

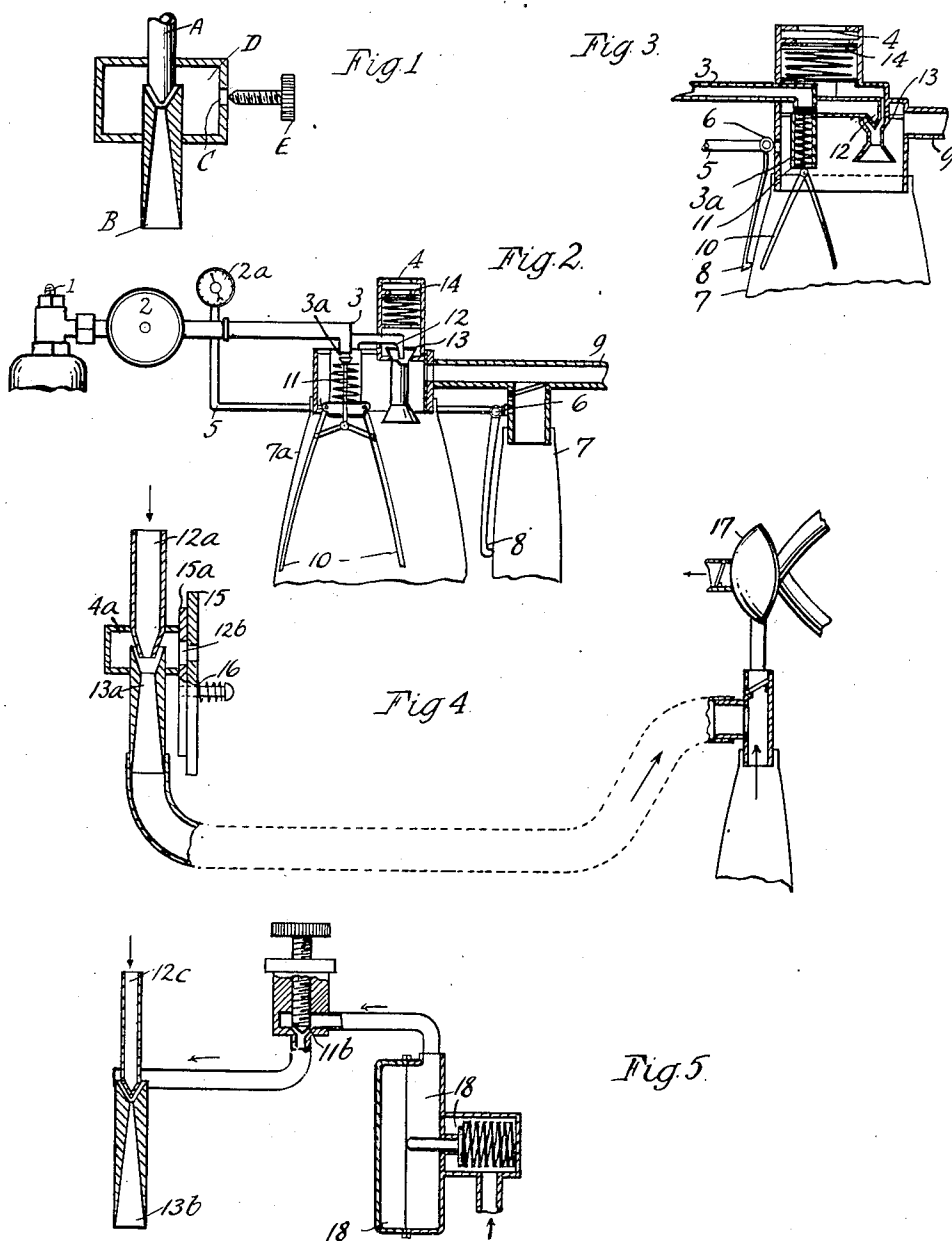
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ANESTHETIC ADMINISTRATION APPARATUS

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ANESTHETIC ADMINISTRATION
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3 Claims. (Cl. 128—202)

This invention relates to a method of and apparatus for the administration of anesthetics or other medical gas-therapy, its object being to provide means whereby two gases, whether compressed or not, or a gas and atmospheric air, can be mixed in such a manner that the entrained gas (or air) is always in constant concentration with respect to the gas passing through a jet, regardless of the rate of flow of gas through such jet.

