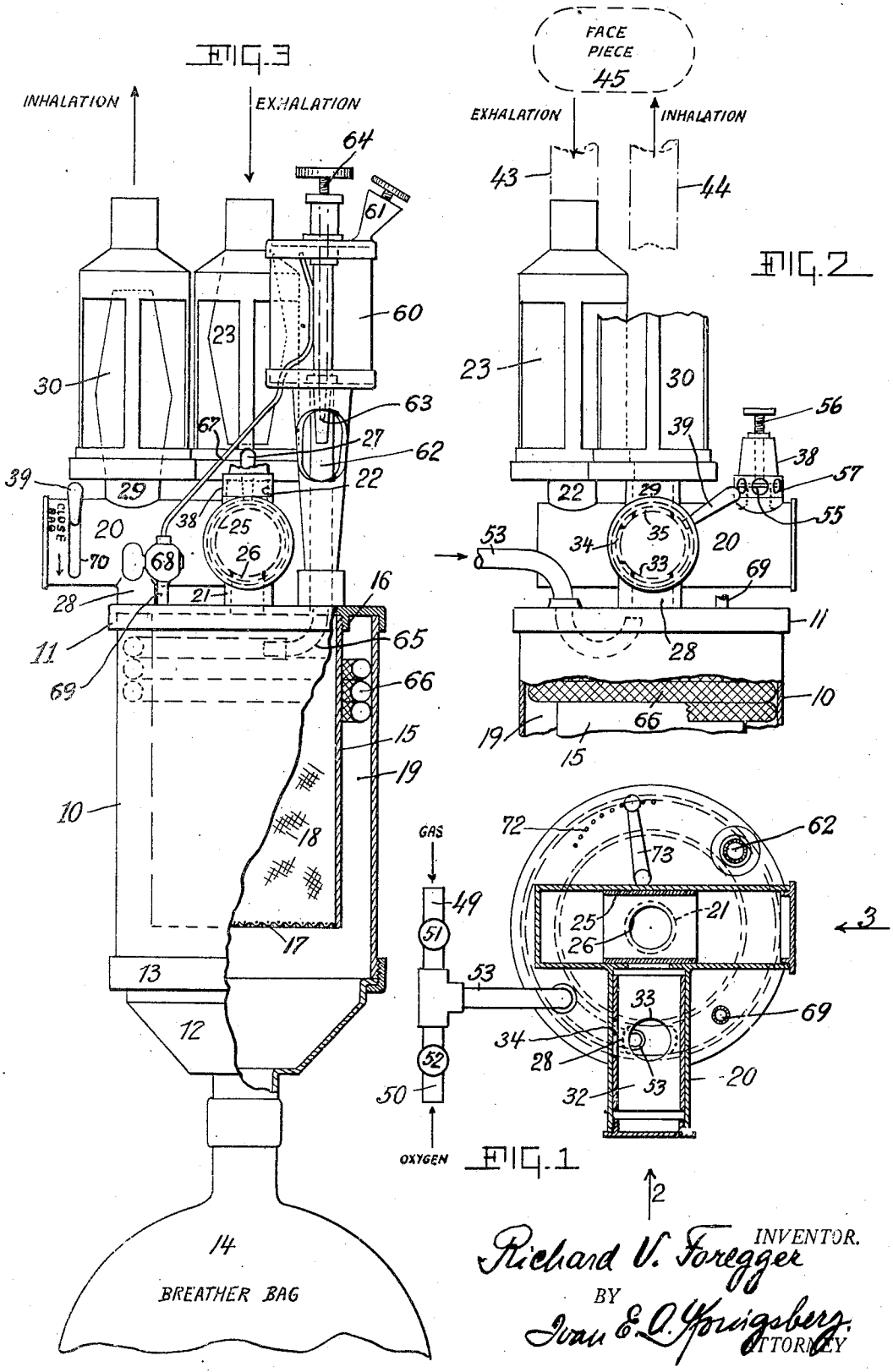
May 19, 1936. R. V. FOREGGER 2,041,406

ANESTHETIC APPARATUS

Filed July 17, 1935 2 Sheets-Sheet 1



Richard V. Foregger INVENTOR.

