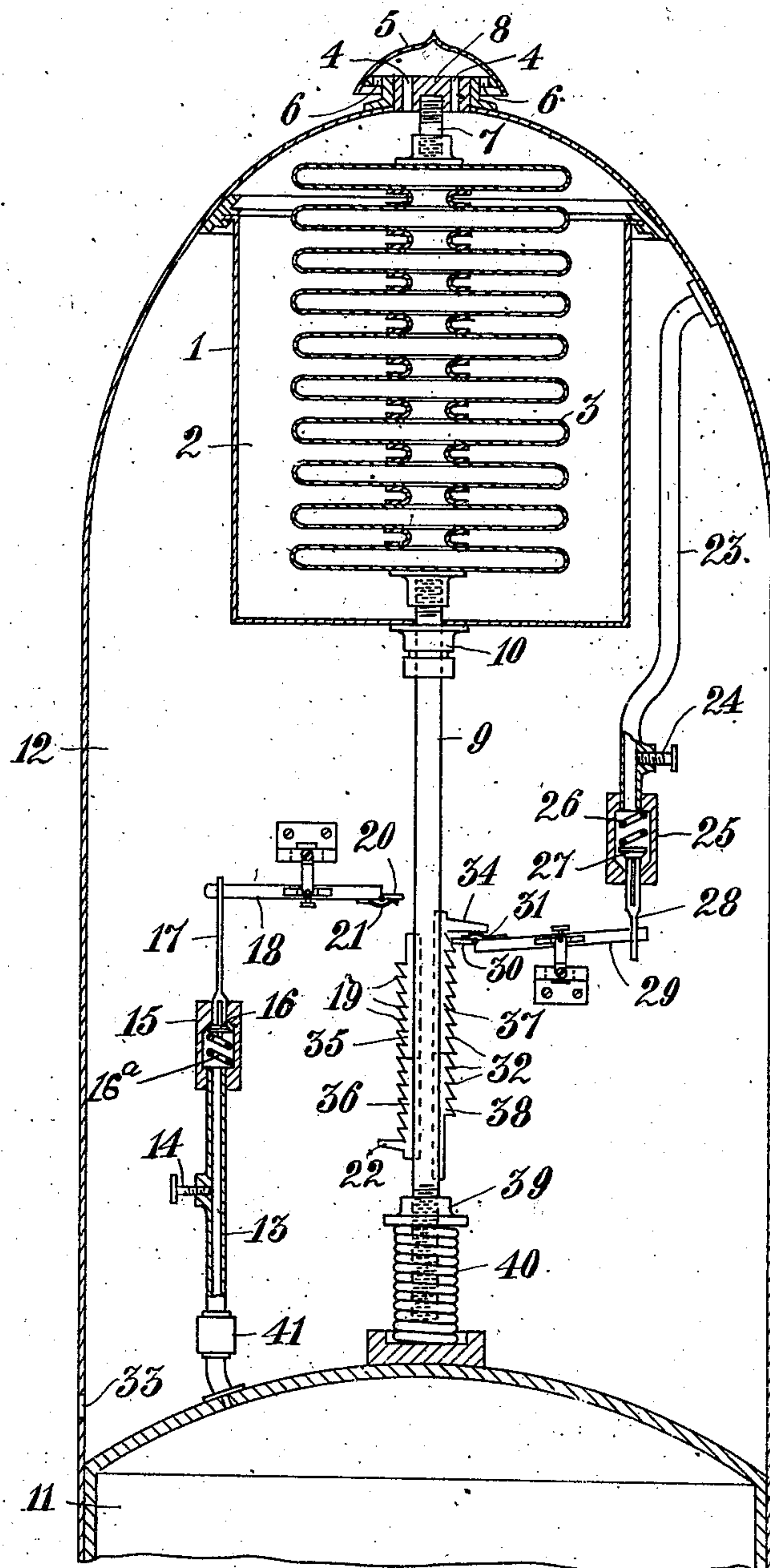


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 AUTOMATIC DEPTH REGULATING DEVICE FOR FREELY SUBFLOATING BODIES.
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952,452.

Patented Mar. 22, 1910.



Witnesses

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AUTOMATIC DEPTH-REGULATING DEVICE FOR FREELY-SUBFLOATING BODIES.

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Specification of Letters Patent. Patented Mar. 22, 1910.

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To all whom it may concern:

Be it known that I, KARL OSKAR LEON, a subject of the King of Sweden, and resident of Gottenborg, in the Kingdom of Sweden, have invented new and useful Improvements in Automatic Depth-Regulating Devices for Freely-Subfloating Bodies, of which the following is a specification, reference being had to the drawing accompanying and forming a part hereof.