In one form of the invention intended particularly as an intermittent flow type of apparatus for inducing analgesia with greater rapidity than hitherto, pure nitrous oxide from a compressed cylinder is allowed to trickle into a gas bag or the like advantageously of a pre-determined capacity, provided with a check valve, the patient inhaling the contents of the bag or the like. When the bag or the like is exhausted the continued inhalation by the patient causes him to inhale nitrous oxide mixed with air which enters the gas bag or a separate bag associated with the former; the gas enters through a jet and venturi brought automatically into action at the deflation of the gas bag containing the pure gas, and the air enters through an air intake or entrainment duct or the like.

In applying the method to the use of oxygen and air for oxygen therapy treatment, the oxygen is passed through a jet and venturi whilst air is sucked in through a controllable orifice (or orifices) the mixture being delivered to a suitable inhaler with inspiratory and expiratory valves of known type in conjunction with a mask applied to the nose or mouth, or both, of the patient.

Finally in the application of the invention for inducing anesthesia, nitrous oxide is taken as the primary gas delivered from a reducing valve through a jet, whilst the gas sucked in would be oxygen, requiring preferably the employment of a vacuum operated reducing valve or some other suitable control means.

In order that the invention may be more fully understood reference will be had hereinafter to the accompanying drawing which illustrates, diagrammatically, means for carrying the method into effect in accordance with the particular application required.

Figure 1 shows the general principle involved in the method according to the invention; Fig. 2 shows the application of the method in connection with the administration of gas and gas-air, using two associated gas bags; Fig. 3 shows the arrangement of Figure 2 using a single gas bag; 55

Fig. 4 shows the application of the method in connection with oxygen therapy treatment; Fig. 5 shows the application of the method in connection with the administration of two compressed gases.

In principle the method as illustrated in Fig. 1, consists in delivering gas from a cylinder through a main jet A at any velocity. The gas then passes to a Venturi tube B causing a fall in pressure in the entrainment duct D. The negative pressure in the entrainment duct varies conversely as the square of the velocity of the gas through the main jet A. Unless the entrainment orifice C is of a suitable type, the entrained gas will increase in concentration to the gas passing through the main jet A as this latter gas increases in velocity. A plate-hole-type of orifice can be used, the resistance law of such a type of hole being selected to correct the effect of the increase in concentration of the entrained gas to enable the flow of gas through the main jet A to be varied without altering the proportions of the gases being mixed. That is to say the law of the plate-type of orifice is such that the flow of gas therethrough varies inversely as the square of the negative pressure developed in the entrainment duct by the velocity of the gas through the main jet A and venturi B whereby proportional mixing is obtained at any rate of flow. The entrainment orifice can be varied in area by the use of a needle valve E so that any proportion of the two gases can be obtained.

Where two compressed gases are employed, the entrained gas is advantageously controlled from the cylinder by means of a vacuum controlled regulator which is operated by the negative pressure developed in the entrainment duct.

In the construction shown in Figs. 2 and 3, the former showing the use of two associated gas bags and the latter the use of a single gas bag or the like, nitrous oxide passes from a cylinder 1 through a reducing valve 2 and gauge 2a, both of which are optional, then firstly through a pipe 3 to a control device 3a and air intake or entrainment duct 4, and secondly through a passage 5 and valve 6 which allows it to trickle into a gas bag 7 at a given rate until the bag is full and contacts an arm 8 external thereof in order to close the valve 6. Gas is prevented from escape into the atmosphere by a check valve 6a or the like (not shown in Fig. 3).

