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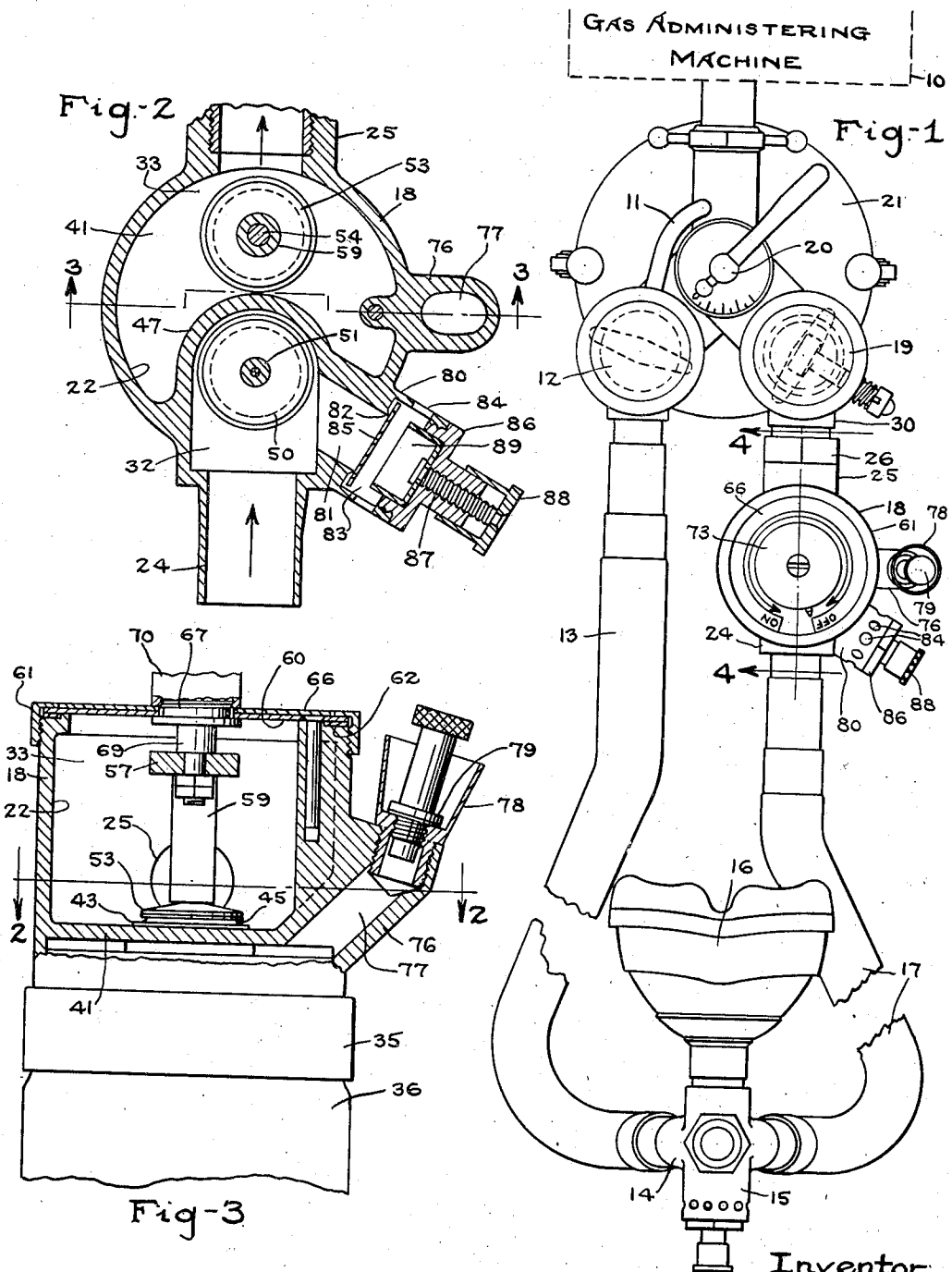
J. A. HEIDBRINK

