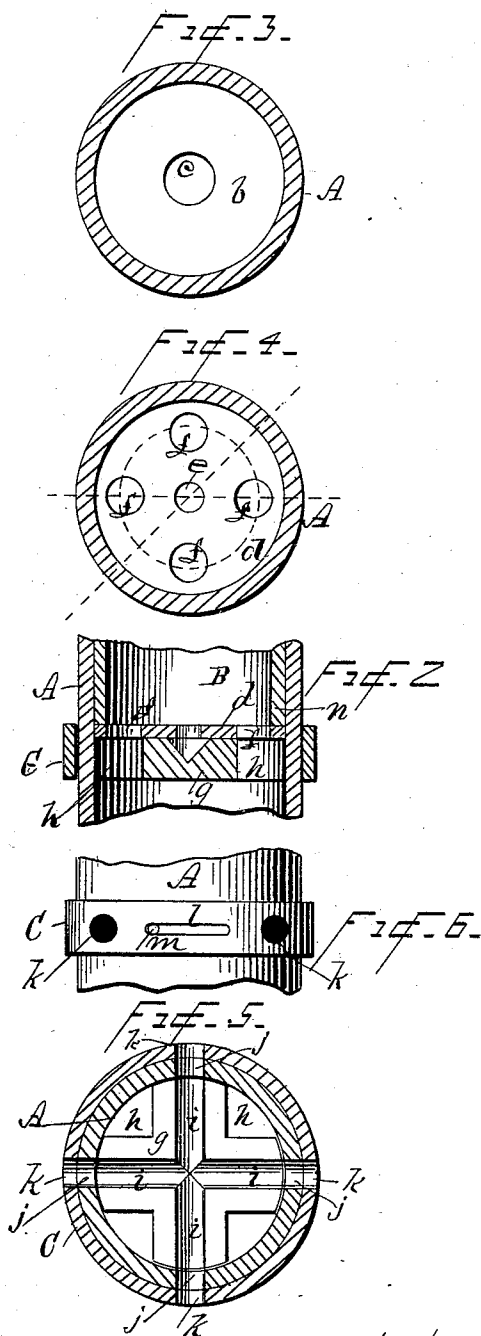
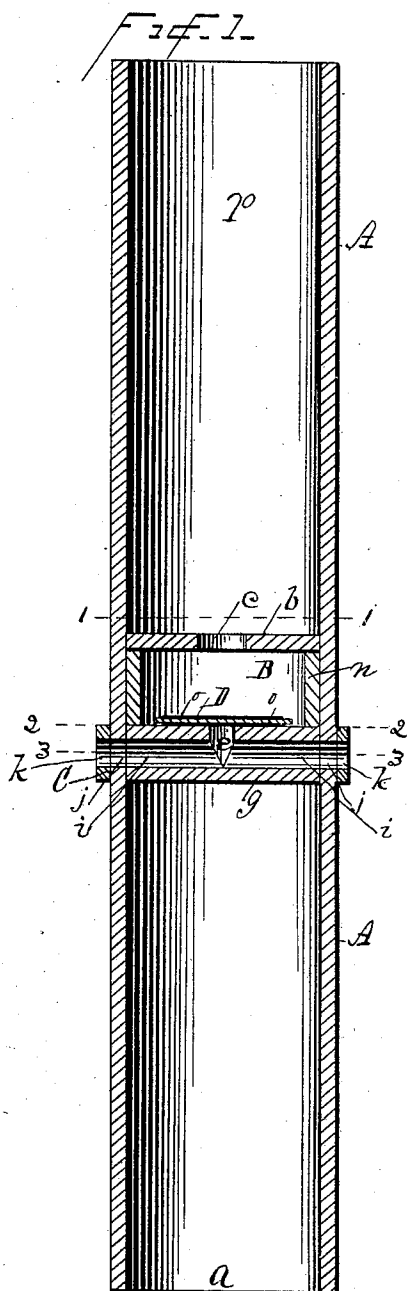


C. E. WARREN.
INHALER.

No. 393,869.

Patented Dec. 4, 1888.



WITNESSES.

Norris A. Clark,
Walter A. Brown

INVENTOR

Charles Everett Warren,
By his Attorney,
J. S. Brown.

