

[54] RESPIRATORY REANIMATION AND ANAESTHESIA APPARATUS

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[58] Field of Search 128/188, 274, 196, 197,
 128/207, 210, 145.5, 146.3; 137/597, 608,
 63 R; 248/298; 211/13

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[57] ABSTRACT

A portable, multipurpose apparatus for anaesthesia and respiratory reanimation provided with means, for the vaporization of anaesthetic liquids and for the administration of anaesthetics and respiratory reanimation. The assembly comprises T-pieces, with a switch, for the connecting of a self-inflating bag or of a respiratory bellows ahead of the vaporizer and for connection of a respiratory bag, downstream the vaporizer; a third shutting-off T-piece, with a switch is provided with a self-occluding valve or with a soda lime canister and a self-occluding valve, united by corrugated tubes, with connections for a closed-circuit respirator bag or for a respirator for closed circuit. The portable apparatus has the pieces of the assembly and of the first administering circuit mounted on the upper cross-bar of a supporting frame for the table; in a wall version, with a lower support for the new circuit, the frame can be fixed detachably to a bar fastened in the wall.

6 Claims, 16 Drawing Figures

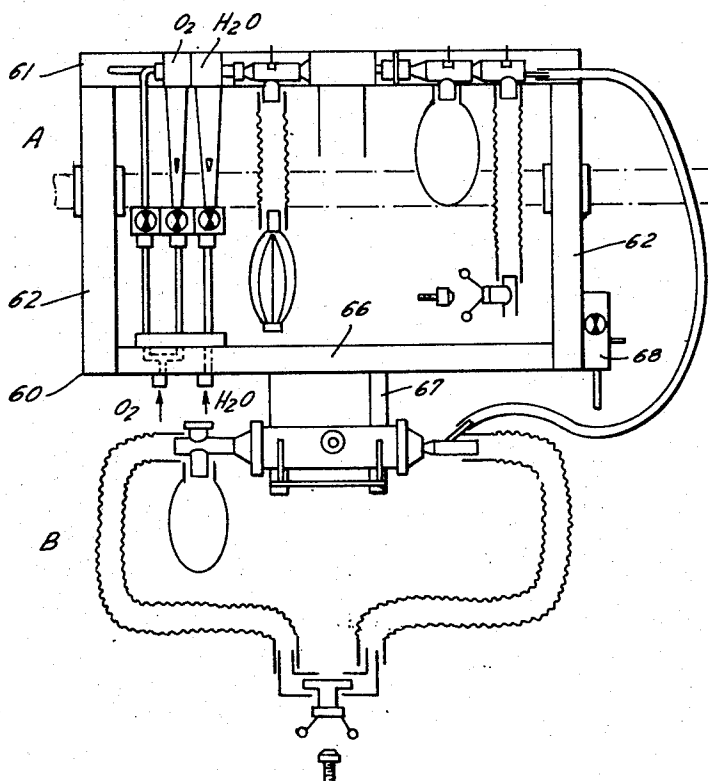


FIG. 1

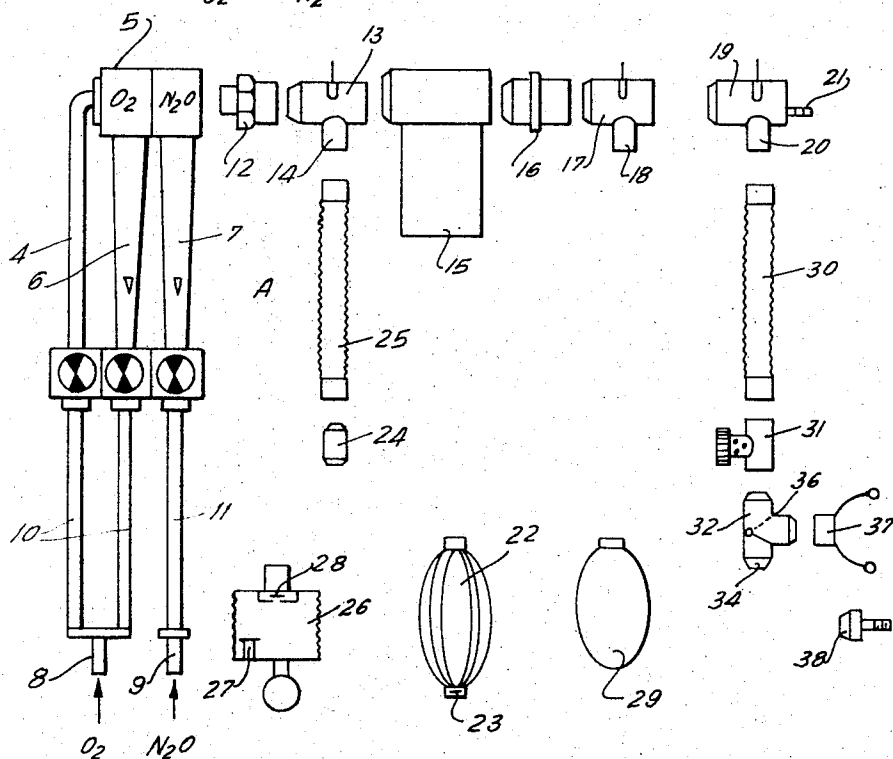
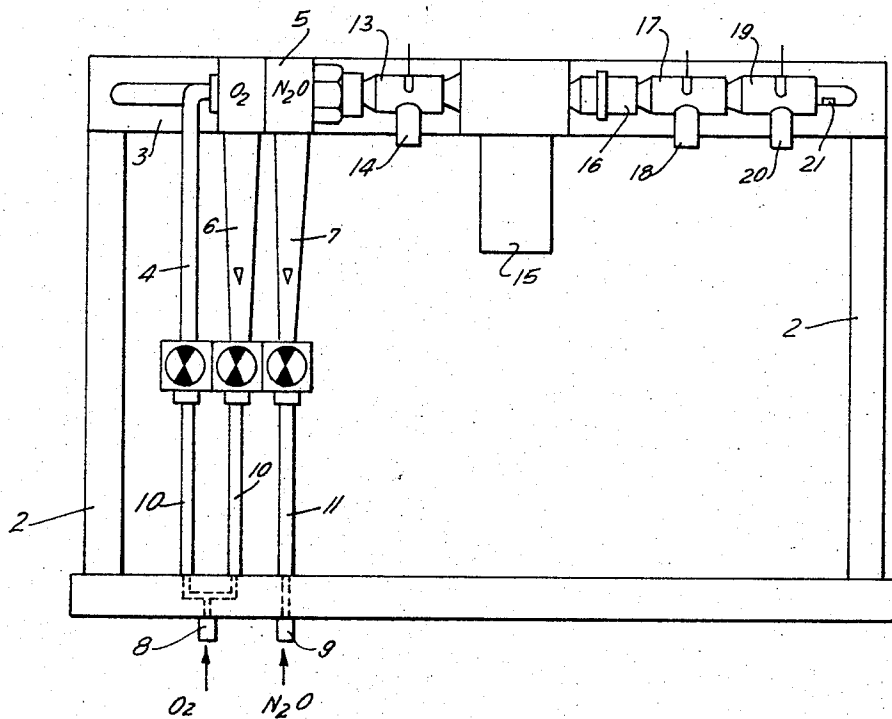


