June 21, 1938. J. A. HEIDBRINK 2,121,196

ANESTHETIZING APPARATUS

Filed July 18, 1934 5 Sheets-Sheet 1

GAS ADMINISTERING MACHINE

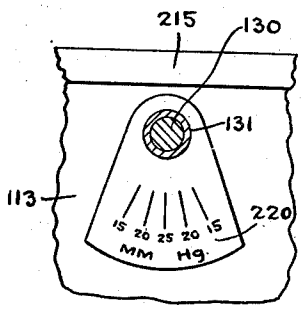


Fig.-5b

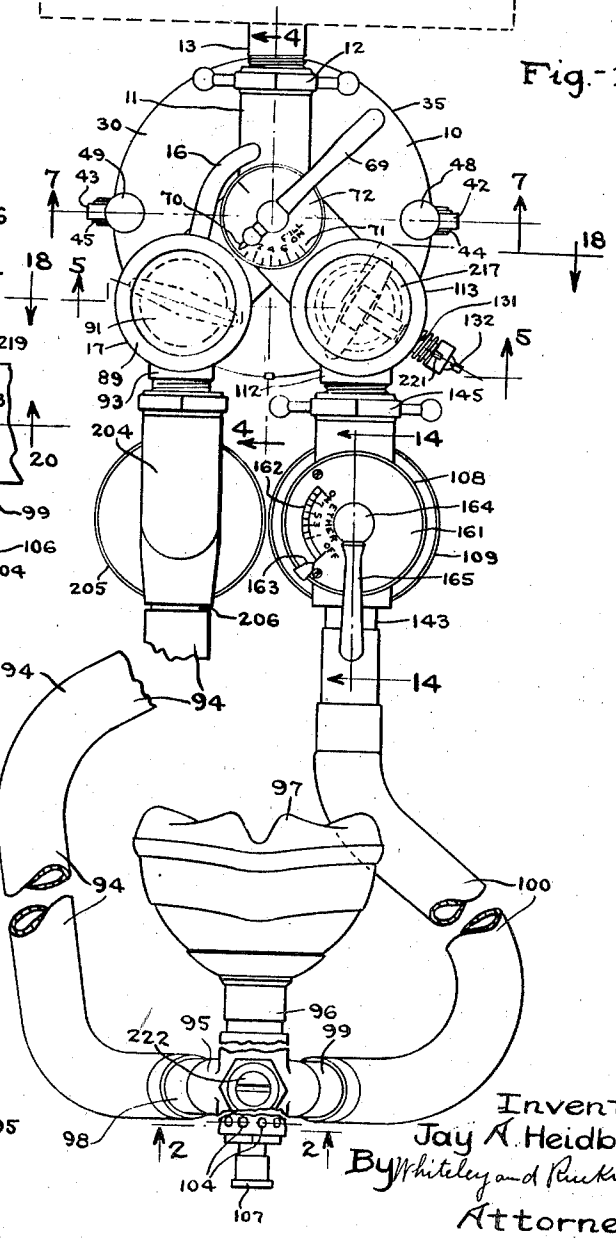


Fig.-1

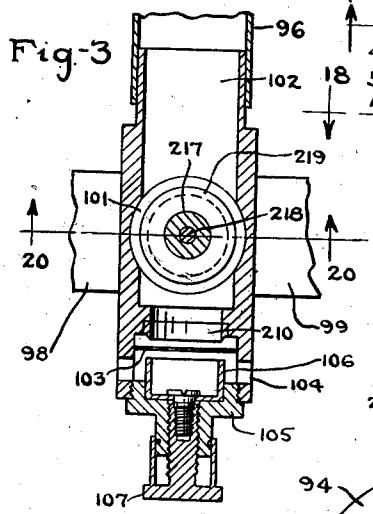


Fig.-3

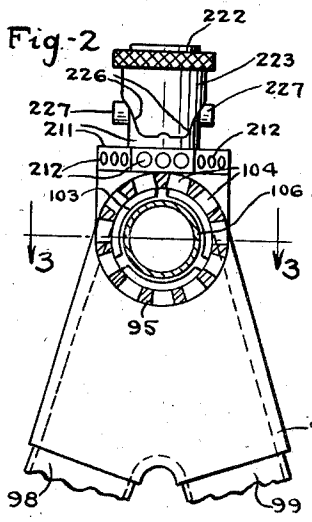


Fig.-2

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ANESTHETIZING APPARATUS

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Fig.-4

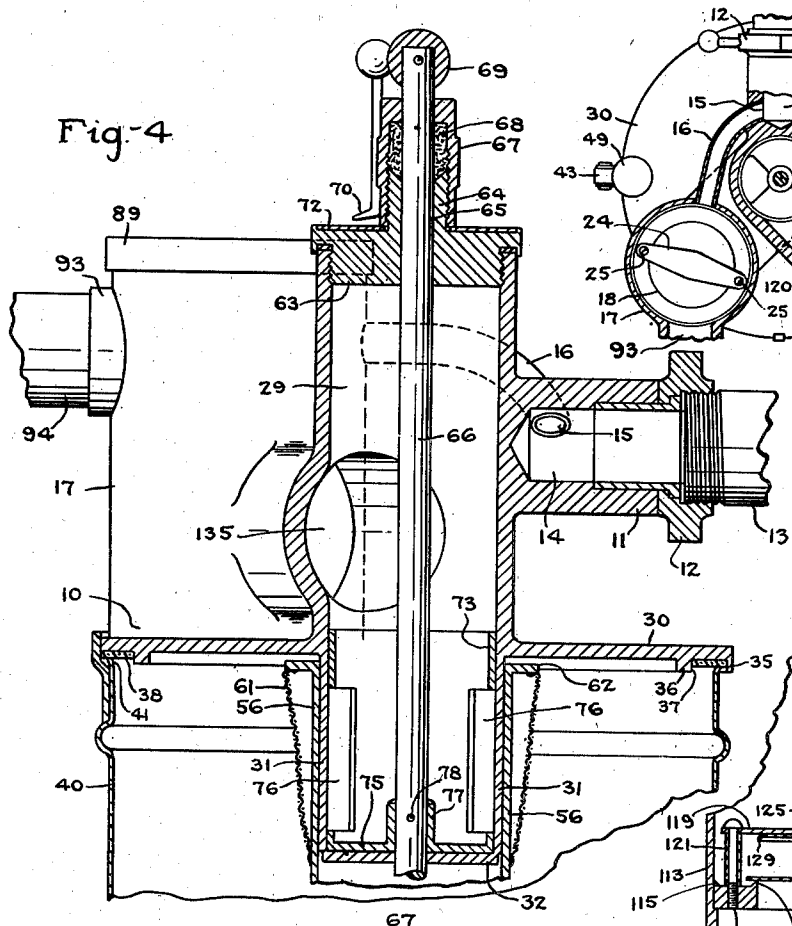


Fig.-6

