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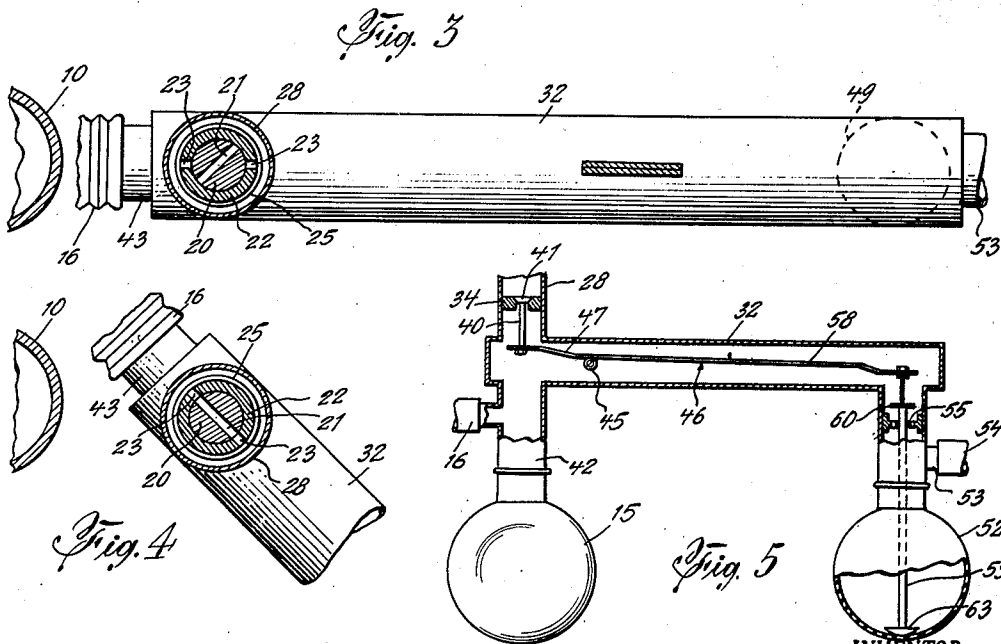
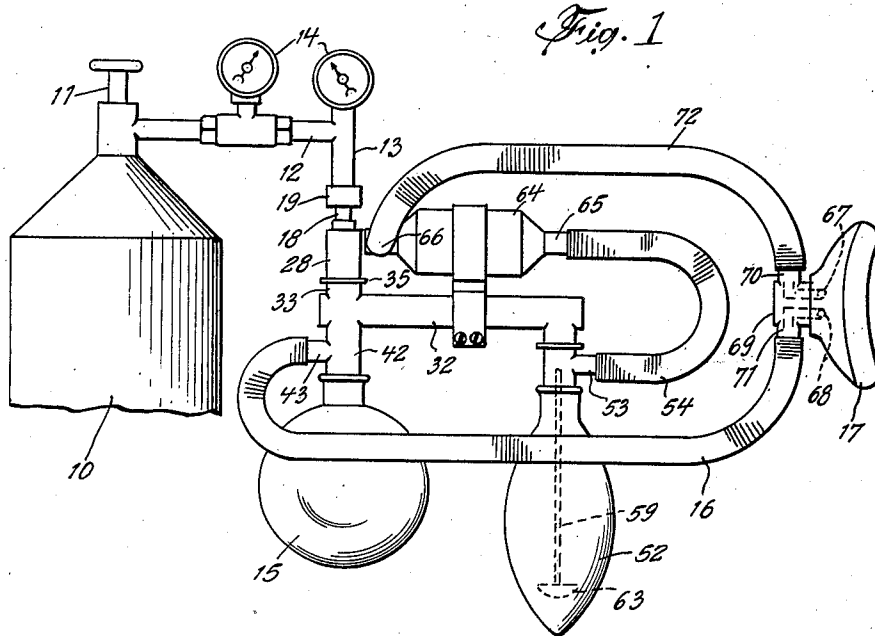
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2,296,496

