

- [54] **CARBON DIOXIDE ABSORBER APPARATUS**
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[22] Filed: **Oct. 22, 1970**
[21] Appl. No.: **82,975**

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Related U.S. Application Data

- [65] Continuation-in-part of Ser. No. 843,947, July 23, 1969.
[52] U.S. Cl.....128/191 R, 23/252, 55/267, 128/142.6
[51] Int. Cl.....A62b 7/10
[58] Field of Search.....128/191 R, 188, 203, 142, 142.6, 128/142.2, 142.3, 142.4, 145-145.6, 145.7, 145.8, 146.6, 146.7; 137/533, 533.19, 559; 23/252, 288 R, 284

[57]

ABSTRACT

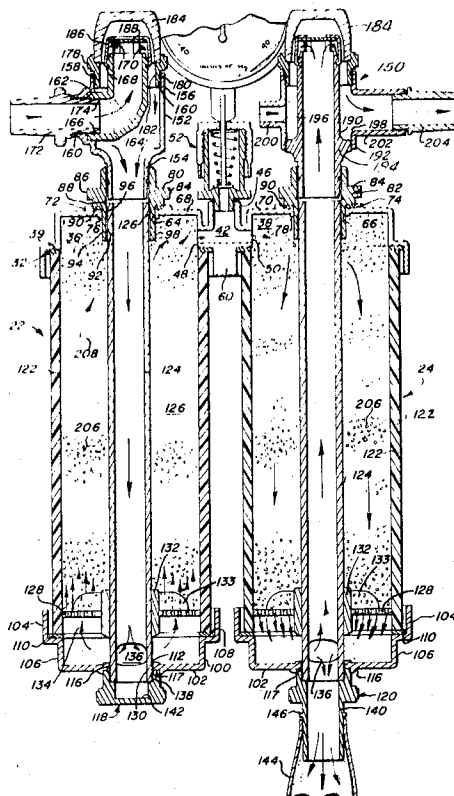
A carbon dioxide absorber apparatus for use in the administration of anesthesia, said apparatus being demountable in its entirety to a plurality of components all sterilizable in demounted condition by use of conventional autoclave equipment, said absorber apparatus having solely internal passageways to define a unidirectional path for the passage of gases therethrough, with all portions of the path being demountable and accessible for said sterilization.