Fig.-5a

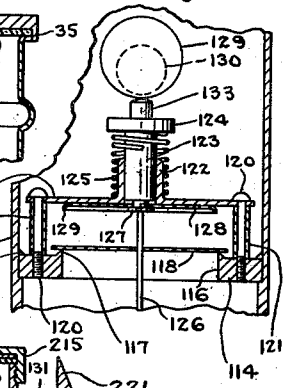
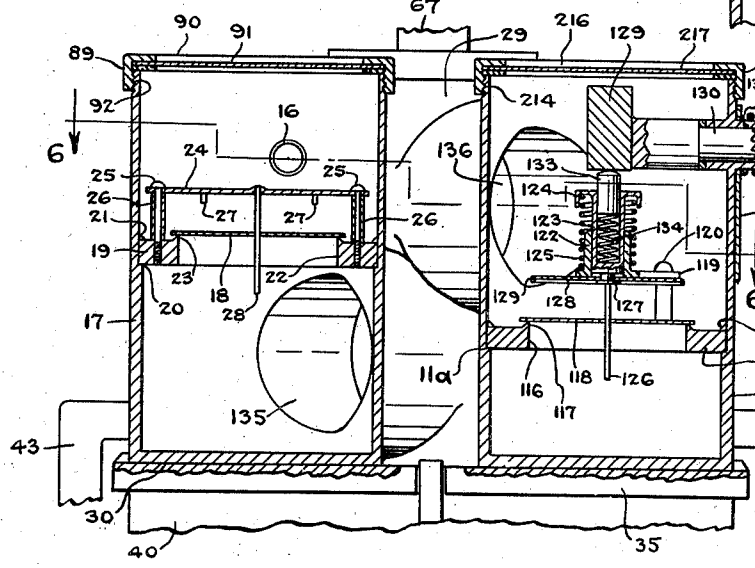


Fig.-5



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ANESTHETIZING APPARATUS

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Fig-7

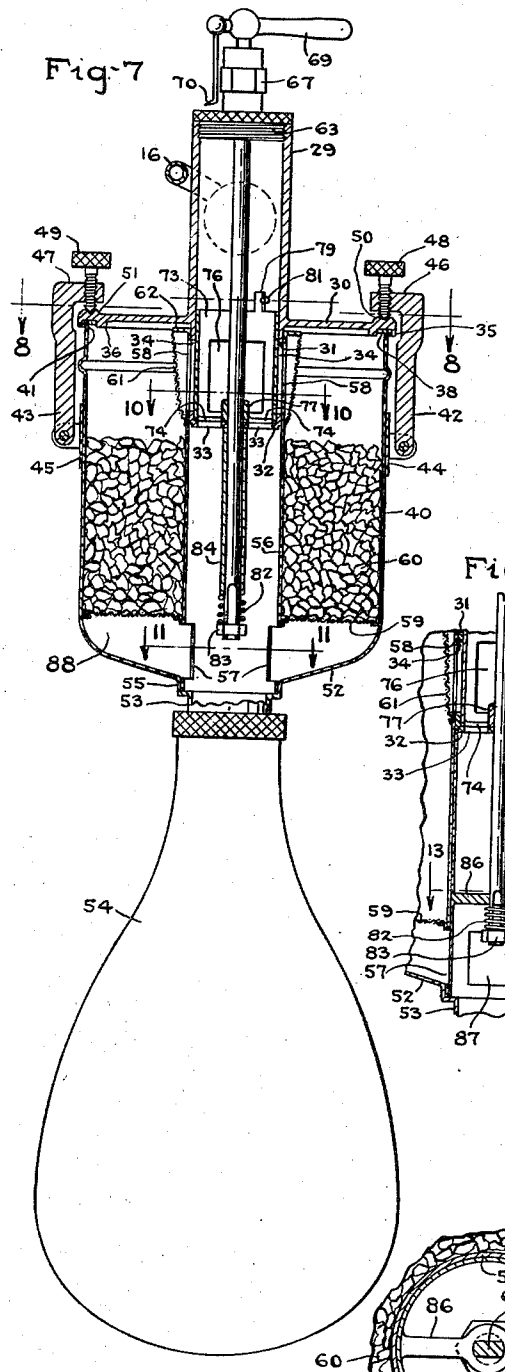


Fig-8

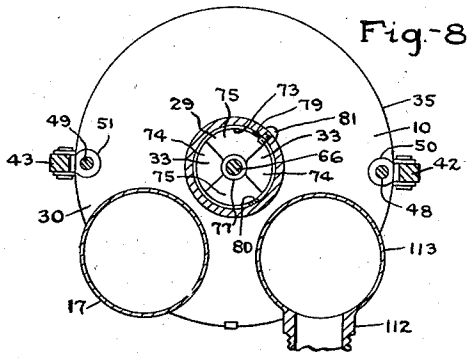


Fig-9

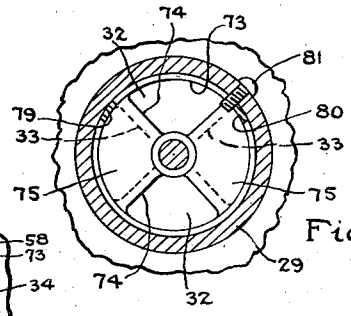


Fig-12

Fig-10

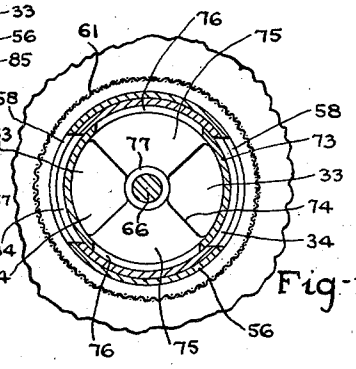


Fig-11

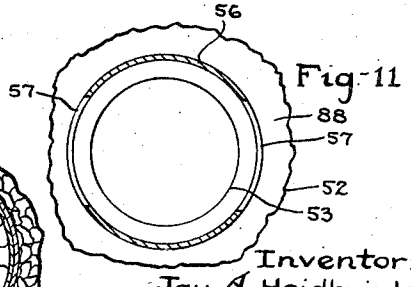
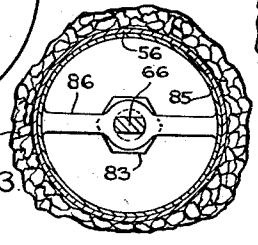


