

UNITED STATES PATENT OFFICE.

RUSSELL M. COOK, OF TAMAQUA, PENNSYLVANIA, ASSIGNOR TO ATLAS POWDER COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

EXPLOSIVE.

No Drawing.

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To all whom it may concern:

Be it known that I, RUSSELL M. COOK, a citizen of the United States, residing at Tamaqua, in the county of Schuylkill and State of Pennsylvania, have invented certain new and useful Improvements in Explosives, of which the following is a specification.

My invention relates to ammonium perchlorate explosives, which are similar in their explosive properties to existing standard grades of nitroglycerine dynamite.

Since dynamite was discovered, numerous attempts have been made to produce explosives more powerful than, or equally as powerful as dynamite, yet possessing superior qualities with respect to stability, economy, resistance to freezing, or physiological effect of handling the powder. By the last named effect is meant the characteristic headaches produced by handling nitroglycerine dynamites.

Among the many proposed substitutes for nitroglycerine dynamite may be mentioned the mixtures of chlorates, sodium or potassium, with resins, gums, and nitroaromatic compounds, and mixtures of inorganic nitrates with resins or nitroaromatic compounds. Each of these proposed explosives possessed some property which recommended it to the attention of the explosive consumer. In most cases this was the property of being non-freezing, or of not causing headaches. In some cases cheapness was claimed as a virtue. However each of these proposed explosives suffered from one or more major, inherent defects which precluded its acceptance as a substitute for or competitor of nitroglycerine dynamite. The explosives consisting of inorganic nitrates mixed with nitroaromatic compounds, such as T. N. T., have not met with favor because of low initial sensitiveness and of the tendency of the powder to become hard with resulting impossibility of detonation. This last named objection applies also to the chlorate powders.

For some years the development of proposed substitutes for, or improvements over, dynamite, seemed to be in a state of comparative coma, induced no doubt by a feeling that success was well nigh impossible, judging by the many previous failures. This condition was suddenly changed, within the last few years, by the development and man-

ufacture of a new type of explosive, having for its base the comparatively new explosive salts, the perchlorates. These have sometimes included only one perchlorate as, ammonium perchlorate for example. In other cases a mixture has been used, as ammonium and potassium perchlorates. Perchlorate explosives since their introduction on a commercial scale have enjoyed a remarkable success. Aside from the satisfactory results of several years of extensive use, which period has served to show the satisfaction with their non-freezing and non-headache properties, as well as with their general explosive properties, one testimonial to their value is the large number of recently proposed explosive compositions which have as a necessary ingredient a perchlorate. These compositions usually contain, in addition to perchlorate, a nitro-aromatic compound, such as di- or trinitrotoluol, and if ammonium perchlorate is used, a nitrate such as sodium nitrate, or an oxide such as manganese dioxide, to fix the poisonous chlorine resulting from the explosive decomposition of the ammonium perchlorate. They may also contain various so-called sensitizers, such as powdered metals, sulphur, or sulphides, waterproofing ingredients, such as paraffin and ceresin, and an anti-acid, such as chalk.

The period of use to which perchlorate explosives has been subjected has served to show that while, as now manufactured, they are adapted for general blasting work and other uses to which dynamite is put, some limitations are placed upon their use by their comparatively low propagation sensitiveness, as compared with nitroglycerine dynamites.

The object of my invention is to provide explosive compositions the main explosive in which comprises a large percentage of a perchlorate, or mixture of perchlorates, and in which the above mentioned disadvantage, i. e., that of too low propagation sensitiveness for certain special work, is to a large extent avoided.

It might be reasoned that a logical way to approach this problem, that of combining the desirable properties of both perchlorate explosives and nitro-glycerine dynamite, and yet eliminating the undesirable properties of both, would be to effect a mixture of certain ingredients of each explosive. I have found

such to be the case. By exhaustive tests I have found that perchlorate explosives prepared in the manner hereinafter set forth give the desired results. This may be accomplished by including in the explosive composition a low percentage of an explosive liquid organic nitrate, such as might be used in dynamite. This may be further defined as a material, liquid at 75° F., which when mixed with 25 percent of the inert substance kieselguhr and packed in an 1¼"x8" dynamite cartridge, can be completely detonated with a No. 6 cap. Among these explosive liquid organic nitrates, as above defined, may be mentioned nitro-glycerine, tetranitrodiglycerine, the nitroglycols, the nitrochlorhydrins, any of these mixed with nitrated sugars, and any mixtures of these with themselves.