BY

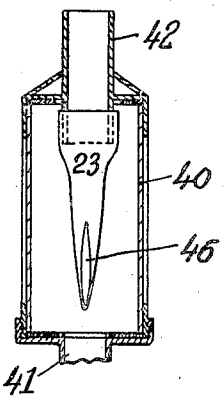
Ivan E. O. Youngsberg ATTORNEY

May 19, 1936. R. V. FOREGGER 2,041,406

ANESTHETIC APPARATUS

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FIG. 5



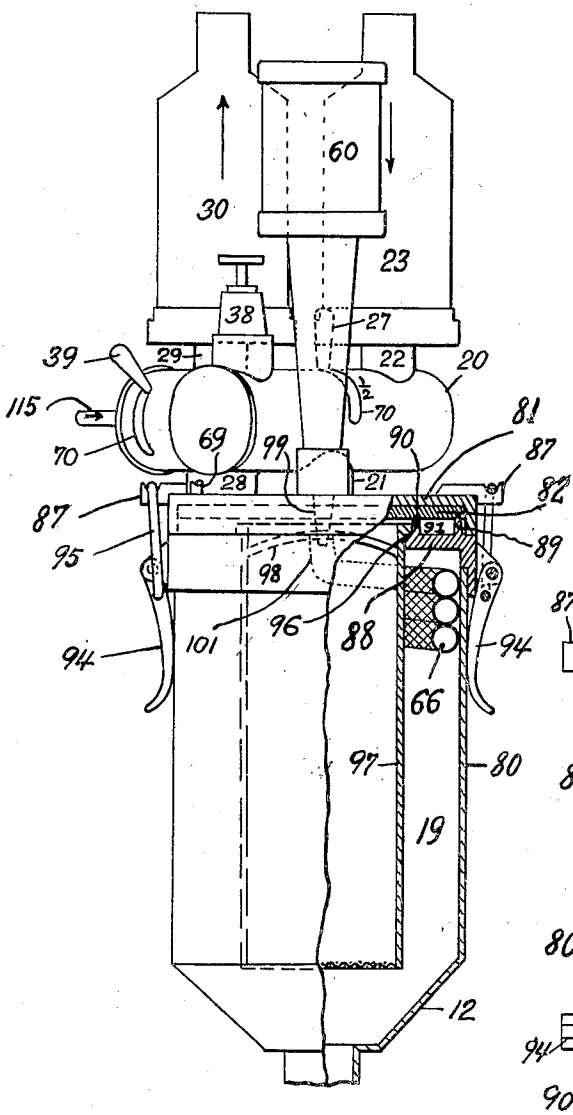


FIG. 6

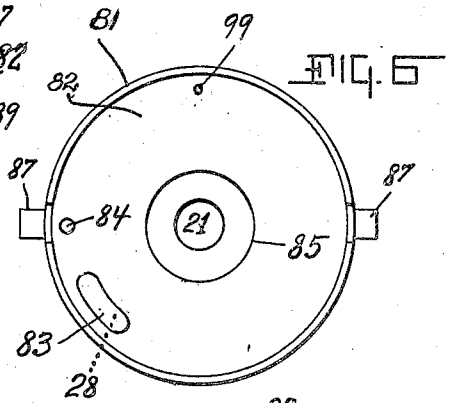


FIG. 7

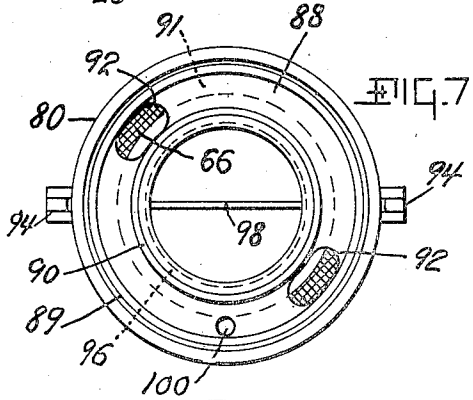


FIG. 4

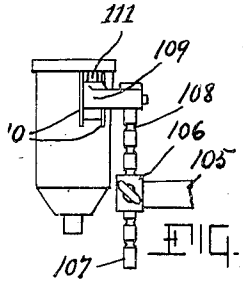


FIG. 8

Richard V. Foregger INVENTOR.

BY

Ivan E. A. Konigsberg ATTORNEY

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UNITED STATES PATENT OFFICE

2,041,406

ANESTHETIC APPARATUS

Richard V. Foregger, Roslyn, N. Y.