FIG. 2

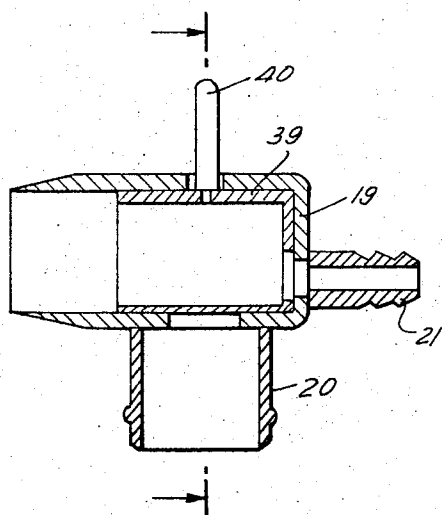


FIG. 3

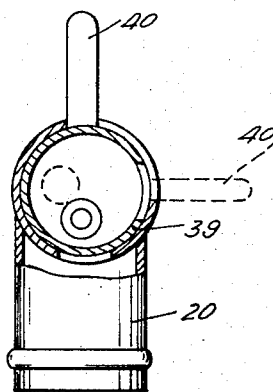


FIG. 4

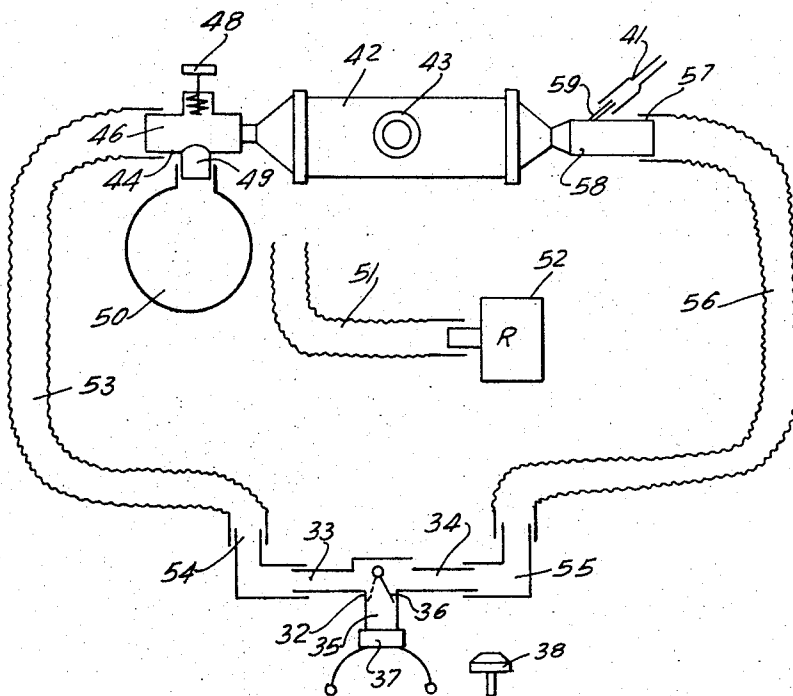


