United States Patent

[11] **3,580,250**

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[73] Assignee **U.S. Divers**

[54] **OXYGEN GENERATORS**
14 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **128/203,** 23/281
[51] **Int. Cl.** **A62b 7/08**
[50] **Field of Search** 128/203; 23/281; 244/118

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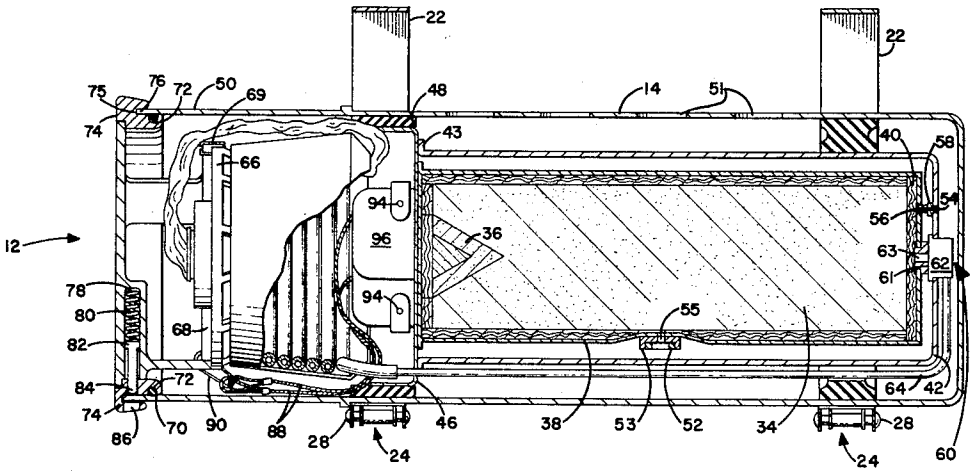
ABSTRACT: An Oxygen Generator which may be used for emergency purposes generally comprising an elongated housing for the receipt of a material which when burned produces a gas having a substantial amount of oxygen, said housing having a check valve permitting the release of the gas therefrom into a conduit connected to flexible tubing; said flexible tubing being connected to a plenum bag which feeds a face mask attached to a removable cover of the housing; said cover having a lanyard which releases hammers to fire percussion caps adjacent the oxygen-producing material of the container upon removal of said cover.



