

Dredging arrangement comprising a biasing device**TECHNICAL FIELD**

The invention relates to a dredging arrangement for dredging material from an underwater bottom. The invention further relates to a dredging vessel comprising such a dredging arrangement.

The invention also relates to a method for dredging material from an underwater bottom using such a dredging vessel.

BACKGROUND

Dredging is often done by dragging a drag head over an underwater bottom by a dredging vessel, such as a trailing suction hopper dredger vessel. The drag head is connected to the vessel by means of a suction pipe. The drag head is lowered to the underwater bottom by one or more hoisting wires. One or more pumps are provided to suck bottom material from the underwater bottom via the drag head, the suction pipe into a hopper of the dredging vessel.

Different dredging tools are known, for instance from US4249324, EP1786982 en US7895775.

Drag heads are known comprising a visor at their trailing end. The visor is rotatable about an axis rotation which is, in use, substantially perpendicular to a dredging direction and substantially horizontal or parallel to the underwater bottom being dredged. The visor may be mounted such that it can rotate freely about its axis of rotation.

US1840606 shows a casing and a drag (visor) which is rotatable about an axis of rotation which is substantially perpendicular to a dredging direction and substantially horizontal. On top of the drag are two lugs with slots, wherein lower pins of links are slideably engaged. The other end of the link is connected to the casing via spring shock absorber arrangements. The drag head can rotate freely until the lower pins of the links reach one end or the other of the slots. The spring shock absorber arrangement is provided to absorb the shock when the lower pins reach an end of the slots. In US1840606 the visor moves freely within its moving range.

A disadvantage of freely moving visors is that the visor will not always follow the contour of the underwater bottom (trenches, dunes) as it is only held against the

underwater bottom by its weight. Also, such a drag head will give a limited penetration depth of the visor (resulting in less production), due to the limited own weight of the visor. Placing additional weights on the visor is usually not a cost effective solution as it requires more hoisting power when lifting the drag head out of the water.

5 Alternatives are known to overcome this problem.

For instance, it is known to fix the visor in a desired rotational position. This solution provides suboptimal results in case of changing dredging conditions, such as changing dredging depths as a result of swell, tidal motions, changing draught of the vessel when being loaded or unloaded, depth of the underwater bottom etc. and
10 changing soil characteristics (e.g. hard packed or loosely packed etc.). This solutions also can result in lift of the heel of the drag head (leading part) from the soil when positioned to deep (resulting in less production). Also a fixed visor will not be able to cope with obstacles and may get damaged..

Another known solution is to control the rotational position of the visor using
15 hydraulic actuators. For example, GB2128663 uses a hydraulic actuator to control the rotational position of the visor. US4123859 and US4150502 each use hydraulic actuators to control the position of the cutting tool or chisel. _However, this is an expensive and complex solution, which requires control effort. Hydraulic systems are prone to leakage and malfunction.

20

SUMMARY

It is an object to provide an improved dredging arrangement.

Therefore, according to an aspect, there is provided a dredging arrangement for dredging material from an underwater bottom, the dredging arrangement comprises a
25 drag head body and a visor, the visor being connected to the drag head body and is moveable with respect to the drag head body over a predetermined range, wherein a biasing device is provided in between the drag head body and the visor exerting a biasing force on the visor over a biasing portion of the predetermined range, the biasing portion being at least 25% of the range.

30 The predetermined range may be adjustable and may be defined by mechanical stops being provided limiting the movement of the moveable parts.

The force is applied such that the visor is pushed towards the underwater bottom. The visor may comprise a plurality of teeth mounted on a row substantially parallel to

the axis of rotation. The force exerted by the biasing device pushes these teeth into the underwater bottom.

This visor can move freely over the remaining portion of the rotational range, but may also be controlled over the remaining portion of the rotational range, for instance
5 by hydraulics or the like.

By using biasing device, a force is applied to the visor resulting in more penetration depth, while maintaining compliance to give way to heavy objects.