Fig-13



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ANESTHETIZING APPARATUS

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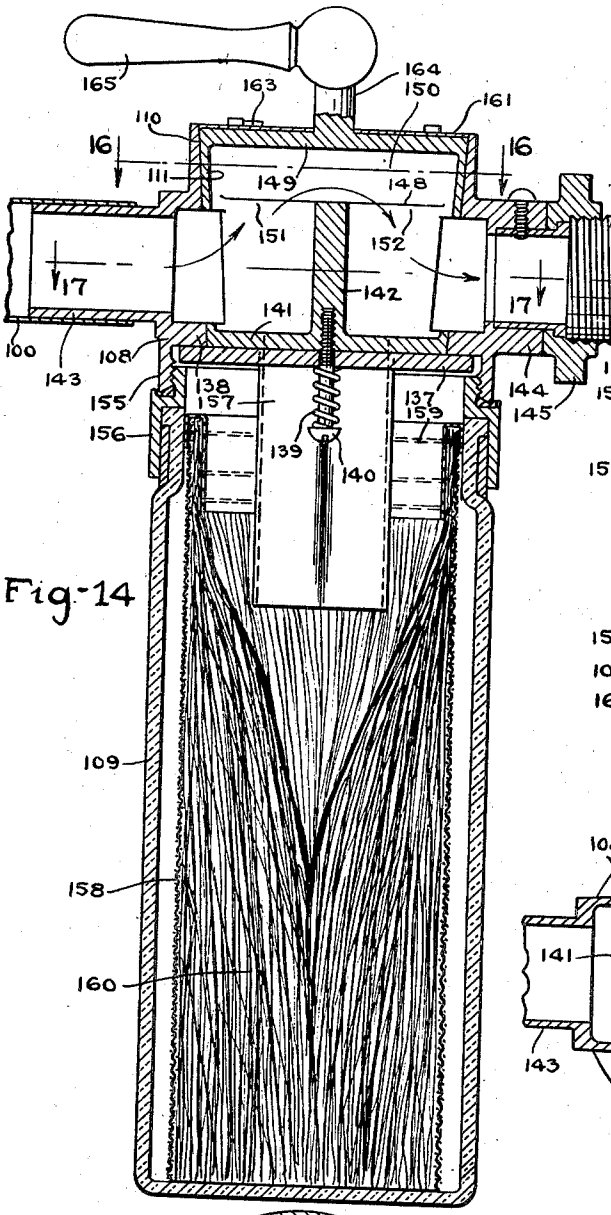


Fig-14

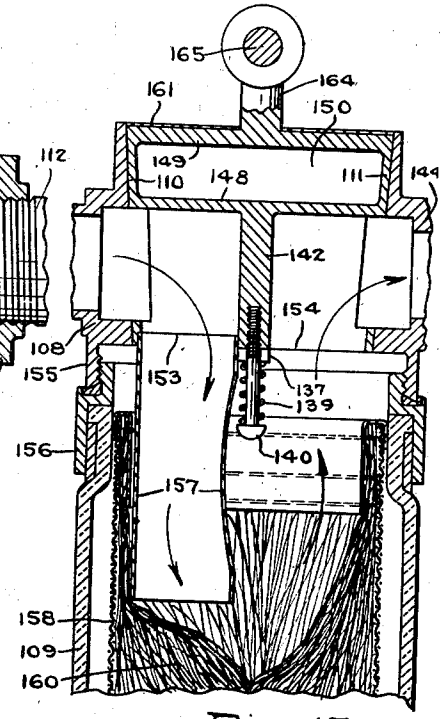


Fig-15

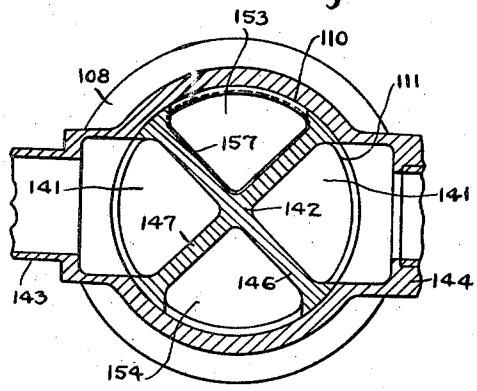


Fig-17

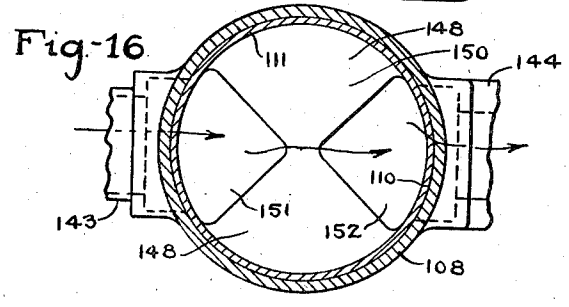


Fig-16

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ANESTHETIZING APPARATUS

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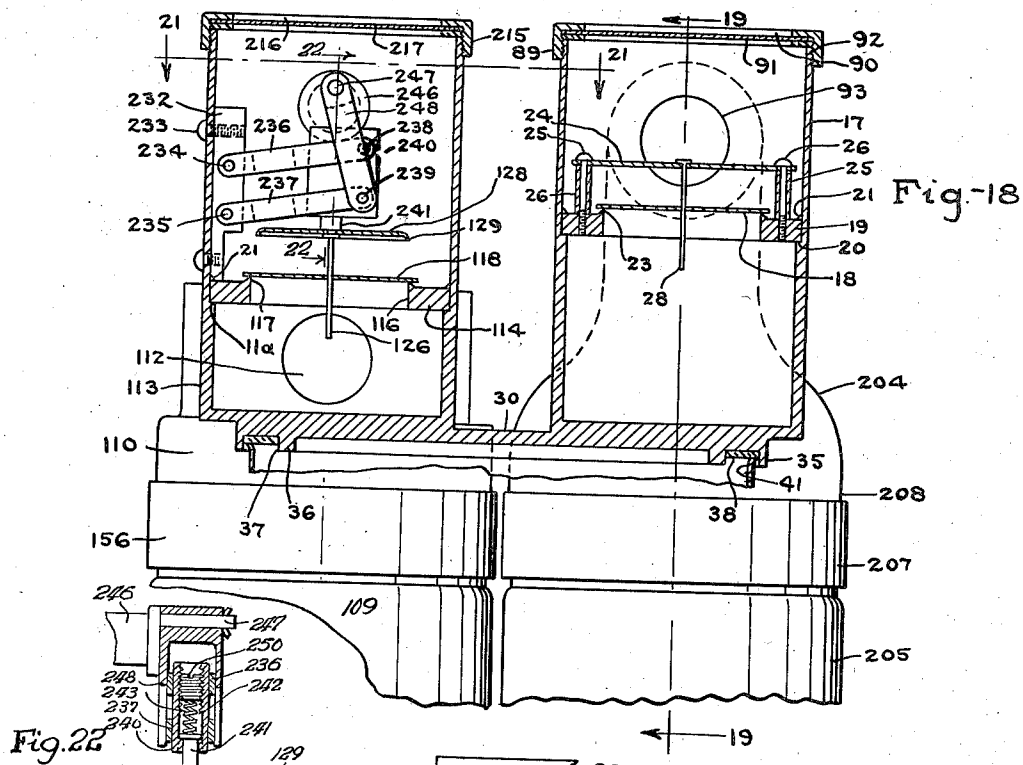


