April 22, 1958 A. J. BERNDT 2,831,607

INHALATION APPARATUS

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Fig. 1.

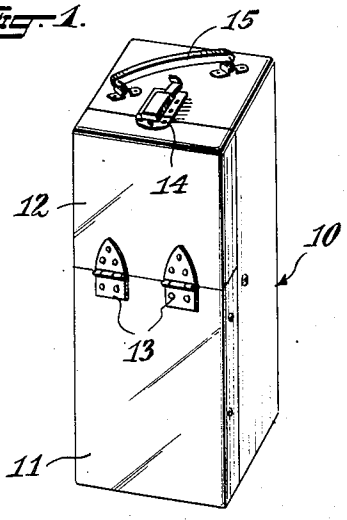

Fig. 4.

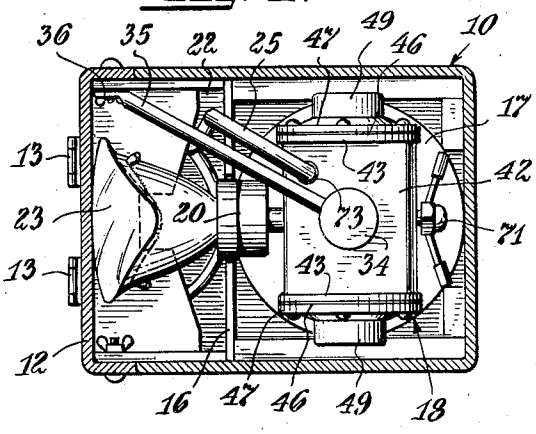

Fig. 3.

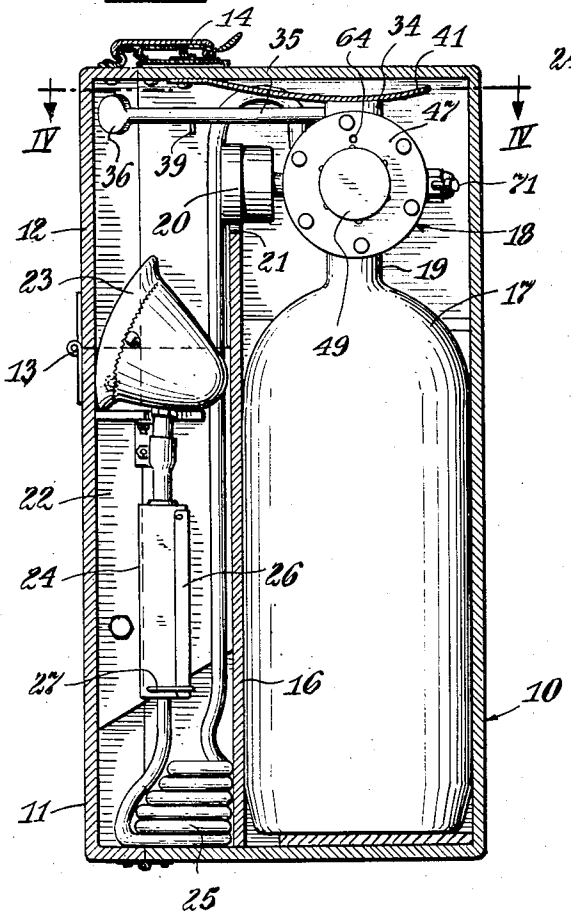

Fig. 2.

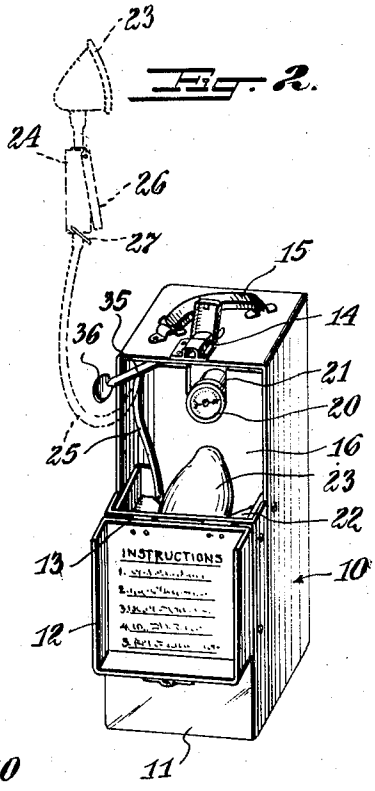

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Fig. 5.

