

J. TISSOT.
RESPIRATORY APPARATUS.
APPLICATION FILED APR. 18, 1908.

932,515.

Patented Aug. 31, 1909.
6 SHEETS—SHEET 1.

FIG. 1.

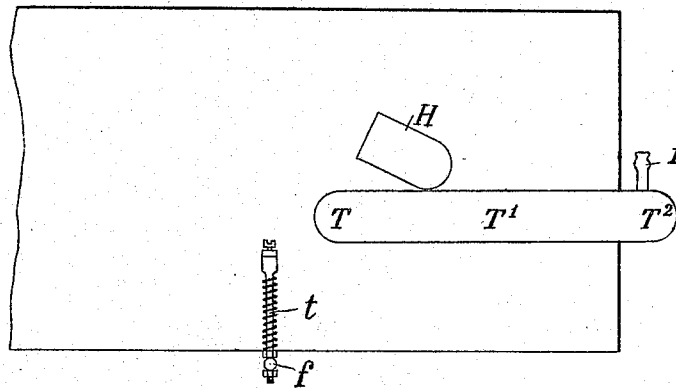
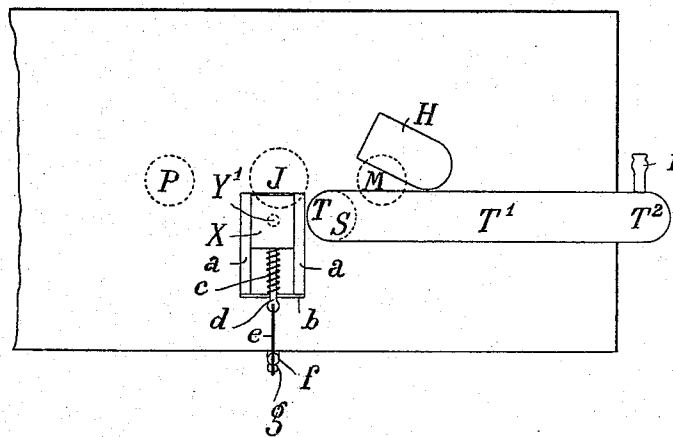


FIG. 4.

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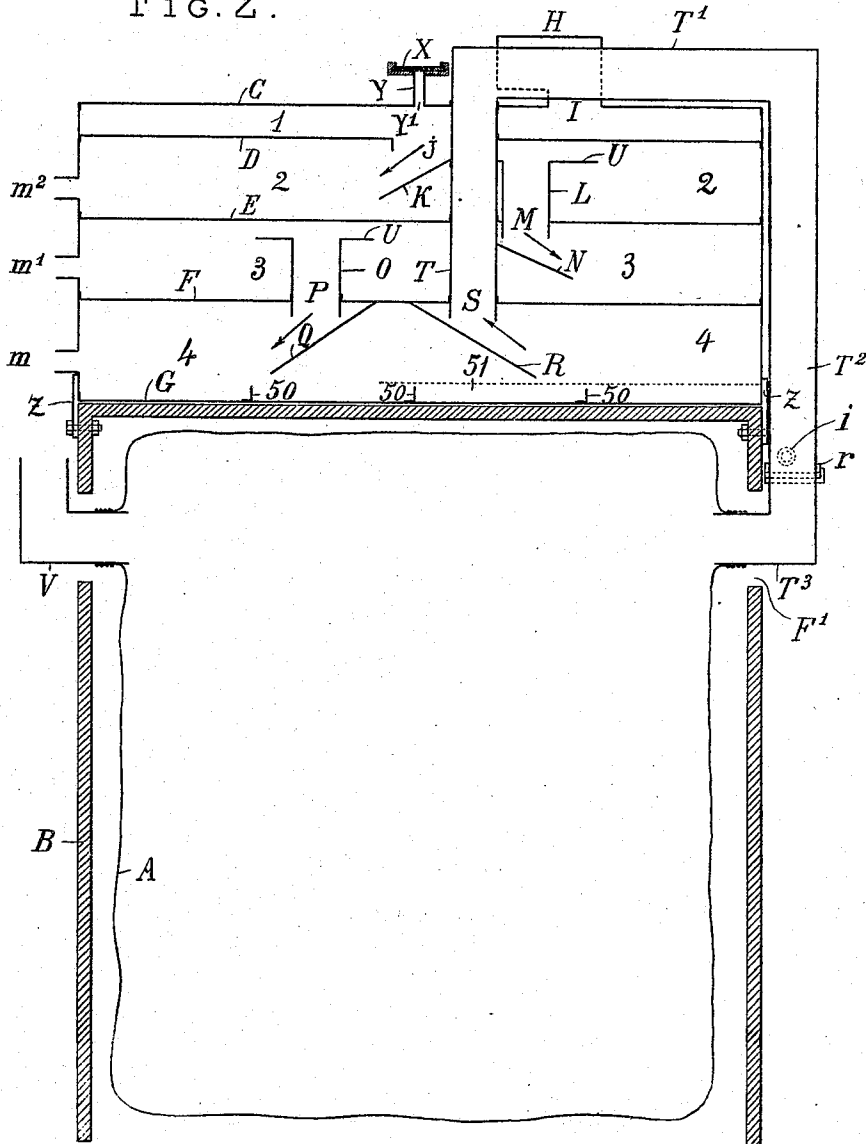
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6 SHEETS—SHEET 2.

