Jan. 19, 1965 B. B. GIRDEN 3,166,083

BREATHING APPARATUS FOR SWIMMERS

Filed Dec. 12, 1962 2 Sheets-Sheet 1

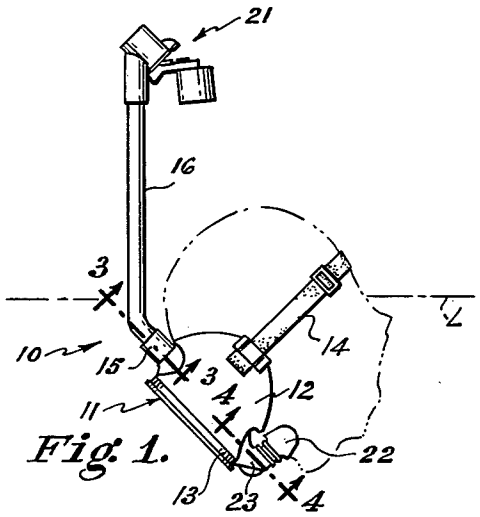

Fig. 1.

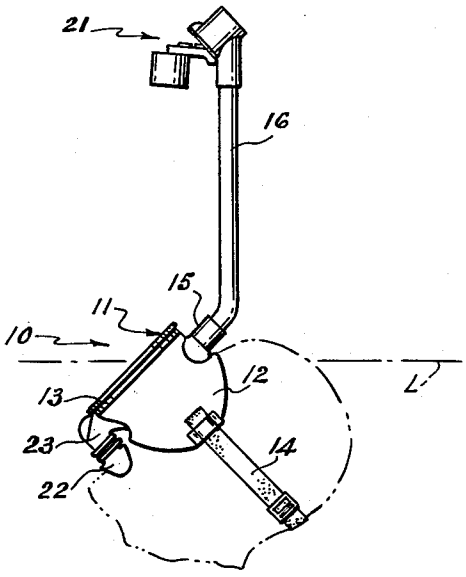

Fig. 2.

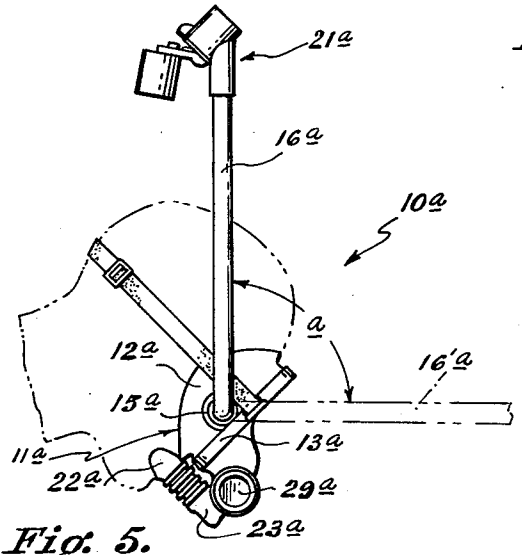

Fig. 5.

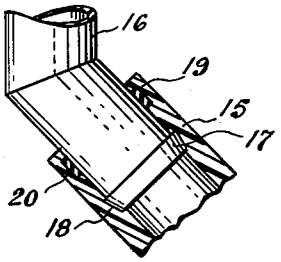

Fig. 3.

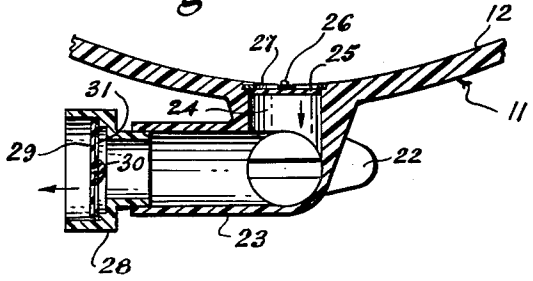

Fig. 4.

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BREATHING APPARATUS FOR SWIMMERS

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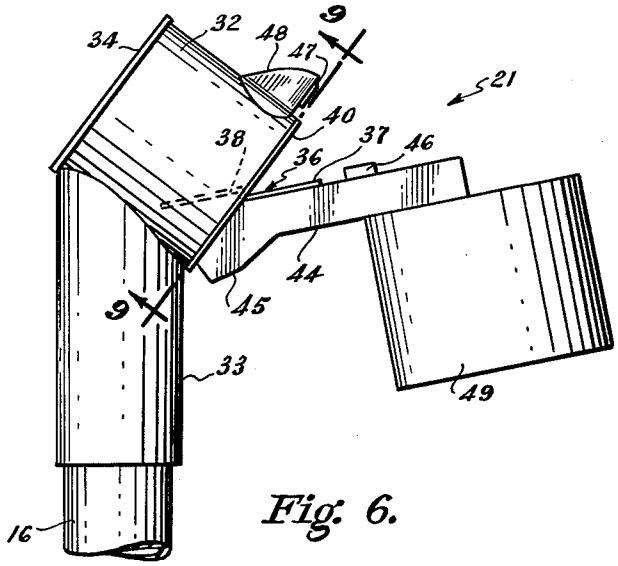

Fig. 6.