2,136,245

ETHER VAPORIZER

Filed Aug. 23, 1935

3 Sheets-Sheet 1



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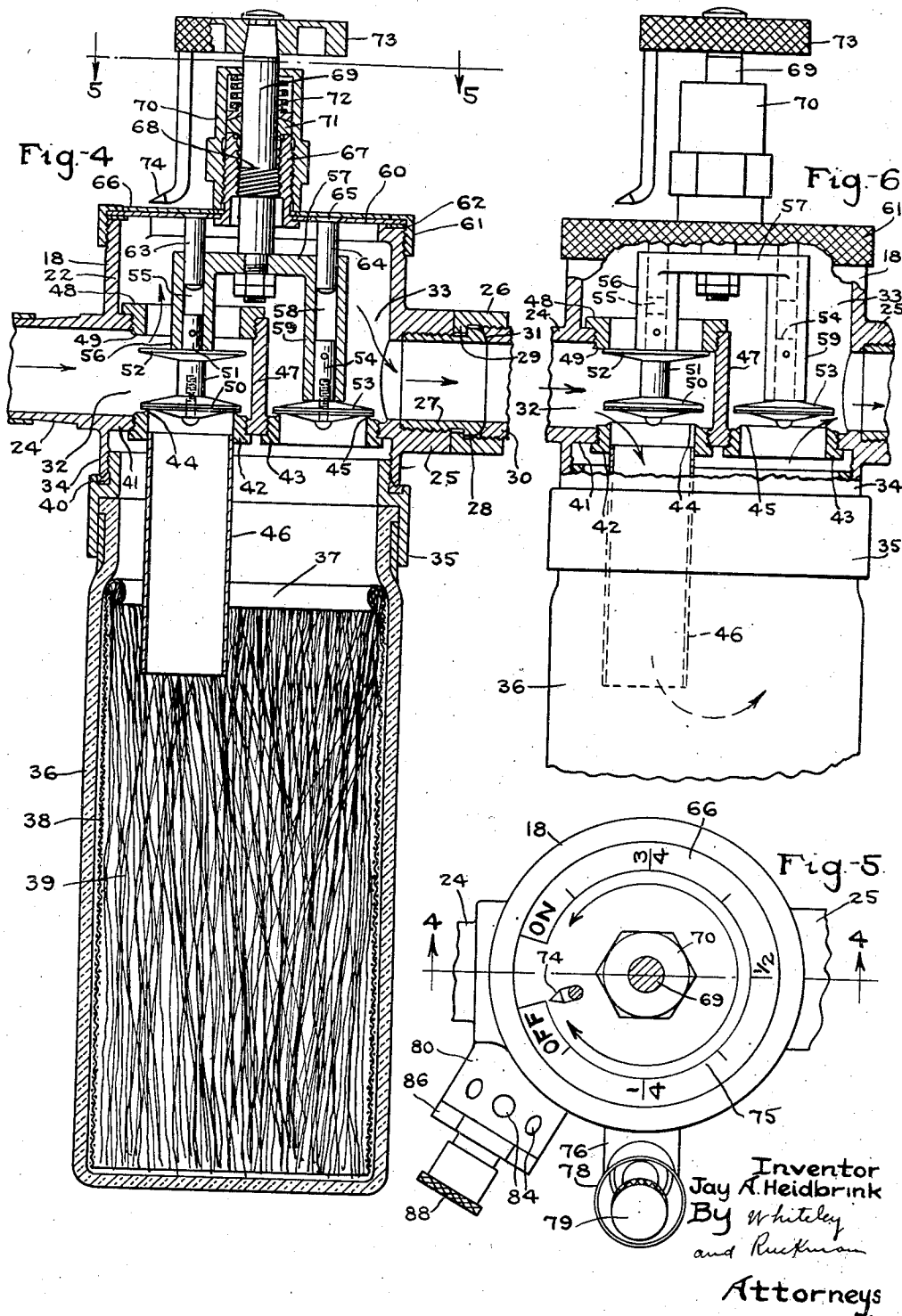
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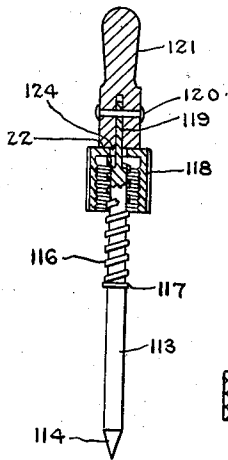