OXYGEN ADMINISTERING APPARATUS

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2 Sheets-Sheet 1



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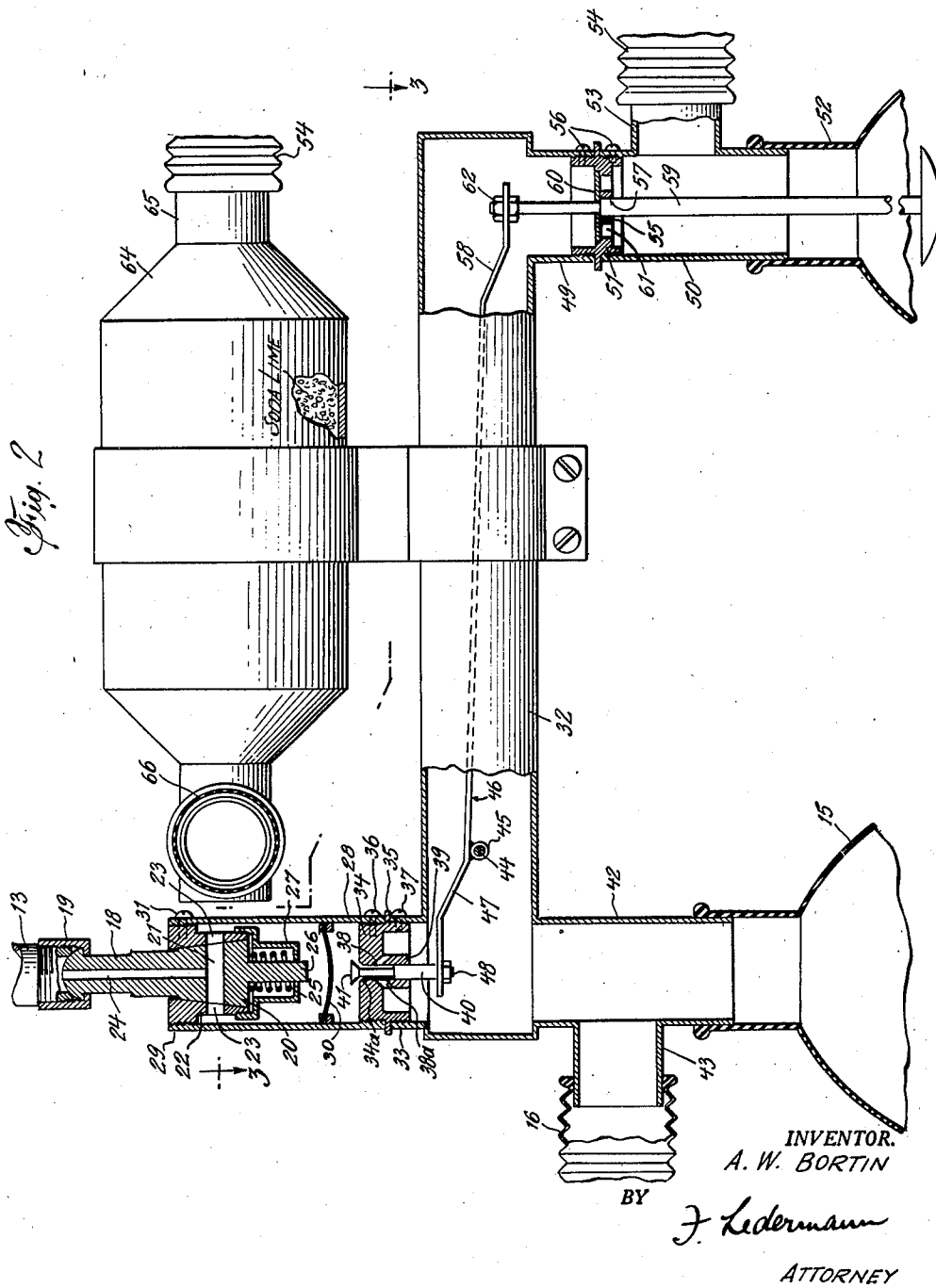
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UNITED STATES PATENT OFFICE

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OXYGEN ADMINISTERING APPARATUS

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3 Claims. (Cl. 128—191)

This invention relates to apparatus for administering oxygen to patients, and aims to provide certain new and useful improvements for increasing the efficiency of the device and reducing the cost of operation.

