June 22, 1937. W. R. HENION 2,084,804

ANESTHETIZING APPARATUS

Filed Nov. 25, 1932 4 Sheets-Sheet 1

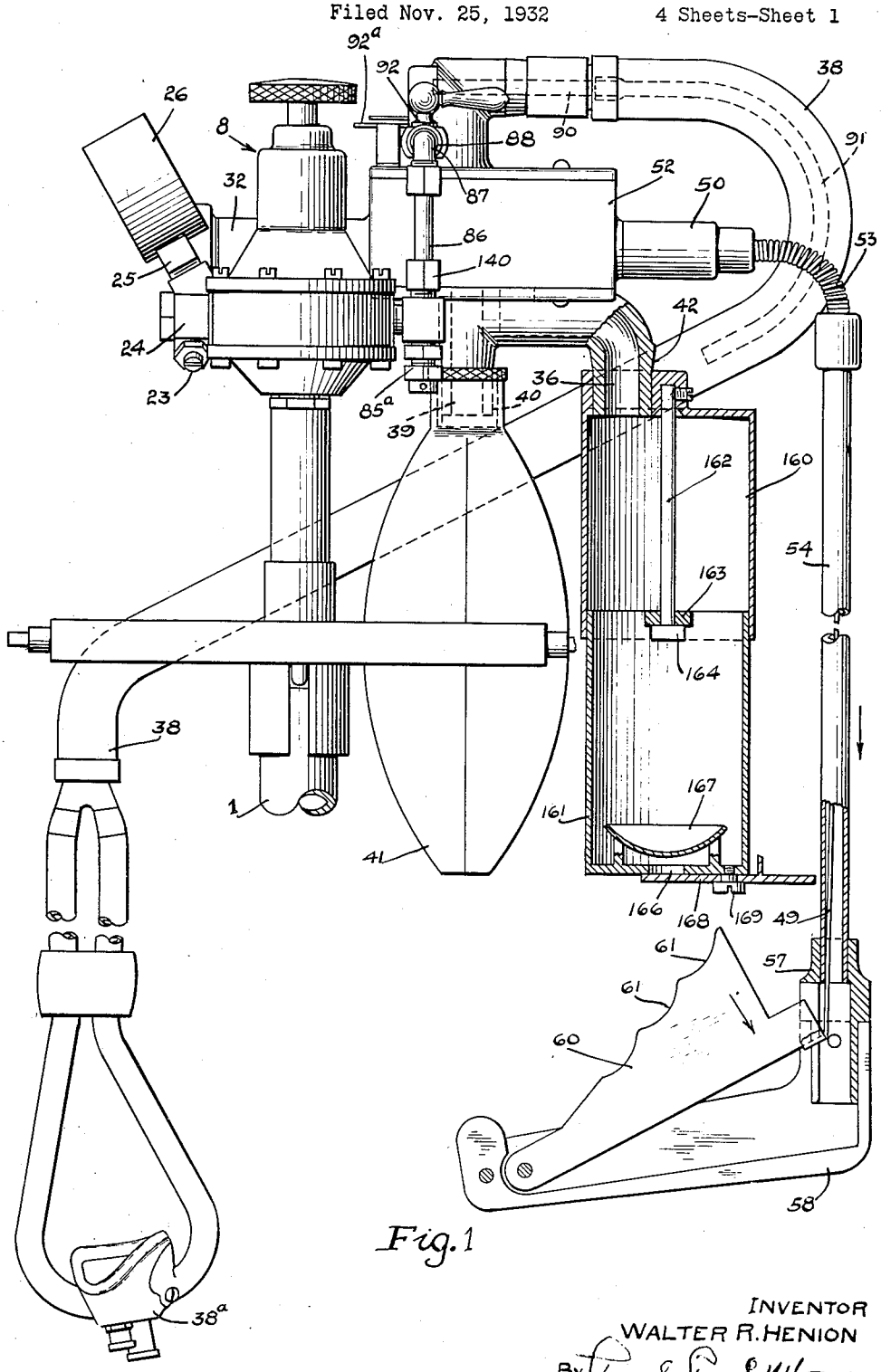


Fig. 1

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ANESTHETIZING APPARATUS

Filed Nov. 25, 1932 4 Sheets-Sheet 2

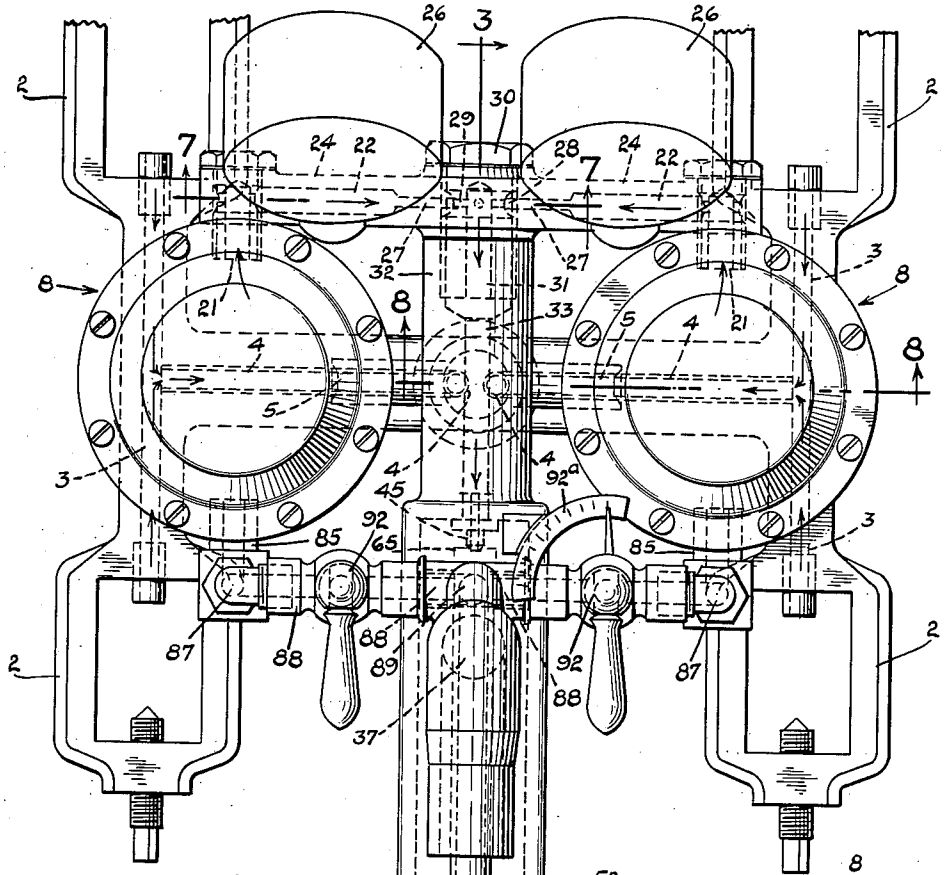


Fig. 2

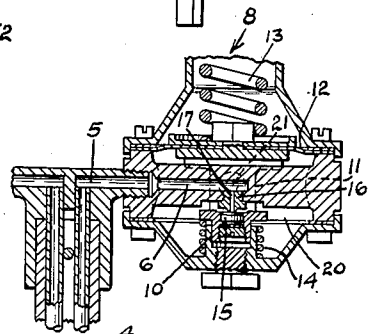


Fig. 8

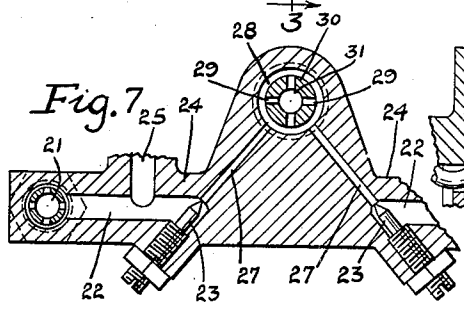


Fig. 7

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ANESTHETIZING APPARATUS

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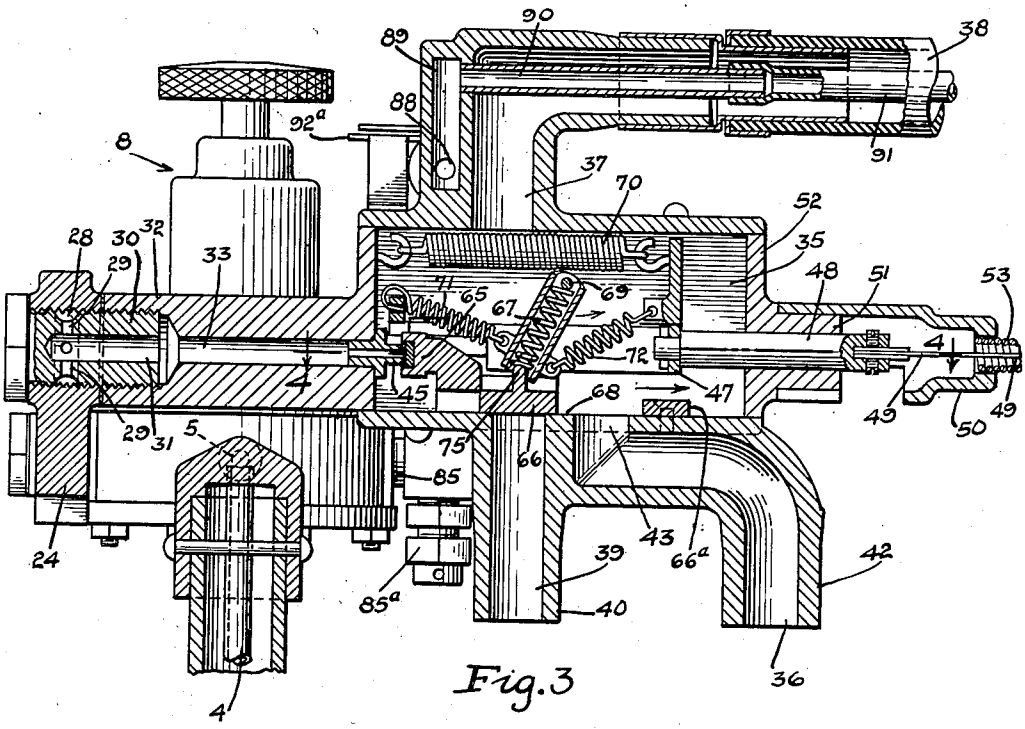


Fig. 3

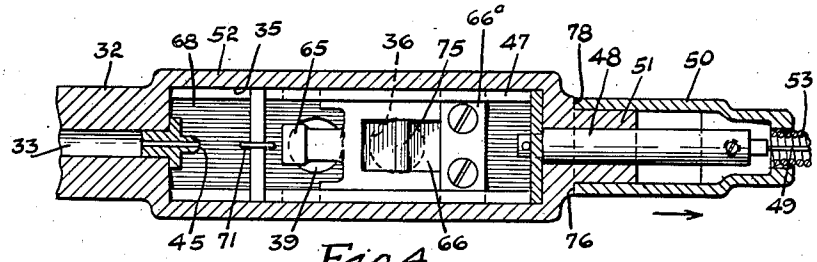


Fig. 4

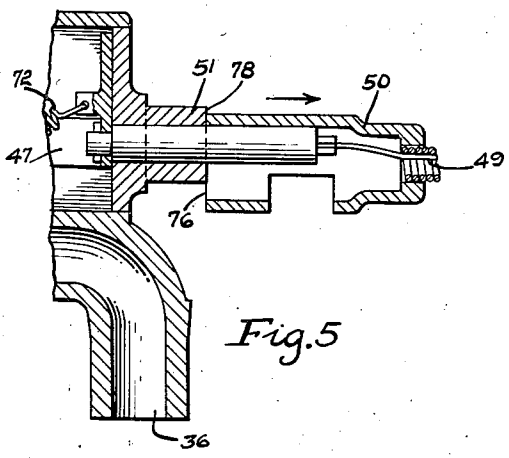


Fig. 5

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ANESTHETIZING APPARATUS

Filed Nov. 25, 1932 4 Sheets-Sheet 4

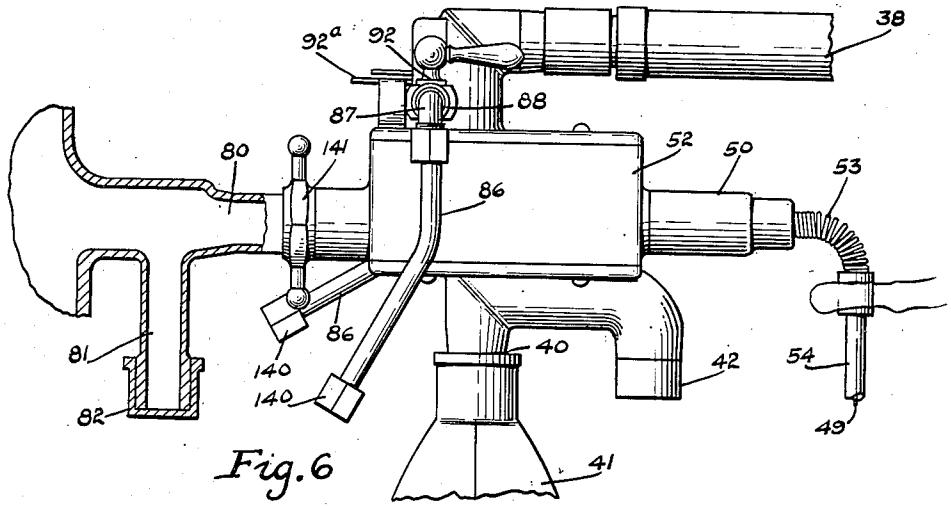


Fig. 6

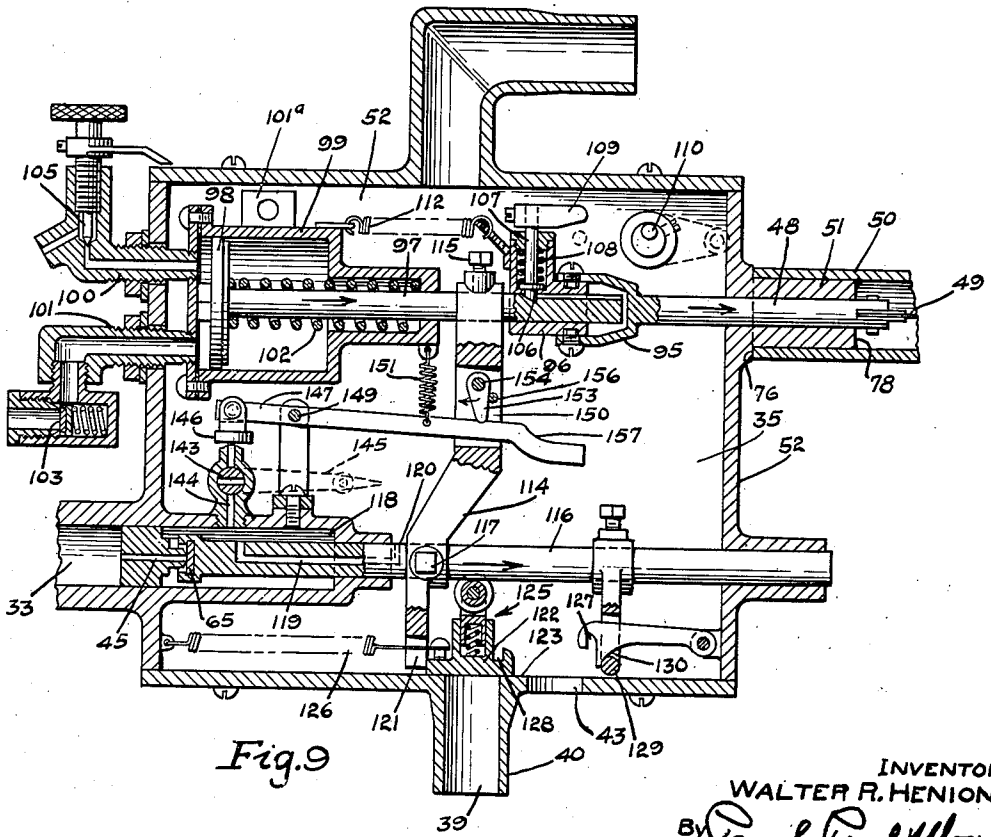


Fig. 9

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Patented June 22, 1937 2,084,804

UNITED STATES PATENT OFFICE

2,084,804

ANESTHETIZING APPARATUS

Walter R. Henion, Minneapolis, Minn., assignor to The Heidbrink Company, Minneapolis, Minn., a corporation of Minnesota

Application November 25, 1932, Serial No. 644,219

37 Claims. (Cl. 128—203)

This invention relates to improvements in anesthetizing apparatus and is particularly concerned with means operable by the patient to keep the patient in a state known as analgesia, in which consciousness is maintained but no pain is felt. The condition resembles twilight sleep in which the patient cannot feel pain but retains voluntary motor ability. The present device is useful in obstetrical cases.

The invention takes advantage of the reflex and/or voluntary gripping tendency of a person in pain, this gripping tendency being due to nervous tension. In the present device, as gripping progresses, more of the analgesic substance is delivered to the patient for breathing, and as gripping is lessened, less is delivered. On the other hand by this device, an anesthetic substance can be delivered or shunt off independently of the patient and while the patient continues to grip the control.