According to an embodiment the biasing portion is at least 40% of the rotational range.

10 According to an embodiment the biasing portion is at least 60% of the rotational range.

According to an embodiment the biasing portion is 80% or 100% of the rotational range.

A larger biasing range makes dredging easier, as less control is necessary during
15 dredging to take into account changing dredging conditions, e.g. dredging depths.

According to an embodiment the visor is rotatable with respect to the drag head body about a rotational axis, the predetermined biasing range being a predetermined rotational range, the rotational axis, in use, being substantially parallel to the underwater bottom and perpendicular to a dredging direction, and the predetermined
20 biasing range being a predetermined rotational biasing range. The visor may be connected to a trailing side of the drag head body.

The predetermined rotational range may for instance be set by two mechanical stops limiting the freedom of rotational movement of the visor, for instance to a range of 20°, 30°, 40°, or 50°.

25 Alternatively, visors may be used which are moveable in another manner, such being sliceable, translational or are arranged to perform a combination of a rotational and translational movement.

The range may in this case for instance be 50°, wherein the biasing portion of the range is 20° (40%).

30 According to an embodiment the biasing device exerts a force on the visor such that the visor is pushed into a downward direction. In use, the visor is pushed towards the underwater bottom.

In case of a rotational visor, the visor is pushed to rotate such that the visor effectively moves downwards.

The biasing device is with one end connected to the visor and with another end connected to another part of the dredging arrangement such as the drag head body or lower end of the suction pipe such that the biasing device can apply a force onto the visor. The biasing force pushes the visor in a (rotational) downward direction.

The biasing device is preferably mounted on top of the dredging arrangement.

According to an embodiment the biasing portion of the range is an upper portion of the range and the visor moves freely in a remaining lower portion of the range.

The biasing force is preferably applied over the upper portion of the (rotational) range. The lower portion of the (rotational) range will typically be used when the dredging arrangement is hoisted or positioned on a rest position on deck of vessel. The lower portion of the (rotational) range will also be used when the dredging arrangement meets a dip in the underwater bottom.

According to an embodiment the biasing device is adjustable to set the biasing force being exerted.

By adjusting the biasing force, the behavior of the visor can be adjusted. For instance, in case the biasing device is set to exert a relatively high preloading force, the visor will be pushed into the underwater bottom relatively deeply, resulting in a relatively large dredging depth. The visor will in that case be relatively stiff when an obstacle is met, such as a rock.

It will be understood that depending on the biasing device used, the actual biasing force may vary over the biasing portion of the (rotational) range. However, by adjusting the biasing force, the biasing force can be increased or decreased over the entire biasing portion.

According to an embodiment the biasing device comprises spring devices, the spring device being loaded in the biasing portion of the range such that the spring device exerts a biasing force on the visor.

A spring device is an advantageous device of providing a biasing device. Also, spring devices have the advantage that they can deal with shocks in a reliable manner, for instance when the drag head is dragged over an obstacle, such as a stone or the like.

Also, spring devices may be employed wherein the biasing force increases over the biasing portion of the (rotational) range towards the upper position of the visor.

Spring devices are suitable for creating a predetermined force characteristic along the (rotational) range.

Also, spring devices have the advantages that no external power supply is needed.

According to an embodiment the spring device comprises one or more torsion
5 springs.

According to an embodiment the spring device comprises one or more coil
springs.

The coil springs may be orientated such that their longitudinal direction is parallel
to the dredging direction or at an upward angle with respect to the dredging direction.

10 In case of a rotational visor, the longitudinal direction may be perpendicular to the axis
or rotation. The coil spring can be at an angle with respect to the horizontal direction.

The coil springs may be compression springs, i.e. when unloaded, neighboring
coils do not touch each other. The coil springs are constructed and mounted such that
they are compressed over at least the above defined (rotational) biasing portion of the
15 range.

