April 17, 1962 B. L. TAYLOR 3,030,064

OXYGEN INHALATOR

Filed Oct. 5, 1959

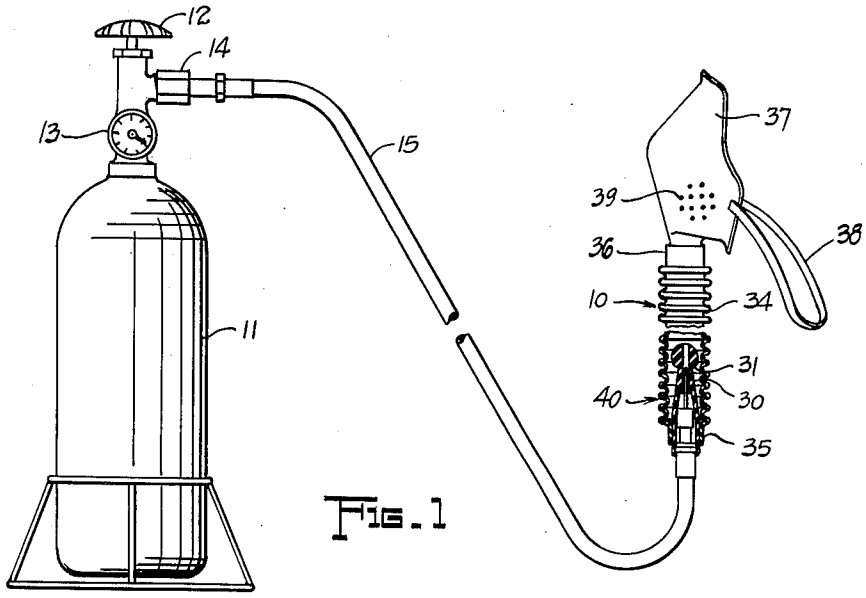


Fig. 1

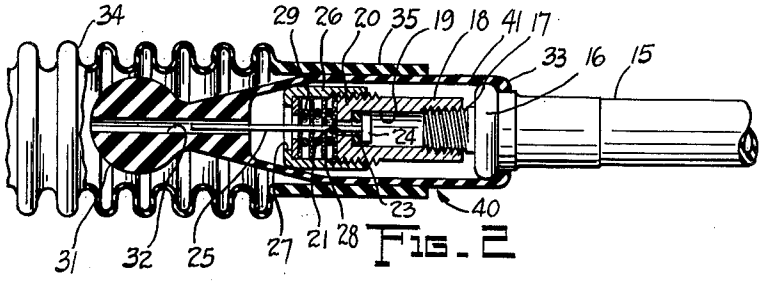


Fig. 2

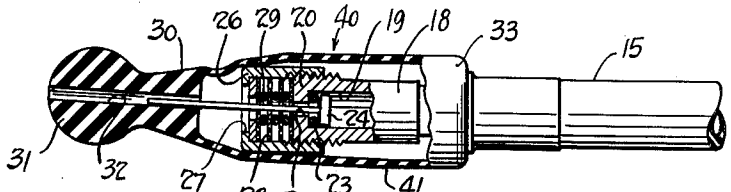


Fig. 3

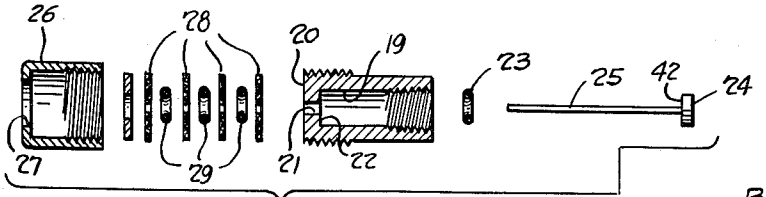


Fig. 4

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OXYGEN INHALATOR

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This invention relates to inhalators and particularly to a portable structure for the emergency administration of oxygen.

The primary object of this invention is to provide an inhalator for the administration of oxygen, that can be attached to any source of oxygen under pressure, either in the form of a portable tank or a permanent installation.