Fig-9

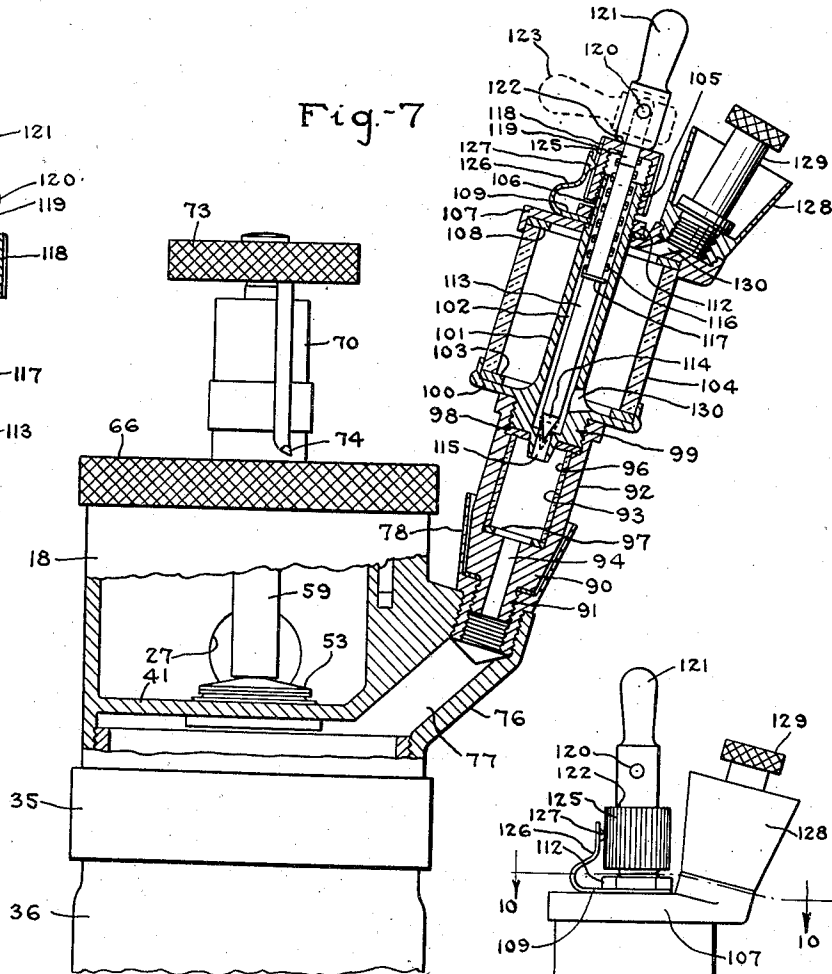


Fig-7

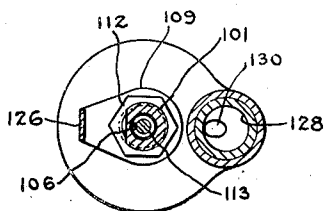


Fig-10

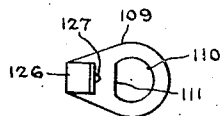


Fig-11

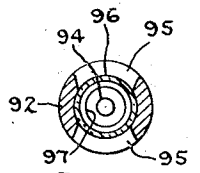


Fig-12

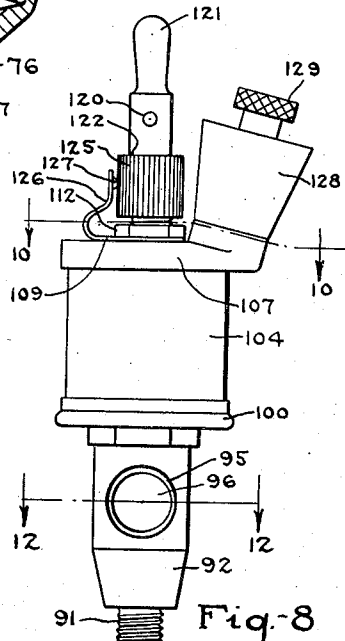


Fig-8

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UNITED STATES PATENT OFFICE

2,136,245

ETHER VAPORIZER

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Application August 23, 1935, Serial No. 37,499

6 Claims. (Cl. 128—203)

My invention relates to an ether vaporizer and has for its object to provide an ether vaporizer of novel construction preferably adapted to be used in conjunction with a gas-administering machine or such a gas-administering machine embodying an absorber of CO₂ gas.

