

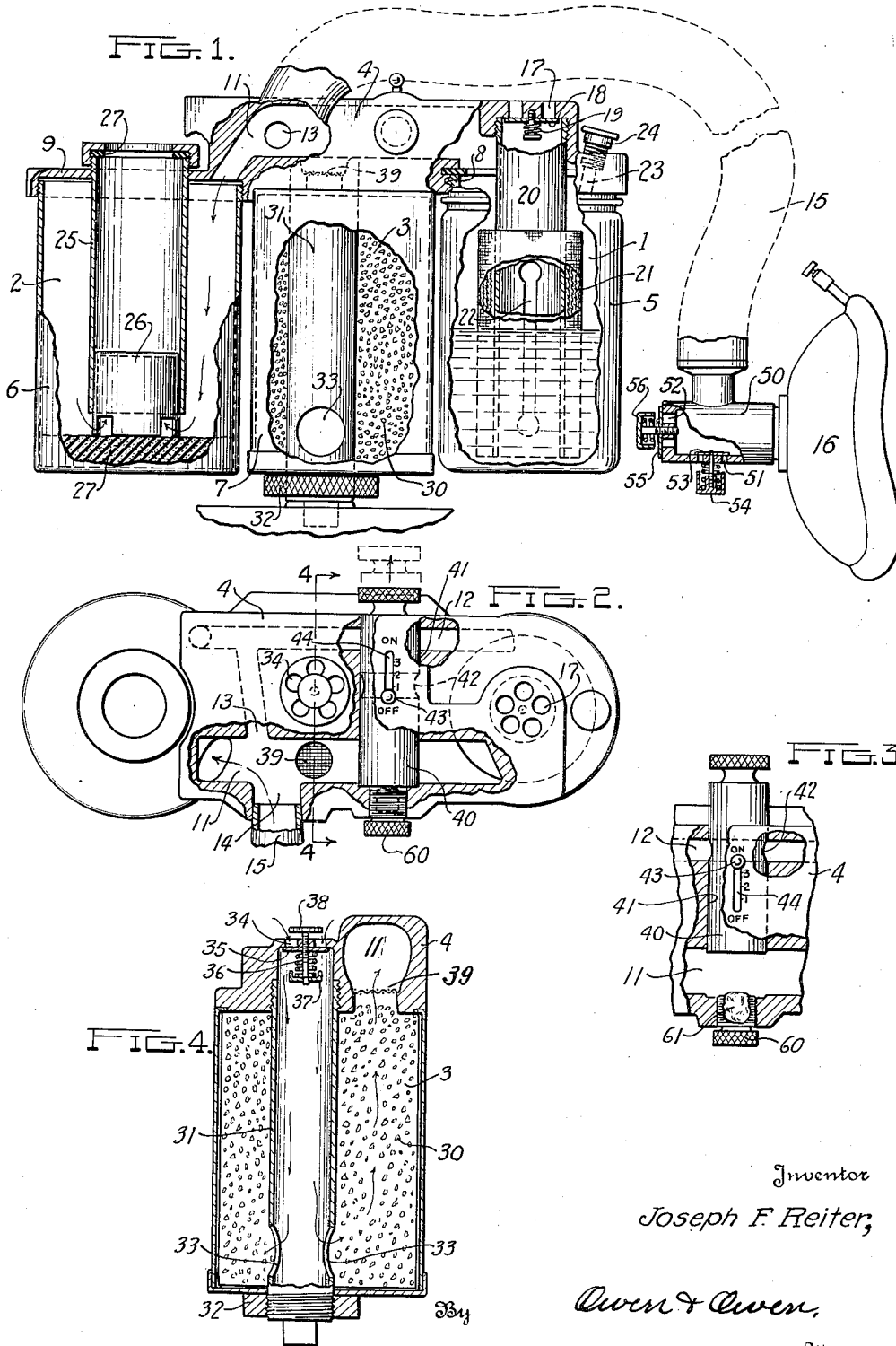
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ANESTHETIZING ADMINISTERING APPARATUS

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## ANESTHETIZING ADMINISTERING APPARATUS

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13 Claims. (Cl. 128—186)

This invention relates to an anesthetizing apparatus, and particularly to such an apparatus adapted for administering ether.