FIG. 2.



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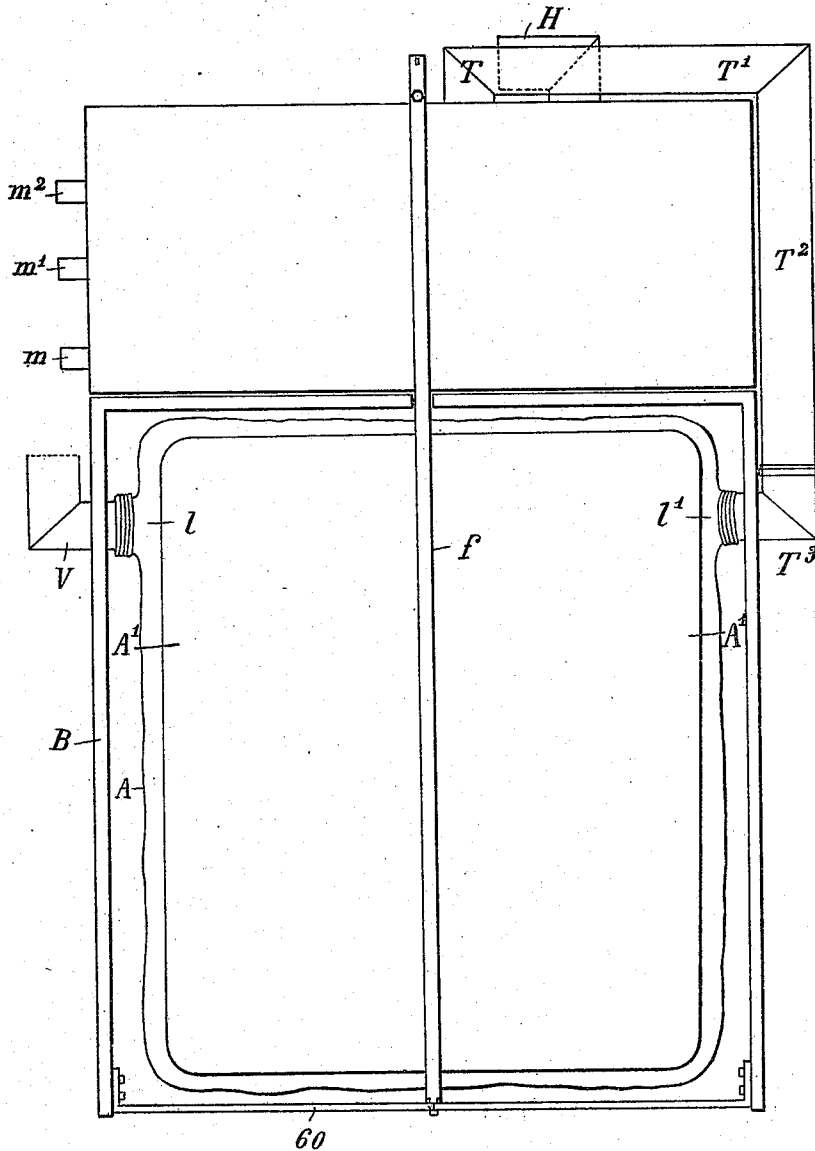
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FIG. 3.