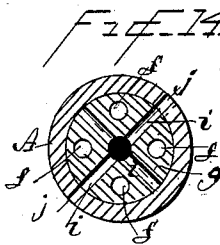
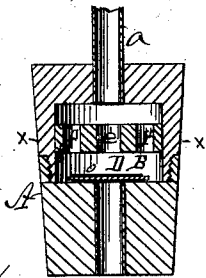
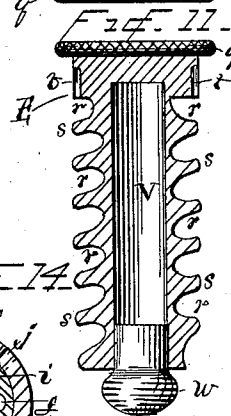
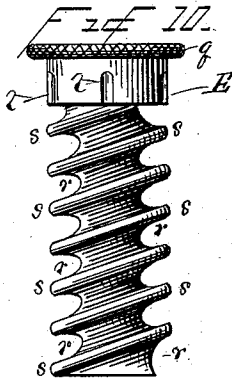
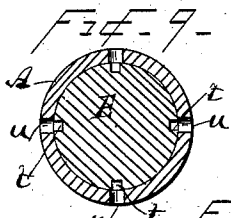
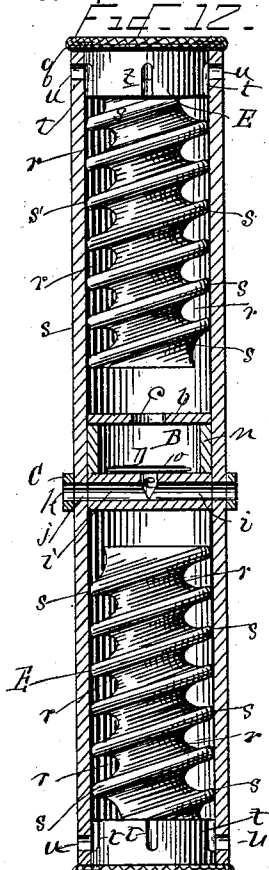
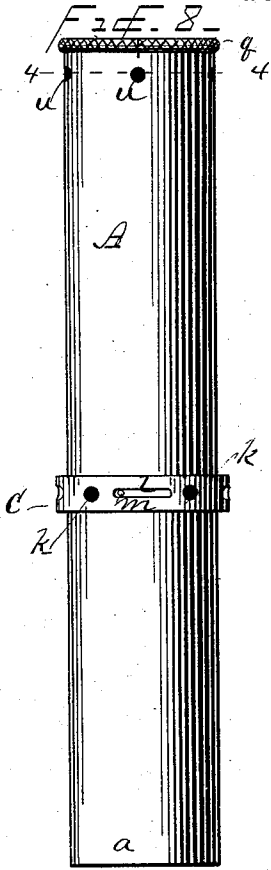
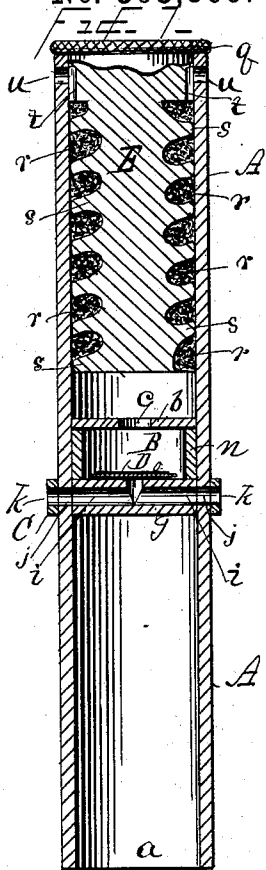
(No Model.)

2 Sheets—Sheet 2.

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Walter A. Brown.

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J. S. Brown.

UNITED STATES PATENT OFFICE.

CHARLES EVERETT WARREN, OF BOSTON, MASSACHUSETTS.

INHALER.

SPECIFICATION forming part of Letters Patent No. 393,869, dated December 4, 1888.

Application filed September 13, 1888. Serial No. 285,322. (No model.)

To all whom it may concern:

Be it known that I, CHARLES EVERETT WARREN, a citizen of the United States, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented a new and Improved Inhaler; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, making part of this specification.

My invention relates to improvements in inhalers for the administration of pure air, gases, or medicated vapors to the lungs, bronchial tubes, and other parts of the respiratory system.