FIG. 5

FIG. 6

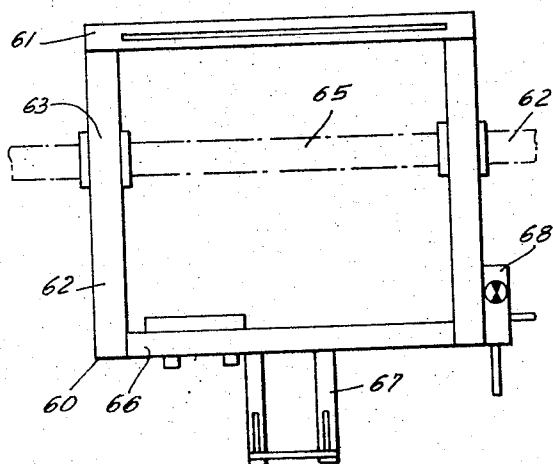
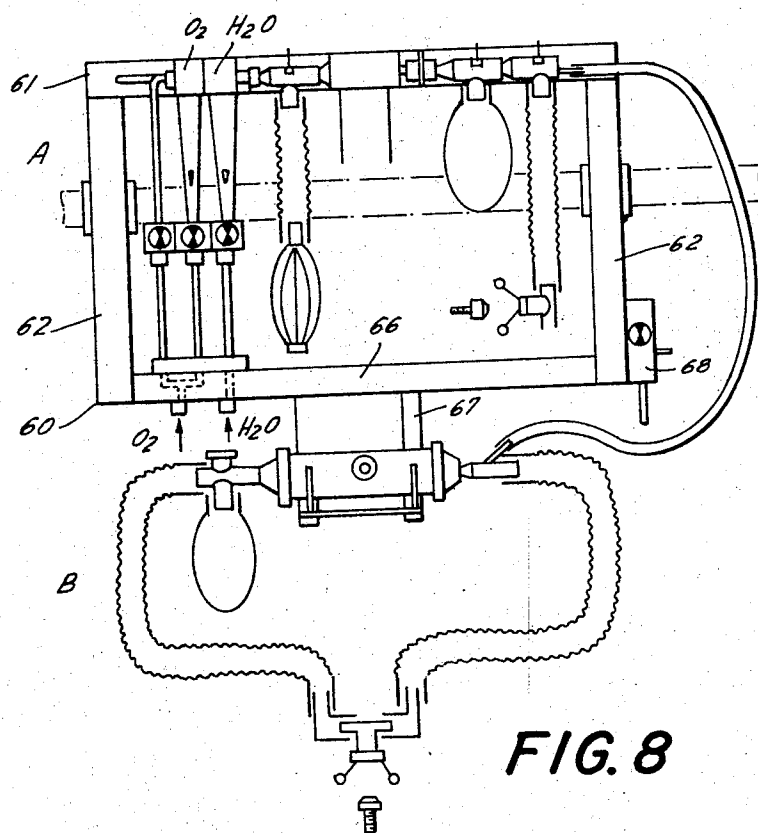
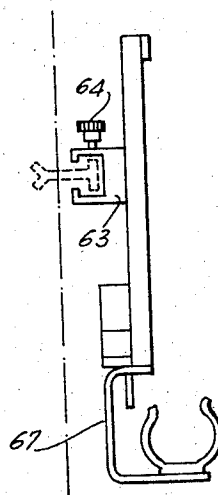
