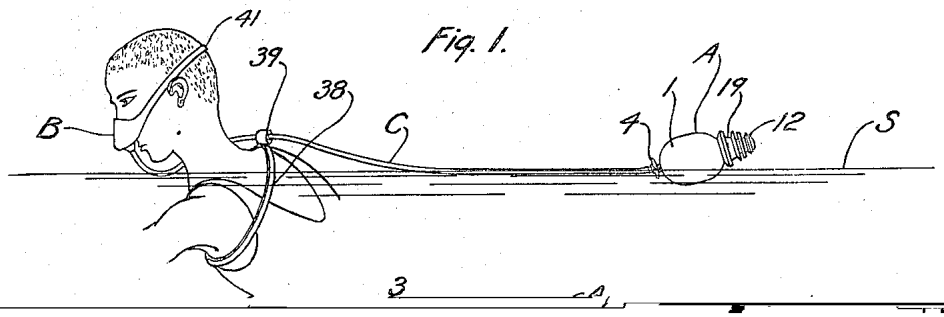
Feb. 6, 1934. W. BLACK 1,946,126

BREATHING DEVICE

Filed July 15, 1932 3 Sheets-Sheet 1

Fig. 1.



Feb. 6, 1934. W. BLACK 1,946,126

BREATHING DEVICE

Filed July 15, 1932 3 Sheets-Sheet 2

Fig. 5

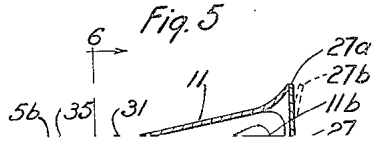


Fig. 6

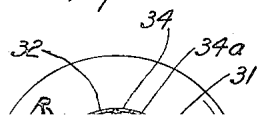


Fig. 7

Feb. 6, 1934. W. BLACK 1,946,126

BREATHING DEVICE

Filed July 15, 1932 3 Sheets-Sheet 3

Fig. 14

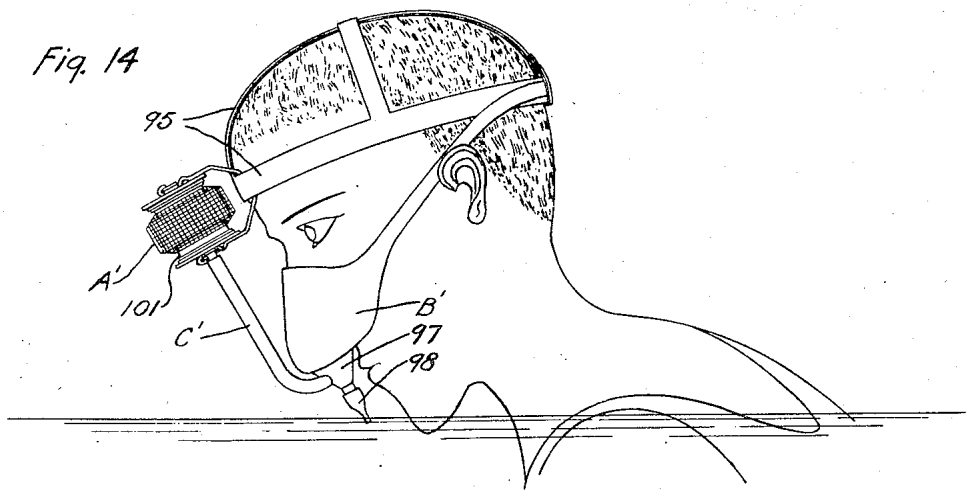


Fig. 15

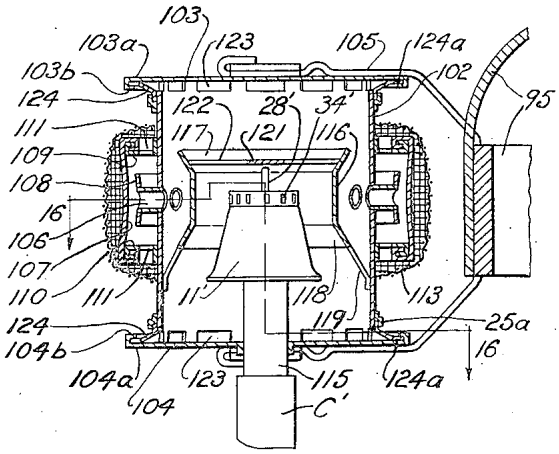


Fig. 16

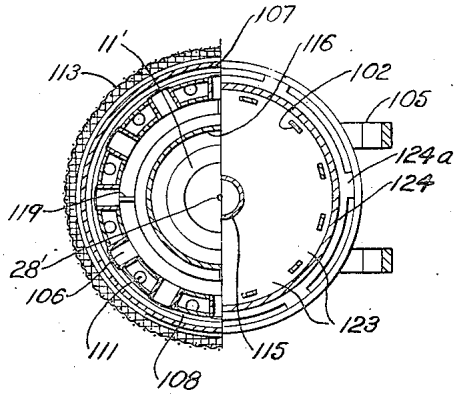
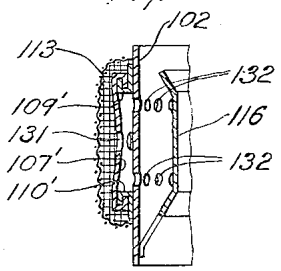


Fig. 17



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1,946,126

BREATHING DEVICE

William Black, Los Angeles, Calif.

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9 Claims. (Cl. 9—20)

This invention relates to a breathing device, and particularly to a device for facilitating communication from said conduit to the breathing organs of said user. The air intake unit may

5 showing various modifications which may be made in the construction of the air cleaning device;

Fig. 10 is a partial sectional view on line 10—10 in Fig. 9;

The air intake unit A is also shown as provided with a protective housing 12 for the air cleaning device 11, and said protective housing is shown as comprising a movable housing portion 13 formed as a cylindrical chamber, and a fixed

18, upon relative forward movement of chamber 13 as hereinafter described.

The housing portion 19 is also preferably provided with a plurality of liquid outlet openings 22 disposed about the periphery thereof and near the larger end thereof, said openings being sealed against inward passage of air by means of a flange 20 which is secured to member 19 by clamping ring 25. Said flange is formed of flexible and preferably resilient material such as rubber and is biased by its own resilience into engagement with flange 19*a*, but is adapted to yield sufficiently to permit outward flow of liquid therebetween as hereinafter described. Flange 20 may be provided with a plurality of extensions 20*a* spaced about the periphery thereof and engaged in clamping ring 21 so as to prevent excessive or accidental distortion thereof.