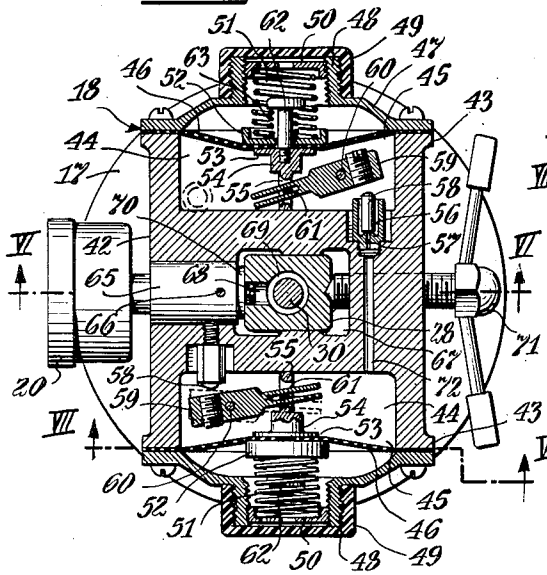


Fig. 6.

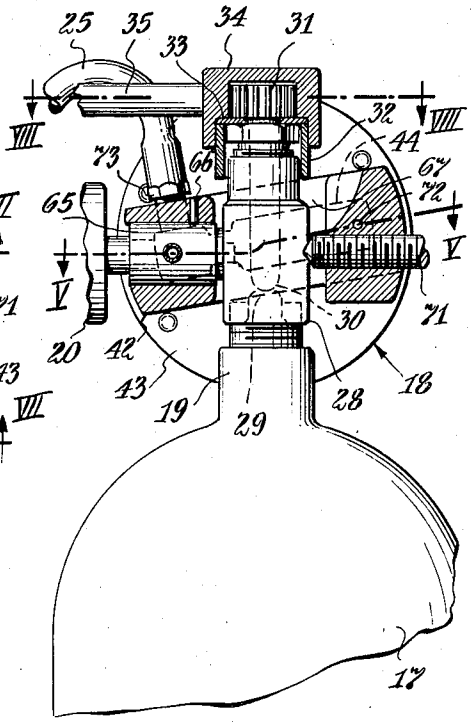


Fig. 7.

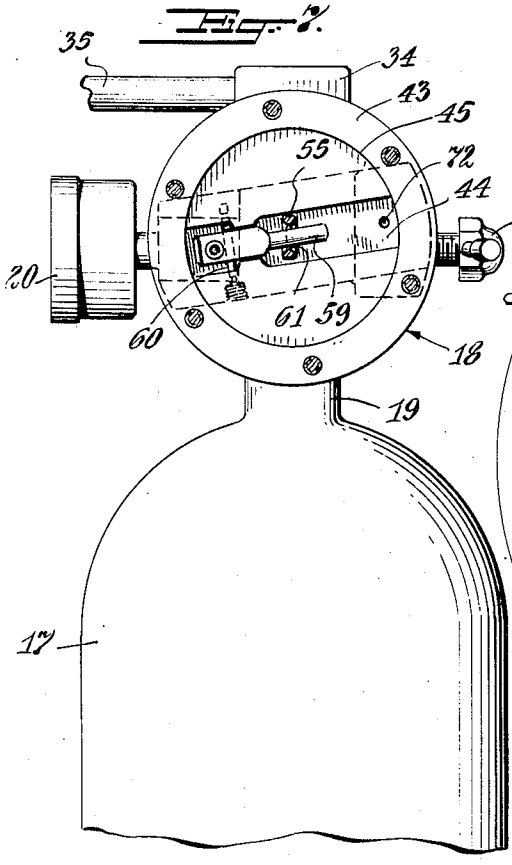
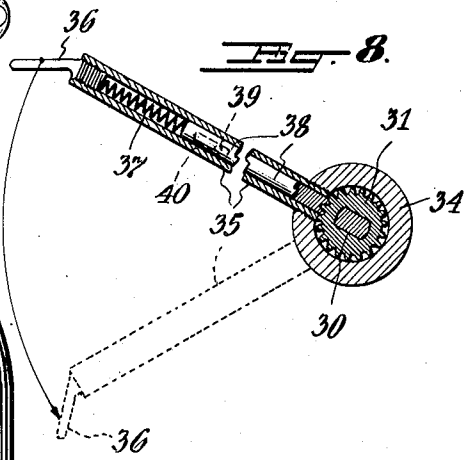