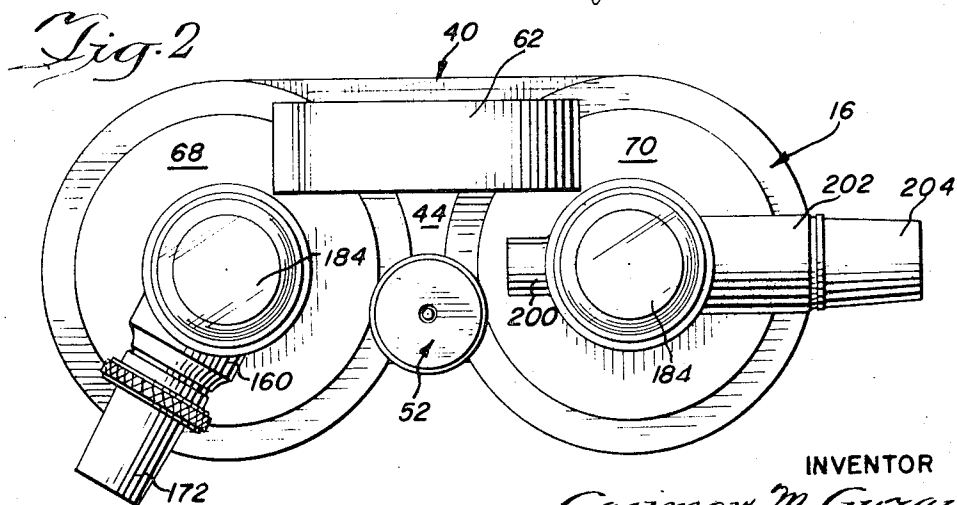
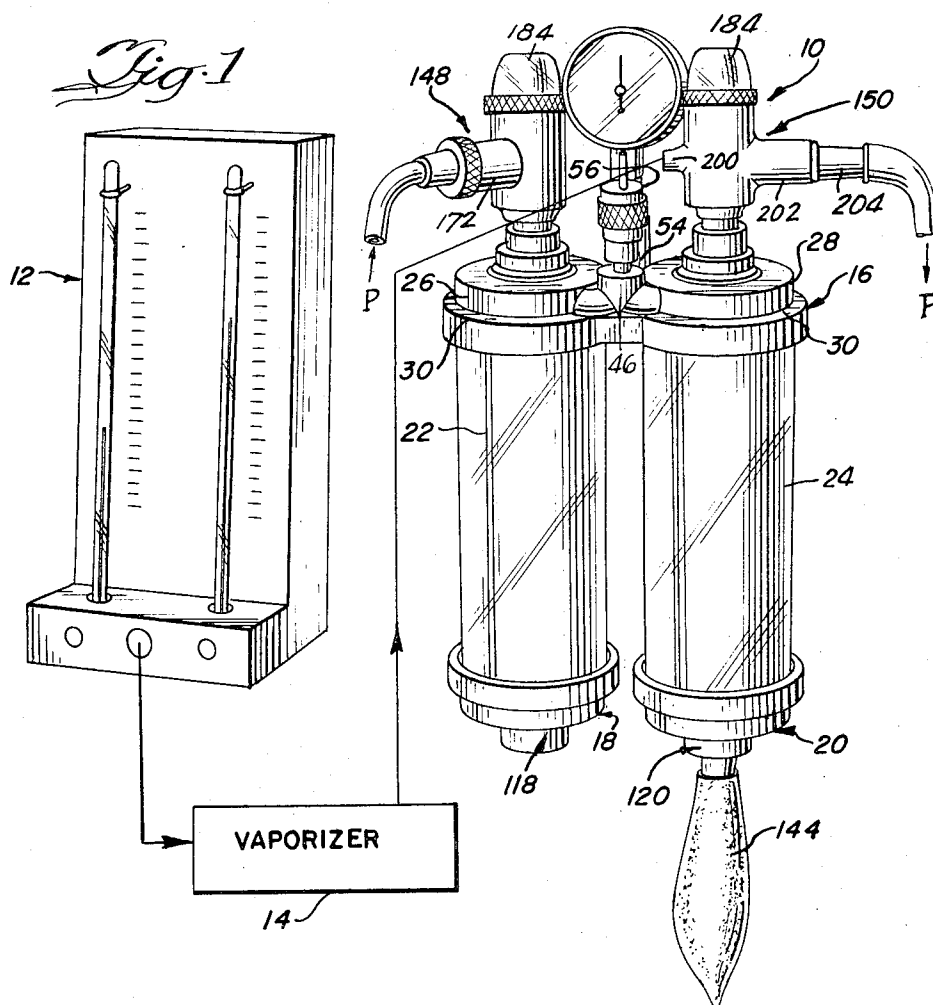
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12 Claims, 3 Drawing Figures