Application July 17, 1935, Serial No. 31,787

15 Claims. (Cl. 128—191)

This invention relates to improvements in anesthetic apparatus for practicing the carbon dioxide absorption method or circle filter method in which the carbon dioxide is removed from the patient's exhaled anesthetic gases by passing the gases through soda lime—sodium and calcium hydrate—contained in a filter.

The principle of absorbing carbon dioxide from exhaled anesthetic gases is known in the art and has been practiced with the so-called to and fro apparatus in which with each respiratory cycle the gases pass through the soda lime twice, once during exhalation on their way to the breather bag and again during inhalation on their return to the patient.

The present invention deals with an anesthetic apparatus for practicing the circle or circuit method in which the expired gases pass from the patient through the soda lime into the breather bag, and during inspiration the gases from the breather bag pass around, not through, the soda lime and to the patient. In apparatus for practicing this method means are also provided for cutting out the soda lime of the circuit whenever it is desired to stimulate respiration by allowing carbon dioxide to be built up in the reservoir system.

The circuit apparatus has also the advantage that the soda lime may be readily switched into and out of the system, or partly so if desired. It requires little handling and the parts are compactly assembled and supported as a unit. Another advantage is that in the circuit apparatus the patient must overcome the resistance of the soda lime granules only during expiration.

The object of this invention is to provide a generally improved anesthetic apparatus for practicing the circle method in a most safe and economic manner. Another object of the invention is to provide means for quick and convenient control of the inclusion or exclusion of the soda lime from the circuit. Still another object is to provide means whereby the supply of soda lime may be quickly replenished. Another object is to provide means for supplying ether to deepen the anesthetic when necessary. Other objects will be pointed out later on. Accordingly my invention is embodied in an anesthetic apparatus arranged and constructed as hereinafter set forth and as illustrated in the accompanying drawings in which:

Fig. 1 is a plan view of the apparatus with parts removed.

Fig. 2 is an elevation looking in the direction of arrow 2 in Figure 1 with parts removed and broken away.

Fig. 3 is an elevation looking in the direction of arrow 3 in Figure 1 with parts in section and broken away.

Fig. 4 is a view similar to Figure 3 but illustrates a modification.

Fig. 5 is a sectional view of a flutter valve.

Figs. 6 and 7 are detail views of parts of Figure 4.

Fig. 8 is a detail view illustrating supporting means for the apparatus.

Generally speaking the apparatus according to this invention comprises a casing or canister arranged to contain a soda lime filter spaced within the canister to provide an inhalation passage around the filter. The breather bag is attached to the bottom of the canister and the necessary valve mechanisms are carried on top of the canister so that the necessary connections between the patient's face piece and the valves may be made in a convenient manner.

Referring to the drawings and more particularly to Figures 1, 2 and 3, the reference numeral 10 denotes a cylindrical casing hereinafter called the canister, which is soldered or otherwise airtightly secured to its cover 11. The canister has a removable bottom 12 secured with a ring 13. The breather bag 14 is secured to the bottom. The cover 11 has a screwthreaded flange 16 for the reception and support of the soda lime filter 15 which is a cylinder having a screen bottom 17. At the top the filter is threaded so as to be screwed onto the flange 16. The filter contains soda lime 18. The filter being of less diameter than the canister there is formed an inhalation chamber 19 within the canister.

The canister carries a valve casing 20 in the form of a T made of tubing. The valve casing has a centrally located connection 21 forming a passage which leads through the cover to the filter 15. It also has an upstanding connection 22 forming a passage which leads to the exhalation flutter valve 23. Thus the latter communicates with the filter by way of passage 22, the valve casing 20 and the central passage 21. Located centrally of the valve casing there is a filter sleeve valve 25 having a single port 26, see Figures 1 and 3, for controlling the passage 21 to the filter. The sleeve filter valve 25 is operated by a handle 27, Figure 3.

The valve casing is also supported upon the canister by means of another connection 28 forming a passage which leads to the inhalation chamber 19 and it has also an upstanding connection

29 forming a passage which leads to the inhalation flutter valve 30. The numeral 32, Figure 1, denotes an obturation sleeve valve, hereinafter called the bag valve, which has three ports 33, 34 and 35, see Figures 1 and 2. The port 33 controls the downward passage 28 from the valve casing to the inhalation chamber 19. The opposite port 35 controls the passage 29 from the valve casing to the inhalation flutter valve 30. The third intermediate port 34 is for establishing communication between the valve casing and the respiratory valve 38 carried thereby.