Fig. 8.



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INHALATION APPARATUS

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Application April 29, 1955, Serial No. 504,810

8 Claims. (Cl. 222—3)

This invention relates to inhalator apparatus, and one intended more especially for emergency use.

A primary object of the invention is to provide a compact, portable inhalator apparatus that can be made readily available at the place where required.

Of equal importance is the purpose to provide such an apparatus which is simple, light in weight, efficient and effective.

Among the important objects of the invention is to provide an apparatus which can be operated by inexperienced persons without delay and without danger to the patient.

More specifically, the invention provides an inhalator apparatus presenting no danger of either too much oxygen or too much pressure being applied to the patient.

Important among the objects of the invention is to provide for factory pre-setting of the permitted pressure of the oxygen to the patient, and to avoid need for the user to manipulate any variable controls or to have to watch gauges for regulation purposes, or, otherwise expressed, to provide an apparatus of inherent automatic character so that the user may devote entire attention to the patient on which used.

Other objects, advantages and novel structural features will become apparent to persons skilled in the art to which the invention appertains as the description proceeds, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawings in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is a perspective view of the portable case in which the mechanisms of the apparatus are enclosed;

Figure 2 is a similar perspective view showing the case opened to the extent required for using the apparatus on a patient;

Figure 3 is a vertical sectional view taken on a plane just inside of the side wall nearest to the observer;

Figure 4 is a cross-sectional view just below the top wall of the case, as on line IV—IV of Fig. 3;

Figure 5 is a cross-sectional view on a horizontal plane through the middle of the automatic pressure regulating valve mechanism, as on line V—V of Fig. 6;

Figure 6 is a vertical central sectional view through said valve mechanism, as on line VI—VI of Fig. 5, and showing said mechanism in place on an oxygen tank or bottle;

Figure 7 is a sectional elevation just inside of one of the controlling diaphragms of said valve mechanism, as on line VII—VII of Fig. 5; and

Figure 8 is a horizontal sectional view of the factory-set adjustment for the manipulating lever which the user swings to obtain or stop flow of oxygen from the tank or bottle to the patient.

In the specific embodiment of the invention illustrated in said drawings, the reference numeral **10** designates the portable case body of rectangular box formation having a front closure the lower part **11** of which is secured at the factory by screws or otherwise so as to remain in place at all times during use. The upper part of said front closure is constituted as a lid **12**, hinged at **13** at its bottom edge to the top edge of the permanent lower part **11** of the closure. A releasable hasp **14** at the top of the body **10** provides means for holding the lid **12** upward in its closed position of non-use of the apparatus, but permits quick opening of the lid when the apparatus is to be put to use. A handle **15** on the top of the body **10** provides means for carrying the apparatus, and is available whether the case is open or closed.