An important feature of the invention is gripping action by the whole hand, as distinguished from the pressing of a button or the pressure of a control device held between the thumb and forefinger. There is a tendency for a person in pain, for example when in the dental chair, to grip the arms of the chair and this natural gripping action while the arms rest on the chair or on the arm of the chair is taken advantage of.

I am aware that there have been some devices which purport to properly control analgesia but, insofar as I am aware, no one has ever produced a really practicable device by which the patient can himself successfully maintain the proper condition of analgesia.

The present device provides means whereby there are, when the patient is breathing air, no back pressures in any part of the mask or in the breathing tube. The device further provides means whereby the flow of analgesic substances is automatically stopped before the patient becomes unconscious and provides means whereby breathing of atmospheric air may be had, without removal of the mask and without removal of any part of the apparatus. In this device, the analgesic agent may be at all times under the control of the patient and immediately the flow of anesthetizing agent is stopped, air can be drawn through the breathing tube only under atmospheric pressure.

The device can be used as an attachment on any type of machine, or can be incorporated as an integral part of any type of machine either for machines of continuous flow type or of the intermittent flow type.

Features of the invention include means for controlling analgesia by the gripping action of the whole hand; the delivery of exhalation of the patient at a point remote from the patient and operator; the control of delivery, breathing bag, and air intake passages, by a single valve means; means for by-passing gas around the valving means; the delivery of this by-passed gas into the breathing tube at a point remote from the air intake opening; means adjustable by the operator for obtaining a supply of analgesic substance after the patient has closed the main delivery valve; means for varying the timing; means for delivering an additional quantity of anesthetizing substance during the timing period, and all details of construction and arrangement of the parts, as disclosed.

Objects, features and advantages of the invention will be set forth in the description of the drawings forming a part of this application, and in said drawings

Figure 1 is a side elevation of the apparatus of this invention;

Figure 2 is a top plan;

Figure 3 is a vertical lonigtudinal section through the valve-controlled gas delivery portion of the machine, taken approximately on line 3—3 of Figure 2;

Figure 4 is a plan section taken approximately on line 4—4 of Figure 3, but with the valve means moved to a control position opposite that shown in Figure 3;

Figure 5 is a fragmentary vertical section corresponding to Figure 3, but with the valve means releasably locked in the position shown in Figure 4;

Figure 6 is a side elevation illustrating the device as an attachment for any suitable type of machine for delivering anesthetizing substance;

Figure 7 is a vertical section on line 7—7 of Figure 2, illustrating auxiliary pressure regulation means;

Figure 8 is a vertical section through the pressure regulator and related parts, taken on line 8—8 of Figure 2; and

Figure 9 is a vertical section taken on a line corresponding to that of Figure 3, illustrating means for timing an extra supply of anesthetizing gas after the patient has sufficiently lessened the grip of the control element to stop delivery of anesthetizing substance.

Numeral 1 indicates the top portion of a floor standard acting as a support for the apparatus. Mounted on the standard is a frame structure including various tubular members forming pas-

sages for the anesthetizing fluid. The lower part of this structure includes the yokes 2 which may be of any preferred form, which support the gas containers. Pairs of yokes are generally provided, two for containers of nitrous oxide, for example, and two for containers of oxygen. In regard to the major features of this invention, there is no intention to limit it to any particular type of anesthetizing apparatus. Moreover, only those parts of the apparatus have been shown in the drawings, in detail or otherwise, which seem essential to the understanding of the functions involved in this general class of machine.

The gas containers have not been shown. Referring to Figures 2 and 8, the passage into which the gas is delivered from the gas or vapor container (held in the yoke) is indicated at 3. This passage communicates with pipe 4 which communicates with horizontal passage 5, which connects with passage 6 to the pressure regulating device, generally indicated at 8 and of any preferred form. In this case, there are two of these devices, one to regulate the oxygen and one to regulate the nitrous oxide. The valve mechanism for this pressure regulator includes a piston-like valve 10 which is part of yoke 11 attached to diaphragm 12. The diaphragm is adjusted by spring 13, the compression of which is controlled by the usual means. When this adjustment takes place, the element 10 is raised or lowered, as a piston, against the action of the spring 14 which acts in opposition to the spring 13, and moves the valve 10 to seating position. The valving washer 15 cooperates with the end of a plug or seat 16 to control passage 17 communicating with the passage 6. The gas escapes past the valve into chamber 20 and thence into a passage indicated in dotted lines at 21 which, in Figure 8 of the drawings, is at the same level as the passage 6 and appears at the center of the figure. This passage 21 is also indicated in dotted lines in Figure 2. The gas, after passing through the regulator, enters the passage 21 and from this passage is delivered into passage 22, see also Figure 7. The passage 22 is formed in a cross arm 24, and this passage is in communication through tube 25 with a suitable pressure gauge indicated at 26, see also Figure 1. There are two of these pressure gauges, one for oxygen and one for nitrous oxide, and they may be of any suitable construction, and, therefore, have been only diagrammatically represented in the drawings. The gauges indicate pressures corresonding to regulator adjustments. The passage 22 is constricted as at 27 and leads into an annular mixing chamber 28 (see also Figure 3) from which chamber it is delivered through radial passages 29 in plug 30 into an axial passage 31 of the plug. The plug is in threaded engagement with a tubular member 32 having passage 33 leading forwardly, see also in dotted lines in Figure 2. This passage is designated herein as the delivery passage for the mixed or unmixed anesthetizing fluid or gas or vapor, or oxygen. The course of the fluid has only been traced for one side of the machine. The course for the opposite side of the machine is substantially identical. It will be understood that gases of different kinds can be delivered from opposite sides of the machine to the annular chamber 28, where they are mixed, and whence they are delivered into delivery passage 33. The arrangement or position of the passages of the machine, and of the various controls, are features of the invention.

Referring to Figure 7, which is a section on line 7—7 of Figure 2: Each passage 22 leading from the regulator to the mixing channel 28 is provided with a needle valve 23 operable for adjusting the flow of the gas in a manner to compensate for pressure gauge inaccuracy. Each valve seats in the end of the corresponding restricted passage 27. This is a feature of the invention.

An important feature of this invention relates to the control by the patient of the delivery of the anesthetizing or analgesic substance from the passage 33 to the inhaler. The construction now to be described may be an integral part of the new machine, above described, or it may be an attachment, and its use as an attachment for any type of machine is important. In Figures 1, 2 and 3, it is shown as an integral part of the machine, while in Figure 6 it is shown as an attachment which may be connected to the delivery passage 33 (or equivalent passage) of any machine of the general class previously described.

Another feature of the invention relates to a patient-controlled means interposed in the breathing line between the point of delivery of the gas supply and the patient's nose, and performing three functions, to wit: control of gas delivery into the bag, into the breathing tube, and entry of air into the breathing tube.

This control device, as an integral part or as an attachment, includes a structure providing a chamber or passage designated 35 into which chamber the passage 33 delivers. This chamber has an air-intake passage 36, a passage 37 to which a breathing tube 38 is attached, and a passage 39 in extension 40, the extension being provided for the attachment of a breathing bag 41. The passage 36 is formed in a tubular extension 42, but it will be understood that this extension may be dispensed with and the casing may simply have an opening at the point 43. The inhaler or mask is indicated at 38^a. The usual double tube connects it with the tube 38, but tube 38 may be connected directly to element 38^a and such a connection is contemplated herein.

Valve means, controllable by the patient in a manner hereinafter to be described, is provided for simultaneously controlling the delivery of gas or anesthetizing substance from delivery passage 33 through the passage in the fitting 45 into the chamber 35, controlling entry of the gas through the bag passage 39, and controlling entry of air into the chamber 35 through the passage 36. The invention also contemplates the separate control of any two of these passages, for example the delivery and air intake passages only.

This valve means and control therefor, in the illustrated embodiment, comprises a frame 47 slidable longitudinally of the chamber, sliding motion being controlled by a plunger 48 slidable in the casing and suitably connected to control wire 49, which wire passes through a tubular member 50 rotatable upon extension 51 of the casing 52 in which the chamber 35 is formed. The wire passes through a section of flexible tube 53, see Figure 3, and thence through a metal (or flexible) tube 54 and into the tubular portion 57 of a hand grip element 58, see Figure 1. This tubular portion is suitably secured to a handle or grip section 58 which has somewhat the form of the grip of an automatic pistol. The element 58 may represent the arm of a chair in a groove of which the trigger, or button 60 is pivoted, or with which arm it is operably attached in any suitable manner. The positioning of this trigger

or its equivalent in any way on the arm, is a feature.