It is an object of my invention to provide in the breathing line of a gas-administering machine, preferably on the exhalation side, an ether vaporizer having means for wholly excluding the ether therein from communication with the said breathing line.

It is a further object of my invention to provide an ether vaporizer adapted to be put in the breathing line, preferably the exhale side thereof, with means for causing all of the gases moving in said breathing line, specifically the exhaled gases, to pass through the ether vaporizer before going through the absorber and thence to the inlet side of the breathing line.

It is a further object of my invention to provide an ether vaporizer adapted to be put in the breathing line, preferably in the exhale side thereof, with valve mechanism such that a desired and predetermined part of the gases passing through the breathing line, specifically the exhaled gases, shall go through the ether vaporizer and the remainder thereof shall follow the direct course through the breathing line on the exhale side thereof.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and their novel features are particularly pointed out in the claims.

In the drawings, illustrating an application of my invention in one form,—

Fig. 1 is a plan view of a gas-administering machine having my ether vaporizer positioned on the exhale side thereof. Fig. 2 is a transverse section through the ether vaporizer in the position of line 2—2 of Fig. 3. Fig. 3 is a vertical section through part of the ether vaporizer on line 3—3 of Fig. 2. Fig. 4 is a sectional elevation view on line 4—4 of Figs. 1 and 5. Fig. 5 is a sectional plan view taken on line 5—5 of Fig. 4. Fig. 6 is a sectional elevation view of a portion of what is shown in Fig. 4 with the valve members in a different position. Fig. 7 is a sectional elevation view similar to Fig. 3 and taken on line 3—3 of Fig. 2 but with some parts not in section, and showing an addition to what is shown in Fig. 3. Fig. 8 is an elevation view of the addition above referred to. Fig. 9 is a detached part sectional view of the central control member shown in Figs. 7 and 8. Fig. 10 is a sectional plan view taken

on line 10—10 of Fig. 8. Fig. 11 is a detail view of an element of the control device shown in Figs. 7, 8 and 10. Fig. 12 is a sectional view on line 12—12 of Fig. 8.

As illustrated in Fig. 1, a gas-administering machine 10 of well-known construction provides a stream of gas mixture which passes through a conduit 11 into valve chamber 12 communicating with the gas-delivery tubing on the inlet side 13 of the breathing line. Tubing 13 connects at 14 with respirator valve mechanism 15 of well-known construction leading to the respirator 16 for delivering gas through tube 13 from valve chamber 12, which gas may comprise in addition to the mixture of fresh gases going from 11, rebreathed gases from a rebreathing bag of ordinary construction not shown. From the respirator the exhaled gases pass through the respirator valve mechanism 15 to tubing 17 of the outlet or exhale side of the breathing line. An ether vaporizer 18 is preferably positioned in the exhale part 17 of the breathing line as indicated in Fig. 1, through which, either directly out of contact with the ether therein or contacting and picking up ether vapor, as may be desired, the exhaled gases pass through valve chamber 19, and, controlled by valve 20, through absorber 21 to a rebreathing bag not shown and thence to inlet valve chamber 12, all as shown and described in my copending application Serial Number 735,803.

The ether vaporizer 18 comprises a casing 22 which embodies an inlet nipple 24 and an outlet nipple 25. The inlet nipple 24 is secured to the exhale tubing 17 of the breathing line while the outlet nipple 25 is secured to valve casing 19 in the exhale side of the breathing line in the following manner, see Fig. 4: A lock nut 26 is rotatably held upon the end of nipple extension 27 by means of an externally-threaded retainer nut 27 threaded into the interior of extension 25 and engaging with an outwardly-extending flange 28 thereon an inwardly-extending annular flange 29 on the lock nut 26. The lock nut 26 in turn is interiorly threaded upon an extension 30 of valve casing 19. This extension and the connector nut 27 have milled surfaces 31 such that by means of the lock nut 26 the vaporizer casing 22 and parts carried thereby may be secured in gas-tight relation to the extension 30 of valve casing 19. The interior of nipple 24 leads into an inlet valve chamber 32, and the interior of outlet tube extension 25 leads into an outlet valve chamber 33. To an interiorly-threaded annular extension 34 of casing 22 is secured by means of an exteriorly-threaded securing and packing nut 35 an ether jar