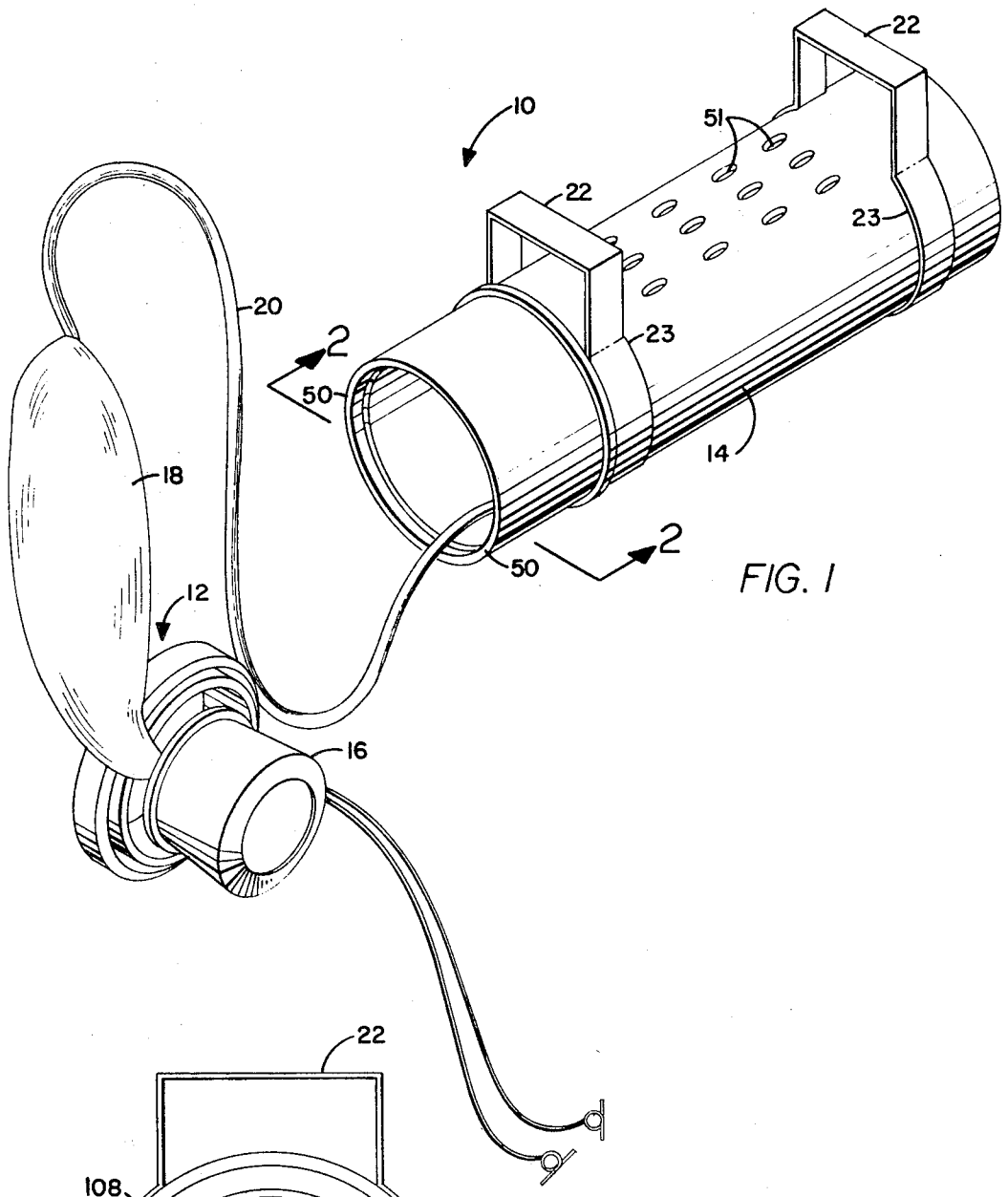


FIG. 1

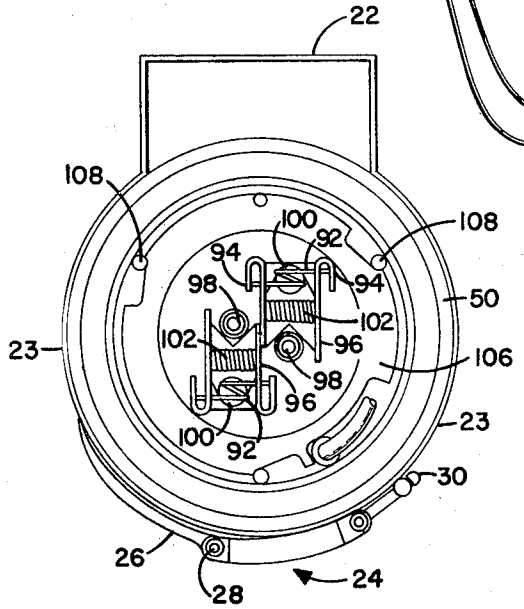


FIG. 2

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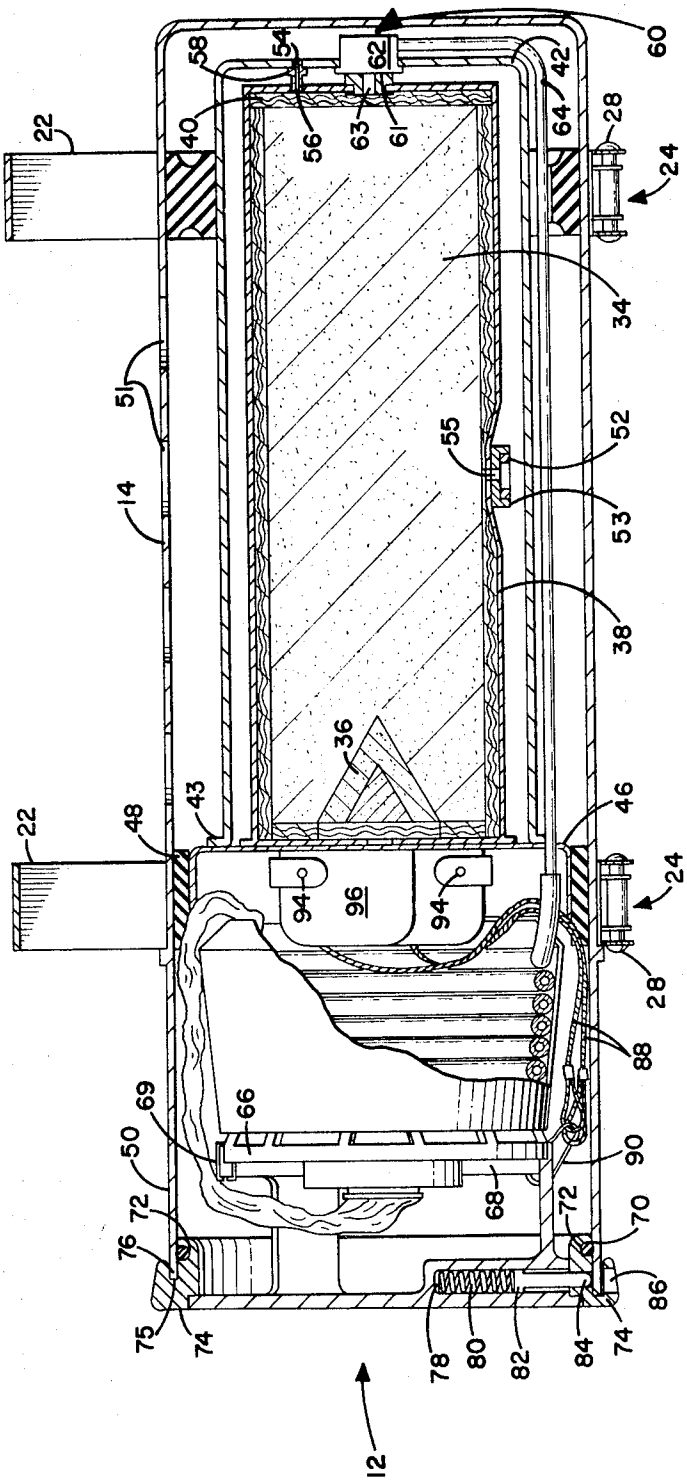

FIG. 3

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OXYGEN GENERATORS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of this invention lies within the art of generating oxygen for breathing purposes, especially during emergency conditions when the oxygen has been depleted from a users environment.

2. Description of the Prior Art

It is well known that when there is not a sufficient source of environmental oxygen available, that human existence must rely upon oxygen from sources other than the surrounding environment. To supply such oxygen various forms of apparatus have been utilized. Some forms of apparatus have relied upon air or oxygen store under pressure and distributed through a series of conduits. Later advances in the art have employed chemical generation of oxygen by means of burning such compounds as sodium chlorate. The sodium chlorate has generally been placed in the form of a hardened mass which in the parlance of the art is referred to as a candle. When the candle is ignited, it burns gradually, liberating oxygen for breathing purposes.

Prior art chemical oxygen generators have generally been large and cumbersome in their design and size. They have not provided a rapid and ready supply of oxygen on short notice which may be utilized by an untrained person. In essence such chemical oxygen generators of the prior art have generally been large canisters, and other apparatus such as retorts which do not provide a ready source of oxygen on short notice.

Another deficiency of the prior art is that such generators have not been easily used in close proximity to their user. This stems from the fact that such generators impart a substantial amount of thermal energy to their surroundings. Unless the user is removed from close proximity to the generator, the prior art generators are a source of danger.

