No. 810,769. PATENTED JAN. 23, 1906.

E. C. JONES.

INHALER.

APPLICATION FILED NOV. 18, 1904.

Fig. 1.

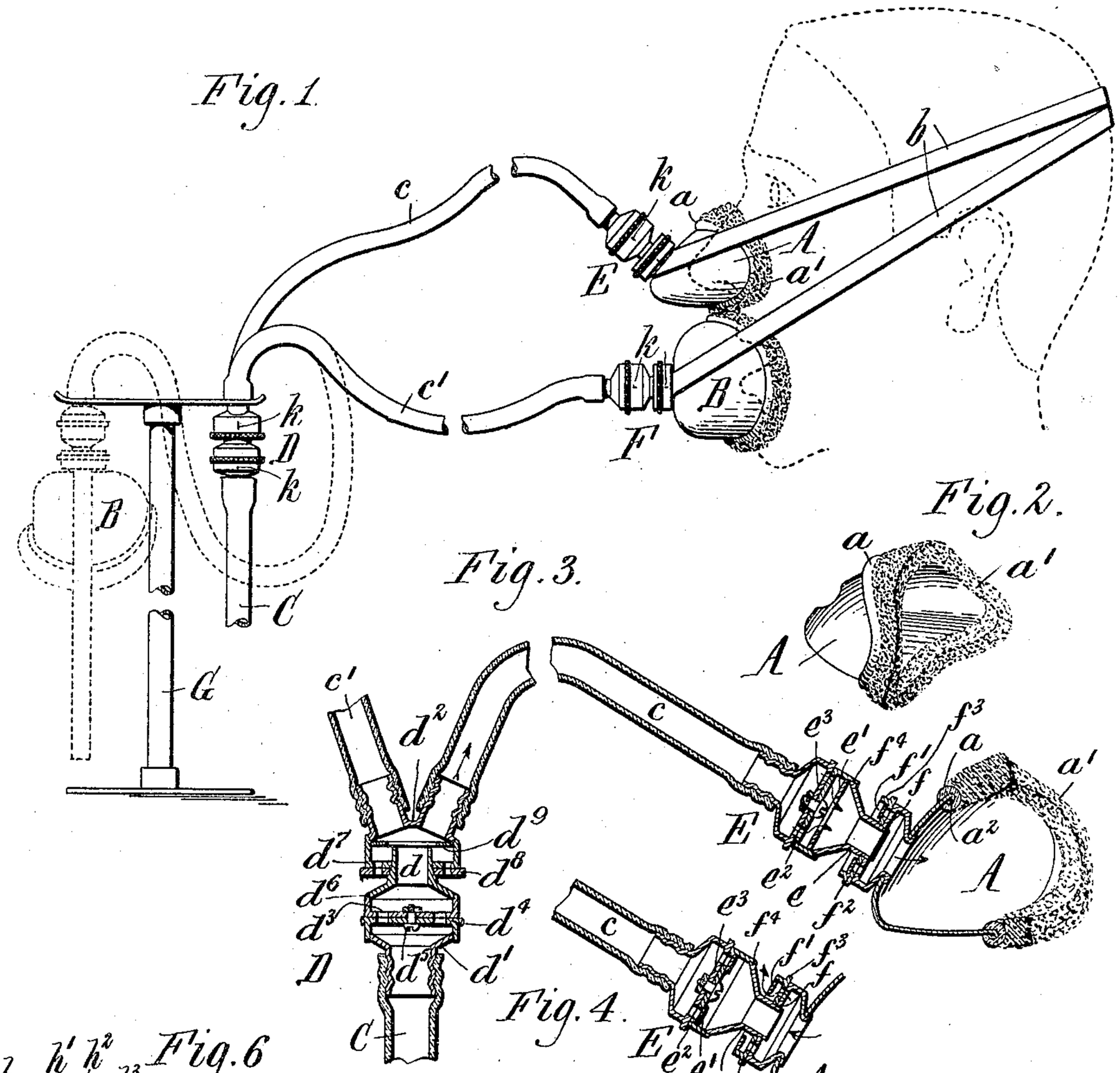


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 6.