Various forms of air cleaning devices 11 may be used, but a preferred construction of such device is shown particularly in Fig. 5. The device shown in this figure comprises a wall 11*a* of frusto-conical shape, having its smaller end disposed forwardly, and inclosing a liquid separating chamber 11*b*. Said device further comprises a hub portion 29 secured to a shaft 28 and provided with a plurality of vane members or paddles secured to said hub portion, said vane members being shown as comprising radially or outwardly extending portions 30 and forwardly extending portions 30*a* disposed radially just inside the frusto-conical wall 11*a* and secured thereto, as for example by soldering or welding the outer edges of the portions 30*a* to said wall. Shaft 28 is slidably and rotatably disposed within a bearing [illegible] indicated in dotted lines at 27*b*, so as to permit said liquor to be discharged from the interior of the device 11. The edge portion 11*c* is shown as flared outwardly so as to define an annular pocket or recess 36 for accumulation of separated liquid in a position adjacent the flexible liquid releasing member 27.

It will be seen that the air cleaning device 11 is rotatably supported by engagement of shaft 28 within collar 33*a* and by engagement of flange 35 and baffle member 31 with the tube portion 5*b*. Furthermore, in normal operation the device is held forwardly by the air pressure as hereinafter described, this forward movement being limited by engagement of the forward end of shaft 28 in the tapered forward end 33*b* of sleeve 33 which serves to provide further rotatable support for the device. However, the device 11 is free to slide rearwardly with respect to the tube portion 5*b*, in the event of sudden forward movement of the breathing tube, but this relative sliding movement is limited by means of a stop plate 37 to the cylindrical housing portion 13, said stop plate being centrally disposed in position to be engaged by the rearward end of shaft 28 and thus prevent displacement of the device 11 from its rotatably supported engagement with tube portion 5*b*.

The breathing tube C may be formed of rubber water proofed fabric, or other suitable flexible material and is shown as secured to the user by means of a strap 38 which may be secured in any suitable manner about the user's neck, shoulder or the like, said strap being provided with a clip or sleeve 39 supporting said breathing tube. The [illegible]

in Fig. 1 serving to hold said blades in submerged or partially submerged position.