Of course, other suitable spring devices may be used, such as rubber devices.

According to an embodiment the biasing device is mounted between the visor and
the drag head body or lower end of a suction pipe.

The suction pipe may be connected to the drag head body, or may be integrally
20 formed with the drag head body.

The preloading device may be connected to the drag head body or lower end of
the suction pipe in any suitable manner. The connection may be a direct connection or
may be established by means of a connection member. The connection may be a
rotational connection allowing rotational movement of the biasing device about an axis
25 of rotation parallel to the rotational axis of the visor with respect to the drag head body
or lower end of the suction pipe.

The biasing device may be connected to the visor directly. The biasing device
may be connected to the visor by means of a rotational connection allowing rotational
movement of the biasing device about an axis of rotation parallel to the rotational axis
30 of the visor with respect to the visor.

Alternatively or additionally, the connection allows sliding or lateral movement.

According to an embodiment the biasing device is connected to the dredging
arrangement by means of a force transmitting construction.

The force transmitting construction comprises two or more rotatably connected beams which transfer the force from the preloading means to the visor. Alternatively or additionally, the force transmitting constructions allows sliding or lateral movement.

According to an embodiment the force transmitting construction is adjustable to
5 set the moment of force exerted on the visor by the biasing device.

According to an embodiment, the force transmitting construction is adjustable to set the predetermined range.

According to an embodiment, the moveable part is a visor and the biasing device is arranged to exert a biasing force resulting in a moment of force acting on the visor
10 which is, averaged over the biasing portion at least 50% of the moment of force acting on the visor as a consequence of gravity acting on the visor.

Preferably, the moment of force acting on the visor which is, averaged over the biasing portion at least 75% or at least 100% of the moment of force acting on the visor as a consequence of gravity acting on the visor.

According to an aspect there is provided a dredging vessel comprising a dredging
15 arrangement for dredging material from an underwater bottom according to any one of the preceding claims and a suction pipe connecting the dredging arrangement to the dredging vessel.

According to an aspect there is provided a method for dredging material from an
20 underwater bottom using a dredging vessel comprising a dredging arrangement, the dredging arrangement comprising a drag head body and a visor, the visor being moveable with respect to the drag head body over a predetermined range,

wherein the method comprises

- adjusting the predetermined range through the use of mechanical stops,
- 25 - lowering the dredging arrangement to an underwater position with the drag head positioned on the underwater bottom,
- dredging by dragging the drag head over the underwater bottom in a dredging direction by means of a dredging vessel,

the dredging arrangement comprising a biasing device provided in between the
30 drag head body and the visor exerting a biasing force on the visor over a biasing portion of the predetermined range, wherein the method comprises,

- adjusting the biasing device to set the biasing force being exerted.

As described above, the visor may be rotatable with respect to the drag head body, may be provided at the trailing end and the predetermined range may be a predetermined rotational range. Adjustment is preferably done prior to lowering the dredging arrangement.

5 According to an embodiment the biasing device is connected to the dredging arrangement by means of an adjustable force transmitting construction, and the method comprises,

- adjusting the force transmitting construction to set the moment of force exerted on the visor by the biasing device.

10 The force characteristic (force as a function of the position of the visor within the range) can be adjusted prior to lowering the dredging arrangement.

Adjustment is preferably done prior to lowering the dredging arrangement.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Embodiments will now be described, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, and in which:

FIG. 1 schematically shows completed dredging vessel and a dredging arrangement,

20 Fig.'s 2a – 2c schematically show a perspective, top and side view of a dredging arrangement according to an embodiment,

Fig. 3 schematically shows a side view of a dredging arrangement according to an embodiment,

Fig.'s 4a – 4b schematically show graphs describing the embodiments.

25

The figures are only meant for illustrative purposes, and do not serve as restriction of the scope or the protection as laid down by the claims.

