

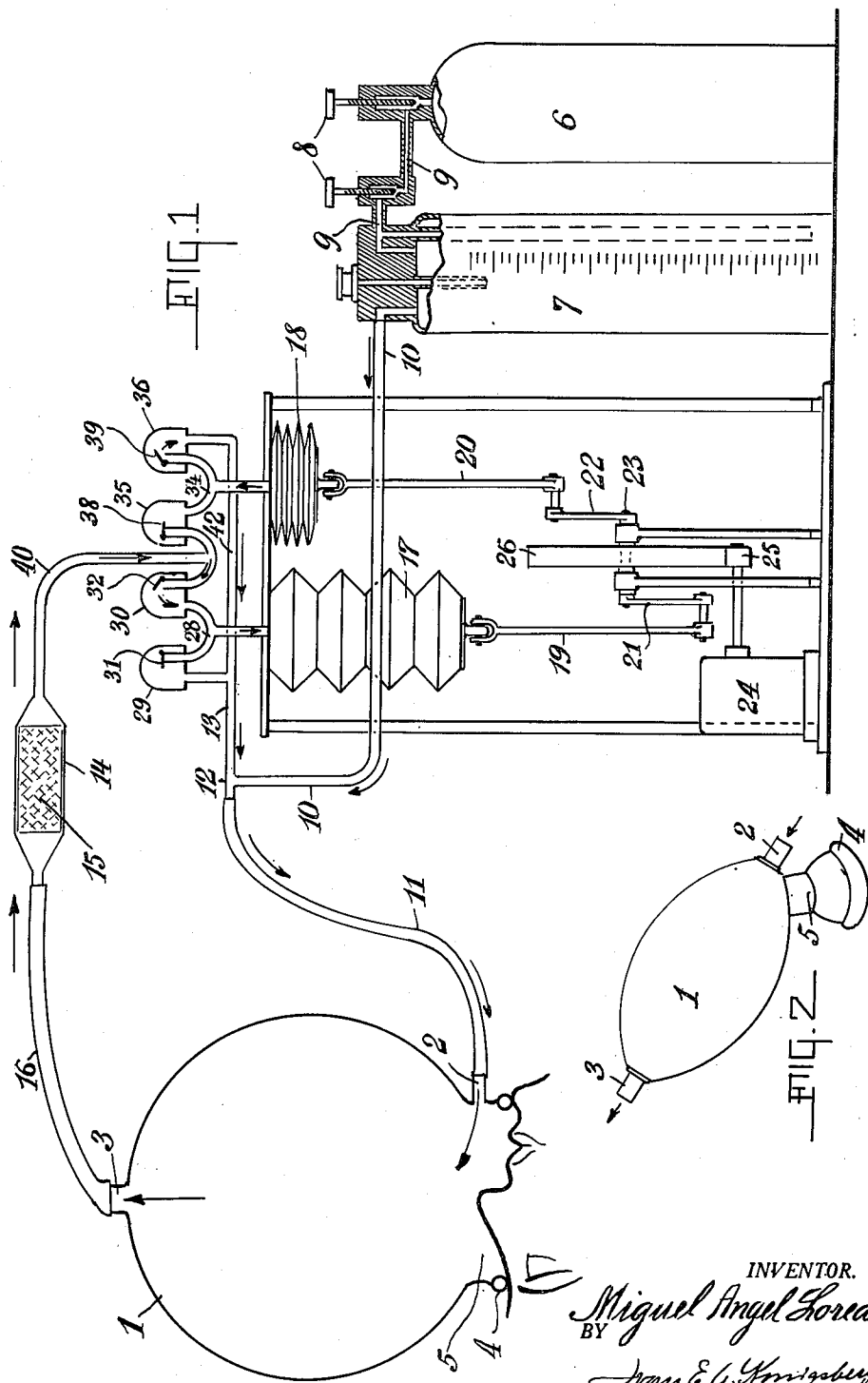
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APPARATUS FOR NO-EFFORT INHALATION ANESTHESIA

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## UNITED STATES PATENT OFFICE

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APPARATUS FOR NO-EFFORT INHALATION  
ANESTHESIA

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1 Claim. (Cl. 128-188)

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This invention relates to apparatus for administering gases employed in the application of inhalatory anesthesia, by the closed or confined method. The invention is characterized and distinguished in that it eliminates mechanical obstacles which heretofore have been interposed in the respiratory circuit of the apparatus. The invention, therefore, provides a no-effort inhalation method and apparatus in which the patient needs only the kind of respiratory force of a person in normal repose and forced respiration is eliminated.

