Candidate's answer

Description

Valve for a Snorkel

The invention concerns a valve for a snorkel according to the preamble of claim 1. The snorkel valve may remain closed when submerged, but opens when surfaced.

Different snorkel valves are on the market, which prevent water from entering the breathing tube. These snorkel valves automatically close the free end of the snorkel when the snorkel submerges.

The most well-known of these snorkel valves is sold by Nemo Tubes Ltd. under the name "Nautilus". ~~*Fig. 1 shows a snorkel equipped with a Nautilus valve. Figs. 2A-2C show a Nautilus valve in use.*~~

The snorkel ~~1~~ has a J-shaped breathing tube ~~2~~ with a mouthpiece ~~3~~ at one end. At the other end of the breathing tube ~~2~~, a tube portion ~~5~~ of a mushroom-shaped snorkel valve ~~4~~ is releasably fixed. Alternatively, the tube portion ~~5~~ may be integrally formed with the breathing tube ~~2~~.

The tube portion ~~5~~ opens into a hemispherical end piece ~~6~~. ~~As can be seen from Figs. 1 and 2A~~ several openings ~~8~~ are provided in the flat surface ~~7~~ of the end piece ~~6~~. Through these openings ~~8~~ breathing air can flow towards the mouthpiece ~~3~~ via the end piece ~~6~~, the tube portion ~~5~~ and the breathing tube ~~2~~.

A float ~~9~~ comprises a hollow ring-shaped body ~~10~~, which is made of plastic and surrounds the tube portion ~~5~~ such that the float can move up and down along the tube portion. ~~Fig. 2A shows~~ a stop may be mounted on the tube portion 5 of the snorkel valve ~~4~~ for limiting the movement of the float ~~9~~ away from the end piece. A seal ~~12~~ is arranged in the top portion of the hollow ring-shaped body ~~10~~ facing the end piece ~~6~~.

During snorkelling at the water surface, the snorkel valve ~~4~~ projects from the water ~~as shown in Fig. 2A~~. The gravity force G acting on the float ~~9~~ keeps it at a rest position in which the float rests on the stop ~~11~~. The free space between the end piece ~~6~~ and the float ~~9~~ ensures that breathing air can flow through the openings ~~8~~ into the tube portion ~~5~~, ~~as indicated by the dashed arrow in Fig. 2A~~.

Sometimes the snorkel valve submerges ~~as shown in Fig. 2B.~~ According to Archi... Principle, a body submerged in water experiences a lifting force, called the buoy... force. The buoyancy force corresponds to the weight of the water displayed by t... submerged body. As the gravity force G acting on the hollow float ~~9~~ of the Nautilus valve is much smaller that the buoyancy force B acting on the float under water, the force R resulting from B and G promptly pushes the float upwards until it makes contact with the flat surface ~~7~~ of the end piece ~~6~~. In this position ~~shown in Fig. 2B~~ the seal ~~12~~ is pressed against the flat surface ~~7~~ so that the openings ~~8~~ are closed. No water can enter the tube portion ~~5~~.

However, a problem with such known snorkel valves is it only functions if it remains upright and requires the snorkeler not to turn his head too much, otherwise the valve may open and water may enter.

An improvement to the Nautilus style valve can be obtained by placing magnets in the end piece close to the openings/orifices and an annular sheet of ferromagnetic metal around the buoyant seal or float.

When the float ~~9~~ is in the closed position the holding force F applied by the magnets 13exceeds the force R resulting from the gravity force G and the buoyancy force B acting on the float. Therefore, the float ~~9~~ is held in the closed position, even when the snorkel valve is upside down ~~as shown in Fig. 30~~.

