

UNITED STATES PATENT OFFICE

GEORGE ST. JOHN PERROTT, OF PITTSBURGH, PENNSYLVANIA, AND GEORGE BURKLE
HOLDER, OF SCARSDALE, NEW YORK, ASSIGNORS, BY MESNE ASSIGNMENTS, TO
THE PEOPLE OF THE UNITED STATES OF AMERICA

EXPLOSIVE

No Drawing.

Application filed March 23, 1931. Serial No. 524,756.

This invention relates to explosives and more particularly, to the type of explosives in which a highly volatile oxidizing agent, such as liquid air or liquid oxygen, is employed.

comparatively safe to handle, nevertheless retains its effectiveness in that its shattering or disruptive properties and propulsive strength are not materially impaired.

In general, the objects of the present invention are carried out by intimately mixing a finely divided inert material in proper proportions with the carbon employed in forming the explosive mixture prior to the saturation of the carbon with the volatile oxidizing agent.

Various inert materials may be employed as the desensitizing agent, and in general, it is preferred to use a substance which does not combine with oxygen and which is available in a highly divided or pulverized state. Substances such as diatomaceous earth, talc, magnesium carbonate and calcium carbonate have been found to act as satisfactory desensitizing agents. In general, magnesium carbonate and calcium carbonate are somewhat more satisfactory than diatomaceous earth or talc.

In preparing our improved explosive, the finely divided carbon is thoroughly and intimately mixed with the desensitizing agent and is then packed in a suitable pervious bag or other container to form a cartridge. The prepared cartridge is immersed in liquid oxygen or any other suitable volatile oxidizing agent until a sufficient quantity thereof has been absorbed by the carbon, and the saturated cartridge is subsequently fired by any known means, such as a fuse, an electric spark or any desired detonator or primer.

When diatomaceous earth or talc is used as the desensitizing agent, at least 20% of one of these materials is preferably employed. Smaller percentages of calcium or magnesium carbonate have been found more satisfactory as desensitizing agents than either diatomaceous earth or talc. Thus, approximately 10% of magnesium carbonate gives a satisfactory desensitizing effect, and in general, the percentage of this desensitizing agent may vary from about 5% to 20% or more with good results. Calcium carbonate is slightly more effective as a desensitizer than is magnesium carbonate and it has been found that with certain carbons, about 10% of calcium car-

It has heretofore been proposed to use as an explosive a mixture of a combustible compound or substance, such as finely divided carbon, and a highly volatile oxidizing agent, such as liquid oxygen, liquid air or liquid ozone. This explosive is customarily utilized by forming cartridges of the finely divided carbon, soaking these cartridges in liquid oxygen or an equivalent volatile oxidizing agent and immediately employing the saturated cartridge in blasting operations. This type of explosive is powerful and has certain advantages over explosives previously employed. Thus, since the ingredients of the explosive are mixed at the place where they are to be employed and since these ingredients are not of themselves likely to explode, all dangers resulting from the conveyance of an explosive mixture are avoided. Further, if the prepared charge fails for any reason to detonate, the evaporation of the volatile oxidizing agent subsequently renders the charge harmless. On the other hand, the use of explosives of this type has in the past been hazardous due to the fact that the carbon cartridges, after being saturated with liquid oxygen, are in most instances highly sensitive to detonation by impact and friction. Thus, there is considerable danger of premature explosions caused by stones or other objects falling on the saturated cartridges as they are being lowered into drill holes or by shocks accidentally transmitted to the saturated cartridges or in any other manner.

With the above and other considerations in mind, it is proposed in accordance with the present invention to provide an improved explosive of the liquid oxygen type which is less sensitive to detonation by impact or friction than are known explosives of this nature. It is a further object of the invention to provide an explosive of the type described which, although desensitized to detonation by impact or friction to such an extent that it is

bonate gives approximately the same desensitizing action as that obtained by the use of about 15% of magnesium carbonate. In general, the proportion of calcium carbonate used may be varied from about 5% to 20% or more.