36, which may be of any suitable material, such, for example, as a transparent material such as glass, and which contains a holder ring 37 embodying a reticulate cover 38 and an evaporator 39, which may be composed of a multiplicity of strands of good capillary absorbing material such as long fiber cotton or linen cords. A packing ring 40 between the preferably sharpened edge of extension 34 and securing nut 35 makes the union of the ether container 36 and the interior of casting 22 gas-tight.

Opening through the bottom wall 41 of casting 22 are circular apertures having threaded thereinto valve rings 42 and 43 which are provided with valve seats 44 and 45, as clearly shown in Figs. 3 and 4. An extension tube 46 prolongs the passageway through valve ring 42 into ether container 36 and within the evaporator cords 39 to a desired extent. A semi-circular partition 47, best shown in Fig. 2, closes the chamber 32 from the chamber 33 except for the opening through valve ring 48 provided with valve seat 49. A valve disc 50 on valve stem 51 cooperates with valve seat 44, and a valve disc 52 on the same valve stem 51 co-operates with valve seat 49. Similarly, a valve disc 53 on valve stem 54, in the same plane as valve disc 50, is adapted to cooperate with valve seat 45. The valve discs 50 and 52 are in inlet chamber 32, and the valve disc 53 is in outlet chamber 33. Valve stem 51 is secured within a guide hole 55 in one arm 56 of a U-piece support 57, and valve stem 54 is secured within the guide hole 58 of a second arm 59 of said U-piece 57.

Chamber 33 within casting 22 is closed by a top plate 60 held in closing position by ring nut 61 which engages a washer 62 to render the connection gas-tight. Guide pins 63 and 64 are secured to top plate 60 in any desired manner, as by integral casting therein, or, as shown, by having countersunk heads 65 held to said plate by a clamping disc 66. The top plate 60 has a central aperture in which is seated a hollow extension member 67 interiorly and exteriorly threaded into the interior threads as indicated. At 68 is a valve stem 69 which is revolvably secured to U-piece 57. Threaded upon the outer threads of extension 67 is a packing nut 70 which engages a packing washer 71 through a compression spring 72 to render the revolvable valve stem gas-tight in position. Upon the top of valve stem 69 is secured a knurled hand disc 73 which carries a pointer 74 adapted to cooperate with a scale 75, Fig. 5, on the plate 66, which scale shows the fully "off" and "on" positions of the valves, and various intermediate positions, as "1/4", "1/2", "3/4" and the like. The casting 22, see particularly Fig. 3, is provided with an extension 76 formed with a channel or passageway 77 which leads through the bottom member 41 of casting 22 to discharge within the ether container. A filler funnel 78 is secured thereto with a removable cap 79 adapted to open the bottom of the funnel 78 to the passageway 77 whereby fresh supplies of ether may be conveniently supplied to the inside of the ether container.

Under some circumstances, it may be desirable to permit escape of exhalation at the ether vaporizer before going through the same instead of at the respirator in which case a respirator without an exhalation escape valve may be employed. To accomplish this, I form on the casting 22 an extension 80 connected through passageway 81 with chamber 82, the extension 80 having a chambered portion 83 which opens to atmosphere

through apertures 34. The passageway 81 is provided with a valve seat 82 which will be closed upon the negative pressure of inhalation by a valve disc 85. A cap 86 is secured inside of the extension 80 and has therein a screw member 37 which may be operated by a finger piece 88 to cause a clamp cup 89 to engage valve disc 85, and hold it closed, in that way rendering the exhalation escape mechanism inoperative, but available at any time the operating anaesthetist may think appropriate to be opened to permit exhalation escape at this point and relieve pressure.

