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Dryden

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[54] **DISPOSABLE APPARATUS FOR CIRCLE ABSORPTION SYSTEM**

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[22] Filed: **Jan. 31, 1973**

[21] Appl. No.: **328,311**

Related U.S. Application Data

[63] Continuation of Ser. No. 131,873, April 7, 1971, abandoned.

[52] **U.S. Cl.** **55/387**

[51] **Int. Cl.** **B01d 53/04**

[58] **Field of Search** 55/68, 74, 387, 388, 389

[56] **References Cited**

UNITED STATES PATENTS

2,469,842	5/1949	Paguin et al.	55/387
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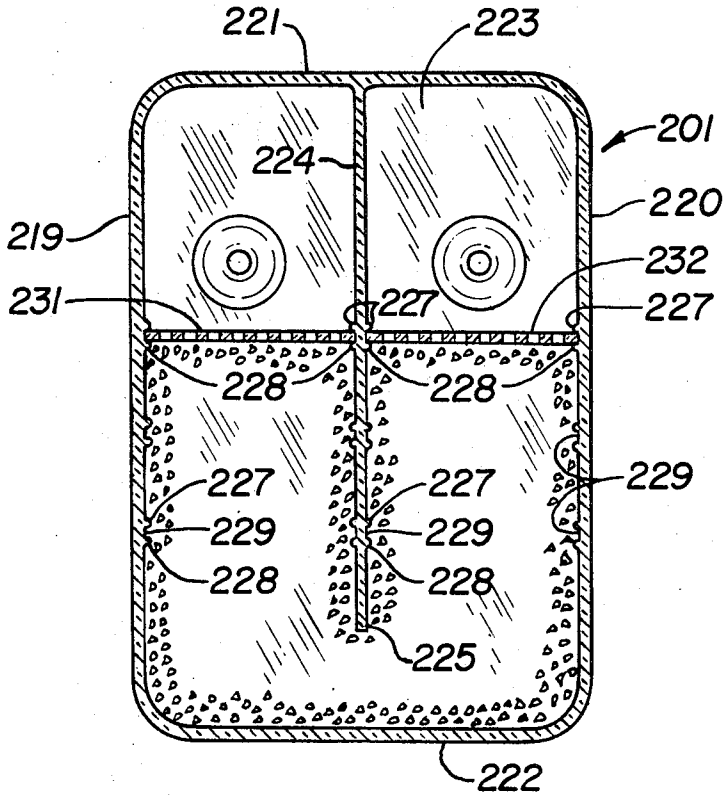
[57] **ABSTRACT**

A circle absorption system for anesthesia, including a gas machine, a carbon dioxide absorbing canister, a gas supply hose thereto, rebreathing hoses and a mask connected thereto, absorbing medium therein, and a four way coupling having a pair of one way directional valves, a bleed valve and an outlet for receiving a rebreathing bag. The canister is rectangular in configuration and has recessed fittings for receiving the various hoses. The canister has a plate-groove arrangement whereby the size of chambers within the canister may be readily controlled while allowing quick and easy assembly of the canister.

