

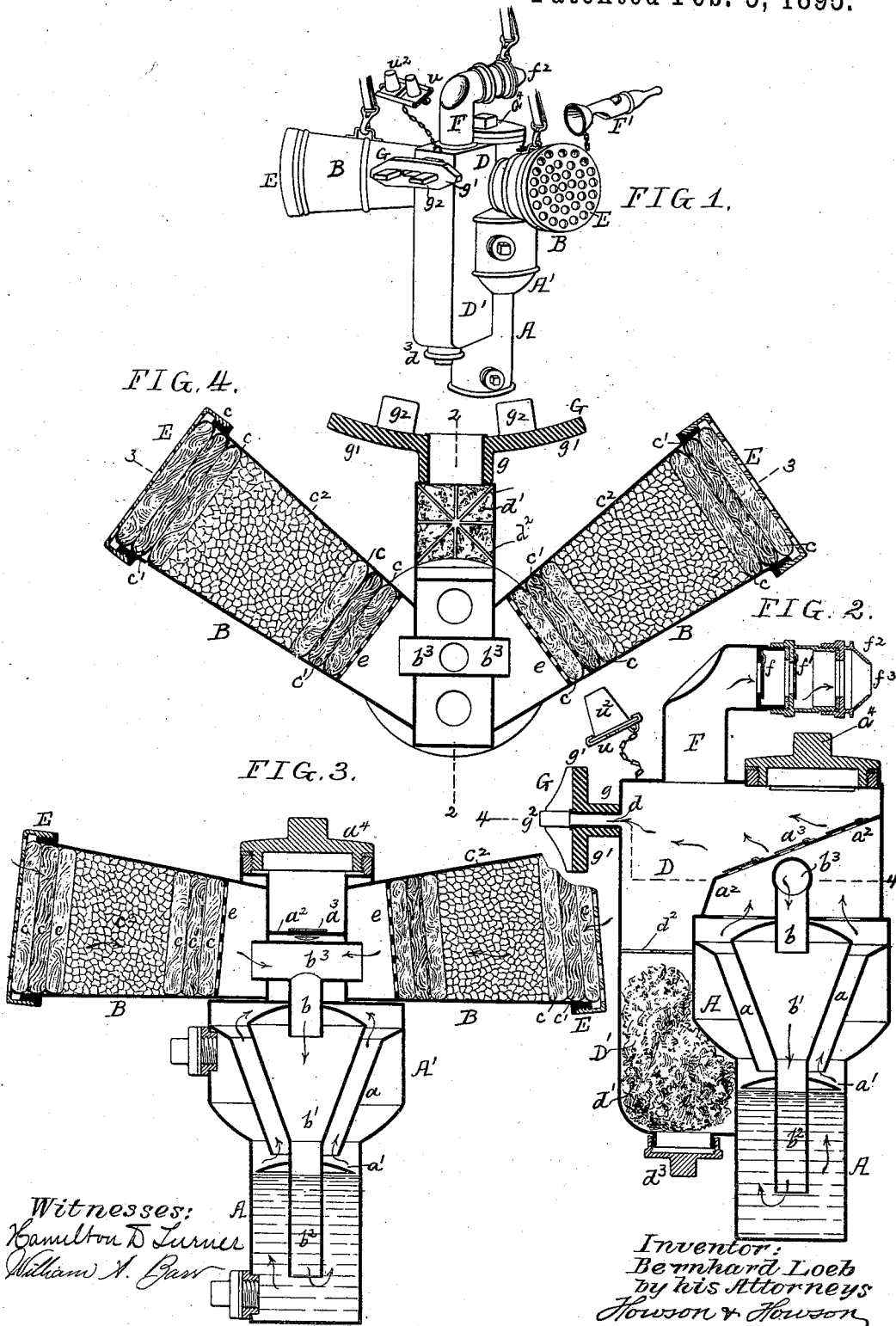
(No Model.)

6 Sheets—Sheet 1.

B. LOEB.
RESPIRATOR.

No. 533,854.

Patented Feb. 5, 1895.



(No Model.)

6 Sheets—Sheet 2.

B. LOEB.
RESPIRATOR.

No. 533,854.

Patented Feb. 5, 1895.

FIG. 8.

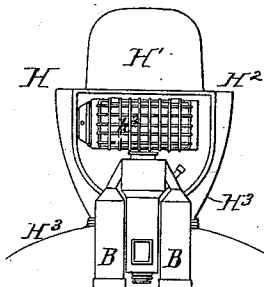


FIG. 9.

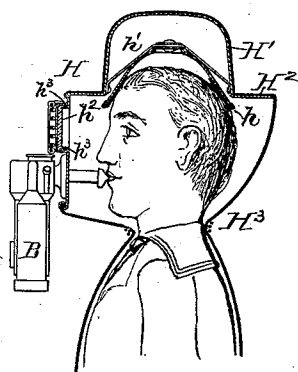


FIG. 7.

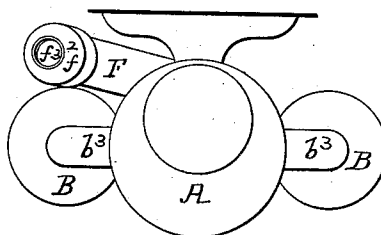


FIG. 5.