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6 SHEETS—SHEET 4.

FIG. 5.

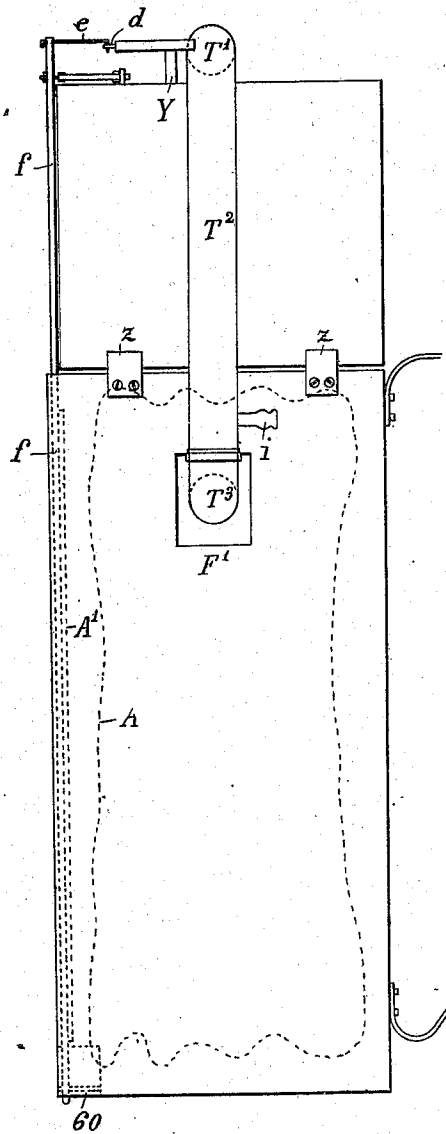


FIG. 6^a.

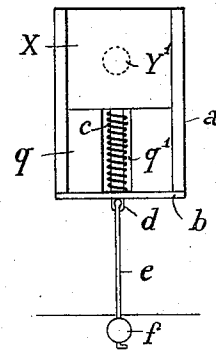
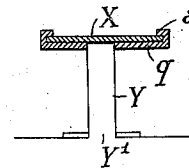


FIG. 6.