Prior art generators have relied upon starting techniques, and apparatus which are not readily usable by untrained persons. Thus, if an untrained user of prior art chemical oxygen generators were to rely upon the oxygen supplied therefrom the user might not be able to obtain sufficient oxygen in time to sustain his life.

The invention described herein is a substantial step forward in the state of the art of chemical oxygen generation for emergency purposes. The invention enables an untrained user to effectively sustain himself by means of a simple manipulation, which actuates a reliable source of oxygen as well as providing the user with a well-positioned mask. The apparatus is highly reliable, and does not require service or attention during extended periods of time.

The invention has specifically overcome the requirement of a pressurized emergency oxygen system for airplane cabins. The prior art has generally relied upon sources of oxygen kept under pressure, with an elaborate system of pipes and conduits to supply oxygen to each respective passenger. This has involved a substantial increase to the plane's overall gross weight. More importantly, such an oxygen system has to be constantly maintained and checked to assure that the oxygen is of a sufficient pressure, and that the supply lines are operable. The mask in such prior art systems must be actuated by mechanical or electrical means which let the mask drop down to the proximity of the user. If any of the apparatus of the prior art systems is not maintained in proper working condition, all the passengers are placed in jeopardy, should their cabin become depressurized. The instant invention overcomes the foregoing disadvantages by providing a reliable individually controlled source of oxygen for each passenger.