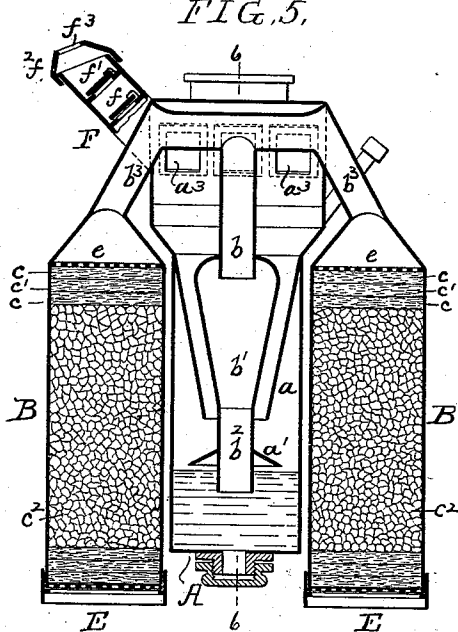
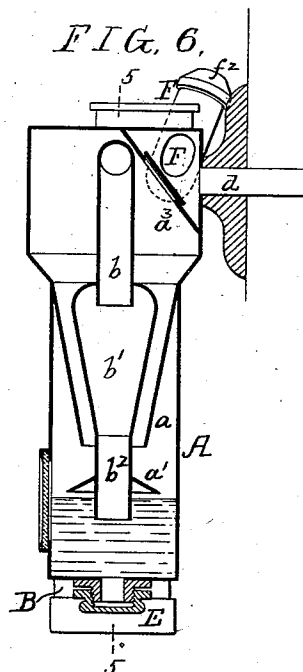


FIG. 6.



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(No Model.)

B. LOEB.
RESPIRATOR.

6 Sheets—Sheet 3.

No. 533,854.

Patented Feb. 5, 1895.

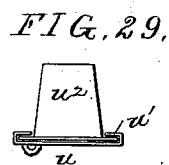
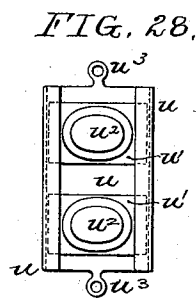
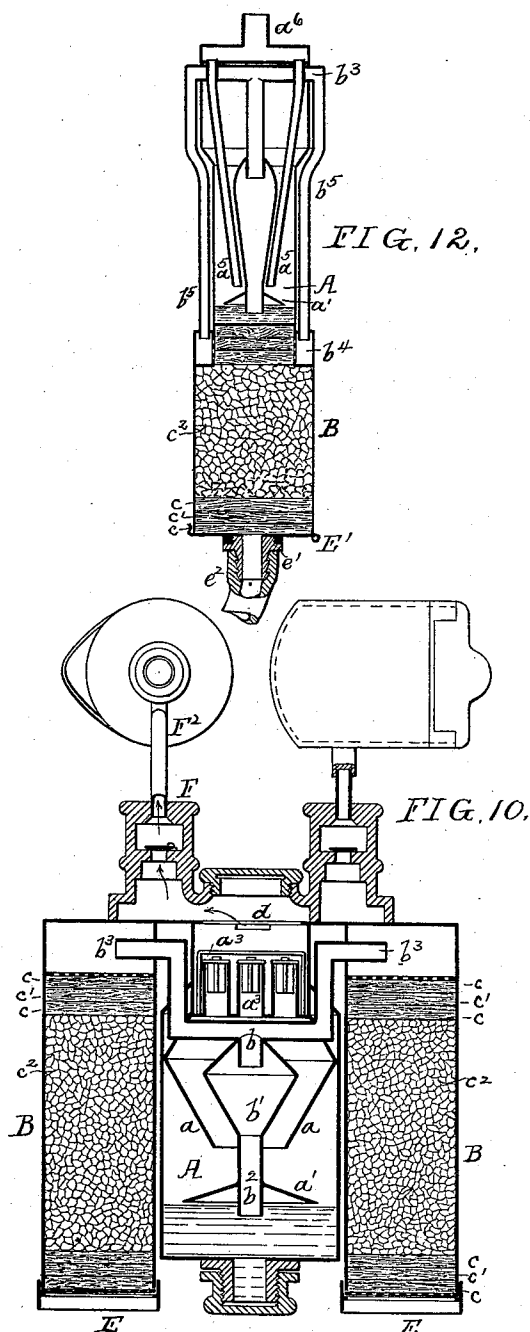
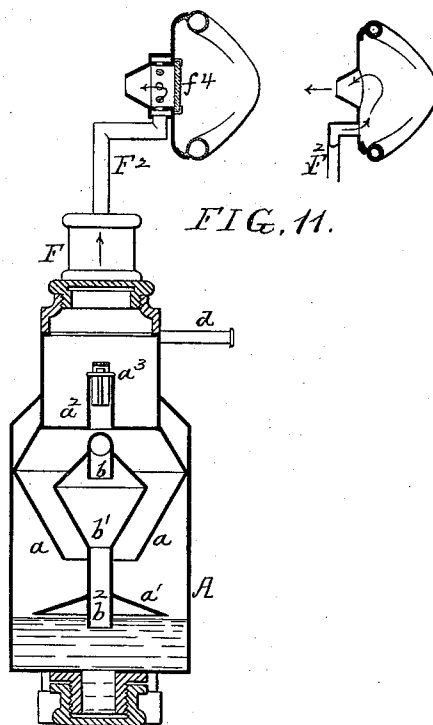


