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BACK PLATE FOR SELF-CONTAINED UNDERWATER BREATHING APPARATUS

Filed Aug. 8, 1960

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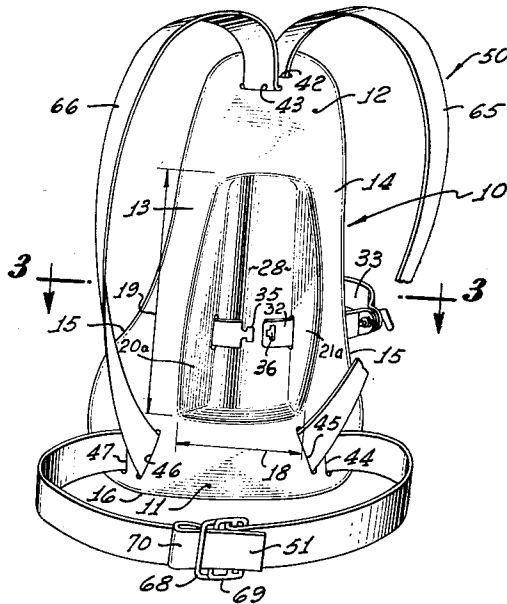


FIG. 1.

FIG. 2.

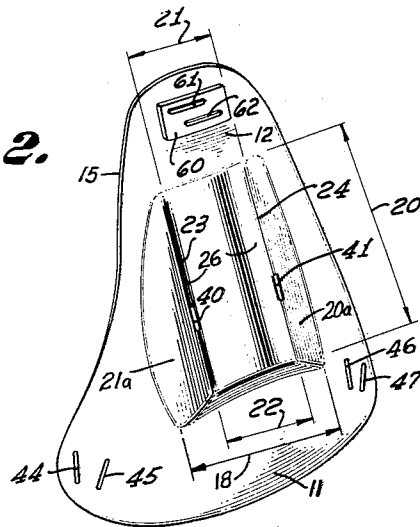
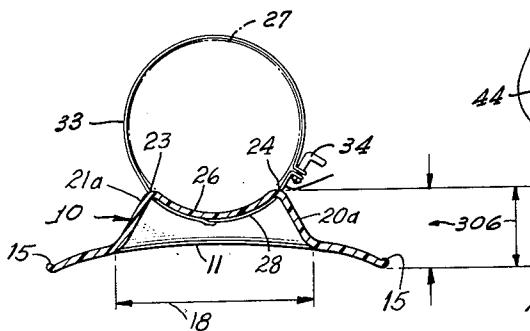


FIG. 3.



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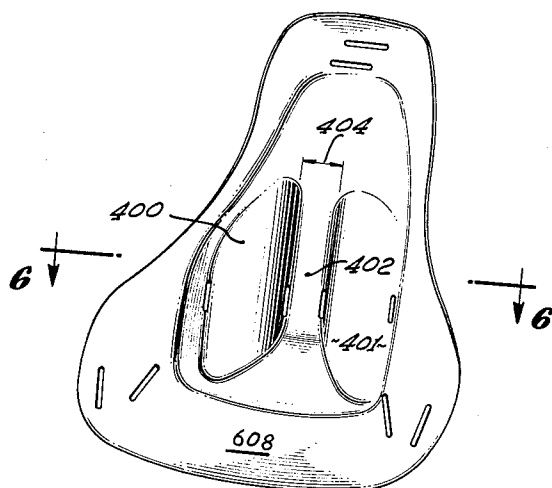
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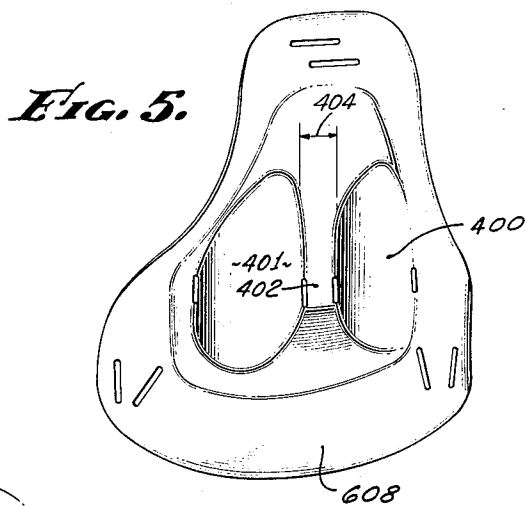
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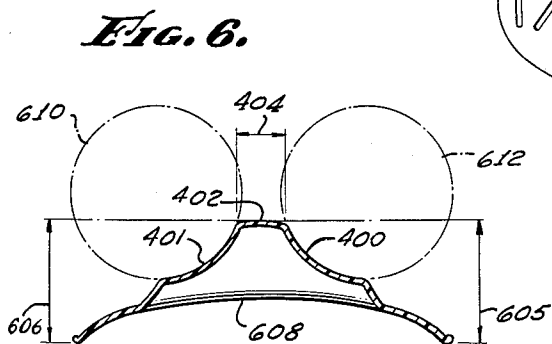
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**Fig. 4.**



