches that the outer ends of the lugs 30, 40 can be outwardly twisted to form a greater convergence angle, but with the flukes 23A, 24A present this twisting can be removed or reduced.

Modifications are of course possible. Thus, some other means than the upper edges of the shank longer leg 4 could be employed to constitute the support means for the inverted anchor. Plate means could be used for this purpose, and if for example a shank of straight leg form is used these separate plate means could be attached to the straight shank. The fluke member 1 need not have a concave central part 15 but this part could be fully flat with the lugs 21, 22 attached directly to this flat construction. Again, the fluke member 2 may be constituted purely by upstanding lug parts with no central sole.

Figs. 16 to 19 show two anchors which are generally similar to the anchor shown in Figs. 1 to 5 and features in Figs. 16 to 19 corresponding to the features of this previous anchor carry the same reference numerals or letters.

However, the anchor of Figs. 16, 17 has auxiliary flukes (or trigger elements) each comprised by an outwardly extending portion 23A, (24A), equivalent to the flukes 23, 24 of the previous anchor, and additionally by an inwardly extending portion 23B, 24B; while the anchor of Fig. 18 has solely inwardly extending auxiliary flukes (or trigger elements) 23', 24'.

In Figs. 16, 17 the fluke portions 23A/B, 24A/B are again carried by upstanding side lugs 21, 22 on the anchor fluke 2, and these lugs 21, 22 can be set at an angle α from the vertical exactly as in the previous anchor of No. 8522062. Also, the fluke portions 23A/B, 24A/B are set at an acute angle β_1 to the fluke 2 within the range specified previously for β_1 ; the inner and outer portions are

preferably set at the same acute angle β_1 , but it would be possible to have these portions set at different acute angles relative to the fluke. The forwardly facing area of the outer portions 23A, 24A can have any suitable proportion relative to the equivalent area of the inner portions 23B, 24B, and in the example of Figs. 16, 17 the outer portions have a greater forwardly facing area than the inner portions. With regard to the anchor of Figs. 1 to 5 the outer portions 23A, 24A of the present anchor could have proportionally smaller area than the equivalent flukes 23, 24 of the previous anchor. A twin-leg shank 3 of cranked form is again used in accordance with European Patent 0 020 152.

The flukes 23A/B, 24A/B function as trigger elements when the anchor lies inverted on the sea bed and supported by an outer surface (edge) of the shank 3 and serve to orientate the anchor towards an upright working burial attitude. More specifically the orientating action is as described for the anchor of Figs. 1 to 5. By providing the auxiliary flukes 23, 24 with outer and inner portions it should be possible to reduce the stress loading on the anchor structure during anchor operation.

Additionally the shank 3 carries laterally and rearwardly extending support ears 45, 46 for an anchor chaser or retrieval device 47 (shown dashed) which can be pulled down the anchor line (not shown) by means of a pennant line 48 and onto the shank 3 to the position shown. The chaser 47 is preferably constructed in accordance with UK Patent 1 578 129 (US Patent 4 098 216). The ears 45, 46 may also serve to assist anchor orientation particularly when the anchor line (not shown) connected at hole 5 is incident at a fairly substantial angle from the horizontal and away from the sea bed.

In the embodiment shown in Fig. 18, the auxiliary flukes 23', 24' extend wholly inwardly from the side lugs 21, 22 towards the anchors plane of symmetry S-S. In this case the lugs 21, 22 are preferably set at a greater acute angle α to the vertical than previously and this will tend to ensure that the moment arm M from the centre of area of the auxiliary fluke to the anchors plane of symmetry S-S will be substantially the same as in the previous embodiment. The angle B will be similar as in previous embodiments. It is felt that the absence of outwardly extending auxiliary fluke portions could convenience the handling of the anchor in some situations.

The flukes 23', 24' will again serve as trigger elements in the manner set out for the previous embodiment to orientate the anchor to an upright working burial attitude.

Further modifications are of course possible. Thus the trigger elements could take some other form than the auxiliary flukes 23, 24. For example in Fig. 7 the trigger elements comprise U-form bars 49 carried by the side lugs 21 (22).

Claims

1. A marine anchor having a vertical plane of symmetry and comprising a main fluke, a shank attached to the main fluke, the main fluke including a pair of upwardly projecting portions which are transversely spaced apart on respective sides of the vertical plane of symmetry of the anchor, characterised in that trigger elements (23, 24) are carried by the upwardly extending portions (21, 22) so as to extend laterally relative thereto, said trigger elements (23, 24) serving to orientate the anchor towards a working burial attitude and in that support means (4) are provided to position a trigger element (23, 24) for digging in to orientate the anchor on forward motion of the anchor when the anchor lies inverted on a firm sea bed.