3 Claims, 7 Drawing Figures



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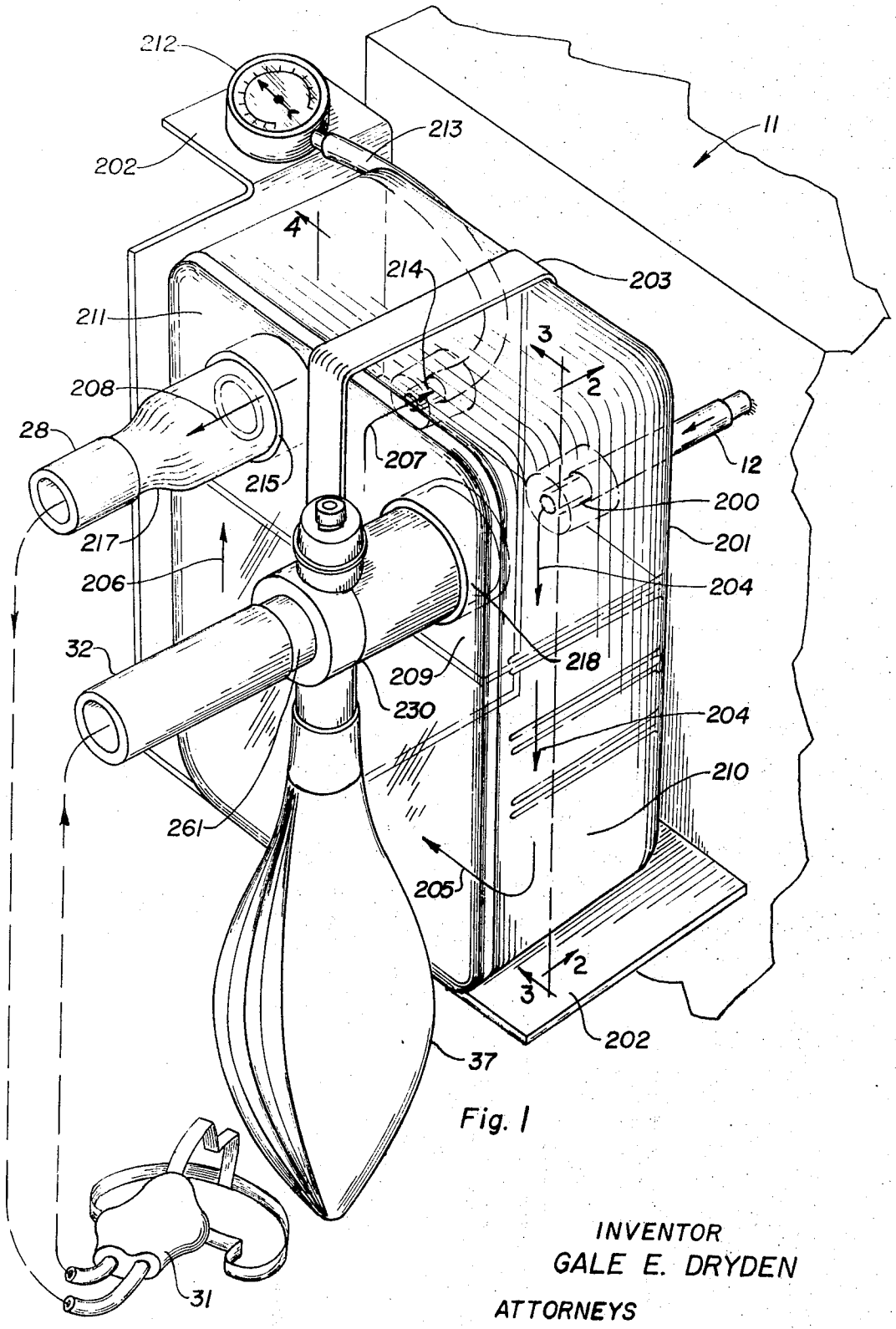

Fig. 1

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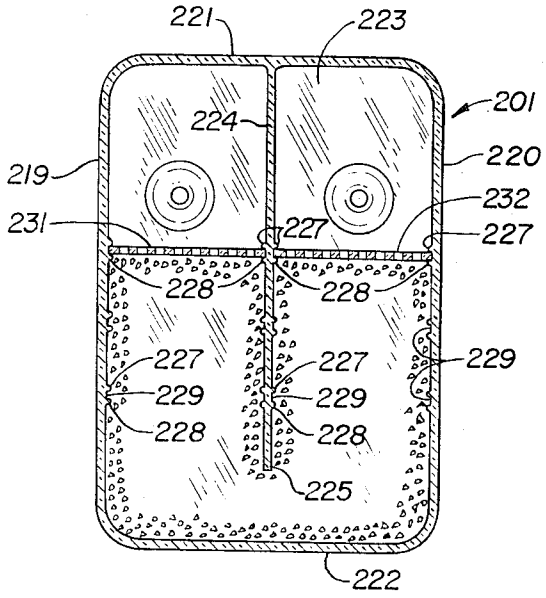

