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OXYGEN GENERATING CANISTER

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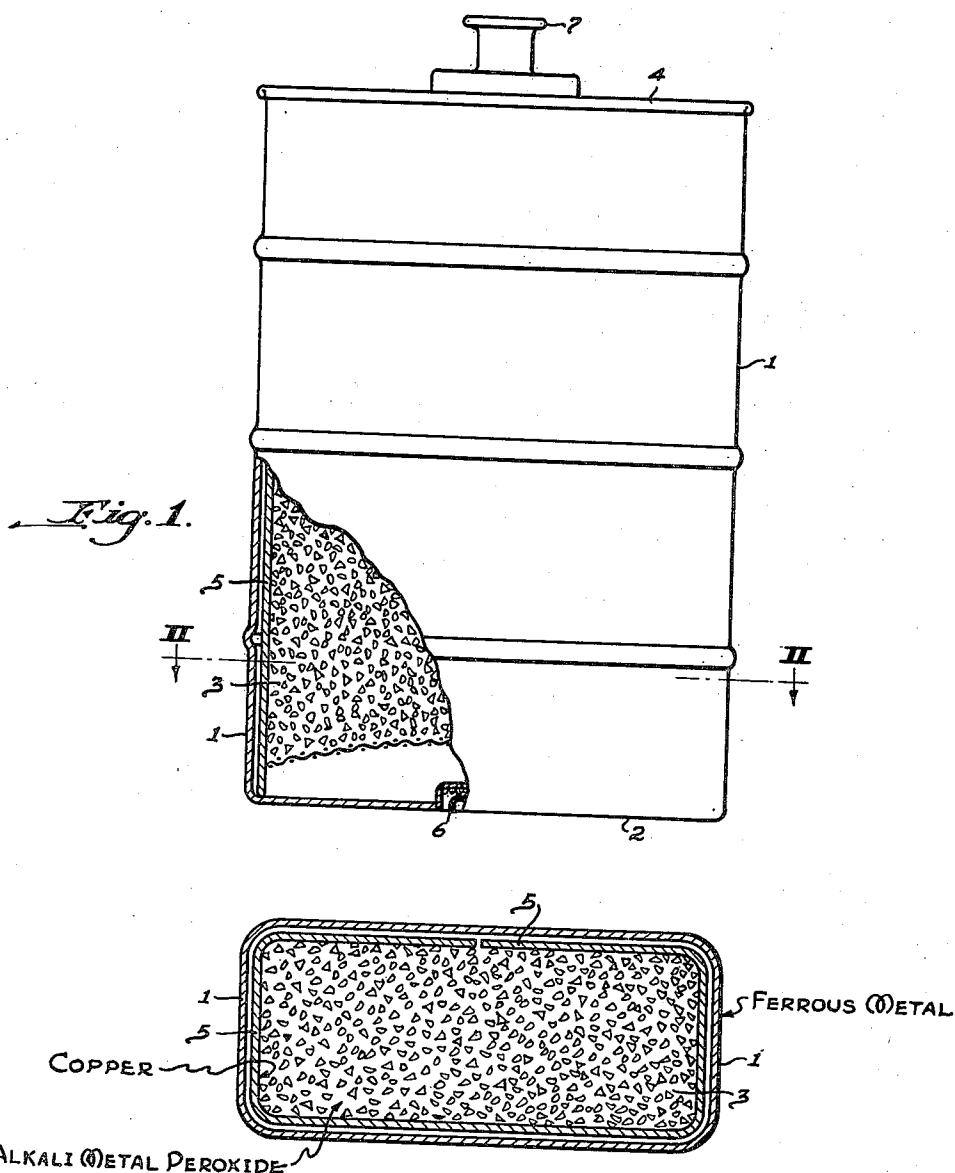


Fig. 2.

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OXYGEN GENERATING CANISTER

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4 Claims. (Cl. 23-281)

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This invention relates to oxygen-generating apparatus and to containers for oxygen-liberating compositions.