In addition to the ordinary uses of inhalers as receptacles for medicaments and means for applying the same, the inhaler herein described is also so constructed that it mechanically and automatically produces a pneumatic differentiation, there being a free and unimpeded passage of the air through the medicament and then into the air-passages of the respiratory system through the mouth during inspiration, but, on the contrary, during expiration the air being impeded to a greater or less degree at the will of the patient, the pressure within the lungs increasing proportionately as the exit of the expired air is impeded.

In the accompanying drawings, illustrating my invention, Figure 1 is a central longitudinal section of the inhaler proper and arranged as a simple respirator; Fig. 2, a central longitudinal section of a portion of the same in a plane at right angles to the plane in Fig. 1; Fig. 3, a transverse section of the inhaler in a plane indicated by the line 1 1, Fig. 1; Fig. 4, a transverse section thereof in a plane indicated by the line 2 2, Fig. 1; Fig. 5, a transverse section thereof in a plane indicated by the line 3 3, Fig. 1; Fig. 6, a side view of a portion of the inhaler, showing the register-ring used on the outside of the inhaler for regulating the size of the air-exit apertures in the tube or case of the inhaler; Fig. 7, a central longitudinal section of the inhaler provided with a medicament-holder in side view, according to my invention; Fig. 8, a side view of the same; Fig. 9, a cross-section of the same in a plane indicated by the

line 4 4, Fig. 7; Fig. 10, a side view of the medicament-holder; Fig. 11, a central longitudinal section of the same, constructed, also, as a receptacle to hold a supply of medicament; Fig. 12, a central longitudinal section of the inhaler provided with two medicament-holders; Fig. 13, a central longitudinal section of a bottle-stopper provided with an inhaler and valve-chamber according to my invention; Fig. 14, a transverse section of the same in a plane indicated by the line 5 5, Fig. 13.

Like letters designate corresponding parts in all of the figures.

The body or case A of the inhaler is preferably a simple tube, as shown, though no particular form is essential, and it is made of hard india-rubber or other suitable material. This is applied at one end, *a*, to the mouth, and the breath of the person using it passes in and out through it. In some part of the tube—generally in its middle part—is located the valve-chamber B, which forms an essential feature of my invention. Although this valve-chamber may be varied in special construction, the construction represented in the drawings is a simple and suitable one and the principle of its operation will be clearly understood thereby. At one end of the chamber is a head or disk, *b*, closely fitting in the inhaler-tube A and having a central hole, *c*, through it. At the other end of the chamber is another head or disk, *d*, also fitting closely in the inhaler-tube, and having not only a central hole, *e*, through it, but a number of other holes, *f f*, through it near the periphery of the same, there being four shown in Fig. 4 of the drawings.

Formed with the head or disk *d*, or placed in contact with it, is a part, *g*, having radial parts reaching to the interior surface of the inhaler-tube, with holes or open spaces *h h* between, as shown in Fig. 5, and having radial grooves or openings *i i* in its radial parts, as seen in the same figure. These radial grooves or openings meet in the center of the part and communicate with the central hole, *e*, through the head or disk *d*, as shown; but they are closed from any communication with

the intermediate holes or openings, *h h*, as shown in Figs. 2 and 5. These holes or openings *h h* communicate directly with or form continuations of the holes *f f* through the head or disk *d*. The grooves or openings *i i* communicate at their outer ends, respectively, with holes *j j*, opening through the wall of the inhaler-tube A, whereby air may be expelled from the valve-chamber laterally through the sides of the same. The holes *j j* are opened, more or less, or entirely closed by a register, preferably in the form of a ring, C, closely surrounding the inhaler-tube, as shown, and provided with holes *k k*, coinciding in position and size with the holes *j j* through the inhaler-tube, so that the ring may be moved to bring its holes directly opposite to the holes of the inhaler-tube and open them to their full size, or be moved around partially or entirely to one side of the said holes *j j*, and thereby partially or entirely close them. A peripheral slot, *l*, Fig. 6, in the ring, fitting over a pin, *m*, projecting from the inhaler-tube, serves to guide and limit the adjusting movements of the register-ring.

In the formation of the valve-chamber B the two heads or disks *b d* may be suitably held in proper relative positions by a short intermediate tube, *n*, fitting closely inside of the main tube or body A of the inhaler.