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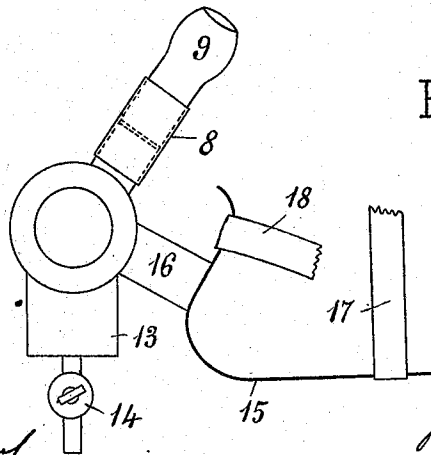
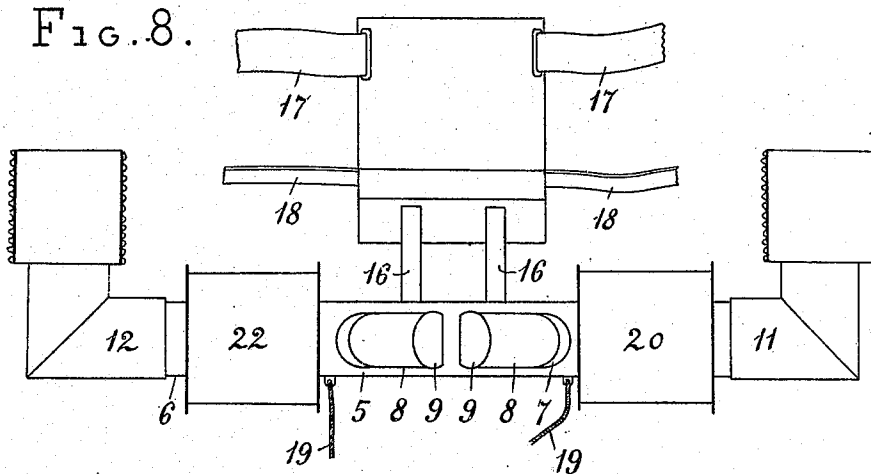
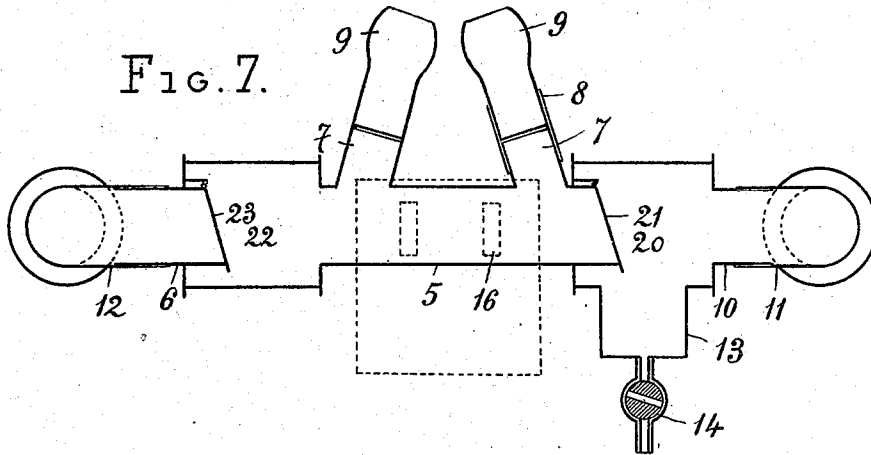
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6 SHEETS—SHEET 5.



Witnesses.
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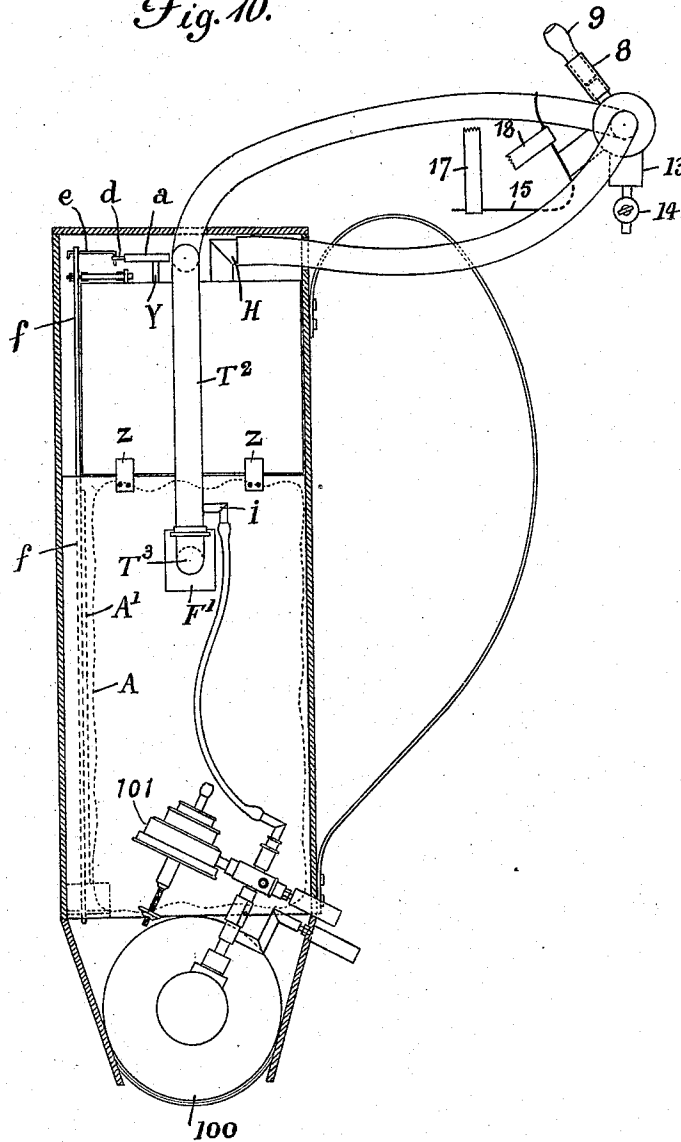
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6 SHEETS—SHEET 6.