FIG. 11^a



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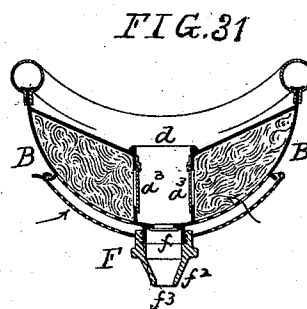
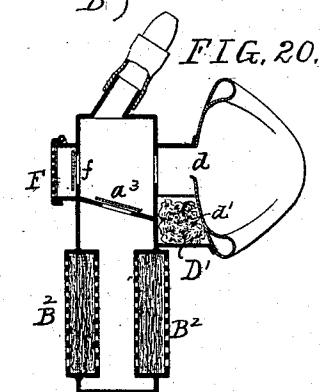
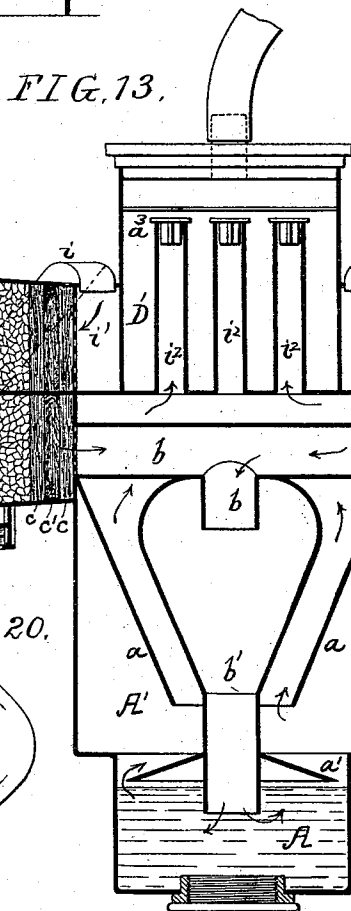
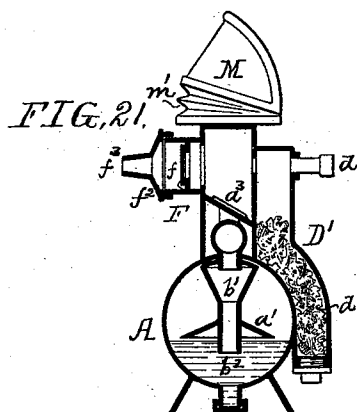
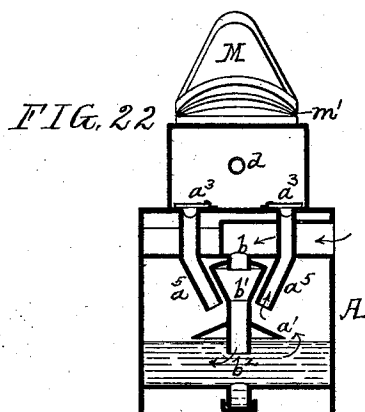
(No Model.)

6 Sheets—Sheet 4.

B. LOEB.
RESPIRATOR.

No. 533,854.

Patented Feb. 5, 1895.