Fig-18

Fig-22

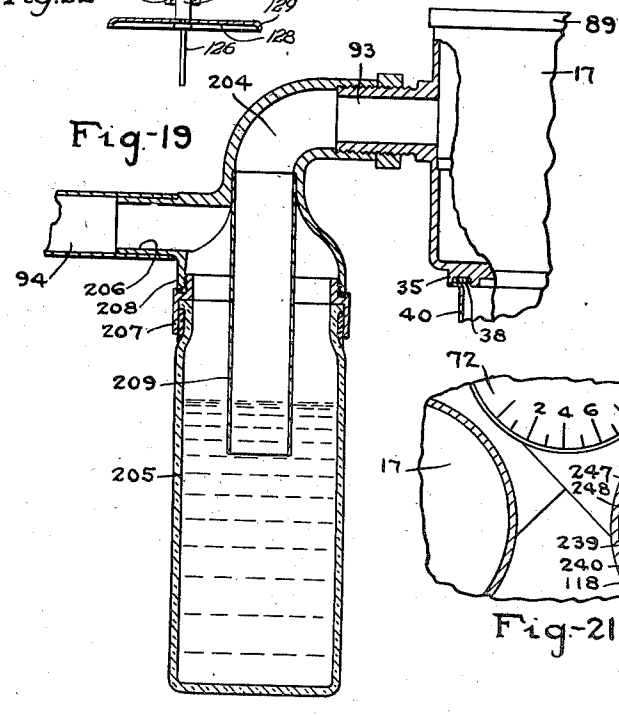


Fig-19

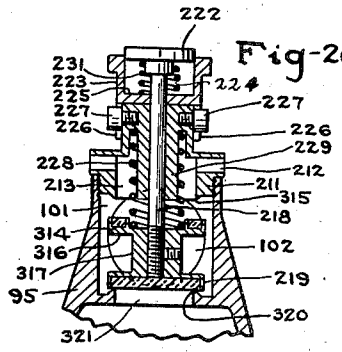


Fig-20

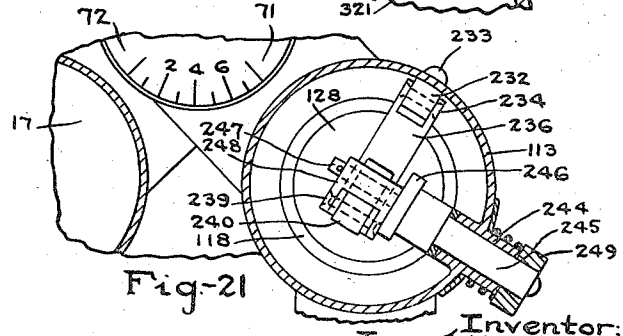


Fig-21

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Patented June 21, 1938 2,121,196

UNITED STATES PATENT OFFICE

2,121,196

ANESTHETIZING APPARATUS

Jay A. Heidbrink, Minneapolis, Minn., assignor to The Ohio Chemical and Manufacturing Company, Cleveland, Ohio

Application July 18, 1934, Serial No. 735,803

15 Claims. (Cl. 128—203)

My invention relates to anesthetizing apparatus, and has for its object to provide apparatus for delivering to patients a gas, or gases, in predetermined mixtures, which will act upon the patient to produce a desired state of anesthesia or analgesia. It is a particular object of my invention to provide such apparatus with rebreathing means such that as the gas is exhaled and inhaled it may selectively be caused to pass through material capable of absorbing out carbon dioxide, such as soda lime, or pass to and from the rebreathing bag directly without going through such an absorber. It is a further object of my invention to provide in conjunction with such rebreathing and absorber mechanism, means for delivering to the patient continuously a predetermined amount of a gas, or of a mixture of gases in suitable proportions, whereby the gas breathed and rebreathed by the patient will be maintained with a predetermined and suitable amount of the anesthetizing agent therein.

It is a further object of my invention to provide in conjunction with the rebreathing and absorber mechanism an ether vaporizer mounted upon the exhaling tube between the inhaler at the mouth or nose of the patient and the absorber, together with means for connecting or disconnecting the ether vaporizer in the breathing line of the exhaling tube as desired, whereby if ether is supplied an admixture in the gases will take place during the exhaling action and before the gas has passed through the absorber. In this manner the heat of exhalation is utilized in vaporization of the ether and the ether-charged gases are further warmed by the released heat of absorption in the absorber and are thoroughly and completely mixed with the body of gas drawn from the rebreathing bag through the absorber before passing into the lungs of the patient.

The absorption of carbon dioxide from the gas mixture exhaled by the patient not only permits a great saving in the use of expensive anesthetizing gases, but in the continuous rebreathing of such of the gas as goes through the lungs there are advantages to the patient probably derived from the uniformity of gas mixture going into the lungs both as regards the mixture of the component parts and as regards physical characteristics such as temperature and moisture content, and this produces better conditions of anesthesia and a more favorable recovery from it by the patient. Under certain conditions, however, more or less carbon dioxide advantageously may be rebreathed, and it is a further object of my invention to provide means for regulating and determining the extent to which the exhaled gases shall go through the absorber from none at all to all of them, and in that manner to regulate and determine the degree of absorption of carbon dioxide from substantially zero to substantially 100 per cent.

It is a further object of my invention to provide a continuous breathing circuit with an absorber in said circuit and means in association with the circuit whereby the gas is moved through the absorber both on inhalation and on exhalation. It is a further object of my invention to provide a continuous breathing circuit closed to atmosphere including an inhaler and with means in the inhaler whereby the closed circuit can be shut off and the circuit opened to breathe air.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and its 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 top plan view of the invention shown as applied to a gas administering machine, which may be of any well-known form, and which is indicated diagrammatically. Fig. 2 is a sectional detail taken on line 2—2 of Fig. 1, somewhat enlarged. Fig. 3 is a sectional view taken on line 3—3 of Fig. 2. Fig. 4 is a sectional elevation view taken on line 4—4 of Fig. 1 viewed in the direction of the arrows and somewhat enlarged. Fig. 5 is a sectional view taken on line 5—5 of Fig. 1 viewed in the direction of the arrows and somewhat enlarged. Fig. 5*a* is a fragmentary sectional view on line 5*a*—5*a* of Fig. 6. Fig. 5*b* is a part sectional fragmentary view taken on line 5*b*—5*b* of Fig. 5. Fig. 6 is a sectional plan taken on line 6—6 of Fig. 5 and reduced to the scale of Fig. 1. Fig. 7 is a sectional elevation view taken on line 7—7 of Fig. 1 viewed in the direction of the arrows. Fig. 8 is a sectional plan view taken on line 8—8 of Fig. 7 viewed in the direction of the arrows. Fig. 9 is an enlarged sectional view of the central valve part shown in Fig. 8 with the valve turned 90 degrees from the position of the valve in Fig. 8. Fig. 10 is a somewhat enlarged sectional plan view of the absorber valve taken on line 10—10 of Fig. 7. Fig. 11 is a similar sectional view taken on line 11—11 of Fig. 7. Fig. 12 is a sectional elevation of the flow passage through the absorber chamber similar to what is shown in Fig. 7 with a modified valve construction. Fig. 13 is a sectional view on line 13—13 of Fig. 12. Fig. 14 is a sectional elevation of the ether vaporizer mounted on the exhaling tube and taken on the line 14—14 of Fig. 1. Fig. 15 is a section of part of what is shown in Fig. 14 with the valve at right angles to the position in Fig. 14. Fig. 16 is a sectional plan view taken on line 16—16 of Fig. 14. Fig. 17 is a sectional view taken on line 17—17 of Fig. 14. Fig. 18 is a sectional elevation view taken on line

18—18 of Fig. 1 viewed in the direction of the arrows. Fig. 19 is a sectional elevation view on line 19—19 of Fig. 18. Fig. 20 is a sectional elevation view on line 20—20 of Fig. 3. Fig. 21 is a sectional plan view taken on line 21—21 of Fig. 18. Fig. 22 is a sectional detail taken on line 22—22 of Fig. 18.