2. A marine anchor comprising a fluke member arranged transversely to a longitudinal plane of symmetry of the anchor, a shank adapted at one end for attachment to an anchor line and at the other end for attachment to said fluke member, said fluke member including an upstanding lug on each side of said plane of symmetry; characterised in that auxiliary flukes (23, 24) are each attached to a respective lug (21, 22) so as to be remote from the plane of symmetry (S-S), each auxiliary fluke (23, 24) extending substantially transversely to said plane of symmetry (S-S) and providing a leading surface (25) inclined upwardly at an acute forwardly opening angle β_1 to a plane at right angles to said plane of symmetry (S-S) and containing the fluke central line or a fluke longitudinal line as hereinbefore defined; and in that support means (4) are provided about which the anchor may tilt when inverted on a firm horizontal mooring bed surface to bring a lug (21, 22) and/or an auxiliary fluke (23, 24) into contact with the mooring bed with said leading surface (25) of the auxiliary fluke (23, 24) inclined upwardly at an obtuse forwardly opening angle β_2 to the horizontal mooring bed surface.

3. An anchor as claimed in claim 2, characterised in that said tilt is sustained under gravity on a firm horizontal mooring bed surface.

4. An anchor as claimed in claim 2 or 3, characterised in that at least a portion of the surface of said lug (21, 22) facing the shank (3) has a forward opening angle α measured in the forward direction at right angles to the plane of symmetry (S-S) in the range -2 degrees $+ 20$ degrees.

5. An anchor as claimed in any one of claims 2 to 4, characterised in that at least a portion of said lug (21, 22) or said upwardly projecting portion has an upwards opening angle α relative to said plane of symmetry (S-S) in the range of 0 degrees to 40 degrees measured in a plane orthogonal to the forward direction.

6. An anchor as claimed in any one of claims 2 to 5, characterised in that the said forward opening angle β_1 of the leading surface of the auxiliary fluke (23, 24) is in the range 20 degrees to 80 degrees.

7. An anchor as claimed in claim 6, characterised in that said angle β_1 is in the range 55 degrees

preferably set at the same acute angle β_1 , but it would be possible to have these portions set at different acute angles relative to the fluke. The forwardly facing area of the outer portions 23A, 24A can have any suitable proportion relative to the equivalent area of the inner portions 23B, 24B, and in the example of Figs. 16, 17 the outer portions have a greater forwardly facing area than the inner portions. With regard to the anchor of Figs. 1 to 5 the outer portions 23A, 24A of the present anchor could have proportionally smaller area than the equivalent flukes 23, 24 of the previous anchor. A twin-leg shank 3 of cranked form is again used in accordance with European Patent 0 020 152.

The flukes 23A/B, 24A/B function as trigger elements when the anchor lies inverted on the sea bed and supported by an outer surface (edge) of the shank 3 and serve to orientate the anchor towards an upright working burial attitude. More specifically the orientating action is as described for the anchor of Figs. 1 to 5. By providing the auxiliary flukes 23, 24 with outer and inner portions it should be possible to reduce the stress loading on the anchor structure during anchor operation.

Additionally the shank 3 carries laterally and rearwardly extending support ears 45, 46 for an anchor chaser or retrieval device 47 (shown dashed) which can be pulled down the anchor line (not shown) by means of a pennant line 48 and onto the shank 3 to the position shown. The chaser 47 is preferably constructed in accordance with UK Patent 1 578 129 (US Patent 4 098 216). The ears 45, 46 may also serve to assist anchor orientation particularly when the anchor line (not shown) connected at hole 5 is incident at a fairly substantial angle from the horizontal and away from the sea bed.

In the embodiment shown in Fig. 18, the auxiliary flukes 23', 24' extend wholly inwardly from the side lugs 21, 22 towards the anchor's plane of symmetry S-S. In this case the lugs 21, 22 are preferably set at a greater acute angle α to the vertical than previously and this will tend to ensure that the moment arm M from the centre of area of the auxiliary fluke to the anchor's plane of symmetry S-S will be substantially the same as in the previous embodiment. The angle B will be similar as in previous embodiments. It is felt that the absence of outwardly extending auxiliary fluke portions could convenience the handling of the anchor in some situations.