Another object is to provide an oxygen inhalator that can be attached directly to a source of oxygen under high pressure, and is operable without requiring pressure reducing valves, pressure gages, or re-breather bags, such as required by the conventional oxygen mask systems.

Another object is to provide an inhalator whose oxygen flow may be easily regulated by merely flexing the supply hose, the flow being cut off automatically, upon release of the hose.

Another object is to provide a device of the type stated whose regulating valve requires no close fits between the moving parts, but is held gas tight by the pressure exerted by the oxygen itself.

Still another object is to provide an oxygen inhalator whose elements on the low pressure side are joined through slip-fits so that excessive pressure cannot be built up on the low pressure side to which the administrating mask is attached.

Another object is to provide a device of the type stated that can be used to deliver oxygen intermittently, that is two or three breaths at a time, as desired by the user.

A further object is to provide a complete emergency oxygen dispensing unit that is so compact that it can be carried in a brief case or stored in any other small space.

Another object is to provide an oxygen dispenser that is instantly self-operating, without requiring physical adjustments or attention on the part of the user, other than the slight flexing of the supply hose, mentioned hereinabove.

These and other objects of the invention will become apparent from a reading of the following specification and claims, together with the accompanying drawings, wherein:

FIGURE 1 is a perspective view of the oxygen inhalator that is the subject of this invention, as it appears connected to a tank of oxygen, and ready for use;

FIGURE 2 is a sectional view through the gas flow metering valve showing the needle valve in its closed position;

FIGURE 3 is a sectional view through the gas flow metering valve showing the needle valve in a tilted, or open position; and

FIGURE 4 is an exploded view of the gas flow metering valve.

Referring more particularly to the drawing, there is seen in FIGURE 1 the oxygen inhalator, that is the subject of this invention, broadly indicated by reference numeral **10**, in its operative condition connected to a tank **11** containing oxygen under 2,000 p.s.i. pressure.

The device comprises essentially 4 elements, namely, the high pressure hose **15**, the gas flow metering valve assembly **40**, the low pressure hose **34**, and the face mask **37**.

The gas flow metering valve assembly **40** comprises a cylindrical body member **18**, having a blind bore **19** of

approximately 0.339" diameter, its open end internally tapped with a ⅛" pipe thread.

The dimensions given herein are typical of an operative model intended to deliver 8 liters of oxygen in 22 seconds when fully open. The measurements are not to be considered in a limiting sense, but may be varied proportionately to deliver a greater or lesser volume of oxygen per unit time, to suit different conditions.

The end wall **20** of the body **18** is approximately 0.225" thick and has an axial gas metering orifice **21** therethrough whose diameter is 0.087".

The inner face **22** of the end wall **20** is flat, square with the metering orifice **21**, and highly polished to define a valve seat.

A circular valve head **24**, whose diameter is 0.313", is loosely fitted within the bore **19**, with its stem **25**, of 0.082" diameter, projecting through and beyond the metering orifice **21**, as seen in FIGURES 2 and 3.

The face **42** of the valve head **24** is also flat, highly polished, and square with the stem **25**.

An annular washer, or so-called O ring **23**, approximately 0.339" in diameter so that it will fit snugly in the bore **19**, is positioned on the stem **25** between the valve seat **22** and the head seat **42**. This O ring is made of a resilient, oxidation resistant material such as "neoprene" (chloroprene rubber).

Reference numeral **26** indicates a cap threadedly mounted on the body member **18** having a large opening **27** through which the end of the valve stem **25** passes, and defining a muffler cavity in which a series of brass wire screen discs **28** of approximately 150 mesh, separated by resilient O rings **29** are mounted. Each of the screens **28** and the O rings **29** has a central opening through which the stem **25** passes in a snug fit, as seen in FIGURES 2 and 3. The cap **26** is tightened against the contained series of screens and O rings to form a muffler or sound silencer for the valve assembly, as well as giving lateral snubbing support to the valve stem **25**, for a purpose to be hereinafter described.

The body member **18** is connected to the high pressure hose **15** through a threaded coupling **17** and a lock ring **16**.