The air then passes through openings 34 and the inward velocity thereof acts upon the inclined vanes 34a to cause rotation of the air cleaning device 11 in the direction indicated by the arrow at R in Fig. 6. The air is caused by baffle member 31 to engage the rotating vanes 30, which serve to maintain the rotary movement of the air in the same direction as the rotation of the device itself. The air is therefore kept in rotation or whirling movement in its passage through the separating chamber 11b and the resulting cen-

[redacted]

trifugal force acts upon any suspended liquid particles and causes the same to be thrown outwardly against the wall 11a and into the annular recess or pocket 36, while the clean air is again deflected and passes forwardly within the air conducting tube 5 and breathing tube C to the breathing mask B and thence to the nose or mouth of the swimmer.

The separated water accumulating in pocket 36 is further acted upon by centrifugal force due to whirling movement thereof and exerts sufficient pressure against the flexible releasing plate 27 to cause said plate to open away from the rearward edge of wall 11a, as indicated at 27b, to permit outflow of such liquid therebetween. In general however, a sufficient quantity of liquid will be retained within the pocket 36 to substantially prevent inflow of air at this point.

The water discharged from the cleaning device 11 as above described may escape through the opening 24 and between flanges 14, or may drain forwardly through housing 13 and be discharged as above described through openings 22 and beneath flange 20.

It may be pointed out that, during normal operation of the device, the pressure drop required to force the air through openings 34 and vanes 34a will serve to maintain a somewhat greater pressure on the outer or rearward side of plate than exists inside the cleaning device 11, and said device will therefore be held forwardly in the normal operating position above described and illustrated in Fig. 5.

In case of a sudden forward pull by the swimmer upon the breathing tube, such as might be liable to cause momentary accidental submergence of the air intake unit, the forward pull on the breathing tube will act through collars 7 and 8 to draw the housing portion 13 forwardly and bring flange 16 into engagement with plate 2 and flange 15 into engagement with flange 17, thus substantially sealing the device against accidental inflow of water during the period of such submergence. As soon as the forward pull is released, the spring 10 will return the housing portion 13 to its normal position, and intake of air as above described will be resumed.

It will be understood that the swimmer, while

Various modifications may be made in different parts of the apparatus without departing from the spirit of this invention. For example, in Figs. 7 and 8 I have shown two possible modifications in the construction of the liquid discharging means for the air cleaning device or separator unit 11.

In Fig. 7 the rearward end of the device 11 is normally closed by a closure plate 44 slidably mounted on shaft 28. Said closure plate is biased forwardly toward engagement with the flared edge portion 11c by means of resilient arms 45 secured at their forward ends to said plate and at their rearward ends to a flange sleeve 46 fixed to shaft 28. Arms 45 are provided with weights 47 of suitable size, such that the centrifugal force exerted thereon by rotation of the device serves to bow the arms 45 outwardly and thus move the closure plate 44 rearwardly, for example to some such position as indicated at 44b, thus providing a space between said closure plate and the rearward edge of the frusto-conical wall 11a, for centrifugal discharge of liquid separated from the air within said device. However the weights 47 are so proportioned with respect to the strength of spring arms 45 that the space thus provided will be only sufficient to permit outflow of liquid, without permitting any appreciable inflow of air at this point.

In Fig. 8 the frusto-conical wall 11a of the air cleaning device 11 is provided adjacent its rearward edge with a cylindrical wall portion 48, and the rear closure plate 57 is shown as being rigidly secured to or formed integrally with said cylindrical wall portion and also secured to shaft 28. Said cylindrical wall portion 48, is provided with a plurality of liquid discharge openings 49 disposed at intervals about the periphery thereof and adjacent the face of closure plate 57. Said openings 49 are normally closed by an annular sleeve or ring 51 slidably mounted around the cylindrical wall portion 48 and normally held in such position by means of radially extending arms 52 provided with forwardly extending portions 52a secured to said sleeve. The inner ends of arms 52 may be provided with eyes 52b slidably engaging spring arms 53 secured to plate 57. All of the arms 52 are also shown as secured to a circular ring or frame member 54 to provide the necessary rigidity and cause all of said arms to move backward and forward together. The arms 53 are inclined rearwardly and outwardly and are biased inwardly by their own resilience, so that the engagement of said arms in the eyes 52b tends to draw the arms 52 and sleeve 51 rearwardly, against suitable stop members 55 secured to plate 57. Spring arms 52 are provided at their rearward extremities with weights 56. In this form of device the inwardly projecting vanes 30'' are shown as being of a somewhat different shape than in the forms here-

It will be understood that the means of air cleaning device shown in Figs. 7 and 8 may be mounted upon the rear portion 5*b* of the air conducting tube 5, in the same manner as shown in Figs. 2 and 5.