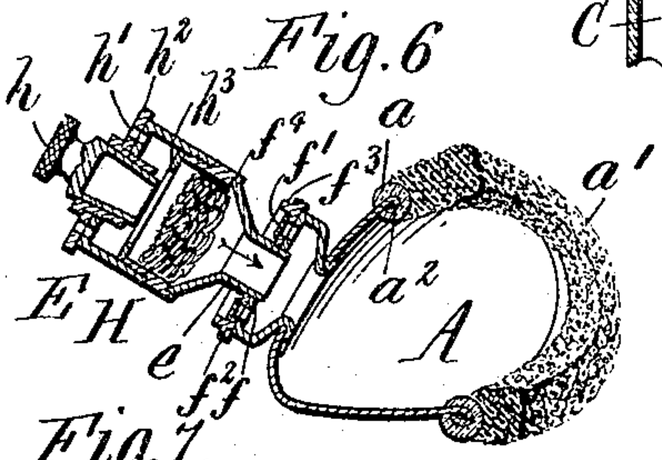


Fig. 7.

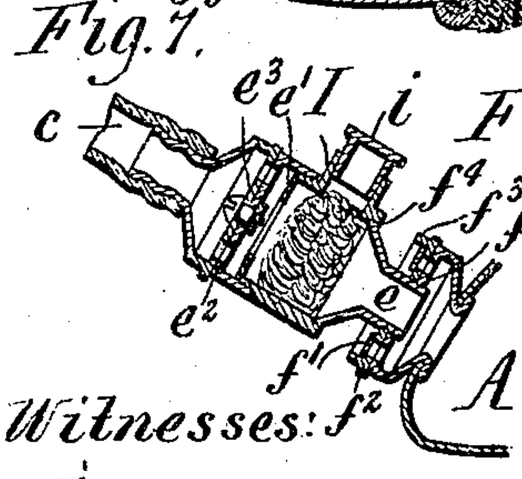


Fig. 5.

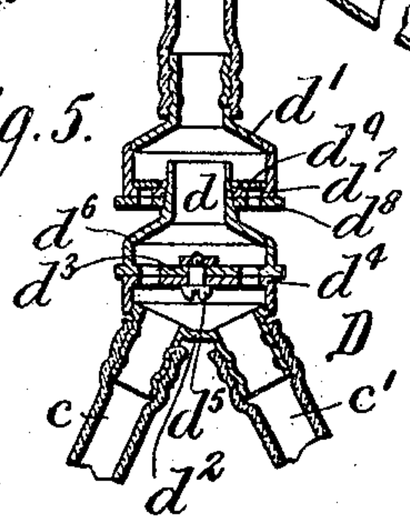
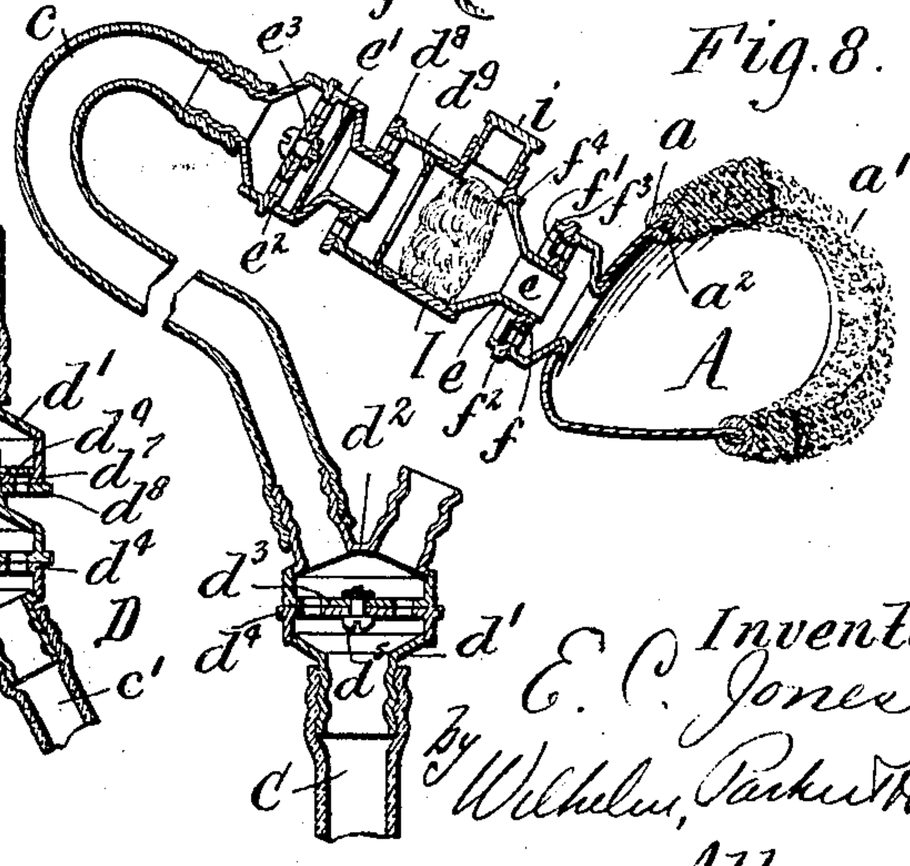