In the modification shown in Figs. 7 to 12 inclusive, I may provide an efficient ether delivering construction in place of the removable cap 79. A closure casting 90 embodying a shank 91 is threaded into the base of the funnel member 78 in the same manner as the closure cap 79. The member 90 is formed with a cylindrical extension 92 and a cylindrical chamber 93, there being a bore or passageway 94 from chamber 93 to the passageway 77 through extension 76. As best shown in Figs. 8 and 12, the extension 92 is provided with openings 95 on opposite sides to a section of glass tubing 96 which is held seated at its lower end against a washer 97 and at its upper end against a washer 98 by a cup casting having a boss 99 threaded into extension 92, as clearly shown in Fig. 7. The cup casting comprises a lower disc base 100 and a central tubular extension 101 formed with an inner cylindrical channel 102. Upon the base 100 and resting upon a packing ring 103 thereon, is a glass cylinder 104. The upper end of the tubular extension 101 is threaded as indicated at 105 and is formed with a flattened side at 106, see Fig. 10. A flanged cap 107 rests upon a washer 108 over the upper edge of glass cylinder 104. A spring plate 109 is formed with an aperture 110 having a flat side 111 as clearly shown in Fig. 11, and this spring plate closely surrounds the tubular member 101 and the flat face 106 thereon and rests upon the outer face of the cap 107. The assemblage is firmly held together by a nut 112 threaded on to the threaded portion 106 of the extension 101. Within the channel 102 is the stem 113 of a needle valve 114 adapted to seat in a cylindrical opening 115 formed in a depending extension of the boss 99. The needle valve 114 is normally held in closing position by means of a strong compression spring 116 engaging between the flange 117 on the stem 113 and the top of an interiorly-threaded screw cap 118 which is screwed on the threaded portion 106 of the extension 110.

The stem 113 is continued at its upper end in a flattened bar 119 to which is pivoted at 120 a rocking cam handle 121 having a cam face 122 held, when in the erect position of Figs. 7 and 9 for feeding ether, against the outside surface of the top screw cap 118 by spring 116, which is the operative position for administering ether by this arrangement. When the handle 121 is shifted to the dotted-line position indicated at 123 in Fig. 7 that will release the stem 113 to be actuated by spring 116 to close needle valve 114 which is the inoperative position when ether is not being administered. It will be noted on Fig. 9 that the flattened bar 119 of stem 113 passes through an aperture 124 in the top of screw cap 118 and leaves a space therein on each side of said aperture which permits escape of air or gas which might otherwise be trapped in the channel 75

102 and render the construction inoperative or difficult of operation.

The outer wall of the screw cap 118 is formed with a multiplicity of longitudinal grooves 125 as best shown in Figs. 7, 8 and 9. A spring finger 126 formed as a part of plate 109 has a detent 127 adapted to take into the grooves 125 of screw cap 118 and hold it in adjusted position. By turning the screw 118 in one direction or the other it will be obvious that a greater or less degree of opening of needle valve 118 will be effected when the handle 121 rocks the cam face 124 to the operative position of Fig. 7. A filling cup 128 closed by a screw plug 129 admits ether through aperture 130 to the chamber within cylinder 104.

In use the above-described modification provides means whereby the proper amount of ether for administering a given anaesthetic may be placed in the ether container within the cylinder 104. This ether so positioned will pass through aperture 130 in the member 99 to the channel 102 and thence past the needle valve 114 for delivery through the opening 94 and passageway 77 to the inside of the ether vaporizing chamber 36. By adjusting the needle valve by the means provided a dropping of ether may be effected which will provide vaporization in the container 36 at just the rate of consumption. In this way overproduction and waste of ether vapor is prevented, the operation of administering the anaesthetic is rendered more certain and a generally improved technique results, while at the same time there are no supplies of liquid ether left in the jar 36 to gradually dissipate while the apparatus is not in use. Sight openings enable the anaesthetist to observe operation.

The mode of operation and the advantages of the valve mechanism for controlling flow of exhaled gases are as follows: When the valve discs 50 and 53 are in the position of Figs. 3 and 4, that is when the pointer 74 is in the "off" position, as in Fig. 5, the ether container is entirely cut off from the breathing line and the exhalation of the patient goes to the absorber and the rebreathing bag as it would if there were no ether vaporizer in the system, and no ether vapor can get into the breathing line. On the other hand, when the valves are in the position of Fig. 6 all of the exhalations must pass down into the ether container through the extension 46 into chamber 33 and from there to the absorber and rebreathing bag. Movements of the triple valve structure are synchronized and rendered uniform by reason of the fact that the guide pins 63 and 64 extend into the guide holes 55 and 58 within the U-piece extensions 56 and 59 whereby operation of the hand wheel 73 moves these valves uniformly from one position to the other.