An object of the invention is the provision of a simple and efficient apparatus of this character, which permits ether to be administered to a patient in practically a closed system, whereby the waste of ether by evaporation, which takes place in the exposed drop or saturated gauze mask method commonly employed, is avoided, thus preventing to a very large extent the presence of the disagreeable odor in rooms where ether is being used as an anesthetic.

A further object of the invention is the provision of an apparatus of this character, wherein the respiration takes place, and the liquid ether, as well as the ether saturated air, are contained in a substantially closed system to effect economy in the administering of ether and to enable its administration to be more effectually controlled to suit the condition of the patient than with the unprotected open-air method commonly employed.

The invention is fully described in the following specification, and one embodiment thereof illustrated in the accompanying drawing, in which—

Figure 1 is an elevation of an apparatus embodying the invention with parts broken away; Fig. 2 is a top plan view thereof, with parts broken away and with the main control valve shown in closed position; Fig. 3 is a fragmentary sectional detail of the valve portion of the apparatus with the valve in open position, and Fig. 4 is a section on the line 4—4 in Fig. 2.

Referring to the drawing, the apparatus includes a vaporization chamber 1 for containing the liquid ether or other anesthetizing liquid to be vaporized, a rebreathing chamber 2, and a soda-lime chamber 3 carried by a body structure 4 through which the several chambers are in intercommunication through a substantially closed breathing system, as hereinafter described.

The chambers 1, 2 and 3 are formed, respectively, by cylinders 5, 6 and 7, which, in the present instance, are attached to the under side of the body 4 and are closed except as hereinafter described. The cylinder or receptacle 5 for containing the liquid to be vaporized is preferably of glass, so as to render its contents visible. This receptacle has its top open and removably threaded into a socket 8 in the bottom of the body 4 near one end. The rebreathing cylinder 6 has its top open and removably threaded into a socket 9 in the bottom of the body 4 near its other end. The soda-lime cylinder 7 is attached to

the under side of the body 4 intermediate the other two cylinders.

The body 4 is provided with a main passage 11 and an auxiliary passage 12, each of which extends lengthwise of the body and communicates at one end with the top of the chamber 1 and at its other end with the top of the chamber 2. The body also has a connecting passage 13 between the two passages 11 and 12, and of a cross-sectional size considerably less than that of the main passage 11. An opening 14 is provided in a side of the passage 11, preferably substantially opposite the cross passage 13, into which may be fitted an end of a tube 15 leading to a mask 16 for fitting over the nose and mouth of a patient.

In the top of the body 4 over the vaporizing chamber 1 are provided one or more air inlet openings 17 normally closed by an inwardly opening check-valve 18, which is normally held closed by a light tensioned spring 19. A tube 20 extends from the opening down through the open top of the receptacle 5 to near its bottom. This tube is wrapped, within the receptacle, by a gauze or other suitable material 21, which becomes saturated with ether, or the like, contained in the receptacle and extends above the top of the liquid. A slot 22, in a side of the tube, extends above the normal height of the liquid in the receptacle and is covered by the gauze 21, thus air drawn into the receptacle 5 through the tube 20 will pass through the portion of the slot 22 above the liquid and through the ether saturated gauze, and if the inhaling force is sufficient, the air will also pass around the lower end of the tube through the ether so that in either case the air entering the receptacle 1 through the tube 20 will be saturated with ether. Ether may be supplied to the receptacle 5 when the receptacle is removed from the body 4, or it may be introduced through a filling opening 23 in the body 4, which opening is closed by a plug 24.

The body 4 over the chamber 2 is provided with an opening through which is threaded, or otherwise suitably mounted, a tube 25, which at its outer end is open to the atmosphere, and has its inner end extending to near the bottom of said chamber. A light weight piston 26 is mounted for free reciprocatory movements in said tube and closes it to prevent air from entering or escaping from the chamber 2 through the tube. When a patient exhales, the gases of exhalation enter the chamber 2 and force the piston upward, thus increasing the gas holding volume of such chamber, and when the patient inhales, the pis-

ton falls by gravity to the bottom of the tube. This movement of the piston thus corresponds to the breathing action of the patient, the size of the chamber 2 successively expanding and contracting during the administering period as the patient exhales or inhales. The operator can view the movement of the piston through the upper open end of the tube 25 and thus determine the control necessary to suit the condition of the patient, as will hereinafter be more fully described. Bumpers 27 of soft rubber, or the like, are provided in the lower and upper ends of the tube 25 against which the piston may strike at the limit of its respective movement.