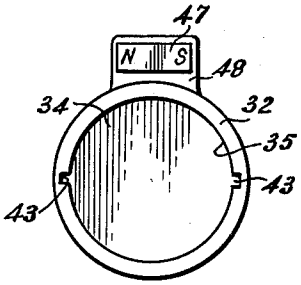

Fig. 9.

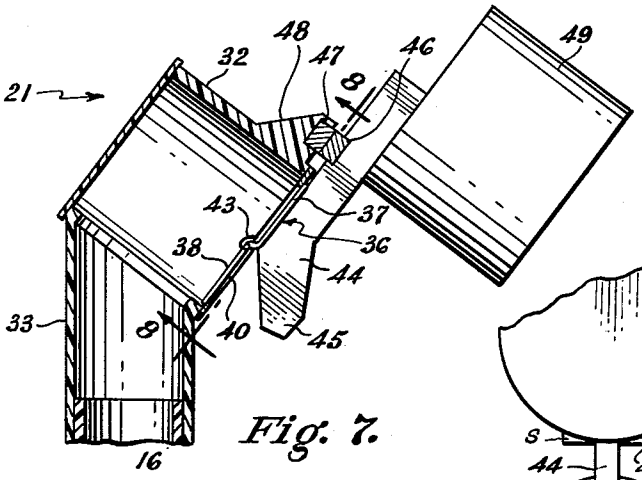

Fig. 7.

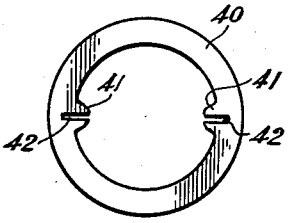

Fig. 10.

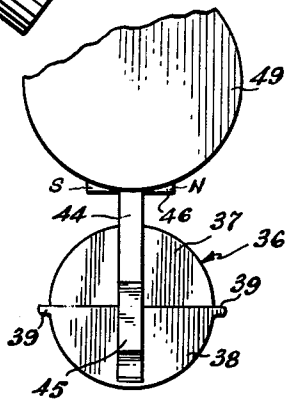

Fig. 11.

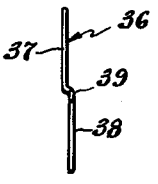

Fig. 12.

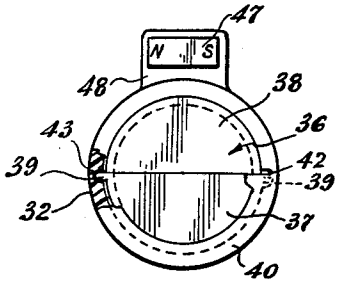

Fig. 8.

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3,166,083

BREATHING APPARATUS FOR SWIMMERS

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Filed Dec. 12, 1962, Ser. No. 244,120
5 Claims (Cl. 137—63)

This invention relates generally to breathing apparatus for swimmers, and more particularly is directed to apparatus of the described character that permits the user to breathe air from above the surface of the water when at least the user's face is submerged.

Breathing apparatus for swimmers has been proposed and generally takes the form of a hollow pipe or pipes opening at one end into a mouthpiece or into a close fitting mask that engages over the nose and eyes or the entire face of the swimmer, with the pipe or pipes being arranged so that the end or ends thereof remote from the mouthpiece or mask will project above the surface of the water when the swimmer's face is submerged to permit the supplying of air to the swimmer to the pipe or pipes. Such apparatus makes it possible for the swimmer to remain on the surface with his head submerged continuously for improved observation of underwater activity and, in order to make it possible for the swimmer to dive to a depth where the upper end of the pipe or pipes is submerged, the above-described apparatus has been previously improved by the addition of a float controlled check valve at the upper end of each pipe that closes automatically, when the upper end is submerged, and thereby prevents the entry of water into the pipe. In the existing breathing apparatus for swimmers, each snorkel tube, that is, the hollow pipe extending from the mouthpiece or mask and having a float controlled valve at the end remote from the mouthpiece or mask, is in fixed position relative to the latter so that the snorkel tube extends upwardly from the mouthpiece or mask when the swimmer's head is disposed for comfortable downward viewing of underwater activity. However, if a swimmer wearing a breathing apparatus of the described character floats on his back on or near the surface of the water, for example, as when resting or floating in the water, the valved end of the snorkel tube in fixed relation to the mouthpiece or mask is submerged and the swimmer cannot breathe fresh air through the snorkel tube.

