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. 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 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 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.

SUMMARY

It is an object to provide an improved dredging arrangement.

Therefore, according to ~~an~~ first aspect of the invention, there is provided a dredging arrangement for dredging material from an underwater bottom, the dredging arrangement comprises a 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, wherein the predetermined range is adjustable and defined by mechanical stops.

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 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 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 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 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 a~~n~~ second aspect of the invention, there is provided a method for dredging material from an 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,
- 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,

wherein the dredging arrangement comprising a biasing device 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, wherein the method comprises,

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

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.

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 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)~~.

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 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 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)~~.

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)~~.

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,

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)~~,

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.

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)~~.

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