The end of the control wire **49** is attached to a lever or trigger **60** suitably pivoted to the grip section **58**. This trigger normally, as before gripping by the patient, stands in the position shown, and suitable depressions **61** are provided to receive the fingers. This form of grip is a valuable feature of this invention inasmuch as it takes advantage of the gripping action of the entire hand to control the delivery of the anesthetizing agent. An important object is to produce and maintain a condition of the patient known as analgesia, in which there is a loss of sensation to pain, without total loss of consciousness, and in which voluntary motor ability is retained. It will be understood that this idea of utilization of the gripping action of the entire hand, or more than two fingers, particularly as distinguished from control by means of the thumb and forefinger, can be applied to the arm of a dental chair, for example, which arm the patient generally naturally grips when in pain.

When the trigger **60** is moved in the direction of the arrow, the valve means is moved (see Figure 4) to admit anesthetizing substance to the breathing tube and to the bag, and to close the air intake passage. When the trigger **60** is in the position shown in the drawings, the valve means is in the position shown in Figure 3, in which no gas can enter the chamber **35**, nor the bag passage **39**, and in which the air passage is open so that air may pass through chamber **35** into the passage **37** and into the breathing tube **38** and thence to the patient.

Below the sliding frame **47** and movable independently thereof, are valve elements, one of which, designated **65**, controls passage **45**, and the other of which, **66**, alternately controls bag passage **37** and the air intake passage **43**, these valves being movable in unison. Spring **67** keeps the valve element **66** against the bottom surface **68** out of the chamber to maintain a seal, the spring being carried in a tubular member which is pivoted to the casing **52** as at **69**. Spring **70** automatically moves the frame to the position shown to cause the valves to close the gas delivery and bag passages, and the gripping action of the patient is exerted against the action of this spring to move the frame to open the valve **65** and move the valve **66** from its position over the air intake passage **36**.

Springs **71—72** are each attached at one end to the frame **47** and each at its opposite end is attached to the tube containing spring **67**. The bottom end of the tube is forked and engages pivotally over projection **75** of the valve element **66** so that the springs **71—72** act upon the tube, to move the valve means in the appropriate direction. It is obvious that when the patient moves the element **60** in the direction of the arrow, the frame correspondingly moves, spring **72** acting to pull the tube to move the valve, which then moves to the position shown in Figures 4 and 5, in which position anesthetizing gas is delivered to the patient and air entry is prevented. Upon release of the grip and its movement to the position shown in Figure 1, the spring **70** acts to move the frame in a direction opposite to that shown by the arrows. Stop **66a** limits motion of valve **66** to a position over the air intake **36** or **43**. Frame **47** is, of course, suitably slidably guided. After the valve **66** passes across a vertical line passing through pivot **69**, the valves are snapped to the position toward which they are traveling. Spring **67—71** acting in one direction, and springs **67—72** acting in the other direction.

Another feature of this invention is the means whereby the valve means can be locked in the position shown in Figures 4 and 5. This is accomplished by grasping the tube **50** and pulling in direction of the arrow. The result is that the tubular member **50** is pulled off of the extension **51**, whereafter it is made to assume the position shown in Figure 5 in which its end **76** abuttingly engages the outer end **78** of the extension **51**. This releasably locks the valve means in a position to close the air intake passage **43** and open the chamber **35** and the bag passage **39** to a supply of anesthetizing substance. Of course, the tube **54** could also be flexible, and could act as a conduit for conductors for the electrical operation of the valve means, by means of a button on the arm of the dental or other chair.

When the control is used as an attachment for any machine which has a bag, the bag passage **39** may be closed by a suitable cap not shown. Referring to Figure 6, which shows the attachment applied to the delivery passage of a machine of the bag type, the delivery passage is designated **80**, the bag passage or tube **81**. In this case, the tube **81** is closed by a cap **82**, but when it is desired to attach the bag to the machine, the cap **82** is removed and the bag slipped over the tube, these parts generally having a friction fit. The cap **82** is interchangeable and is then placed over the end of the tube **40**. Of course, in case of transfer of the bag from **40** to **81**, there will be no control of the bag opening by the patient-controlled valve means. The bag may, in some instances, be dispensed with.

By-passing

Another feature relates to means by which gas from either supply carboy can be directly introduced into the breathing tube, without passing through the main delivery passage **33**. This feature is referred to herein as by-passing. Gas, either N_2O, or oxygen, or both, may be by-passed, and for this purpose, pipe connections are made with chamber **20** of each regulator, see Figures 1, 2 and 8, as at **85** leading by suitable pipes and connections, including unions and pipes **86—87—88**, to common passage **89** (Figure 3) which, in turn, delivers into pipe **90** to which flexible breathing tube **91** is attached. This latter tube delivers into flexible breathing tube **38** at a point relatively remote from the chamber **35** and valving means therein, and, therefore, remote from the bag opening **39** and air intake passage **36**. Each pipe **88** has a valve **92**. By this means, when desired, any amount of gas may be delivered independently of any control by the patient and at the will of the anesthetist or operator. By this means also, either oxygen or an anesthetizing gas or vapor can be by-passed to the patient.

During by-passing, the by-pass valve for the anesthetizing gas is (when the patient is gripping) opened and gases are delivered from two sources, to wit: a mixture of N_2O and oxygen by the main valve and some extra N_2O through the by-pass.

It is noted that the point of delivery of gas, directly into the breathing tube through the by-pass, is between the patient and the bag or air intake passage or main delivery point.

A suitable safety valve **85a** is provided for each

chamber 20, and the valves 92 have graduated dials 92a.

The valve of the by-pass is generally adjusted to supply a lesser or greater quantity of gas than is normally delivered through the main valve or passage 33.

When the by-pass feature is used, the bag is also by-passed so that gas is shot directly and quickly to the patient without mixture in the bag. With the by-pass the patient cannot entirely cut off the anesthetic gas. Although he can close the main supply valve from the machine to the chamber, the by-pass continues to deliver to, or into, the inhaling tube. However, when he does close the main valve, he gets a mixture of air, as before, the only result being that he cannot get as much air as he wishes, as in the construction of Figure 3.

Timing

Another feature of the invention relates to means whereby the valve means can be independently controlled to continue delivery of anesthetizing substance for a timed period, after operation of the valve means by the patient to stop delivery of such substance. This is necessary in some instances where the operator or doctor believes that the patient is not capable of making proper judgment as to when the supply of anesthetizing substance should be stopped. One form of device for performing this function is best shown in Figure 9, which is a vertical longitudinal section. This device may be an attachment for any suitable machine, or may be an integral part of such machine.

The rod 48 has a yoke 95 pivoted to a sleeve 96 slidable on a piston rod 97 having a piston head 98 operable in cylinder 99, which cylinder is secured to the wall of the casing 52 within chamber 35 by means of two pipe connections respectively indicated at 100 and 101 and a fastening device or devices 101a. A spring 102 acts to move the piston to the position shown, against the gripping action of the patient, which gripping action moves the rod 97 in the direction of the arrows. The piston and cylinder constitute timing means. When the piston is moved to the right from the position shown, as the result of gripping action of the patient, air enters the cylinder through check valve 103. When the patient releases the grip, the piston travels under the action of spring 92, against air pressure toward the left, and its speed is regulated by the exit of air past needle valve 105. By means of this valve, the timing period can be varied.

In order to release the rod 97 so that timing may be had independently of any control by the patient, the following means is provided: The rod 97 is notched as at 106 and this notch is engaged by a vertically slidable pawl 107 held yieldably in engagement with the notch by spring 108. At the top of the pawl is provided a cam 109 which can engage a trip pin 110, the position of which can be moved by rotation, by means of a set lever, to non-tripping position. When the stroke limit is reached during travel of the patient-controlled element 48 to the right, the cam 109 engages the trip 110 and the detent is disengaged from the notch 106 and the piston rod is released, to travel under the expanding action of the spring 102 to perform the timing operation. The spring 112 acts to move the rod 48 to the initial position shown when the patient sufficiently releases the grip. The gripping action of the patient is against that of the spring 112, as well as against the action of the spring 102. On tripping of the pawl, the patient continues to grip the control against the action of the spring 112, but as soon as the grip is released, the spring 112 acts to bring the collar to the initial position shown in Figure 9, whereat the pawl assumes locking position.

The piston rod 97 operates the valve means through a yoke or connection indicated at 114. This connection is adjustably attached to the rod 97 by set screw 115. At the opposite or lower end, element 114 is attached to rod 116 by means of set screw 117. Piston rod 97 and rod 116 move together. This rod forms part of the valve means and has a sealing fit in cylinder 118, the inner diameter of which cylinder is greater than the outer diameter of the rod to provide a passage to receive delivered gas or vapor. The rod 116 is provided with a gas delivery passage 119 which opens into the chamber 35 at 120. The element 114 has a foot portion 121 which abuttingly engages a valve 122 which is the functional equivalent of the valve 66 and alternately controls the passages 39 and 43. The valve 122 is pressed against the surface 123 of the casing 52 by means of a device generally designated 125 which is the functional equivalent of the device 67—69 of Figure 3. The valve 122 is moved to the position shown by action of spring 126.