Fig. 2

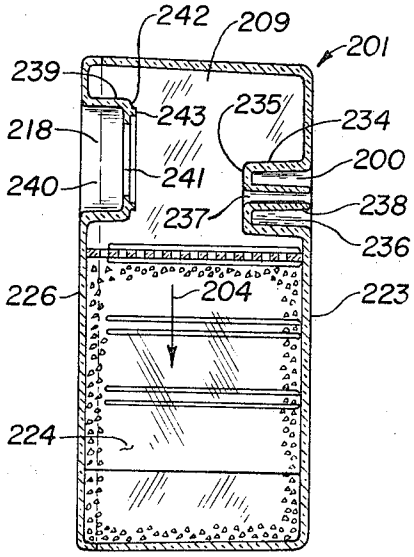

Fig. 3

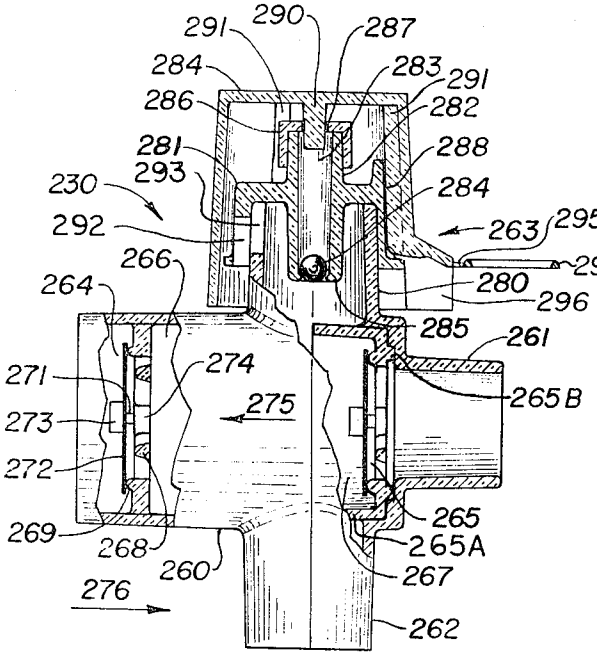

Fig. 5

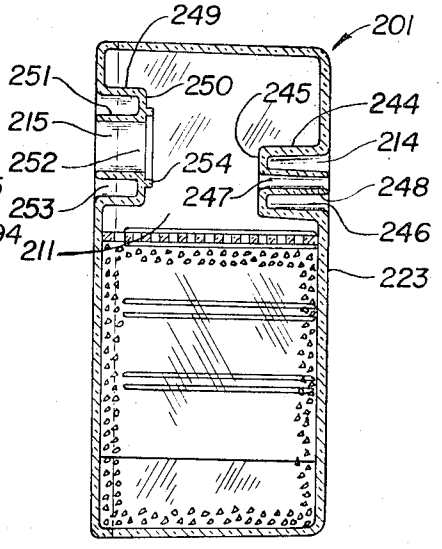

Fig. 4

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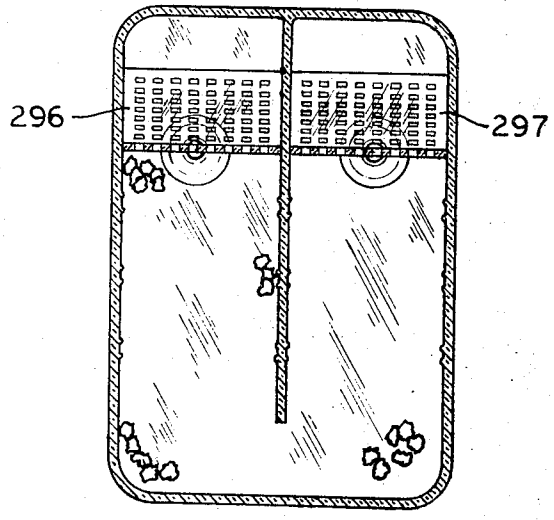