One object of this invention is to provide means whereby the patient is enabled to breathe, freely and directly, the anesthetic mixture within the breathing bag of the apparatus while conserving the vital functions of oxygenation and elimination of carbon dioxide. The patient is entirely relieved of the strain imposed in the use of prior apparatus which necessitated the patient forcing the gases to circulate over soda lime, for example, and through lengthy tubes, pipes, valves and other parts of the apparatus.

Another object of this invention is to provide a novel and improved breathing bag having three communicating passages, namely an inlet passage for the admission into the bag of the purified gases from the absorber unit together with the gases from the standard gas supply unit. Secondly, an outlet passage for the exit of the gases from the breathing bag to the absorber unit. Third, a passage connecting the breathing bag with the face mask. The patient breathes the gases in the bag through this third passage.

It is a feature of this invention that the inlet and outlet passages of the breathing bag are located on opposite sides of the bag or spaced as far apart as possible, while the breathing passage to the face mask is located between the said inlet and outlet passages and in a position to intercept the gas current established within the bag from inlet to outlet thereof. Another object is to include, in the absorption circuit of the apparatus, mechanical means for circulating the gases.

The invention is embodied in a no-effort inhalation apparatus consisting of a closed circuit from which the external atmosphere is excluded and which comprises three intercommunicating circuits, namely the respiratory circuit including the patient's respiratory system and the breathing bag with the face mask. Second, an absorption circuit which includes a mechanical gas circulating device and the absorber which con-

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tains the carbon dioxide absorption material. Third, a gas supply or feeder circuit which includes apparatus of known character and function for supply anesthetizing gases.

Other objects, features and advantages of this invention will be apparent from the following detailed discussion read together with the accompanying drawing in which

Fig. 1 is a diagrammatic illustration of an apparatus embodying the invention, with parts in section.

Fig. 2 is a view of the breathing bag.

In the drawing the reference numeral 1 denotes the breathing bag which is made of the same material as now used for standard breathing bags in anesthesia apparatus. The bag has a gas inlet passage at 2 and a gas outlet passage at 3. The passages are spaced as far apart as is convenient or practicable in the manufacture of the bag. In the preferred construction illustrated the two passages 2 and 3 are on opposite sides of the bag 1. The bag is also formed with a face mask or attached to a face mask 4 to be placed over the face of the patient as shown. The face mask communicates directly with the interior of the bag through a nipple or tube 5. The latter is located between the inlet and outlet passages 2 and 3, respectively, in such a position that it intercepts the gas current passing through the bag. In Fig. 1 the breathing passage 5 is located close to the inlet passage 2 and almost diametrically opposite the outlet passage 3.

The anesthetizing gases are supplied from a source of supply comprising gas mixing cylinders 6 and 7 provided with control devices and interconnecting passages as shown at 8 and 9 respectively. Inasmuch as the gas supply unit is of known construction and function, no further description is deemed necessary. The gases pass from the supply unit to the breathing bag by way of a connecting tube 10 and a second tube 11. At the point 12 the gas supply circuit is connected to the absorption circuit by a tube 13.

The absorption circuit comprises an absorber 14 which contains carbon dioxide absorbing material indicated at 15. The exhaled gases from the breathing bag 1 pass to the absorber 14 by way of a tube 16. The gases then pass through the material 15 and are drawn therefrom by a suction-impulse device in the form of a double pump having two bellows 17 and 18 which are alternately compressed and expanded by the operation of connecting rods 19

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and 20, which in turn are reciprocated by cranks 21 and 22 mounted upon a shaft 23 180 degrees apart as shown. The shaft 23 is rotated by a motor 24 which drives a small pulley 25 which is in driving engagement with a large pulley 26 secured to the shaft 23.