Fig. 10.



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UNITED STATES PATENT OFFICE.

JULES TISSOT, OF PARIS, FRANCE.

RESPIRATORY APPARATUS.

932,515.

Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed April 18, 1908. Serial No. 427,946.

To all whom it may concern:

Be it known that I, JULES TISSOT, a citizen of the Republic of France, residing at 5 Rue de Buffon, Paris, France, have invented certain
5 new and useful Improvements in Respiratory Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it apper-
10 tains to make and use the same.

This invention relates to a respiratory apparatus for enabling a person to remain for a long time in irrespirable atmospheres and comprises six different parts. 1st. A gas
15 storage bag made of an air-tight fabric in which the gases serving for respiration are stored. 2ndly. A regenerator or purifier for freeing the air which has been exhaled from the carbonic acid contained therein. 3rdly.
20 A face piece furnished with valves which fits to the nostrils and separates the currents of inhaled and exhaled air, conveying them into the different passages. 4thly. Two flexible
25 tubes which connect the valved nose piece on the one hand with the regenerator and on the other hand with the air tight storage bag. 5thly. An escape or safety valve operated by special mechanism. 6thly. A re-
30 ceptacle containing compressed oxygen furnished with a reducing valve enabling the flow of oxygen to be regulated as desired.

In the accompanying diagrammatic drawings, furnished by way of example Figure 1 is a plan of the regenerator, Fig. 2 a verti-
35 cal longitudinal section (partially diagrammatic) of the complete storage bag provided with the regenerator, Fig. 3 an end view of the complete storage bag, Fig. 4 is a top view of the regenerator, Fig. 5 a side view of the
40 complete storage bag, Fig. 6 the plan of an escape valve, Fig. 6^a a transverse vertical section thereof, Fig. 7 a longitudinal section of the nose-piece, Fig. 8 a plan thereof, Fig. 9 a side view. Fig. 10 is an elevation in
45 diagram, showing the parts of the invention.

1st. *Gas storage bag.*—The bag A is made of an air tight fabric. On the sides in the upper part thereof are two tubes *l l'* of the same material which are fitted to two metal
50 pipes V. T³. This bag is absolutely air tight but nevertheless, in consequence of the physical phenomenon termed osmose, allows the deleterious gases to pass very slowly through its sides. This passage of the gases
55 is of little importance when making a stay of three or four hours in the deleterious

gases. But if it be desired to remain in them a longer time, it is advisable to employ a bag with double sides, that is to say composed of two thicknesses of material which
60 are movable one over the other and with a very limited space between them containing atmospheric air, in fact two concentric bags arranged one against the other. With such a bag the diffusion of the deleterious
65 gases through the sides is rendered insignificant. The gas storage bag is inclosed in a box B carried by the person on the back by means of two straps for example. This box
70 protects the storage bag on all sides but is nevertheless open, being without a bottom, in order that the person may ascertain with his hand the degree of fullness of the bag. On the sides of the box two openings F'
75 (Fig. 2) are made for the introduction of the tubes T² and V (Fig. 3). The regenerator is arranged for example at the top of the box.