The patient is provided with the usual face piece with connecting tube 9 to the apparatus and when he inhales the pure nitrous oxide con-

tained in the bag 7 the check valve 6a opens. When the bag 7 is exhausted, under the effect of continued inhalation, it presses upon control members or arms 10 of a spring loaded member 11 (Fig. 3) which then allows nitrous oxide from the cylinder 1 to pass at a pre-determined pressure such as 60 lbs. per sq. inch to a jet 12 opening into a Venturi tube 13 or similar passage in the air inlet or entrainment duct 4 so as to be inhaled directly by the patient. Exhalation occurs through a suitable valve at the face-piece end.

The control device 11 thus normally closes the passage of nitrous oxide from the cylinder 1 to the jet 12 until the patient has inhaled the pre-determined quantity of pure nitrous oxide after which it opens as above stated so that nitrous oxide passes to the jet 12 and in its passage therethrough causes air to be entrained through the inlet 4 and venturi 13, and then to the patient. The control device may be adjustable in any suitable manner. Whilst the patient inhales the mixture of nitrous oxide and air the trickle feed continues to operate to refill the bag with pure nitrous oxide. In the case of Fig. 2 the continued inhalation causes bag 7a to act on the control arms 10 as before.

There can be one bag for the pure nitrous oxide and one for the control device.

The air intake or entrainment duct 4 may have its orifice closed by a spring loaded plate 14, a non return valve, or otherwise.

The sequence of inhalation of pure nitrous oxide, then of nitrous oxide mixed with air, takes place regularly and automatically and there is constant mixing of gas and air, no cooperation by the patient as is normally required, being necessary after the application of the face-piece and his usual inhalation.

Fig. 4 shows the application of the method for oxygen-therapy without the need of an automatic control, though this can be embodied where necessary. Oxygen enters the jet 12a whilst air is taken in an orifice 12b of the entrainment duct or air intake 4a consisting of a pair of apertured plates of which the front plate has orifices of various diameters any one of which can be brought into alignment with the orifice 12b for which purpose the front plate 15 can be revolved and is held in gas tight contact with the stationary back plate 15a by spring means 16 or otherwise. The Venturi tube 13a leads to the face-piece 17. The arrows indicate the flow of gas.

Obviously any other compressed gas can be used in place of oxygen.

In Fig. 5 two different compressed gases are made use of as for instance nitrous oxide and oxygen more particularly for inducing anaesthesia. The primary gas that is the nitrous oxide passes to the jet 12c and the oxygen is delivered through a control device to the Venturi tube 13b and thence to the patient as before. The control device must in this case permit of mixing the entrained gas in an infinite number of proportions and for this purpose it is advantageous to employ a needle type of control valve 11b; otherwise the apparatus remains the same as in the previous example.

The entrainment duct in this case comprises a vacuum controlled regulator 18 of ordinary construction which is operated by the negative pressure developed in the entrainment duct. The arrows indicate the flow of the gases, oxy-

gen entering through 18 and admixing with the nitrous oxide arriving from 12c.

It is to be understood that any suitable secondary gas may be used and that this term is also intended to cover air as the secondary gas.

I claim:

1. Apparatus for administering anesthetics comprising a primary gas supply, a first conduit therefrom, a control device for opening and closing said conduit, a passage leading from said control device to a jet, a Venturi tube having its mouth in proximity to said jet, an air inlet surrounding the jet and Venturi tube, an inflatable gas bag enclosing the delivery end of the Venturi tube and the control means, means responsive to deflation and inflation of said gas bag to respectively actuate the said control device to open and close said conduit, a second conduit from the primary gas supply to the gas bag, a trickle charging valve inserted in the said second conduit, means actuated by the inflation of the gas bag for closing the trickle charging valve, and a delivery passage from the gas bag to a face mask.