Accordingly, it is an object of this invention to provide a breathing apparatus for swimmers with a snorkel tube extending from a mask and having at least a portion of the snorkel tube movable relative to the mask so as to be capable of extending upwardly from the mask when the swimmer is floating on his back, as well as when the swimmer is prone in the water and faces downwardly for convenient underwater viewing, whereby the swimmer can breathe fresh air through the snorkel tube in both positions of use.

When a swimmer wearing a breathing apparatus of the described character dives below the surface of the water to a depth sufficient to cause submerging of the entire snorkel tube, thereby to cause closing of the valve at the end of such tube, the increasing water pressure acting on the face mask tends to cause pressing of the latter against the face of the user, which phenomenon is generally referred to as "squeeze." In order to overcome this uncomfortable and often dangerous condition, particularly, in relatively deep dives, it is necessary for the swimmer to breathe out into the mask for increasing the pressure within the latter to a value approximately equal to the water pressure acting externally on the mask. However, since the mask is normally disposed at a depth greater than that of the upper or valved end of the snorkel tube, the equalized pressure within the mask, and hence the pressure acting through the snorkel tube at the inner surface of the float controlled check valve, will be greater than the water

pressure acting at the exterior side of the valve. Where the float controlled check valve is in the form of a buoyant ball check valve, or in the form of a float controlled flap valve, the difference in the pressures acting at the inner and outer surfaces of the valve may be sufficient to open the latter and thereby permit the escape of air so that the desired balancing of pressures cannot be obtained. In order to avoid the foregoing, I have disclosed in United States Letters Patent No. 2,888,010, issued May 26, 1959, a float controlled valve for breathing apparatus of the described character, which valve is balanced, that is, is insensitive to any difference in the pressures acting on the opposite sides thereof, so that, during a dive when the swimmer exhales air into the mask to increase the pressure within the latter, and upon surfacing, when the pressure within the mask may be low in relation to atmospheric pressure, any differences in the pressures acting upon the opposite sides of the valve will not affect the float controlled operation thereof.

Although the above mentioned float controlled balanced valve avoids opening thereof as a result of a difference between the pressures acting on the opposite sides of the valve when the latter is submerged, and further avoids the retention of the valve in its closed condition by reason of the existence of a relatively low pressure within the mask upon reemergence of the valve into the atmosphere, the described float controlled balance valve is still susceptible to the opening thereof while submerged in the event that the swimmer turns upside down, in which case the buoyancy of the float controlling the valve will act in the direction for opening the latter, rather than in the normal direction for ensuring closing of the valve. When a swimmer wearing a breathing apparatus of the described character is engaged in underwater exploration or spear fishing, concentration of the swimmer on such activities may cause the swimmer to forget that a normal swimming position must be maintained in order to ensure the continued closing of the float controlled valve of the snorkel tube, and drownings or other serious accidents have frequently occurred by reason of such lapses.

Accordingly, it is a further object of this invention to provide a balanced valve for the snorkel tube or tubes of breathing apparatus for swimmers, which valve is positively retained in its closed condition whenever the valved end of the snorkel tubbe is submerged, without regard to the position or orientation of the swimmer in the water or the existence of a difference between the pressures acting at the inner and outer sides of the valve, and which further ensures the opening of the valve when the latter is exposed to the atmosphere, even though a reduced pressure may then exist within the mask to which the snorkel tube is attached.

In accordance with an aspect of this invention, breathing apparatus for swimmers is provided with at least one snorkel tube terminating in a valve housing having a valve member mounted thereon for rocking on an axis about which the valve member is symmetrical so that even different pressures acting against the opposite sides of the valve member will produce balanced turning moments, a control arm extending from the valve member and carying a permanent magnet spaced from the rocking axis of the valve member and adapted to cooperate with a permanent magnet secured on the valve housing for retaining the valve member in its closed position, and a valve control body suspended from the control arm and being of a weight sufficient to readily overcome the attraction between the permanent magnets carried by the control arm and valve housing for moving the valve member to its open position whenever the valve control body is removed from the water and exposed to the atmosphere, the valve control body further having only substantially neutral buoyancy in water so that, when the valve control

body is submerged in water with the breathing apparatus in its normal position of use, the neutral buoyancy of the control body will permit the permanent magnets to move the valve member to its closed position, but such neutral buoyancy of the valve control body will not influence the effectiveness of the permanent magnets in retaining the valve member in its closed position in the event that the swimmer turns over and hence inverts the breathing apparatus while fully submerged.