Reference numeral **30** indicates a resilient rubber nipple having a central bore **32** therethrough and a sleeve portion **41** that is fitted snugly around the body member assembly, just described, in gas tight engagement. Reference numeral **33** indicates a thickened closure ring, formed integral with the sleeve, which fits snugly against the lock ring **16** of the high pressure hose coupling.

The diameter of the nipple bore **32** is at least twice that of the stem **25** so that oxygen may flow freely around the stem and through the bore. The nipple **30** has an enlarged, ball shaped portion **31** at its free end. When the nipple **30** is mounted on the body **18**, the end of the valve stem **28** is held within the bore **32** thereof, as seen in FIGURE 2.

As described hereinbefore, the valve head **24** and stem **25** are loosely mounted within the several bores **19**, **21** and **32** and through the O rings **23**, **29** and the screens **28**. Thus, the valve head **24** can be easily tilted by flexing the nipple end **31** against the contained valve stem **25**, as seen most clearly in FIGURE 3.

The described valve assembly **40** is fitted into the end **35** of the low pressure hose **34** and a face mask **37** of a shape adapted to fit over the nose and mouth of the user is slip-fitted into the upper end **36** of the hose **34**. The hose **34** is thin walled with accordion folds so that it may be easily flexed and also expand if more oxygen is being released than is being inhaled by the user.

The mask **37** has an elastic band **38** attached thereto so that the mask may be held against the face by looping the band **38** around the head in cases where the user is

not able to hold the mask to his face, or wishes to have his hands free.

Reference numeral **39** indicates a plurality of vent holes in both side faces of the mask **37** which permit atmospheric air to enter the mask and mix with the oxygen supply, thus reducing the amount of oxygen inhaled to that more normal concentration, that can be readily absorbed by the lungs.

The diameter of the ball end **31** of the nipple **30** is such that its spherical surface will just contact the inner wall of the low pressure hose **34** as is seen most clearly in FIGURE 2.

In use, the high pressure hose **15** is connected to an oxygen tank **11**, such as illustrated in FIGURE 1, by means of a standard threaded coupling **14**. It should be understood that the coupling **14** may take the form of any coupling that will engage any I.C.C. approved tank, whether U.S., Canadian or of European type, as well as medically coded tanks containing special mixtures.

In the instant case the tank **11** contains oxygen under 2,000 p.s.i. pressure. The gauge **13** is built into the tank and indicates tank pressure at all times. The valve **12** is a simple closure valve and is not a metering or pressure reducing valve.

The full tank pressure is admitted to the high pressure hose **15**, when the valve **12** is opened.

Immediately upon the build up of pressure in the hose **15**, the valve head **24** is pressed against the O ring **23** which is compressed axially and expanded radially to effect a gas tight seal between the valve seat **22** and the valve head seat **42**. Thus, the valve assembly **40** is self-sealing under pressures of 2,000 p.s.i. or more, and as long as the valve stem **25** is free of intentional tilt, as illustrated in FIGURES 1 and 2, the gas cannot pass through the metering orifice **21**.

After the inhalator **10** is thus readied for use, the mask is placed over the nose and mouth of the user and held in place either by the hand or by the elastic mask strap **38**.

To deliver oxygen to the mask at any desired volume up to 8 liters in 22 seconds, with the metering structure described, it is only necessary to apply the fingers to the low pressure hose **34** at the point where the nipple ball **31** is located and press slightly. The resultant flexion of the nipple **30** causes the end of the valve stem **25** to be tilted, as seen in FIGURE 3, wherein the nipple is shown as being flexed upward of the axis of the stem **28**.

This causes the valve head **24** to be tilted away from contact with the O ring **23** thereby permitting oxygen to escape past the valve head face **42**, through the center hole of the O ring **23** and through the metering orifice **21** and nipple bore **32**, into the low pressure hose **34** and mask **37**.

The sound of the gas rushing through the metering orifice **21** is absorbed by the muffler screens **28**, making for quieter action. The compression of the series of screens **28** also acts to stiffen or snub the movement of the stem **25** so that it is less sensitive to tilting pressures, thereby insuring that slight movements of the low pressure hose **34** will not cause unintentional opening of the valve.