Fig. 6

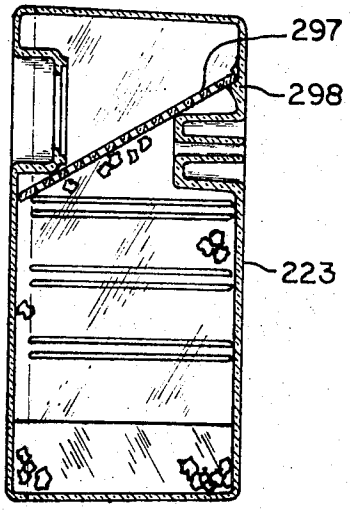

Fig. 7

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DISPOSABLE APPARATUS FOR CIRCLE ABSORPTION SYSTEM

This is a continuation of application Ser. No. 131,873, filed Apr. 7, 1971 and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to anesthesia apparatus and more particularly to the canister and fittings.

2. Description of the Prior Art

As explained in my U.S. Pat. No. 3,566,867 issued on Mar. 2, 1971, and my pending application Ser. No. 775,761, filed Nov. 14, 1968, it is desirable to provide a low-cost and disposable canister having absorbent material therein. Although considerable prior art has been cited in those applications, none have had the expendable, disposable aspects which I consider necessary for significant improvement in safety for patients. As a result of further thought on this matter, I have some additional concepts as follows: As a result of the disposable nature of the canister, a great number of canisters are transported. Thus, it is desirable for the fittings of the canister to be recessed preventing damage thereof during the transportation of the canister. In addition, it is desirable for the canister to be rectangular in configuration in order to minimize the space needed for the transportation of a plurality of canisters.

My canisters have three chambers, one of which has absorbent material therein. Depending upon the exact use requirements of the canister, the amount of absorbent material may be varied. Thus, the size of the chamber containing the absorbent material may be altered in accordance with the use requirements. It can be appreciated that it is relatively expensive to produce a variety of canisters having different sized chambers for receiving absorbent material. Thus, it is desirable to produce a single canister body which will easily receive walls during the assembly of the canister in such a way that the size of the chamber may be varied. A canister disclosed herein has a main body which will receive walls in such a way so that the size of the chamber may be greatly varied during the assembly of the canister.

SUMMARY OF THE INVENTION

One embodiment of the invention disclosed herein is the combination comprising: rectangular container means having first, second, and third chambers therein, said second chamber being adjacent to said first and third chambers, a first recessed inlet fitting in said container means communicating with said first chamber, a first recessed outlet fitting in said container means communicating with said third chamber, said first chamber communicating with said third chamber through said second chamber, an absorbent material for carbon dioxide disposed in said second chamber, a plurality of additional recessed fittings in said container means communicating with said chambers, and a removable, valved coupling all of which is disposable as a unit. This disposable unit is employed with a conventional anesthesia machine having means receiving said container means thereon, said container means and coupling being removable from said anesthesia machine and completely disposable, and of such inexpensive construction as to be expendable.

It is a general object of the present invention to improve anesthesia by reducing the possibility of exposure of patients to cross contamination from equipment employed.

It is an object of the present invention to provide a compact expendable canister assembly for an absorption anesthesia system.

It is a further object of the present invention to provide a canister with protected and versatile fittings for an absorption anesthesia system.

Yet another object of the present invention is to provide a circle absorption anesthesia canister assembly having an expendable coupling incorporating a bleed valve and a pair of one way directional valves with a fitting for receiving a rebreathing bag.

Related objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a fragmentary perspective view of the canister assembly of the present invention mounted to the anesthesia machine.

FIGS. **2** through **4** and **6** and **7** are on a smaller scale than FIG. **1**, and FIG. **5** is on a larger scale.

FIG. **2** is a cross-sectional view taken along a line and viewed in the direction of the arrows **2—2** of FIG. **1.**

FIG. **3** is a cross-sectional view taken along a line and viewed in the direction of arrows **3—3** of FIG. **1.**

FIG. **4** is a view taken along a line and viewed in the direction of arrows **4—4** of FIG. **1.**

FIG. **5** is side view of the four way coupling shown in FIG. **1** with portions thereof fragmented.

FIG. **6** is a section like FIG. **2** but showing another embodiment.