Another modified form of air cleaning device or separator unit is shown in Figs. 9 and 10, said device being also shown as mounted on the rearward portion 5*b* of the air conducting tube. In this case the outer wall or shell of the air cleaning device comprises a cylindrical portion 58, a frusto-conical portion 59 extending rearwardly from said cylindrical portion and a plate 61 extending across the rear end of the frusto-conical portion 59. An annular space 62 is provided between plate 61 and member 59, and a plurality of inclined vanes 63 are secured within said space for imparting whirling motion to the air passing therethrough. A frusto-conical baffle member 63*a* is preferably provided at the forward side of vanes 63 for deflecting entering air outwardly. Plate 61 is secured to a shaft 64 which is slidably mounted in a sleeve 65 secured by arms 66 to tube portion 5*b*. The separator shell comprising parts 58, 59 and 61 is biased rearwardly by means of compression spring 67 disposed between plate 61 and sleeve 65, and such rearward motion is limited by an outwardly projecting baffle and stop flange 68 secured to shaft 64. A plate or disk 69 is secured to tube portion 5*b*, and another baffle plate 71 is also secured thereto somewhat rearwardly of plate 69 and of somewhat less diameter than casing 58. When the parts are at rest, the spring 67 holds the [illegible] so that the forward edge

is believed to be obvious in view of the above description of the operation of the device shown in Figs. 5 and 6. Liquid contained in the air drawn in through openings 34′ and between vanes 34*a*′ is separated therefrom by centrifugal action, and accumulates in the annular pocket provided betwen the engaging edge portions 11*c*′ and 27*a*′, and the centrifugal force on the liquid so collected exerts sufficient pressure against the member 27′ to bend the same outwardly to some such position as indicated in dotted lines at 27*b*′, so as to permit outflow of such liquid.

In Fig. 12 there is shown a possible modification in the construction of the rearward end portion of the protective housing of the air intake unit. The cylindrical housing portion indicated at 13′, may be mounted, with respect to the other parts of the apparatus, in substantially the same manner as the movable housing portion 13 shown in Fig. 2. The rearward end portion thereof is flared outwardly, as shown at 76, and a disc shaped valve member 77 is provided, normally held in engagement with the face of the flared portion 76 by means of spring 78. Valve member 77 is mounted on a shaft 79 which is slidably supported in a sleeve 81 secured to housing portion 13′ by means of arms 82. Spring 78 is disposed between sleeve 81 and a flange 83 secured to shaft 79. The outer edge portion of valve member 77 may be provided with a gasket 84 of rubber or other suitable yielding material so as to form a substantially tight seal at this point. In this form of device, water accumulating within the forward end portion of the protecting housing acts by gravity to open the valve member 77

of the wall portion 58 is out of engagement with plate 69. However, when air is drawn inwardly through the device, the pressure drop created

sufficiently to release such water, and the valve member is then returned to closed position by spring 78.

is shown particularly in Figs. 15 and 16. Said unit comprises a protective housing 101 consisting of a cylindrical casing 102 whose upper and lower ends are closed by plates 103 and 104 respectively. Said housing is secured by means of a metal strap 105 to the head straps 95 above mentioned. Air is admitted to the interior of said housing to inlet tubes 106 which open through the cylindrical casing 102 at approximately the mid-height thereof and are disposed at suitable intervals around the circumference of said casing. In order to prevent entrance of liquid through said inlet tube in case the air intake unit becomes submerged, a flexible cylindrical diaphragm 107 of rubber or other resilient material is disposed around the outer ends of said inlet tubes, and is normally held by its own resilience in a position somewhat outwardly therefrom but is adapted to be pressed inwardly, upon application of external pressure, into engagement with an annular seating ring 108 secured to the outer ends of said inlet tubes. Said diaphragm may be secured at its upper and lower ends to flanges 109 and 110 respectively which are secured to cylindrical casing 102 and project outwardly therefrom, and said flanges are shown as provided with openings 111 permitting inflow of air to the interior of said diaphragm. A screen or pervious casing member 113 is preferably also provided, said member inclosing diaphragm 107 and flanges 109 and 110 so as to prevent entrance of solid objects or particles into the interior of the air intake unit.