DETAILED DESCRIPTION

30 Fig. 1 schematically depicts a dredging vessel 1 according to an embodiment. The dredging vessel 1 comprises a drag head 10 which is attached to the dredging vessel 1 via a suction pipe 2. The suction pipe 2 comprises a hinge point half way the suction pipe 2.

The drag head 10 and the suction pipe 2 are shown in a lowered position with the drag head 10 resting on an underwater bottom 6. In use, the dredging vessel 1 sails in a dredging direction DD and drags the drag head 10 over the underwater bottom 6.

The drag head 10 and the suction pipe 2 are connected to a wire 4, the wire 4
5 being controlled by wire controller 5. Half way the suction pipe 2, the suction pipe 2 may be connected to a further wire 4' controlled by further wire controller 5'. The further wire controller and wire controller are mainly used for lifting and lowering the suction pipe 2.

The wire controller 5 comprises a first wire control device, in this case formed by
10 a controllable winch 51 and a second wire control device.

The wire controller 5 may further comprise a control unit 55 or the like to control the first, second and further wire control devices. The control unit 55 may be a standalone control unit or may be arranged to cooperate with other remote control units. The control unit 55 may be a computer. The control unit 55 may also be arranged
15 to receive instructions from an operator via a user interface.

The second wire control device may be a heave compensator, in this case formed by a number of pulleys 52, at least one of the pulleys 52 being moveable in a direction perpendicular to the rotational axis of the pulley 52 by an actuator 53. In Fig. 1, the actuator 53 is an hydraulic actuator comprising a cylinder and a piston which can move
20 up and down the cylinder. The moveable pulley 52 is connected to the cylinder. The actuator 53 is also under control of the control unit 55.

The drag head 10 comprises two main parts: the drag head body 11 and the visor 12. The drag head body 11 is on one side connected to the suction pipe 2 via
25 appropriate connection means 13. The drag head body 11 and the (lower end of the) suction pipe 2 may also be formed as one piece.

The drag head body 11 may have any suitable shape and its main purpose is to form a chamber in which an underpressure can be created to vacuum up dredging material from the underwater bottom 6. A pump 21 may be provided to create the
30 required underpressure. The pump 21 may be positioned on board of the dredging vessel 1 (as shown in Fig. 1) and/or at or nearby the drag head 10. The drag head 10 may comprise jet nozzles 22 to create a water jet to loosen the underwater bottom 6. A jet pump 23 and a jet pipe lane 24 may be present.

The visor 12 is a moveable part of the drag head 10.

The visor 12 is moveable with respect to the drag head body 11 to change the dredging characteristics of the drag head 10. In the embodiment shown, the visor is provided on the trailing end of the drag head 10 and is rotatable about a rotational axis RA, which runs perpendicular to the plane of the drawing of Fig. 1, i.e. parallel to the underwater bottom 6 and substantially perpendicular to a dredging direction DD. Rotating the visor 12 to a lower position (counter clockwise in Fig. 1), results in deeper dredging and a higher sand-water ratio.

The drag head 10 may further comprise a valve 14. As shown in Fig.1, the valve 14 is attached to the visor 12 and is arranged to open and close an opening 18 in the visor 12. Alternatively, the valve 14 may be attached to the drag head body 11 and be arranged to open and close an opening 15 in the drag head body 11.

In Fig. 1 the drag head 10 is only shown schematically. Details of the drag head 10 in accordance with the embodiments of the invention are shown in Fig. 2a - 2c and in Fig. 3.

Fig.'s 2a – 2c show the dredging arrangement according to an embodiment in more detail.

Fig. 2a schematically shows a perspective view of a dredging arrangement for dredging material from an underwater bottom 6. The dredging arrangement comprises the drag head body 11 and the visor 12 connected to the drag head body 11 in a moveable manner. As shown in Fig. 2a, the visor is rotatable about a rotational axis RA, but alternative relative movements of the visor 12 and the drag head body 11 are also possible, such as a translational movement, possibly in combination with a rotational movement.