Thus it will be seen that the inhalation flutter valve 30 communicates with the inhalation chamber 19 through the passage 29, the valve casing and the passage 28 via the bag valve ports 35 and 33. A handle 39 operates the bag valve.

The flutter valves, see Figure 5, are sensitive rubber valves contained within transparent cylinders 40 protected by a metal framework which at its bottom has a neck 41 adapted to be inserted in the valve casing connections 22 and 29. At its upper end the flutter valve has a neck 42 to which the exhalation tube 43 and the inhalation tube 44, respectively are attached. The tubes lead to the usual face piece 45. The latter and the tubes are shown diagrammatically only in Figure 2. Figure 5 illustrates the exhalation flutter valve; the expired gases passing out through slits 46 in the valve. The inhalation valve is exactly like the exhalation valve except that the rubber valve itself is supported in reverse position from that shown in Figure 5. The respective positions of the rubber valves are shown in Figure 3.

Anesthetic gas and oxygen are supplied to the inhalation chamber 19 through pipes 49 and 50 controlled by valves 51 and 52. The pipes 49 and 50 connect with a single supply pipe 53 which leads to the canister. Within the latter the pipe 53 is curved upwardly so that it leads directly upward into the passage 28 besides leading generally into the chamber 19. This is done to insure that oxygen will be supplied quickly and directly to the inhaling side of the circuit in the event that for some reason an extra instant supply becomes necessary.

The respiratory valve 38 has a disk 55 operated from a screw 56 to control a passage from the valve casing 20 via the respiratory valve to the atmosphere through openings 57.

Ether may be supplied to deepen the anesthetic whenever required. The ether is contained within an ether cup 60 having an inlet 61 and which communicates with the inhalation chamber 19 by way of a glass tube 62. The supply of ether is controlled by a needle valve 63 operated by a screw 64. A pipe 65 leads from the glass tube into the chamber 19 within which there is attached to the pipe a coil 66 of braided copper pipe. A small pipe 67 leads from the top of the ether cup 60 to the inhalation chamber 19. A pet cock 68 controls the passage through the pipe. The pet cock 68 is carried by a small connection 69 leading to the chamber 19.

During an anesthesia the patient inhales from the breather bag 14, through the inhalation chamber 19, passage 28, bag valve ports 33 and 35, passage 29, inhalation flutter valve 30, tube 44 to the face piece 45. The exhalation circuit is from the face piece through tube 43, exhalation flutter valve 23, passage 22 to valve casing 20, through filter valve port 26 to connection 21 and into the filter 15.

Gas and oxygen are supplied to the breathing circuit by way of the supply pipes 49 and 50, and as stated above, should an additional amount of, for instance, oxygen be required at any time, such additional amount is easily supplied by further opening the oxygen supply valve 52. The supply pipe 53 because of its upwardly curved form insures that the additional supply of oxygen alone or also of gas passes directly into the inhaling circuit through the connection 28 leading to the inhalation flutter valve 30.

Ether from the glass ether cup 60 is supplied whenever required to deepen the anesthetic by opening the needle valve 63. Ether then drops down through the glass tube 62 to the pipe 65 and into the coil 66. Because of the heat developed by the reaction caused by exhaling through the soda lime granules the temperature rises within the canister and inasmuch as the coil 66 is perforated so to speak because of the braided wire of which it is made, the ether is quickly vaporized within the chamber 19 and mixes with the inhaled gases from the breather bag.

While the anesthesia is applied as described both the valve handles 27 and 39 are in up position as shown in Figures 2 and 3. The breather bag is of course filled as usual before an operation. If the face piece is attached then the bag is filled by closing the bag valve, i. e. by moving the handle 39 down and the filter valve is closed half way, i. e. the handle 27 is swung half way down in a clockwise direction in Figure 3. In this position it will be seen that the connection 28 leading from the valve casing to the inhalation flutter valve 30 is closed in that valve port 33 has been moved upwardly to the left in Figure 2. The inhaling circuit is under these conditions through respiratory valve 38, valve casing 20, bag valve port 34—which is now in uppermost position—inhalation flutter valve 30 to the face piece. The exhaling circuit is from the face piece through tube 43 to the valve casing and through the half open filter valve port 26, Figure 3, into the filter.