In previously existing balanced valves for breating apparatus of the described character, the valve member has been provided with an axle or trunnions projecting therefrom and being turnably received in diametrically opposed holes formed in the wall of the valve housing so that a problem existed in obtaining a fluid-tight seal around the trunnions or axle ends in such holes. Accordingly, it is a further object of this invention to provide a valve arrangement of the described character for breathing apparatus for swimmers in which the rockable mounting of the valve member is designed to avoid the necessity of piercing the wall of the valve housing and thereby ensures the fluid-tightness of the latter.

The above, and other objects, features and advantages of the invention, will be apparent in the following detailed description of illustrative embodiments thereof which is to be read in connection with the accompanying drawings forming a part hereof, and wherein:

FIG. 1 is a side elevational view of a breathing apparatus for swimmers embodying this invention, and shown in one position of use thereof;

FIG. 2 is a view similar to that of FIG. 1, but shown in another position of use thereof;

FIG. 3 is an enlarged, fragmentary sectional view taken along the line 3—3 on FIG. 1, and illustrating a constructional detail of the breathing apparatus;

FIG. 4 is an enlarged fragmentary sectional view taken along the line 4—4 on FIG. 1, and illustrating other constructional details of the breathing apparatus;

FIG. 5 is a side elevational view of a breathing apparatus for swimmers constructed in accordance with another embodiment of this invention;

FIG. 6 is an enlarged side elevational view of a valve arrangement or assembly embodying this invention for use in the breathing apparatus of FIGS. 1 and 2 or FIG. 5, and which is shown in its open condition;

FIG. 7 is a vertical sectional view of the valve assembly of FIG. 6, but shown in its closed condition;

FIG. 8 is a detail sectional view taken along the line 8—8 on FIG. 7;

FIG. 9 is a detail sectional view taken along the line 9—9 on FIG. 6;

FIG. 10 is an elevational view of a valve seat member forming a part of the valve assembly of FIGS. 6 and 7;

FIG. 11 is an elevational view, partly broken away, of a valve member and its associated control elements included in the valve assembly of FIGS. 6 and 7; and

FIG. 12 is a detail end or edge elevational view of the valve member of FIG. 11.

Referring to the drawings in detail, and initially to FIGS. 1 and 2 thereof, breathing apparatus for swimmers constructed in accordance with one embodiment of the invention is there illustrated and generally identified by the reference numeral 10. The apparatus 10 includes a face mask 11 of conventional form shown to be of the type which covers the eyes and nose of the swimmer, but which may be of the type covering the mouth as well as the eyes and nose. The face mask 11 includes a body 12 preferably made of a natural or synthetic rubber or other elastromeric material to enable the close fitting thereof to the face and head of the wearer, and having a front aperture with the margin thereof being in the form of a frame 13 in water-tight sealing relationship to a transparent face plate (not shown) which extends across the aperture. Adjustable straps 14 extend from the sides of the body 12 of the face mask for detachably securing the latter on the wearer's head.

A tubular extension 15 projects from the body 12 of face mask 11 and, in the embodiment of the invention illustrated on FIGS. 1 and 2, the tubular extension 15 is provided at the top of the face mask. A hollow pipe or snorkel tube 16 is mounted, at one end, in tubular extension 15 and, in accordance with the present invention, the snorkel tube 16 is rotatable with respect to the tubular extension 15. As shown on FIG. 3, the end portion of snorkel tube 16 extending into tubular extension 15 may be formed with an external bead or rim 17 which tapers toward the end edge of the snorkel tube and which is turnably received in a correspondingly contoured internal groove 18 formed in the inner sruface of extension 15 so that the engagement of bead 17 in groove 18 prevents axial removal of the snorkel tube 16 from extension 15. Further, the inner surface of extension 15 may be provided with a groove 19 adjacent the end of the tubular extension to receive a sealing ring 20 which effects sealing engagement with the outer surface of snorkel tube 16, thereby to prevent seepage of water into extension 15 past the snorkel tube, and hence into the interior of face mask 11, and further to hold the snorkel tube 16 against inadvertent turning within the tubular extension 15.

As shown on FIGS. 1 and 2, the snorkel tube 16 is longitudinally bent adjacent the end portion thereof received in tubular extension 15 so that the major portion of the length of the snorkel tube extends at a substantial angle which, in the embodiment of the invention illustrated on FIGS. 1 and 2 is approximately 45 degrees, with respect to the turning axis of the snorkel tube in tubular extension 15.

