No. 819,392. PATENTED MAY 1, 1906.

W. N. WAYMAN.

GAS ADMINISTERING APPARATUS.

APPLICATION FILED JUNE 28, 1905.

Fig. 1.

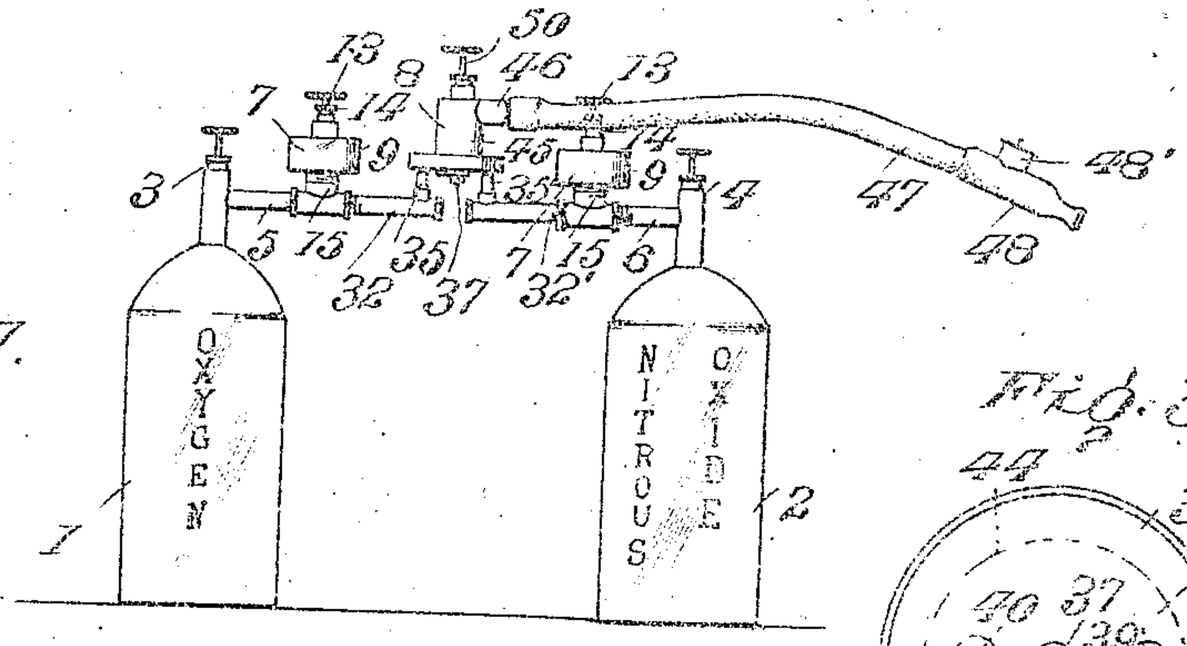


Fig. 3.