If the face piece is not attached to the apparatus then the bag is filled by closing both valves, i. e. move both valve handles down thereby cutting off both the filter and the bag from the flutter valves. In practice the induction of the anesthetic gases is started with the bag valve fully open while the filter valve is closed. When the required degree of anesthesia is reached, the filter valve is opened fully and the respiratory valve is closed. Also the oxygen flow is reduced according to the patient's requirements and the supply of anesthetic gas is shut off.

The valve handles 27 and 39 move in slots 70 cut in the valve casing. The length of the slots limits the stroke of the handles. Figure 3 shows the slot 70 for the bag valve handle 39 and Figure 4 shows both of the slots 70 for the two handles. Suitable indicia for operating the valve handles are placed upon the casing as shown. The supply of soda lime is designed to last about eight hours before it must be discarded. To enable the anesthetist to check up on the length of time during which the apparatus has been in use there is provided a scale 72 with a handle 73 which is moved forward one step for each hour of use, Figure 1. The scale consists of small depressions into which the handle snaps and is held in an obvious manner. The scale is marked numerically. The numbers are not shown so as not to obscure the drawing.

During the operation the pet cock 68 is open to equalize the pressure in the ether supply cup 60. When the latter is to be replenished through the filler inlet 61 the pet cock is closed.

The soda lime filter is quickly removed from the apparatus by first unscrewing the ring 13 to detach the bottom of the canister and then reach in and unscrew the filter from the flange 16. Then the same or another freshly filled filter may be placed in position and the canister closed. This method involves the unscrewing and screwing in of both the filter and the ring 13.

Figure 4 illustrates a modification in which the exchange of soda lime filters may be done with extreme rapidity. In this case the canister 80 has a removable cover 81 which carries the valve mechanisms and other parts exactly as described in connection with Figures 1–3. The same reference numerals are applied to corresponding parts. Within the cover 81 there is placed a substantial rubber gasket disk 82 which is cut out as at 83 to afford passage through the connection 28 leading from the bag valve to the inhalation chamber 19. There is also an opening 84 to register with the pet cock connections 69 and a central opening 85 to register with the central connection 21 from the filter valve. The cover carries two hooks 87, 87.

The canister in Figure 4 has a lateral annular shelf 88 provided with two upstanding annular flanges 89 and 90 adapted to engage the gasket 82. There is thus formed an annular closed passage 91 between the shelf 88 and the gasket. This passage 91 communicates upwardly through the gasket opening 83 with the aforesaid connection 28 leading to the bag valve. Downwardly the annular passage 91 communicates with the inhalation chamber 19 by way of two ports 92, 92 in said shelf 88, Figure 7. The canister has a permanently closed bottom 12 to connect with the breather bag and carries two closing clasps 94, 94 for operating two loops 95, 95 to engage the hooks 87 in an obvious manner whereby to lock the cover airtight upon the canister. The latter has a narrow annular ledge 96 for the support of the soda lime filter 97 which has a flange resting upon the ledge. The filter has a handle 98. The curved pipe connection 65 between the ether glass tube 62 and the coil 66 is omitted. Instead the tube ends with a spout 99 which projects downwardly through the gasket 82 and fits into a hole 100 in the shelf 88 which hole registers with the upturned upper end 101 of the pipe coil 66, Figure 4.

Anaesthetic gas and oxygen are supplied to the apparatus in Figure 4 by way of a supply nipple 115 which is inserted into the end of the valve casing adjacent the bag valve. Thus this construction embodies also the feature of affording means for introducing an additional supply of oxygen directly below the inhalation connection 29 from the valve casing to the inhalation flutter valve 30 the same as provided by the curved pipe 53 in Figure 2.

When the parts are assembled as in Figure 4 the circuits of the gases may be traced exactly as above described. When it is desired to replenish the soda lime the clasps 94 are unhooked, the cover 81 lifted away from the canister, the filter 97 is lifted out by taking hold of its handle 98. A new filter is dropped into place, the cover put upon the canister and locked and the apparatus is ready to continue operation. Obviously it takes but very little time to place a filled filter in position. Inasmuch as the valve mechanisms are alike in Figures 2 and 4, only the merest outline is shown in Figure 4.