The valve D may be a simple thin metallic disk having soft india-rubber, leather, or equivalent disks or surfaces *o o*, which will fit tightly against the two heads or disks *b d*, which form seats for the valve, particularly the disk *b*. This valve does not fill the whole diameter of the valve-chamber. It is of sufficient diameter to completely cover the central apertures, *e e*, of the two heads or disks, but not to wholly cover and close the outer holes, *f f*, through the head or disk *d*. It is free to play between the two heads or disks as the breath is drawn and expelled through the inhaler-tube alternately.

As described above, the inhaler proper is complete, and its operation may now be illustrated by describing its action as a simple respirator for inflating the lungs with pure air. The end *a* having been applied to the mouth of the person using it, the inspiration of the breath draws air freely through the inhaler-tube, since the valve is drawn by the inflow from the head or disk *b*, thereby allowing a free passage through its hole *e*, while even if the valve is brought into close contact with the head or disk *d* it only closes the central hole, *e*, and only partially closes the holes *f f*, so that there is always a free inspiration; but in expelling the breath from the lungs the valve is thrown back against the head or disk *b*, and is thereby made to close the hole *e* through the same, the consequence of which is that the air can only be expelled from the valve-chamber through the hole *e* in the disk *d*, and thence out through the grooves or openings *i i* and holes *j j* in the sides of the

inhaler-tube. Now, since these holes *j j* may be closed more or less or entirely by the ring C the degree of resistance to the expulsion of the air may be adjusted at will, requiring more or less power to be exerted by the muscles of the chest and diaphragm to effect them, thereby effecting the respiratory results set forth in the foregoing purposes of the invention. So far as these mechanical respiratory results are concerned, the effects are or may be the same whether a medicament is used in the inhaler or not, and its operation is the same with the medicament as without.

The medicament is applied so as to medicate or charge the inhaled air as it comes into the outer end or chamber, *p*, opposite to the mouth end *a* thereof. It may be deposited or suspended in any suitable way for the purpose; but I have invented a very effectual and complete device for this purpose and make it an additional feature of my invention, as represented in Figs. 7 and 10.

The device consists of a holder, E, of hard india-rubber or other suitable material, of substantially the form and construction shown in Figs. 8 and 9, made in the form of a plug or stop to fit into the end of the inhaler-tube, and having a flange or milled head, *q*, fitting outside against the end of the tube and preferably flush or nearly flush with the periphery of the tube, as shown in Fig. 10. The inner end of the plug continues in the form of a deep spiral groove, *r*, with a spiral flange or screw-thread, *s*, between the turns of the groove, as shown, the outer edge of the flange or screw-thread being adapted to reach nearly or quite to the inner surface of the inhaler-tube, as shown in Fig. 7. The spirally-grooved part of the plug may reach inward nearly to, but not quite to, the head or disk *b* of the valve-chamber, so that there will be sufficient room for the flow of the air between the plug and head or disk, as shown. The spiral groove *r* is filled with some fibrous or equivalent material, with interstices in the same—such as cotton, wool, wicking, or fibrous asbestos—as indicated in Fig. 7. The medicament is placed in this fibrous substance and held there by pervasion or absorption, according to the condition or consistency of the medicament; and as the air is drawn into the inhaler-tube by the inspiration of the person using the instrument it traverses the interstices of the fibrous material throughout the length of the spiral groove and becomes thoroughly commingled therewith. Then when the breath is expelled from the lungs it is prevented from returning through the outer end of the inhaler-tube by the valve D, closing the hole *e* in the head or disk *b*, and therefore is expelled through the sides of the inhaler-tube, as set forth in describing the operation of the inhaler. Therefore the medicament is not made foul by the impure breath expelled from the lungs and may remain pure

in the inhaler for any desired length of time. The outer end of the plug E fits tightly in the end of the inhaler-tube; and in order to provide a way for the inflow of air into the inhaler while the plug is still in place I provide the side of the plug at intervals with longitudinal channels *tt* in its periphery, reaching not quite to the outer end or flange of the plug, as shown in Fig. 10. The outer terminations of these channels coincide in position with holes *uu* through the sides of the inhaler-tube, so that air flows through these holes and along these channels to the spiral groove. This construction also fulfills another purpose, since by turning the plug a little in the inhaler-tube the channels *tt* are moved away from the holes *uu*, in which position no air can enter the medicament-chamber, and it cannot be dissipated, even if kept in the inhaler between the times of using. Then when the inhaler is to be used the plug is turned back to bring the channels into communication with the holes. Marks, as at *x x*, Fig. 8, respectively, on the inhaler-tube and plug may indicate when the channels and holes are together.