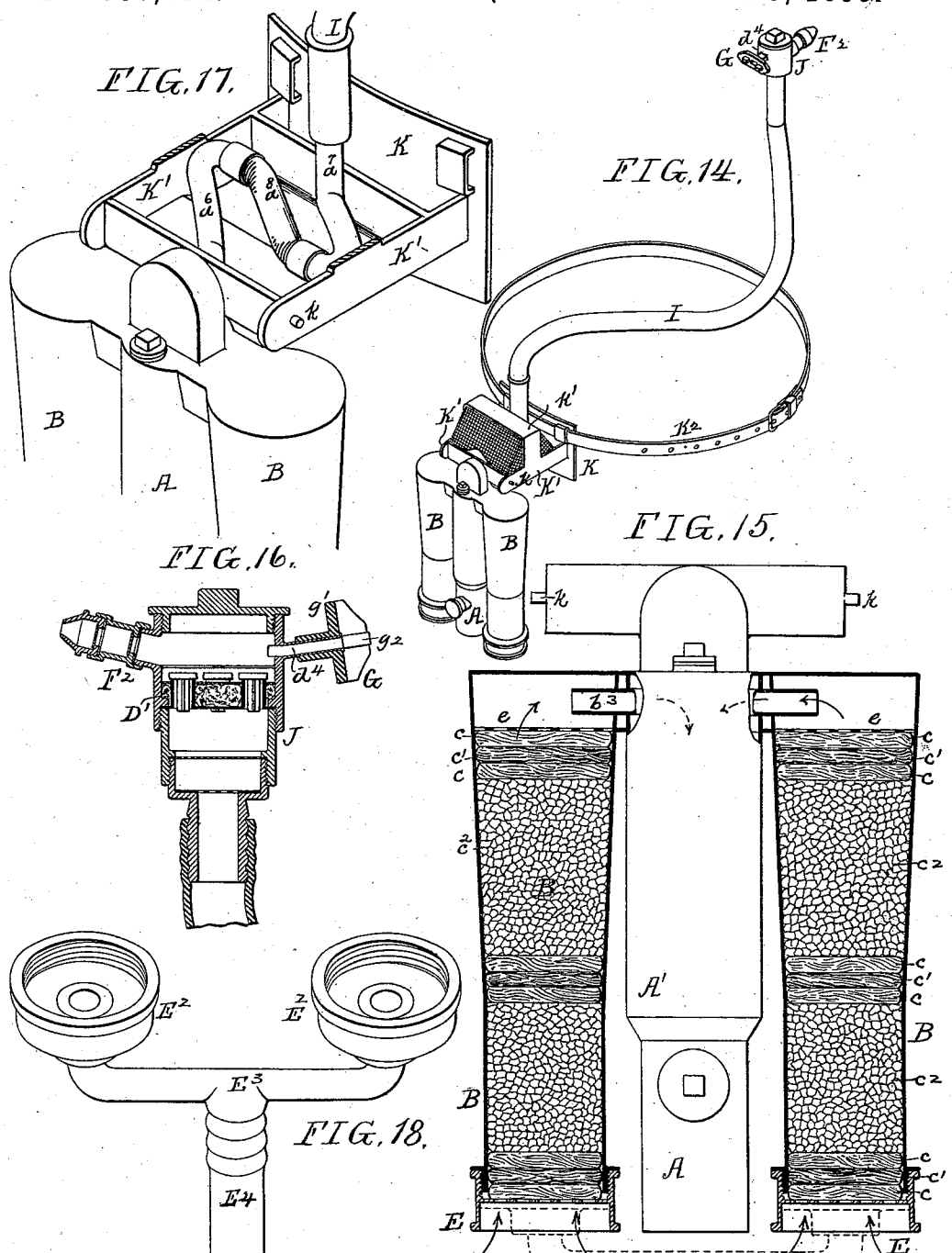
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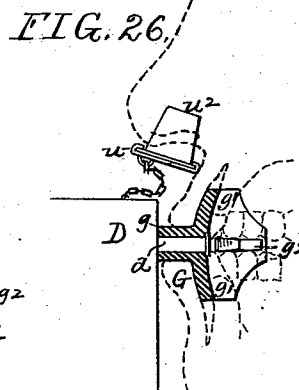
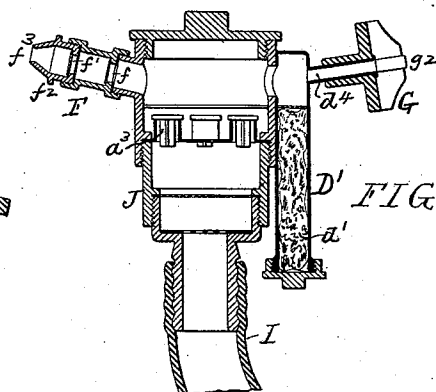
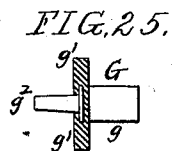
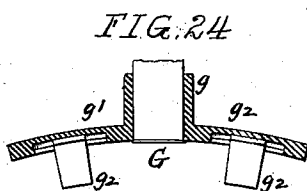
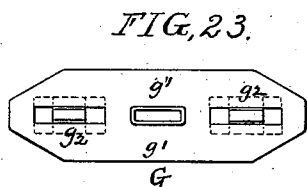
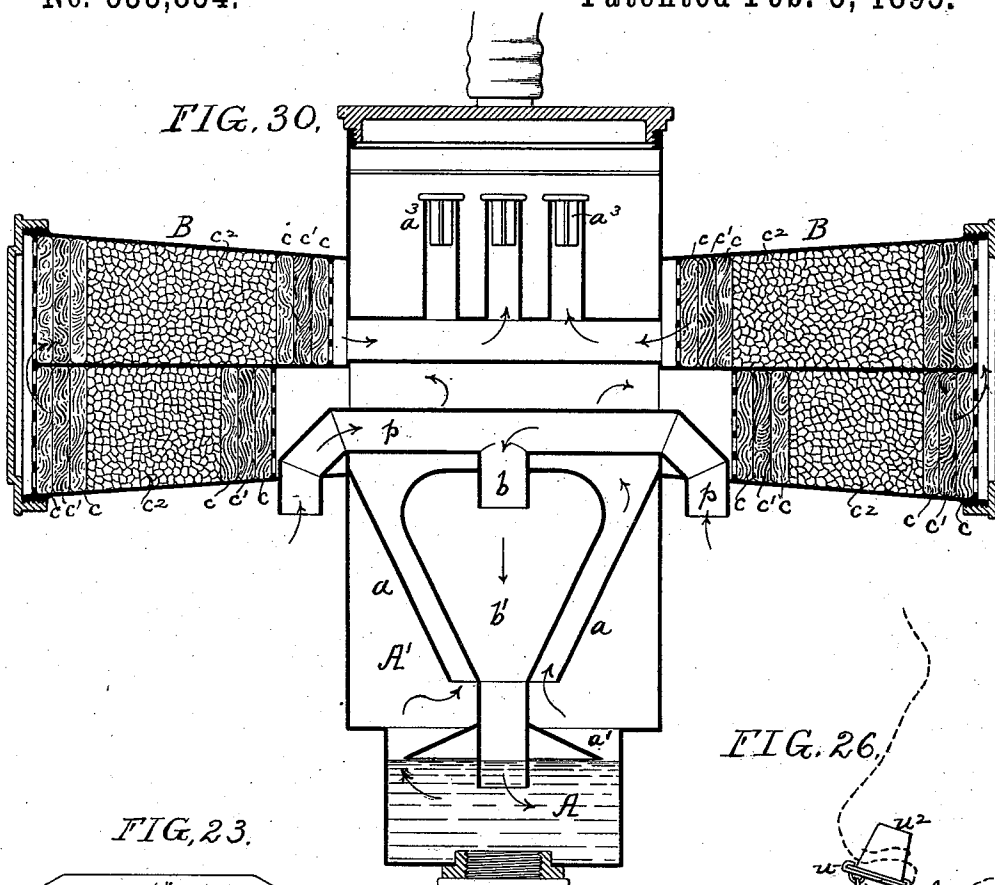