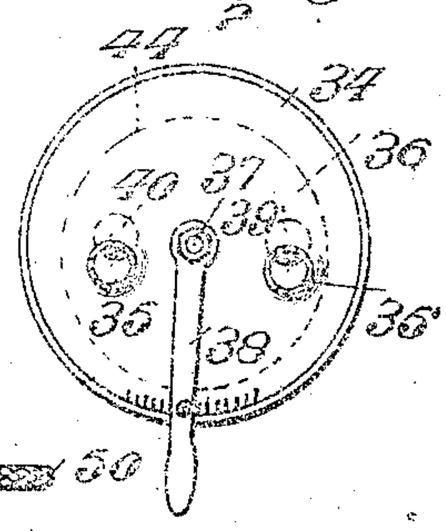
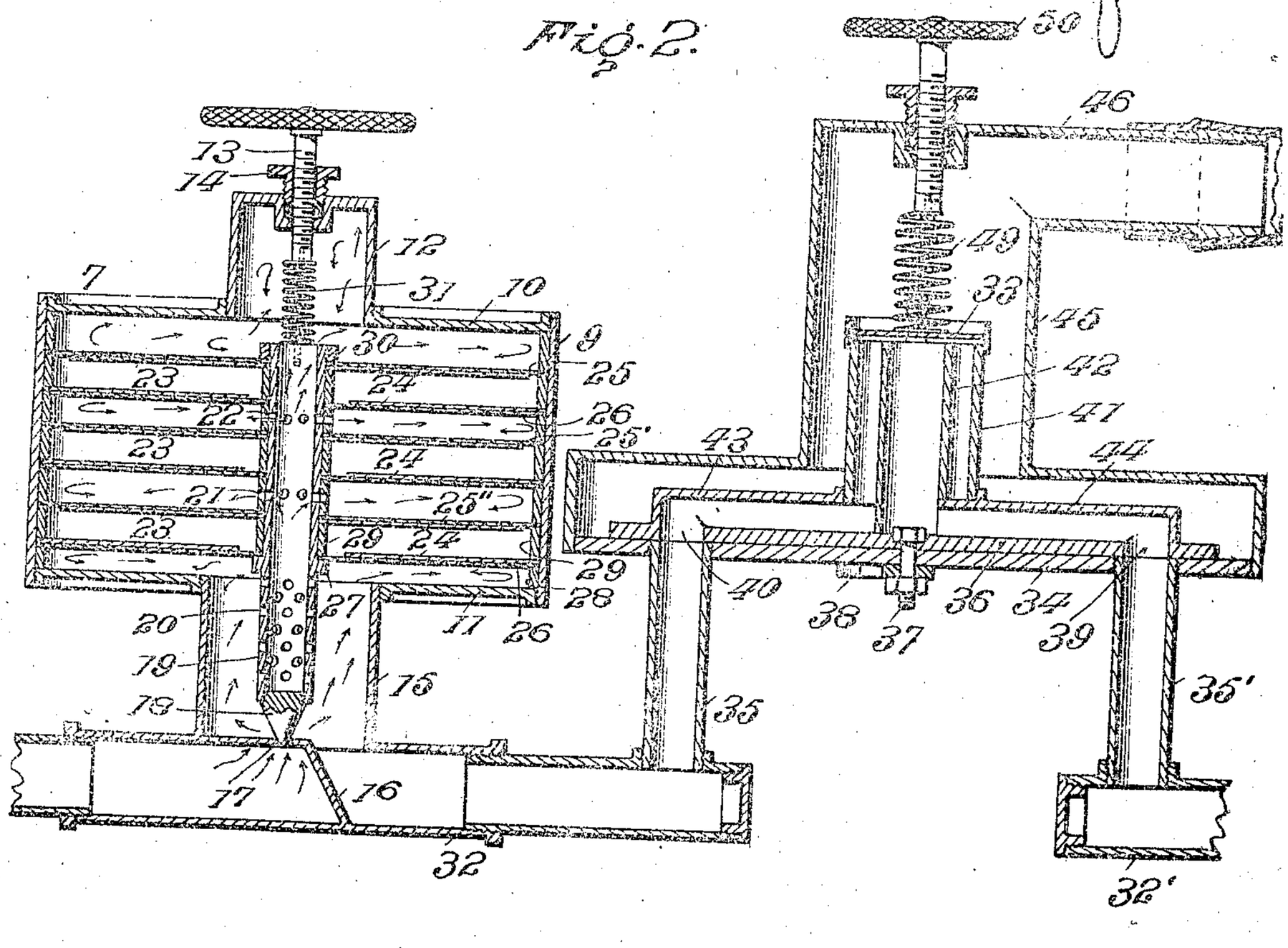


Fig. 2.



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UNITED STATES PATENT OFFICE.

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GAS-ADMINISTERING APPARATUS

No. 819,392. Specification of Letters Patent. Patented May 1, 1906.

Application filed June 28, 1905. Serial No. 267,432.

To all whom it may concern:

Be it known that I, WALTER N. WAYMAN, of Staunton, Virginia, have invented a new and useful Improvement in Gas-Administering Apparatus, which invention is fully set forth in the following specification.

This invention relates to gas-administering apparatus, and especially to means for reducing and controlling the pressure of gases delivered from gas-cylinders and for administering such gases separately or combined in regulated proportions.

The object of this invention is to provide simple means whereby an anesthetic, such as nitrous oxid or a mixture of the same and oxygen under heavy pressure, may be administered to a patient at any desired low pressure with a minimum waste of gas and to regulate the flow of gas to correspond with the respirations of the patient and to automatically stop the flow of gas by the mere withdrawal of the mouthpiece, and this without special manipulation of valves by the operator.

A further object is to improve the means for administering two or more gases separately or combined and regulating their proportions as desired.

My invention further consists and resides in the construction and combination of cooperating elements hereinafter to be more fully described and then recited in the claims.

