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RESPIRATORY APPARATUS

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Fig. 1

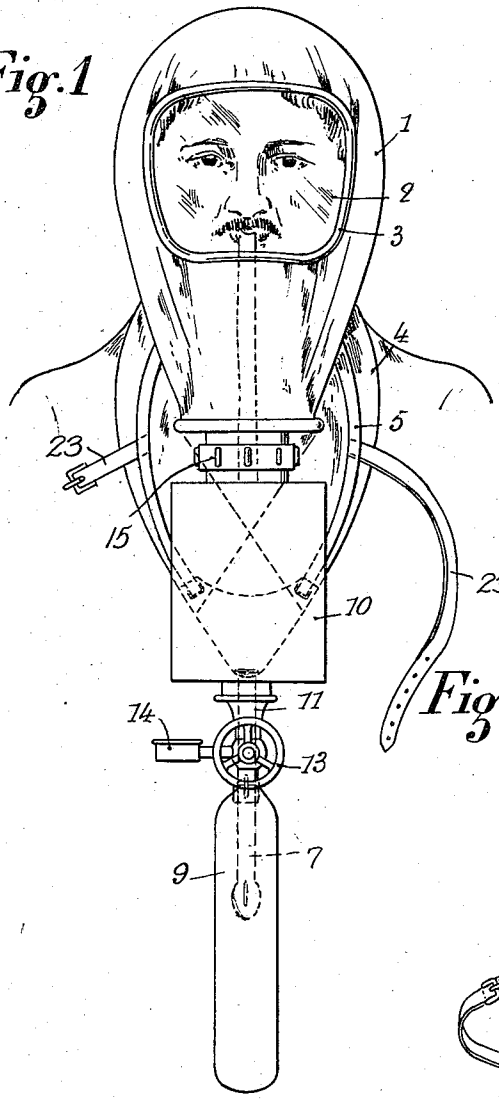


Fig. 2

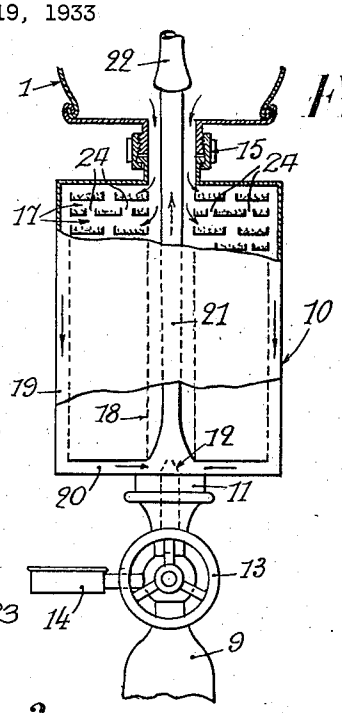


Fig. 3

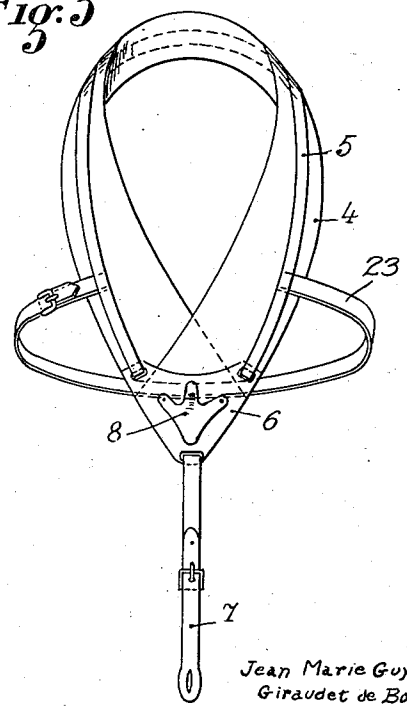
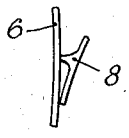


Fig. 4



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RESPIRATORY APPARATUS

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8 Claims. (Cl. 128—191)

The present invention relates to respiratory apparatus of the oxygen type, and has chiefly for its object to provide light and reliable apparatus of simple manufacture and of a ready use and upkeep.