The visor 12 is moveable along a predefined path and has a predefined freedom of movement, indicated with the term range. According to the embodiment shown in Fig. 2a – 2c and 3 the visor is rotatable with respect to the drag head body 11 over a rotational range, which typically is 50°.

A biasing device 60 is provided on top of the dredging arrangement connected to the visor 12 and the drag head body 11 arranged to generate and apply a biasing force between the drag head body 11 and the visor 12. The biasing force pushes the visor 12 in a rotational downward direction, into the underwater bottom 6.

The biasing force is applied over a predetermined portion of the range, for instance over the upper 25% of the range. In the example mentioned above, in which the rotational range typically is 50°, this results in a biasing force being applied to the visor 12 over the upper 12.5°. Of course, the biasing portion may be any suitable
5 percentage, such as 40%, 60%, 80, or 100%. In the remainder of the range (except in case of 100%), the visor 12 is not biased.

Different biasing devices 60 may be used, such as torsion spring 61 or coil springs 63.

A force transmitting construction 62 may be provided to mount the biasing
10 device, such as the torsion spring(s) 61 or coil spring(s) 63, to the dredging arrangement and ensure that the biasing force is applied to the visor 12. This will be explained in more detail below.

Fig. 2a shows torsion springs 61 on top of the dredging arrangement in a direction perpendicular to the dredging direction DD and substantially parallel to the underwater
15 bottom 6 (in use). A lever 621, part of the force transmitting construction 62 is mounted to the torsion springs 61 perpendicular to the torsion springs 61 towards a trailing end of the dredging arrangement. The lever 621 is rotatable about longitudinal axis 625.

The force transmitting construction 62 further comprises a connection rod 622, which is rotatable connected to a distal end of the first lever 621 forming axis of
20 rotation 627.

As shown in Fig. 2a, a connector is provided as part of the force transmitting construction 62 on top of the visor 12, in this case formed by two lugs 623. The lugs 623 are rotatable connected to the connection rod 622 forming axis of rotation 624.

The connection rod 622 and the lever 621 are connected by means of a rotatable
25 and slideable connection. The connection rod comprises a slot extending over a top portion of the connection rod 622 to which the lever 621 is slideably connected, for instance by means of a bolt.

As more clearly indicated in Fig. 2c, schematically depicting a side view of the dredging arrangement, the lever 621 has an arm L1, and the connection rod 622 has an
30 arm L2.

The force transmitting construction 62 is adjustable to set the moment of force exerted on the visor 12 by the biasing device 60. Adjustments may be made to change

the location where the connection rod 622 is attached to the connector in this case formed by the two lugs 623.

Adjusting the force transmitting construction also allows to set the predetermined range. Stops may be provided to limit the movement of the visor, for instance, stops
5 may be provided to limit movements of lever 621, thereby setting a maximum range for the visor 12. The stops may be provided to prevent overload of the springs 61, 63.

For instance, if axis of rotation 624 is in the upper opening provided by lugs 623 (as shown in the figures), the range may be 20° , in which the visor 12 is biased (biasing portion of 100%).

10 If axis of rotation 624 is in the second highest opening provided by lugs 623, the range may be 30° , the upper 20° of which may be biased (biasing portion of 66, 6%).

If axis of rotation 624 is in the second lowest opening provided by lugs 623, the range may be 40° , the upper 20° of which may be biased (biasing portion of 50%).

15 If axis of rotation 624 is in the lowest opening provided by lugs 623, the range may be 50° , the upper 20° of which may be biased (biasing portion of 40%).

Spring devices may be used, such as a torsion spring 61, which generate an increasing force when being deformed. The same applies for a coil spring (an example of which is provided with reference to Fig. 3).