Certain mechanical expressions of the inventive idea involved are shown in the accompanying drawings, which are designed merely as illustrations to assist in the description of the invention and not as defining the limits thereof.

Figure 1 is a front elevation of the gas-administering apparatus. Fig. 2 is a vertical central sectional view showing the interior construction of the valves, and Fig. 3 is a detail view.

Referring to Fig. 1, two gas-cylinders 1 and 2 of ordinary construction, holding under pressure gases, such as oxygen and nitrous oxid, respectively, are shown. These cylinders are provided with the usual needle-valves 3 4 and branch pipes 5 6 for connecting the cylinders up with the pressure-reducing and mixing devices 7 8. As illustrated, only two reservoirs are connected with the mixing device 8; but the number may be increased by adding a reducing-valve for each additional cylinder.

In Fig. 2 is illustrated the preferred embodiment of my pressure-reducing and gas-cut-off valve, together with gas-mixing means. The reducing-valve comprises a valve and diaphragm-supporting casing 9, having end closures 10 11, one of which, 10, is provided with a tubular member 12 for supporting valve-adjusting means, such as a screw-threaded rod 13, which is made to pass gas-tight through the wall of member 12 by means of a packing-joint 14. Casing 9 is provided at its ends with interior screw-threads which engage the peripheral threads on the end closures 10 and 11. To the bottom 11 of the casing is secured a T-shaped connection 15, within which is a partition 16, having a valve-seat 17 for receiving a valve 18, which when seated closes communication between the high-pressure reservoir side and the low-pressure side communicating with the delivery end of the apparatus. The valve 18 is yieldingly supported by a hollow valve-stem 19, having lower openings 20, which permit gas to enter the valve-stem and pass upward and out at the top and also at the sides through openings 21 22, as clearly indicated by the arrows. The valve-stem is centrally and yieldingly supported within the casing 9 and supports a series of rigid disks 23, which alternate with a series of rigid annular plates 24, circumferentially supported. Alternately above and below the disks are a series of flexible diaphragms 25 26, fast at their central portions to the valve-stem and at their circumferences to the wall of the casing. For the purpose of securing these elements in place I preferably provide the valve-stem with a supporting-ledge 27 and place in the casing 9 a ring 28. A flexible diaphgram 26 is then introduced and an annular plate 24 placed above it. Separating-rings 29 are introduced, followed by a disk 23, and so on till the desired number of diaphragms are in place. A nut 30 is screwed down on the valve-stem to make the elements fast to the latter, and by means of head 10 the disks are similarly secured at their circumferences. A spring 31 is secured to the upper end of the valve-stem and makes a swivel connection with the end of the rod 13. The spacing-rings opposite the openings 21 22 are provided with corresponding openings for permitting free communication between the hollow valve-stem and alternate spaces between the diaphragms.

For the purpose of automatically cutting off the flow of low-pressure gas through conduit 32 means are provided which will respond to slight reduction of pressure caused by inhalations of the patient, thereby permitting escape of gas, and which will automatically close the instant such reduction of pressure ceases. For this purpose I provide, preferably, an outwardly-opening spring-pressed valve 33, which closes the outlet of conduit 32 against the reduced gas-pressure therein. This valve is also arranged to simultaneously close the outlet of each conduit leading from each reducing-valve, and in connection therewith a manually-operated valve is employed, which enables the gas to be cut off from each or all the cylinders or to be mixed in any desired proportion. The means preferably employed to effect these combined objects comprises a supporting-plate 34 for receiving connections 35 35′, which are merely continuations of conduits 32 from the reducing-valves. Resting on plate 34 is a valve-plate 36, pivotally secured thereto by a bolt 37, provided with an index-handle 38 for rotating the valve. This valve is provided with openings 39 40 out of line with the center of the plate, as shown in Fig. 3, and positioned to alternately register in part or whole with the ends of connections 35 35′. Fast to plate 36 and movable with it are concentric tubes 41 42, communicating, respectively, with connections 35 35′ through conduits 43 and 44, and surrounding the whole is a casing 45, fast on plate 34 and provided with a pipe 46 for attachment of a flexible tube 47, having suitable mouthpiece 48, provided with yielding outwardly-opening exhaling-valve 48′. A spring 49 and adjusting-screw 50 permit the tension of the spring to be regulated to any pressure desired.