Fig. 8.



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INHALER.

No. 810,769. Specification of Letters Patent. Patented Jan. 23, 1906.

Application filed November 18, 1904. Serial No. 233,384.

To all whom it may concern:

Be it known that I, EDWIN CHARLES JONES, a subject of the King of Great Britain, residing at Woodstock, in the Province of Ontario, Canada, have invented a new and useful Improvement in Inhalers, of which the following is a specification.

This invention relates to anesthetizers or inhalers for administering gases or vapors to produce anesthesia.

The objects of the invention are to produce an efficient, light, and compact inhaler adapted especially for dentists' use, which while in place on the patient can be readily adjusted to administer either an anesthetic or air singly, or both, in any desired proportion, and different anesthetics separately or in admixture and either with or without air; to provide an inhaler with separate movably-connected nose and mouth masks, enabling the anesthetic to be administered at first through both the nose and mouth to accelerate the operation, and then when anesthesia has progressed far enough or is complete permitting the mouth-mask to be removed and the operator to work on the mouth while the nose-mask is allowed to remain in place to complete or continue the anesthesia; to provide cushions for the masks which will adapt themselves readily to faces differing greatly in countour and always insure perfect gas-tight closures about the respiratory organs, and which can be detached from the masks for cleansing or renewing the cushions, and to improve inhalers of this character in the respects hereinafter described, and set forth in the claims.

In the accompanying drawings, Figure 1 is an elevation of an inhaler embodying the invention, showing the same arranged for administering a single anesthetic, and also showing, by broken lines, the mouth-mask removed from the patient. Fig. 2 is a perspective view of the nose-mask detached. Fig. 3 is a section, on an enlarged scale, of the air and gas mixing valve, the nose-mask and connecting parts showing the position of the inhaling and exhaling valves when the patient is inspiring. Fig. 4 is a section of the combined inhaling and exhaling valve, showing the position of the valves when the patient is exhaling. Fig. 5 is a section of the air and gas mixing valve adjusted for the administration of two gases. Fig. 6 is a section of the nose-mask equipped with a receptacle for a volatile anesthetic. Fig. 7 is a section showing a combination of parts for simultaneously administering a gaseous and volatile anesthetic. Fig. 8 is a section showing another combination of parts for administering a gaseous and volatile anesthetic.

Referring particularly to Figs. 1 to 4, A and B represent two separate or independent hollow masks or pieces which are placed, respectively, over the nose and mouth of the patient and are connected by branch tubes *c c'* with a main gas-supply tube C, which in turn connects with a supply-reservoir (not shown) for the gas or anesthetic to be administered. An air and gas mixing valve D is provided, which is preferably interposed between and connects the main and branch tubes, and each of the masks is provided with a combined inhaling and exhaling valve E and F, to which the branch tubes are connected. The masks are similar except as to shape, each being of a size and countour to fit over and inclose the respiratory organ for which it is intended. The nose-mask incloses the nasal orifices and bears against the upper lip, cheeks, and sides and bridge of the nose, while the mouth-mask surrounds the mouth and bears against the upper lip, cheeks, and chin, as shown in Fig. 1. Each mask consists of a hollow cup-shaped body, preferably of thin metal, having a soft pliable cushion around its rim adapted to yield and conform to the features of different patients and effect a tight closure between the mask and face of the patient to prevent the escape of the anesthetic. As the features, espepecially the nose, differ so materially in different persons, it has been a matter of great difficulty to produce a mask to properly fit different patients and effect a proper closure. The rim cushion shown in the drawings obviates this difficulty. It consists of a flexible elastic rubber annulus *a*, having a continuous slit or channel into which is inserted the rim of the body of the mask, and a thick soft pliable bearing portion or pad *a'*, which is made of sponge-rubber or the like and is vulcanized or otherwise permanently secured to the harder annulus *a*. The latter is stretched and sprung over the rim of the mask, on which it is detachably retained by its elasticity. The mask preferably has a marginal bead a^2 or is roughened to secure a better hold on the elastic annulus and prevent the accidental displacement of the cushion. The thick soft

rubber pad readily conforms to the features even when very angular and prominent and always insures a perfect closure. The cushion being detachable from the mask can be readily cleansed by removing and soaking it in an antiseptic solution. The masks are held in place on the face by the usual head-straps *b*.