The end of snorkel tube 16 remote from face mask 11 carries a valve assembly 21 which is preferably of the type hereinafter described in detail and functions to permit air to be drawn into the face mask through the snorkel tube whenever the valve assembly is disposed in the atmosphere and to close the end of the snorkel tube remote from the face mask whenever the valve assembly 21 is submerged in water. The illustrated breathing apparatus is further of the type in which the rebreathing of residual air, that is, exhalation contained in the face mask 11, is discouraged. Thus, it is intended that the swimmer will inhale only through his nose, thereby to draw in air entering the interior of face mask 11 through snorkel tube 16, and that the user will exhale through his mouth into a mouthpiece 22 which communicates with an exhaust tube 23 (FIG. 4). Since the illustrated face mask 11 is of the type covering only the eyes and nose of the wearer, the exhaust tube 23 and mouthpiece 22 are mounted below the body 12 of the face mask, but it is to be understood that, in the case of a face mask covering the mouth, as well as the eyes and nose of the wearer, the mouthpiece will be disposed within the face mask and communicate with an exhaust tube extending from the mouthpiece to the exterior of the face mask and which communicates with the interior of the latter only in the maner hereinafter described.

As shown particularly on FIG. 4, the exhaust tube 23 preferably has an opening 24 communicating with the interior of face mask 11 at the bottom of the latter, and a diaphragm check valve 25 is positioned in the opening 24 and opens only outwardly from the interior of the face mask, that is, in the direction from the latter into the exhaust tube 23, to pass seepage water or other fluids which accumulate within the mask into the tube 23 for exhaust from the latter. The valve 25 may consist of an elastic disk secured, at its center, by a rivet 26 to a perforated valve seat 27 which is secured, at its periphery, within opening 24. The exhaust tube 23, at the exterior of the face mask 11, opens into a valve housing 28 containing a diaphragm check valve 29 which opens only outwardly from the interior of exhaust tube 23 and which also consists of an elastic disk secured by means of a

central rivet 30 to a perforated valve seat 31 fixed, at its periphery, in valve housing 28.

When using the breathing apparatus 10 described above, the face mask 11 is donned in conventional fashion, with the mouthpiece 22 being positioned in the wearer's mouth. As the user swims or floats on the surface of the water, or just below it, so that the valve assembly 21 is disposed above the surface of the water, as indicated at L on FIGS. 1 and 2, and thus maintains communication between the atmosphere and the snorkel tube 16, the user inhales through his nose or mouth, thus drawing fresh air into the mask 11 through the snorkel tube. The user exhales through his mouth only and such exhalation is directly evacuated into the water through the mouthpiece 22, exhaust tube 23 and check valve 29. Since the user's breath is not evacuated into the face mask 11, no moisture from the breath can condense upon the inside surface of the transparent face plate of the mask or upon the surfaces of eyeglasses which the user may be wearing. If seepage water, spittle or other liquids collect in the mask, they drain through check valve 25 into exhaust tube 23 and are exhausted from the latter merely by exhaling through valve 29. When the swimmer dives, valve assembly 21 automatically closes, as hereinafter described in detail, thereby to prevent the entry of water into face mask 11 through snorkel tube 16.

In previously existing breathing apparatus for swimmers, the snorkel tube has been fixedly positioned with respect to the face mask so as to extend upwardly from the latter when the user is in a normal swimming position, that is, facing downwardly in the water. However, if the swimmer floats on his back at or just below the surface of the water, so that the swimmer's face is directed upwardly, the snorkel tube extending fixedly from the face mask will have its end remote from the face mask submerged in the water and thereby prevent the breathing of fresh air through the snorkel tube. Thus, with the previously existing breathing apparatus, the user could not float restfully on his back. However, the above described breathing apparatus 10 permits the user to turn the snorkel tube 16 relative to the tubular extension 15 of the face mask body through approximately 180 degrees between the position illustrated on FIG. 1, in which the main portion of the length of the snorkel tube extends upwardly from the face mask when the user is in a normal swimming position, that is, with the face directed downwardly for convenient underwater viewing, and the position illustrated on FIG. 2, where the main portion of the length of the snorkel tube 16 is directed upwardly from the face mask when the user is floating on his back with his face directed upwardly, for example, as when resting after an exhausting dive.