Inside of the case, parallel to and back from the front closure, is a factory-placed partition **16** which extends from side to side of the body and from the bottom thereof and nearly to the top of said body sufficient to substantially enclose an oxygen tank or bottle **17** within the body together with an automatic pressure regulating mechanism designated generally by numeral **18** and which is applied at the factory to the neck outlet **19** of the bottle. As this pressure regulating mechanism is substantially enclosed within the case behind the partition where not readily reached by a user, it is adequately protected from being tampered with in the field. Projecting from the front of the pressure regulating mechanism is a pressure gauge **20** conveniently protruding through a slot **21** in the partition, thereby keeping the bottle from twisting axially, and providing an indication to the user as to remaining supply of oxygen in the bottle.

The interior of the case, in front of partition **16**, provides a pocket **22** for receiving and carrying a mask **23**, hand control **24** and rubber or other flexible tubing **25** connecting the control and mask with the outlet from the automatic regulating valve. This mask is conveniently available to the user upon opening the lid, and the length of tubing is adequate to enable the mask to be applied to the face of a patient over his mouth and nose. The hand control has a hand-grip **26**, which, when held inward manually or by clip **27** as in Fig. 3, shuts off passage of oxygen to the mask. Said hand-grip is spring loaded and tends, when released, to swing outward, as in Fig. 2, and when in that position the valve within said hand control is open and oxygen passes to said mask, assuming that oxygen is being admitted to said tubing from the bottle.

The bottle **17** has a fitting **28** applied to the neck **19** thereof before the bottle is filled with the oxygen, said fitting providing an interior valve seat **29** the opening through which is capable of being opened and closed by a male valve member **30** threaded in the fitting so as to be moved to and from the valve seat by partial rotation. Thirty degree rotation, more or less, is allowed for said member, ample oxygen passing the valve seat when the said member is rotated to that extent even with the threads on said member as fine as thirty two to the inch. The upper end of said male valve member **30** protrudes from the upper end of the fitting and made angular in cross-section, as shown in Fig. 8, for presenting an appropriate bite for turning means applied thereto. Said turning means constitutes a feature of the present invention.

For the purpose of turning said male valve member **30** to either open or close the valve manually, I provide a gear or pinion **31** having its center cut out to fit the angular shape of the protruding end of said member. Inasmuch as the upper end portion of fitting **28** is hexagonal or otherwise shaped to enable it to be screwed into tight engagement in the bottle neck **19**, I apply a cylindrical collar **32** therearound so as to provide a cylindrical outer surface. A washer **33** is applied at the top of said collar, and then gear or pinion **31** is applied to the pro-

truding male valve member. A hub 34 having a closed upper end is then applied over said gear, said gear being rotatable in said hub and the hub having a cylindrical skirt depending therefrom around and in rotatable engagement with said collar 32. Projecting radially from said hub 34 is a rigid tubular handle 35 which is fast with respect to said hub so as to rotate the hub when the handle is swung horizontally. The outer end of said tubular handle is conveniently closed by a permanent finger-piece 36 screwed or otherwise applied and held therein. Within said tubular handle is a coil spring 37 the outer end of which is kept from displacement by engagement with said finger piece 36, and the inner end of which applies spring loading to a slidable bolt 38 within the handle. The inner end of said bolt is engageable between adjacent teeth of said gear, whereby swinging the handle will correspondingly rotate said gear and the male valve member.

A pin or knob 39 projects laterally from said bolt 38 through a slot 40 longitudinal of the tubular handle, so that the bolt may be set in the proper valley between the gear teeth when the handle is at its desired position. A leaf-spring 41 in the top of case 10 applies adequate pressure to retain the hub and gear assembled on the fitting 28.