During motion of the valve 122 in direction of the arrow or to the right by means of the foot 121 of the yoke 114, and as the parts reach their limit of motion, a latch 127 engages a projection 128 of the valve to hold the valve over the air intake opening 43 until the end of the timing period, that is during the time that the motion of the parts moves in a direction opposite the arrows or to the left. At the end of this period, a trip 129 engages a camming surface 130 of the pawl, to raise it and release the valve 122 which is then moved to its initial position by means of the spring 126, to abut the foot 121.

The valving means may be modified to control only the passage 45 and the air intake passage 43, as previously mentioned in relation to the form of the invention shown in Figure 3. It will be understood that the intention herein is to cover control of either a two or three orifice valve means by the gripping on the part of the patient.

It is to be noted that the reciprocable valve bar 116 projects beyond the casing 52 whatever its position, so that the operator or doctor can see it at all times. After the bar is moved to its extreme position to the right (main delivery valve open) and as the bar moves in the opposite direction during the timing period, the doctor can judge by the length of the projecting portion of the bar, the stage of the timing period.

It is further noted that by fully opening the valve 105, the timer can be rendered inoperative.

During timing, breathing and rebreathing takes place in the bag, and is continuous throughout the timing period because valve 122 is released by latch 127 only at the end of that time period. The important point is that the patient cannot breath air during this period because valve 122 is held in a position to close the air intake passage, and is released to close the bag opening only at the end of this period.

When the timer is used the speed of the patient's recovering from analgesia is lessened and this timing is resorted to because the patient may be of a type who will not maintain the grip long enough to maintain analgesia over a period as long as the doctor thinks is necessary, and this scheme enables the doctor to deepen or continue

analgesia and, therefore, to obtain a finer or more accurate control of analgesia, conformably to the type of patient.

Means for increasing the amount of gas during timing period

Another feature of the invention relates to means for increasing the amount of the delivered gas during the timing period, so that the patient will for the relatively short timing period, be made to breath more analgesic gas for this shorter period; or a greater volume of gas can be delivered, whether the timer is operative or not. To this end, a valve 143 controls passage 144, leading from the chamber 118 in communication with the gas delivery line 45, when the valve 65 is opened. A suitable hand lever 145 at the outside of the case controls this valve. An automatically controlled auxiliary valve 146 controls delivery of gas into the case 35 after passage through the valve 145. This latter valve 146 is attached to one arm 147 of a lever suitably pivoted as at 149 to the cylinder 118.

The opposite end of the lever passes loosely through a slot 150 in the yoke 114 and a spring 151 raises the lever to close the valve 146. Closure is initially prevented, however, by means of detent 153 pivoted within the slot 150 as at 154, said detent engaging a stop 156. During motion of the element 114 to the right from the position shown, the detent is moved away from the stop in the direction of the arrow to release the lever and obtain closure of valve 146, and rides upon the top of the lever and reaches the downwardly off-set portion 157. On return movement of the element 114, that is during the timing period, the detent 153 engages the stop and rides along the upper surface of the lever in a manner to open the valve 146 or move it to the initial position shown. An extra amount of gas is, therefore, delivered through the orifice 144 during the timing period and until valve 65 closes.

The timing mechanism is so constructed that timing can be controlled by the patient or can be controlled entirely independently of the patient, according to the position of the element 110. When the support carrying element 110 is rotated so that 110 lies sufficiently below the level shown, 109 does not engage it and no tripping takes place, but the elements 48 and 97 remain coupled. Automatic control independently of the patient is, of course, obtained as the result of the cam 109 engaging the trip 110. The position of the trip is changed by rotating its support by means of the lever shown in dotted lines. The lever has a suitable handle and a translatable locking pin, not shown, which can be engaged with either one of two openings of the casing.

Means is provided and associated with the air intake passage to prevent loss of anesthetizing gas to the atmosphere, during a by-pass period, that is after the patient has released his grip to close the main valve. This device is illustrated in Figure 1 and comprises cylindrical elements 160 and 161 telescopically engaged so that the volume of the chamber can be changed, in this instance by sliding the lower cylindrical section 161 vertically relative to the element 160. The element 160 has a removable friction fit with the tube 42 and carries a rod 162, which rod slidably passes through a cross piece 163 carried at the top of the cylindrical element 161. A head 164 on the rod limits downward movement of the element 161. At the bottom of the element 161 there is an air intake opening 166 and above this opening, in spaced relation, is placed a guard 167. A valve plate 168 is arranged to control the opening 166, the plate being pivoted at 169 and having a handle. The volume is so adjusted as to catch only that volume which the operator judges the patient should breathe. This receptacle can be used with the timer, and by-pass features, and is useful for lessening waste of gas or gases.

After closure of the main gas supply the patient is breathing by-pass gas back and forth through the chamber, by means of passages 36—166. Under these conditions, part of the anesthetizing gas is trapped at each exhalation, and through this trap gas air is in-breathed. As the result, of course, there is a mixture of air and gas in the chamber and in the breathing tube. If the chamber were not used, a substantially greater amount of anesthetizing gas would be lost to the atmosphere.

When using the by-pass, gas delivery continues after closure of the main delivery valve. With the timer, and also when the valve 146 is used, all gas is stopped after such timed closure. Of course, the by-pass feature may be used with the timing feature, and the machine can be used for anesthesia or analgesia. By-pass gas cannot be stopped by the patient or timer.

The regulator is set to deliver more than would normally be delivered from orifice 120 which orifice is smaller in caliber than passage 119.

When the device is used as an attachment shown in Figure 6, the by-pass pipes 86 are each provided with a union 140 which is adapted to be attached respectively to the oxygen and gas delivery pipes of any type of machine. The means by which the attachment is completed to the delivery pipe 80 is herein shown as a union nut 141.

Another feature is that the cross-sectional area of the air intake is always equal to, and can be greater than, the corresponding area of the breathing tube so that the patient can substantially immediately get a supply of air. In most of the devices with which I am acquainted, the air intake or exit orifices are so small that free exhaling is not obtainable and the patient immediately senses this condition and is fearful that he cannot get enough air, or cannot get it when he wants it.

At present, in dentistry, there is no means by which the patient can properly control analgesia, when a continuous flow machine is used, unless he removes the inhaler. When an intermittent type of machine is used, the patient has to be told by the doctor to breathe through the mouth. The present invention controls analgesia without the adjustment of any parts or valves at the inhaler or mask, and control can be had entirely by the patient's own effort.

In the present device no double tube connection to the inhaler is necessary, but only a single tube of relatively large diameter. In operating the device, the patient does not grip any part of the inhaler tube. In fact, the hand which operates the device may rest on the arm of the chair and is always well below the operating zone so that the patient cannot interfere in any way with the operation, as is likely when he has to raise his hands to the inhaler to adjust a valve.

Another advantage is that with the present device the patient will not move the mask or nasal inhaler in his attempt to control analgesia. Moreover, even if the inhaler is strapped to the patient's face, he will have confidence that he can control the gas just as he pleases.

Different persons react quite differently to the administration of an anesthetic and in addition, a proper state of analgesia is more difficult to maintain in one person than another. Most persons are afraid to breathe such substances because of a feeling of suffocation and they always feel more secure when they believe they have such a control as will enable them to get air when they want it. On the other hand, the patient's judgment as to the quantity of analgesic substance required is not always sound and when this is so, the doctor or operator must be able to get control without letting the patient know that he no longer has full control. The present invention provides for all contingencies.

It will be noted that the orifice or tube for attachment of the bag is placed between the point of delivery of the anesthetic substance into the chamber, and the air intake opening and with this arrangement, there is no pressure on the bag or in the breathing line when delivery of the analgesic substance has been stopped by closure of the valve. Experiments have proven that pressure on the bag is not necessary, and some anesthetists do not desire that a quick on-rush of gas take place immediately that the valve is opened, because this on-rush is disconcerting to the patient. It will, of course, be understood that the gas bag can be placed on the machine at the opposite side or entry side of the delivery orifice.

It will be understood that the full hand gripping scheme is claimed broadly herein, whether the trigger grip be applied to a member which can be swung and swiveled, or whether it be applied to the arms of a chair so that when the patient grips the arms (as he naturally does when in pain), the trigger or button is moved to operate the valve to obtain delivery of more analgesic or anesthetic substance. Of course, the whole grip idea can be applied directly to a machine which is so placed that the patient can reach it when in the dental or other chair. Moreover, this idea can be applied on a bed, operating table, etc.