2ndly. *Regenerator.*—This is fixed on the box B and is employed for freeing the ex-
80 haled air from the carbonic acid contained therein. It is made of suitable form and material and divided into several compartments, for example four as in Fig. 2, by means of three horizontal partitions D, E, 85
F (Fig. 2). In each of the compartments 2, 3 and 4 a certain quantity of a substance that absorbs carbonic acid is placed, for example a solution of potash. The compartment No. 1 communicates with the compart-
90 ment No. 2 through the orifice J. A plate K which forms an inclined plane and is fixed to the partition D is employed for guiding the air in the direction of the arrow. The compartment No. 2 communicates with
95 the compartment No. 3 through the orifice M and the tube L fixed on the partition E. The tube L as well as the tube O is of a height sufficient to prevent the absorbent substance from being projected from one
100 compartment into the other. The flange U on the upper part of these two tubes is intended for the same purpose. The plate N, like the plate K and the plates Q and R is intended for causing the air to flow in the
105 direction of the arrows. The compartment 3 communicates with the compartment 4 through the tube O and the orifice P, constructed like the tube L. The exhaled gases, conveyed into the regenerator through the
110 tube H (Fig. 2) and having passed through all the compartments 1, 2, 3 so as to enter

No. 4, pass out through the tube T, T', T² connected with the bent tube T³, and enter the gas storage bag. The compartment No. 4 is slightly higher than the others, to meet the case of the accidental entrance of a certain quantity of absorbent material coming from the other compartments, and which would raise the level of the absorbent material in the compartment No. 4. The compartment No. 1 which has not yet been dealt with does not contain any potash. The small quantity of potash which may enter that compartment when the person walks or lies down falls into the compartment No. 2 whence it comes, and can never enter the tube H, this being the purpose fulfilled by that compartment.

The position of the tubes H, L, O, T is not immaterial. It is determined so that the person can lie on his stomach, on his side, or on his back, without the potash being able to pass from one compartment into the other. The drawing indicates these positions and shows how the regenerator may be turned about on all sides without the potash passing from one compartment into the other. The tube H may be in the form of a crescent so as to prevent the liquid potash from flowing into the inhalation tube.

The compartment No. 1 may be divided into two compartments by an impermeable partition, one of the two compartments No. 1 serving for the inhalation and the other for the exhalation.

A special arrangement is provided whereby when the person bends while walking or working, the potash is prevented from collecting in one corner or on one side only of the compartments, that is to say the diminution of the absorption surface is prevented. This arrangement consists in partitioning the bottom of each of the potash compartments by means of longitudinal and transverse partitions forming compartments which retain a portion of the potash when the person bends. All these transverse partitions 50 and the one longitudinal partition 51 (shown by a dotted line in Fig. 2) are illustrated in the compartment No. 4. They are further intended to reduce the shaking of the liquid when the person is moving.

The tubes m , m' , m^2 serve for introducing the potash and for clearing and washing the regenerator.

The tube T² carries a small lateral tube i intended for keeping up in the storage bag a supply of the oxygen held in reserve in a bottle.

All the joints between the parts forming the regenerator may be absolutely impermeable.

3rdly. Valved face piece that fits to the nostrils.—This apparatus is composed of two cylindrical boxes 20 and 22 (Figs. 7 and 8) fixed on the tube 5. To one end of this

tube which is made sloping a hinged exhalation valve 21 is fitted. The sloping edge is made thin, the effect of which is that the valve is prevented from sticking. The inhalation valve 23 mounted on the tube 6 is constructed in the same manner. On the tube 5 moreover are fixed two tubes 7 to which tubular pieces 9 made of suitable material are fitted by means which allow them a certain degree of mobility, the india rubber tube 8 for example. The two tubes 6 and 10 are capped by the two bent tubes 11 and 12 (Fig. 8) on which are bound two flexible tubes. These two flexible tubes can be removed as desired, they can also be fixed inseparably from the apparatus according to requirements.

The cylindrical box 20 carrying the exhalation valve is furnished in the lower part with the small reservoir 13 and the cock 14 acting as a purging cock and intended for expelling the water of condensation arising from respiration.

