

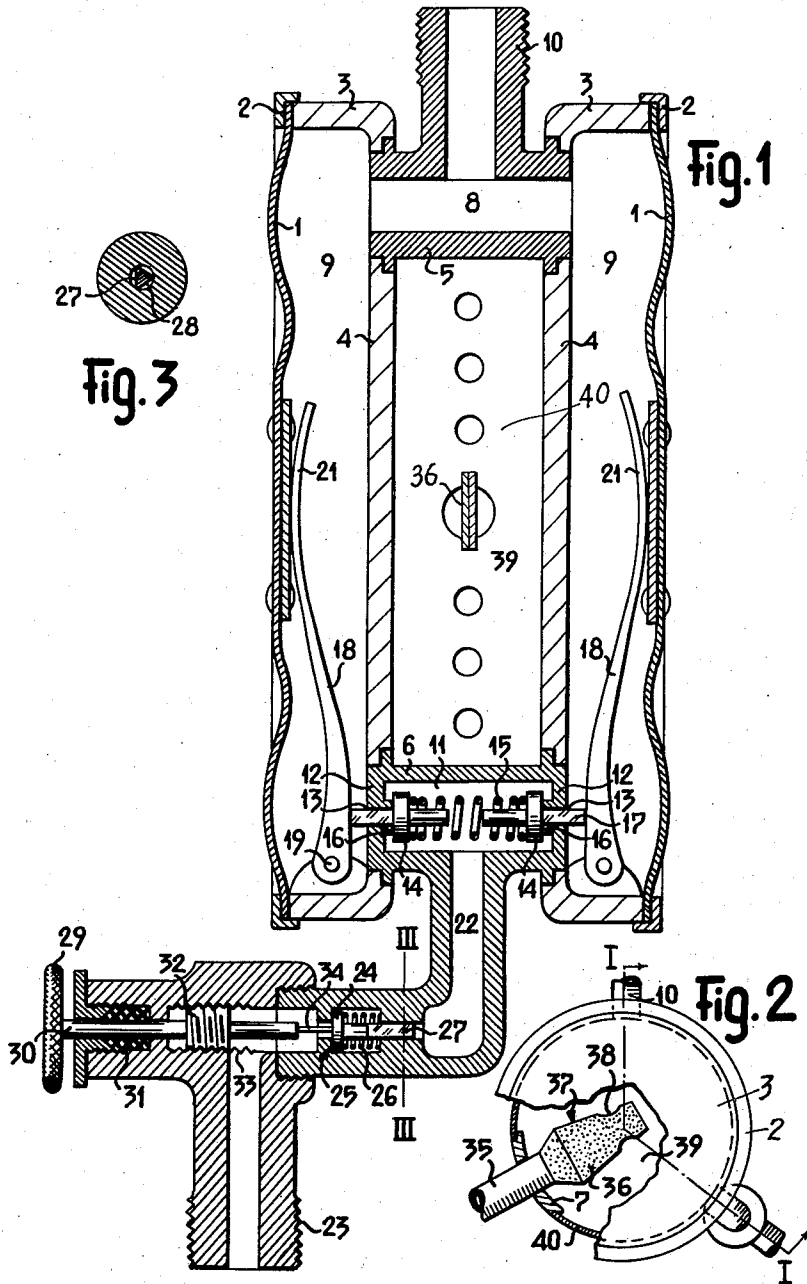
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DEVICE FOR SUPPLYING A DIVER WITH AIR

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DEVICE FOR SUPPLYING A DIVER WITH AIR

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The present invention relates to a device for supplying a diver with air and comprising a discharge valve for the air breathed out, said valve being disposed in the vicinity of a manometric device regulating the pressure of the fresh air supplying the diver's mask or helmet. It is known that in order to prevent the diver from rapidly becoming out of breath, the pressure of the fresh air supplying the diver must be so adjusted as to correspond approximately to the pressure necessary to cause the discharge of the air which the diver breathes out. The air supply devices which are provided at the present time on diver's or underwater swimmer's harnesses generally comprise a valve for the discharge of the air breathed out, disposed in the vicinity of a manometric cell having a deformable diaphragm subjected on the one hand to the ambient pressure and on the other hand to the pressure of the air supplying the diver's mask.

Now, depending on the position of the diver in space, this discharge valve is situated at a greater or less depth than the diaphragm of the pressure gauge. The result is that according to the respective positions in space of this valve and this diaphragm, the diver must either apply considerable effort to expel the air he has breathed, or must make an effort to draw in the fresh air supplied by the supply device. Even a difference in level between the discharge valve and the manometric diaphragm of a dozen centimetres causes the diver to become quickly out of breath.