**Fig. 5.**



**Fig. 6.**

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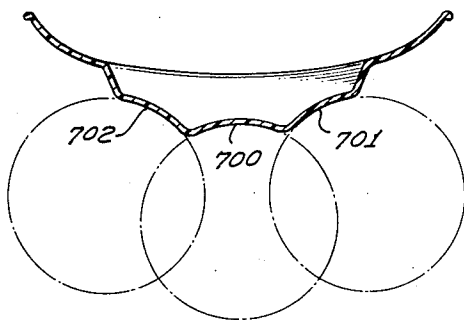
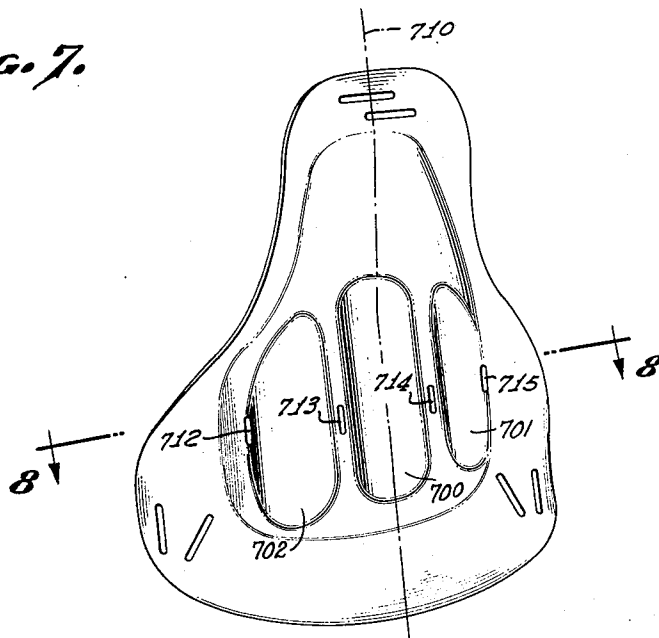
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BACK PLATE FOR SELF-CONTAINED UNDERWATER BREATHING APPARATUS

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**FIG. 7.**



**FIG. 8.**

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**BACK PLATE FOR SELF-CONTAINED UNDER-WATER BREATHING APPARATUS****Robert B. Henderson, Whittier, and Jack R. Drake,  
Santa Ana, Calif.****Filed Aug. 8, 1960, Ser. No. 48,195  
8 Claims. (Cl. 224-5)**

This invention relates to improvements in back plates and harness worn by underwater swimmers for carrying compressed air high pressure cylinders which supply air to a diver through a self-contained underwater breathing apparatus known as "scuba."

The invention is also applicable to portable welding apparatus in which case two gas-filled cylinders are mounted on a back plate.

It is an object of this invention to provide a back plate contoured to the back of a human body and also contoured to a gas cylinder.

It is an additional object of this invention to provide the back plate of the above type which is light in weight, easily releasable in case of emergency, and, because of its contoured shape with respect to the back of the user as well as with respect to the gas cylinders, makes the entire breathing or welding apparatus positively strapped to the diver or welder with a single, continuous strap.