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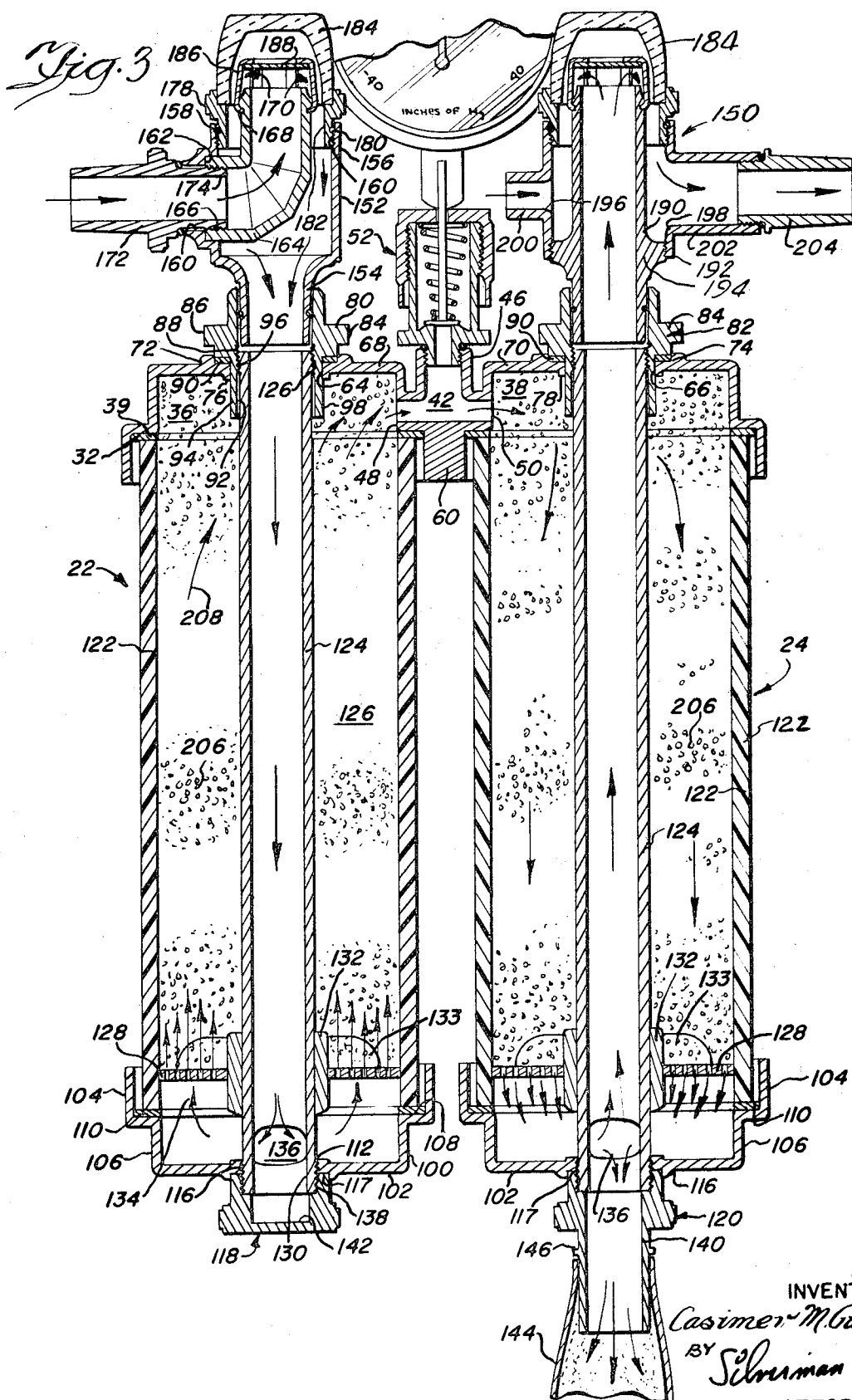




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CARBON DIOXIDE ABSORBER APPARATUS**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation-in-part of my copending United States Patent application Ser. No. 843,947 filed July 23, 1969 for "CARBON DIOXIDE ABSORBER APPARATUS."

FIELD OF THE INVENTION

This invention relates generally to apparatus utilized to remove carbon dioxide from respiratory gases in the course of procedures utilized in the administration of anesthesia. More particularly, the invention is concerned with the provision of an improved carbon dioxide absorber apparatus for closed system administration of anesthesia, said apparatus capable of being knocked down to a plurality of components all capable of autoclave sterilization in their entirety, yet said apparatus having solely internal passageways for the passage of gases therethrough; being formed of component parts which are capable of economic fabrication; and, being unusually versatile as compared to apparatus heretofore available.

My earlier co-pending application provided, for what is believed to be the first time, a carbon dioxide absorber apparatus for the function desired which was capable of being knocked-down to component parts, all sterilizable utilizing conventional autoclave equipment. This was possible because of the available accessibility of all passageways and interior formations of the absorber apparatus in its knocked-down condition. The earlier apparatus included an absorber head formed of a pair of components each fabricated as a unitary casting. The head included mounting structure for internal pressure indicating means, for relief valve means, for means for introducing oxygen for enrichment of the respiratory gases and for valve means for conducting the respiratory gases between the patient and the absorber. Gases from the patient enter the absorber apparatus by way of the absorber head which is formed on a pair of castings, one being a hollow cover and the other being formed as an annular spoked frame. The castings were coupled one to the other and also mounted in direct communication with an absorbent containing canister having a perforate top and floor. The bottom or floor of the canister was coupled directly to a dish shaped base member, also formed as a casting. Passage means were provided coupling the interior of the base to an exterior placed airway which, in turn, was coupled to an inhalation valve means to which was mounted a breather bag and conduit means leading back to the patient. The path of travel of the gas through the absorber apparatus was unidirectional, that is downward from the wide mouth outlet of the absorber head through the absorbent in the canisters and to the wide mouth entry to the interior of absorber base, thence to and through the exterior airway to the inhalation valve means and breather bag, and then back to the patient.