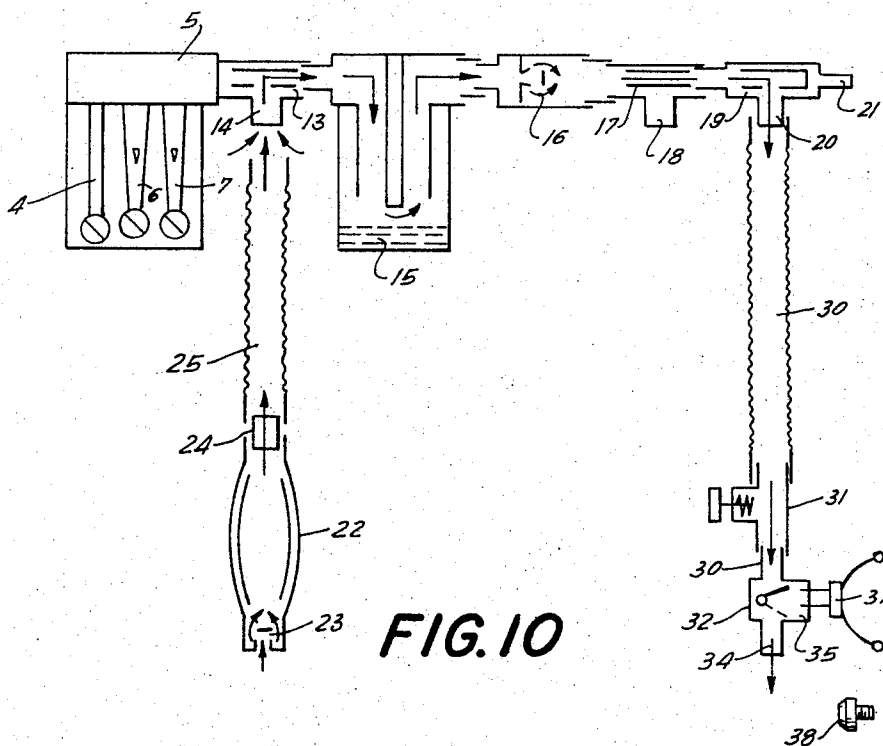
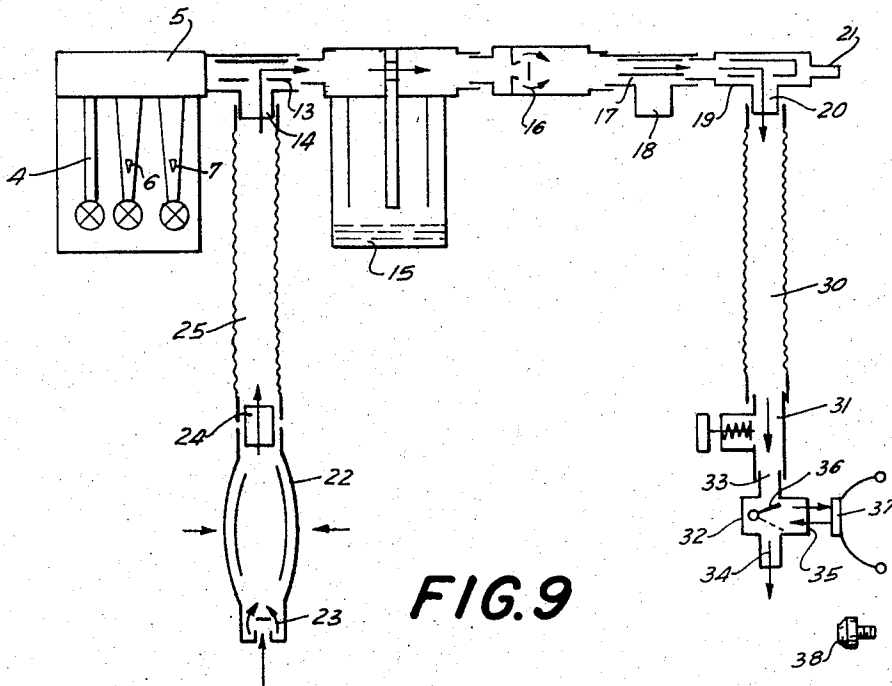
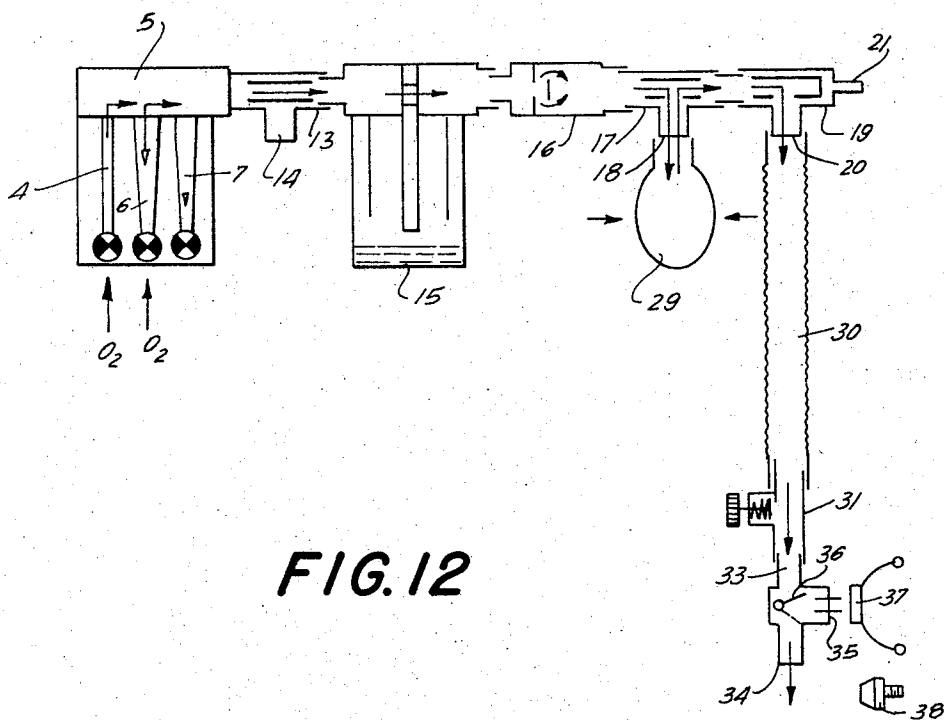
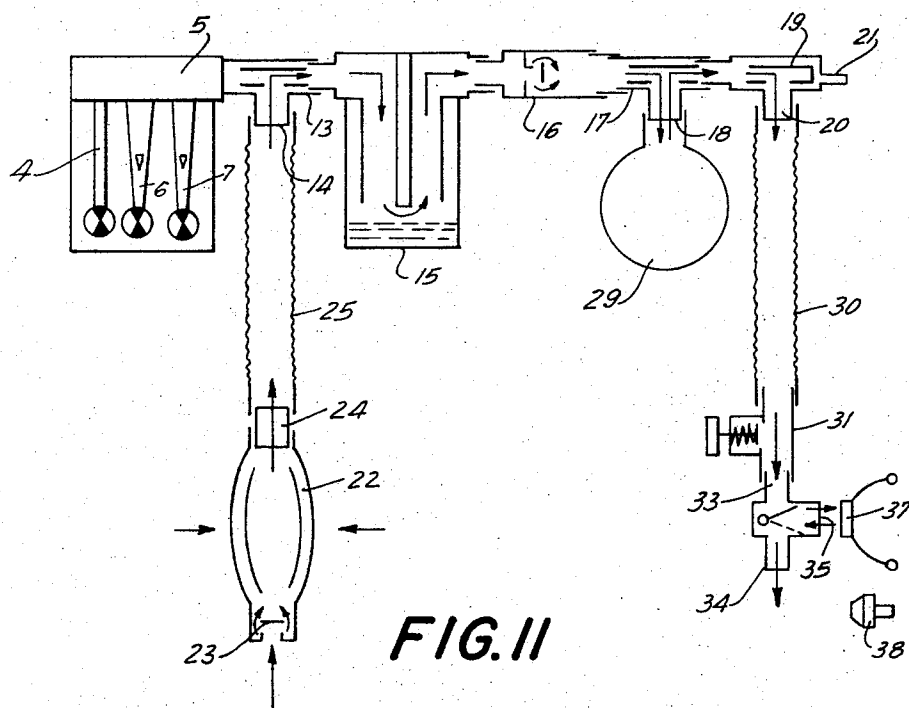