The flukes 23', 24' will again serve as trigger elements in the manner set out for the previous embodiment to orientate the anchor to an upright working burial attitude.

Further modifications are of course possible. Thus the trigger elements could take some other form than the auxiliary flukes 23, 24. For example in Fig. 7 the trigger elements comprise U-form bars 49 carried by the side lugs 21 (22).

Claims

1. A marine anchor having a vertical plane of symmetry and comprising a main fluke, a shank attached to the main fluke, the main fluke including a pair of upwardly projecting portions which are transversely spaced apart on respective sides of the vertical plane of symmetry of the anchor, characterised in that trigger elements (23, 24) are carried by the upwardly extending portions (21, 22) so as to extend laterally relative thereto, said trigger elements (23, 24) serving to orientate the anchor towards a working burial attitude and in that support means (4) are provided to position a trigger element (23, 24) for digging in to orientate the anchor on forward motion of the anchor when the anchor lies inverted on a firm sea bed.

2. A marine anchor comprising a fluke member arranged transversely to a longitudinal plane of symmetry of the anchor, a shank adapted at one end for attachment to an anchor line and at the other end for attachment to said fluke member, said fluke member including an upstanding lug on each side of said plane of symmetry; characterised in that auxiliary flukes (23, 24) are each attached to a respective lug (21, 22) so as to be remote from the plane of symmetry (S-S), each auxiliary fluke (23, 24) extending substantially transversely to said plane of symmetry (S-S) and providing a leading surface (25) inclined upwardly at an acute forwardly opening angle β_1 to a plane at right angles to said plane of symmetry (S-S) and containing the fluke central line or a fluke longitudinal line as hereinbefore defined; and in that support means (4) are provided about which the anchor may tilt when inverted on a firm horizontal mooring bed surface to bring a lug (21, 22) and/or an auxiliary fluke (23, 24) into contact with the mooring bed with said leading surface (25) of the auxiliary fluke (23, 24) inclined upwardly at an obtuse forwardly opening angle β_2 to the horizontal mooring bed surface.

3. An anchor as claimed in claim 2, characterised in that said tilt is sustained under gravity on a firm horizontal mooring bed surface.

4. An anchor as claimed in claim 2 or 3, characterised in that at least a portion of the surface of said lug (21, 22) facing the shank (3) has a forward opening angle α measured in the forward direction at right angles to the plane of symmetry (S-S) in the range -2 degrees $+ 20$ degrees.

5. An anchor as claimed in any one of claims 2 to 4, characterised in that at least a portion of said lug (21, 22) or said upwardly projecting portion has an upwards opening angle α relative to said plane of symmetry (S-S) in the range of 0 degrees to 40 degrees measured in a plane orthogonal to the forward direction.

6. An anchor as claimed in any one of claims 2 to 5, characterised in that the said forward opening angle β_1 of the leading surface of the auxiliary fluke (23, 24) is in the range 20 degrees to 80 degrees.

7. An anchor as claimed in claim 6, characterised in that said angle β_1 is in the range 55 degrees



to 70 degrees.

8. An anchor as claimed in any one of claims 2 to 5, characterised in that the leading surface (25) of said auxiliary fluke (23, 24) has a downwardly and forwardly opening angle Δ relative to the plane of symmetry (S-S), measured in a plane at right angles to both said leading surface and the plane of symmetry, in the range 60 degrees to 90 degrees.

9. An anchor as claimed in any one of claims 2 to 5, characterised in that the area of the leading surface (25) of each auxiliary fluke (23, 24) does not exceed 12 per cent of the area of the main fluke member (2) viewed at right angles to the forward direction parallel to the plane of symmetry (S-S).

10. An anchor as claimed in any one of claims 2 to 9, characterised in that said auxiliary fluke (23, 24) is spaced above the fluke central line.

11. An anchor as claimed in claim 2, characterised in that the support means (9, 10) is located such that, when the anchor is inverted on a firm horizontal planar surface (M-M) of a mooring bed and tilted thereon with said lug (21, 22) and said auxiliary fluke (23, 24) just buried in the bed, the portion of the fluke surface facing the mooring bed and adjacent the lug (21, 22) is inclined to the horizontal at not less than 45 degrees (Fig. 7).

12. An anchor as claimed in claim 2, characterised in that the fluke member (2) has a bent up side portion (16, 17) to which said lug (21, 22) is attached.