Carbon-dioxide absorber apparatus other than the apparatus disclosed and claimed in my earlier co-pending application, have been characterized by the presence of interior passageways configured so as to be incapable of being completely cleared of residue for sterilization, and in fact were believed incapable of

being demounted and sterilized in their entirety, generally due to the nature and arrangement of the interior passageways. The co-pending apparatus solved these difficulties and many others as enumerated in the copending application but possessed certain attributes which limited its versatility in commercial use. One could not utilize the same absorber in surgery, dentistry and veterinary medicine applications.

One other of the limitations involved the utilization of an exterior airway between the base and the exhalation valve means. This provided opportunity for inadvertent disconnection and also provided an obstruction object and hazard to the passage of persons thereabout. The compactness of the overall structure was not good as ultimately desired. It would be more advantageous to utilize totally internal passageways rather than an external airway without the need for portions extending exterior of the absorber. Further, even though the castings were relatively simple as compared with other available carbon-dioxide absorbing apparatus, a more economically fabricated structure still was desired. Improvements in assembly and disassembly also were desired.

Accordingly, the invention herein provides an improved carbon dioxide absorber apparatus economic in structure and a solely internal flow path for gases eliminating the presence of any external airways with their attendant disadvantages.

SUMMARY OF THE INVENTION

A carbon dioxide absorber apparatus which comprises a unitary absorber head casting, a pair of base castings means for accommodating inhalation valve means and exhalation valve means upon the absorber head, tubular means for connecting the absorber head to the pair of base elements and canister means interposed between the absorber head and the pair of base elements, said canister means arranged in side by side relationship, the path of gas flow being entirely internal of the absorber apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, partially diagrammatic, partially perspective, of the carbon-dioxide absorber apparatus according to the invention as incorporated in a system for the administration of anesthesia to a patient.

FIG. 2 is a top plan view of the absorber apparatus as illustrated in FIG. 1.

FIG. 3 is an enlarged cross section taken along lines 3-3 of FIG. 2 and in the direction indicated.

DESCRIPTION OF A PREFERRED EMBODIMENT

The carbon-dioxide absorber apparatus according to the invention is designated generally by reference character 10 in FIG. 1 and is illustrated as incorporated in a system which includes a gas mixing and delivery head 12 and a vaporizer 14. The absorber apparatus 10 has an absorber head 16 and a pair of absorber bases 18 and 20. A pair of canisters 22 and 24 of cylindrical configuration are received between the head 16 and bases 18 and 20. The canisters 22 and 24 are arranged vertically parallel one next to the other as shown in FIG. 1.

The absorber head 16 is formed as a unitary casting and includes a pair of inverted cup-like portions 26 and 28, each portion having an annular depending flange 30 of L-shaped cross-section, the inner diameter of which being slightly larger than the outer diameter of the canisters 22 and 24 respectfully. Said flanges 30 each define seats 32 carrying gaskets 34. The portions 26 and 28 define respectively interior chambers 36 and 38, the inner diameter thereof being substantially equal to the inner diameter of the cylinders 22 and 24. The portions 26 and 28 are spaced one from the other but share a common horizontal plane. A bridging formation 40 is provided integral with said portions 26 and 28. Formation 40 includes a hollow passage 42 and a platform 44. The hollow passage 42 provides sole communication between the chambers 36 and 38 and has an upstanding internally threaded hollow conduit 46 opening thereto. Each of the portions 26 and 28 are provided with side openings 48 and 50 establishing communication from chambers 36 and 38 to the hollow passage 42. A pressure relief valve arrangement 52 is threadably engaged within the conduit 46. The platform 44 carries a vertical tube 54 which has a narrow diameter portion 56 at the upper end thereof. A passage is provided in the tube 54 adjacent the platform 44 to establish communication to the hollow passage 42. A depending column 60 is carried by the undersurface of the platform 44 coaxial with the tube 54 for mounting the apparatus 10 to a conventional stand or the like at the scene of use. (not shown) A manometer 62 or other pressure measuring gauge is sealably mounted to said tube 54.

Central openings 64 and 66 are formed in the top walls 68 and 70 of portions 26 and 28. Each of these openings 64 and 66 are surrounded by annular ribs 72 and 74 spaced slightly from the openings 64 and 66 on the upper surface of the walls 68 and 70. Depending annular ribs 76 and 78 are formed in the under surface of said walls 68 and 70 immediately adjacent and bordering said openings 64 and 66.