It is an additional object of this invention to provide a back plate which is capable of accommodating either one or two tanks, with one tank being mounted along the central portion of the plate when only one tank is desired.

Other objects of the invention will become more apparent from a more detailed description given with the aid of the drawings in which:

FIGURE 1 is a perspective view of the back side of a single cylinder plate and of a single strap harness.

FIGURE 2 is a perspective view of the rear, or cylinder side, of the back plate illustrated in FIG. 1.

FIG. 3 is a transverse sectional view of the plate taken along line 3-3 illustrated in FIG. 1.

FIG. 4 is a perspective view of the back side of a two-cylinder plate.

FIG. 5 is a perspective view of the tank side of the two-cylinder plate.

FIG. 6 is a transverse sectional view of the plate of FIGS. 3 and 4 taken along line 6-6.

FIG. 7 is a perspective view of a plate which is suitable for two cylinders or only one cylinder, when only one cylinder is desired.

FIG. 8 is a transverse sectional view of the plate, taken along line 8-8 illustrated in FIG. 7.

Referring to FIGS. 1, 2 and 3, they illustrate two perspective views and a transverse sectional view of a back plate 10 provided with a continuous, contoured, form-fitting circumferential flange, including a wide arcuate lower flange portion 11 which fits the small of the back, a relatively flat upper flange portion 12 which rests on that upper portion of the back of the wearer, which is on a level with the shoulder blades of the wearer, and two arcuate side flange portions 13 and 14 which join the lower and the upper portions of the circumferential flange along its two sides. An outwardly projecting bead 15 is provided along the periphery of the plate except its lower transverse edge 16. The interior surface of the plate defines a central outwardly projecting portion, indicated in FIG. 1 by two dimensional arrows 18 and 19, which is pressed outwardly a significant distance sufficient to permit relatively free movement, particularly bending movements, of the back of a wearer in the region of said central portion. The outer surface of said central portion is, moreover, shaped to provide a generally semi-cylindrical concave surface 26 which extends through the greater length of the plate, as indicated by the three di-

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mensional arrows 20, 21 and 22, illustrated in FIG. 2. The shaping also provides two ridges 23 and 24, which indicate the length and also the width of the centrally positioned semi-cylindrical cylinder supporting seat having the outer concave surface 26, best seen in FIG. 3, and an inner convex surface 28. This overall shaping of the central portion, particularly of the outer surface 26 thereof, is used for mounting and rigidly supporting a compressed air cylinder 27 which is indicated by a circular dotted line in FIG. 3 adjacent to a circular strap 32-33. The semi-cylindrical tank supporting seat is depressed (as viewed in FIG. 1), or pressed inwardly, but because of the raised side walls 20a and 21a, none of the convex surface 28 of the tank seat makes contact with the central portion of the wearer's back. Therefore, the plate rests on, and makes contact with, the back of the wearer by means of the circumferential flange having lower, upper and side flange portions 11, 12, 13 and 14. The air tank, or cylinder 27 is strapped to the back plate by means of a two-piece stainless steel strap 32-33, which fits around the surface 28 of the plate (see FIGS. 1 and 3) and the tank. The strap is provided with a single wing bolt 34 and a slot-and-hook combination 36-35 for joining the other two ends of the strap. In view of the large area, length and width of the tank-supporting area 26, there is a very positive engagement between the plate and the tank, with the result that the tank cannot be knocked off the plate even if it accidentally strikes a rock during the actual use of the apparatus.

The plate is provided with eight slits 40 through 47. Slits 40 and 41 are used for attaching the band pieces 32 and 33 around the plate and the tank, and the remaining slits 42-47 are used for attaching a single length webbing 50 to the plate in the manner indicated in FIGS. 1 and 2. The webbing 50 is fastened to the plate by passing its end 51 through the slots in the following order: 47, 46, 43, 42, 45, 44. After the end 51 is passed through slot 43, a buckle 60 with two slots 61 and 62, is also mounted on the webbing in the manner indicated in FIG. 2. Buckle 60 normally rests on the plate and prevents the slippage of the webbing back and forth through slits 42 and 43, when there may be a variation in the amount of pull exerted on the left and right shoulder straps 65 and 66, formed by the webbing between the slots 42-43 on the top and slots 46-47 and 44-45 on the bottom.