Another object of the invention is the provision of means whereby the exhalations of the patient, instead of being expelled into the atmosphere, are passed through a canister of soda lime or other suitable carbon dioxide remover and thence into an auxiliary bag or container from which the recovered oxygen is available to be inhaled by the patient. Thus, a given quantity of oxygen in the original tank will last a great deal longer, since the patient breathing the oxygen absorbs only a part thereof, between 20% and 50%. The remainder is wasted in the case of the ordinary apparatus because the exhalations of the patient pass into the atmosphere, whereas it is fully utilized in the case of the instant apparatus.

The above and other objects will become apparent in the following description, reference being had to the accompanying drawings which form a part hereof. It is to be understood that the drawings are intended for purposes of illustration only, and it is neither intended nor desired that the invention be limited in any manner excepting within the spirit and scope of the appended claims.

Referring briefly to the drawings, Figure 1 is a front elevational view of the apparatus of this invention.

Figure 2 is an enlarged fragmentary longitudinal cross-sectional view through Figure 1, with some parts omitted, and in part broken away to expose the interior, with the auxiliary valve closed.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2, showing the inlet valve closed.

Figure 4 is a fragmentary view similar to Figure 3, but showing the extension tube swung through an arc and the inlet valve consequently in open position.

Figure 5 is a reduced partly sectional view similar to Figure 2, with parts omitted, illustrating the auxiliary valve in open position.

Referring in detail to the drawings, the numeral 10 indicates an oxygen storage tank or capsule of standard manufacture, such as is available on the market for the delivery of oxygen under pressure. The exhaust valve for the tank is shown at 11, which delivers the oxygen into the outlet pipe 13 through the connecting pipe 12. Suitable standard gages are shown at 14, 55

which are of no consequence to the present invention. The apparatus in common use today has a single flexible bag, such as 15, suspended from and fed by the pipe 13, with a flexible tube such as 16 leading therefrom to a breather mask such as 17. The patient inhales the oxygen through the tube 16 in such apparatus and exhales it into the air.

In the present invention, the rounded head of a hollow stem 18 is clamped against the end of the pipe 13 by a nut 19. At its lower end the stem 18 is provided with an enlarged conical body 20 having a horizontal opening 21 extending diametrically therethrough. A tapering sleeve 22 surrounds the body 21 and has the latter registering slidably therein; the sleeve 22 is provided with opposed diametrical openings or ports 23 in the same plane as the opening 21. The opening 24 through the stem 18 communicates with the horizontal opening 21. A nut 25 is threaded on the lower end of the sleeve 22 and is provided with a central opening through which a reduced extension 26 of the body 20 extends; a coiled spring 27 surrounds the extension 26 and, as is obvious, urges snug registration of the body 20 in the sleeve 22 at all times in order to prevent leakage between these two parts of the valve.

A housing 28 is threaded at 29 on the upper peripheral edge of the sleeve 22 and encloses the valve just described, having also a screen 30 interposed below the valve. A set screw 31 locks the housing against rotation with respect to the sleeve 22. A T having the long arm 32 horizontal, has one short arm 33 joined to the housing 28 through the medium of a spider 34 whose peripheral surface is threaded; the lower end of the housing 28 is threaded to the upper portion of said surface, and the upper end of the arm 33 is threaded to the lower portion. A flange 35 extends between the meeting ends of the housing 28 and the arm 33, and a set screw 36 locks the housing 28 against the spider 34; a set screw 37 similarly locks the arm 33 against the spider 34. It is thus apparent that when the arm 32 is swung through a horizontal arc, the valve sleeve 22 will rotate synchronously therewith.