The receptacle 7 for the soda-lime 30 has a tube 31 extending downward therein from the body 4, and, in the present instance, this tube extends entirely through the receptacle and below its bottom and receives at its lower end a nut 32 which cooperates with the tube to clamp the receptacle to the bottom of the body 4. The tube 31 has openings 33 communicating with the interior of the receptacle through the material 30 and has its upper end in valve-controlled communication with the atmosphere through one or more openings 34 in the top of the body 4. These openings are closed by an inwardly opening check-valve 35, which is normally held to its seat by a spring 36. A thrust of this spring in opposition to the valve 35 is received by a member 37 carried at the inner end of a stem 38 that is threaded through the top of the body 4 and passed freely through the valve 35. The stem 38 may be turned to adjust the tension of the spring 36 or to entirely collapse the spring and firmly retain the valve to its seat. The tension of the spring 36 may be the same as the spring 19 which normally holds the air valve 18 seated, or it may be increased the desired extent, depending on conditions of operation. The top of the chamber 3 is in communication with the main passage 11 through a screened opening 39. It is thus apparent that under certain conditions hereinafter described, air will be drawn from the atmosphere through the tube 31, soda-lime 30, chamber 3 and opening 39 into the passage 11 when the patient is inhaling, and that such air is cleaned of impurities by its passage through the soda-lime.

A main control valve 40, in the present instance of cylindrical form, is mounted for reciprocatory adjusting movements in an opening 41 provided transversely through the body 4 in intercepting relation to both the main passage 11 and auxiliary passage 12. The valve intercepts each passage 11, 12, between the point of communication of each of such passages with the vaporizing chamber 1 and with the passage 14 with which the mask is connected. When the valve is in closed position, its inner end seats against a side wall of the passage 11, and when such valve is pulled outwardly to a greater or less extent, fluid is permitted to pass from one end to the other of the passage 11 around such end. When the valve 40 is in substantially full open position with respect to the passage 11, an opening 42 therethrough registers with the passage 12, so that fluid is permitted to pass from end to end through such passage. The movement of the valve is limited by a pin 43 projecting therefrom through a slot 44 in the body 4. The pin 43 may register with graduation marks on the body at the side of the slot 44, so as to indicate the position of the valve.

The mask 16 is of the usual type adapted to cover the nose and mouth of a patient and com-

municates with the tube 15 through a valve chamber 53 having two sets of openings 51 and 52 to the atmosphere. The opening 51, in the present instance, is controlled by an inwardly opening check-valve 53 normally held seated by a spring, the tension of which is controlled by a cap 54 threaded on the valve stem. The openings 52 are controlled by an outwardly opening check-valve 55 normally held seated by a spring, the tension of which is controlled by a cap 56 on the valve stem.

The operation of the apparatus is as follows:

When the device is used in administering ether, a supply of ether is placed in the receptacle 5 and the mask 16 held over the nose and mouth of the patient. If the main valve 40 is open, each inhalation of the patient causes a supply of fresh air to be drawn into the receptacle 5 through the valve openings 17, tube 20, ether liquid in the receptacle and ether saturated gauze 21, and this air, which becomes saturated with ether, is inhaled by the patient. Upon the next exhalation the ether saturated air from the lungs of the patient is forced into the rebreathing chamber 2 and its capacity expands by reason of the piston 26 moving to the upper end of the tube 25. Upon the next inhalation, the exhaled air, which is admitted to the chamber 2, and is fairly saturated with ether, is drawn back into the lungs of the patient, together with a supply of freshly etherized air drawn from the vaporizing chamber 1. Upon such inhalation, the piston 26 drops to the bottom of the tube 25. It is thus apparent that as the respiration of the patient continues, a greater portion of the exhaled air containing the ether vapor is rapidly delivered to and discharged from the rebreathing chamber 2, causing the piston 26 to reciprocate in response to such action, and at the same time fresh air saturated with ether is admitted to the breathing system of the apparatus. A greater or less amount of fresh ether saturated air may be delivered to the patient from the vaporizing chamber 1, depending on the extent of opening of the main valve 41, which, if entirely open, provides full communication between the ether chamber 1 and the mask tube 15 through both the main and auxiliary passages 11 and 12. The valve 40 may be regulated to completely close the passage 12 and partially close the passage 11, depending on the condition desired. The administering of ether and of rebreathed saturated air to the patient may be further controlled by a regulation of the valves 53 and 55 associated with the mask 16, the valve 53 permitting the inlet of fresh air to the mask and the valve 55 permitting the discharge to the atmosphere portion of the exhaled air. The operator watches the action of the piston 26 and if it is found that the upward movement of the piston is too strong, a portion of the exhaled air is permitted to be exhausted through the outlet openings 52, and vice versa. The valve control 38 may also be regulated to permit fresh air to be drawn into the apparatus through the soda-lime in the chamber 3 whereby impurities are removed from the air.

In opposition to the valve 40, through the side wall of the passage 11 against which such valve seats, is a removable plug 60 having a pocket in its inner end for containing cotton 61, which may be saturated with some perfume to obviate the offensive ether odor.

It is apparent that the apparatus enables ether to be administered in a substantially closed system which not only effects a very material saving in

the quantity of ether used during the administering of an anesthetic, but also obviates a great many of the discomfitures incident to the administering of ether by dropping it on a gauze applied to the patient's mouth and nose. With this apparatus, the operator can more perfectly control the administering of ether to suit the condition of the patient than with the old drop method.

I wish it understood that my invention is not limited to any specific construction, arrangement or form of the parts, as it is capable of numerous modifications and changes without departing from the spirit of the claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent, is:

1. An apparatus of the class described, means for containing an anesthetizing liquid, means forming an expansible rebreathing chamber, a mask in communication with said first means and chamber, valve means regulating said communication with said means, means forming communication between said first means and the atmosphere to cause air drawn therein to be saturated with said liquid, said means having an inwardly opening check-valve.

2. An apparatus of the class described having a vaporizing chamber for containing an anesthetizing liquid, an expansible rebreathing chamber, a mask having communication with both said chambers, valve means controlling said communication at least with said means, and means having an inwardly opening check-valve permitting atmospheric air to be drawn into said vaporizing chamber and saturated with the vapors of said liquid when inhalation takes place through the mask, and regulable means for purifying and admitting air to said communication.

3. An apparatus of the class described having a vaporizing chamber for containing an anesthetizing liquid, an expansible rebreathing chamber, a mask in valve controlled communication with at least one of said chambers, whereby upon inhalation therethrough air is drawn from both the rebreathing chamber and the vaporizing chamber, and means for admitting atmospheric air to the vaporizing chamber and causing it to be saturated with vapor from the liquid contained therein, said last means having an inwardly opening check-valve.

4. An apparatus of the class described having a vaporizing chamber for containing an anesthetizing liquid to be vaporized, a rebreathing chamber, a tube in said rebreathing chamber having communication at one end with the atmosphere and at its other end with the chamber, a piston freely movable in and closing the passage through said tube, said piston moving in one direction when air is forced into such chamber and in the opposite direction when air is drawn therefrom, a mask in communication with said chambers, and means for admitting air to the vaporizing chamber and causing it to have contact with the liquid therein when inhalation takes place through the mask.

5. An apparatus of the class described having a vaporizing chamber for containing an anesthetizing liquid to be vaporized, a rebreathing chamber, a tube in said rebreathing chamber having communication at one end with the atmosphere and at its other end with the chamber, a piston freely movable in and closing the passage through said tube, said piston moving in one direction when air is forced into such chamber and in the opposite direction when air is drawn therefrom,

a mask in communication with said chambers, and means for admitting air to the vaporizing chamber and causing it to have contact with the liquid therein when inhalation takes place through the mask, the operation of said piston being visible externally of said tube.