It has been proposed for many years to use the alkali metal peroxides as materials for producing substantially pure free oxygen. One reason is that oxygen can be generated rapidly and in large volume by the controlled addition of suitable reagents to those peroxides, for instance in an apparatus on the principle of the Kipp generator. More particularly, however, these peroxides react promptly and quantitatively with carbon dioxide and moisture contained in exhaled air to liberate oxygen and fix the carbon dioxide, wherefore they are particularly applicable to self-contained breathing apparatus, such, for example, as is used in non-respirable atmospheres and for high altitude flying.

For such purposes the alkali metal peroxide, whether pure sodium peroxide (Na_2O_2), pure potassium tetroxide (K_2O_4), or mixtures of them, is packed in canisters made from sheet iron, or black plate, and generally similar in shape to those that have been used with gas masks for many years. They have proved to be satisfactorily efficient in performing their intended function, the oxygen reacting promptly with respired air to maintain the proper oxygen balance, even at low temperatures.

Extended experience with such canisters has shown, however, that the great reactivity of these peroxides makes possible the occurrence of serious and dangerous accidents. Thus, these peroxides react with explosive violence with such oxidizable materials as lubricating oil and gasoline. It is easy enough to avoid the entry of such materials into the canister, but the reactivity of the peroxides is such as equally to cause spontaneous combustion of other combustible organic materials such as paper, wood and rubber, with the rapid liberation of large amounts of heat. In the production of such canisters on a large scale it is virtually impossible to prevent a small piece of rubber, paper, wood or similar organic solid from finding its way into an occasional canister. This is unimportant as long as the canister remains sealed, but when it is placed in use the locally high concentration of oxygen causes the foreign matter to begin to be oxidized rapidly with development of a local hot spot. In fact, so much heat may be liberated as actually to burn a hole through the canister wall. Apart from rendering the canister useless, that is not serious. However, once the iron has reached a temperature such that a hole is formed conditions are such that oxidation of the metal may proceed more and more rapidly and extensively with destruction of the canister and with the development of so much heat as actually to melt both the peroxide and the

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canister metal. This has happened in actual use of these canisters, and it is gravely serious, not only because the user wears the canister so that his body is exposed to the molten matter which pours forth when penetration takes place, in contact with his chest, but also because the falling of molten iron and peroxide are potentially dangerous where combustible or explosive matter is in the immediate vicinity. Extensive destruction of the canister is particularly likely if the hot spot develops in contact with or close to one of the iron wire screens that has been used in these canisters to prevent channeling of the circulating gases.

It is among the objects of this invention to provide alkali metal peroxide oxygen-liberating apparatus, such as breathing apparatus canisters, or oxygen generators, which is simple, efficiently eliminates the danger created by the presence of small pieces of wood and other combustible organic solids that may be present in the peroxide, and whose construction neither complicates nor interferes with the production of the containers or their assembly with the peroxide.

Another object is to provide a container for alkali metal peroxides which renders harmless the presence of a small amount of wood or other combustible organic matter.

The invention will be described with reference to the accompanying drawings in which Fig. 1 is a vertical elevation of a conventional type of breathing apparatus canister, parts being broken away for purposes of illustration; and Fig. 2 a cross section taken on line II-II, Fig. 1.

The invention is predicated upon our discovery that the danger attendant upon the presence of a small piece of wood, rubber, paper, or other combustible organic solid when present in contact with alkali metal peroxide in a breathing apparatus canister or oxygen generator can be avoided by so constructing the canister or other container that at least the inner surface which is in contact with the peroxide is much more highly conductive of heat than iron or steel. In this way when combustion of such foreign matter occurs the heat is rapidly absorbed by that surface and rapidly carried away from the zone of reaction so that the temperature in the vicinity of the organic matter does not become high enough to initiate melting or burning of the canister.

The metals which are suitable for the purposes of the invention are those which are highly heat conductive and which do not combine directly with or do not burn readily in pure oxygen. Gold and silver might be used for this purpose, and the thermal conductivity of such metals as molybdenum and tungsten is sufficiently high for the purpose of the invention if the mass

present is such as to take up the amount of heat that must be dissipated to prevent the formation of local hot spots in accordance with the invention. Those metals, are, however, expensive, and some of them constitute critical materials at the present time. For most, if not all, purposes we have found that copper is perfectly satisfactory from all standpoints, and is the metal best suited for the purposes of the invention. Its heat conductivity is high, sheet copper is readily formable, and we have found that it acts satisfactorily to completely avoid the danger noted above.