Adaptors 80 and 82 are received within said openings 64 and 66. The adaptors 80 and 82 are identical in construction and tubular in configuration, each having a stepped annular collar 84 formed on the outer circumferential surface thereof spaced from the ends of the adaptor, the wide diameter portion 86 carrying knurling to enable facile manipulation and the narrower diameter portion 88 thereof carrying a gasket 90 secured thereon about the circumference of the adaptor. The outer diameter of portion 88 is substantially the same as the diametric distance between inner edges of ribs 72 and 74 respectively. The adaptors 80 and 82 each have an axial bore 92. The wall 94 defining the bore 92 is provided with threading 96 for coupling to the airway conduits as will be explained hereinafter. The outer diameter of the lower end portion 98 of the adaptors 80 and 82 is selected to be substantially the same as the diameter of the respective openings 64 and 66 so that the said portions 98 slip into the said openings 64 and 66 in a close fit with the gaskets 90 seated in the seat defined by ribs 72 and 74 respectively and the walls 68 and 70.

Base means comprising bases 18 and 20 are each dish shaped castings identical in construction. Said bases 18 and 20 are formed having an annular stepped

wall 100 and a floor 102. Wall portion 104 has a greater diameter than the wall portion 106 and therefor a gallery 108 is defined and seats a gasket 110. A central opening 112 is formed in the floor 102 and is provided with threading 114. An annular abutment 116 is provided, spaced slightly from the opening 112 to define a seat 117. The diameter of the opening 112 is the same as the diameter of the openings 64 and 66 and when installed or assembled, said openings 112, 64 and 66 are coaxial. Cap means are provided comprising caps 118 and 120, seated in seat 113 over the openings 112 of bases 18 and 20 respectively.

Canisters 22 and 24 likewise are identical in construction. Canisters 22 and 24 each are formed of a pair of cylinders 122 and 124 coaxially arranged one within the other. Cylinder 124 is of relatively narrow diameter compared to cylinder 122 and is longer than cylinder 122 to extend outwardly therefrom at both ends thereof. A chamber 126 is defined therebetween. The upper end of cylinder 122 is open, and, when assembled, is seated in seat 32 of the absorber head. The cylinder 124 has external threading provided at its upper end as shown at 126. Thus, cylinder 124 is adapted to be threadably engaged with the threaded portion 86 of adaptors 80, 82.

A perforate disc 128 is mounted permanently to the cylinder 124 at a location spaced from the lower end 130 thereof, by a collar 132 and is supported rigidly by radial top and bottom ribs 132 and 134. The diameter of the disc 128 is substantially the same as the inner diameter of the cylinder 122 so that said disc 128 as installed, serves as the floor of the canister. Cylinder 124 is provided with a pair of opposite openings 136 of oval configuration spaced from the lower end thereof. The lower end of the cylinder 124 is provided with a threaded portion 138 for threadably engaging caps 118 and 120 to complete the assembly of the absorber head 16, absorber bases 18 and 20 and the canisters 22 and 24.

Cap 120 differs from cap 118 in that cap 120 has a hollow tubular formation 140 opening to what can be described as equivalent to the well 142 of cap 118. A conventional breather bag 144 is secured to the end of the formation 140, annular ridge 146 being provided thereon.

Directing attention now to the exhalation valve means 148 and the inhalation valve means 150 which are arranged to be frictionally sealably received in adaptors 80 and 82 respectively. The exhalation valve means 148 receive the gases from the patient while the inhalation valve means 150 provide the outlet for the carbon-dioxide free, anesthetic containing gases from the absorber apparatus 10 to the patient.

The exhalation valve means 148 comprises a housing 152 of cylindrical configuration which includes a depending hollow tapered conduit 154 and an open top 156. The open top 156 has an interior gallery 158 and a threaded portion 160 adjacent said gallery 158. A side opening formation 160 is provided in the housing 152. A seat 162 is provided surrounding the opening 160. A right-angle pipe 164 carrying interior threads at one end 166 and an annular groove 168 in the circumferential surface at the opposite end 170 thereof, is seated in seat 162 and an inlet pipe 172 carrying a threaded end 174 is engaged with end 170. A collar

178 is received sealably within open top 156 of housing 152, the seal being effected by means of O-ring 180 mounted on threaded portion 182 of collar 178. Collar 178 carries thereon viewing cap 184. Retaining cage 186 is secured to annular groove 168 of pipe 164 and a thin disc 188 is normally seated over end 170 of pipe 164 and lifted off of said end during gas flow.