SUMMARY OF THE INVENTION

In summation, the instant invention provides a self-contained easily operated solid state chemical oxygen generator which utilizes the burning of an oxygen-producing substance. The oxygen generator utilizes an elongated tubular container which acts as a reaction vessel to contain the burning of the oxygen-producing substance therein. A second container and housing surround the reaction vessel to provide an appropriate structure and insulate the user from the heat of reaction. The housing and combination of the containers provide a small compact accessible unit.

The invention provides a reliable solid state source of oxygen which may be actuated at the users discretion on short notice. The generator remains on a stand by basis for an extended period of time and is actuated by merely uncapping the cover thereof and placing the mask provided over the users mouth.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective view of the generator in its operative position with the cap removed;

FIG. 2 is a view along line 2–2 of FIG. 1 and shows an end view of the oxygen generator with its cover removed revealing the hammers and percussion caps which serve to ignite the oxygen-producing substance;

FIG. 3 shows a partially fragmented, longitudinal cross section view of the oxygen generator.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more specifically to FIG. 1, an Oxygen Generator **10** embodying this invention is shown as it would be used. A cover **12** is shown removed from the generator housing **14**. The cover **12** has a mask **16** which is affixed to the interiorally facing portion of the cover **12**.

A plenum bag **18**, which helps to supply a constant source of oxygen during use, is shown in a partially expanded condition. The plenum bag **18** is operably connected at one end to the base of the mask **16** and at the other end to a length of flexible tubing **20**. The flexible tubing **20** is in turn connected to the source of oxygen supplied by the oxygen generator. A sufficient length of flexible tubing **20** is supplied so that the user may remove the cover **12** from the housing **14** and have enough tubing **20** to place the mask **16** over his mouth.

In order to secure the oxygen generator **10** in a position which is easily accessible to a potential user, a pair of brackets **22** are provided which may be secured to the underside of an airplane seat. However, any suitable attachment means may be employed for attaching the housing **14** to a structural member.

With more specific reference to FIGS. **2** and **3**, it is seen that the tubular housing **14** of the oxygen generator **10** is removably mounted in the brackets **22**. The brackets **22** comprise flexible metal bands **23** which wrap around the housing **14**. The flexible metal bands **23** are secured in tight-fitting contact around the housing by means of snap-buckles **24**. The snap-buckles **24** may be formed as a continuation of the bands **23** and brackets **22**. The snap-buckles **24** are of a well-known type in the fastening art which generally have a handle **26** pivotally mounted by means of a pin **28**. The tightness of the buckles and in turn the flexible bands is controlled by means of a tightening screw **30**.

The specific showing of the oxygen generator **10** in FIG. **3** shows the interior of the oxygen generator through the core. The core comprises a cylindrical mass **34** which is formed from an oxygen-producing material, such as sodium chlorate. The sodium chlorate is usually formed with a ferrous material to enhance its burning qualities. The cylindrical mass **34** has an enriched portion shown generally by a conical portion **36**. The enriched section **36** permits rapid ignition after which the material burns in an even manner toward its base.

The oxygen-producing material is surrounded by a canister **38**. In order to insulate the canister **38** from the heat of reaction, a surrounding layer of fibrous glass **40** or other high temperature-insulating material is provided. The fibrous glass **40** not only serves as an insulating medium, but helps to filter the gaseous products which have been generated.

A second container **42** is provided, which surrounds the tin canister **38**. The second container **42** serves as a protective

thermal cover as well as a structural receptacle for said canister **38**. The second container **42** is provided at one end with a flange **43** and can be connected by any suitable means such as a weld, rivet or screw connection to a bracing member **46**. The bracing member **46** is connected to a spacer, or ring **48** which is in turn either affixed to or a portion of an outer housing **50**, or shell.

The outer housing **50** is generally made of a lightweight material such as plastic. The housing **50** can be partially opened by slots **51** or other openings provided in its surface, so that air may circulate between the outer housing **50** and the second container **42**. In this manner a flow of air is provided for cooling the reaction vessel. Thus, the coolness of the outside surface of housing **50** is maintained so that the generator may be placed in close proximity to a user, such as under an airplane passenger's seat.

In order to effectuate safe operation of the oxygen generator **10**, and excess pressure release means is provided in the form of a blowout disc **52**. The blowout disc is shown seated in an annulus **53** with an opening **55** leading into the canister **38**. The blowout disc **52** may be in any suitable form as long as it will burst out of position and release the internal pressure within the canister **38** when the pressure therein approaches the bursting strength of the canister.