The apparatus is conveniently supported as shown in Figure 8 in which the numeral 105 denotes an arm which is a part of an anesthetic or operating table or the metric gas machine usually used. The arm has a socket 106. A rod 107 fits into the socket and is there held adjustably by a screw engaging notches 108. The rod 107 carries a block 109. The canister has guides 110 and a stop 111 and is attached to the block 109 by being hooked onto the block as will be understood.

The apparatus herein disclosed embodies several novel features of importance in administering an anesthetic. Mechanically the apparatus is compact, yet easily operable. The several units are easily taken apart and assembled. This is important for purposes of repairs and cleanliness. The canister and filter are separable and the flutter valves are easily unscrewed from the valve casing. The inhalation chamber 19 is an important feature in that it provides a distinct inhalation passage separate from the filter and the increase in temperature within the chamber is advantageously used in vaporizing the ether and insures that the re-inhaled gas is warm which in turn serves to conserve the patient's body heat and moisture, resulting in more perfect and easy breathing during the anesthesia. The means for supplying ether and quickly vaporizing it are believed to be a wholly novel and important adjunct to the apparatus. The construction of the flutter valves is very simple and very efficient. They are self closing as is obvious. For instance it will be seen from Figure 5 that when the patient exhales the gases pass out through the slits 46, one on each side, which however during inhalation automatically close. The flutter valves are in effect one way check valves. The important feature and advantage of a quickly detachable filter for the purpose set forth are obvious to persons skilled in the art.

Obviously the invention is susceptible of changes and variations in the disclosures presented and I contemplate as within the scope of my invention all such modifications and equivalents as fall within the appended claims.

I claim:

1. In an anesthesia apparatus of the character described including a face piece, a breather bag and mechanisms for administering the anesthetic forming a continuous inhalation passage from the breather bag and to the face piece and a separate continuous exhalation passage from the face piece and to the bag, a filter in said inhalation passage located between the face piece and the bag for absorbing exhaled carbon dioxide and means in said inhalation passage forming an inhalation chamber around and apart from said filter.

2. In an anesthesia apparatus of the character described including a face piece, a breather bag and mechanisms for administering the anesthetic forming a continuous inhalation passage from the breather bag and to the face piece and a separate continuous exhalation passage from the face piece and to the bag, a filter in said inhalation passage located between the face piece and the bag for absorbing exhaled carbon dioxide, means in said inhalation passage forming an inhalation chamber around and apart from said filter and mechanism for detachably supporting said filter within the said inhalation chamber.

3. An apparatus of the character described

comprising a canister, a breather bag removably secured thereto, a soda lime filter removably secured within said canister which latter forms an inhalation chamber around said filter, exhalation and inhalation valves supported on said canister in communication with said filter and chamber respectively, a face piece and breathing tubes between the latter and the said valves.

4. An apparatus of the character described comprising a canister, a breather bag removably secured thereto, a soda lime filter removably secured within said canister which latter forms an inhalation chamber around said filter, exhalation and inhalation valves supported on said canister in communication with said filter and chamber respectively, a face piece and breathing tubes between the latter and the said valves and means carried by said canister for supplying ether to the said inhalation chamber.

5. An apparatus of the character described comprising a canister, a breather bag removably secured thereto, a soda lime filter removably secured within said canister which latter forms an inhalation chamber around said filter, exhalation and inhalation valves supported on said canister in communication with said filter and chamber respectively, a face piece and breathing tubes between the latter and the said valves and means carried by said canister for supplying anesthetic gas to said inhalation chamber.

6. An apparatus of the character described comprising a closed container including a removable bottom, a soda lime filter detachably supported within said container which latter forms a chamber surrounding said filter, a face piece, an exhaling and an inhaling tube between the face piece and the container, valves in said tubes for establishing separate communications between the filter and the exhaling tube and between the said chamber and the inhaling tube, said valves including means for cutting the filter off from the exhaling tube and cutting the chamber off from the inhaling tube and a breather bag secured to the said removable container bottom.

7. An anesthesia apparatus of the character described comprising in combination with a face piece, a breather bag, mechanisms forming a continuous exhalation passage between the face piece and the breather bag, a filter containing carbon dioxide absorption material in communication with said exhalation passage, other mechanisms forming a continuous inhalation passage between the face piece and the breather bag, said inhalation passage including a chamber formed around and apart from said filter, means for supplying anesthetic gas and ether to said chamber and means for accessibly and detachably supporting the filter within said chamber.

