

UNITED STATES PATENT OFFICE.

ADOLPH FRANK, OF CHARLOTTENBURG, GERMANY.

EXPLOSIVE COMPOSITION.

SPECIFICATION forming part of Letters Patent No. 792,512, dated June 13, 1905.

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To all whom it may concern:

Be it known that I, ADOLPH FRANK, a subject of the King of Prussia, German Emperor, residing at Berlinerstrasse 26, Charlottenburg, Germany, have invented new and useful Improvements in Explosive Compositions, of which the following is a specification.

The present invention relates to the use of cyanamids—*i. e.*, cyanamid, dicyandiamid, tri-
 10 cyantriamid (melamin)—the salt of the said substances with acids or metals for the manufacture of explosives and the explosives containing cyanamids. The object of the said
 15 use of the cyanamids consists, especially, in reducing the temperature of the gases formed by the detonation of the explosive without diminishing the propelling or blasting power of the explosive. In explosives, as smokeless
 20 powder, of nitrocellulose or a mixture of nitroglycerin and nitrocellulose by the addition of cyanamids the temperature of the gases formed by the detonation is diminished, whereby an injury made by the detonation to the guns is en-
 25 tirely avoided or diminished. In mining-explosives the inflammation of fire-damp is avoided by the said addition of cyanamid or cyanamids and a great safety against mining accidents is obtained.

According to the present invention gener-
 30 ally, cyanamids, or a single cyanamid, or salts of the cyanamids with acids or metals may be added to every substance or mixture of substances which are capable of detonation.

In the following the present invention is
 35 described, in the way of example, in the use for gelatinous or gelatinized explosives containing nitrocellulose.

Cyanamid having the formula CH_2N_2 , dicyanamid having the formula $\text{C}_2\text{H}_2\text{N}_4$, tricyan-
 40 triamid (melamin) having the formula $\text{C}_3\text{H}_3\text{N}_3$, contain in hundred parts 28.572 parts carbon, 4.762 parts hydrogen, 66.666 parts nitrogen. For burning the carbon of the said compounds to carbon monoxid, one atom of oxygen is re-
 45 quired for each atom of carbon. Most of the gelatinous or gelatinized explosive mixtures containing nitrocellulose or nitrocellulose and nitroglycerin are capable of yielding the said
 50 quantity of oxygen without injuring their own complete combustion. In the combus-

tion of the said mixtures to which an addition of cyanamids, a single cyanamid, or a mixture of the cyanamids, their salts, with acids or metals, has been previously made, the nitrogen being present in a very high per-
 55 centage is delivered, whereby no heat is formed, but a part of the heat formed by the combustion or detonation is absorbed or made latent. Therefore by the addition of the cy-
 60 anamids or their salts a reduction of the temperature of combustion or detonation and an increase of the propelling force is obtained.

A further advantage to be obtained by the addition of cyanamids and their combina-
 65 tions to explosives containing nitrocellulose consists in the alkaline or basic reaction toward remainder or residues of acids that may be of influence in irrational keeping or detrimental atmospheric actions on the powder. The stability of the nitrocellulose powder con-
 70 taining cyanamids or their salts is therefore essentially increased.

The manufacture of explosives and powders containing nitrocellulose and cyanamids according to the present invention is carried out
 75 in the usual manner known for the manufacture of gelatinous or gelatinized explosives or powders containing nitrocellulose or pyroxylin. One may mix guncotton, as collo-
 80 dion, nitrocellulose, or soluble guncotton, with nitroglycerin in a gentle heat and add to the mass cyanamid—*i. e.*, cyanamid, dicyandiamid, tricyantriamid, (melamin,) or mixtures of the said substances. One may also add the
 85 cyanamid (or the cyanamids) to the guncotton or the nitroglycerin before or during the gelatinizing. One may use, for instance, the following proportions: four parts cyanamid, (or the cyanamids,) ninety-three parts nitro-
 90 glycerin, three parts collodion nitrocellulose. One may vary the proportions of the substances according to the requirements that the explosive is intended to fulfill. The skilled workman will choose the proportions
 95 according to experiments. The gelatinized mass is molded or pressed into the required shape.