The biasing force is therefore not constant over the portion of the range. This may
20 be at least partially overcome by positioning axes of rotation 624 and 625 with respect to axis of rotation RA of the visor 12 and by choosing length L1 and L2 carefully, i.e. such that rotation of lever 621 about axis of rotation 625 as a function of the rotation of the visor around axis of rotation RA is such that it cancels out the behavior of the spring. The typical behavior of a torsions spring is given by a linear relation between
25 angle of rotation and torque (see Fig. 4a). In order to achieve a constant force being exerted on the visor 12, a preload can be applied to the torsion springs 61. The ratio D of the change in angle of the torsion spring as a function of the change in visor angle, $D = (d \text{ angle}_{\text{spring}} / d \text{ angle}_{\text{visor}})$, is preferably such that it cancels out the spring behavior. An approximated example can be seen in graph 4b, showing ratio D along the vertical
30 and the angle of the visor 12 along the horizontal. Point C is determined by the preload and the desired force. Slope α is determined by the spring stiffness and the applied preload.

Effectively there is a gear ratio between the torsion spring 61 and the visor 12 that changes when the force transmitting device 62 is adjusted. In case of torsion springs the moment of force on the spring times gear ratio is the moment of force on visor.

5 As can be seen from Fig.'s 2a – 2c, the biasing force is applied in the upper portion of the range in which the visor can move. In the lower portion of the range, the visor 12 can move without being influenced by the biasing device 60 as lever 621 can slide freely through the slot of connection rod 622.

Fig. 3 shows an alternative embodiment, wherein the torsion springs 61 are no longer present and instead a linear spring 63 is provided, such as a coil spring 63, attached to a protrusion 631. The torsion springs 61 are replaced with a rod which is rotatable about its longitudinal body axis 625. The protrusion 631 may be formed as part of lever 621.

15 The coil spring 63 is mounted between the protrusion and the drag head body 11 or the lower end of the suction pipe 2.

It will be understood that the dredging arrangement shown in Fig. 2a – 2c and in Fig. 3 can be used in combination with the dredging vessel 1 shown in Fig. 1.

The use of the embodiment will now be described in more detail. The
20 embodiments described can be used in a method for dredging material from the underwater bottom. Such a method may involve use of a dredging vessel 1 as described with reference to Fig. 1 and dredging arrangements described with reference to Fig.'s 2a – 3.

Dredging may be started by lowering the dredging arrangement to the underwater
25 position until the drag head 10 is positioned on the underwater bottom 6. Lowering may be done using the wire controller 5 described above.

Next, dredging may be done by dragging the drag head 10 over the underwater bottom 6 in a dredging direction DD by sailing the dredging vessel in the dredging direction.

30 The biasing device 60 may be set to set the biasing force being exerted. For instance, the torsion springs or the linear spring may be adjusted to set the biasing force. Torsion springs 61 may for instance be set by rotating the torsion springs 61 with respect to the dredging arrangement.

However, adjusting the biasing device 60 may also comprise replacing the springs with alternative springs, having a different force characteristic or changing the amount of springs.

Furthermore, the force transmitting construction may be adjusted to set the
5 moment of force exerted on the visor 12 by the biasing device 60 may be set. For instance, the location where the connection rod 622 is attached to the connector, e.g. the two lugs 623, may be adjusted.

The descriptions above are intended to be illustrative, not limiting. It will be apparent to the person skilled in the art that alternative and equivalent embodiments of
10 the invention can be conceived and reduced to practice, without departing from the scope of the claims set out below.