This invention relates to automatic depth-regulating devices for freely sub-floating bodies, such as sub-floating drift mines, torpedoes, submarine boats, and the like.

In my earlier application for patent Serial No. 368498, filed April 16, 1907, a sub-floating drift mine is described which is provided with means acting to retain the mine within certain predetermined depths of submersion. To this end a receptacle for compressed air or gas (high-pressure chamber) and a depth-regulating chamber working with air or gas pressure from the high-pressure chamber are arranged within the mine, said depth-regulating chamber having a normally closed outlet for the pressure-fluid therein. The connections of the depth-regulating chamber are controlled by a valve, or the like, operated by a water-pressure-actuated device in such a manner that the displacement of the mine is increased or decreased, respectively, according as the mine is below or above a predetermined normal depth of submersion. This depth-regulating device has, however, proved itself not to be fully as practical as desired, inasmuch as the displacement is continually increased, after the mine has commenced to ascend, and is continually decreased, after the mine has commenced to sink, whereby the vertical movements of the mine become greater than is generally desirable.

This invention has for its object to remove the said drawback and provide a depth-regulating device for sub-floating bodies of any kind by which the floating power of the body is increased, as soon as the body commences to sink, and is decreased, as soon as the body commences to ascend, so that the body is at every time counteracted in its movements and may be kept floating at a nearly constant depth, if desired.

The invention consists generally, in providing means, controlled by the outer water

pressure, for increasing the floating power of the body, as soon as the body commences to sink, and decreasing the floating power of the body, as soon as the body commences to ascend.

More particularly the invention consists in the combination with a sub-floating body, of a high-pressure chamber, a depth-regulating chamber, a connection between the said chambers, means acting to normally keep the said connection closed, an outlet for the pressure-fluid contained in the depth-regulating chamber, means acting to normally keep the said outlet closed, means controlled by outer water pressure for opening the connection between the high-pressure chamber and the depth-regulating chamber, whenever the body ascends, and means controlled by the outer water pressure for opening the aforesaid outlet, whenever the body ascends.

Preferably, the invention is carried out in such a manner that the connection between the high-pressure chamber and the depth-regulating chamber, or the outlet for the pressure-fluid within the last-mentioned chamber, respectively, is opened intermittently, as the body descends or ascends, respectively. To this end the device movable under the influence of the varying water pressure is provided with teeth, cogs, pins, or similar organs one set of which acts to intermittently open the connection between the high-pressure chamber and the depth-regulating chamber, when the said organs move in one direction, while another set of said organs acts to intermittently open the outlet for the pressure-fluid within the depth-regulating chamber, when the said organs move in the opposite direction.

The invention further comprises the construction and combination of parts herein-after more particularly set forth.

In the drawing, I have shown, by way of example, an axial section of the upper part of a sub-floating drift mine provided with a depth-regulating device embodying the invention.

Referring to the drawing, 1 is a cylinder inclosing a chamber 2 at the top of the mine. Placed in the said chamber 2 is a water-pressure-actuated device, suitably consisting of a series of metal boxes or bellows 3 communicating with each other. Contrary to

what is the case in the mine described in the earlier application for patent hereinbefore referred to, the bellows 3 are supposed, in the embodiment illustrated, to be perfectly closed. Said bellows are supposed to be filled with air or other gas and are actuated by the water pressure at the outer side thereof, the chamber 2 communicating through openings 4 at the top of the mine with the water outside the latter. In order to prevent too strong a pressure upon the bellows, when the mine is ejected, a cap 5 is placed in front of the openings 4, the interior of said cap communicating through backwardly opening apertures with the water outside the mine. The bellows 3 are attached, at the top, by means of a screw 7 to the top-plate 8 having the openings 4 and is screwed, at its lower end, to the upper end of a rod 9 passing through a stuffing-box 10 situated at the bottom of the chamber 2 and closing water-tightly against the rod. By arranging the bellows in such a manner that the water acts at the outer and the air at the inner side thereof the advantage is gained that the rod 9 need only be tightened against water in the passage through the bottom of the chamber 2 which is obviously considerably easier than to provide a tightening against air or other gas. The device for moving the rod 9 in one or the other direction according to the variations in the water pressure dependent on the depth of immersion of the mine is not essential since to this end any suitable contrivances might be employed, for instance a piston moving in a cylinder and having a diaphragm or the like fitting tightly against the cylinder. It is, therefore, to be understood that the invention is not limited to any particular device for transmitting the action of the pressure to the movable part entering the depth-regulating chamber.