The automatic pressure regulating mechanism 18 has a body portion or casting 42 having a generally oblong shape but flaring at opposite ends to provide circular flanges 43 in planes parallel to each other and perpendicular to the medial rectangular portion of said body. By virtue of the flanges being ring-shape and the metal connecting it with the oblong body being somewhat dome-shape, there is a circular cavity at each end of the casting. The rectangular end portion of the casting contiguous to said chamber provides a further approximately rectangular hollow 44 disposed diametrically to the cavity so that the cavity and rectangular hollow together constitute an end chamber 45. A diaphragm 46 of suitable flexible and impervious material, such as rubber, extends across the outer end of said chamber and is peripherally secured to said flange by a conforming cover 47. This cover is somewhat dome-shape with its crest shaped into an outwardly projecting neck 48 with both internal and external threading. A removable protective cap 49 is screwed onto the external threading of said neck. A pressure regulating head 50 is within said neck and threaded to engage adjustably with the internal threading of the neck. Diaphragm 46 is normally pressed concavely inwardly of chamber 45 by a spring 51 located centrally thereof and seating in a cup 52 resting on said diaphragm and bearing at its other end against said regulating head 50. At the other side of the diaphragm from said cup said diaphragm is engaged by a plate 53 from which oppositely projects a central boss 54 terminating in an eyelet 55 that stands perpendicular to said plate. Engagement of the end of said eyelet with the bottom of hollow 44 limits the inward displacement of the diaphragm.

In the bottom of each hollow 44, and here shown as a separate entity that can be screwed into place, is a valve seat 56 with a passage 57 therethrough adapted to be closed by a movable valve member 58 engageable against said seat. A teeter-bar 59 is pivoted on a transverse pivot rod 60 and overlying the location of said valve seat so that by oscillation of said teeter-bar toward the seat closing pressure may be applied to the movable valve member to close said passage 57. The opposite end of said teeter-bar is forked and engages a transverse pin 61 in the eyelet with minimum of lost motion whereby the diaphragm 46 will function without chatter and with desired precision to open and close the valve.

Setting of pressure regulating head 50 for compression of spring 51 determines the prevailing pressure of gas in end chamber 45. A safety escape for the gas is provided in event pressure builds up beyond the desired prevailing pressure in said end chamber. I have devised a simple expedient of extending a stud 62 from said plate 53 and boss 54, through the diaphragm with a loose fit and with equally as loose a fit through cup 52. Said stud is headed beyond said cup and a spring 63 between the head and cup holds the plate normally tightly against the diaphragm, but when teeter-bar 59, by seating of the valve, can swing no further, said plate and stud are thereby stopped so that an excess of gas pressure will then lift the diaphragm and cup away from said plate, and excess gas will escape through the central openings of the said diaphragm and cup. A suitable bleed hole 64 (Fig. 3) in the cover will permit escape of the excess gas therefrom so as not to build up back pressure.

Afore-mentioned pressure gauge 20 is mounted at what may be arbitrarily termed the front edge of the body or casting 42 of the pressure regulating mechanism 18, and is shown in Fig. 5 to best advantage, as coaxially at the front end of a hollow cylinder 65 which is situated in a hole or bore tightly fitting the same at the front part of said body. A suitable dowel or the like 66 holds said cylinder in its assembled position. The rear end of said cylinder extends to an opening 67 transverse to the cylinder and vertically through the body or casting, said opening being of appropriate size and shape to admit afore-mentioned fitting 28 therethrough. Said fitting has a lateral flow passage 68 from the male valve stem 30 and its clearance space 69 toward and axially aligned with the hollow of cylinder 65 and thus will admit full pressure from the bottle to said gauge when the bottle valve is open. A gasket 70 seals the end of the cylinder to said fitting, and is compressed thereat by a screw clamp 71 located at the back of the body or casting 42 and pushing against the back of said fitting. Release of this clamp enables the entire pressure regulating mechanism to be removed from one bottle and applied to another with ease and facility.

One of the valve units having valve seat 56 in one of the end chambers 45 of the body or casting 42 communicates with the hollow interior of cylinder 65 and for that purpose may conveniently be screwed into a side of said cylinder in a lateral hole prepared for the purpose. The gas or oxygen is therefore admitted to that one chamber with the valve therein reducing the pressure in accordance with setting of pressure regulating head 50. For convenience, this chamber will be specifically identified as the intermediate pressure chamber.