FIG. **7** is a section like FIG. **3** but showing the embodiment of FIG. **6.**

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now more particularly to FIGS. **1** through **5,** a portion of an anesthesia machine **11** is shown in FIG. **1** having a bracket **202** on which the canister case **201** is secured by a metal strap **203.** Other mountings for the canister might also be used. Just one example is a metal basket mounted on the gas machine **11** and into which the canister may be dropped. A controlled amount of gas from machine **11** is provided through hose **12** to a first inlet fitting **200** integral with the canister case. The incoming gas flows in the direction of arrows **204** through a first chamber **209** and into a second chamber **210.** The gas continues to flow throught the second chamber **210** around end **225** of center partition **224** (FIG. **2**) in the direction of arrow **205** (FIG. **1**) and up into a third chamber **211** in the direction of arrow **206.** A pressure indicator **212** mounted to bracket **202** is in communication with chamber **211** via a hose **213** connected to the outlet fitting **214** integral with the canister case. Thus, the gas may flow in the direction of arrow **207** through hose **213** to indicator **212.** In addition, the gas may flow in the direction of arrow **208** out through an outlet fitting **215** which is integrally connected to the canister case. The gas flows through a coupling **217** which is received by fitting **215** and through hose **28** connected to the coupling. Face mask **31** is connected to hose **28** and to hose **32** which in turn is connected to a four way coupling **230** received by an inlet fitting **218** integral with the canister case. As will be described later in this specification,

coupling 230 has a pair of one way directional valves, a bleed valve and an outlet connected to a rebreathing bag.

FIGS. 2 through 4 are reduced cross-sectional views of the canister case shown in FIG. 1 with the hoses and coupling shown in FIG. 1 being deleted for the sake of clarity. Case 201 is rectangular in configuration having a pair of side walls 219 and 220 integrally joined to end walls 221 and 222 and rear wall 223. Case 201 is produced from molded plastic and has a separating wall 224 integrally joined to end wall 221 and rear wall 223 and being spaced equidistant from walls 219 and 220. The bottom edge 225 of wall 224 is in spaced relationship to end wall 222. A plurality of ridges 227 and 228 are provided on the mutually facing surfaces of walls 219, 220 and 224 to receive perforated walls 231 and 232. As previously mentioned, it is desirable to select the amount of absorbent material within the canister case depending upon the desired period of time which the canister is to be utilized. In other words, although it is desirable to manufacture the canister in the same overall dimensions for virtually all uses, there will be no need for the complete filling of the canister if the canister is to be used for only a comparatively short period of time. Thus, ridges 227 and 228 are provided at fixed intervals along the lengths of walls 219, 220 and 224 in order that perforated walls 231 and 232 may be installed between the appropriate ridges depending upon the amount of absorbent material to be provided in chamber 210. The laterally extending and aligned grooves 229 formed between the laterally extending ridges 227 and 228 slidably receive the edges of the perforated walls 231 and 232. Thus in assembling the canister, walls 231 and 232 may be inserted into the appropriate grooves 229 and the absorbent material may then be placed into chamber 210 with the lid 226 then being fixedly secured to the side walls, end walls and separating wall 224 by adhesives or other suitable fastening means.

The longitudinally extending wall 224 in conjunction with the perforated walls 231 and 232 separates case 201 into a first chamber 209, a second chamber 210 and a third chamber 211. Chamber 209 is separated from chamber 211 by wall 224 which extends partially into chamber 210. The perforated walls 231 and 232 slidably received in the aligned grooves 229 have apertures of a sufficiently small size to prevent passage of the absorbent material from chamber 210 to chambers 209 and 211. Of course, the apertures are of a sufficient size so as to allow gas to pass therethrough.

FIG. 3 is an enlarged cross-sectional view taken along the line and viewed in the direction of arrows 3—3 of FIG. 1 illustrating the fittings 200 and 218. Fitting 200 has a generally circular recessed wall 234 integrally joined to a flat wall 235 provided with an aperture 237 extending through stem 238 which is centrally positioned with respect to circular wall 234. The annular cavity 236 between stem 238 and circular wall 234 is sized to receive hose 12. The gas from hose 12 may thereby pass through aperture 237 and through wall 232 in the direction of arrow 204. The gas then continues to flow around wall 224 in the direction of arrow 205 (FIG. 1).