6. An apparatus of the class described having a vaporizing chamber for containing an anesthetizing liquid to be vaporized, a rebreathing chamber, a tube in said rebreathing chamber having communication at one end with the atmosphere and at its other end with the chamber, a piston freely movable in and closing the passage through said tube, said piston moving in one direction when air is forced into such chamber and in the opposite direction when air is drawn therefrom, a mask in communication with said chambers, means for admitting air to the vaporizing chamber and causing it to have contact with the liquid therein when inhalation takes place through the mask, the operation of said piston being visible externally of said tube, and means in communication with the mask and operable to permit the controlled exhaust of exhaled air to the atmosphere.

7. An apparatus of the class described having a vaporizing chamber for containing an anesthetizing liquid to be vaporized, a rebreathing chamber, a tube in said rebreathing chamber having communication at one end with the atmosphere and at its other end with the chamber, a piston freely movable in and closing the passage through said tube, said piston moving in one direction when air is forced into such chamber and in the opposite direction when air is drawn therefrom, a mask in communication with said chambers, means for admitting air to the vaporizing chamber and causing it to have contact with the liquid therein when inhalation takes place through the mask, the operation of said piston being visible externally of said tube, means in communication with the mask and operable to permit the controlled exhaust of exhaled air to the atmosphere, and means to permit the controlled admission of atmospheric air to the mask when inhalation takes place therein.

8. An apparatus of the class described having an ether vaporizing chamber, an expansible rebreathing chamber, a mask in communication with said chambers, means permitting air to enter said vaporizing chamber and be saturated with ether when inhalation takes place through said mask, and valve controlled means for admitting air to the mask and removing at least a portion of the impurities therefrom.

9. An apparatus of the class described, means for containing an anesthetizing liquid, means forming an expansible rebreathing chamber, a mask in communication with said first means and chamber, valve means regulating said communication at least with said first means, means forming communication between said first means and the atmosphere to cause air drawn therein to be saturated with said liquid, said means having an inwardly opening check-valve, and valve controlled means for admitting atmospheric air to said mask communication and removing at least a portion of the impurities therefrom.

10. In an apparatus of the class described, means forming a chamber for containing an anesthetizing liquid, means forming an expansible rebreathing chamber, a mask, means forming a passage between said mask and each of said chambers, means forming communication between said first chamber and the atmosphere to

cause air drawn therein to be saturated with said liquid, said last means having an inwardly opening check-valve, main valve means operable to regulate the communication between said first chamber and the mask, and valve controlled means for admitting air from the atmosphere to said passage at the mask side of said main valve means and removing a portion at least of the impurities from such air.

10 11. In an apparatus of the class described, means for containing an anesthetizing liquid, a mask having double communication with said means, means for admitting air to said first means upon inhalation through the mask and  
15 causing the air to be saturated with said liquid, and means operable to regulate both communications between said mask and chamber.

12. In an apparatus of the class described, means forming a chamber for containing an  
20 anesthetizing liquid, means forming a rebreathing chamber, means forming an air purifying chamber, a purifying agent in said last chamber, an inwardly opening valve for admitting air to said first chamber from the atmosphere, an inwardly opening valve regulable to admit air from  
25 the atmosphere to said purifying chamber, and a mask having communication with all three of

said chambers whereby upon inhalation through the mask air may be drawn from the atmosphere through both said liquid containing and purifying chambers and exhalation may take place through the mask into said rebreathing chamber. 5

13. In an apparatus of the class described, means forming a chamber for containing an anesthetizing liquid, means forming a rebreathing chamber, means forming an air purifying chamber, a purifying agent in said last chamber, an inwardly opening valve for admitting air to said first chamber from the atmosphere, an inwardly opening valve regulable to admit air from the atmosphere to said purifying chamber, a mask  
15 having communication with all three of said chambers whereby upon inhalation through the mask air may be drawn from the atmosphere through both said liquid containing and purifying chambers and exhalation may take place through the mask into said rebreathing chamber, means  
20 in said liquid chamber for causing air drawn therethrough to be saturated with the liquid contained in the chamber, and means for controlling the communication between the liquid chamber and mask. 25

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