As can be understood, when the exterior of the oxygen generator is exposed to reduced pressure, a means for release of the excess pressure inside the second container **42** should be provided for. In order to provide for such a release, a valve **54** is placed within the second container **42** which provides for the relief of any pressure differential built up therein. The valve **54** can comprise a rubber flapper valve with an opening **56** therein and is seated by means of an annular portion **58**. Any pressure release means is sufficient as long as the pressure differential is relieved. For instance, a simple rubber flap can be utilized which will move under positive pressure.

At the end of the canister **38** a check valve **60** is seated in the wall of the canister **38**. The check valve **60** can be of any suitable type having a spring biased valve surface which will permit the escapement of the generated oxygen. An inner portion **61** of the valve **60** is seated in the canister **38**, and is provided with an opening **63** through which the oxygen may pass. The valve **60** has an outer portion **62** which passes through the intermediate container **42**. The outer portion **62** has a suitable spring-loaded valve surface which may be of any suitable type such as a mushroom valve. The outer portion **62** has a tube **64** seated therein in tight-fitting engagement so that the oxygen expanding into the outer portion of the check valve **62** will pass into the tube **64**.

The tube **64** extends along the base of the longitudinal portion of the oxygen generator **10** between the outer housing and the second container **42**. In this area, the air is free to circulate over the tube **64** so that a cooling of the gasses is effectuated. In this manner the tube **64** acts as a heat exchanger for cooling the oxygen to the temperature at which it can be breathed. The tube **64** extends through the support member **46** and is connected to the flexible tubing **20**.

When the oxygen generator is not in use the flexible tubing **20** is coiled in the interior portion of the mask **16**. The mask **16** has an annular base portion **66** which is secured to a structural portion **68** of the cover **12**. The securing element can be in the form of a metal clip **69** which clasps the annular base **66** of the mask.

The cover **12** which is affixed to the annular base portion **66** of the mask **12** is inserted into the interior of the housing **50** prior to use. The cover is held in place by a garter spring **70** which surrounds an annular depression **72** in the outer periphery **74** of the cover **12**. The garter spring maintains a lip **71** of the cover **12** in overlying relationship with the edge of the housing **50** to maintain the internal portion free from dust and dirt.

The cover **12** is provided with a tamper indicator. The tamper indicator comprises a detent **76** in the outer portion **74** forming an annulus of the cover **12**. The detent is effectively secured in a slot or depression **75** within the exterior surface of the housing **50** so that the cover **12** cannot be axially rotated with respect to its longitudinal axis. Thus, the cover **12** must be pulled from the housing **50** along a longitudinal axis if it is to be removed, which provides actuation of the tamper indicator.

The tamper indicator is partially encased in an opening **78** which is formed from the interior of the cover **12**. The opening **78** provides a cylindrical channel in which a spring **80** is held under compression. The spring **80** is biased against a plunger **82** which has a rounded end surface **84**. In the outer portion of the lip of the cover **12** an opening **86** is provided. The opening **86** permits the plunger **82** to pass therethrough by the pressure of the spring **80** forcing it into the opening **86** when the cover is longitudinally moved with respect to the axis of the generator **10**. Thus, when so moved, the plunger **82** will be forced into the opening **86** indicating that the cover **12** has been tampered with. The replacement of the cover cannot then be effectuated until the plunger **82** has been pushed internally of the inner circumference of the housing **50**.

In order to operate the oxygen generator, the cover **12** is removed. Upon removal of the cover, a pair of lanyards **88** are put in tension by virtue of the fact that they are attached to the cover by means of a loop **90**. As the lanyards are put in tension they pull a pair of trip release "Q" springs **92** which have their ends secured in holes **94** formed in the surrounding structure **96**. The structure **96** surrounds a pair of percussion caps **98** which are exposed on the interior of the canister **38** to the enriched portion **36** of the oxygen generating material **34**. A pair of hammers **100** are provided which flip over and fire the percussion caps **98** under pressure provided by coiled springs **102**.

The structure **96** can be secured by an annular base **106**. The annular base **106** is attached by twisting it in a counterclockwise direction and then turning down three screws **108**.

In lieu of using the percussion caps for igniting the oxygen generating material **34** other means may be utilized. One means employs an electrical heating element which may be inserted partially into the enriched portion **36** of the material **34**, or in close proximity thereto.

The electrical heating element can then be connected to a source of electrical energy which will heat the element sufficiently to ignite the oxygen-producing material **34**.