FIG. 27.

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UNITED STATES PATENT OFFICE.

BERNHARD LOEB, OF BERLIN, GERMANY.

RESPIRATOR.

SPECIFICATION forming part of Letters Patent No. 533,854, dated February 5, 1895.

Application filed January 4, 1893. Serial No. 495,594. (No model.) Patented in Germany April 24, 1891, Nos. 66,803 and 68,231; in France May 2, 1892, No. 221,321; in Italy May 12, 1892, XXVI, 31,790, and LXII, 273; in Belgium May 14, 1892, No. 99,685; in England May 23, 1892, No. 9,766, and in Austria-Hungary October 8, 1892, No. 22,803 and No. 44,461.

To all whom it may concern:

Be it known that I, BERNHARD LOEB, a subject of the Emperor of Germany, and a resident of Berlin, Germany, have invented certain Improvements in Respirators, (for which I have obtained patents in Germany, Nos. 66,803 and 68,231, dated April 24, 1891; in France, No. 221,321, dated May 2, 1892; in Great Britain, No. 9,766, dated May 23, 1892; in Austria-Hungary, No. 22,803 and No. 44,461, dated October 8, 1892; in Belgium, No. 99,685, dated May 14, 1892; in Italy, Vol. XXVI, No. 31,790, Vol. LXII, No. 273, dated May 12, 1892,) of which the following is a specification.

The object of my invention is to construct an apparatus to purify foul or vitiated air, and render said air breathable.

My invention is especially applicable for breathing air rendered foul by smoke, dust or noxious gases and vapors.

In the accompanying drawings:—Figure 1, is a perspective view of my improved respirator, and illustrates one of the smaller forms. Fig. 2, is a transverse section on the line 2—2, Fig. 4. Fig. 3, is a vertical section on the line 3—3, Fig. 4. Fig. 4, is a section on the line 4—4, Fig. 2. Fig. 5, is a vertical section on the line 5—5, Fig. 6, showing the apparatus differently arranged. Fig. 6, is a sectional view on the line 6—6, Fig. 5. Fig. 7 is a plan view of Fig. 5. Figs. 8 and 9, are views showing the application of the device illustrated in Fig. 5, to an inclosing hood covering the head of the wearer. Figs. 10 and 11, show still other modified arrangements of the apparatus, and illustrating the method of conveying the exhaled air through a passage in the eyeglasses. Fig. 11^a, is a view of a modification of the eyeshield. Fig. 12, is a view showing the purifying chamber mounted below the liquid chamber. Fig. 13, is a sectional view of a modification of the invention. Fig. 14, is a perspective view showing the apparatus hung to the waist of the wearer, and having a tube extending up to the mouth piece. Fig. 15, is a vertical sectional view of the device shown in Fig. 14. Fig. 16, is a sectional view of the mouth piece. Fig. 17, is a perspective view of a detail of the device shown in Fig.

14. Fig. 18, is a view of a coupling to be applied to the device shown in Fig. 15. Figs. 19, 20, 21 and 22, are views illustrating modifications of my invention. Figs. 23, 24 and 25, are views illustrating the mouth piece as I prefer to make it. Fig. 26, is a view showing the mouth piece adapted to the mouth of the wearer. Fig. 27, is a view of a blow pipe. Figs. 28 and 29, are plan and end views of the nose piece; and Figs. 30 and 31 are views illustrating modifications of the invention.

Referring in the first instance to Figs. 1, 2, 3 and 4, which illustrate the preferred form of the apparatus I would state that the apparatus consists of a chamber in which purifying liquid is contained, preferably concentrated glycerine, used as a wash liquid for smoky air or a mixture of concentrated glycerine and an absorbing liquid, either a strong acid, or a saturated alkaline solution, when acid or alkaline vapors are to be neutralized, and one or more chambers containing dry wadding, wadding saturated with glycerine, and charcoal. The parts are preferably so arranged that the air is drawn through the several layers of wadding and charcoal, and then passes through the liquid and from this point it is conveyed to the mouth through suitable valves. The exhaled air passes from the mouth through other valves, and is either discharged directly, or passes through the spectacles, so as to keep the glass clear.