FIG. 7







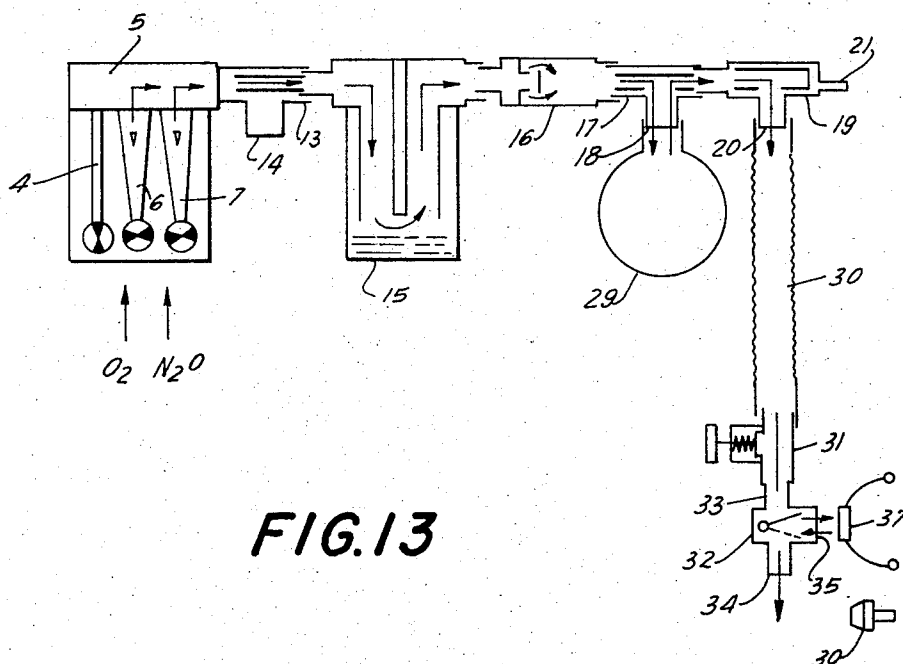


FIG. 13

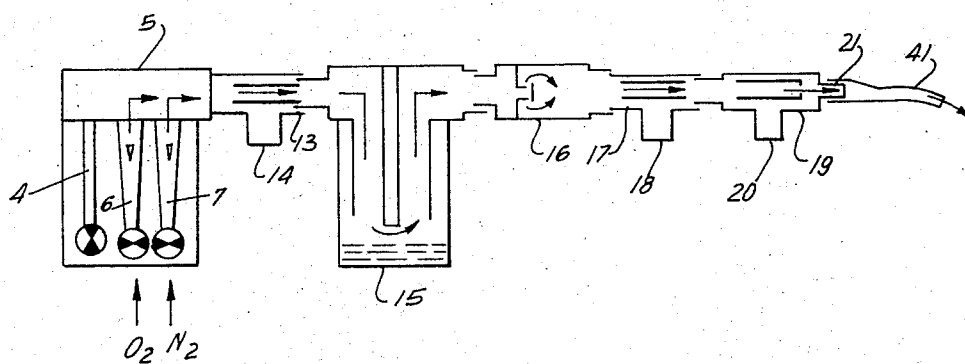


FIG. 14

RESPIRATORY REANIMATION AND ANAESTHESIA APPARATUS

FIELD OF THE INVENTION

The invention relates to a portable multipurpose apparatus for anaesthesia and respiratory reanimation, able to work both in the presence and the absence of medicinal gases, for the vaporization of the anaesthetic liquids and permitting anaesthetization and reanimation.

BACKGROUND OF THE INVENTION

There are known portable systems for anaesthesia and respiratory reanimation which have fixed mountings, and the drawback of not being able to cope with the various situations arising in daily practice, since they cannot be adapted to separate cases.

In general known portable apparatus for anaesthesia and respiratory reanimation may be classified by the technique of feeding the medicinal gases into three groups: a. apparatus operating without an oxygen source, the vaporization of the anaesthetic being performed by the air, which is also used to carry out respiratory reanimation; b. apparatus dependent on a source of medicinal gases, permitting the performance of respiratory reanimation with oxygen and the administration of anaesthesia with anaesthetic vapors and accurately dosed amounts of oxygen and nitrogen protoxide; such apparatus cannot work without a source of medicinal gas; and c. apparatus able to work either in the absence of medicinal gas sources or in the presence thereof; the latter systems offer greater technical possibilities and an easier handling, but have, as a rule, the disadvantage of being noradaptable to the various requirements occurring in daily practice and consequently have no multipurpose character.

Conventional portable apparatus for anaesthesia and respiratory reanimation are constructed, as a rule, with fixed circuits the incorporation technical achievement — a new vaporizer, a new anaesthetic circuit — calls for a complex modification of the apparatus.

In order to meet the requirements of small space, there has been provided a series of anaesthesia devices, fixed to the wall and fed from the hospital distribution with medicinal gases. Such apparatus, too, cannot have a fixed scheme and cannot ensure the continuation of administration of anaesthesia in the case of an accidental interruption of the medicinal gas distribution.

Some apparatus is provided with semi-open anaesthetic circuits, endowed with self-occluding (self-cleaning) valves, so-called "inflating valves"; these valves are used in apparatus that permits respiratory reanimation. In the case of semi-open circuits the self-occluding valve is by the inspiratory branch to the corrugated tube for gas, and by the transverse branch to the face-mask or to the endotracheal tube, while its expiratory branch remains free.

Finally, mention must be made here also of the various known types of administering circuits: the Sword filtering circuit, the Waters to and fro circuit, the semi-open circuits of Magill, Kuhn, Digby-Leigh, Ayre, etc.

SUMMARY OF THE INVENTION

The present invention relates to a portable anaesthesia and respiratory reanimation apparatus comprising

an assembly of elements for the feeding of the circuits with gas or air, for the vaporization of anaesthetic liquids and the mixing and transport thereof, and circuits with units for respiratory reanimation or for the administration of general anaesthesia.

In the apparatus according to the invention, the assembly comprises two T-members for the connection of units for manual air feeding, rearwardly of or downstream of the vaporizer and for the connection of a breathing bag forwardly of upstream of the vaporizer, both having switching possibilities; the assembly comprises also a third shutting-off T-member, with a switch, permitting the lateral or continuous feeding of the administering circuits.