In regard to a connection such as 53, or its equivalent, which permits relatively extensive motion of the hand of the patient relative to the breathing line including tube and inhaler, there is no intention to limit the invention as to the exact location of the valve means. This flexible connection between the gripping piece or the hand-operable means could be on the tube or on the inhaler, but under such conditions, and with the present invention, the patient can move the arm relatively extensively, while maintaining the gripping control. In this device, the constricting action of the whole hand including the thumb is used, as distinguished from the pressing of a button or lever which is at the end of an element which is gripped by the remaining fingers.

The words "breathing line" as used herein are meant to designate any part of the passage from which the patient draws anesthetizing gas or vapor or air or both, or oxygen, after such gas has been delivered from the machine.

Another feature of the invention is the idea of by-passing without patient control, or without the use of valve means other than that necessary to control delivery of anesthetizing substance into the breathing line. Another feature is by-passing around the main valve directly into any part of the breathing line, including the inhaler or mask, or delivering directly into the breathing line of an inhalable substance, independently of delivery through the delivery passage of the machine.

The timer can operate, in fact generally does operate, while the patient is tightly gripping the automatic-pistol-like grip, so that the patient is unaware that he no longer has control of the anesthetizing substance. On the other hand, if the trip 110 is adjusted so that it will not be engaged by the element 109, timing can still be obtained if the patient releases the grip, and the timing period can be extended or lessened. When the trip 110 is in position to trip, and during timing, the patient releases the grip and tightens it again, and re-starts the timer, thus extending the time. Automatic timing only takes place when the trip is operative. When the trip is not in operative position, and as the patient releases his grip, the various springs in Figure 9 act to move the elements 48, 97 and 116 in direction opposite that shown by the arrows. Thus timing can be controlled by the patient, or independently of the patient. Moreover, timing can be used with or without by-passing, and by-passing can be used with or without the valves 65 or 122.

When 110 is so positioned as not to trip 109 to disconnect 97 from 48, and if timing valve 105 is fully open, valve 65 (when used alone) or both valves 65 and 122 can be under entire and sole control of the patient. Of course, in the form shown in Figure 9 and when the trip 110 is not operative, valve 65 can be eased or slowly allowed to assume closed position. Nevertheless the valve 122, when it is used, is only allowed to snap to closed position when 116 closes valve 65. In the form of Figure 3, both valves 65 and 66 are snapped to either open or closed position after the valve 66 passes a vertical line passing through pivot 69.

Although I have disclosed means for obtaining graduated rebreathing, see elements 160, 161, 168, Figure 1, it will be understood that a chamber the equivalent of that shown can be used, without the volume-variation feature. Another feature is the use of gas conserver so positioned that the air is drawn therethrough, but so related to the rebreathing bag that one only is used at a time, whatever the position of the bag. In case the bag is at that side of the delivery valve opposite that shown in Figure 3, then when valve 65 is opened, air passage 36 is closed, and the patient can breathe in the bag, but not through the air opening, and when valve 65 is closed, passage 36 is opened to the patient, and bag is not open to the patient.

Another feature relates to the production of an anesthetizing machine including gauges 26, for indicating the relative volumes of the gases to be mixed, with means for separately delivering one or a number of such gases in a manner not to affect the gauges, including a valve which has graduations by which it is possible to regulate the volume of this by-passed gas, relative to the readings of the gauges, to obtain a known volume or quantity of by-passed gas, or gases, or mixture of such gases. One of these valves is shown at 92 in Figure 2, and its graduations are shown at 92a. Thus when the gauge hand is set at a certain position, the amount of gas delivered by the direct valve is known measurable and variable. In this way, when analgesia or anesthesia is being controlled by anesthetizing substances from two sources, one of the substances being by-passed, it is desirable that the relative volumes be known to the operator.

I claim as my invention:

1. In combination with a machine for delivering inhalation fluids, a breathing tube attached

to the machine and having a mask, valve for controlling delivery of fluid from the machine into the tube, automatic means for closing said valve and means separate from the breathing tube and mask attached directly to the machine and adapted for swinging adjustment and having a movable element thereon operable only by a circumscribing or grasping action of the entire hand of a patient, to open said valve when grasping is completed, and operable when grasping action ceases to permit instant closure of said valve by said automatic means to stop delivery.

2. In combination with a machine for delivering inhalation fluids, a casing providing a chamber into which the fluid is delivered from the machine, said chamber having an air inhaling and exhaling passage, and having a passage through which fluid delivery is made into the chamber, a breathing tube for the patient communicating with said chamber and having a mask applicable to the face of a patient, valve means associated with the chamber for controlling said passages to automatically close the delivery passage and open the air passage when moved to one position, and to open the delivery passage and close the air passage when moved to another position, and means operable by translation by a positive action of a patient to move the valve means to open the delivery passage, and means by which said patient-operable means can be translated to a position to releasably lock the valve means in a position to open the fluid delivery passage and close the air passage.

3. In combination with a machine for delivering inhalation fluids, an elongated breathing tube for the patient attached by one end to the machine, valve means at the machine and between the machine and the tube for controlling delivery of the fluid from the machine into the tube, and automatically operable to stop delivery, and elongated swingingly adjustable means directly connected by one end to and made a part of the machine and having at the opposite end a movable element thereon operable only by the grasping action of the whole hand of a patient for controlling said valve means for obtaining and maintaining delivery of fluid.

4. In combination with a machine for delivering inhalation fluids, a breathing tube for the patient, a quickly self-closing valve controlling delivery of the fluid from the machine into the tube, means operable at the will of the patient by a sustained positive action for moving the valve to and holding it in open position and for allowing the valve to quickly close when such positive action ceases, and means whereby fluid can be delivered directly into said breathing tube forwardly of said valve in direction of the patient, independently of said patient-controlled valve means and operative position thereof.

5. In combination with an apparatus for delivering inhalation fluids, a breathing line into which the fluid is delivered from the machine, a valve for controlling delivery of fluid into the line, and means for automatically closing said valve, means for controlling said valve to retard the closure thereof, means by which the valve can be controlled by a patient independently of or in conjunction with said retarding means, including means by which the patient-controlled means can act to open the valve and initiate a timing operation and thereafter allow the timing operation to ensue while said patient-control means is in the position it assumes for opening the valve.

6. In combination with an apparatus for administering inhalation fluids, a breathing line for the patient into which fluid is delivered, a valve for controlling the delivery of fluid into the line, means for retarding valve closure, means operable by the patient to automatically couple with said valve means for opening the same and conditioning the retarding means for retarding action, and means for automatically uncoupling said means to initiate retarding action, said means being capable of recoupling during the retarding action.

7. In combination with an apparatus for administering inhalation fluids, a breathing line for the patient into which the fluids are delivered, a valve for controlling the delivery of fluid to the line, and timing means for retarding valve closure to shut off the supply, means operable by the patient and capable of coupling and uncoupling with the timing means, and for coupling with the timing means to set the timer and for releasing the timing means after setting, said means being capable of recoupling to re-set the timer during the timing period, and means by which the timer can be rendered inoperative so that the patient has full control of said valve means.

8. In combination with a machine for administering inhalation fluid, a casing providing a chamber having a passage connecting with a delivery passage of the machine, a breathing line connecting with the chamber, a valve for controlling delivery of fluid through the passage into the chamber, means for controlling said valve including a stiff tube and means connecting it to the casing for universal motion, an element translatable in the tube and connected to control the valve means, and an automatic pistol grip rigidly attached to the tube, and having a lever pivoted thereto and attached to the translatable element, said lever being adapted to be encircled by a hand applied to the grip and to be moved as a result of grasping action of the hand.

9. In combination with an apparatus for administering inhalation fluids, including plural sources of fluid supply, means for mixing fluids from said plural sources, a passage into which the mixed fluids are delivered and a breathing line connected with said passage, an air intake port connected with said line, valve means for simultaneously controlling fluid delivery from the passage to the line, and from the air port to the line to stop fluid delivery and open the air port, or vice versa, means by which the patient controls said valve means, and a passage leading directly from one source of fluid supply and delivering into the breathing line forwardly of said valve means in direction of delivery to the patient.

10. In combination with an apparatus for delivering inhalation fluid including a source of fluid supply, a breathing line in connection with the source, a breathing bag in connection with the line, an inhaling and exhaling air port in connection with the line, a secondary re-breathing chamber connected with the air port for causing the patient to rebreath exhaled fluid mixed with air, and open to the atmosphere at a point remote from its connecting point, and valve means simultaneously operable when moved in one direction to stop delivery of fluid to the bag and permit air entry to the line, and stop fluid delivery from the source to the line, and when moved in the opposite direction to permit fluid delivery from the source to the line and bag, and prevent air entry.