The heating element may be connected in series to other heating elements in other generators, so that they may all be supplied a source of electrical energy at the same time from a general source. A further embodiment incorporates a source of electrical energy supplied to the heating element through a line which is energized by a switch activated when the cover **12** is removed.

It can be seen from the foregoing description of the preferred embodiments that the oxygen generator **10** provides accessible and readily used equipment in the eventuality an emergency arises. It should be understood that other alternative embodiments and equivalents may be substituted for the various portions of the oxygen generator **10**. Therefore, the invention is to be read only in light of the following claims which substantially define the scope and spirit of the invention over the prior art.

I claim:

1. An oxygen generator comprising:

a housing;

oxygen-generating material contained within said housing;

means for starting the generation of oxygen by said oxygen-generating material;

a conduit connected to said container for the conduction of the generated oxygen away from said housing;

a breathing mask attached to said conduit for supplying the generated oxygen to a user for breathing purposes; and

means attached to said breathing mask linking said mask with said starting means so that when said mask is substantially removed, said starting means will initiate the generation of oxygen by causing the oxygen-generating material to start burning.

2. An oxygen generator as claimed in claim 1 wherein said starting means comprise:

at least one releasable spring-biased striking member linked to said mask;

at least one percussion actuated charge in sufficient proximity to said oxygen-generating material for the ignition thereof when said striking member strikes said charge;

means for retaining said striking member from spring-biased movement.

3. An oxygen generator as claimed in claim 1 wherein said conduit is of sufficient length and thickness to provide an exchange of heat between the generated oxygen and the surrounding environment to cool the oxygen which has been generated to a temperature at which it may be breathed.

4. An oxygen generator as claimed in claim 1 wherein said housing comprises:

a reaction vessel containing said oxygen-generating material;

a container surrounding said reaction vessel; and

an outer shell surrounding at least a portion of said container.

5. An oxygen generator comprising:

an outer housing;

an interior reaction vessel within said outer housing;

oxygen-generating material contained within said interior reaction vessel;

a mask removably mounted on said housing;

a firing means within said housing and in sufficient proximity to said oxygen-generating material to cause ignition thereof upon firing;

means for mechanically linking said mask and said firing means for operably actuating said firing means so that when said mask is removed from its mounting, said firing means will be actuated; and

a gas conduit connected to said reaction vessel at one end, and at the other end to said mask by a suitable connection means, so that when said oxygen-generating material generates oxygen it will be transferred from said conduit to said mask.

6. An oxygen generator as claimed in claim 5 wherein said starting means comprises:

at least one percussion fired ignition charge within sufficient proximity to said oxygen-producing material for ignition thereof upon firing;

at least one spring-biased releasable hammer in sufficient proximity to said ignition charge to permit impingement against said charge at the terminal end of its path; and

wherein said mechanical linking means between said mask and said firing means comprises a flexible connector.

7. An oxygen generator as claimed in claim 5 further comprising:

a cover forming a portion of said housing; and

means for securing said mask to said cover, so that when said cover is removed from said housing said mask is dismounted.

8. An oxygen generator as claimed in claim 5 further comprising:

a spring-biased plunger cooperatively linked to said mask, and in proximity to an edge portion of the housing of said generator so that when said mask is removed from said housing the bias of the spring will project said plunger beyond said edge region, thereby indicating the removal of said mask and preventing the replacement thereof without the application of pressure against the spring bias.

9. An oxygen generator as claimed in claim 7 further comprising:

a plunger seated within the structure of said cover which is maintained internally of said housing when said cover is in place so that when said cover is moved with respect to said housing, said plunger will project from said cover externally of said housing.

10. An oxygen generator as claimed in claim 9 wherein:

said plunger is spring biased so that when said cover is removed from said housing said spring-biased plunger will project from said cover externally of said housing.

11. An oxygen generator as claimed in claim 5 wherein said firing means comprise:

an electrical heating element.

12. An oxygen generator as claimed in claim 11 further comprising:

electrical switching means for activating a flow of electrical current through said heating element; and

wherein said mechanical linking means link said mask and said electrical-switching means for activation thereof upon removal of said mask.

13. An oxygen generator as claimed in claim 1 wherein said means for starting the generation of oxygen by said oxygen-generated material comprises:

an electrical heating element for igniting said oxygen-generating material.

14. An oxygen generator as claimed in claim 12 further comprising:

electrical-switching means for activating a flow of current through said heating element.