The operation of the device as thus far described is as follows: Valve 18 is raised just to clear its seat by manipulating adjusting-screw 13. Valve 33 is seated to close the outlet-conduits 41 42, connecting with conduit 32 and 32′, and the tension of spring 49 adjusted to apply the desired pressure to valve 33, which also determines in large measure the pressure at which the reducing-valve operates to open and close. Valve 36 is set, by means of index-handle 38, to permit a single gas or a mixture of gases from the gas-reservoir to flow past valve 33. As shown, provision is made for only two reservoirs; but it is evident that a larger number may be used without departing from the principle of the invention. Assuming that the oxygen-tank alone is to be used, the valve 33 being normally closed, gas under heavy pressure will lift valve 18, enter the space above the valve, and through the valve-stem will distribute itself and exert a downward pressure on diaphragms 25 25′ 25″ and through disks 23 to the valve-stem, and thereby close valve 18. It will be noted that the upward pressure of the gas is substantially neutralized by the annular plates 24, and therefore practically the whole combined area of the diaphragms resting on disks 23 is utilized in the downward pressure, and it is opposed only by the upward pressure on the small annular areas of the alternate diaphragms where they are attached to the valve-stem and side wall of the casing.

The number of the diaphragms may be increased, thereby giving a greater difference between the high and low pressure sides of the valve and also decreasing the diameter of the casing. When it is desired to administer or withdraw gas from the cylinders, the pressure above valve 33 is reduced, as when the patient inhales, thus resulting in a slight lowering of pressure in the casing 9, thereby unbalancing the pressure on the lower face of valve 18 and causing escape of reservoir-gas. Valve 33 will then seat when left to itself. The gas can also be delivered past valve 33 by diminishing the pressure of spring 49 on the valve, and thus be manually controlled.

It will be evident from the foregoing that a low pressure can be made to balance a very high pressure by a very simple arrangement of the diaphragms, that the escape of gas is automatically cut off after use, and that different gases can be used separately or combined in any desired proportions and all automatically cut off when not being used—a matter of obvious economy and safety.

What is claimed is—

1. In gas-administering apparatus, the combination of a valve-casing having a high-pressure inlet open to reservoir-pressure and a low-pressure valve-closed outlet, a partition separating the inlet from the outlet, and having an opening, a valve seating in said opening and a hollow valve-stem for said valve, a plurality of resilient diaphragms supported by the casing and supporting said valve-stem, rigid disks on said stem centrally supporting alternate diaphragms, annular plates fast to the casing alternating with said disks and circumferentially reinforcing alternate diaphragms, said stem being provided with openings to admit low-pressure fluid to one side of each of said centrally-supported diaphragms, resilient means controlled outside the casing for adjusting the valve to its seat.

2. In gas-administering apparatus, the combination of a valve-casing having a high-pressure inlet open to reservoir-pressure, and a low-pressure outlet, a partition separating the inlet from the outlet and having an opening therein, a valve seating in said opening, and a hollow valve-stem for said valve, a plurality of resilient diaphragms supported by the casing and supporting said valve-stem, rigid disks on said stem centrally supporting

alternate diaphragms, annular plates fast to the casing alternating with said disks and circumferentially reinforcing alternate diaphragms, said stem being provided with openings to admit low-pressure fluid to one side of each of said centrally-supported diaphragms and for closing said outlet.

3. In gas-administering apparatus, a combined mixing and automatic cut-off valve, comprising a casing having a plurality of gas-inlets, a sliding valve opening and closing said inlets, centrally-disposed gas-receiving tubes in said casing provided with a common spring-pressed valve for closing outlets of same, the inlet ends of said tubes being controlled by said sliding valve, and said casing being provided with connections for delivering said gas or gases.

4. In gas-administering apparatus, the combination of a valve-casing having an inlet open to reservoir-pressure and a low-pressure outlet, a pressure-reducing valve therein controlling the passage of fluid from said inlet to said outlet, and a low-pressure outlet-valve subject to reduced reservoir-pressure on one side and to spring-pressure on the opposite side for normally closing said outlet.

5. In gas-administering apparatus, the combination of a valve-casing having an inlet open to reservoir-pressure and a low-pressure outlet, a pressure-reducing valve in said casing controlling the passage of fluid through the same, a conduit communicating with said outlet, a spring-pressed outwardly-opening valve normally closing said conduit, and a casing inclosing said valve and provided with a mouthpiece, said casing constituting a pressure-reducing and gas-delivery chamber.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WALTER N. WAYMAN.

Witnesses:
JAS. A. GLASGOW
WM. H. AST.