To the shut-off T-member of the assembly one can connect circuits for anaesthesia and respiratory reanimation, namely

a known semi-open administering circuit, provided with a self-occluding valve or

a new closed or semi-closed administering circuit provided, with a self-occluding valve.

Instead of the latter circuit it is possible to connect other known circuits, according to the clinical requirements of the respective case.

The various members of the assembly as well as the components of the various circuits used, are provided with means for rapid assembling and disassembling, which permits the replacement and the multiple use, respectively, of some of the members.

The apparatus, according to the invention, permits the administration of anaesthesia with medicinal gases and anaesthetic vapors, on the mask or endotracheally, to adults or children; the administration of anaesthesia can be effected also in the absence of medicinal gases, using as the carrier anaesthetic atmospheric air also permits. The apparatus respiratory reanimation with air or oxygen. Thanks to these multiple technical possibilities the apparatus has, consequently, a multipurpose character.

The three T-members with respective switches, enable a rapid change over from one mode of administration to another. The new closed or semi-closed circuit extends, the field of utilization of the self-occluding valves. It is lighter than the closed filtering circuits of the art and can work in any position.

DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical elevational view, partly in diagrammatic form of an anaesthesia and respiratory reanimation apparatus according to the invention;

FIG. 2 is a view similar to FIG. 1 showing various possibilities of modifying the system of FIG. 1;

FIG. 3 is a longitudinal section, in a vertical plane, through the shutting-off T-member which is the terminal member of the assembly and which serves also for the feeding of the circuits;

FIG. 4 is a cross section, in vertical plane, through the T-member in FIG. 3;

FIG. 5 is a flowing diagram of the closed or semi-closed administering circuit, with self-occluding valve;

FIG. 6 is a side view of the support on which the apparatus is detachably mounted, in its wall version;

FIG. 7 is a front-elevational view of the support in FIG. 6;

FIG. 8 is an overall side view of the apparatus mounted on the wall support shown in FIGS. 6 and 7;

FIG. 9 is a flow diagram of the apparatus in the system in which it is used for respiratory reanimation with air;

FIG. 10 is a flow diagram of the apparatus in the system in which it is used for the administration of general anaesthesia with anaesthetic vapours carried by atmospheric air;

FIG. 11 is a flow diagram of the apparatus in the system which enables intervention with atmospheric air when medicinal gas stops;

FIG. 12 is a flow diagram of the apparatus in the system used for respiratory reanimation with oxygen;

FIG. 13 is a flow diagram of the apparatus in the system used for carrying out anaesthesia with medicinal gases and anaesthetic vapors in semi-open circuit;

FIG. 14 is a flow diagram of the apparatus in the system used for carrying out anaesthesia with the circuit of FIG. 5 and with known circuits;

FIG. 15 is a flow diagram of the circuit in FIG. 5 working in the inspiratory phase;

FIG. 16 is a flow diagram of the circuit of FIG. 5 working in the expiratory phase.

SPECIFIC DESCRIPTION

The apparatus consists of two main parts (FIG. 2): the assembly A for the feeding of fluids to the circuits, and the administering circuits B.

The feeding assembly, represented in FIG. 1 comprises a support with a base plate 1, columns 2 and an upper gliding cross-bar 3, on which the component pieces are slidably.

To the cross-bar 3 is brought the pipe 4 with a stop cock, for the emergency feed of oxygen, which is assembled with a block 5 for the mixing of the delivered gases and for the fastening of the flowmeters to the cross-bar 3; to the block 5 is connected the adjustable oxygen flowmeter 6 and the adjustable nitrous oxide (nitrogen protoxide) flow-meter 7. These gases are supplied from cylinders or from a central distributing facility, through fittings 8 and 9, at the connecting pipes 10 and 11, respectively. The connecting fitting 12 is screwed into block 5. To the connecting fitting joined in order: the T-connector 13, having a switching lever and a vertical branch 14; the vaporizer 15, which is also secured to the cross-bar 3; the uni-directional valve 16, the T-piece 17, identical with piece 13, with the vertical branch 18; the feeding assembly terminates with the shutting-off T-piece 19, secured to cross-bar 3 and provided with a switching lever, permitting the alternating shutting-off of the vertical branch 20 and of the horizontal branch with a flexible connecting tube, 21.

The various pieces are secured to the cross-bar 3 by means of screws, which are penetrating the slide-way thereof and are fastened at the back side with nuts. The assemblies of the line of pieces 13, 15-17 and 19 are made with assembling cones.

In case of need, the feeding assembly A may comprise two vaporizers, for differing liquids.

The feeding assembly A may be quipped, according to FIG. 2, as follows:

to branch 14 of T-piece 13, can be mounted a self-inflatable bag 22, provided with an inlet valve 23, directly or through the agency of a sleeve 24 and of a short corrugated tube 25;

also to branch 14 can be mounted, in another version, by means of the short corrugated tube 23, the respiratory bellows 26, provided with an inlet valve 27 and an outlet valve 28;

to branch 18 of T-piece 17 one can mount directly the respiratory bag 29;

to branch 20 of the shut-off T-piece 19 one can mount a long corrugated tube 30, followed by piece 31, with an over-pressure (relief) valve and by the self-occluding valve 32, with an inspiratory branch 33, an expiratory branch 34 and an administering branch 35, provided inside with a valvelet 36; to branch 35 is assembled the face mask 37 or the connector of the endotracheal tube 38; these pieces, connected to branch 20 form a semi-open administering circuit.