The opposite end of webbing 50 terminates in a double loop belt fastener 68 and 69 which is sewn to the end of the webbing. The manner in which end 50 is fastened and threaded through the loops, is illustrated in FIG. 1. It forms a "quick release" loop 70, which can be pulled out and the entire one-piece harness released very quickly by pulling it out of engagement with the fastener 68 and 69. It is to be noted that the one-piece harness also acts as a belt which can be used for mounting the balancing weights. The one-piece harness is completely adjustable so as to increase or decrease the length of the shoulder straps 65 and 66 as well as the length of the belt. In order to make the adjustments, the breathing apparatus is mounted on one's back by slipping the shoulder straps on the shoulders, and then strapping the belt around the waist. The apparatus is then adjusted to the most comfortable position by moving the webbing forward or backward through the bottom slots 44-45 and 46-47, having more or less length in the shoulder straps 65 and 66, and then readjusting the belt portion of the harness. The above adjustment of the harness is preferably done before the tank is mounted on the back plate. The tank is then mounted on the back plate and adjusted to the proper position by means of band 32-33 and the single wing bolt 34.

FIGS. 4, 5 and 6 illustrate two perspective views and a sectional view of the back plate which is provided

with two raised semi-cylindrical tank seats having concave surfaces 490 and 401 for supporting two tanks. The central tank seat spacing ridge 402, and its transverse dimension 494, is proportioned so as to allow enough room for connecting the valves and ducts to the outlet portion of the tanks. Another feature which differentiates the two-tank plate from the one-tank plate is the shape of the plate below the concave, cylindrically-shaped surfaces 400 and 401 as viewed in FIG. 6, or the dimensions 605 and 606. These two identical dimensions in FIG. 6 are longer than a similar dimension 306 in FIG. 3. Also, the lower flange portion 608 is made wider than the flange portion 11 in FIG. 1. This is due to the fact that when two tanks are used by a diver, it becomes necessary to compensate for the increased buoyancy provided by the two tanks, by means of lead weights, which are strapped to the back portion of the belt of the diver. The weights, then, rest on top of the arcuate flange 608. Therefore, the over-all length of the two-tank plate is longer than the length of the single tank plate.

It is very desirable to have a more universal plate than those illustrated in FIGS. 1 through 6. It is obvious that the plate illustrated in FIGS. 1 through 3 can be used only with one tank and the plate which is illustrated in FIGS. 4 through 6 can be used only with the two tanks. The latter plate cannot be used with one tank because it will produce an unbalanced combination and, therefore, will always tend to turn or rotate the diver in one direction or the other, depending upon the degree of balance existing at any given time with only one tank positioned on one side of the two-tank plate. Such unbalance may be corrected to some extent by means of the buoyancy-adjusting weights which are mounted on the belt, but such adjustment is not as satisfactory as if the tank were positioned along the center portion of the plate.

The plate which can accommodate two tanks whenever two tanks are desired, or only one tank when one tank is desired, is illustrated in FIGS. 7 and 8. Examination of these figures indicates that this plate is similar to that illustrated in FIGS. 4 through 6 except that the ridge portion 402 of the two-tank plate now has been made wider and converted into a centrally located, raised semi-cylindrical tank seat having a concave surface 700 positioned along the central longitudinal axis of the plate and between two additional raised semi-cylindrical tank seats having concave surfaces 701 and 702 which correspond to the concave surfaces 400 and 401 provided in the two-tank plate.