13. An anchor as claimed in any one of the claims 2 to 12, characterised in that the auxiliary fluke (23, 24) has at least a portion extending outwardly from said lug (21, 22) or upwardly projecting portion of the fluke (2).

14. An anchor as claimed in any one of claims 2 to 13, characterised in that the auxiliary fluke (23, 24) has at least a portion (23B/24B) extending inwardly from said lug (21, 22) or upwardly projecting portion of the fluke (2).

15. An anchor as claimed in any one of the preceding claims, characterised in that the leading edges of the fluke (2) on each side of the plane of symmetry are of indented form (I) as viewed in plan.

Patentansprüche

1. Ein Schiffsanker mit einer vertikalen Symmetrieebene, umfassend eine Hauptankerschar, einen an der Hauptankerschar angebrachten Schaft, wobei die Hauptankerschar ein Paar nach oben ragender Teile aufweist, die quer in einem Abstand voneinander auf entsprechenden Seiten der vertikalen Symmetrieebene des Ankers angeordnet sind, dadurch gekennzeichnet, daß die nach oben ragenden Teile (21, 22) Klappenelemente (23, 24) tragen, die in Bezug auf die Teile seitlich verlaufen, wobei die Klappenelemente (23, 24) zum Ausrichten des Ankers in eine Arbeitsankerstellung dienen, und dadurch, daß eine Tragvorrichtung (4) vorgesehen ist, um ein Klappenelement (23,

24) so zu positionieren, daß es sich eingrät, um den Anker bei einer Vorwärtsbewegung des Ankers auszurichten, wenn der Anker umgekehrt auf einem festen Meeresgrund liegt.

2. Schiffsanker, umfassend ein quer zu einer Längssymmetrieebene des Ankers angeordnetes Ankerscharelement, einen Schaft, der an einem Ende an einer Ankerleine und am anderen Ende an dem genannten Ankerscharelement befestigt ist, wobei das genannte Ankerscharelement an jeder Seite der Symmetrieebene einen aufrecht stehenden Ansatz aufweist, dadurch gekennzeichnet, daß an jedem Ansatz (21, 22) Hilfsankerschar (23, 24) jeweils von der Symmetrieebene (S-S) entfernt angeordnet sind, wobei jede Hilfsankerschar (23, 24) im wesentlichen quer zu der genannten Symmetrieebene (S-S) verläuft und eine Vorderseite (25) bildet, die in einem scharfen, nach vorne geöffneten Winkel β , zu einer Ebene, die im rechten Winkel zu der genannten Symmetrieebene (S-S) verläuft, geneigt ist und die Mittellinie der Ankerschar oder eine Längslinie der Ankerschar wie oben definiert einschließt, und dadurch, daß eine Tragvorrichtung (4) vorgesehen ist, um die der Anker kippen kann, wenn er auf einem festen horizontalen Muringgrund umgekehrt ist, um einen Ansatz (21, 22) und/oder eine Hilfsankerschar (23, 24) so mit dem Muringgrund in Kontakt zu bringen, daß die genannte Vorderseite (25) der Hilfsankerschar (23, 24) in einem stumpfen, nach vorne geöffneten Winkel β_2 zu der Oberfläche des horizontalen Muringgrunds hin geneigt ist.

3. Anker nach Anspruch 2, dadurch gekennzeichnet, daß die genannte Schräglage unter Schwerkraft auf einem festen, horizontalen Muringgrund aufrechterhalten wird.

4. Anker nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß wenigstens ein Teil der Fläche des genannten, dem Schaft (3) zugewandten Ansatzes (21, 22) einen nach vorne geöffneten Winkel α aufweist, der, nach vorne im rechten Winkel zur Symmetrieebene (S-S) gemessen, im Bereich zwischen -2 Grad und $+20$ Grad liegt.

5. Anker nach einem der Ansprüche 2 bis 4, dadurch gekennzeichnet, daß wenigstens ein Teil des genannten Ansatzes (21, 22) oder das genannte nach oben ragende Teil einen nach oben geöffneten Winkel α in Bezug zu der genannten Symmetrieebene (S-S) aufweist, der, gemessen in einer Ebene orthogonal zu der Vorwärtsrichtung, im Bereich zwischen 0 Grad und 40 Grad liegt.

6. Anker nach einem der Ansprüche 2 bis 5, dadurch gekennzeichnet, daß der genannte, nach vorne geöffnete Winkel β_1 der Vorderseite der Hilfsankerschar (23, 24) im Bereich zwischen 20 Grad und 80 Grad liegt.