I preferably make the apparatus of sheet metal, and of the form shown in Fig. 1, in which A is the chamber containing the glycerine, or other liquid. This chamber is enlarged at A', and within the chamber is a funnel shaped partition *a*, which extends down into the chamber A, as shown, and directly below the terminal of this partition is a deflector *a'*. The object of shaping the partition and deflector in the manner shown, is to prevent the liquid entering the mouth in the event of the apparatus being tilted by the wearer. If, for instance, the device was tilted, the liquid would simply seek the space between the partition *a* and the outer walls of the casing A', Figs. 2 and 3. Inclined tubes may be used as shown in Fig. 12, instead of the funnel shaped partition. The inlet tube

b extends into a funnel shaped tube b' , the lower portion b^2 extending into the liquid in the chamber A, as shown in Fig. 3. The object of making the funnel shaped enlargement of the inlet is to catch the liquid in the funnel, when the device would be accidentally upturned, preventing it entering the inlet tube b and saturating the dry wadding. The tube b is connected to a cross tube b^3 , which communicates, in the present instance, with two chambers B B, preferably conical in form, and each of these chambers contains the charcoal, the dry wadding, and the wadding saturated with glycerine.

I preferably place the above described materials in the chambers B, in the manner shown in Fig. 15, the air having to pass through three sets of waddings, and two layers of charcoal, but in Fig. 3, I have shown two sets of wadding, and one layer of charcoal.

c are the layers of dry wadding, and c' are the layers of wadding saturated with glycerine or other suitable liquid, and c^2 is the charcoal.

In the inner end of each chamber B is a perforated plate e and screwed onto the end of the chambers are perforated caps E, (Fig. 3,) the perforations being sufficient to allow the free flow of air to the chambers.

The partition a^2 has one or more openings, three in the present instance, provided with inlet valves a^3 . These valves are hinged in the present instance, and are made of rubber, but they may be of any ordinary construction, and may be made for instance as shown in Figs. 10 and 16. The air after it passes from the fluid chamber through the inlet valves passes into a chamber D, with which communicates the mouth piece through the tube d . This chamber as shown in Fig. 2, is extended, forming a chamber D' for the water of condensation and for the accumulation of spittle that may enter the chamber through the mouth piece. I preferably place a sponge d' within this chamber between a screen d^2 and the bottom. The opening in the bottom is closed by a screw cap d^3 and is provided so that the liquid can be readily removed and the sponge cleansed. Capped openings are also provided for the liquid chamber A for the purpose of refilling, discharging, or cleansing the chamber. Above the valves a^3 is a screw cap a^4 , which can be removed, and the valves cleansed or repaired if necessary.

F is the outlet pipe communicating with the chamber D, and this outlet pipe has two outlet valves $f f'$, and on the end of the pipe is screwed a tapered nozzle f^2 having a reduced opening f^3 , through which the exhaled air passes. The arrangement of the two valves and the reduction of the outlet opening prevents foul air gaining access to the chamber D, and the mouth piece, through the outlet pipe. The opening f^3 is of such a diameter, as to prevent a quantity of foul air gaining access to the pipe, yet it will freely

discharge the exhaled air. By making the nozzle f^2 tapered, the whistle F', Fig. 1, which is provided with a tapered nozzle f^4 , can be readily applied to the nozzle f^2 of the device, and a signal can be given.

When the device is used for stone cutters and sawyers working in dust, a blow pipe, shown in Fig. 27, can be adapted to the opening, and the dust blown away from the work. It will be understood that this arrangement can be applied to other apparatus of a similar character, such for instance, as that shown in Fig. 31, in which wadding is now used, or the device shown in Fig. 21, in which liquid is only used, or it may be used in a device simply provided with charcoal.

The mouth piece G is preferably formed as shown in Figs. 1, 2 and 4, and is made of soft rubber, so as to readily accommodate itself to the mouth. The mouth piece consists of a tubular portion g fitted to the flat tube d and flanges g' , which are passed into the mouth, and are located between the teeth and the lips, as shown in Fig. 26, and projecting from the mouth piece are lugs g^2 , preferably of rubber, which extend between the teeth of the wearer, and by closing the teeth upon these lugs, the mouth piece is held firmly in the mouth. The lips fit snugly over the flanges g' , preventing the ingress of air to the mouth except through the apparatus. While I prefer to use this mouth piece, the apparatus may be used in connection with a hood inclosing the head (Fig. 9) or it may be used with a mouth piece resting against the mouth, as shown in Figs. 20 and 28.

I preferably make the lugs g^2 adjustable laterally so that they can be adapted to the teeth of the wearer. The lugs may be provided with T-heads adapted to undercut ways in the mouth piece, as clearly shown in Figs. 23, 24 and 25.