The concave surfaces 490 and 401 span an angle of approximately 30°. The concave surfaces 700, 701 and 702 on the other hand, span a smaller angle which is in the order of 20°. These angles are preferably made equal so that the entire multi-concave surface portion of the plate presents a symmetrical structure, symmetrically disposed along the longitudinal axis 710 illustrated in FIG. 7. The four slots 712, 713, 714 and 715 are positioned along the ridge portions of each tank seat and they are uniformly spaced with respect to each other, along the periphery of the plate. In this manner, the back plate offers the same surface area for strapping each tank against the plate, and, therefore, irrespective of whether the plate is used for two tanks or one tank, each tank can be strapped to the plate with an equal degree of security.

The remaining features of the plate illustrated in FIGS. 7 and 8 are identical to those of the plate illustrated in FIGS. 4, 5 and 6.

The harnesses are the same for all the plates, single as well as double tank plates, except that the harness for the plates illustrated in FIGS. 4 through 8 is slightly longer because of the greater lengths of these plates.

Suitable materials for making the back plate are fiberglass cloth impregnated with thermosetting resins, such as epoxy, phenol formaldehyde and polyester. "Dacron"

and "Nylon," and other synthetic fibers could also be used for making the cloth. Metals are suitable, also, especially non-corroding alloys, such as aluminum or nickel alloys. The harness can be made of cotton, Orlon, or Nylon fibers. A 2-inch cotton webbing, 1/8-inch thick, is suitable.

What we claim as new is:

1. A back plate adapted to be mounted on the back of a wearer for supporting at least one cylindrical tank, said plate comprising a single piece member having a circumferential flange generally contoured to the back of a wearer and adapted to extend from the small of the back substantially to the shoulder blades of the wearer, said flange having a lower portion curved to substantially fit the small of the back and to wrap at least part way around the waist of the wearer, said flange also having an upper portion adapted normally to rest over the central upper portion of the back of the wearer, and two side portions joining the lower and upper portions of said flange, said side portions being curved to substantially fit the respective side portions of the back of the wearer which are between said central upper portion of the wearer's back and the wearer's waistline, the remainder of said back plate, within the area subtended by said circumferential flange, being bulged away from the back of the wearer to define a central tank-supporting part projecting outwardly from said flange and connected to and blending into said flange, the interior surface of said tank-supporting part being spaced from the back of the wearer by a significant distance sufficient to permit relatively free movements of the wearer's back in the region of said tank-supporting part when said back plate is being worn, said central part including at least one seat on the exterior surface thereof for a tank, said seat having an outer concave surface shaped to wrap at least part way around the cylindrical matching surface of said tank, means for holding a tank on said seat, and means for supporting said back plate on the back of the wearer.

2. A back plate for a breathing apparatus adapted to engage certain spaced portions of a wearer's back while leaving the central portion of the wearer's back substantially unengaged and free for movement, said back plate comprising a single piece, continuous, rigid member adapted to be placed on the back of a wearer, said member having a centrally located offset portion projecting outwardly from the back of a wearer in freely spaced relation to the central portion of a wearer's back, the interior surface of said centrally located portion being relatively widely spaced from the back of the wearer by a distance sufficient to permit relatively free bending movement of the wearer's back, the outer surface of said centrally located portion being shaped to define at least one seat for a cylindrically shaped gas-filled storage tank, said seat including an approximately semi-cylindrical concave surface for matching the engaging portion of the convex cylindrical surface of the tank, means for holding a tank in engagement with said seat, and a continuous circumferential contoured flange comprising a portion of said back plate extending around said centrally located outwardly projecting portion, said flange having a lower portion curved substantially to fit around the small of the back of the wearer of said plate, said flange also having an upper portion, narrower than said lower portion, shaped substantially to rest on the upper and central portion of the back of said wearer, said flange further having left and right side-portions joining the lower and upper portions and curved substantially to fit the corresponding side-portions of the wearer's back, said lower, upper, and left and right side portions of said flange comprising the portions of said back plate which engage the back of a wearer thereby to position said centrally located back plate portion in said freely spaced relation to the central portion of a wearer's back, and holding means for holding said back plate on the wearer's back.