Fitting 218 has a circular slightly tapered wall 239 integrally jointed to lid 226 thereby defining a round cavity 240 which receives the circular body of four way coupling 230 (FIG. 1). Circular wall 239 has an inward turned flange portion 242 defining circular opening 241 which allows gas to pass from cavity 240 into chamber 209. Annular ridge 243 is integrally formed with flange portion 242 and surrounds opening 241 and can furnish an internal piloting surface for a valve cup, if desired.

FItting 214 (FIG. 4) is identical to fitting 200 having a circular wall 244 integrally joined to a flat wall 245. An aperture 247 through wall 245 extends through stem 248 with an annular cavity 246 surrounding the stem. It is to be noted that stems 248 and 238 are tapered having a small outside diameter adjacent to wall 223 and increasing in diameter as the fitting extends into the chambers. These provide a tight fit with respect to the hoses received. Fitting 215 likewise has a circular wall 249 which turns inwardly forming a flange wall portion 250 which is integrally joined to stem 251. An aperture 252 extends through stem 251 allowing gas from chamber 211 to pass outwardly to hose 28 (FIG. 1). Annular cavity 253 is formed between stem 251 and circular wall 249. Ridge 254 is integrally formed with wall 250 surrounding aperture 252, and can furnish an external piloting surface for a valve cup if desired. It is to be noted that the stem of each of the previously desired fittings as well as the other portions of the fittings do not extend or protrude beyond the canister case, thereby preventing damage to the fittings during packing and transportation of the canister case. Also it should be noted that the orientation of the fittings 215 and 218, and the tapers and draft on the surfaces thereof, are such that the lid, with these fittings thereon, can be simply molded in one piece. The same is true of the case.

An enlarged fragmentary view of the four way coupling 230 of FIG. 1 is shown in FIG. 5. Coupling 230 may be referred to as a modified tee fitting and has a main body 260 with an inlet fitting 261 for receiving hose 32 (FIG. 1). Main body 260 is frictionally and sealingly received into the annular cavity 240 (FIG. 3) of fitting 218 and is fragmented at 266 and 267 to illustrate a pair of one way directional valves 264 and 265. Valve 264 includes a circular rim with radially inwardly projecting integral spokes forming a spider 268 integrally joined in a hub 274 at the center of the spider, with openings provided therebetween to allow the gas to pass therethrough. The center 274 of spider 268 has a protrusion 271 receiving a flexible rubber sheet 272 which is secured thereon by cap 273 press fitted onto the protrusion. An annular ridge 269 is formed on the rim of spider 268 and serves as a valve seat sealingly receiving sheet 272. Ridge 269 cooperates with sheet 272 to prevent gas flow in the direction of arrow 276 while allowing gas flow in the direction of arrow 275. The rim is adhesively or otherwise sealed entirely around its circumference to the inner wall of body 260.

Valve 265 is similar to valve 264, including a rim, spokes, hub, rubber flapper, flapper mounting stem, and retaining cap on the stem. However, the rim is cup shaped, having the axially extending circular flange 265A. Also the cup has a rib 265B extending in a circle around the upstream face of the valve assembly. The cup is sealed by an adhesive or other means around its entire circumference to the main body and is thereby sealed and retained firmly in place. Therefore, one way directional valve 265 allows gas flow only in the direction of arrow 275. Fitting 262 opens into main body 260 and receives rebreathing bag 37.