The shut-off T-piece 19 with its vertical branch 20 and its horizontal tube connection 21, is presented in more detail in FIGS. 3 and 4; it comprises the horizontal cylindrical body 19, with a conical end to be assembled to T-piece 17 and with a bottom at its other end. Inside is a cylindrical valve 39, also with a bottom that can be rotated integrally with lever 40, which ensures alternately, in one position, the communication with connection 21 and, in another position, the communication with the vertical branch 20, through the openings represented in the two figures.

To tube connection 21 is mounted a rubber tube 41 to which are connected the known administering circuits or, preferably, the new closed or semi-closed administering circuit with self-occluding valve.

The latter circuit, represented in FIG. 5, consists of: a soda lime canister 42 with a sight hole 43 for the observation of the colour of the soda lime; to one of the connection sleeves of the canister is assembled the cross-piece 44 with the connection sleeves 45, 46 to the circuit, with the lateral branch 47, within which is the overpressure valve 48, and with the lateral branch 49, to which can be mounted, either the respiratory bag 50 or the long corrugated tube 51 and the respirator 52, working in closed circuit. To the connection sleeve 46 of the cross-piece 44 is mounted the long corrugated tube 53, to the other end of which is mounted an elbow 54, to which is assembled the self-occluding valve 32 by its inspiratory branch 33; to its expiratory branch 34 is assembled an elbow 55, to which is mounted a long corrugated tube 56, the other end of which is mounted to piece 57 for the feeding of the circuit, provided with connexion sleeve 58 for its assembling to canister 42, as well as with the lateral connection sleeve 59, to which is connected the flexible tube 41, the other end of which is mounted to tube connection 21 of the shut-off T-piece 19. To the branch 35 for administering and connecting to the patient, of the self-occluding valve 32, is assembled either the face-mask 37 or the connector 38 of the endotracheal tube.

The apparatus may be constructed also in a version to be fixed to the wall. This is achieved by means of the support presented in FIGS. 6 and 7. The support is formed of a rectangular frame 60, whose upper horizontal side 61 constitutes a gliding cross-bar. On the vertical sides 62 of the support are secured the fixing and sliding pieces 63, with screws 64, of the frame, on the metal bar 65, with its ends embedded in the wall. To the lower horizontal side 66 is fastened underneath the forked support 67, for the sustainment of the closed or half-closed circuit with self-occluding valve.

The apparatus, with the feeding assembly A and the above circuit B is presented in FIG. 8, mounted on the wall support shown in FIGS. 6 and 7.

A suction nozzle 68 is mounted laterally on the side 62 of the frame, for the aspiration of the secretion of the patient.

The portable, multipurpose apparatus for anaesthesia and respiratory reanimation permits the performing of the following operations:

- a. Respiratory reanimation with air in the absence of medicinal gases. The assemblage required is shown in FIG. 9. To the vertical branch of T-piece 13 is mounted the short corrugated tube 25, the sleeve 24 and the self-inflating bag 22, with the valve 23. The T-piece 13 is in an open position, while the vaporizer 15 and the T-piece 17 are closed. T-piece 19 is open towards branch 20, to which is mounted the known semi-open administering circuit.

By pressing the self-inflating bag 22, the air existing within passes through assembly A and the mounted semi-open circuit and is administered, through the agency of face-mask 27 or of the connector of the endotracheal tube 38, to the patient. Immediately as the pressing on the bag 22 ceases, the position of the valvelet 36 of the respiratory valve 32 changes and the air from the lungs of the patient is evacuated into the atmosphere, through the expiratory branch 34. At the same time, the self-inflating bag 22 returns to its original form, by the aspiration of the air outside, through valve 23 after which the cycle is repeated. The over-pressure valve 31 avoids the creation of a dangerous positive pressure in the circuit, during the inspiratory phase.

Instead of the self-inflating bag 22, one can mount and use the respiratory bellows 26, with its valves.

In the presence of contaminated air, it is possible to apply to the suction of bag 22 a filtering element, not shown in the scheme.

- b. Administration of general anaesthesia by means of anaesthetic vapours carried by air. One uses in this case the assemblage presented in FIG. 10, similar with that described in the preceding point, with a vaporizer which opposes a slight resistance to inspiration. One can use, possibly, a vaporizer that can be used successively for various anaesthetic liquids.

Anaesthesia may be administered on the mask or endotracheally. After the anaesthesia is stabilized and the patient breathes spontaneously, the self-inflating bag 22 or the respiratory bellows, respectively, may be removed and the patient can inspire directly through branch 14 of the T-piece 13, the inspired air passing through vaporizer 15.

- c. Intervention with air, in case of an accidental stopping of the feeding of medicinal gases, in the administration of general anaesthesia, with a calibrated vaporizer in the assemblage, that opposes a high resistance to the gas flow. One uses the assemblage represented in FIG. 11, which differs from that presented in FIG. 10 by the opening towards branch 18 of the T-piece 17 and by the mounting to branch 18 of the respiration bag 29.

In the case of stopping of the medicinal gas feed, through the flow-meters 6 and 7, one mounts the tube and the sleeve 25, 24 and the bag 22. The air from within the bag 22 is pushed through assembly A; it passes through vaporizer 15 and accumulates in the re-

spiratory bag 29 from which the patient inspires, through the semi-open circuit, a mixture of air and anaesthetic vapours. One avoids, in this way, the higher resistance opposed to the inspiratory flow by the calibrated vaporizer 15.

- d. Respiratory reanimation with oxygen. To this end, the apparatus is connected to an oxygen source, realizing thus the assemblage shown in FIG. 12. The T-piece 13 and the vaporizer 15 are in shut-off position. To branch 18 of T-piece 17, being in open position, is mounted the respiratory bag 29. To T-piece 19, open towards branch 20, is mounted the semi-open administering circuit.