As clearly shown in Figs. 1 and 4, a casting 10 is provided with a tubular connector member 11 adapted to be removably secured by means of a wing nut 12 to the gas-delivery tube 13 of a gas administering machine indicated diagrammatically in Fig. 1, which may be any well-known form of machine for delivering a gas, or gases in suitable mixtures, to a patient, and the details of which are no part of the present invention. Within the member 11 is a passageway 14, Fig. 6, which connects through an opening 15 with a tube 16. This tube 16 in turn connects with a tubular chamber 17 formed as a part of casting 10 above a valve disc 18. This valve disc and its mounting is shown in detail in Fig. 5. A washer 19 rests upon a circumferential flange or ledge 20 and is secured in gastight position by means of solder 21. Surrounding the opening 22 formed through this washer is a milled annular sharp-edged lip 23 upon which the valve disc 18 rests. A stop bar 24 is held in position by screws 25 threaded into the washer 19 with spacer members 26 extending between the bar 24 and the upper surface of washer 19. Stop members 27 extend downward equal distances from stop bar 24, and a guide pin 28 fast on stop bar 24 extends through a central opening in valve disc 18. As clearly shown in Fig. 4, the tubular connector member 11 is formed as part of casting 10 in conjunction with a central tubular passageway 29 which extends centrally through a circular plate 30 and prolonged into a tubular valve chamber 31 below the plate 30, which valve chamber 31 is formed as an integral part of casting 10 and is provided with a bottom wall 32 formed with oppositely-disposed quadrant ports 33, and whose cylindrical walls are provided with oppositely-disposed rectangular ports 34, the ports 33 and 34 having their center lines in the same common planes, as clearly shown in Fig. 10.

The top plate 30 is provided with an outer flange 35 and an inner flange 36, Fig. 4, forming an annular groove 37 in which is seated a packing ring 38 of well-known construction. A container 40 of general cylindrical shape is adapted to engage, with its slightly outturned upper edge 41, the flange ring 38. Arms 42 and 43 are hingedly secured by means of plates 44 and 45 in diametrically-opposed position to the walls of the container 40. These arms embody offset portions 46 and 47 which have threaded therein thumb screws 48 and 49 adapted to engage seats 50 and 51 on the top of plate 30. By these means the container 40 can be removably secured in gastight relation upon the plate 30 of casting 10.

The bottom wall 52 of container 40 is preferably formed in a semi-spherical manner with a central tubular projection 53 to which is secured a gas rebreathing bag 54 of well-known construction as shown in Fig. 7. The bottom 52 is formed with an annular seat 55 in which is rigidly mounted an upstanding tube 56 formed with rectangular ports 57 on opposite sides of its lower portion. The tube 56 is also provided with ports 58 registering with the ports 34 in the tubular valve chamber 31 as clearly shown in Fig. 7. Immediately above the ports 57 is secured a reticulate wall 59 upon which rests the soda lime 60 or other absorbing material which fills the container 40 above the reticulate wall 59. A conical reticulate wall 61 surrounds the portion of tube 56 which embodies the ports 58 and is held spaced therefrom by an annular washer-like member 62.

The top of the tubular member 29 is closed by means of a threaded cap 63 provided with a threaded extension 64 and with a central bore 65 which forms the seat of a valve stem 66. Upon the threaded extension 64 is screwed a packing nut 67 which by means of packing 68 around valve stem 66 makes the bearing of said stem through the cap gastight. Upon the top of valve stem 66 is mounted a handle 69 from which depends a pointer 70 which cooperates with a scale 71 formed on a plate 72 on the top of cap 63. A valve cylinder 73 is formed in the shape of a cylindrical cup having valve ports 74 in its bottom wall 75, and valve ports 76 in its cylindrical side walls, said ports 74 and 76 respectively being in oppositely-disposed pairs with the center lines through them at right angles, as clearly shown in Figs. 4 and 10. The bottom wall 75 of the cup valve member 73 has secured thereto a cylindrical boss 77 through which extends the valve stem 66 which is keyed to said boss as indicated at 78 in Fig. 4. Upon the top of the cylindrical cup valve 73 are a pair of projecting stop members 79 and 80 adapted to engage a screw 81 projecting into the inside central passageway 29 as shown in Figs. 7 and 8, so as to limit the rotary movement of valve member 73 for maximum opening or closing of one or the other of the sets of valve ports 33—74 or 34—58—76, according to whether it is desired to have the exhaled and rebreathed gas to and from the rebreathing bag 54 pass directly thereto or through the absorbing material 60, or they may be opened and closed relatively predetermined amounts as indicated by the pointer 70 on the scale 71. The cup valve member 73 is held with its bottom wall 75 in firm engagement with the bottom wall 32 of the valve chamber 31 by means of a fairly strong spring 82 engaging between a nut 83 on the projected lower end of valve stem 66 and a sleeve 84 surrounding said valve stem.

The valve stem 66, sleeve 84 and connection above described are shown extended to a point toward the bottom of the tube 56 to adapt it to a modification which is sometimes desirable, and which is illustrated in Fig. 12. In this modification the cylindrical cup valve 73 is retained as in Fig. 7 and a central cylinder 85 is applied to its bottom wall 32. The sleeve 84 is omitted and the spring 82 takes between nut 83 and a crossbar 86 secured to cylinder extension 85. The lower part of said cylinder extension 85 is formed as a valve member having side ports 87 corresponding in position with the side ports 76 in the cup valve 73, so that when ports 76 are in open or delivery position, ports 87 will likewise open to the space 88 below the partition 59 and holding the absorbing material 60. But when the ports 76 are closed with ports 33, 74 open, the lower ports 87 will likewise be closed and gas exhaled into and breathed from the rebreathing bag 54 will be entirely cut off from any possible contact with the absorbing material in container 40 such as might possibly occur to an extremely limited extent, in the form of Fig. 7,

by passing out into the space 88 below the reticulate partition 59.

The passageway in 17 is closed by a cap 89 having a central opening 90 and by means of a transparent cover 91 held in position by the cap being threaded upon the member 17 as indicated at 92. As best shown in Figs. 4 and 18, an outlet 93 leads from the chamber or member 17 above valve disc 18, which, as clearly shown, is below said outlet 93 and fresh gas inlet 16. The outlet 93 is connected either directly with a tubing 94, or, in the form shown in Fig. 19, to said tubing 94 through an intermediate casting 204 which supports a humidifier jar 205 and from which a nipple 206 leads for connection with tubing 94. As clearly shown in Fig. 19 the jar 205 is secured to the connector casting 204 by means of a turn-nut 207 which screws into a threaded seat 208. Within the jar 205 is an extension tubing 209 which goes down into a wicking formed of separated strands of cord similar to that employed in the ether vaporizer hereinafter described. By this means, when desired, particularly when using explosive gases such as ethylene, water in the jar 205 will be taken up by the wicking and transferred to saturate the gas passing through to the patient's supply line 94, thus insuring against explosion. This humidifier arrangement is shown connected in the machine, but it will be obvious that the supply tubing 94 may be connected directly to the extension 93 as shown in Fig. 4, and this will be practically sufficient for many uses of the apparatus.