A bleed valve **263** is provided to allow the gas within main body **260** to controllably escape to an external environment. Bleed valve **263** has a cap **281** received by fitting **280** communicating with the hollow interior of main body **260.** A stem **282** is integrally connected to the circularly shaped cap **281** and has a chamber **283** receiving a ball **284.** The bottom end **285** of stem **282** is restricted so as to prevent the ball from falling from the chamber. Likewise, a bonnet **286** is received at the top end of the stem having an aperture **287** of a sufficiently small size so as to prevent ball **284** from being forced from the chamber as a result of gas pressure. An overcap **289** having an integral plug **290,** and internal ribs such as **291** received in circularly spaced grooves **288** extending longitudinally down the outside of cap **281,** is normally used, though not shown in FIG. **1.**

To use the bleed valve for bleeding some gas from the system, cap **281** is manually turned on fitting **280** to obtain some registry of an aperture **292** in the skirt of cap **281** with a slot **293** in the wall of fitting **280.** The shape of the edges of the aperture and slot can be designed as desired to obtain various rates of attainment of registry of the openings per degree of turning of the cap. The gas thus vented can escape from under the lower edge of the overcap.

To avoid accumulation of vented gas in the vicinity, a vacuum line can be employed. For this purpose, a loop **294** is provided on the overcap, and is sized to fittingly receive a vacuum hose. The loop is turned downward on its integral plastic hinge **295** and the hose end is projected through it to the space **296** to extract from under the overcap **289** all vented gas and discharge it to the exhaust of the vacuum system.

In some instances it may be desirable to bleed gas from the system through the tapered passageway **283.** For this purpose, the overcap is raised so plug **290** is removed from aperture **287.** The friction fit of the ribs **291** in grooves **288** will retain the overcap in position with plug **290** out of the aperture. Then gas can escape upwardly through passageway **283.** At higher internal pressures, the ball will be raised further in the passageway, whose internal diameter increases at increasing distances from the bottom. If the anesthetist squeezes the rebreathing bag, of course the ball will seat on the edge of the aperture **287,** terminating the bleeding and facilitating production of the effect desired from squeezing the bag.

It was mentioned above that the valve assembly **265** employed the rib **265B** on the upstream face of the cup. Rib **243** in FIG. **3** and rib **254** in FIG. **4** were also mentioned. If it is desired to have the valves built directly into the canister, valve assemblies like **265** can be employed. At fitting **215** (FIG. **4**) the cup would be mounted with its rim abutting wall **250** and located around rib **254,** and adhesively or otherwise secured and sealed around its circumference at the abutment of the rim with wall **250.** Thus it will permit flow only out of the canister at this fitting. At fitting **218** (FIG. **3**) the cup would be mounted with rib **265B** centered within rib **243** and adhesively or otherwise secured and sealed around its circumference at that location. Thus the valve will permit flow only into the canister at this fitting. The outside and inside diameters of rib **265B** of the cup, and rib **254** of the fitting **215** are essentially the same. Also the outside and inside diameters of the flange **265A** at the rim of the open end of the cup are essentially the same as they are for rib **243** of fitting **218.** Therefore, if an attempt were made to install the cups in the wrong direction on the respective fittings there would be no mating of the cups to the fittings, and the error would be immediately noticed and corrected.

Referring now to FIGS. **6** and **7,** note that in this embodiment the perforated partitions **231** and **232** of the previous embodiment are absent from the grooves on the walls. Instead there are perforated partitions **296** and **297,** both inclined as best shown in FIG. **7.** One or more buttons or a ledge can be provided on the inner face of wall **223** as shown at **298** to support the upper edge of each of the partitions. The upper ribs **227** of the walls **219, 220** and **224** can support the lower portion of the partitions. This of course does not show in FIG. **6** because the location of the section plane is the same as that for FIG. **2.** The partitions can be adhesively or otherwise sealed to the walls of the canister, if desired, prior to installation of the cover.

Some benefits derived from the sloped upper partitions are increased available space for absorbent material, facility of filling with absorbent material, desirable gas flow distribution through absorbent material. Of course additional perforated partitions can be employed if and where desired between the various sets of ribs **227.** Also, if desired, the inclined partitions can be employed in a unit having an additional pair of perforated partitions, one on each side of wall **224** and in the upper grooves, as shown in FIG. **2** for partition **231** and **232,** or in lower grooves, with the additional partitions serving to confine the absorber material, leaving free space between the additional partition and the inclined partitions. When a full volume of absorbent material is filled completely to the inclined partition, the particles are normally larger than the I.D. of the apertures in fittings **200** and **214,** and are not likely to clog them. If believed necessary or desirable, a fiberglas gauze or filter material can be employed in the apertures.

