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EXPLOSIVE MATERIAL

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This invention relates generally to a composition of matter primarily designed and intended as an explosive.

More particularly, it relates to an explosive material which has extremely high explosive force and which at the same time is extremely stable, easy to handle and to manufacture.

Still further, the present invention has for an object the provision of an explosive material which inherently has an extremely high specific gravity thus making it peculiarly adaptable for use in small calibre ammunition whereby to provide small calibre explosive projectiles which have an over-all weight and specific gravity sufficiently high to give them a stable trajectory in flight.

Still further, the present invention contemplates the provision of an explosive material which is easily, simply, and cheaply manufactured out of ingredients which in and of themselves are not difficult to obtain or to prepare.

Yet another object of the invention consists in the provision of an explosive formed of powdered materials which are sufficiently stable so that the same, when mixed, may be compressed to less than one-third their normal volume when uncompressed.

Many other and further objects, advantages and features of the invention herein disclosed will become clearly apparent from the following specification.

The principal constituent of the explosive material to which the present invention relates is a basic perchlorate of a material toward one extreme of the electromotive series and this material is combined with a material selected from those toward the opposite end of the electromotive series.

By way of specific illustration, in one specific embodiment, my explosive material may include about 84% by weight of basic perchlorate of lead [$Pb_3(OH)_4(ClO_4)_2$]. This material is in powdered form and of a fineness sufficient to permit its passage through a 200 to 400 mesh sieve. This material is mechanically mixed with aluminum powder of a similar fineness and when the two have been thoroughly mixed, the resultant mixture is compressed at a ratio of 2½:1, that is, two and one-half volumes of the mixed powder are compressed to produce a briquette of about one volume, in other words reducing the powders to a volume of less than one-third that which they occupied in their uncompressed state.

The operation of compressing these powders may require a pressure of upwards of 4,000 pounds per square inch depending, of course, on the fineness of the powders, their moisture content and the other contributing factors. The compression of these powders may be carried out in a conventional hydraulic press or similar apparatus and it is significant to note that the material has sufficient stability so that these powders may be compressed to a rigidly coherent mass without risk of detonating the explosive.

While the above specific embodiment of the invention refers to a composition comprising 84% by weight of basic lead perchlorate and 16% aluminum, the invention herein described and claimed is by no means limited to these specific proportions or even to these materials.

For example, the proportion of powdered basic perchlorate of lead in the above described composition may be increased to 89% or may be reduced to 78%, thereby varying the proportion of aluminum powder from 11% to 22%. It may be pointed out that reduction of the percentage of basic perchlorate of lead tends to cause the explosive to generate more heat, but renders it somewhat slower burning and, therefore, less powerful than is the case with the optimum percentages mentioned in the specific example mentioned above. It is also noted that when the percentage of powdered basic perchlorate of lead is increased above the optimum percentages set forth in the specific example given above, the resultant material again tends to burn less rapidly and thereby to lose effectiveness, as a result of its slower action.

The explosive material herein described differs from conventional explosive materials now in use in that instead of exploding as a result of rapid oxidation, the detonation of the explosive materials manufactured in accordance with the teachings of the present invention starts an extremely rapid oxidation and reduction reaction process.

Bearing the above in mind, it will be readily seen that the invention herein described is not limited even to the specific materials mentioned above, but may include a combination of two materials widely separated in the electromotive series. As above described, the basic lead perchlorate is highly electropositive, while the aluminum is highly electronegative. Thus, these materials are readily attracted to each other and the reaction of the aluminum with the perchlorate is very rapid. In addition, the aluminum is a powerful reducing agent while the lead perchlorate is a very strong oxidizing agent. Further, the basic lead perchlorate, although a

stable salt, readily loses its oxygen once the reaction with the aluminum starts.