The tubing 94 leads to a union casting 95 which is connected at 96 with an inhaler 97. The casting 95 is provided with an extension 98 which connects with the inhaler tubing 94 and with a second extension 99 which connects with the exhaler tubing 100. Both these tubings lead into a chamber 101 which communicates on one side with a passageway 102 leading to the inhaler, as best shown in Fig. 3, and on the other side through a passageway 210 leading to an exhaling valve 105. A valve disc 103, Fig. 3, is adapted to fluctuate to permit exhaling through apertures 104, but may be closed by means of the stop cap 106 controlled by thumb nut 107 threaded into exhaling valve 105, whereby the flicker valve disc 103 may be restrained a greater or less degree or held completely inoperative to prevent any breathing to atmosphere, which is a condition usually employed when the absorber mechanism is in operation. Chamber 101 which is closed at the top by cap member 211, Fig. 20, is provided with a multiplicity of apertures 212 leading from atmosphere through a passageway 213 to chamber 101, as clearly shown in Fig. 20. The passageway 213 is adapted to be closed by engagement of rubber washer 314 with annular valve projection 315 surrounding opening 213, said washer being carried by a valve disc 316 on a member 317 carried by a valve stem 218. The member 317 carries another valve disc 219 which is adapted to engage with the annular lip 320 which surrounds an opening 321 leading to the chamber connected with the tube-connecting extensions 98 and 99. The valve stem 218 has on its outer end a screwhead 222 which is held within a cam cup 223 by means of a coiled compression spring 224 taking between the underside of screw 222 and a bottom wall 225 of cam cup 223. Cam cup 223 is formed with notches 226 on opposite sides of a portion extended outside of the floor 225, and which notches take on the sides of corresponding screws 227. A coil compression spring 228 engages between member 317 and a guide member 229 formed as part of cap 211, and which has an opening for receiving and guiding the valve stem 218. By turning the cam cup 223 in either direction the wing extensions 226 in engagement with the screw heads 227 will pull up on the valve stem 218, compressing springs 224 and 228 and bringing the valve washer 314 against the lip 315 so as to close passageway 213. In this position the inhaler operates in the usual way by inhaling through tube 94 and exhaling through tube 100. It is, however, frequently desirable to let the patient breathe air particularly before the beginning of administering an anesthetic. When this is desired the exhaling valve heretofore described is opened, the cam nut 223 is turned to let the springs 224 and 228 push the valve stem and the valve 219 in a position to seat against the valve lip 320, closing communication through opening 321 to the tubing 94 and 100 and opening communication through passage 213 to atmosphere. In this position, with the inhaler attached, the patient will breathe air comfortably, and the anesthetizing apparatus can be thrown into operation instantly by merely turning the cam piece 223.

From the inhaler 97 exhaled gas passes through the exhaling tube 100 to a casting 108 providing a support for an ether jar 109 and a valve chamber 110, and passes through the valve 111 in this chamber into a passageway within an extension 112 projecting from a vertically-extended cylindrical valve chamber 113 forming part of casting 10 as shown generally in Figs. 1 and 8 and more in detail in Fig. 14. Details of valve chamber 113 are shown in Figs. 5 and 5a. The valve chamber 113 has a threaded top 214 and a cap 215 adapted to be secured upon said threaded top 214, the cap 215 being formed with a central opening 216 closed by a transparent member 217. The valve construction there shown is similar to the valve construction heretofore described found in valve chamber 17. A washer 114 rests upon a circumferential flange or ledge 11a at a point materially lower than the flange 20 in valve chamber 17, and the washer 114 is secured in gastight position by means of solder 115. Surrounding a central opening 116 in the circumferential member 114 is a milled annular, sharp-edged lip 117 upon which rests a flicker valve disc 118. A bar 119 similar to bar 24 is held in position by screws 120 and sleeves 121. The bar 119 is provided with a tubular boss 122 (Fig. 5a) in which operates a hollow piston 123 formed with a flanged top 124 in which is seated a coil spring 125 which surrounds the tubular boss 122, as shown in Figs. 5 and 5a. A vertical guide pin 126 is secured to the piston member 123 and has thereon a flange portion 127 which embraces and secures to said piston member a disc 128 formed with a circumferential depending edge 129 adapted to engage the valve disc 118 and to hold it closed whenever it is desired to close off exhalation through valve chamber 113. To force the disc 128 into its valve-closing position a cam 129 is mounted on a stub shaft 130 journaled in a boss 131 formed in the side of the valve casing 113, said shaft 130 adapted to be rocked by means of hand lever 132 and the cam engaging a push button 133 mounted in the hollow piston 123 and projected therefrom by means of a spring 134, Fig. 5. The springs 125 and 134 project the disc 128

so that it engages the flicker valve 118 before the cam 129 is rocked into its maximum closing position, said additional rocking after engagement serving further to compress said springs, at which point the valve is held closed against pressures less than that of twenty-five millimeters of mercury; and as the cam is rocked in either direction a less pressure will serve to lift the flicker valve against the force of said springs. These pressures are indicated on a scale 220 in Fig. 5b with which a pointer 221 on rockshaft 130, projecting away from handle 132, is adapted to register, whereby desired varying degrees of pressure closing flicker valve 118 may be maintained.

Another form of device for accomplishing the same result in a somewhat different way is shown in Figs 18 (left-hand side) and 21. In this form, piece 232 is secured by screws 233 along an element of the cylindrical casing 113. Pivotally connected at 234 and 235 to said piece are fork links 236 and 237. The outer forks of said fork links are pivoted at 238 and 239 to the opposite sides of a vertical movable piece 240 which carries a depending plunger 241 journaled in a bore 242 in piece 240 and pressed outwardly therein by a compression spring 243. The plunger 241 has fast thereon the closure disc 128 heretofore described which also carries the guide stem 126. Journaled in a hollow boss 244 secured in the wall 113 (Fig. 21) is a shaft 245 which carries a crank disc 246. Journaled upon the crank disc 246 at 247 is a link 248 which in turn by the long pin 239 is pivotally connected with the piece 240. Upon the shaft 245 is a handle 249 by means of which shaft 245 and crank disc 246 are rotated. An adjusting screw 250 in the top of bore 242 determines the pressure of spring 243. When by means of handle 249 the crank disc 246 is rotated it will first bring the annular lip 129 against the valve disc 118 and will add pressure thereto through compression of spring 243 to a desired amount.