The upper portion of the spider 34 is in the form of a solid disc which, except for the central opening 38 therethrough, obstructs the passage through the housing 28. The upper end of the opening 38 has a valve seat 34a, and this opening continues down through the hub 39 which is rigid with the spider disc. A valve stem 40 is

snugly slidable in the opening 33, but the upper portion thereof is of reduced diameter so that a peripheral space is provided between the same and the walls of the opening 38. A by-pass 38a is cut through the side of the hub 39 and extends angularly upward into the upper portion of the opening 38, below the valve seat 34a. The stem 40 has a valve head 41 adapted to seat in the valve seat 34a.

The other short arm 42 of the T has the flexible bag 15 secured thereto and suspended therefrom; this bag is simply a storage or pressure equalizer bag. The arm 42 is further provided with a nipple 43 intermediate its length, to which one end of the flexible tube 16 is attached.

Extending interiorly from one wall of the long arm 32, in a horizontal direction, is a fixed pin 44 having a collar 45 pivotally mounted thereon. A link 46 is rigidly secured, near one end thereof, to the collar 45, and the short arm or end 47 of this link is attached to the lower end of the valve stem 40 by a screw 48. At its outer end the tube 32 has a nipple 49 extending downward therefrom, to which a tube 50 is secured through the intermediation of the externally threaded flange 51 of a perforated disc 55, and set screws 56, in the same manner as before described in reference to the spider 34. An auxiliary flexible bag 52 is secured to the lower end of the tube 50, and to a nipple 53 on the latter is attached one end of another flexible tube or hose 54. The disc 55 is provided with a central opening 57 in which a stem 59 is slidably mounted. A disc 60 is rigid about the stem 59 above the disc 55, and when it rests on the latter it covers the perforations 61 through the latter to close the passage through the nipple 49, as is obvious. The extremity of the longer arm 58 of the link 46 is secured by a screw 62 to the upper end of the stem 59. At its lower end the stem 59 has a rounded base 63 which, when the bag 52 is wholly or partially deflated, lies positioned above the central floor of the bag, as shown in Figure 1, being supported in that position by contact of the disc 60 with the disc 55; the disc 60 serves as a limit stop to the downward movement of the stem 59.

Mounted on the tube 32 in any desired manner, is a canister having an inlet nipple 65 and an outlet nipple 66, shown at 64. The other end of the hose 54 is secured to the nipple 65. For the purposes of this invention, the breather mask 17 is of a novel type, in that it has two spaced apart openings thereinto, shown at 67 and 68. A union 69 having two opposed nipples opening thereinto, shown at 70 and 71, is secured to the mask, and the nipples thereof communicate with the mask openings 67 and 68, respectively. The tube or hose 16, which has one end secured to the nipple 43 over the bag 15, has its other end secured to the mask nipple 71. Another hose 72 joins the mask nipple 70 with the canister nipple 66. The canister 64 contains a mass of small particles of soda lime which, as is well known, is an excellent absorber of carbon dioxide.

The operation of the device is as follows. Assuming that the tank 10 has just been connected to the apparatus, both bags 15 and 52 will be deflated and will appear substantially as only the one bag 52 is shown in Figure 1. When not in use, the arm 32 will lie in the position shown in Figure 3, in radial alignment with the tank 10, in which position the passage 21—23 from the inlet channel 24 into the housing 28 will be closed. Then, with the tank valve 11 open, there will be no flow of oxygen past the sleeve 22.