The use of an O ring gasket **23** is critical to this application since the rounded surfaces of the ring offer no resistance to the flow of gas, but permit the high pressure gases to slip over the surface without ripping the gasket to pieces, as occurs with flat gaskets which present a sharp edge to the gas stream. The high polish of the valve surfaces **22** and **42** provides a true point seal between the surfaces of the O ring and also prevents mechanical abrasion or scoring of the O ring surface even after repeated openings and closings of the valve. This is especially important when operating with high pressure gases since any roughening of the soft gasket surface will lead to quick destruction thereof by the high pressure gas stream.

By varying the pressure against the ball **31**, the degree of tilt of the stem **25** can be closely controlled to provide any rate of oxygen flow desired up to the maximum of 8 liters per 22 seconds in the instant case. Removal of the tilting pressure causes the valve head **24** to immediately re-seat, cutting off the flow of oxygen.

The higher the pressure in the tank **11**, the more effective is the valve action, so that any pressure that the hose **15** can hold may be used.

Since the low pressure hose **34** and mask **37** are fitted to each other and to the gas metering valve assembly **40** through slip-fits, any accidental build up of pressure on the low pressure side will cause the parts to safely separate to relieve such pressure before it becomes excessive.

The vents **39** in the mask **37** also act as safety features to prevent suffocation if the oxygen supply is cut off without removing the mask from the face, since atmospheric air can enter through the vents as well as be expelled therethrough, when exhaling.

In the ordinary emergency use of the inhalator, continuous flow of oxygen is not necessary or desirable. By the proper flexion of the low pressure hose **34** at the nipple ball **31**, several deep inhalations of oxygen may be taken and then the flow easily cut off by relieving the flexion until the need for more oxygen is felt.

While the invention has been illustrated in connection with a simple nose and mouth mask, the collar **36** may be attached to any kind of a full face mask such as those that have filters or charcoal canisters, as well as ammonia masks, army gas masks and the like.

Another desirable feature of this oxygen inhalator is that its construction requires no close tolerances between the parts, since the only moving part, the valve head **24** and attached stem **25**, must be loosely fitted and free to tilt, for the proper operation of the device.

By varying the diameters of the metering orifice **21** and the valve stem **25**, the flow rate of the oxygen can be controlled between wide limits. The tilting pressure required to tilt the valve head **24** against high pressure can be adjusted by varying the length of the stem **25** which has a lever action.

It will now be clear that there is provided a device which accomplishes the objectives heretofore set forth.

While the invention has been disclosed in its preferred form, it is to be understood that the specific embodiment thereof as described and illustrated herein is not to be considered in a limited sense as there may be other forms or modifications of the invention which should also be construed to come within the scope of the appended claims.

I claim:

1. A high pressure gas metering and shut-off valve, comprising in combination, a body member having a high pressure gas inlet bore terminating in a flat valve seat having a high pressure gas inlet bore terminating in a flat valve seat having a gas metering orifice centered therein; a flat valve head loosely mounted in the inlet bore, including a stem extending through and beyond the metering orifice; an O ring gasket positioned in the inlet bore, between the valve seat and head, with the valve stem extending therethrough; a muffler cap mounted on the body member on the low pressure side of the gas metering orifice, having a large opening in the end wall thereof, a plurality of fine mesh screen discs, spaced apart by resilient rings, mounted in the cap cross-wise of the long axis thereof, and having holes centered therein for the passage of the valve stem therethrough; a flexible nipple mounted on the body capping the muffler cap, the nipple having a central bore therethrough aligned with the metering orifice for receiving the free end of the valve stem therein, the diameter of the nipple bore being greater than that of the valve stem; and, an outlet pipe mounted in gas-tight engagement with the nipple, the valve head being normally held, by the gas pressure in the inlet bore, in sealed engagement with the valve seat O ring gasket

to close the metering orifice against the passage of gas therethrough, the valve stem and attached head being tiltable relative to the valve seat, upon lateral pressure exerted upon the nipple, to unseal the metering orifice for the release of gas therethrough.

2. A high pressure gas metering and shut-off valve of the type defined in claim 1 and further distinguished by the flexible nipple having a rigid ball on the free end thereof, formed integral therewith, whose diameter is substantially the same as the inside diameter of the outlet pipe.

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