Fig. 5, illustrates the device in slightly different form. Instead of the chambers B extending laterally, they are arranged vertically at each side of the liquid chamber A. They are connected to the chamber A in a manner similar to Fig. 3. The inlet valves are arranged in a partition at one side of the upper portion of the chamber, and the outlet pipe is connected to the triangular chamber formed by this partition, as clearly shown in Fig. 6. This device, as well as the device shown in Fig. 1, may be mounted on a hood H, Figs. 8 and 9, which consists of a cap H' from which is suspended a rigid frame H², carrying the purifying apparatus, and a flexible cape H³, which extends down upon the body, and can be tied tightly around the neck. When this device is used, I preferably mount within the hat portion, a perforated crown h of stiff material suspended on cross bands h' of fabric in the present instance, which are fastened to the hat. Thus the apparatus is firmly supported upon the head, and at the same time, the crown being perforated, allows free ventilation. Directly in line with

the eyes, is a glazed opening h^2 , through which the wearer can see objects in front of him. The glasses may occasionally sweat, but this moisture can be removed by the wiper which is attached to a bar h^3 . When the bar is drawn out the wiper is drawn across the glass. The glass is protected by a wire grating hinged to the hood H.

In some instances, I prefer to pass the exhaled air from the discharge pipe F through a conduit F^2 , as shown in Figs. 10 and 11, to a space in front of the glass adapted to one or both of the eyes, so as to keep the glass clear, and as shown in Fig. 10, the glass in front of one eye is reduced, and the exhaled air passes up through this reduced space, while the other eye has the ordinary large glass, and the wiper is used to clear the glass. The air passes into the space f^4 through a series of radial holes and from this point it passes out the contracted opening in front. This glass in some instances may be dispensed with and the escaping air may enter the space directly in front of the eye, as shown in Fig. 11^a.

In Fig. 12, I have shown an arrangement of the apparatus in which the chamber B containing the wadding and charcoal is situated directly below the liquid chamber, and annular chamber b^4 opening into the chamber containing the wadding is connected to the cross tube b^5 by upright tubes b^5 , one on each side of the liquid chamber A, and instead of the funnel shaped partition a , shown in Fig. 3, I use, in this instance, two pipes a^5 , each extending from a point directly above the deflector a' to a chamber in the upper portion of the device. This chamber may connect directly through a mouth piece with a series of valves in the chamber, or may connect with a hose or other flexible tube coupled to the nipple, a^6 , which extends to a mouth piece, as shown in Fig. 14. The cap E' , instead of being perforated as is the cap E, (Fig. 3) may be provided with a nozzle e' , to which can be attached a hose or other flexible tube e^2 , which can trail along the floor of the room, or extend to a point outside of the room, if necessary.

Fig. 13, shows a modification of the device illustrated in Fig. 3. In this device, however, the passage of the air is indirect, that is, it enters receptacles B' containing one or more layers of wadding, and then passes from each receptacle through a conduit i to a chamber i' then through a preliminary set of wadding and charcoal, around a partition B^2 in the chamber B, through a final set of wadding and charcoal, to the cross pipe b^3 , down the pipe b into the funnel shaped pipe b' , and into the liquid chamber A, through the liquid in said chamber, and up to and through the tubes i^2 and past the inlet valves a^3 to the mouth piece. By elongating the tubes i^2 , as shown in Fig. 13, I am enabled to form a spittle chamber D' .

Figs. 14, 15, 16 and 17, illustrate a construc-

tion of the device especially designed for firemen, as the apparatus is strapped to the waist and is connected by a flexible tube to a small valve chamber and mouth piece at the mouth.

The apparatus shown in Fig. 15, is somewhat similar to the device shown in Fig. 10, with the exception that the chambers are much longer, and contain successively repeated layers of dry wadding, glycerine wadding and charcoal, so that the best results are attained. The air passes through the successive layers, and into the liquid chamber, and from the liquid chamber through the flexible tube I to the valve box J, at the mouth, which is constructed as shown in Fig. 16. This valve box has a tube d^4 , to which is attached the mouth piece G, and has a valved outlet pipe F^2 , similar in construction to that shown in Fig. 2. The device is pivoted at k to arms K' projecting from the waist plate K, and the pipe a^5 is connected to a pipe a^7 by a flexible tube a^8 , the pipe a^7 being secured to the waist plate. The apparatus can swing freely on the pivots k and the flexible connection is protected by a shield k' , clearly shown in Fig. 14. The waist plate K is strapped to the wearer by a waist band or belt K^2 , as clearly shown in Fig. 14. In some instances, the perforated caps E of the chambers B, Fig. 15, may be removed, and the caps E^2 of the coupling E^3 , Fig. 18, may be attached. To this coupling is attached a hose or other flexible tube E^4 which extends to the floor, or to a point outside of the compartment or room.

Fig. 19, is a view showing a modification of the valve box, showing the spittle chamber D' between the box and the mouth piece, instead of within the box as shown in Fig. 16.

Fig. 20 is a view showing the spittle chamber between the purifier and the mouth piece. In this instance the wadding only is used, being mounted in the compartment B^2 . This is one of the simplest forms of construction, although not as effective as the device described above, and is simply intended for preventing dust entering the mouth. The mouth piece in this instance, simply fits snugly against the mouth, and does not enter into the mouth as shown in Fig. 26. Straps or bands may be used to hold the mouth piece in position.