In the explosive mixtures described above, it is preferred that a certain amount of moisture be present in the carbon. The amount of moisture present may vary between wide limits, but in general, a moisture content in the neighborhood of 10% is satisfactory. It is believed that the presence of moisture in the mixture causes improved adhesion between the carbon particles and the particles of inert desensitizing material, and in this manner, decreases the sensitivity of the explosive to detonation by impact.

The most plausible theory which we are able to advance in explanation of the desensitizing action obtained in our improved explosive is based on a well known phenomenon of colloidal chemistry, that is, the adsorption of a solid by a solid. It is known that when a relatively fine powder is thoroughly intermixed with a relatively coarse powder, the fine powder tends to be adsorbed or coated on the surfaces of the individual particles of the coarse powder. Thus, in our explosive, it is believed that the fine particles of the inert desensitizing material coat the larger particles of carbon and to a degree prevent the propagation of combustion from particle to particle of the carbon by forming a uniform non-combustible layer or coating around each carbon particle. The presence of a small percentage of moisture in the carbon is believed to increase the tenacity with which the particles of inert material adhere to the carbon particles, and thereby to improve the desensitizing effect. In accordance with the theory here advanced, it is believed that the inert material should be in a finer state of division than the carbon particles employed. It is further possible that when magnesium carbonate or calcium carbonate is used as the desensitizing agent, the absorption of heat accompanying the liberation of carbon dioxide is in part responsible for the decrease in sensitiveness to detonation by impact obtained. While the above theories represent our present understanding of the desensitizing action obtained, it should be understood that the invention is in no way limited to or dependent upon the soundness of these theories.

Our improved explosive presents numerous advantageous features. Thus, although the sensitivity to detonation by impact or friction of our explosive is approximately the same as or less than that of 40% dynamite, the effectiveness of our explosive is substantially unimpaired by the desensitizing agents employed. Thus, the rate of detonation of our improved explosive is identical with that

of a similar liquid oxygen explosive in which no desensitizing agent is used, and consequently, the shattering or disruptive properties of our explosive are the same as that of previously known liquid oxygen explosives. The use of our desensitizing agents has no effect on the detonation of the explosive by influence, and accordingly, the transmission of detonation from one cartridge to another in a drill hole is not adversely affected. We have also found that the use of our desensitizing agents has no material effect on the propulsive strength of the explosive.

Although only a limited number of suitable desensitizing agents have been described herein, it should be understood that the invention, in its broader aspects, includes other inert desensitizing agents which are available in finely divided form. Further, the proportions of the desensitizing agents used, as well as an amount of moisture present, may be varied between wide limits without departing from the scope of the invention.

We claim:

1. In an explosive adapted for explosion with the aid of a liquefied gas, the combination of finely divided carbon and an incombustible material in a finer state of division than said carbon.
2. In an explosive adapted for explosion with the aid of liquid oxygen, the combination of finely divided carbon containing moisture and an incombustible desensitizing material in a finer state of division than said carbon.
3. An explosive comprising a mixture of finely divided carbon and magnesium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said mixture.
4. An explosive comprising an intimate mixture of finely divided carbon containing about 10% moisture and magnesium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said mixture.
5. An explosive comprising an intimate mixture of about 70 to about 85% of finely divided carbon and at least 5% of magnesium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said mixture.
6. An explosive comprising a mixture of about 70 to about 85% of finely divided carbon, about 8 to about 11% moisture and about 5% to about 20% magnesium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said mixture.
7. An explosive comprising a mixture of finely divided carbon and calcium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said mixture.
8. An explosive comprising a mixture of finely divided carbon containing about 10% moisture and calcium carbonate in a finer

state of division than said carbon, and liquid oxygen permeating said mixture.

5 9. An explosive comprising an intimate mixture of about 70 to about 85% of finely divided carbon and at least 5% of calcium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said mixture.

10 10. An explosive comprising an intimate mixture of about 70 to about 85% of finely divided carbon, about 8 to about 11% moisture and about 5 to about 20% calcium carbonate in a finer state of division than said carbon, and liquid oxygen permeating said
15 mixture.

In testimony whereof we affix our signatures.

GEORGE ST. JOHN PERROTT.
GEORGE BURKLE HOLDERER.

20

25

30

35

40

45

50

55

60

65