11. In combination with an apparatus for administering inhalation fluid including a source of fluid supply, a breathing line into which the fluid is delivered from the source, an exhaling and inhaling air port connected with the line adjacent the source of fluid supply, and a re-breathing chamber connected with the port and open to the atmosphere at a point remote from its connecting point, and valve means simultaneously operable to stop delivery of fluid from the source to the line and open the air port, or to start fluid delivery and close the air port.

12. In combination with an apparatus for administering inhalation fluids including two passages through which the same fluid or different fluids can flow, a breathing line for the patient with which both passages are connected, a valve for each passage, means by which a patient can open one of the valves to obtain delivery of fluid from the corresponding passage into the line, and means by which this valve is automatically closed when the patient ceases to operate said means, whereby two inhalation fluids can simultaneously flow to the breathing line and whereby the flow of one fluid can be started or stopped by a patient, while the other is flowing.

13. In combination with an apparatus for administering inhalation fluid, a breathing line for the patient, an automatically closing valve for controlling flow of fluid from the apparatus to the breathing line, manual means movable to a certain position by a positive action on the part of an operator to open the valve, means by which closure of the valve can be delayed for a predetermined time following such positive valve opening action by the operator, and means by which the valve can accomplish its delayed closure independently of said manual means, and while said manual means is in the position assumed to obtain opening of the valve.

14. In combination with an apparatus for administering inhalation fluid, a breathing line for the patient, an automatically closing valve for controlling flow of fluid from the apparatus to the breathing line, manual means operable from a point remote from the apparatus by a positive action on the part of a patient to open the valve, means by which closure of the valve can be delayed for a predetermined time following positive valve opening action by the patient, and means by which the valve can accomplish its delayed closure independently of said manual means, and while said positive valve-opening action by the patient on said manual control means continues.

15. In combination with a machine for delivering inhalation fluids, a breathing line for the patient in operative connection with the machine, means for controlling delivery of fluid from the machine to the breathing line including a valve and means for timing the valve to close and stop fluid delivery, means operable by a positive action of a patient for opening the valve and conditioning the timer for timing action, said means including means for coupling with a part of said timing means whenever positive action by the patient ceases, and means operable to automatically disconnect said coupling means for timing action to obtain valve closure, when positive action on the part of the patient is completed following coupling action.

16. In combination with a machine for delivering inhalation fluid, a breathing line for the patient in operative connection with the machine, means adjacent the machine for controlling delivery of fluid from the machine to the breathing line, including a valve and means for automatically moving it to close and stop delivery, means remote from the valve and operable by a positive action on the part of a patient for opening the valve, and having means adapted for detachably coupling with the valve means whenever positive action by the patient ceases and means operable to automatically disconnect said coupling means when said positive action by the patient occurs following coupling action, to release the valve for automatic closure.

17. In combination with a machine for delivering inhalation fluids, having a fluid delivery line, a casing providing a chamber, said casing connected to the machine, said casing having a breathing line passage with which a breathing tube for the patient communicates, and having a fluid inlet passage communicating with the delivery line of the machine and which, when open, is in free communication with the breathing line passage across the chamber, said casing having an air passage also in free communication with the breathing line across said chamber, valve means adapted to automatically close the inlet and open the air passage for inhaling and exhaling when moved in one direction, and when moved in the opposite direction to open the inlet and close the air passage to prevent inhalation of air and said means having a part which is swingingly connected with the casing said swingingly connected part having a part movable thereon and operable only as a result of continued grasping action of the whole hand of a patient, without muscular action except that of the hand, to move the valve means to and hold the same in position to obtain delivery of the inhalation fluid to the breathing line passage, and so operable that when grasping action ceases the valve means is allowed to automatically move to stop fluid delivery by the machine, and open the inhaling and exhaling air port.

18. In combination with a machine for delivering inhalation fluids and having a fluid delivery line, a casing providing a chamber, said casing being attached to said machine, said casing having a breathing line passage with which a breathing tube for the patient communicates, and having a fluid inlet passage communicating with the delivery line of the machine, and further having an air passage as an inhaling and exhaling port, each of the last mentioned passages when open being in free communication with the breathing line passage across the chamber, valve means adapted to automatically close the inlet and open the air passage for inhaling and exhaling when moved in one direction, and when moved in the opposite direction to open the inlet and close the air passage, to prevent inhalation of air and means including a part remote from the machine and valve, and operable by a positive and continued action on the part of a patient for moving the valve means to and holding the same positioned to obtain delivery of inhalation fluid, and operable when such positive action ceases to allow automatic operation of the valve means to stop fluid delivery by the machine, and open the inhaling and exhaling air port.

19. An attachment for a machine for delivering inhalation fluids comprising a casing providing a chamber adapted for direct connection to the machine, said casing having a breathing line passage with which a breathing tube for the patient communicates, and having a fluid inlet

passage and a bag passage, and further having an air passage as an inhaling and exhaling port, each of the last mentioned passages when open being in free communication with the breathing line passage across the chamber, means for detachably securing the casing to the machine with the fluid inlet passage connecting with a main fluid delivery passage of the machine, valve means adapted to automatically close the inlet and bag passage, and open the air passage for inhaling and exhaling when moved in one direction, and when moved in the opposite direction to open the inlet and bag passages, and close the air passage to prevent inhalation of air, and means operable by a positive and continued action on the part of a patient for moving the valve means to and holding the same positioned to obtain delivery of inhalation fluid, and operable when such positive action ceases to allow automatic operation of the valve means to stop fluid delivery by the machine, close the bag passage and open the inhaling and exhaling air port.

20. In combination with a machine for delivering inhalation fluids and having a fluid delivery line, a casing directly connected to the machine and providing a chamber, said casing having a breathing line passage with which a breathing tube for the patient communicates, and having a fluid inlet passage communicating with the delivery line of the machine and having a bag passage, and further having an air passage as an inhaling and exhaling port, each of the last mentioned passages when open being in free communication with the breathing line passage across the chamber, valve means adapted to automatically close the inlet and bag passage and open the air passage for inhaling and exhaling when moved in one direction, and when moved in the opposite direction to open the inlet and bag passages and close the air passage, and means operable by a positive action on the part of a patient for moving the valve means to and holding the same positioned to obtain delivery of inhalation fluid, whereby when such positive action ceases, the valve means is immediately automatically moved to stop fluid delivery by the machine, and close the bag passage and open the inhaling and exhaling air port.

21. In combination with a machine for delivery of inhalation fluid, including a casing providing a chamber, a breathing line for the patient operably connecting with the casing and chamber, means for controlling delivery of fluid from the machine to the breathing line including a translatable valve automatically movable to stop delivery, said casing having a tubular extension, a sleeve translatable upon said extension, means operable by a patient for controlling the valve, including an element attached to the sleeve, and an element which pases therethrough and through the sleeve and tubular extension and which is operably associated with the valve, the degree of translative motion of the valve in opening direction being sufficient to permit the inner end of the sleeve to be engaged with the outer end of the tubular extension as a stop to lock the valve in open position, whereby by grasping the sleeve and pulling it, the valve can be pulled to and locked in open position.

22. In combination with a machine for delivery of inhalation fluid, a casing providing a chamber, a breathing line for the patient operably connecting with the casing, and chamber, means for controlling delivery of fluid from the machine to the breathing line including a translatable valve automatically movable to stop delivery, said casing having a tubular extension, a sleeve translatable upon said extension, a stiff tube, flexible tubular means attaching one end of the stiff tube to the sleeve, an automatic pistol grip attached at an angle to the opposite end of the stiff tube, and having a lever pivoted thereto to be encircled by the hand of a patient when grasping the pistol grip, a wire passing through all tubular elements and connecting said lever with the valve for translating the valve from its closed position to obtain fluid delivery, the degree of motion of the valve in opening direction being sufficient to permit the inner end of the sleeve to be engaged with the outer end of the tubular extension as a stop, to lock the valve in open position, whereby by pulling on the sleeve and translating it, the valve can be pulled to and locked in open position.

23. In combination with a machine for mixing and delivering inhalation fluids including a casing providing a chamber in operative connection with the fluid supply of the machine, a breathing line for the patient in communication with the chamber, a valve automatically movable to instantly stop fluid flow from the machine to the chamber, means operable by a positive action on the part of a patient to move the valve to obtain fluid flow, means for by-passing a fluid or fluids from the machine directly into the patient breathing line around said valve and remote therefrom, including a by-pass tube within the breathing line delivering axially in direction of fluid flow to the patient at a point forwardly of the valve, and tubular elements connected to said casing and delivering directly into said by-pass tube, and a valve for each tubular element for controlling and indicating the amount of the flow.