One example of such proposed explosive would have the following composition:

	Per cent.
Ammonium perchlorate-----	30
Manganese dioxide-----	7
Sodium nitrate-----	36
Trinitrotoluol-----	24
Nitroglycerine and tetranitro diglycerine-----	2
Chalk-----	1

Another example would have the following composition:

	Per cent.
Ammonium perchlorate-----	24
Potassium perchlorate-----	25
Manganese dioxide-----	4
Sodium nitrate-----	17
Wood meal-----	1
Trinitrotoluol-----	26
Dinitromonochlorhydrin-----	2
Chalk-----	1

Other examples may be given as follows:

	Per cent.
Ammonium perchlorate-----	23.0
Manganese dioxide-----	5.
Coated sodium nitrate-----	44.
Nitroglycerine-----	2.
T. N. T-----	24.5
Sulphur-----	1.0
Chalk-----	0.5

	Per cent.
	100.0
Ammonium perchlorate-----	21.0
Manganese dioxide-----	4.
Coated sodium nitrate-----	47.5
Nitroglycerine-----	2.0
T. N. T-----	23.
Sulphur-----	2.0
Chalk-----	0.5
	100.0

It is understood that the percentage of these ingredients may be varied and other ingredients added, in order to give explosives with certain desired properties with respect to strength, fumes, velocity of detonation, and density, without departing from the idea of my invention. For instance, I do not limit myself to the use of two percent explosive liquid organic nitrate, since the results I desire can be obtained from the use of from one-half to three and one-half percent (0.50% to 3.50 percent).

The purpose of the explosive liquid organic nitrate is to raise the propagation sensitiveness of the perchlorate explosives so that they compare more favorably in this respect with dynamites, and can, as a result, be successfully used in special cases in which at present only the more sensitive nitroglycerine dynamites can be applied. I have found, by extensive tests, that these new explosives, made as before described, do not cause headaches on being handled.

Moreover, repeated subjection of these new explosives for long periods of time to the temperatures encountered in practical use has resulted in no apparent change in their physical or explosive properties.

On the other hand, under the same conditions, nitroglycerine dynamites become hard, their propagation sensitiveness decreases, they are subject to freezing and they are more dangerously sensitive to some forms of handling.

Having described my invention what I claim is:

1. An explosive mixture comprising a main explosive consisting of a mixture of a perchlorate and trinitrotoluol, and a small percentage of an explosive liquid organic nitrate, and sodium nitrate.

2. An explosive mixture comprising a main explosive consisting of a mixture of trinitrotoluol and a perchlorate, wherein the said perchlorate forms a large percentage of such mixture, in combination with a small percentage of nitro-glycerine, and sodium nitrate.

3. An explosive containing a perchlorate and from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate.

4. An explosive containing a perchlorate and from one-half to three and one-half percent (0.50% to 50%) of a mixture of explosive liquid organic nitrates.

5. An explosive containing ammonium perchlorate and from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate.

6. An explosive containing a perchlorate and from one-half to three and one-half percent (0.50% to 3.50%) nitroglycerine.

7. An explosive containing a perchlorate, from one-half to three and one-half percent

(0.50% to 3.50%) of an explosive liquid organic nitrate and sodium nitrate.

5 8. An explosive containing ammonium perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate and sodium nitrate.

10 9. An explosive containing a perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, and a nitro-aromatic compound.

15 10. An explosive containing a perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of a mixture of explosive liquid organic nitrates, and a nitroaromatic compound.

20 11. An explosive containing a perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, and trinitrotoluol.

25 12. An explosive containing ammonium perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, and trinitrotoluol.

13. An explosive containing a perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, sodium nitrate, and trinitrotoluol. 30

14. An explosive containing ammonium perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, sodium nitrate, and trinitrotoluol. 35

15. An explosive containing a perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, sodium nitrate, trinitrotoluol, and manganese dioxide. 40

16. An explosive containing ammonium perchlorate, from one-half to three and one-half percent (0.50% to 3.50%) of an explosive liquid organic nitrate, sodium nitrate, trinitrotoluol and manganese dioxide. 45

In testimony whereof I affix my signature in the presence of two witnesses.

RUSSELL M. COOK.

Witnesses:

MABEL A. HARKER,
F. H. GILLUM.