The connection between the high-pressure chamber 11 and the depth-regulating chamber 12 is established by means of a tube 13 whose cross-sectional area can be regulated by means of a screw 14 having tightly fitting screw-threads. Situated at the upper end of the tube 13 is a valve casing 15 having a valve 16 tightly held against a seat at the upper part of the valve casing by a spring 16^a. The valve rod 17 is not actuated directly by the rod 9 but the movement is transmitted through the intermedium of a lever 18 arranged in such a manner as to be operated by teeth 19 arranged on the rod 9. The lever 18 is, suitably, journaled in such a manner that the ratio between the lengths of the lever arms can be varied as required. Pivotally attached to the lever 18, at the end thereof adjacent to the rod 9, is a finger 20 adapted to be pressed downwardly against the action of a spring 21 but not to be folded upwardly. When the water

pressure increases and causes the bellows 3 to contact, the rod 9 is moved upwardly whereby the teeth 19 act in turn upon the finger 20 and cause the lever 18 to swing so that the valve 16 is opened and admits compressed air into the depth-regulating chamber. Whenever a tooth passes the finger 20, the valve 16 is again closed, so that compressed air will be admitted by portions into the depth-regulating chamber whenever a tooth acts upon the finger 20. If all teeth pass the finger 20 without a sufficient quantity of compressed air having been admitted into the depth-regulating chamber in order to cause the mine to ascend, a nose 22 situated below the teeth 19 will act upon the finger 20, or the lever 18, respectively, so that the latter is caused to open the valve 16 and keep it in open position until a sufficient quantity of water has been driven out from the depth-regulating chamber to allow the mine to ascend. When the mine ascends, the bellows again expand whereby the rod 9 is slowly moved downward, the teeth 19 then moving the finger 20 downwardly, against the action of the spring 21, without the lever 18 being turned.

In order to allow the air within the depth-regulating chamber to escape, a tube 23 is arranged in the upper part thereof, said tube communicating, at its upper end, with the water outside the mine. The cross-sectional area of the tube 23 can be regulated by means of a screw 24 fitting tightly in the wall of the tube. Situated at the inner end of the tube 23 is a valve casing 25 inclosing a valve 27 actuated by a spring 26. The valve rod 28 is actuated by a lever 29 suitably journaled in the same manner as the lever 18. Pivotally attached to the free end of the lever 29 is a finger 30 adapted to be folded upwardly against the action of a spring 31 but which cannot be folded downwardly. When a downward pressure is exerted on the said finger, the lever 29 is thus caused to swing and open the valve 27.

When the rod 9 is moved downwardly, one after the other of a series of teeth 32 will act upon the finger 31 and cause the lever 29 to intermittently open the valve 27 so that air is blown out and water is admitted through an opening 33 in the lower part of the depth-regulating chamber. As a safety device in case the whole series of teeth 32 should pass the finger 30 without a sufficient quantity of water having been admitted into the depth-regulating chamber to cause the mine to sink, a nose 34 is situated above the teeth 32, said nose serving to keep the lever 29 pressed down and thereby the valve 27 open until the mine commences to sink. While the mine is sinking, the finger 30 is caused by the teeth 32 to swing upwardly without the lever 29 being turned.

If the levers 18 and 29 are arranged in

such a manner as to be able to swing freely a certain distance in one direction without actuating the valve but to cause the valve to open, when they swing in the opposite direction, the fingers and the springs acting thereon may obviously be dispensed with. Obviously, the teeth need not have the form indicated in the drawing but may be given any suitable symmetrical or unsymmetrical form or be substituted by pins or the like.

In order to enable the teeth to be changed according to the movements to be performed by the mine, the teeth 19 and 32 are not formed on the rod 9 proper but on metal parts adapted to be inserted in longitudinal grooves in the rod 9. In the drawing each series of teeth is shown divided in two halves, each formed on a separate plate 35, 36, 37, 38 so that by moving the upper and the lower teeth plate 35, 36 or 37, 38, respectively, apart a middle field is obtained in which the mine is free to move without the valves being actuated. Furthermore, the teeth may be arranged in several ways, for instance in such a manner that they increase in length upwardly or downwardly or increase or decrease in length toward the middle according to the functions to be performed by the mine. Moreover, the two series of teeth may, obviously, be placed at different heights, and so on. The chief thing is that the connection between the high-pressure chamber and the depth-regulating chamber is kept open substantially while the mine is sinking and that the connection between the upper part of the depth-regulating chamber and the space outside the mine is kept open substantially while the mine ascends.