However, there is a problem with such designs *since the holding force F applied by the magnets in the closed position of the float ~~9~~ is greater than the gravity force G acting on the float, the float remains in the closed position upon resurfacing, ~~as can be seen in Fig. 3D.~~ To reopen the snorkel valve, the snorkeller needs to pull the float ~~9~~ away from the end piece 6 by hand.*

It is therefore an object of the invention to provide a snorkel valve of the type described above, with a float and holding means to hold the valve in the closed position, which can be kept closed when submerged in all orientations, and can open automatically, without action by the user, when the valve merges from the water. This object is achieved by the snorkel valve according to the combination of features of claim 1.

With this arrangement, not only does the holding means supply a closing force that retains the valve in a closed position when submerged in any orientation, but the valve also opens automatically under the action of gravity when the snorkel valve is above the water. This is achieved by ensuring that the closing force applied by the holding means is smaller than the gravity force acting on the valve member, and when the snorkel is submerged, the closing force exceeds the force resulting from the gravity force and the buoyancy force. The holding means and the mass and volume of the valve member are configured to achieve this.

Further advantageous embodiments of the snorkel valve according to the invention have been specified in the dependent claims.

Claims

1. A snorkel valve (4, 104) comprising:
- a valve member (9, 109) comprising a float (10, 110);
- one or more valve orifices (8, 108) in the form of openings, the valve member being moveable between an open position where the valve orifices are open, and a closed position where the valve orifices are closed by the valve member; and
- further comprising holding means (13, 15, 115) to exert a closing force (F) to hold the valve member in the closed position
characterised in that:
- the holding means (13, 15, 115) and the mass and volume of the valve member (9, 109) are configured such that the closing force (F) is smaller than the gravity force (G) acting on the valve member, and, when the snorkel valve (4, 104) is submerged, the closing force (F) exceeds the force (R) resulting from the gravity force (G) and the buoyancy force (B).

2. A snorkel valve (4, 104) according to claim 1 wherein the float (8, 108) comprises a hollow ring shaped body filled with a material.

3. A snorkel valve (4, 104) according to claim 2 wherein the material is rubber.

4. A snorkel valve (4, 104) according to claim 2 wherein the material is a liquid.

5. A snorkel valve (4, 104) according to claim 1 wherein the float (8, 108) comprises a ring shaped hollow body made of a heavy material.

6. A snorkel valve (4, 104) according to claim 5 wherein the heavy material is stainless steel.

7. A snorkel valve (4, 104) according to any preceding claim wherein the holding means comprises a magnet (13) and a ferromagnetic material (12).

8. A snorkel valve according to any preceding claim wherein the valve further comprises an end piece in which the orifices are provided.

9. A snorkel valve according to claim 8 when dependent on claim 7 wherein the magnet is located adjacent to the orifices and the ferromagnetic material is located on the valve member.

10. A snorkel valve according to any of claims 1-6 wherein the holding means is one or more springs.

11. A snorkel valve according to claim 10 wherein the spring extends through the orifices.

12. A snorkel valve according to claim 10 or 11 wherein the spring is a tension spring.

13. A snorkel valve according to claim 10 wherein the valve member comprises an end piece (109) forming an enclosure around a tube piece.

14. A snorkel valve according to claim 13 wherein the spring is a compression spring.

15. A snorkel valve according to claim 14 wherein the spring is attached at one end to the end piece (109) and at the other end to the tube piece.

16. A snorkel valve according to any of claims 13-15 wherein the tube piece includes an annular collar projecting from the tube end, the orifices being defined by a gap between the annular collar and the valve member.

17. A snorkel valve according to claim 16 wherein a seal (112) is arranged on the portion of the valve member facing the collar (111).

18. A snorkel valve according to claim 16 or 17 having one or more axial channels between the valve member and the tube portion, to allow air to pass to the orifices.

19. A snorkel valve according to claim 18 wherein the axial channels are formed by axial recesses in the inner surface of the valve member facing the tube portion (105).

20. A snorkel including a snorkel valve according to any preceding claim.

21. A snorkel valve according to any of claims 1-15 further comprising a tube portion suitable for connection to a snorkel.