7. Anker nach Anspruch 6, dadurch gekennzeichnet, daß der genannte Winkel β_1 im Bereich zwischen 55 Grad und 70 Grad liegt.

8. Anker nach einem der Ansprüche 2 bis 5, dadurch gekennzeichnet, daß die Vorderseite (25) der genannten Hilfsankerschar (23, 24) einen nach unten und nach vorne geöffneten Winkel Δ relativ zu der Symmetrieebene (S-S) aufweist, der,



gemessen in einer Ebene im rechten Winkel zu den beiden genannten Vorderseiten und der Symmetrieebene, im Bereich zwischen 60 Grad und 90 Grad liegt.

9. Anker nach einem der Ansprüche 2 bis 5, dadurch gekennzeichnet, daß die Fläche der Vorderseite (25) jeder Hilfsankerschar (23, 24) 12 % der Fläche des Hauptankersharelements (2), im rechten Winkel zur Vorwärtsrichtung parallel zu der Symmetrieebene (S-S) gesehen, nicht übersteigt.

10. Anker nach einem der Ansprüche 2 bis 9, dadurch gekennzeichnet, daß die genannte Hilfsankerschar (23, 24) oberhalb der Mittellinie der Ankerschar in einem Abstand angeordnet ist.

11. Anker nach Anspruch 2, dadurch gekennzeichnet, daß die Tragvorrichtung (9, 10) so positioniert ist, daß der Teil der Ankerscharseite, der dem Muringbett zugewandt ist und sich neben dem Ansatz (21, 22) befindet, um wenigstens 45 Grad zur Waagerechten geneigt ist (Fig. 7), wenn der Anker auf einer festen, horizontalen, planaren Fläche (M-M) eines Muringbettes umgekehrt und darauf so gekippt ist, daß der genannte Ansatz (21, 22) und die genannte Hilfsankerschar (23, 24) leicht in das Bett eingegraben sind.

12. Anker nach Anspruch 2, dadurch gekennzeichnet, daß das Ankersharelement (2) ein nach oben gebogenes Seitenteil (16, 17) aufweist, an dem der genannte Ansatz (21, 22) angebracht ist.

13. Anker nach einem der Ansprüche 2 bis 12, dadurch gekennzeichnet, daß wenigstens ein Teil der Hilfsankerschar (23, 24) von dem genannten Ansatz (21, 22) bzw. von dem nach oben ragenden Teil der Ankerschar (2) nach außen verläuft.

14. Anker nach einem der Ansprüche 2 bis 13, dadurch gekennzeichnet, daß wenigstens ein Teil (23B/24B) der Hilfsankerschar (23, 24) von dem genannten Ansatz (21, 22) bzw. dem nach oben ragenden Teil der Ankerschar (2) nach innen verläuft.

15. Anker nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Vorderkanten der Ankerschar (2) auf jeder Seite der Symmetrieebene wie aus dem Plan ersichtlich eine eingekerbte Form (I) aufweisen.

Revendications

1. Une ancre marine ayant un plan de symétrie vertical et comprenant une aile principale, une tige attachée à l'aile principale, l'aile principale composée d'une paire de portions relevées qui sont transversalement séparées respectivement de chaque côté du plan de symétrie vertical de l'ancre, caractérisée par le fait que les éléments de déclenchement (23, 24) sont supportés par les portions relevées (21, 22), afin de s'étendre latéralement vers lesdits éléments de déclenchement (23, 24) servant à orienter l'ancre en direction d'une position de travail d'ancrage et dans le fait que des dispositifs de support (4) permettent de positionner un élément de déclenchement (23, 24) pour s'enfoncer afin d'orienter l'ancre dans sa

position de mouvement vers l'avant lorsque l'ancre est à l'envers sur un fond ferme.