8. An anesthetic apparatus of the character described comprising a soda lime filter, a casing surrounding said filter and forming a chamber around the same, a breather bag secured to said casing in communication with the chamber, means for supplying ether to the chamber including a coil of woven pipe surrounding the filter for vaporizing the ether in the chamber, an inhalation valve and an exhalation valve mounted in operative relation to said chamber and filter, passages communicating between the said inhalation valve and the said chamber, and between the said exhalation valve and the said filter, a pipe for supplying anesthetic gas to said chamber, said pipe having an outlet located adjacent the said communication between the chamber and the inhalation valve, a face piece and breathing tubes between said face piece and the said valves.

9. An apparatus of the character described comprising a container, a soda lime filter supported within the same, an open ended coil of braided wire tubing surrounding said filter within the container and means for supplying ether to the said coil of tubing.

10. An apparatus of the character described comprising a container having a closed top and a removable bottom, a soda lime filter detachably carried by said top within the container, which forms an inhalation chamber around the filter, a valve casing mounted upon said container top in communication with the said filter and chamber, an inhalation and an exhalation flutter valve and a respiratory valve carried by said valve casing in communication therewith and valves in said valve casing for establishing communications between the inhalation flutter valve and the said chamber, and between the exhalation flutter valve and the said filter and for cutting off the said flutter valves from the chamber and filter and establishing communication between the inhalation flutter valve and the respiratory valve.

11. An apparatus of the character described comprising a container having a removable top and a closed bottom, a soda lime filter detachably carried by said container within the same, said container forming an inhalation chamber around the filter, a valve casing mounted upon said container top in communication with the said filter and chamber, an inhalation and an exhalation flutter valve and a respiratory valve carried by said valve casing in communication therewith and valves in said valve casing for establishing communications between the inhalation flutter valve and the said chamber, and between the exhalation flutter valve and the said filter and for cutting off the said flutter valves from the chamber and filter and establishing communication between the inhalation flutter valve and the respiratory valve.

12. An apparatus of the character described comprising a container having a closed top and a removable bottom, a soda lime filter detachably carried by said top within the container, which forms an inhalation chamber around the filter, a valve casing mounted upon said container top in communication with the said filter and chamber, an inhalation and an exhalation flutter valve and a respiratory valve carried by said valve casing in communication therewith and valves in said valve casing for establishing communications between the inhalation flutter valve and the said chamber, and between the exhalation flutter valve and the said filter and for cutting off the said flutter valves from the chamber and filter and establishing communication between the inhalation flutter valve and the respiratory valve, and means for supplying anesthetic gas and oxygen to the said chamber.

13. An apparatus of the character described comprising a container having a removable top and a closed bottom, a soda lime filter detachably carried by said container within the same, said container forming an inhalation chamber around the filter, a valve casing mounted upon said container top in communication with the said filter and chamber, an inhalation and an exhalation flutter valve and a respiratory valve carried by said valve casing in communication therewith and valves

in said valve casing for establishing communication between the inhalation flutter valve and the said chamber, and between the exhalation flutter valve and the said filter and for cutting off the said flutter valves from the chamber and filter and establishing communication between the inhalation flutter valve and the respiratory valve, and means for supplying anesthetic gas and oxygen to the said chamber.

14. An apparatus of the character described comprising a container including a removable bottom, a soda lime filter removably supported within the container, which latter forms an inhalation chamber around the filter, an inhalation and an exhalation valve carried by said container in separate communication with the said chamber and filter respectively, an inhalation flutter valve and an exhalation flutter valve supported in operative relation to the valves aforesaid, a face piece, breathing tubes between the latter and the said flutter valves and a breather bag secured to the container in communication with the said inhalation chamber.

15. An apparatus of the character described comprising a container having a removable cover, manually operated means for locking the cover to the container and unlocking said cover, a soda lime filter removably supported in said container which forms a chamber around the filter, a coil of braided wire tubing supported in said container and surrounding said filter, a valve casing on said cover, exhaling and inhaling valves in said valve casing, an ether cup supported on said cover, means in the cover serving as communications between the exhaling valve and the filter and between the inhaling valve and the chamber when the cover is locked to the container, a spout leading from said ether cup through the said cover and adapted to connect with the said coil of tubing when the cover is locked and means for supplying anesthetic gas to said valve casing.

RICHARD V. FOREGGER.