According to one feature of the invention, the respiratory apparatus comprises a collapsible sack or hood of material which is flexible and is impermeable to gas, said sack being of some size and entirely surrounding the head, in such manner as to form a tight respiratory chamber which is maintained somewhat swelled out by over-pressure, and to permit the elimination of the usual economizer sack.

In conformity to another feature of the invention, the hood is cemented or otherwise attached in a non-leaking manner to a closed collar through which the head may be passed, said collar consisting of a band of flexible and compressible material such as spongy india-rubber, which assures non-leaking conditions and is placed flatwise upon the skin of the neck and of the upper part of the chest, and by means of which the hood is secured to the body.

According to another feature of the invention, a non-expanding breast-strap is placed flatwise upon the collar, and is secured by cementing it to the collar, to the hood, or to both of these at the same time, in such manner as to assure a close contact between said collar and the skin, and to support the weight of an oxygen-producing apparatus and of an apparatus or reagent case for purifying the air issuing from the lungs.

The said collar is held in place by the weight of the oxygen bottle or optionally of the reagent box, or of both, and also by the pressure of the usual clothing, coat, vest, etc., which are placed and buttoned above this collar, and further, by a belt passing below the arms.

In the accompanying drawing, which is given by way of example:

Fig. 1 is an elevational view of a respiratory apparatus in conformity with the invention.

Fig. 2 is a diagrammatic view showing a partial vertical section on a larger scale, indicating the circulation of the air.

Fig. 3 is an elevational view of the collar upon which the hood is mounted.

Fig. 4 is a side view of the member used for attaching the oxygen generator and the air-purifier, to the collar.

In the form of construction represented in Fig. 1, the apparatus comprises a sack or hood 1 consisting of a strong, flexible and gas-tight substance, such as fabric treated with oil or india-rubber. The said hood entirely surrounds the head, and it has a sufficient size to form a respiratory chamber and to remain somewhat inflated by over-pressure even during the inspiration time. The front face of the hood preferably comprises a window 2 through which the major part of the face can be seen from the exterior.

This window may consist of one or more sheets of a transparent and incombustible substance, which is proof against the formation of mist. In the case in which these transparent sheets are flexible, they are preferably mounted on a metallic frame 3 by which the device is made sufficiently rigid, however said frame will be flexible enough in order to allow the hood to be adapted to the wearer's face. In this manner, the lower side of the frame 3 may be given a convex form, in order to prevent the window 2 from making contact with the wearer's nose.

The lower edge of the hood 1 is secured by any suitable means assuring non-leaking conditions, to a collar fitting upon the wearer's neck and upon the upper part of the breast, preferably in contact with the skin, or in case of emergency, upon the shirt and even upon the outer clothing. In the present construction, said collar consists (Figs. 1 and 3) of a wide band or a tube 4 which forms a non-leaking packing and consists of a compressible substance such as a spongy india-rubber from which the outer crust has been removed upon the face in contact with the skin. A close contact between the collar and the skin is assured by the pressure of a breast strap 5 consisting of a strong and non-elastic substance, of stout canvas, for instance said strap may be laid flatwise upon the collar and may be secured, by cementing or the like, to the collar 4 or to the hood 1, or to both of these.

The strap 5 also serves to support the devices for producing oxygen and for purifying the air, and it supports all traction stress; the band 4 distributes the traction stress in such manner that the weight of the apparatus can be supported, and it assures non-leaking conditions without being subjected to traction stress, which permits the exclusive use of substances which preserve their qualities for a long time, and even assures such non-leaking conditions when the material is only imperfectly preserved.

To the strap 5 may be attached a belt 23 or a piece of harness which serves to hold the said collar in place, and to which may be attached the devices for producing oxygen and for purifying the air.