The apparatus is fixed on the chin strap 15 by means of two pieces 16, 16 (Figs. 7, 8 and 9). The apparatus is fitted on to the head of the person by bands 17, 18 which are fixed to a leather cap or to a helmet or to any suitable part. The bands 19 complete the fixing and are attached above the forehead to the cap or helmet.

The apparatus serves for separating the inhaled and exhaled currents of air. The inhaled air is conveyed from the gas storage bag through a flexible tube fixed to the tube V (Fig. 2). The exhaled air expelled through the valve 21 (Fig. 7) is conveyed to the regenerator through a flexible tube fixed on the one hand to the tube 11 (Fig. 8) and on the other hand on the tube H (Fig. 2).

4thly. Communication tubes connecting the nose piece with the regenerator.—There are two flexible tubes. One of them connects the bent tube V (Fig. 2) with the bent tube 12 (Fig. 8) and conveys the air from the storage bag to the nostrils. The other connects the bent tube H (Figs. 1 and 2) with the bent tube 11 (Fig. 8) and conveys the exhaled air from the nose piece to the regenerator. These two tubes are sufficiently long and suitably arranged for allowing the head to move sidewise.

5thly. Escape or safety valve.—This automatic valve is intended for the escape of a portion of the gas contained in the whole apparatus, when the pressure of the gas therein reaches a height which becomes troublesome to the person. This valve X which can be seen in Figs. 1 and 2, is shown on a larger scale in Figs. 6 and 6^a. It is placed on the regenerator, in the example cited, but may be placed at other points of the apparatus. It is however preferable that it should be placed on the regenerator because it is better to lose gas which has al-

ready altered than regenerated gas. This valve is formed by a slide arrangement. The plate *q* which is very smooth (Figs. 6 and 6^a) has raised edges which form a guide and seat for the valve plate X which is likewise smooth and the movement of which is intended to open or to close the opening in the tube Y which communicates with the regenerator at Y'. To the valve X a rod *d* is fixed on which the spring *c* is wound which is intended for returning the valve X automatically into the closing position when the apparatus which effects the opening does not act. The plate *q* is notched at *q'* to allow of the passage of the rod *d* and carries moreover a transverse plate *b* drilled with a hole in which the rod *d* slides. The rod *d* is flexibly connected with the rod *f* by means of a suitably rigid wire or rod *e*. This valve is operated automatically in the following manner:—When the storage bag is distended and the pressure of the gas amounts to a value of 3 to 7 centimeters of water, its back part A (Fig. 5) bears against the light slab A' (Figs. 3 and 5) and pushes it back as well as the rigid rod *f* fixed to the slab. This rigid rod, which is pivotally connected by its lower part with the rod 60 (which is likewise rigid), when moving actuates the rod *d* (Fig. 5) and the valve X (Fig. 6) and effects the opening of the orifice in the tube Y through which a portion of the gas flows away until the pressure has again become insufficient for distending the bag.

Before the apparatus is used two or three drops of oil must be put between the valve X and seat *q* (Fig. 6). Under these conditions the valve is absolutely impermeable and may for a time even contain a vacuum.

6thly. Bottle of compressed oxygen and reducing valve.—The person carries a bottle of compressed oxygen, of suitable capacity and furnished with a reducing valve enabling a supply of oxygen of 0 to 3 liters per minute being delivered. This bottle is connected to the tube T² by the tube *z*.

What I claim and desire to secure by Letters Patent is:—

1. A respiratory apparatus comprising a casing, an air or gas bag mounted therein, a respirator, valves therein to separate exhaled from inhaled air, a regenerator carried by the casing intermediate the respirator and the casing for absorbing the carbonic acid in the exhaled air, a valve therein, and means controlled by the bag for operating said valve.

2. A respiratory apparatus comprising a casing, an air or gas bag therein, a respirator, a regenerator, a valve in said regenerator, and means operated by the bag for controlling the valve.

In testimony whereof I have affixed my signature, in presence of two witnesses.

JULES TISSOT.

Witnesses:

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CHARLES FABER.