Although aluminum and magnesium are satisfactorily heat conductive, they are unsuited for this purpose because they oxidize so readily. In fact, magnesium can burn in ordinary air. The use of such metals would therefore add to the danger described.

The entire canister or other container might be constructed from copper or equivalent metal of high heat conductivity. That is unnecessary, however, and from some standpoints might be undesirable. Thus, canisters made from sheet copper are not so strong mechanically as those made from ordinary black plate or other ferrous sheet, and to make them heavy enough to resist damage would make them unduly unexpensive. We have found, on the other hand, that entirely satisfactory results are to be had merely by inserting within the canisters as now made and used a liner of sheet copper which is of the same size as and extends completely around the wall of the container body.

This preferred embodiment of the invention is shown somewhat schematically in the drawings, which show a breathing apparatus canister of a form commonly used and made by the drawing of sheet iron to provide a body portion 1 which is integral with a base 2. After the canister has been filled with the peroxide material 3 a cap or closure member 4 is fastened in any suitable way to seal the canister, as by crimping the edges followed by soldering. In accordance with the invention there is disposed within the body of the canister prior to filling it a sheet 5 of pure copper which, as appears particularly from Fig. 2, extends entirely around the inside of the body 1 and with which the peroxide charge 3 is in contact.

The canisters and other types of containers may, of course, be formed in various other ways and take various other shapes or forms. Likewise, they may be provided with suitable inlet and outlet means, as for introducing a reagent or exhaled air and for withdrawing oxygen. Thus, the breathing apparatus canister shown in Fig. 1 is provided, as is customary in the canister art, with an inlet 6 for air that is to be treated, and with a member 7 for coupling the canister to a breathing facepiece and through which air is withdrawn after being regenerated by passing through the peroxide charge 3. Both the inlet 6 and the coupling outlet 7 are, as is customary, closed by suitable seals that are broken when the canister is to be put in use. Such details are well known or are mere design features, and they form no part of the present invention; therefore they do not require detailed illustration or further description.

We have found through numerous carefully conducted tests that canisters of the type shown in the drawings and described above act with complete efficiency to negative the danger poten-

tially presented by the presence of a small amount of solid combustible organic matter that may find its way into the peroxide filling, and included in our investigation were tests that were much more severe than any condition that is likely to obtain except under the most unusual conditions. Many tests have demonstrated that the hot spot which has characteristically occurred in the use of canisters as made heretofore when such organic matter gets into the peroxide, and which causes destruction of the canister, is absent when such organic matter is present in canisters provided by this invention. The organic matter is oxidized as before, and at the same rate, but the heat of reaction is rapidly absorbed by and distributed uniformly throughout the heat conductive surface. When such combustion occurs the canister becomes uniformly warm to the touch throughout its body. Thus, to repeat, the heat is carried away from the zone of reaction at a rate such as to keep the temperature low enough to avoid undesired consequences.

Various modifications may, of course, be made. Thus, the heat conducting surface of this invention may be provided in other ways than by liners, as by plating or spraying copper or the like on the inner surface of the container, or by the use of copper clad metal. Similarly, added protection may be had by using screens of copper wire instead of iron wire screens.

According to the provisions of the patent statutes, we have explained the principle and mode of practicing our invention, and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. An oxygen-liberating canister comprising a metallic shell having an inner lining of sheet metal of high heat conductivity not combustible readily in pure oxygen, an alkali metal peroxide disposed therein, an inlet conduit positioned in one end of the shell, and an exhaust conduit positioned in the other end of said shell.

2. A canister according to claim 1, said shell being formed from ferrous metal.

3. A canister according to claim 1, said liner being formed from copper.

4. A canister according to claim 1, said shell being formed from ferrous metal, and said liner being formed from copper.

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