The oxygen fed in initially through the pipe with a cock 4, then through the oxygen flowmeter 6, passes through the assemblage and accumulates in the respiratory bag 29. By the compression thereof, the oxygen passes through the semi-open circuit, to the patient, valvelet 36 shutting off the expiratory orifice 34; the unidirectional valve 16 impedes a reversal of the gaseous flow. In the expiratory phase, valvelet 36 shuts off the inspiratory branch 33 of valve 32, while the bag 29 re-fills with oxygen.

- e. Administration of anaesthesia with oxygen and nitrous oxide and with anaesthetic vapours in semi-open circuit. One uses the assemblage in FIG. 13, similar with that in FIG. 12, in which is open also the nitrous oxide feed, through flow meter 7, while the mixture of medicinal gases passes also through the vaporizer 15. Administration takes place in the way described in point d.

- f. Anaesthesia with the new administering circuit, with self-occluding valve, working in closed or semi-closed circuit or with known anaesthetic circuits. The mounting shown in FIG. 14 is realized, completed with the selected anaesthetic circuit. The T-pieces 13 and 17 are shut off, while T-piece 19 is open towards connection sleeve 21.

The feeding of oxygen and nitrous oxide is made through flowmeters 6 and 7, the mixture of which passes through the vaporizer 15, and, charged with anaesthetic vapours, arrives in the anaesthetic circuit through the flexible tube 41.

- g. Working of the closed or semi-closed circuit for anaesthesia or respiratory reanimation, provided with self-occluding valve. In the inspiratory phase, represented in FIG. 15, the gas mixture, fed-in through tube 41, passes through the canister with soda lime 42, and accumulates in the respiratory bag 50. In case of spontaneous breathing of the patient, the gas mixture passes through the cross-piece 44, the corrugated tube 55 and arrives, through the self-occluding valve 32, with the valvelet 36, shutting off the expiratory branch 34, at the patient through the face mask 37 or the connector of the endotracheal tube 38. In the expiratory phase, represented in FIG. 16, valvelet 36 shuts off the inspiratory branch 33 of valve 32, while the expired gaseous mixture passes through the expiratory branch 34, the corrugated tube 56, the piece 57 where it mixes with fresh gaseous mixture, passes through canister 42, where the expired carbon-dioxide is absorbed; further through the cross-piece 44 and accumulates in the respiratory bag 50. The described cycle is repeated identically when working in closed circuit. In working with semi-closed circuit, the excess gaseous mixture is vented

into the atmosphere by the overpressure valve 48.

In case of using controlled breathing, the respiratory bag 50 is replaced by the corrugated tube 51 and the anaesthesia respirator 52, working in closed circuit. Gas circulation in the described circuit, with closed and semi-closed operation, remains the same.

The application of the invention results in the following advantages:

one disposes of a multipurpose anaesthesia and respiratory reanimation apparatus, that can be used both in the hospital and outside it, in the presence or in the absence of medicinal gases, in all clinical situations occurring, both in adults and children; the apparatus is lighter, with pieces that can be readily assembled and disassembled; it is of multiple use, being executed in a portable version and in a detachable version to be fixed to the wall.

We claim:

1. An apparatus for administering an anaesthetic and for respiratory reanimation comprising:
 - a support;
 - a gas-mixing assembly mounted on said support and provided with an inlet and an outlet and a main flow path therebetween for at least one gas adapted to be administered to a patient;
 - at least two T-fittings detachably connected in series with one another and to said assembly on said support, each of said fittings having a main flow path connected in series with one another and with the main flow path of said assembly, a branch extending laterally from the respective main flow paths of said fittings and respective selectively operable closure members for selectively effecting communication between the respective branch and main flow path;
 - a vaporizer detachably connected between said fittings on said support and in series with the main flow paths thereof;
 - a shutoff fitting detachably connected to the main flow path of said T-fittings downstream thereof and provided with a selectively operable flow-blocking closure member;
 - an administering mask system detachably connected to said shutoff fitting, and
 - respective inflatable bags detachably connectable to

said branches.

2. The apparatus defined in claim 1 wherein each of said fittings comprises a cylindrical body defining the main flow paths thereof and provided with formations at least at one end for detachable connection to other elements of the apparatus, and said closure members each include a cylindrical sleeve rotatably received in the respective body and provided with a lateral opening, and a lever projecting from the respective body and affixed to the respective sleeve for rotating same about its axis, said bodies each having an arcuate slot receiving the respective lever.

3. The apparatus defined in claim 1 wherein said support comprises a base, a pair of columns spaced apart and extending upwardly from said base, and a crossbar receiving elements of said apparatus including said assembly, said fittings and said vaporizer, said gas-mixing assembly including:

- a mixing block mounted on said crossbar;
- an oxygen flow meter extending between said base and said block;
- a nitrogen protoxide flow meter extending between said base and said block; and
- an emergency-oxygen duct provided with a valve and extending between said base and said block.

4. The apparatus defined in claim 1 wherein said support comprises a frame adapted to be affixed to a wall and means for mounting said assembly, said fittings and said vaporizer on said frame.

5. The apparatus defined in claim 1 wherein said administering mask system comprises a single elongated conduit detachably connected to said shutoff fitting at one end thereof and a mask having an exhalation port to the atmosphere attached at the other end of said elongated conduit, whereby the closure members are operated to communicate the branches of the T-fittings with the main flow path providing for an open system.

6. The apparatus defined in claim 1 wherein said administering mask system comprises a closed loop breathing circuit whereby the closure members are operated to prevent communication between the branches of the T-fittings and the main flow path providing for a closed system.

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