The quantity used of cyanamid may be so chosen that the carbon of the cyanamid will be oxidized by the oxygen evolved in the

detonation to carbon monoxid. One may, however, also use a larger quantity of cyanamid, so that the oxygen present is not able to oxidize the whole carbon of cyanamid to carbon monoxid. One uses such a quantity of cyanamid (dicyandiamid, tricyantriamid) that the cyanamid may be diazotized by the nitrous acid evolved in the detonation. Cyanamid may act as a cyanogen guanidin, which is converted by combining with water into guanylurea and by combining with ammonia into biguanid. The amido groups will be diazotized by the nitrous acid evolved in the explosion. The diazo compounds have a peculiar velocity of decomposition which is very useful for the power of the explosive and avoiding an increasing of temperature.

One may substitute, completely or partly, for the nitrocellulose nitrohydrocellulose, nitrated wood, jute, and such like. One may substitute, completely or partly, for the nitroglycerin nitrobenzene, nitrotoluol, and such like. One may add cyanamid, or the cyanamids, or their salts only to nitrocellulose.

One may add cyanamid (cyanamid, dicyandiamid, tricyantriamid, their salts, with acids or metals) to all powders or explosives that contain gelatinous or gelatinized nitrocellulose or another sort of nitrocellulose alone or mixed with other substances. One may add, for instance, cyanamid (cyanamid, dicyandiamid, tricyantriamid, or their salts) to nitrocellulose, cordite, amberite, and such like.

For instance, one may use the following proportions: first, sixty parts nitroglycerin, thirty-nine parts nitrocellulose, (soluble,) one part cyanamid; second, fifty-eight parts nitroglycerin, thirty-seven parts guncotton, (insoluble,) five parts cyanamid. The proportions may vary according to the requirements to be fulfilled by the explosives.

One may also use cyanamid, dicyandiamid, tricyantriamid, (melamin,) their mixtures or their salts, besides other additions that are made to gelatinous or gelatinized explosives or gunpowders containing nitrocellulose or

nitroglycerin and nitrocellulose, as diphenylamin, urea, or such like.

One may also use cyanamid, dicyandiamid, tricyantriamid, (melamin,) their mixtures, or their salts as additions to explosives in combination with solvents for molding the explosives or softening or incorporating the components. One dissolves in the liquid or mixes the substances with the liquid, partly dissolving or softening the components, and evaporates or separates the liquid after or during the gelatinization or the molding.

One may use, preferably, the cyanamid obtained from the metal cyanamids—as, for instance, calcium cyanamid—by treating or lixiviating with hot water and evaporating the obtained liquor. Such cyanamid consists of a mixture of cyanamid, dicyandiamid, tricyantriamid.

As substitutes for the cyanamids and besides the cyanamids one may also use the salts of the cyanamids with acids or bases. One may, for instance, use the nitrate, the oxalate, the sulfate, the sodium, silver, calcium salt, or any other suitable salt of the cyanamid, (dicyandiamid, tricyantriamid.) One may use mixtures of several salts and may also use mixtures of the salts with acids and salts with bases.

What I claim as my invention, and desire to secure by Letters Patent, is

1. Explosives containing nitrocellulose and cyanamid.
2. Explosives containing nitrocellulose, nitroglycerin, and cyanamid.
3. Explosives containing nitrocellulose, nitroglycerin and more cyanamid than may be oxidized by the oxygen evolved in the explosion.

In witness whereof I have hereunto signed my name, this 27th day of July, 1904, in the presence of two subscribing witnesses.

ADOLPH FRANK.

Witnesses:

HENRY HASPER,

WILLIAM MAYNER.