Obviously, therefore, other materials than basic lead perchlorate and aluminum may be used. For example, magnesium may be substituted for the aluminum. When this substitution is made, the reaction is obviously not as vigorous because the heat given off by the magnesium is only about one-third that given off by the aluminum. This is somewhat offset, of course, by the fact that the reaction is inherently somewhat faster.

With a view to providing a material which is more electronegative than aluminum and at the same time sufficiently stable for practical purposes, the present invention contemplates the use with basic perchlorate of lead, an alloy consisting of 50% to 75% aluminum and 50% to 25% calcium. The heat of formation of calcium oxide is approximately the same as that of magnesium, but calcium is more than twice as electronegative as magnesium.

If the specific gravity of the material to be produced is not considered as being an important factor, a satisfactory product may be obtained by substituting basic perchlorate of copper for basic perchlorate of lead in the above specific composition. Likewise, basic perchlorate of copper may be combined with an aluminum calcium alloy of the type described above. In such event, the preferable composition of the material is:

	Per cent
$Cu_3(OH)_4(ClO_4)_2$	72
Al—Ca (75%—25%)	28

In the above described specific composition, the proportion (by weight) of the basic perchlorate of copper may range from 67% to 80% and that of the aluminum calcium alloy correspondingly from 33% to 20%.

This material should be finely powdered, well mixed and compressed to form a coherent mass all as described above.

Bearing in mind the basic principles above described, it will be readily appreciated that in a broad sense the invention herein disclosed contemplates the mixture in finely divided compressed form, of perchlorate salts of such metals as lead, copper, mercury, gold or other metals of such an electropositive nature, together with highly electronegative materials such as aluminum, calcium, magnesium, etc.

It may be noted that the perchlorate salts made from such metals as lead, mercury, etc. are all deliquescent and only the basic salts may be used.

In addition, the presence of the hydroxyl radical provides additional oxygen which serves to increase the violence and rapidity of the reaction.

The magnitude of the pressure used to compress the mixed powders is of great importance and must, of course, be varied depending upon a number of factors such as the fineness of the powdered materials and the proportion and nature of the various materials used. Generally, however, best results have been obtained by determining the volume of the final product and then utilizing a volume of mixed powder approximately two and one-half times the volume of the final product which it is desired to produce. In this way, sufficient pressure may be utilized to compress the mass until the final volume is obtained which will inherently provide a resultant product which is a compact coherent mass. Best results are obtained by applying sufficient pressure to between 2.5 and 2.7 volumes of the loose powdered material to compress it to a compact 1.0 volume.

From the foregoing, it will be obvious that many and various modifications and departures from the compositions above described may be made at the same time falling within the generic spirit and scope of the subjoined invention as defined in the following claims.

What is claimed is:

1. An explosive comprising a mixture of a finely powdered basic perchlorate salt of the group consisting of lead, copper and mercury and a finely powdered metal of the group consisting of aluminum, calcium and magnesium, said mixture being compressed to form a solid coherent mass.

2. An explosive comprising a mixture containing at least 78% of basic perchlorate of lead and a powdered material of the group consisting of aluminum, calcium and magnesium, said mixture being compressed to form a solid coherent mass.

3. An explosive comprising a mixture containing at least 78% of powdered basic perchlorate of lead and a powdered material of the group consisting of aluminum, calcium and magnesium, said mixture being compressed to a substantially solid coherent mass.

4. An explosive comprising a mixture of powdered basic perchlorate of lead between 78% and 89% by weight and powdered aluminum between 22% and 11% by weight, said mixture being compressed to form a substantially solid coherent mass.

5. An explosive comprising a mixture of powdered basic perchlorate of a metal of the group consisting of copper, lead and mercury and a powder of an alloy of aluminum and calcium in which alloy aluminum constitutes at least 50%, said mixture being compressed to form a substantially solid coherent mass.

6. An explosive comprising a mixture of powdered basic perchlorate of lead approximately 84% by weight and the balance consisting substantially of powdered aluminum, said mixture being compressed to occupy a volume about one-third of the volume occupied by the powders in the uncompressed state.

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