The breathing tube C' is connected to a tube 115 which extends up through the bottom plate 104, and an air cleaning device 11', which may be of the same type as shown in Fig. 11 or of any of the other types above described, is mounted on the upper end of said tube 115. The air intake unit is also shown as provided with an internal baffle member 116 provided with flared upper and lower end portions 117 and 118, said baffle member being mounted on arms 119 secured to casing 102 and being disposed opposite the air inlet tubes 106, so that the air entering through said inlet tubes is deflected and caused to pass above or beneath said baffle member in order to reach the inlet openings 34' of the air cleaning device 11'. A stop plate

tion, upon each inhalation by the swimmer, air is drawn in through openings 111, passes between diaphragm 107 and seating ring 108 to the air inlet tubes 106, thence around the ends of baffle member 116 to the interior thereof, and through the air cleaning device 11' and tube C' to the breathing mask B'. Any suspended liquid particles which are not trapped from the air before reaching the air cleaning device 11' are effectively separated by centrifugal action within said device, so that only air substantially free from liquid is permitted to pass to the breathing mask B'. The liquid separated within the cleaning device 11' is discharged therefrom, either centrifugally or otherwise, depending upon the type of cleaning device used. This liquid, together with any other liquid separated in the interior of casing 102 is discharged from said casing through the openings 123, the weight of this accumulated water being sufficient to displace the sealing flange 124 sufficiently to permit outflow of such water.

In Fig. 17 I have shown a modified construction of the air inlet means through which air is admitted through the interior of the cylindrical casing 102'. In this case, a flexible resilient diaphragm 107' is disposed around said casing and secured to the flanges 109' and 110' in such manner as to normally assume a position somewhat spaced from the wall of said casing. Said diaphragm is provided with a plurality of air inlet openings 131, preferably at substantially the mid-height thereof, and one or more rows of openings 132 are also provided in casing 102', said openings 132 being vertically offset with respect to the openings 131. During normal operation, the diaphragm 107' is held by its resilience out of engagement with casing 102', so that air may be drawn in through openings 131 and thence between said diaphragm and casing to the openings 132, through which it passes to the interior of said casing. However, in case the device should become submerged beneath the water, the pressure of the water against the outside of diaphragm 107' serves to force said diaphragm inwardly against casing 102' so as to prevent inward passage of air through the openings 131. This form of device may also be provided with a protecting screen 113' disposed over the diaphragm 107' and connected to casing 102'

sitioned as to be normally supported above the of separated liquid within said separating cham-

surface of the water by said supporting means, said air cleaning device being operable to separate suspended water particles from air passing therethrough, a breathing mask adapted to be secured in a position of communication with the breathing organs of a swimmer, a breathing tube connecting said air cleaning device to said mask, and valve means for shutting off said air inlet openings of said air cleaning device from the atmosphere and from inflow of water in case of an excessive pull upon said conduit of sufficient intensity to cause submergence of said air cleaning device.

3. The device set forth in claim 2, and comprising in addition: means for closing said valve means in response to such excessive pull prior to submergence of said air cleaning device.

4. In a breathing device for swimmers, an air cleaning device provided with air inlet openings and operable to separate suspended liquid particles from air by centrifugal action and provided with means for effecting discharge of separated liquid from the interior thereof by centrifugal

ber.

7. An apparatus as set forth in claim 5, said closure member being movable to open position by the action of centrifugally operable actuating means associated therewith.

8. A breathing device for swimmers which comprises: a buoyant supporting means; air cleaning means disposed at the rearward end of said supporting means and including air inlet means; a breathing mask adapted to be secured in position of communication with the breathing organs of a swimmer; a breathing tube leading from said mask and secured to the forward end of said supporting means in communication with said air cleaning means, the weight of said air cleaning means being so proportioned to the weight of said breathing tube in relation to said buoyant supporting means as to tilt said air cleaning means upwardly and rearwardly.

9. A breathing device for swimmers which comprises: a buoyant supporting means; air cleaning means disposed at the rearward end of said supporting means adapted to obtain separation