The air and gas mixing valve D, hereinafter termed the "mixing-valve," is constructed as follows: The valve-casing preferably has end enlargements connected by a contracted tubular waist *d* and removable or screw end caps *d' d²*. The cap *d'* has a single nipple for attachment to the main gas-tube C, while the other cap *d²* has two nipples for attachment to the branch tubes *c c'*, leading to the nose and mouth masks. The end of the casing which connects with the main gas-supply tube has a cross-head or diaphragm *d³*, provided with gas passages or holes, (there may be one or more,) which are controlled by a rotatable regulating disk or valve *d⁴*, having holes adapted to be moved into and out of register with the holes in the head *d³*. In the construction shown the gas-regulating disk *d⁴* constitutes a part of the enlarged portion of the mixing-valve casing and is rotatably held against the head *d³* by a pivot or screw *d⁵*. By turning the valve the gas-passages in the head can be opened to any desired extent to regulate the flow of gas therethrough, as required, or completely closed to shut off the flow of gas. This enlarged portion of the casing containing the gas-regulating valve is detachably connected to the waist of the casing, as by a screw connection *d⁶*, enabling the separation of the parts for a purpose hereinafter stated. The other enlargement of the valve-casing has an annular wall *d⁷* connecting it with the contracted waist of the casing, said wall having air-inlet holes, which are controlled by a regulating disk or valve *d⁸*, rotatably mounted on the contracted waist of the casing between a suitable shoulder thereon and the wall *d⁷* and having holes adapted to register with the air-inlet holes. By adjusting this disk more or less air can be admitted, or the air-inlets can be completely closed, and by a proper relative adjustment of the gas and air regulating disks *d⁴* and *d⁸* a mixture of the gas and air in any desired proportion can be secured. By closing the gas-regulating disk the patient can be given air alone. The tubular waist of the valve-casing projects into the air-inlet-valve chamber beyond the air-inlets in the direction of the flow of the gas, forming a gas-nozzle, and an annular air-inlet valve *d⁹* loosely surrounds this nozzle and is movable toward and from the wall *d⁷* to close and open the air-inlets. When the patient inhales, the air-inlet valve is unseated and air rushes in through the inlets to mix with the gas from the nozzle. This valve on account of its position relative to the gas-nozzle prevents the escape of the gas through the air-inlets, for as soon as the inspiration ceases the gas-pressure in the air-inlet-valve chamber will automatically seat the valve and hold it to its seat until again unseated by the patient inhaling.

The combined inhaling and exhaling valves E and F for the nose and mouth masks are alike, and each is preferably constructed as follows: The valve is quite similar in size and general structure to the mixing-valve, having a casing with end enlargements and a contracted tubular waist or connecting portion *e*. The casing is secured at its inner end to the mask in any suitable manner and is provided at its outer end with a nipple for the attachment of the branch tube. The outer enlargement forms a chamber for an inwardly-opening annular inhaling-valve *e'*, which is loosely confined in its chamber and is movable toward and from a diaphragm or cross-head *e²* to control gas-passages in the latter. The size of these passages is determined by a rotatable perforated regulating-disk *e³*, similar in construction and operation to the gas-regulating disk of the mixing-valve. The inner enlargement of the combined inhaling and exhaling valve casing has an annular wall or plate *f*, provided with orifices through which the patient exhales and which are controlled by an annular exhaling-valve *f'*, which loosely surrounds the contracted waist of the casing and is movable toward and from the exhaling-orifices. A rotatable regulating-disk *f²* surrounds the tubular waist of the casing between the exhaling-valve *f'* and the annular wall *f* of the inner enlargement of the casing, being held from longitudinal movement by a suitable shoulder on the waist of the casing. The regulating-disk is provided with holes adapted to register with the exhaling-orifices, the size of which is determined by the rotary adjustment of the disk. The latter has an outwardly-projecting annular flange *f³*, which surrounds and protects the exhaling-valve. The act of inhaling unseats the inhaling-valve and permits the passage of the anesthetic to the patient and seats the exhaling-valve to prevent the entrance of air, as shown in Fig. 3, while exhalation causes the seating of the inhaling-valve and the opening of the exhaling-valve, as shown in Fig. 4. The enlargement of the casing which forms the inhaling-valve chamber is made in separable parts screwed together at *f⁴* to enable the administration of a volatile anesthetic alone or in combination with another gas, as will be described.