It may be observed from the drawings that the entire case, including lid, is made of a transparent plastic. This is true also of the four-way coupling. Therefore the interior as well as exterior of the entire unit can be observed during use. Also the shape of the case and location of fittings and shape and placement thereof, and the tapers and draft of the surfaces involved facilitate molding thereof in one piece. The same is true of the lid, and the plastic portions of the valve assemblies. Because the plastic is expendable, all of this contributes significantly to low cost whereby the entire canister and four-way coupling are expendable, and can be discarded after use with a single patient.

Perhaps it should be mentioned that, while the chamber below the perforated partitions FIGS. FIG. **1** through **4** and **6** and **7** are shown with only a comparatively few particles of absorbent material therein, this is for convenience of illustration of other features of the unit, and it should be understood that wherever the particles are shown, the chamber is actually filled with the absorbent material.

In the use of the equipment, because of the low cost, and because of the various possibilities for absorbent material capacity with-in canisters of a standardized size, where anesthesia will be needed for an extended period on an adult patient of large lung capacity, a canister partitioned for maximum volume of absorber material may be used. After anesthesia, the entire circle absorption system may be discarded economically, in-

cluding not only the hoses, rebreathing bag, and face mask, but also the four-way coupling and valve assembly, and canister. A new system may be assembled for the next patient and may employ a canister with the perforated partitions located such that the canister is filled to a lesser volume with absorbent material, depending on the needed duration of the anesthesia and the size of the patient. While possible, it is not intended that the canister be filled at the site of use, but rather that a more practical approach is to stock pre-filled and sealed canisters, filled with various volumes of absorbent material depending upon anticipated patient requirements.

Incorporation of the valves in a separable coupling member as shown in FIGS. **1** and **5**, and which can be friction fitted into and removed from fitting **218** in a succession of canisters, makes possible the use of this valve coupling with several patients in succession if desired, even though a different canister is used for each patient. The valved coupling may be succeptible to certain sterilization technique making its re-use completely safe. However it is contemplated and preferred that the entire circle system of FIG. **1** be assembled of new parts for each patient in succession, and discarded after use with that patient. Naturally the gas machine would not be discarded, nor is it likely that the pressure gauge or mounting bracket would be discarded. While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiments have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

The invention claimed is:

1. The combination comprising:

container means including a rectangular case having partition means therein and a lid cooperating with said partition means to define first, second, and third chambers in said case, said second chamber being adjacent to said first and third chambers, a first inlet fitting in said container means communicating with said first chamber, a first outlet fitting in said container means communicating with said third chamber, an absorbent material for carbon dioxide disposed in said second chamber, and said first chamber being isolated in said case with respect to said third chamber except for communication through said absorbent material in said second chamber, said fittings being recessed;

additional apertured fittings in said container means communicating with at least one of said chambers therein;

said additional fittings being disposed on a wall opposite said inlet and outlet fittings, said fittings having parallel axes.

2. The combination of claim **1** wherein at least three of said fittings include apertured stems outwardly directed with respect to said container means but terminating substantially in alignment with the respective walls on which said fittings are disposed.

3. The combination comprising:

container means including a rectangular case having partition means therein and a lid cooperating with said partition means to define first, second, and third chambers in said case, said second chamber being adjacent to said first and third chambers, a first inlet fitting in said container means communicating with said first chamber, a first outlet fitting in said container means communicating with said third chamber, an absorbent material for carbon dioxide disposed in said second chamber, and said first chamber being isolated in said case with respect to said third chamber except for communication through said absorbent material in said second chamber, said fittings being recessed;

a four way coupling mounted to said second inlet fitting, said coupling having a fourth chamber with a one way inlet fitting allowing gas to pass only in a direction into said fourth chamber, said coupling having a one way outlet fitting allowing the gas to pass from said fourth chamber into said first chamber, said coupling having a gas bag fitting and a bleed valve.

* * * * *