It will be seen that the main portion of the length of the snorkel tube 16 of breathing apparatus 10 has its longitudinal axis directed rearwardly at an angle of approximately 45 degrees with respect to the plane of the transparent face plate of face mask 11 in the position of FIG. 1, and that the longitudinal axis of the main portion of the length of tube 16 is directed forwardly at an angle of approximately 45 degrees with respect to the plane of the transparent face plate in the position illustrated on FIG. 2. Where the snorkel tube extends from the top of the face mask, as in FIGS. 1 and 2, the change between these two positions is achieved by longitudinally bending the snorkel tube through an angle of approximately 45 degrees by turning the snorkel tube through 180 degrees, as described above. However, as shown on FIG. 5, a breathing apparatus 10*a* embodying this invention may be provided with a snorkel tube 16*a* which extends turnably from a tubular extension 15*a* directed laterally from one side of the body 12*a* of the face mask 11*a*. When the snorkel tube extends from the side of the face mask, as in the breathing apparatus 10*a*, the major portion of the length of the snorkel tube 16*a* is directed substantially at right angles to the end portion of the snorkel tube which is rotatable in the laterally directed tubular extension 15*a*. Thus, the snorkel tube 16*a* is turned through an angle *a* of approximately 90 degrees between a position shown in full lines on FIG. 5, where the major portion of the length of tube 16*a* is directed rearwardly at an angle of approximately 45 degrees with respect to the plane of the transparent face plate held within the frame 13*a* so as to extend upwardly from the face mask 11*a* when the user is in a normal swimming position, and the position shown in broken lines at 16'*a*, where the major portion of the length of the snorkel tube is directed forwardly at an angle of approximately 45 degrees with respect to the plane of the transparent face plate so as to extend upwardly from the face mask 11*a* when the user is floating on his back. In the embodiment of FIG. 5, as in the embodiment of FIGS. 1 and 2, the major portion of the length of the snorkel tube is displaced through an angle of approximately 90 degrees in moving between the two normal positions of use.

Referring now to FIGS. 6 and 7, it will be seen that the valve assembly 21 of swimming apparatus 10, as well as the valve assembly 21*a* of the swimming apparatus 10*a*, includes a hollow housing 32 which may be cylindrical, as shown, and has a tubular coupling member 33 extending from the side wall thereof and dimensioned to telescope onto the upper end of the snorkel tube 16 and to be secured to the latter, as by adhesive. A wall 34 closes one end of housing 32 and tubular coupling member 33 preferably has its axis inclined away from end wall 34 so that, when tubular coupling member 33 is secured on upwardly extending snorkel tube 16, the opening 35 (FIG. 9) at the end of housing 32 remote from wall 34 will be directed more or less downwardly to avoid the splashing of water into snorkel tube 16 through the open end of the valve housing.

In accordance with the present invention, the valve assembly 21 further includes a balanced valve member 36 which, as shown particularly on FIGS. 11 and 12, as in the form of a rigid circular disk divided diametrically into two semi-circular portions 37 and 38 which are disposed in parallel, offset planes. Diametrically opposed ears or projections 39 extend from portion 38 of valve member 36 immediately adjacent the diametrical division between portions 38 and 37 so that the areas of the portions 37 and 38 at opposite sides of an axis extending through the ears 39 are substantially equal.

The diameter of valve member 36 is slightly smaller than the interior diameter of valve housing 32, and the valve member is intended to be engaged with a valve seat ring 40 (FIG. 10) which may be formed of thin metal and which is secured to the open end of valve housing 32 following engagement of valve member 36 with ring 40 in the manner hereinafter described in detail. The valve seat ring 40 has an inner diameter which is slightly smaller than the diameter of valve member 36 and, at diametrically opposed locations, is formed with inwardly directed noses 41 each having an inwardly opening slot 42. In assembling the valve member 36 with the seat ring 40, the valve member is initially disposed substantially at right angles to the plane of ring 40 and the portion 38 is inserted in ring 40 until ears 39 pass through slots 42. Then valve member 36 is turned until portion 38 thereof underlies the inner peripheral portion of one-half of ring 40 while portion 37 of the valve member overlies the inner peripheral portion of the opposite half of ring 40, as shown on FIGS. 7 and 8. During such swinging movement of valve member 36 relative to ring 40, the ears 39 of the valve member move away from slots 42 and underlie the noses 41 at one side of the slots. Thus, after the valve member 36 and ring 40 have been assembled together, they can be separated only by swinging of the valve member to a position at right angles to the plane of the ring, in which position the portion 37 of the valve member can pass through the slots 42 or the ears 39 of the valve member can be withdrawn through the slots.