2. Apparatus for administering anesthetics comprising a primary gas supply, a conduit from said supply, a control device located in said conduit, a jet at the free end of such conduit, another conduit from said primary supply to an inflatable gas bag which by-passes the jet and the control valve, a trickle charging valve inserted in the latter conduit, means whereby said trickle charging valve is closed by the gas bag when the latter becomes filled with gas, means actuated by the deflation of the gas bag for operating the control device to permit passage of primary gas to the jet, a Venturi tube whose mouth is in close proximity to the jet and an entrainment duct surrounding the Venturi tube through which air can pass thereto for admixture with the primary gas.

3. Apparatus for administering anesthetics comprising a primary gas supply, a conduit from said supply, a jet and control device therein, another conduit from said supply to an inflatable gas bag, a trickle charging valve inserted in the latter conduit, means actuated by the deflation of the gas bag for operating the control device to permit passage of primary gas to the jet, a Venturi tube located in proximity to the jet, an entrainment duct surrounding the jet and Venturi tube, a supply passage for secondary gas to the entrainment duct and a vacuum controlled valve inserted in such supply passage consisting of a chamber communicating with the entrainment duct, a diaphragm member located in said chamber, and a spring pressed plunger bearing against said diaphragm and responsive to the diaphragm to control flow of said secondary gas through said supply passage.

4. Apparatus for administering anesthetics comprising a supply of primary gas, a first conduit therefrom, a control device located in said conduit consisting of a spring loaded valve with depending arms, a second conduit from the primary gas supply to a gas bag, a trickle charging valve inserted in said second conduit, a passage from the gas bag to the patient, a check valve between the gas bag and said passage actuated by the inhalation of the patient, continued inhalation causing the deflation of the bag to automatically actuate the arms of the control device, a jet in the first primary gas conduit through which gas passes when the control device is

actuated, a Venturi tube located in proximity to said jet, an entrainment duct surrounding said Venturi tube and jet and means actuated by the gas bag for closing the trickle charging valve.

5. Apparatus for administering anesthetics comprising a primary gas supply, a first conduit therefrom, a control device and a jet located in said conduit, another conduit from said gas supply to an inflatable gas bag, a trickle charging valve inserted in the latter conduit, an external arm for said gas bag adapted to be actuated by the latter when full to close said trickle charging valve, means actuated by the deflation of the gas bag for operating the control device to permit passage of primary gas to the jet, a Venturi tube into which the jet depends and a secondary gas entrainment duct surrounding said Venturi tube.

6. Apparatus for administering anesthetics comprising a supply of primary gas, a first conduit therefrom, control means for opening and closing the mouth of said conduit, a second conduit from the primary gas supply to a chamber, to which is fitted an inflatable gas bag and an adjustable air intake, a trickle charging valve inserted in the second conduit, a passage leading from the first conduit to a jet located within said chamber, a Venturi tube surrounding said

jet, a discharge orifice from the chamber connected to a face mask for the patient, a check valve between the discharge orifice and the face mask, and means actuated by the inflation of the gas bag for closing the trickle charging valve and for actuating the automatic control means

7. Apparatus for administering anesthetics comprising a primary gas supply, a first conduit therefrom to a control device having an open mouthed chamber, an inflatable gas bag closing the open mouth of said chamber, a passage from said first conduit to a jet located in an air entrainment duct and depending into a Venturi tube connected with said entrainment duct and said Venturi tube depending into the gas bag, an outlet passage from the open-mouthed chamber to a face mask, a second gas bag provided with a check valve and connected to the outlet passage, a second conduit from the gas supply to said second gas bag and a check valve inserted in the second conduit.

8. Apparatus for administering anesthetics as claimed in claim 7, having a control device consisting of a spring actuated valve, lever means for such valve actuated by the deflation of the said second bag to effect the opening of the passage of gas to the jet.

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