The object of the device for supplying air to a diver according to the invention is to obviate this disadvantage in that it has two manometric devices each comprising a member which is sensitive to a pressure difference and each controlling a supply valve, and in that the two members sensitive to a pressure difference are disposed at equal distances one on each side of the discharge valve for the air breathed out.

One form of embodiment of the device according to the invention is illustrated diagrammatically and by way of example in the accompanying drawings.

Fig. 1 is a sectional view taken on the line I—I of Fig. 2.

Fig. 2 is a plan view, on a smaller scale, with some parts broken away.

Fig. 3 is a detail view.

According to the accompanying drawing, the device for supplying fresh air to a diver's mask comprises two circular elastically deformable diaphragms 1, each of which is clamped by means of a ring 2 to a case 3. The bottom walls 4 of these cases are fixed rigidly to cross-members 5, 6, 7. The cross-member 5 has an axial hole 8 connecting together the inner spaces 9 of the cases 3. This hole 8 also communicates with a stub pipe 10 for receiving a pipe for supplying fresh air to the diver's mask.

The cross-member 6 has an inner chamber 11 whose end walls 12 each comprise a circular aperture 13 opening into the spaces 9. Each aperture 13 is obturated by a valve 14, the latter being urged by a spring 15

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against a seating 16. Each valve 14 is provided with a stem 17 of triangular cross-section slidable in the apertures 13. These valve stems project into the interior of the spaces 9 and are operated in opposition to the action of the spring 15, by levers 18 which are pivotable on pins 19 carried by lugs 20 fast with the walls of the cases 3. The free end 21 of each lever 18 is in contact with the central portion of one of the deformable diaphragms 1.

The chamber 11 is connected by a channel 22 and a safety device to a stub pipe 23 which is intended for receiving a pipe connected to a bottle (not shown) of compressed air. The safety device comprises a valve 24 which is urged on to a seating 25 by a spring 26 and comprises a stem 27 of triangular cross-section slidable in a conduit 28 (Fig. 3) opening into the channel 22. This safety device comprises an operating member 29 provided with a rod 30 traversing a stuffing-box 31 and carrying a screw 32 which is engaged in a screwthreading 33. This screw 32 carries a push member 34 which extends through the seating 25 and whose end comes to act on the valve 24 in opposition to the action of the spring 26.

The cross-member 7 is traversed by a conduit 35 which is connected to the diver's mask and whose end is provided with a discharge valve 36 of the type known as a "duckbill" valve, said valve being constituted by two blades of rubber whose edges 37 are welded together except at two escape points 38 formed by notches. This discharge valve is situated centrally of the chamber 39 formed by the two bottom walls of the cases 3, and a perforated cylindrical wall 40 connecting these two bottom walls is fixed to the cross-members.

The device which has been described operates as follows:

When the diver is under water, the two manometric diaphragms 1 are subjected to the pressure of the water, which varies with the depth to which the diver has proceeded. This pressure causes the elastic deformation of the diaphragms, which, by way of levers 18, controls the opening of the valves 14. Fresh air coming from the bottle of compressed air can therefore enter the spaces 9. As soon as the internal pressure is equal to the external pressure, the valves 14 are closed. Thus, when the diver breathes in, he causes a reduction in the pressure prevailing in the spaces 9, and the diaphragms 1 at once cause immediately the valves 14 to be opened.

Consequently the diver breathes in air which is at the same pressure as that to which his body is subjected.

When the diver breathes out, he causes the pressure inside his mask to increase slightly. This increase in pressure is propagated to the spaces 9 so that the valves 14 are closed immediately. The air breathed out then escapes through the conduit 35 and the valve 36. Now, since this valve is held closed by the pressure of the water acting upon these two flexible rubber lips, it is clear that it allows the air breathed out to escape as soon as the pressure within the conduit 35 is equal to or greater than the pressure of the water acting on its lips. If the discharge valve and the two diaphragms 1 are located at the same level, the diver can cause the breathed-out air to be expelled without any difficulty, since the two inlet valves 14 are closed. If, on the other hand, the two diaphragms 1 are at different levels, the valve 36 is then at an intermediate level. As a result the diver can expel the breathed-out air without difficulty, one of the valves 14, controlled by the diaphragm 1 which is located at a lower level, remaining very slightly open. Since these diaphragms are spaced from 10 to 15 centimetres from one another and are disposed one on either side of and equally spaced from the discharge valve 36, this flow of fresh air during breathing-out is very small and