After assembling of valve member 36 and seat ring 40, the latter is secured to the end edge of valve housing 32 around the opening 35 thereof, as by adhesive or the like, as shown on FIGS. 6, 7 and 8. Further, the end edge surface of housing 32 around opening 35 is preferably provided with diametrically opposed, inwardly opening recesses 43 (FIGS. 7, 8 and 9) to receive the ears 39 of valve member 36 assembled together with the seat ring 40. The engagement of ears 39 in recesses 43 obviously prevents the passage of valve member portion 37 through slots 42 into the interior of housing 32 even when the valve member 36 is disposed at a substantial angle relative to the plane of seat ring 40. Further, as shown on FIGS. 6, 7 and 11, a control arm 44 is secured, as by adhesive or other suitable means, to the outer surface of portion 37 of the valve member and extends substantially at right angles to the rocking axis of valve member 36 which corresponds to the diametrical line of division between the portions 37 and 38 of the valve member. The arm 44 has an angled projection 45 extending over the portion 38 of the valve member and being disposed at a substantial angle with respect to the plane of the latter. The extension 45 of arm 44 is intended to engage seat ring 40, as in FIG. 6, thereby to limit rocking of valve member 36 relative to seat ring 40 in the clockwise direction, as viewed on FIG. 6, that is, in the valve opening direction. Thus, the engagement of extension 45 of the control arm with seat ring 40 prevents movement of valve member 36 to the position at right angles to the plane of ring 40 at which ears 39 of the valve member can pass through slots 42 and thereby permit disassembly of the valve member from the seat ring.

The control arm 44 extends substantially beyond the periphery of valve member 36 and has fixedly secured thereto a permanent magnet 46 which is attracted by a permanent magnet 47 mounted in a projection 48 on valve housing 32. The magnets 46 and 47 are preferably bar magnets which are oppositely disposed so that the north and south poles of magnet 46 confront the south and north poles, respectively, of magnet 47, thereby to provide a strong force of magnetic attraction tending to move magnet 46 against magnet 47 for closing valve member 36, as in FIG. 7. Since magnet 46 is carried by arm 44, the line of action of the magnetic force of attraction is disposed a substantial distance from the rocking axis of valve member 36 and thereby provides a very considerable turning moment for urging the valve member to its closed position.

The valve assembly 21 is completed by a valve control body 49 (FIGS. 6, 7 and 11) suspended from the end of control arm 44. The valve control body 49 may be of cylindrical form, as shown, and, in accordance with the present invention, is of substantial weight so as to exert a turning moment on valve member 36 in the clockwise direction, as viewed on FIG. 6, which is effective to overcome the oppositely directed turning moment resulting from the force of magnetic attraction between magnets 46 and 47, thereby to move valve member 36 to its open position illustrated on FIG. 6 so long as the valve control body 49 is out of the water. However, in accordance with this invention, the valve control body 49 has a neutral buoyancy or, at most, a very slight positive buoyancy, so that, when the valve control body is submerged in water, the magnetic force of attraction between magnets 46 and 47 is effective to turn valve member 36 in the counterclockwise direction, as viewed on FIGS. 6 and 7, thereby to move valve member 36 to its closed position (FIG. 7). The term "neutral buoyancy" as used herein with respect to the body 49 means that the weight of the latter is substantially equal to the weight of the volume of water displaced by body 49 when the latter is fully submerged.

When the swimmer dives so that the valve control body 49 is submerged, the magnets 46 and 47 move valve member 36 to its closed position and thereby prevent the entry of water through valve housing 32 and snorkel tube 16 into the face mask 11. As the swimmer descends in a dive, he may breathe air into the face mask 11 in order to equalize the pressure within the latter with the increased external water pressure, thereby to avoid collapse or "squeeze" of the mask upon his face and eyes. This may be done without fear that the valve member 36 will open, as such valve member is a balanced valve, that is, it is pivoted or rockably mounted so that the areas of the valve member bisected by its rocking axis are equal so that the position of the valve member is not affected by any difference in the pressures acting at the inner and outer sides or surfaces of the valve member. Similarly, when the swimmer returns to the surface, a partial vacuum produced within the face mask by inhalation of some of the air therein will not affect the return of the valve member 36 to its open position upon the removal of the valve control body 49 from the water.