The purpose served by either form of the construction last above described is three-fold. First, it is a convenient means of shutting off flow of exhaled gases through the valve and to the re-breathing bag, whereby when desired the rebreathing bag may be evacuated into the air without removing the inhaler, it being only necessary to free the exhaling valve 103 from the inhaler. This is effected because when the movement of exhaled gases through valve 113 is blocked, the back pressure from exhalation on top of valve 124 will cause it to be held firmly closed and exhalation to take place to atmosphere.

Second, under certain conditions it may be desirable to inflate the lungs of the patient by direct pressure from the gas-administering machine. This is done either with mixtures or gases delivered from the machine as determined by the operator or with any one of the several gases such as oxygen, nitrous oxid or ethylene. As above stated the adjustment of the springs is such as to hold the valve closed against some selected maximum pressure, say twenty-five millimeters of mercury, which is generally regarded as a safe pressure for tolerance of lung tissues under all ordinary conditions. The mechanism permits of other adjustments, including all less pressures to meet extraordinary conditions.

Third, this arrangement for closing the flow of exhaled gases through valve 113 also permits employment of the apparatus in delivering mixtures to a patient without rebreathing if under some conditions that might be desirable.

The two valve casings 17 and 113 are connected with the central passageway 29 leading to the rebreathing bag, as clearly shown in Figs. 4, 5 and 6, said connections being formed directly in casting 10. The connection 135 between central passageway 29 and valve chamber 17 is below the inhaler passage 93 and below the valve 18, as clearly shown in Figs. 4 and 5. The connection 136 between the central passageway 29 and valve chamber 113 is above valve 118 and of course above the exhaler inlet 112 to said valve chamber 113.

The operation of this arrangement of passageways and valves is that when negative pressure is established in the inhaler 97 by means of inhalation, the effect of that negative pressure below valve 118 will be to hold said valve closed and above valve 18 to open said valve, whereby gas will be drawn through tubing 94, inlet connection 93 past valve disc 18 through opening 135 and central passageway 29, and from the rebreathing bag 54 either directly through central passageway 56 or indirectly through valve openings 57 and 76 after passing through the absorber material 60 in the absorber container 40. When the positive pressure from exhalation is produced in the inhaler 97 it will have the effect of closing flicker valve disc 18 and opening flicker valve disc 118 and exhaled gas will flow through exhaling tube 100, valve casing 108 (either through the ether chamber therein or directly as may be desired, as hereinafter pointed out), thence through passageway and connection 112 into valve casing 113, past flicker valve disc 118 and through passageway 136 to central passageway 29 and thence into the rebreathing bag 54 either directly through passageway 56 or through valve openings 76 and 57, going through the absorbing material 60 in absorber chamber 40.

Within the conical valve chamber 110 a conical valve 111 is held seated by means of a bar 137 held in engagement with an annular flange portion 138 by means of a compression spring 139 surrounding a screw 140 threaded into the base 141 and central web 142 of the valve 111. The casting 108 is provided with oppositely-disposed tubular extensions 143 and 144, one connected with tubing 100, and 144 by a union nut 145 by means of which connection is made to extension 112 from chamber 113 formed on casting 10. The passageways in extensions 143 and 144 lead into opposite sides of valve chamber 110 and are controlled by valve 111. As shown in Fig. 17 this valve is divided into four portions by the webs 146, 147 meeting in the junction part 142. These webs carry a top wall 148 spaced from the top wall of the valve 149 to form a passageway 150, as clearly shown in Fig. 15. The top wall 148 is provided with ports 151 and 152 as shown in Fig. 16, so when the valve is in the position of Fig. 16, exhaled gas will pass up through port 151 through passageway 150 down through port 152 and through passageway in 144 to the valve chamber 113. Similarly the base portion 141 of valve 111 is provided with ports 153 and 154 extending downwardly under the imperforate portions of the top 148 as shown in Figs. 15 and 17 and opening into the space within ring extension 155 into which the union nut 156 on ether jar 109 is threaded. The open top of the ether jar is thus exposed to the ports 153 and 154 and port 153 is provided with an extension 157

which reaches down a desired distance within the ether jar and within an evaporator comprising a reticulate cylindrical member **158**, a clamp at the top **159** and a multiplicity of cord wick members **160** within the reticulate cylinder **158**. When, therefore, the valve **111** is in the position shown in Fig. 15, exhaled gas will be forced down through extension **157** into and through the wicking **158** and thence will pass through port **154** to the passageway in extension **144** and to the valve chamber **113**.

The top member **149** of valve **111** is provided with a scale plate **161** provided with a scale **162** registering against a pointer **163**, Fig. 1. Fast on a central boss **164** and formed on valve top **149** is a handle **165** by which the valve **111** is operated as desired from the off-position shown in Figs. 1 and 14 to the on-position shown in Fig. 15, or to any intermediate position as indicated by the stationary pointer **163** on scale **162** movable with valve **111**.

With inhaler cam cup **223** set in the positions of Figs. 2 and 20 the inhaler mask **97** is applied to the face of the patient. In this form breathing is maintained directly to atmosphere through apertures **212**, since the valve members connected with cam cup **223** operate to close communication with the inhaler **97** through tubes **94** and **100**. The operator then opens the appropriate valves of the gas-administering machine to permit enough of the proper mixture or gas to flow through the system to fill it and to fill rebreathing bag **54**. At this point the cam cup **223** is turned to the position wherein the wing extensions **226** in engagement with the screw heads **227** will pull up on the valve stem **218** so as to bring the valve washer **314** against the lip **315** and thus close the passageway to atmosphere and open to the inhaler the passageways into tubes **94** and **100**. Breathing through the system is thus established, and the operator will adjust the gas-administering machine to deliver a stream of gas into the system equivalent to that consumed in the patient as oxygen and withdrawn in the absorber as CO_2 and what is waste.

Where the absorber is used the cup **106** will ordinarily be positioned to engage flicker valve **103** and prevent any exhalation to atmosphere. When the parts are in this position gas is drawn through the rebreathing bag and passageway **112** where above valve **118** it mixes with the gas supply from the gas-administering machine and then passes through either the humidifier **205**, if that is used, or directly, as may be desired, through tube **94** to the inhaler and lungs of the patient. Exhalation passes through tube **100** above, or to any extent desired through, the ether vaporizer **109** into the lower part of the valve chamber **113** and past valve **118** to and through the absorbing material **60** in the absorber and to the rebreathing bag. From there upon the next exhalation the gas will pass from the rebreathing bag through the absorber material **60** and back into the circuit as above described. In the event that it is desired to employ the machine without passing the gas through the absorbing material, the valves may be set by means of handle **69** to cut out the passageways to the absorbing material and the inhaler valve **103** will be opened to a desired extent to permit whatever degree of exhalation to atmosphere and of rebreathing may be desired.

The advantages of the above arrangement and of the entire organization heretofore described will be apparent. As to the ether vaporizer and its position on the exhaling side of the inhaler, this has a marked advantage in that it avoids unequal distribution of the ether vapor in the gases going to the patient, employs the heat of exhalation not only in aiding vaporization, but also in maintaining suitable temperature and aids rebreathing of the exhaled gases charged with ether vapor by providing this mixture in a uniform condition best adapted to react favorably in the lungs of the patient. In order that there may be no undue restrictions in exhaling, the exhaled gases are not bubbled through the ether, but pass continuously through wide-open passageways. The employment of the string wicking, made up of a very large number of wicking cords, which dip into the liquid ether and carry it by capillary action to the enormous exposed surfaces of these cords, facilitates the necessary rapid evaporation of the ether while permitting this full open flow.