The operation of the apparatus thus far described is as follows: The weight of the apparatus is carried by a portable or adjustable stand or support G of any suitable construction which will hold the apparatus stationary and permit the ready adjustment of the valves. The masks are applied to the pa-

tient's nose and mouth to start the anesthesia, and the gas and air regulating disks d^4 and d^8 of the mixing-valve D are adjusted to produce the desired mixture of the anesthetic and air. The patient inhales, drawing the anesthetic past the inhaling-valve e', and exhales through the exhaling-orifices controlled by the valve f', as explained. The patient may be given either gas or air alone by a proper adjustment of the gas and air regulating disks d^4 and d^8, and a perfect anesthesia is insured by adjusting the regulating-disks e^3 and f^2 of the inhaling and exhaling valves to suit the conditions of respiration of the patient under treatment. When anesthesia has progressed far enough, the mouth-mask can be removed, as indicated by dotted lines in Fig. 1, thus permitting operation upon the mouth, while the anesthesia is completed or continued through the nose-mask alone. If it is desired to administer two gases or anesthetics simultaneously, it is accomplished by arranging the parts of the mixing-valve as indicated in Fig. 5. The end caps d' and d^2 of the casing are removed and interchanged, the branch tubes $c\,c'$, attached to the cap d^2, being connected with two gas-reservoirs, (not shown), while the single tube C, connected with the other cap d', is attached to either of the masks. This interchanging of the caps $d'\,d^2$ does not affect the operation of the mixing-valve, and either the gases alone, air alone, or a proper mixture of air and the gases can be administered. When it is desired to administer a volatile anesthetic, such as chloroform or ether, the outer part of the casing for the inhaling-valve e' is detached at the screwc onnection f^4, and a receptacle H for the volatile anesthetic is attached in its place, as shown in Fig. 6. The receptacle contains cotton or the like, which is saturated with the liquid anesthetic introduced through a filling-opening, which is closed by a removable stopper or cap h. The head of the receptacle is provided with air-inlet openings h' and equipped with a rotatable regulating-disk h^2, similar to the regulating-disks already described, to regulate the quantity of air passing through the holes. When the patient inhales, air is drawn in through the air-inlets h' and saturated cotton, carrying with it the vaporized anesthetic. Exhalation takes place through the exhaling-valve f' just as when the inhaling-valve is used. The receptacle H is also preferably provided with an internal annular valve h^3, which controls the air-inlets h' and prevents exhalation and escape of the volatilized anesthetic through the air-inlets.

As shown in Fig. 7, the apparatus can be used to simultaneously administer a gaseous and a volatile anesthetic by detaching the inhaling-valve from the exhaling-valve at the screw connection f^4, as above stated, attaching in its place an open-ended receptacle I, and then attaching the inhaling-valve to the outer end of the receptacle. The latter contains cotton or the like for saturation with the liquid anesthetic, which can be introduced through a filling-opening closed by a removable stopper or cap i. With the parts thus connected the air is supplied through the air-inlet valve d^9 of the mixing-valve D. If preferred, the air can be admitted and regulated directly at the receptacle I by connecting up the parts as shown in Fig. 8. In this arrangement the receptacle I is applied to the exhaling-valve, as in Fig. 7; but the central portion of the mixing-valve D, containing the air-inlet valve d^9 and air-regulating disk d^8, is removed from between the end portions of the mixing-valve D and screwed on the outer end of the receptacle I, and the inhaling-valve is then screwed on the outer end of the part supplied from the mixing-valve. The cap d^2 of the mixing-valve is then screwed on the remaining end portion of the mixing-valve which contains the gas-regulating disk d^4. This combination of the parts enables the mixture of the gas, volatile anesthetic, and air to be nicely proportioned, and the air-inlet valve d^9 prevents exhalation through the air-openings, as in the case of the other receptacle H. When either of the masks is used alone, the branch tube for the other mask is closed to prevent escape of the anesthetic by means of the regulating-disk e^3 of its inhaling and exhaling valve.