There is a passage 72 interconnecting this first or intermediate pressure chamber to the passage 57 of the valve seat 56 of the second chamber, now to be referred to as the low pressure chamber. Setting of the regulating head 50 for the diaphragm of this second chamber is such that the gas pressure therein is again reduced. An outlet nipple 73 leads out of said low pressure chamber, and it is to this nipple that the flexible tubing 25 to the hand control 24 and mask 23 is attached.

It now may be pointed out that the apparatus is prepared at the factory all equipped with a filled oxygen tank or bottle, and adjusted for delivery of the proper pressure. The bottle is initially charged with a pressure of approximately 2500 pounds to the square inch, and may be used efficiently and effectively at least until the gauge 20 thereon registers fifty pounds or somewhat less. The pressure regulating heads are adjusted at the factory to maintain a pressure in use in the first or intermediate pressure chamber of approximately three and a minimum of two and a half pounds to the square inch, whereas the final or low-pressure chamber maintains a pressure of between two-thirds and one third pound per square inch, which is thus the pressure delivered to the patient at the mask 23 by operation of hand control 24. When the apparatus is to be used, upper closure is opened, and by virtue of factory adjustment, finger-piece 36 on tubular handle 35 will be located at the extreme left next to the side wall of the case. The user swings

that handle to the right, thereby opening the bottle valve, whereupon oxygen will be delivered, automatically regulated as to pressure, to the hand control, and upon release of hand grip **26** passes to the mask and patient. The non-rotatable retention of the bottle in the case, enables the side walls of the case to be utilized as stops for the open and closed positions of the main control tubular handle **35**.

I claim:

1. An inhalator apparatus comprising a carrying case having walls and compartments, a partition between said compartments, a gas-containing bottle in one compartment, said bottle having a control valve thereon operated by a lever, said lever projecting from said one compartment through the partition into the other of said compartments; and one of said case walls constituting the outer limit of said other compartment, said last mentioned case wall also constituting a limitation to the swing of said lever, and means for preventing said bottle from rotational displacement by force applied in swinging said lever.

2. An inhalator apparatus in accordance with claim 1, wherein said partition has a slot and said means for preventing rotational displacement of the bottle comprises a pressure gauge fixed on the bottle and projecting from said slot.

3. An inhalator apparatus in accordance with claim 1, wherein said lever has adjustable attachment to said valve so as to be contiguous to said wall of said case with the valve in its shut-off condition.

4. An inhalator apparatus comprising a carrying case for receiving a gas-containing bottle, said bottle having a valve and valve stem at the neck end thereof, a lever on said valve stem for operating said valve manually, and a spring in said carrying case in engagement with said lever for preventing displacement of said lever off of said valve stem while the bottle remains in said carrying case.

5. An inhalator apparatus in accordance with claim 4 wherein a pressure-reduction valve is mounted at the top

of said bottle in conjunction with said valve operated by said lever, and said pressure-reducing valve being irremovable until said lever is removed.

6. An inhalator apparatus comprising a carrying case with a front opening and having a rear compartment, a gas bottle in said rear compartment, an outlet fitting on the top of said bottle, said fitting having a lateral outlet flow passage, and a pressure-regulating valve on said bottle in said rear compartment and inaccessible for tampering with while in said case, said pressure regulating valve having a body porting surrounding said fitting and having engagement against said fitting at said flow passage and having an outlet hollow juxtaposed to said flow passage, and clamping means maintaining said engagement of said body portion against said fitting.

7. An inhalator apparatus in accordance with claim 6, wherein said clamping means comprises a hand screw having engagement against said fitting at the rear thereof in opposition to aforesaid engagement of the body portion and fitting and inaccessible from the exterior of said case.

8. An inhalator apparatus in accordance with claim 6, wherein said pressure-regulating valve extends laterally within the upper end of said case with each end of the said valve having a pressure chamber therein, and means for effecting a lower gas pressure in one chamber than in the other and both at lower gas pressure than normally provided in said gas bottle.

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