2. Une ancre marine comprenant un membre à aile placé transversalement par rapport à un plan de symétrie longitudinal de l'ancre, une tige adaptée à une extrémité pour être attachée une chaîne d'ancre, et à l'autre extrémité pour être attachée audit membre d'ancrage à aile, ledit membre d'ancrage à aile comprenant une oreille verticale de chaque côté dudit plan de symétrie; caractérisé par le fait que les ailes auxiliaires (23, 24) sont chacune attachées à une oreille respective (21, 22) pour être éloignées du plan de symétrie (S-S), chaque membre auxiliaire (23, 24) qui s'étend principalement transversalement vers ledit plan de symétrie (S-S) et offre une surface directionnelle (25) inclinée vers le haut à un angle aigu ouvert vers l'avant β_1 vers un plan à angles droits vers ledit plan de symétrie (S-S) et contenant la ligne centrale du membre à aile, ou une ligne longitudinale du membre à aile comme défini ci-dessus; et dans le fait que ces dispositifs de support (4) permettent à l'ancre de s'incliner lorsqu'elle est à l'envers sur une surface d'amarrage horizontale ferme, pour permettre à l'oreille (21, 22) et/ou à un membre auxiliaire (23, 24) d'être en contact avec la surface d'amarrage avec ladite surface directionnelle (25) du membre auxiliaire (23, 24) incliné vers le haut à un angle obtus ouvert β_2 vers l'avant par rapport à la surface d'amarrage horizontale.

3. Une ancre selon la revendication 2, caractérisée par le fait que ladite inclinaison est maintenue par la gravité sur un fond d'amarrage horizontal.

4. Une ancre selon les revendications 2 et 3, caractérisée par le fait qu'au moins une portion de la surface de ladite oreille (21, 22) faisant face à la tige (3) a un angle α ouvert vers l'avant mesuré dans la direction avant à angles droits par rapport au plan de symétrie (S-S), et qui s'étend de -2 degrés à $+20$ degrés.

5. Une ancre selon les revendications 2 à 4, caractérisée par le fait qu'au moins une portion de ladite oreille (21, 22) ou de ladite portion qui s'élève vers le haut a un angle ouvert α vers le haut relatif audit plan de symétrie (S-S), et qui s'étend de 0 à 40 degrés, mesuré dans un plan orthogonal vers l'avant.

6. Une ancre selon les revendications 2 à 5, caractérisée par le fait que l'angle β_1 de la surface directionnelle de l'oreille auxiliaire (23, 24), ouvert vers l'avant, s'étend de 20 à 80 degrés.

7. Une ancre selon la revendication 6, caractérisée par le fait que ledit angle β_1 s'étend de 55 à 70 degrés.

8. Une ancre selon les revendications 2 à 5, caractérisée par le fait que la surface directionnelle (25) dudit membre auxiliaire (23, 24) a un angle Δ ouvert vers le haut et vers le bas par rapport au plan de symétrie (S-S), mesuré dans un plan à angles droits par rapport aux deux dites surfaces directionnelles et au plan de symétrie, et qui s'étend de 60 à 90 degrés.

9. Une ancre selon les revendications 2 à 5, caractérisée par le fait que l'aire de la surface



directionnelle (25) de chaque aile auxiliaire (23, 24) n'excède pas 12 % de la surface du membre à aile principal (2) présentée à angles droits par rapport à la direction vers l'avant parallèle au plan de symétrie (S-S).

10. Une ancre selon les revendications 2 à 9, caractérisée par le fait que l'aile auxiliaire (23, 24) est placée au-dessus de la ligne centrale de l'aile.

11. Une ancre selon la revendication 2, caractérisée par le fait que les dispositifs de support (9, 10) sont situés de telle manière que lorsque l'ancre est à l'envers sur une surface plane horizontale ferme (M-M) d'un fond d'amarrage et incliné dessus, avec ladite oreille et ladite aile auxiliaire (23, 24) juste ancrées dans le fond, la portion de la surface de l'aile faisant face au fond d'amarrage, et l'oreille adjacente (21, 22) inclinée par rapport à l'horizontale pas moins de 45 degrés (fig. 7).

12. Une ancre selon la revendication 2, caractérisée par le fait que le membre d'ancrage à aile (2) comprend une portion recourbée vers le haut (16, 17) à laquelle ladite oreille (21, 22) est attachée.

13. Une ancre selon les revendications 2 à 12, caractérisée par le fait que l'aile auxiliaire (23, 24) a au moins une portion qui s'étend vers l'extérieur à partir de ladite oreille (21, 22) ou portion de l'aile se projetant vers le haut (2).

14. Une ancre selon les revendications 2 à 13, caractérisée par le fait que l'aile auxiliaire (23, 24) a au moins une portion (23B/24B) qui s'étend vers l'intérieur à partir de ladite oreille (21, 22) ou portion de l'aile se projetant vers le haut (2).

15. Une ancre selon toutes les revendications mentionnées ci-dessus, caractérisée par le fait que les bords directionnels de l'aile (2) de chaque côté du plan de symétrie ont un bord renforcé (I) comme on le voit sur le plan.

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* C L M S *