From the above examples it will be seen that various different combinations of the parts of the apparatus can be effected to produce different desired results by making the parts similar and interchangeable.

Each of the rotatable regulating disks or valves is provided with means, such as marks k, Fig. 1, on the disks and adjacent parts of the valve-casings, to indicate the relative positions of the disks, so that the operator can judge of the resulting effect on the anesthetic or anesthetics being administered.

I claim as my invention—

1. The combination of a mask, and a rim-cushion for the same comprising an elastic rubber annulus which embraces the rim of the mask, and a soft pliable bearing-pad or portion of sponge-rubber permanently attached to said annulus, substantially as set forth.

2. The combination of two separate masks each provided with inhaling and exhaling valves, and an air and gas mixing valve common to both of said masks and comprising a gas-regulating valve, an air-inlet valve, and an air-regulating valve, substantially as set forth.

3. An air and gas mixing valve, comprising a casing having a connection for a mask at one end and a gas-supply connection at the opposite end, a valve-controlled air-inlet opening, a gas-nozzle projecting beyond said

air-inlet opening in the direction of flow of the gas, and parallel rotatable air and gas regulating valves, substantially as set forth.

4. An air and gas mixing valve, comprising a casing having a connection for a mask at one end and a gas-supply connection at the opposite end, and a valve-chamber having an air-inlet, a gas-nozzle projecting into said valve-chamber beyond said air-inlet, a valve in said chamber surrounding said nozzle and controlling said air-inlet, and a rotatable regulating-valve located outside of said valve-chamber and controlling said air-inlet, substantially as set forth.

5. An air and gas mixing valve, comprising a casing having a valve-chamber provided with an air-inlet, a valve which controls said air-inlet and prevents the escape of gas therethrough, a removable cap at one end of said casing having connections for a plurality of tubes, and a removable cap at the opposite end of said casing having a tube connection, said caps being interchangeable, substantially as set forth.

6. An air and gas mixing valve comprising a casing having tube connections at opposite ends, and an air-inlet valve-chamber provided with an air-inlet, a valve in said chamber controlling said air-inlet, said casing comprising two parts, each having a perforated disk, and means connecting said disks and permitting one casing part to be turned relative to the other to regulate the passage of gas through said perforated disks, substantially as set forth.

7. A tubular valve-casing provided with a perforated cross-head and an enlargement having an annular wall provided with openings, a rotatable disk for regulating the passage of gas through said perforated head, an automatic valve controlling the openings in said annular wall, and a rotatable disk for regulating the size of the openings in said annular wall, substantially as set forth.

8. A combined inhaling and exhaling valve comprising a casing having a contracted waist, an inhaling-valve movable in said casing at one side of the contracted waist to control the passage of gas through the casing, and an annular exhaling-valve surrounding said contracted waist and movable to control exhaling-orifices in the casing, substantially as set forth.

9. A combined inhaling and exhaling valve comprising a casing, a valve therein controlling the inhaling-passages through the casing, an exhaling-valve carried thereby and controlling the exit from said casing, and rotatable regulating-valves which are turned to vary the area of the inhaling and exhaling passages, said several valves being arranged parallel with each other, substantially as set forth.

10. The combination of inhaling and exhaling valves, a casing for the same comprising parts separable between said valves, and a receptacle for a volatile anesthetic constructed for attachment to the part of the casing carrying the exhaling-valve, when said other part of the casing is detached, substantially as set forth.

11. The combination of inhaling and exhaling valves, a casing for the same comprising parts separable between said valves, and an open-ended receptacle for a volatile liquid which is constructed to be placed between said parts of the casing when separated and connect them, substantially as set forth.

12. The combination of inhaling and exhaling valves, a casing for the same, comprising parts separable between said valves, an open-ended receptacle for a volatile anesthetic constructed for attachment to the part of said casing carrying the exhaling-valve, when said other part of the casing is detached, and a part constructed to connect said receptacle and said other part of the casing and having valve-controlled air-holes substantially as set forth.

Witness my hand this 7th day of November, 1904.

EDWIN CHARLES JONES.

Witnesses:
R. H. WALTON,
A. M. CLARK.