It may frequently be desirable to carry the medicament in considerable quantity—more than for a single application in the spiral groove of the holder. In Fig. 11 I show the holder formed with a receptacle, *v*, in its center for holding the medicament in quantity, the receptacle being open at one end and closed by a stopper, *w*. This does not interfere with its use as the vehicle for holding the medicament for immediate use.

In Fig. 12 I show the inhaler provided with two medicament-holders—one fitted into each end thereof and both of like construction.

The operation of the inhaler is the same as set forth above.

The purpose of the two medicament-holders is to employ two different substances for medicaments at the same time in the two holders, the two being of such a character that when the vapor of one passes also through the other in the act of inhaling through the inhaler the two will chemically react on each other, so as to produce a compound gas, thereby acting in the nascent state.

As I have before said, the inhaler need not be in the form of a tube, nor need it be used entirely alone. In Figs. 13 and 14 I have shown it in the form of a stopper to a bottle or other vessel, which may, if desired, contain the medicament, issuing from it in the form of vapor.

This stopper is lettered to correspond with similar parts of the inhaler-tube above described. The mouth end *a* may be a short tube projecting from the stopper. No outer register-ring is shown here. The stopper may be conveniently made in two parts, *y* and *z*, screwed together, as shown, for the purpose of convenient construction or for getting access to the interior part of the same.

I claim as my invention—

1. In an inhaler, a tube or case provided with a valve-chamber and valve in the same, the said valve-chamber thereof having through one end or head an aperture adapted to be closed by the valve, and through the other end or head one or more holes adapted to be not closed by the valve, and another hole adapted to be closed by the valve and opening to grooves or openings leading to the sides of the tube or case and to holes through the said tube or case, substantially as and for the purpose herein specified.

2. In combination with the tube or case, the valve-chamber and valve located therein, one end or head of the valve-chamber having an aperture through it adapted to be closed by the valve, and the other end or head having holes not closed by the valve, and another hole adapted to be closed by the valve and communicating with grooves or openings leading therefrom to the sides of the inhaler tube or case, a series of holes through the sides of the said tube or case, and a register-ring on the outside of the case adapted to open more or less widely the holes through the tube or case, substantially as and for the purpose herein specified.

3. The combination of the inhaler tube or case, the valve-chamber having a central aperture through one end, a central hole in the other head or end, and other holes entirely through the last-named head or end, and radial grooves or openings leading from the central hole to the sides of the tube or case, holes through the tube or case communicating with the said grooves or openings, and a freely-movable valve adapted to play between the two ends or heads of the valve-chamber, substantially as herein specified.

4. In combination with the inhaler tube or case, a medicament-holder formed with a spiral groove in its periphery adapted to hold a fibrous or intersticed material in which the medicament is contained, the intermediate spiral thread nearly or quite filling the interior diameter of the tube or case, substantially as and for the purpose herein specified.

5. The combination of the inhaler tube or case, the medicament-holder forming a closing-plug to one end of the tube or case and adapted to be turned in the tube or case, the tube or case having air-inlet holes in its sides, and the plug having air-inlet channels leading from the said air-inlet holes to the interior chamber of the tube or case, substantially as and for the purpose herein specified.

6. The combination of the inhaler tube or case, the valve-chamber in the tube or case, one end or head thereof having inlet-holes through the same, and an outlet-hole and openings leading out through the sides of the tube or case, a valve located in the valve-chamber adapted to open and close the holes or apertures in the ends or heads thereof, and a medicament-holder located in one end of the

inhaler tube or case, substantially as and for the purpose herein specified.

7. The combination of an inhaler tube or case and two medicament-holders placed, respectively, in the two ends of the tube or case and adapted to contain two different medicaments or materials, substantially as and for the purpose herein specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CHARLES EVERETT WARREN.

Witnesses:

JOSIE M. NORRIS,
W. EVERETT SMITH.