In the construction shown Fig. 3, the two ends of the strap 5 may be secured, in order to afford proper non-leaking conditions at the lower part of the collar, to a plate 6 which may consist of sheet aluminium; this plate is flexible, which allows it to take the proper shape for each person. To this plate, or to the strap itself, are attached one or more short straps 7, adjustable in length, consisting of leather or the like and optionally extensible. The straps 7 are attached at the other ends to a belt of a like piece which is usually worn.

To the plate 6 is secured, by any suitable means such as riveting, an attaching device, which consists, in the construction shown in Figs. 3 and 4, of a plate 8 whose upper part forms a hook for the oxygen apparatus and the air-purifying apparatus; the lower part of the plate consists of an appendage which applies against the plate 6 under the effect of the weights of the parts which are suspended from the hook, and thus holds plate 6 against the wearer's body.

The oxygen apparatus and the air-purifier may communicate with the internal chamber of the hood 1 by means of separate conduits, or of conduits which are common to the two apparatus, at least in part.

In the construction shown in Figs. 1 and 2, the oxygen bottle 9 is rigidly secured below a case 10 containing reagents adapted to absorb the carbon dioxide gas, by means of a coupling member 11 which carries a device 12 for the injection of oxygen (Fig. 2) as well as a cock controlled by a hand-wheel 13 in order to regulate the supply of oxygen.

The coupling member 11 may also be provided with a pressure gauge 14 which shows at each instant, even when the cock is closed, the pressure of oxygen remaining in the bottle. The device consisting of the bottle and the reagent case 10 is attached to the hook of the plate 8 and is connected with the lower part of the hood 1 by a coupling device 15.

The said reagent case, in the apparatus shown in Fig. 2, comprises various chambers 17 formed by horizontal partitions, and containing the reagents in the form of small pieces, tablets, or the like, and preferably in a single layer. The said horizontal chambers communicate, through the holes of perforated metal or wire gauze, on the one hand with a central conduit 18 leading to the interior of the hood 1, and on the other hand with one or more peripheral chambers 19, determined by the side walls of the casing and parallel perforated inner walls, and communicating with a space 20 provided at the lower part of the reagent case. The said space 20 is connected with a tube 21 having preferably a part in the form of a venturi, the injector 12 of the oxygen bottle 9 opening into the lower end of said tube. The tube 21 is contained in the central conduit 18 and opens into the hood. A flexible tube 22, arranged in the hood 1 may be secured in the end of the tube 21, and its outer end may be placed in the mouth by seizing it with the hand through the flexible fabric of the hood.

The apparatus may comprise pockets provided in the interior of the hood and adapted to contain various objects for the alimentation of the wearer, or the like.

It may be clearly understood that the device consisting of the hood and the collar prevents all entrance of the external air in said hood when the collar is applied against the wearer's body. Further when the pressure in the hood rises above a determined limit, the collar is slightly raised against the external pressures and allows the escape of all excess of air contained in the hood.

The operation of the apparatus is as follows. The apparatus is placed in position by inserting the head into the hood 1 through the collar 4—5; the collar is applied against the skin of the neck and of the upper part of the breast by means of the band 4, whereby a tight fit is assured for the hood. The collar is then covered by the garments, and the strap or straps 7 are attached to one of the garments, for instance the trousers. The reagent case 10, with the oxygen bottle 9, is hooked to the plate 8, and is connected with the hood by means of the coupling 15.

The oxygen is delivered into the hood by opening the cock of the bottle 9. The air in the hood is maintained at a slight excess of pressure, so that all entrance of air in case of a lack of tightness is prevented. This excess of pressure can be increased at will by opening the regulating cock, while accidental leaks are stopped up by means of rubber-coated sheets, a box of which is attached to the apparatus. Such sheets may also be used to complete the adhesion of the collar to the skin, if required.