CLAIMS

1. Dredging arrangement for dredging material from an underwater bottom (6), the dredging arrangement comprises a drag head body (11) and a visor (12), the visor (12) being connected to the drag head body (11) and is moveable with respect to the drag head body (11) over a predetermined range, wherein a biasing device (60) is provided in between the drag head body (11) and the visor (12) exerting a biasing force on the visor (12) over a biasing portion of the predetermined range, the biasing portion being at least 25% of the range, wherein the predetermined range is adjustable and defined by mechanical stops.
2. Dredging arrangement according to claim 1, wherein the biasing portion is at least 40% of the range.
3. Dredging arrangement according to claim 1, wherein the biasing portion is at least 60% of the range.
4. Dredging arrangement according to claim 1, wherein the biasing portion is 80% or 100% of the range.
5. Dredging arrangement according to any one of the preceding claims, wherein the visor is rotatable with respect to the drag head body (11) about a rotational axis (RA), the predetermined range being a predetermined rotational range, the rotational axis (RA), in use, being substantially parallel to the underwater bottom (6) and perpendicular to a dredging direction (DD), and the predetermined range being a predetermined rotational range.
6. Dredging arrangement according to any one of the preceding claims, wherein the biasing device (60) exerts a force on the visor (12) such that the visor (12) is pushed into a downward direction.

7. Dredging arrangement according to any one of the preceding claims, wherein the biasing portion of the range is an upper portion of the range and the visor (12) moves freely in a remaining lower portion of the range.
- 5 8. Dredging arrangement according to any one of the preceding claims, wherein the biasing device (60) is adjustable to set the preloading force being exerted.
9. Dredging arrangement according to any one of the preceding claims, wherein the biasing device (60) comprises a spring device (61, 63), the spring device (61, 63) being
10 loaded in the biasing portion of the range such that the spring device (61, 63) exerts a biasing force on the visor (12).
10. Dredging arrangement according to claim 9, wherein the spring device comprises one or more torsion springs (61).
- 15 11. Dredging arrangement according to claim 9, wherein the spring device comprises one or more coil springs (63).
12. Dredging arrangement according to any one of the preceding claims, wherein the
20 biasing device (60) is mounted between the visor (12) and the drag head body (11) or lower end of a suction pipe (2).
13. Dredging arrangement according to any one of the preceding claims, wherein the biasing device (60) is connected to the dredging arrangement by means of a force
25 transmitting construction (62).
14. Dredging arrangement according to claim 13, wherein the force transmitting construction (62) is adjustable to set the moment of force exerted on the visor (12) by the biasing device (60).
- 30 15. Dredging arrangement according to any one of the claims 13 – 14, wherein the force transmitting construction (62) is adjustable to set the predetermined range.

16. Dredging arrangement according to any one of the preceding claims, wherein the moveable part is a visor (12) and the biasing device (60) is arranged to exert a biasing force resulting in a moment of force acting on the visor (12) which is, averaged over the biasing portion at least 50% of the moment of force acting on the visor (12) as a consequence of gravity acting on the visor (12).

17. Dredging vessel (1) comprising a dredging arrangement for dredging material from an underwater bottom (6) according to any one of the preceding claims and a suction pipe (2) connecting the dredging arrangement to the dredging vessel (1).

10

18. Method for dredging material from an underwater bottom (6) using a dredging vessel (1) comprising a dredging arrangement, the dredging arrangement comprising a drag head body (11) and a visor (12), the visor (12) being moveable with respect to the drag head body (11) over a predetermined range,

15 wherein the method comprises

- adjusting the predetermined range through the use of mechanical stops;
- lowering the dredging arrangement to an underwater position with the drag head (10) positioned on the underwater bottom (6),
- dredging by dragging the drag head (10) over the underwater bottom (6) in a dredging direction (DD) by means of a dredging vessel (1),

20 wherein the dredging arrangement comprising a biasing device (60) provided in between the drag head body (11) and the visor (12) exerting a biasing force on the visor (12) over a biasing portion of the predetermined range, wherein the method comprises,

- adjusting the biasing device (60) to set the biasing force being exerted.

25

19. Method according to claim 18, wherein the biasing device (60) is connected to the dredging arrangement by means of an adjustable force transmitting construction (62), and the method comprises,

- adjusting the force transmitting construction to set the moment of force exerted on the visor (12) by the biasing device (60).

30

20. Method for dredging material from an underwater bottom (6) using a dredging arrangement according to any one of the claims 1 – 16.