By means of the described arrangements the movements of the mine may be adjusted without difficulty so that after some time the mine will be practically stationary, the action of only one tooth in either direction being sufficient for causing the mine to ascend and descend.

The rod 9 is shown provided, at its lower end, with an adjustable flange 39 acting on the upper end of a coiled spring 40 serving to counteract and regulate the movement of the bellows.

If desired, a pressure-reducing valve 41 of any suitable construction may be interposed between the high-pressure chamber 11 and the valve 16 controlling the supply of pressure-fluid to the depth-regulating chamber.

Though I have described my invention as particularly applicable to submarine mines, it is obvious that the invention may be used in freely sub-floating bodies of any kind whatsoever.

In conclusion I wish to point out that I do not restrict myself to the precise details of construction and arrangement hereinbefore described and illustrated, for manifestly the

same may be varied considerably and in many particulars without departure from the principle of my invention. Thus, it is obvious that it is not necessary that the outlet for the pressure-fluid within the depth-regulating chamber opens outside the mine, but it may as well open into a chamber inside the mine, if desired.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination with a sub-floating body, of means, controlled by outer water pressure, for intermittently increasing the floating power of the body, as soon as the body commences to sink, and intermittently decreasing the floating power thereof, as soon as it commences to ascend.

2. The combination with a sub-floating body, of means for intermittently increasing the displacement of said body, whenever it descends, and intermittently decreasing the displacement of said body, whenever it ascends.

3. The combination with a sub-floating body, of means for intermittently increasing the floating power of said body, when the body moves downward between certain predetermined depths, means for constantly increasing the floating power of the body, when it sinks below a certain predetermined depth, means for intermittently decreasing the floating power of the body, when it moves upward between certain predetermined depths, and means for constantly decreasing the floating power of the body, when it ascends above a certain predetermined depth.

4. The combination with a sub-floating body, of a high-pressure chamber, a depth-regulating chamber, a connection between the said chambers, means acting to normally keep the said connection closed, an outlet for the pressure-fluid contained in the depth-regulating chamber, means acting to normally keep the said outlet closed, means controlled by outer water pressure for opening the connection between the high-pressure chamber and the depth-regulating chamber, whenever the body descends, and means controlled by the outer water pressure for opening the aforesaid outlet, whenever the body ascends.

5. The combination with a sub-floating body, of a high-pressure chamber, a depth-regulating chamber, a connection between the said chambers, means acting to normally keep the said connection closed, an outlet for the pressure-fluid within the depth-regulating chamber, means acting to normally keep the said outlet closed, means controlled by outer water pressure for intermittently opening the connection between the high-pressure chamber and the depth-regulating chamber, when the body moves downward, and means controlled by the outer water

pressure for intermittently opening the aforesaid outlet, when the body moves upward.

6. The combination with a sub-floating body, of a high-pressure chamber, a depth-regulating chamber, a connection between the said chambers, means acting to normally keep the said connection closed, an outlet for the pressure-fluid within the depth-regulating chamber, means acting to normally keep the said outlet closed, a device actuated by outer water pressure, teeth carried by the said device, means operated by one set of teeth for intermittently opening the connection between the high-pressure chamber and the depth-regulating chamber, when the body descends, and means operated by another set of teeth for intermittently opening the aforesaid outlet, when the body ascends.
7. The combination with a sub-floating body, of a high-pressure chamber, a depth-regulating chamber, an adjustable connection between the said chambers, means acting to normally keep the said connection closed, an adjustable outlet for the pressure-fluid contained in the depth-regulating chamber, means acting to normally keep the said outlet closed, means controlled by outer water pressure for opening the connection between the high-pressure chamber and the depth-regulating chamber, whenever the

body descends, and means controlled by the outer water pressure for opening the aforesaid outlet, whenever the body ascends.

8. The combination with a sub-floating body, of a high-pressure chamber, a depth-regulating chamber, a connection between the said chambers, means acting to normally keep the said connection closed, an outlet for the pressure-fluid within the depth-regulating chamber, means acting to normally keep the said outlet closed, means controlled by outer water pressure for intermittently opening the connection between the high-pressure chamber and the depth-regulating chamber, when the body moves downward, means for keeping the said connection open, when the body descends below a certain predetermined depth, means controlled by outer water pressure for intermittently opening the aforesaid outlet, when the body moves upward, and means for keeping the said outlet open, when the body ascends above a certain predetermined depth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

KARL OSKAR LEON.

Witnesses:

OSKAR GROS,
K. MEISTER.