It may be desirable to permit some ether to be mixed with the exhaled gases, or, stated in another way, to permit some but not all of said exhaled gases, in varying proportions, to pass through the ether container. This is accomplished by moving the valves to various intermediate positions as indicated by pointer 74 on the scale 75 whereby more or less of the exhaled gases will pass through the ether container and more or less ether vapor be taken into the breathing line, as the anaesthetist may determine will best meet the conditions of anaesthesia or analgesia which are required. A chief advantage of this construction is that the valve mechanism positively closes all possible communication of the breathing line with the ether jar and is trouble-free, requiring no attention, whereas the form of

plug-valve closures heretofore employed has permitted such leakage and has required oiling and otherwise being given frequent attention to prevent leakage and sticking since ether vapor quickly dissolves and removes the oil or lubricant.

I claim:

1. In an anaesthetizing apparatus, an ether vaporizer in the breathing line, a valve chamber in the vaporizer formed with inlet and outlet compartments, an ether container, a U-piece in the outlet compartment formed with a pair of hollow valve stems, pins relatively movable in said stems for guiding the U-piece, passageways from each compartment under the respective stems leading into the ether container, and valve discs on the stems adapted to close and open said passageways.

2. In anaesthetizing apparatus, an ether vaporizer in the breathing line formed with inlet and outlet chambers having a port connecting them, an ether container provided with ports to said respective chambers, each having valve seats, a plunger valve in each chamber adapted to cooperate with the valve seat of said last-named ports, and means to move said plunger valves simultaneously away from and toward said seats, whereby more or less or all or none of the gases in the breathing line will be caused to pass into and out of the ether container.

3. In anaesthetizing apparatus, an ether vaporizer in the breathing line formed with inlet and outlet chambers having a port connecting them, an ether container provided with ports to said respective chambers, each having valve seats, a plunger valve in each chamber adapted to cooperate with the valve seat of said last-named ports, means to guide said plunger valves for parallel right-line movements, and means to move said plunger valve simultaneously away from and toward said seats whereby more or less or none of the gases in the breathing line will be caused to pass into and out of the ether container.

4. In anaesthetizing apparatus, an ether vaporizer in the breathing line formed with inlet and outlet chambers having a port connecting them and a valve seat about said port, an ether container provided with ports to said respective chambers each having valve seats, a plunger valve in each chamber adapted to cooperate with the valve seat of said last-named ports, a plunger valve in one of said chambers adapted to cooperate with the valve seat of the first-named port, and means to move said plunger valves simultaneously away from and toward said seats, whereby more or less or all or none of the gases in the breathing line will be caused to pass into and out of the ether container.

5. In anesthetizing apparatus means for delivering a mixture of gases to the patient including a closed breathing line, a vaporizer chamber in and adapted to form a part of said closed breathing line embodying a cylindrical vertically-disposed layer of capillary absorbing material, an ether dispenser comprising means for holding only the proper amount of ether for a normal anesthesia, means controlling release of ether from said dispenser and movement thereafter such that the ether will move by gravity to all of the upper portion of said cylinder of absorbing material and thence through the body thereof only as fast as vaporized and without accumulating any free layer of liquid ether, and means for causing breathed gas in said closed breathing line to go through said vaporizer

chamber within said cylinder of absorbing material.

6. In anesthetizing apparatus means for delivering a mixture of gases to the patient including a closed breathing line, an ether vaporizer in the breathing line including a vaporizer chamber and a cylinder of absorbent material therein, an ether dispenser comprising means for holding the proper amount of ether for a normal anesthesia, means controlling release of

ether from said dispenser and movement thereof such that the ether will drip out of the dispenser and will thereafter move by gravity to all of said cylinder of absorbent material only as fast as vaporized without accumulating any free layer of liquid ether, means for permitting observation of the dripping operation, and means for causing breathed gas moving through said closed circuit to go through the vaporizer chamber.

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