When the arm 32 is now swung forward through an arc of approximately 45 degrees, into the position shown in Figure 4, the passage through the sleeve 22, that is, the passage 21—23, will be opened, and oxygen will flow therethrough into the housing 28. Since, as aforementioned, the bag 52 is deflated, the valve 60—55 will be closed, as the weight of the stem 59 and its associated members will keep the disc 60 down against the perforated disc 55. For the same reason the valve 41 will be in raised or open position, and the gas will flow from the housing 28 through openings 38 and 38a down into the bag 15. After the bag 15 has been inflated, the gas will flow through the tube 16 and into the mask 17 through the breather port 68. The mask is of course held tightly against the face so that no leakage occurs between the mask and the face. The exhaled gases, which comprise essentially oxygen and carbon dioxide, then pass through the mask outlet port 67, through the tube 72, through the canister 64 where the carbon dioxide is trapped, and the remaining pure oxygen passes into the bag 52 through the tube 54, thus beginning inflation of the bag 52 with pure recaptured oxygen. As the above process proceeds, the bag 52 gradually approaches full inflation, and as the pressure builds up therein the bag's horizontal diameter lengthens while its vertical axis conversely shortens. At a point approximating full inflation, the bottom of the bag 52 will have risen sufficiently to lift the base 63 and hence the stem 59 upward so as to raise the disc 60 clear of the perforated disc 55, as shown in the diagrammatic view in Figure 5; simultaneously, the stem 40 will be lowered so as to seat the valve head 41 in its seat 34a, thus closing the inlet passage of oxygen from the tank 10. The oxygen now freed from the bag 52 will, owing to the pressure therein, be forced along the tube 32 and, since the valve 41 is closed, down the tube 42, where it will combine with the oxygen from the bag 15 and pass through the hose 16 into the mask. This will continue until the bag 52 has again become sufficiently deflated to permit fall of the stem 59 and consequent reseating of the disc 60 on the disc 55, whence again only the oxygen coming directly from the tank 10 will pass into the mask. Since the action of alternate opening and closing of the valves 41 and 60 is automatically controlled by the pressure in the bag 52, the same will continue as long as the patient is breathing through the mask, and as soon as the treatment is finished the arm 32 is swung back into its original position (Figure 3), thus shutting off the inflow from the tank. Whatever pressure of recaptured oxygen there may be in the bag 52 upon the said completion of the treatment is thus maintained, and the action as described above is continued as soon as the next treatment begins.

Instead of the single soda lime canister shown, a battery of two or even more might be used either simultaneously or selectively; in the latter case a new one may be connected and the old one disconnected by means of simple valves or petcocks, not shown; for when the soda lime has approached its maximum absorption of carbon dioxide a new supply must be placed in the canister.

It is of course no part of the present specification to provide data as to the amount of oxygen which is thus recovered instead of being wasted, but it is obvious that a substantial percentage is recovered. Thereby a given quantity of oxygen

in a supply tank is made to serve for a substantially greater number of treatments; in actual use it has been estimated that the original supply lasts about twice as long as heretofore.

Obviously, modifications in form and structure may be made without departing from the spirit and scope of the invention.

I claim:

1. A gas administering apparatus adapted to be connected with the outlet of a gas supply tank comprising a T tube having one of the shorter arms thereof secured to said outlet and having a flexible bag secured to the other short arm thereof, the long middle arm of said T tube having an opening at its free end, said long arm having a second flexible bag secured to said opening, a shut-off valve in one end of said T tube and a second shut-off valve in the other end thereof, means on said second valve for opening said second valve upon inflation of said second bag, means joining said valves for closing said first valve simultaneously with the opening of said second valve and vice versa, a housing having an inlet and an outlet and containing a carbon dioxide absorbent substance, a hose connected at

one end to said second short tube, a breather mask having an inlet and an outlet, said hose being connected at its other end to said mask inlet, a second hose connected between said mask outlet and said housing inlet, and a third hose connected between said housing outlet and said opening in said free end of said long arm.

2. The device set forth in claim 1 wherein said first-named short arm is rotatably secured to said tank outlet and valve means are provided partly rigid with said outlet and partly rigid with said first-named short arm for opening said last-named valve means upon rotation of said first-named short arm in one direction and for closing the same upon rotation in the opposite direction.

3. The device set forth in claim 1 wherein said means on said second valve comprises a stem projecting into said second bag to a point intermediate between the lower end of said second bag to a point intermediate between the lower end of said second bag when in deflated condition and said lower end when in inflated condition.

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