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practically negligible. On the other hand, the diver can always breathe air in and out at the pressure of his surroundings, regardless of the respective positions of the diaphragms and of the discharge valve with respect to the surface of the water. In fact, with the arrangement which has been described, each manometric device can be regulated in such manner as to bring about the opening of the supply valve which it controls as soon as the external pressure exceeds the internal pressure. In the known apparatuses, on the contrary, a certain safety margin has to be observed, so as to take into account possible differences in level between the diaphragm and the discharge valve. This feature of the device according to the invention makes it possible for the diver to work in all positions without having his breathing disturbed.

When the pressure of the bottle of compressed air supplying the stub pipe 23 diminishes and falls below 30 kg. for example, the spring 26 causes the valve 24 to close and therefore stops the supply of fresh air. In this manner the diver is warned that his reserve of fresh air is nearly at an end. By actuating the control member 29 he can then shift the push member 34 and cause it to act on the valve 24 so as to open said valve in opposition to the action of the spring 26. The diver has then still a reserve of air sufficient to enable him to reascend to the surface.

One form of embodiment of the device for supplying a diver with fresh air has been described here by way of example with reference to the accompanying drawings, but it goes without saying that any of the members and elements which have been described may be replaced by equivalent members and elements.

I claim:

1. A device for regulating the supplying of air to a diver comprising an inlet pipe adapted to be connected to a source of gas under pressure, first and second chambers, each of said chambers having a flexible wall portion thereof exposed to external water pressure and spaced from each other, first and second conduits connecting said inlet pipe with said first and second chambers, respectively, first and second admittance valves in said first and second conduits, respectively, first and second means respectively connecting said first and second admittance valves with the flexible wall portion of said first and second chambers for opening of said valves upon inward flexure of said wall portions, an exhaust valve adapted to be connected with an exhaust tube from a diver's mask, said exhaust valve positioned between said wall portions and exposed to water pressure, said exhaust valve being urged closed by said water pressure, third and fourth conduits, each connected to one of said chambers, said third and fourth conduits being fluid connected together and adapted to be connected to the inlet pipe of a diver's mask.

2. The device of claim 1, and spring means urging said admittance valves to closed position.

3. The device of claim 1 and a safety device connected to said inlet pipe, said safety device comprising a valve spring loaded to the closed position and an externally actuatable operator to open said valve.

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4. A device for regulating the supplying of air to a diver comprising an inlet pipe adapted to be connected to a source of gas under pressure, first and second chambers, each of said chambers having a flexible wall portion thereof exposed to external water pressure and spaced from each other, first and second conduits connecting said inlet pipe with said first and second chambers, respectively, first and second admittance valves in said first and second conduits, respectively, first and second means respectively and independently connecting said first and second admittance valves with the flexible wall portion of said first and second chambers for opening of said valves upon inward flexure of said wall portions, an exhaust valve adapted to be connected with an exhaust tube from a diver's mask, said exhaust valve positioned between said wall portions and exposed to water pressure, said exhaust valve being urged closed by said water pressure, third and fourth conduits, each connected to one of said chambers, said third and fourth conduits being fluid connected together and adapted to be connected to the inlet pipe of a diver's mask.

5. A device for regulating the supplying of air to a diver comprising an inlet pipe adapted to be connected to a source of gas under pressure, first and second chambers, each of said chambers having a flexible wall portion thereof exposed to external water pressure, said wall portions being spaced from each other, first and second conduits connecting said inlet pipe with said first and second chambers, respectively, first and second admittance valves in said first and second conduits, respectively, said admittance valves being normally closed, a first valve operator means connected only to said first admittance valve and the flexible wall portion of said first chamber to open said first admittance valve upon inward flexure of the flexible wall portion of said first chamber, a second valve operator means connected only to said second admittance valve and the flexible wall portion of the second chamber to open said second admittance valve upon inward flexure of the flexible wall portion of said second chamber, an exhaust valve adapted to be connected with an exhaust tube from a diver's mask, said exhaust valve positioned between said wall portions and exposed to water pressure, said exhaust valve being urged closed by said water pressure, third and fourth conduits, each connected to one of said chambers, said third and fourth conduits being fluid connected together and adapted to be connected to the inlet pipe of a diver's mask.

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