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3. The back plate as defined in claim 2, in which said holding means includes two transverse slots located in an upper portion of said plate, left and right pairs of slots positioned respectively at the left and right ends of a lower portion of said plate, and a continuous harness webbing threaded in sequence through said slots to provide a pair of shoulder straps and a belt for said plate.

4. A tank support structure for underwater breathing apparatus comprising a back plate member adapted to engage certain portions of a wearer's back while leaving the central portion of the wearer's back normally unengaged and free for bending movements, said back plate member defining contoured flange means disposed adjacent the periphery of said plate member and curved to engage surface portions of a wearer's back remote from the central portion of the wearer's back, said contoured flange means having its inner edges merging smoothly into a centrally disposed offset back plate area comprising a portion of said back plate member located in facing relation to the central portion of the wearer's back, said centrally disposed back plate area portion being bulged outwardly away from the central portion of the wearer's back so that all portions of said centrally disposed back plate area portion are spaced a sufficient distance away from the wearer's back to permit relatively free movement of the wearer's back without making contact with said centrally disposed back plate portion, means on said centrally disposed back plate area portion for supporting at least one tank, and means including a plurality of apertures located at spaced portions of said back plate member adapted to retain a harness used for mounting said back plate member on the wearer's back.

5. A back plate for supporting two gas-filled cylinders on the back of a wearer of said plate, said plate comprising a single piece, contoured member having a central, outwardly projecting portion having supporting means engaged therewith to hold said central portion in spaced relationship with respect to the back of a wearer thereby to permit relatively free bending of the adjacent portion of said wearer's back, said supporting means including first and second flange portions, said first flange portion being curved substantially to fit the small of said back, and said second flange portion being shaped to engage an upper portion of said back, said central outwardly projecting portion of said plate including first and second cylinder supporting seats on an outer surface thereof for mounting and supporting said two cylinders, a centrally located ridge joining and separating said seats, said first and second seats having first and second concave surfaces, respectively, substantially matching the corresponding portions of the outer cylindrical surfaces of said cylinders, means for holding a pair of cylinders in engagement with said first and second supporting seats respectively, and means for supporting said back plate on the wearer's back.

6. The back plate of claim 5 in which said first flange portion is wide enough to accommodate buoyance-adjust-

ing weights used when said apparatus is used as underwater breathing apparatus, and a side-flange portion on each side of said back plate, said side-flange portions joining the first flange portion with the second flange portion and adapted to fit the corresponding portion of the user's back.

7. A back plate for supporting one or a pair of cylindrical tanks, said back plate being adapted to be carried on the back of a wearer, said plate comprising peripheral flange means normally resting on and curved substantially to fit spaced portions of the back of the wearer when said plate is in use, the entire inner portion of said flange means merging into an elevated outwardly projecting central portion which is relatively widely spaced from the back of a wearer by a distance sufficient to permit relatively free movements of a wearer's back in the region of said central portion, said elevated central portion having an outer surface defining first, second and third concave, scalloped semi-cylindrical seats, said first seat being substantially centrally located along the longitudinal axis of said plate, and said second and third seats being located respectively to the right and left of said first seat, means for holding a tank in engagement with said first seat when said back plate is used for supporting a single tank, means for holding a pair of tanks in engagement with said second and third seats in substantially symmetrical relation to the longitudinal axis of said plate when said plate is used for supporting a pair of tanks, and means for mounting said back plate on the wearer's back.

8. A support adapted to be mounted on the back of a wearer and adapted to carry at least one gas-filled cylinder on said support, said support comprising a relatively stiff back plate having at least first and second flange portions, said first flange portion being curved to engage the small of a wearer's back, and said second flange portion being shaped to engage the upper central portion of said back, said back plate also including a central member positioned in facing relation to the central portion of the wearer's back, said first and second flange portions having respective inner edges disposed adjacent the central portion of the wearer's back, said inner edges projecting outwardly away from the wearer's back and merging smoothly into said central member and being dimensioned to hold said central member a sufficient distance away from a wearer's back to permit free movement of said back, means on said central member for mounting and supporting said cylinder, and means for holding said support on the back of the wearer.

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