The oxygen passes through the tube 22 which leads into the hood. The air from the hood circulates in the direction of the arrows (Fig. 2) through the conduit 18 and passes horizontally through the horizontal chambers 17, giving up carbon dioxide gas when in contact with the reagents. This air then attains the peripheral chambers 19 and proceeds into the tube 21 into which oxygen is injected.

This circulation of gas takes place due to the suction effect produced by the injector, and optionally any direct inspiration or expiration from the mouth which the wearer may produce through the flexible tube 22.

The supply of oxygen can be conveniently regulated by the large hand-wheel 13.

The said apparatus is of simple construction, and its use and upkeep are easy. On the other hand, its size and weight as much reduced. The internal arrangement of the reagent case assures a better use of the reagent and allows the employment of a reagent case of reduced volume and weight. This advantage can be used to the extreme limit, by using in combination with the method of parallel circulation of the gases, as above indicated, an accessory circulation in series, obtained by the use of perforations 24 (Fig. 2) having a baffle arrangement, known per se. On the other hand, due to the immediate connection of the said case with the oxygen bottle, the expansion of the oxygen serves to partially compensate the heat produced by the action of the reagents. Since a high pressure is made to act upon the injector, this will assure a better circulation through the reagent case, and will prevent any accidental clogging of the injector, which latter may be removed, if necessary, in case of serious damage.

Obviously, the said invention is not limited to the forms of construction herein represented and described, these being given solely by way of example.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a respiratory apparatus of the type operating in closed circuit, a hood adapted to surround the wearer's head and a closed collar made

of a wide band of supple and compressible material, provided with an opening allowing the free passage of the wearer's head, secured to said hood and of freely deformable shape so as to be applied flatwise upon the bottom of the wearer's neck and the upper part of the breast along its entire length by stress acting on its rear lower part as well as by a pressure distributed upon its surface, in order to provide an air-tight fitting of the hood on the wearer's body.

2. An apparatus as claimed in claim 1, further comprising a non-extensible breast strap resting upon said collar and adapted to carry the heavy parts of said apparatus and to distribute their weight over said collar, in order to apply tightly the same against the wearer's body.

3. An apparatus as claimed in claim 1, further comprising a non-extensible breast strap resting upon said collar and adapted to carry the heavy parts of said apparatus and to distribute their weight over said collar, and a belt attached to the lateral parts of said breast strap in order to contribute to the tight application of said collar against the wearer's body.

4. An apparatus as claimed in claim 1, further comprising a non-extensible breast strap resting upon said collar and adapted to carry the heavy parts of said apparatus and to distribute their weight over said collar, and an adjustable strap connected with said breast strap and adapted to be connected with buttons of the wearer's trousers, in order to apply tightly the collar against the wearer's body.

5. In a respiratory apparatus of the type operating in closed circuit, an oxygen bottle, a hand operated regulating cock secured to said bottle, an injector adapted to operate at high pressures directly secured to the discharge end of said cock, whereby the oxygen pressure acting on said injector and consequently the supply of oxygen delivered by the said injector may be controlled by the cock and varied at will, a device utilizing the expansive power of the oxygen delivered by said injector for causing the air to circulate in the apparatus, and a reagent case rigidly secured to said bottle and containing said injector.

6. An apparatus as claimed in claim 5, further comprising a respiratory chamber, said reagent case provided with an inner central conduit and with a tube embodying a Venturi tube arranged within said conduit and extending outside said case within said chamber, and a coupling piece adapted for connection with said central conduit and said chamber, whereby the reagent case may be easily replaced by another one.

7. In a respiratory apparatus of the type operating in closed circuit, a reagent case comprising internal partitions dividing the interior of said case into compartments, each containing a thin layer of solid reagents absorbing the carbon dioxid gas, and an internal arrangement for causing the air to circulate in parallel through said compartments.

8. An apparatus as claimed in claim 7, wherein said partitions are provided with apertures having a baffle arrangement in order to allow an accessory circulation in series of the air.

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