The space within the bellows 17 is connected by a forked tube 28 to two valve chambers 29 and 30 which contain valves 31 and 32. The space within the other bellows 18 is connected by a forked tube 34 to two other valve chambers 35 and 36 which contain valves 38 and 39. The valve chambers and valves are connected to the outlet side of the absorber 14 by a suction tube 40. The valve chambers 29 and 36 are connected by a tube 42 which communicates with the aforesaid tube 13.

Thus the suction side of the valve mechanism 28—39 is connected to the absorber 14 by the tube 40. The supply side or outlet side of the valve mechanism is connected to the breathing bag by the tubes 42, 13 and 11. The gas circuits are indicated by arrows in the drawing.

The operation of the system is as follows: Gas flowing from the supply unit 6—7 passes to the breathing bag 1 through the tubes 10 and 11 and inlet passage 2. The gas flows out of the bag through outlet passage 3 and tube 15 to the absorber 14. If now the motor 24 is started, the connecting rods 19 and 20 will be operated and reciprocated to alternately compress and expand the pump bellows 17 and 18. Thus a vacuum is created in the tube 40 and the exhaled gases are drawn through the material 15 in the absorber 14 where they are freed from carbon dioxide and thereafter circulated through the valve mechanism 28—39 and through the outlet tube 42 and 13 into the gas supply circuit from the unit 6—7. The purified gases from the absorber mingle with the gases from the supply unit and pass through the tube 11 into the bag.

The valves in the valve chambers are shown in open and closed positions corresponding to the operations of the pump bellows 17 and 18. When the bellows 17 are expanded, gas flows from the absorber 14 through open valve 32 and forked tube 28 into the bellows 17, valves 31 and 35 being then closed. On the other side, the impelling movement of the bellows 18 forces the gas which had previously passed into the bellows 18 out of the valve mechanism through forked tube 34, open valve 39 and tube 42. So that, by the exclusive operation of the pump 17—18 the purified gases are drawn from the absorber 14 and circulated back into the breathing bag, the withdrawal and circulating requiring no effort whatsoever from the breathing efforts of the patient.

In the operation of the apparatus of the invention as herein disclosed the anesthetic gases and oxygen are administered as in the known closed standard systems. The absorber of the carbonic gas which forms the greatest obstacle has been separated from the respiratory circuit and placed in connection with an aspirating and

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impelling mechanism, the latter being shown as a suction-impulse bellows pump. This mechanism does not act upon the patient's organism. Its sole function is to renovate the gases in the bag. The patient is not forced to breathe unnaturally but only in proportion to his necessities. The motor force replaces the human force.

The invention has been illustrated diagrammatically because it is not limited to any specific form of apparatus. For example, any suitable suction-impulse motor may be used. The location thereof may be changed. The pump may be connected in the absorber circuit between the bag and the absorber, or between two absorbers, if such be used. The breathing bag may consist of more than one bag.

From the foregoing description and the drawing it will be clear that the invention includes two essential elements, namely mechanical means for forcibly circulating the gases through the absorber and entirely independent of the breathing efforts of the patient, and the use of a bag-mask of suitable size and provided with communicating passages so interrelated that the patient is provided with a breathing space and atmosphere which allow him to breathe without effort.

I claim:

An apparatus for administering anesthetic gases in a closed circuit from which the atmosphere is excluded, comprising an elastic breathing bag having an inlet, an outlet and a breathing passage, a carbon dioxide absorber having an inlet and an outlet, a tube connecting said breathing bag outlet with the inlet of said carbon dioxide absorber, a pumping device having an inlet and a discharge port, a second tube connecting the outlet of said carbon dioxide absorber with the inlet of said pumping device, a third tube connecting said discharge port of said pumping device with the inlet of said breathing bag, an anesthetic gas supply source, a fourth tube connecting said anesthetic gas supply into said third tube connecting said pumping device with the breathing bag inlet, said fourth tube discharging the anesthetic gases coming from said gas supply source into said third tube at a point in the latter between the discharge port of said pumping device and said breathing bag inlet, and means for actuating said pumping device.

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