24. In combination with a machine for delivering inhalation fluids, a casing providing a chamber, a breathing line for the patient in operative connection with the chamber, means carried by the casing for controlling delivery of the fluid from the machine to the chamber including an automatically closing valve, a stiff tube, flexible tubular means attaching one end of the tube in operative relation with the casing, an automatic pistol grip attached at an angle to the opposite end of the stiff tube and including a lever pivoted thereto to be encircled by the hand of a patient as the pistol grip is grasped, and a wire passing through all tubular elements and connecting said lever with the valve for moving it to obtain delivery of fluid, when the lever is moved as a result of grasping action.

25. In combination with an apparatus for delivering inhalation fluids, a breathing line in operative relation with the apparatus, a first valve for controlling flow of fluids from the apparatus to the breathing line, movable means controlling the first valve, manually operable means for moving said movable means to valve-open position and thereafter permitting independent motion of said movable means to valve-closing position, means by which said movable means is moved in valve-closing direction at a governed speed, means by which non-anesthetic fluid can be introduced into the breathing line, a second valve controlling admission of such fluid to said conducting means independently of said first valve and adapted to open automatically, means operable by said movable means when opening the first valve to close said second valve, means for releasably holding the second valve in closed

position during valve-closing motion of the movable means, and means by which the movable means releases the holding means during motion of the movable element to close the first valve, to permit the second valve to automatically open independently of the movable element.

26. In combination with an apparatus for administering inhalation fluids, a valve for controlling flow of fluid to the organs of respiration, manually operable means for moving said valve to obtain flow, a movable element controlling the valve, means by which the movement of said element is coincidentally started by the manual means when moved to open the valve, means by which said element is moved at a governed speed to close the valve, means by which said movement of said element to close the valve can be independent of manually operable means to close the valve, means by which non-anesthetic gas can be conducted to the organs, valve means controlling admission of the non-anesthetic gas to said conducting means, means independently opening said last mentioned valve, means for releasably holding said valve in closed position so that it remains stationary during the movement of the movable element to stop delivery, said movable element being adapted to contact said holding means to release the same to permit said independent means to close it, movement of the movable means and the last mentioned valve being independent of the manually operated means.

27. In combination, a machine as the source of supply of a suitable inhalation fluid or fluids, and means to obtain a predetermined mixture of the fluids, a breathing line, a breathing bag, a casing providing a single chamber having passages communicating respectively with the source of supply of fluids after mixing, the bag, the breathing line, and the atmosphere, valve means automatically movable to a position to close the supply and bag passages and open the atmospheric passage, means operable only by a prehensile or constrictive gripping action of the whole hand of a patient for moving the valve means to and holding it in a position to open the supply and bag passages and close the atmospheric passage, by-passages directly separately connecting the unmixed sources of fluid supply with the breathing line independently of said valve means, and a valve for each by-passage for quantitatively regulating the delivery volume, and means for timing a delayed closure of said valve means to close the fluid supply passage including means operable by said patient-operable means to automatically couple with said timing means when gripping ceases, and thereafter on complete re-gripping to move the timing means to starting position, and means for automatically uncoupling said coupling means after complete regripping to allow timing action, said means being adjustable to prevent uncoupling action, and means for rendering the timer inoperative.

28. An apparatus for producing dental analgesia and preventing anesthesia comprising, a machine supplying inhalation fluid, a mask for the patient, a breathing tube operably connecting said mask with the machine, quickly self-closing valve means for controlling flow of inhalation fluid from the machine to the mask including a valve casing, patient-operable means for controlling said valve means including a tubular member attached to the valve casing and having means adapted when squeezed by the patient's hand to move said valve means to obtain and maintain fluid flow to the mask while squeezing continues, and to operate said valve means to stop flow when squeezing ceases, said tube being freely movable relatively to the casing to permit the hand-operable means to be freely moved and be placed in any convenient position to be continuously held, and so as to be held and operated without any muscular action other than required for moving the fingers, whereby the hand-operable means can constantly remain in the hand, or can constantly rest by gravity in the palm, and whereby the entire arm can constantly assume a restful position, as in the lap or as on the arm of a chair.

29. In combination with an apparatus for administering inhalation fluids, means by which flow of fluid to the organs of respiration is controlled including a casing and a quickly self-closing valve therein, patient-operable means for controlling the valve to quickly open and close it including, a part adapted to be squeezed by the patient's hand to open the valve, and hold it open, and adapted to allow the valve to close when squeezing ceases and including a tubular operating connection between the hand-operable means and said casing of a character and of sufficient length to permit said hand-operable means to be swung and placed in any convenient position to be continuously held, and to be operated, all without any muscular action other than that required for moving the fingers.

30. In combination with an apparatus for administering inhalation fluid, means by which flow of fluid to the organs of respiration is controlled including a valve, manual means operable by the patient to open and hold the valve open, and means by which the valve can accomplish its closure independently of said manual means and while said valve opening action by the patient on the manual control means continues.

31. In combination with an apparatus for administering inhalation fluid, a breathing line for the patient, an automatically closing valve controlling flow of fluid in the breathing line, manual means operable by a positive action on the part of the patient to open and hold the valve open, and means by which the valve can accomplish its closure independently of said manual means and while said positive valve-opening action by the patient on the manual control means continues.

32. In combination with an apparatus for administering inhalation fluids, means by which flow of fluid to the organs of respiration is controlled including a valve, a reciprocable control element for the valve, two springs operably connecting the control element with the valve and so arranged as to be alternately tensioned by the control element respectively to open and to close the valve, one spring to remain tensioned to hold the valve in the given position, one of the springs being de-tensioned when and while the other is tensioned, and a spring for separately moving the reciprocable control element in valve-closing direction.

33. In combination with an apparatus for administering inhalation fluids, means by which flow of fluid to the organs of respiration is controlled including a casing and a valve therein, a reciprocable control element for the valve, two springs operably connecting the control element with the valve to be alternately tensioned respectively to open and to close the valve, one spring to remain tensioned to hold the valve in the given position, one of the springs being de-tensioned when and while the other is tensioned, a spring

for separably moving the reciprocable control element in valve-closing direction, and means for operating the reciprocable control element, including a part adapted to be squeezed by the patient's hand to put one of the springs under tension and open the valve, and to maintain the valve in open position while squeezing continues, and to allow the other spring to close the valve and hold it closed when squeezing ceases and a movable operating connection between the hand-operable means and said casing of sufficient length to permit said hand-operable means to be swung and placed in any convenient position to be continuously held, and to be operated, all without any muscular action other than that required for moving the fingers.

34. In combination with an apparatus for administering inhalation fluid, means by which flow of fluid to the organs of respiration is controlled including a casing having a quickly self-closing valve therein, means for controlling the valve to quickly open and close it, said means having a means operable by the patient's hand, said valve controlling means including a tubular operating connection between the hand-operable means and the casing of a character to permit said hand-operable means to be adjusted and placed in any convenient position relatively remote from the casing so as to be held and operated without any muscular action other than that required for moving the fingers, whereby the entire arm can constantly assume a restful relaxed position as in the lap or as on the arm of a chair, with the hand-operable means disposed for instant operation.

35. In combination with an apparatus for administering inhalation fluid, means by which flow of fluid to the organs of respiration is controlled including a casing having a quickly self-closing valve therein, means detachably securing the casing to said apparatus, means for controlling the valve to open and close it, said means having a means operable by the patient's hand, said valve controlling means including a swingable tubular operating element between the hand-operable means and the casing of a character to permit said hand-operable means to be adjusted and placed in any convenient position relatively remote from the casing so as to be held and operated without any muscular action other than that required for moving the fingers whereby the entire arm can constantly assume a restful relaxed position as in the lap or as on the arm of a chair, with the hand-operable means disposed for instant operation.

36. In combination with an apparatus for administering inhalation fluid, a breathing line for the patient, a casing having therein a quickly self-closing valve for controlling flow of fluid to the patient through said line, patient-operable means for controlling the valve including a part operable by the hand only of the patient without motion of the arm and therefore while the arm can constantly remain in a restful position, and an elongated tubular element through which control power is transmitted, said tubular element acting to connect said part with said valve casing and being adapted to allow said part to be swingingly adjusted to any position convenient to the patient.

37. An anesthetizing machine comprising means for producing a mixture of anesthetizing gas in desired proportions, a conduit for conducting said gases to the patient, valve mechanism in said conduit for normally blocking the flow of gas mixture therethrough, means operative by the patient to open said valve mechanism to permit flow of gas mixture to the patient, said means being automatically operative to permit closure of the valves for continuation of normal blocking of flow of gas mixture to the patient, and means under the control of the anesthetist operator to determine and vary at will the time of such automatic closing of the valves.

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