The inhalation valve means 150 is similar in constructions to the exhalation valve means 148 except that inner plate 190 is threadably connected to the interior of the housing 192 as shown at 194. An opening 196 additional to opening 198 is provided in the wall of the housing 192 and a pipe 200 is provided integral with the housing. An outwardly extending outlet conduit 202 is integral with housing 192 and is joined integral with outlet adaptor pipe 204. Pipe 200 is coupled to the source of anesthetic gases, here coming from the vaporizer 14. All other components of the exhalation valve means are identical in construction to those of the valve means 148.

Each of the component elements of the absorber apparatus 10 is demountable into its parts and all are sterilizable in a conventional autoclave (not shown). The arrows 208 indicate the path of flow of the gases from the patient into and through the apparatus 10. The exhalent gases enter the absorber by way of pipe 164 unseating disc 188 and thence travel through the housing 152 to the conduit 124 into the base 118 by way of openings 136 and thence, past the perforate disc 128 of canister 22 through the absorbent 206 disposed as a charge in cylinder 122, into the chamber 36 of head 16 through passage 42 to the chamber 38 of head 16, through the absorbent carried in the other canister 24 and back to the conduit 124 of canister 24. A portion of the cleaned gases will inflate the breather bag 144 and a portion will flow upward along conduit 124 interior to the pipe 190 unseating disc 188 thereof and thence to the housing 152 of the valve means 150 where it is mixed with the anesthetic gases from the vaporizer 14 apparatus by way of conduit 200 and is directed by way of conduit 202 to outlet adaptor 204 to the patient, P.

The size of the canisters 22, 24 determine the charge of absorbent material and these canisters can be exchanged with canisters of different capacity for different applications. Simply by unscrewing the caps 118 and 120 and the unscrewing of pipes 124 and 124' from the adaptors 80, 82 the apparatus 10 can be disassembled. The valve means 148 and 150 likewise can be disassembled and reassembled easily. Connection of the valve means 148 and 150 to the canisters can be effected merely by frictional engagement, as illustrated. The gaskets, including gaskets 90, shown herein preferably are selected to be formed of silicone rubber materials or polytetrafluoroethylene compositions to withstand autoclave temperatures.

I claim:

1. A carbon-dioxide absorber apparatus demountable to plural externally accessible components each capable of sterilization by autoclave methods and for use in closed circuit administration of anesthesia, wherein exhalent respiratory gases are introduced thereinto, exposed to an absorbent medium therein to remove carbon-dioxide therefrom and released for return as inhalent gases enriched with anesthetic gases, said absorber apparatus comprising:

1. a unitary absorber head having a pair of spaced, like bottom opening recesses defining a pair of head chambers and a bridging passageway formed between said head chambers,
2. a pair of canisters, each having an internal axial conduit extending outward from opposite ends thereof, each of said canisters having an open upper end and a perforate lower end and containing absorbent medium therein,
3. a pair of cup-like base members,
4. means for releasably securing said cup-like base members to said lower ends of said canisters and simultaneously coupling sealably the upper ends of said canisters within respective ones of said recesses of said absorber head, with the axial conduits thereof respectively isolated from said head chambers,
5. demountable exhalation valve means and inhalation valve means releasably coupled to said absorber head in communication with the axial conduits of respective ones of said canisters,
6. said axial conduits each having port means located at the lower ends thereof and below the perforate lower ends of said canisters, said port means communicating with the interior of said base members, securement of said base members to said canisters closing off the lower ends of said canisters whereby a continuous interior unidirectional path for gases is established along a path defined by the exhalation valve means through said axial conduit to said associated base member to the canister interior to the one associated absorber head chamber through said passageway to the other associated absorber head chamber and through said second canister interior to said other base member and by way of said associated axial conduit thereof to and through the inhalation valve means to the exterior of the absorber apparatus.
2. The apparatus as claimed in claim 1 in which relief valve means and pressure monitoring means respectively are removably sealably coupled to said absorber head in communication with said bridging passageway between said head chambers.
3. The apparatus as claimed in claim 1 in which adaptor means are provided having opposite open ends are slidably, sealingly engaged with said absorber head communicating to said head chambers, and said respective inhalation and exhalation valve means are sealably slidably coupled to one end of said adaptor means and means are provided at the other end of said adaptor means for releasably coupling the axial conduits of said canisters thereto.
4. The apparatus as claimed in claim 1 in which said means for releasably securing comprises cap means having means for threadable securement thereof to the lower ends of said axial conduits and seatable on said exterior surface of said base members.
5. The apparatus as claimed in claim 4 in which said cap means includes a cap member having a perforate portion and a depending hollow stem surrounding said portion and having a free open end and a breather bag is secured over the free end of said stem, and a second cap member having a well in lieu of said hollow stem.
6. A carbon dioxide absorber apparatus demountable to plural externally accessible components each capable of sterilization by conventional autoclave