In Figs. 21 and 22, I have shown a compact device in which the liquid chamber A is only employed, and the spittle chamber D' is arranged between the mouth piece and the said liquid chamber. These figures also illustrate another important feature of the invention, which is the application of a nose shield M, which snugly fits around the nose, and is flexibly connected to the device by a bellows section m' , so that it will yield to accommodate itself to different faces, but always remaining tight against the nose.

In Figs. 28 and 29, I have illustrated a nose piece in detail shown in Figs. 1, 2 and 26. This nose piece consists of the plate u having grooves on each side and adapted to receive

the flanges u' of the projections u^2 which are adapted to enter the nose and thus prevent the breathing through the nose. The nose pieces are adjustable so that they can readily fit different persons and are preferably made of unyielding material. The plate is attached to the respirator by a chain or cord, as shown in Fig. 1, and when in position on the person a strap extends from the two eyes u^3 , as shown in Fig. 28, over the ears. Thus the nose piece is held independent of the respirator.

In Fig. 30, I have shown a modification in which the air enters the liquid chamber before entering the chamber containing the wadding and granular filtering material. The air enters the inlet tube p and from thence is guided into the liquid chamber A from which it passes up into the dry filtering chambers B to the mouth piece, as it will be understood that the air can enter the liquid chamber first and then enter the dry chamber, but I prefer the arrangement shown in Figs. 1, 2 and 3.

It will be understood that all the above described devices are preferably strapped to the person, or suspended from the head, as will be readily understood either on referring to Figs. 1, 9, or 14. Thus it will be seen that the above described apparatus can be used to purify foul or vitiated air, and render the same breathable.

The apparatus can be designed and shaped for use of firemen, for sailors and marines on board ship, for workers in stone or wood, or for mill employees who have to work in foul or vitiated atmosphere. Therefore, while I have shown numerous illustrations showing different forms of the device, it will be readily seen that the main features of the invention are, first, subjecting the air to the dry purifiers, then passing the air through a suitable liquid before it enters the mouth, and so constructing the apparatus that the foul air cannot enter the mouth through the outlet passage, and so constructing the mouth piece itself as to make it fit snugly to the mouth, and the construction of the interior of the liquid chamber so as to prevent the liquid escaping from the chamber, when the device is shaken or turned by any movement of the wearer.

I claim as my invention—

1. The process herein described of purifying air, consisting in first drawing the impure air through fibrous filtering materials, such as dry wadding, glycerine wadding and charcoal, and then through a body of liquid glycerine, substantially as described.

2. The combination in a respirator, of the central liquid chamber, with side projecting purifying chambers containing dry wadding, saturated wadding and charcoal, perforated caps for said purifying chambers, a tube extending from the purifying chambers into the liquid chamber, a mouth piece and a valve be-

tween the mouth piece and the liquid chamber, substantially as described.

3. The combination in a respirator, of the mouth piece, the purifying chamber through which the air passes into the mouth with an exhaust pipe having two valves therein one in advance of the other, substantially as set forth.

4. A respirator mouth piece of flexible material having an opening and flanges with lugs adjustable on said flanges for the purpose set forth.

5. The combination of the respirator, the eye frame having a reduced opening, with a tube connecting the exhaust pipe of the respirator with the eye frame whereby the exhaust air passes to a space in front of the eye and out of the reduced opening, substantially as described.

6. The combination of the respirator, the eye frame glass therein, an air passage in said frame, with an exhaust pipe from the respirator connected to the air passage in the frame so that the air as it is exhaled passes in front of the glass.

7. The combination in a respirator, of the plate adapted to be secured to the person, the pivoted casing for the purifying materials, a tube on the casing and a tube on the plate flexibly connected, a mouth piece and a flexible connection between the mouth piece and the tube on the plate, substantially as set forth.

8. In a support for the casing of a respirator, the combination of a perforated cup-shaped cap of stiff material, a hat, with cross bands connecting the perforated cap to the hat, and a respirator casing suspended from the hat, substantially as set forth.

9. The combination in a respirator, of the central liquid chamber A containing glycerine or equivalent material, with the air inlet pipe entering the said liquid chamber, purifying chambers B, B containing dry wadding, saturated wadding and granular material, said chambers being arranged one on each side of the liquid chamber and having perforated caps and communicating with the liquid chamber through inlet pipes, a mouth piece, and a partition having a passage therein communicating with the liquid chamber and the mouth piece, and a valve in said passage, substantially as set forth.

10. The combination in a respirator, of the mouth piece, the central liquid chamber A and side purifying chamber B connected to said liquid chamber, with a spittle chamber back of the liquid chamber and between it and the mouth piece, substantially as set forth.

11. The combination in a respirator, of the nose stopper consisting of a plate with two projections adapted to the nostrils and adjustable toward or from each other on the plate, substantially as described.

12. The combination in a respirator, of the

purifying chambers containing dry wadding
and granular filtering material, and a liquid
chamber, said purifying chamber and liquid
chamber being connected together and to the
5 inlet and outlet for the air, with deflectors in
the liquid chamber preventing the liquid in
the said chamber escaping to the purifying
chamber or to the outlet, substantially as de-
scribed.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BERNHARD LOEB.

Witnesses:

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JOSEPH A. KLEIN.