The arrangement of check valves in the two respective valve chambers **17** and **113** in relation to the inhaling passageway and the exhaling passageway, respectively, and in combination with the central valve mechanism which determines the flow of gas through it and from the rebreathing bag directly or in such a manner as to pass back and forth through the absorbing material, is such as to furnish correct and unrestricted flow of the gases in inhaling and exhaling, and at the same time is extremely easy of control by the operator. The organization is compact with all its parts easily accessible, and is adapted to attach readily to any type of gas mixing and administering machine. The construction is such that its use will not only require much less of the expensive gases employed in anesthetizing operations, and thus prove economical, but at the same time bring such gases to the patient's lungs in better condition for effecting the anesthetizing operation desired.

I claim:

1. In a gas-administering machine, a breathing circuit including an inhaler and a rebreathing bag said circuit closed to atmosphere, means for continuously admitting anesthetizing gas into the inhale side of said circuit, an absorber, means connecting the rebreathing bag in said circuit either through said absorber or independently thereof as desired, and an ether vaporizer positioned in the exhale side of said circuit and between the inhaler and the rebreathing bag, whereby ether goes to the patient only from vaporization in exhaled gases.

2. In a gas-administering machine, a breathing circuit including an inhaler and an absorber, an ether vaporizer on the exhale side of said circuit between the inhaler and the absorber and provided with a valve chamber and an ether container, and a valve in said chamber for controlling movement of exhaled gas either directly to the absorber or through the ether chamber to the absorber.

3. In a gas-administering machine, a breathing circuit including an inhaler and a rebreathing bag, an ether vaporizer in said circuit comprising a valve chamber and an ether container below the same, a tubular wicking consisting of a multiplicity of separate cord strands dipping into the ether in said container, and a valve in said valve chamber for directing gas moving through said circuit into said ether jar and about said wicking or directly along the circuit as desired.

4. In a gas-administering machine, a breathing circuit including an inhaler and a rebreathing bag, an ether vaporizer in said circuit comprising a valve chamber and an ether container below the same, a tubular wicking consisting of a multiplicity of separate cord strands dipping into the ether in said container, and a valve in said valve chamber including a port extension within the tube of wicking for directing gas moving through said circuit to pass into said tube and about said wicking, or to pass directly along the circuit as desired.

5. In a gas-administering machine, a breathing circuit including an inhaler and a rebreathing bag, an ether vaporizer in said circuit comprising a conical valve chamber and cylindrical ether container removably supported below the same, a tubular wicking consisting of a multiplicity of separate cord strands dipping into the ether in said container, a valve in said chamber comprising a passageway directly through said valve in the line of said breathing circuit, and diametrically-opposite ports in the floor of said valve on a line at right angles to said passage, one of said ports embodying an extension into said tubular wicking, whereby gas moving through said circuit may pass through directly, or may be caused to move into and from said tube and about said wicking as desired.

6. In a gas-administering machine, a breathing circuit, a member formed with two valve chambers in said circuit, and valves therein, said chambers connected respectively to the inhale side of the circuit above the valve and to the exhale side of the circuit below the valve, and an extension carried by said member forming a central passageway connected respectively to the valve chambers below the valve on the inhale side and above the valve on the exhale side, and a rebreathing bag connected with said central passageway.

7. In a gas-administering machine, a breathing circuit, a member formed with two valve chambers in said circuit, and valves therein, said chambers connected respectively to the inhale side of the circuit above the valve and to the exhale side of the circuit below the valve, an extension carried by said member forming a central passageway connected respectively to the valve chambers below the valve on the inhale side and above the valve on the exhale side, an absorber surrounding said central passageway, and a rebreathing bag connected with said central passageway below the absorber.

8. In a gas-administering machine, a breathing circuit, a member formed with two valve chambers in said circuit, and valves therein, said chambers connected respectively to the inhale side of the circuit above the valve and to the exhale side of the circuit below the valve, an extension carried by said member forming a central passageway connected respectively to the valve chambers below the valve on the inhale side and above the valve on the exhale side, and an absorber removably secured to said member about said central passageway.

9. In a gas-administering machine, a breathing circuit, a member formed with two valve chambers in said circuit and valves therein, said chambers connected respectively to the inhale side of the circuit above the valve and to the exhale side of the circuit below the valve, an extension carried by said member forming a central passageway connected respectively to the valve chambers below the valve on the inhale side and above the valve on the exhale side, an absorber removably secured to said member about said central passageway, and a rebreathing bag carried by said absorber to connect with said central passageway.

10. In a gas-administering machine, a breathing circuit including two valve chambers and valves therein, and an inhaler with an exhale valve, said chambers connected respectively to the inhale side of the circuit above the valve and to the exhale side of the circuit below the valve, means for supplying anesthetizing gas to the inhale side of the circuit, and means for restricting to a greater or less degree or closing the inhaler, exhale valve and the valve on the exhale side of the circuit.

11. In a gas-administering machine, a breathing circuit including two valve chambers and valves therein, and an inhaler with an exhale valve, said chambers connected respectively to the inhale side of the circuit above the valve and to the exhale side of the circuit below the valve, means for supplying anesthetizing gas to the inhale side of the circuit, and means including a cam, a rotatable handle and a scale cooperating therewith for restricting to a greater or less degree or closing the valve of the exhale side of the circuit and indicating the degree of said restriction.

12. In a gas-administering machine, a breathing circuit including an inhaler, and an absorber located between the inhale and the exhale sides of the circuit, means for continuously admitting anesthetizing gas into the inhale side of said circuit, an ether vaporizer in the exhale side of said circuit between the inhaler and the rebreathing bag, and connections in said circuit whereby exhale gas and vaporized ether is introduced into the inhale side of the circuit along with said anesthetizing gas, after said exhale gas and vaporized ether have passed through the absorber.

13. In a gas administering machine, a breathing circuit including an inhaler and a rebreathing bag, said circuit closed to atmosphere, an absorber in said circuit, and means forming part of said circuit to permit gas to be moved through the absorber to the rebreathing bag on exhalation and through the absorber from the rebreathing bag on inhalation.

14. In a gas-administering machine, a breathing circuit, an absorber having a central passage in said circuit, absorber material surrounding said passage, a rebreathing bag connected with said passage, and means associated with the passage for causing the gas to pass through the absorbing material in its travel to and from the rebreathing bag.

15. In an anesthetizing apparatus embodying a closed breathing line, a conduit therein including a partition and having connection with the exhale and inhale sides of the breathing line, respectively, on opposite sides of the partition, a container for absorber material adapted to be opened for the admission of exhalation gases above the partition and for the discharge thereof below the partition, and valve mechanism including ports for selectively causing exhalation gas to pass directly from one side to the other of said partition or to pass through the absorber material in the container.

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