methods and for use in closed circuit administration of anesthesia, wherein exhalent respiratory gases are introduced thereinto, exposed to an absorbent medium contained therein to remove carbon dioxide therefrom and released for return as inhalent gases enriched with anesthetic gases, said absorber apparatus comprising:

a unitary absorber head having a pair of spaced, bottom opening, chambers arranged side by side and a horizontally arranged passageway formed in said head between said chambers communicating therebetween,

a pair of canisters, each adapted to contain absorbent medium and arranged in parallel, side by side, sealed relationship with said head chambers to close off same,

a pair of axial tubes extending respectively through each of said canisters isolated from said head chambers,

hollow base means arranged at the lower ends of each canister sealably coupled thereto to define a base chamber for each canister,

the lower ends of said axially disposed tubes respectively passing through said head chambers and having side openings communicating with a respective one of said base chambers,

cap means threadably mounted to the lower ends of said axially disposed tubes,

demountable exhalation valve means and inhalation valve means,

adaptor means sealably secured to said absorber head respectively communicating with said head chambers and receiving, threadably, the upper ends of said axially disposed tubes, said exhalation valve means and inhalation valve means received coaxially within said adaptor means, said cap means and said adaptor means cooperating in said securement to couple sealably said head, canisters and base member ones to the others, one of said cap means being imperforate so as to close off its respective base and the other of said cap means having passage means for attaching a breather bag thereto.

7. The absorber apparatus as claimed in claim 6 in which the cap means and adaptor means are internally threaded and the axially disposed tubes are externally threaded adjacent opposite ends thereof.

8. The absorber apparatus as claimed in claim 6 in which check valve means are provided removably coupled to said horizontal passageway in said absorber head.

9. The absorber apparatus as claimed in claim 6 in which said exhalation and inhalation valve means in-

clude a housing, an inlet conduit, a chamber defined within said housing and an outlet conduit, at least said inlet conduit being threadably coupled to said housing and valve means disposed between said inlet conduit and said chamber and arranged to control passage from the inlet to the outlet.

10. The absorber apparatus as claimed in claim 9 in which said inhalation valve means includes a coupling conduit to enable introduction of anesthetic gases from an exterior source into housing.

11. The absorber apparatus as claimed in claim 9 in which the exhalation valve means and the inhalation valve means are slidably, sealingly coupled to said head chambers, respectively, by way of said adaptor means.

12. A carbon dioxide absorber apparatus demountable to plural externally accessibly components each capable of sterilization by autoclave methods and for use in the administration of anesthesia wherein exhalent respiratory gases are introduced thereinto, exposed to an absorbent medium therein to remove carbon dioxide therefrom and released for return as inhalent gases; said absorber apparatus comprising:

a hollow absorber head, at least a pair of vertically arranged canisters communicating with said head, hollow absorber base means closing off the lower end of said canisters first valve and conduit means for receiving exhalent gases, second valve and conduit means for discharging gases subsequent passage through said absorber apparatus, said first and second valve and conduit means coupled to said head, axial tubular passage means within at least a pair of said canisters in communication with said first and second valve and conduit means and said base means bypassing said head, and cap means engaging said axial tubular passage means and said base means, and said tubular passage means being in communication with said pair of canisters by way of said base means whereby to define a unidirectional flow along a path defined through said absorber apparatus from said first valve and conduit means through said tubular passage means and thence into said base means and through one of said pair of canisters to said head, thence again to the other of said pair of canisters to said tubular passage means by way of said base means, thereafter to said second valve and conduit means; the apparatus comprised of said first and second valve and conduit means, said absorber head, said canisters and said base means and said cap means being all demountable to establish free interior access to enable autoclave sterilization.

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