It is also to be noted that the use of a rockably mounted, balanced valve member 36 and the mounting of the permanent magnet 46 on an arm 44 extending beyond the valve member makes it possible to attain a turning moment from a magnetic force of attraction which is sufficient to ensure the secure closing of the valve member so long as the valve control body 49 is submerged. The combined use of the balanced rockably mounted valve member 36, the magnets 46 and 47 for maintaining the valve member in its closed position and the valve control body 49 having only a neutral buoyancy, or at most a very slight positive buoyancy, when submerged, makes it possible to ensure that valve member 36 will remain in its closed position to prevent the entry of water into the snorkel tube 16 during a dive irrespective of the position of the swimmer. This is to be distinguished from the situation with previously proposed breathing apparatus for swimmers wherein the valve is controlled by a float having very substantial buoyancy to urge the valve to its closed position so long as the swimmer is in a normal swimming position during a dive. However, if the swimmer turns on his back during a dive, and thereby inverts the valve assembly, the buoyant float of the previously existing valve assemblies will move the valve member to its open position, notwithstanding the fact that the valve is submerged, and thereby permit the free flow of water into the face mask with obvious serious hazard to the swimmer.

Since the valve member 36 is balanced about its rocking axis and the valve control body 49 is suspended from the free end of the control arm 44 at a greater distance from the rocking axis of valve member 36 that is the magnet 46, and since the valve control body 49 need only have a neutral buoyancy when submerged in water, it is obvious that the weight of control body 49 may be selected so as to be positively certain of the opening of valve member 36 whenever control body 49 is removed from the water, thereby to ensure that the swimmer can again breathe fresh air through the snorkel tube 16 at the conclusion of a dive. Thus, breathing apparatus for swimmers in accordance with the present invention positively avoids all of the dangerous conditions that have previously been associated with the use of breathing apparatus of the described character, particularly when employed by relatively inexperienced users.

Although illustrative embodiments of this invention have been described in detail herein with reference to the accompanying drawings, it is to be noted that the invention is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention, except as defined in the appended claims.

What is claimed is:

1. A valve assembly for controlling the admission of air to a snorkel breathing tube, said assembly comprising means defining a valve housing with a valve seat thereon,

a valve member rockable on an axis about which said valve member is symmetrical so as to be movable between a closed position against said seat and an open position while being insensitive to different pressures acting against the opposite sides of the valve member, cooperative magnet means fixed to said housing and movable with said valve member, respectively, for urging said valve member to rock to said closed position thereof, and a valve control body connected to said valve member and being of substantial weight to overcome said magnet means and rock said valve member to said open position upon removal of said body from water, said valve control body having substantially neutral buoyancy in water to permit movement of said valve member to said closed position by said magnet means upon submerging of said body in water without regard to the orientation of the valve assembly in the water.

2. A valve assembly for controlling the admission of air to a snorkel breathing tube, said assembly comprising means defining a valve housing with a valve seat thereon, a valve member rockable on an axis about which said valve member is symmetrical so as to be movable between a closed position against said seat and an open position while being insensitive to different pressures acting against the opposite sides of the valve member, a control arm extending from said valve member at a substantial angle with respect to said axis, cooperative magnetic means on said valve housing and on said arm, respectively, at locations spaced substantially from said axis for urging said valve member to rock to said closed position, and a valve control body secured to said arm and being of substantial weight to overcome said magnetic means and rock said valve member to said open position upon removal of said body from water, said valve control body having substantially neutral buoyancy in water to permit movement of said valve member to said closed position by said magnetic means upon submerging of said body in water without regard to the orientation of the valve assembly in the water.

3. A valve assembly as in claim 2;

wherein said valve member is in the form of a circular disk divided diametrically into two half-portions lying in offset planes, one of said half-portions having peripheral projections adjacent the opposite ends of the diametrical division between said half-portions; and

wherein said valve housing is cylindrical with an opening at one end, and said valve seat is in the form of a seat ring secured against said one end of the housing around said opening and having diametrically opposed, radially inward opening slots through which said one half-portion of the disk and said projections can pass from the outer side to the inner side of said seat ring whereupon said diametrical division of the disk defines the rocking axis of the valve member.

4. A valve assembly as in claim 3;

wherein said valve housing has diametrically opposed, inwardly opening recesses in said one end receiving said peripheral projections of the disk to hold said projections against the inside of said seat ring.

5. A valve assembly as in claim 4;

wherein said control arm has an extension at an angle to said one half-portion of the disk and engageable with said seat ring to limit the rocking of said valve member to said open position thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

2,362,775	Sebouh	Nov. 14, 1944
2,408,166	Hawkins	Sept. 24, 1946
2,493,297	Landon	Jan. 3, 1950
2,742,899	Warner et al.	Apr. 24, 1956
2,814,292	Girden	Nov. 26, 1957
2,815,751	Ferrando	Dec. 10, 1957

FOREIGN PATENTS

905,890	France	Apr. 30, 1945
472,977	Italy	July 9, 1952