

UNITED STATES PATENT OFFICE.

ADOLPH FRANK, OF CHARLOTTENBURG, GERMANY.

EXPLOSIVE COMPOSITION.

SPECIFICATION forming part of Letters Patent No. 792,511, dated June 12, 1905.

Application filed August 10, 1904. Serial No. 226,226.

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 28, 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, tricyantriamid (melamin), the salts of the said substances—with acids or metals for the manufacture of explosives and the explosives containing cyanamids. The object of the said use of the cyanamids consists especially in reducing the temperature of the gases formed by the detonation of the explosives without diminishing the propelling or blasting power of the explosive. In explosives, as smokeless 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 entirely 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 generally 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 to be detonated.

In the following the present invention is described in the way of example in the use for explosives containing substances being able to give off oxygen by their decomposition or detonation.

Cyanamid having the formula CH_2N_2 , dicyandiamid having the formula $\text{C}_2\text{H}_4\text{N}_4$, tricyantriamid (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 required for each atom of carbon. One may, however, conduct the combustion so

that completely or nearly-completely carbon dioxid is formed. In oxidizing dicyandiamid according to the equation

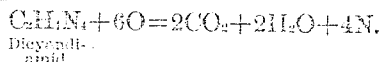


without any remainder from one gram equivalent—*i. e.*, from eighty-four grams dicyandiamid about one hundred and thirty-two liter gases are formed—*i. e.*, from one kilo about sixteen hundred liter gases. To effect this, the addition of 1.143 kilo eight hundred liter oxygen is required. Preferably the required addition of oxygen is effected by mixing cyanamid (dicyandiamid, tricyantriamid) or their salts in a suitable proportion with a compound capable of yielding oxygen in its decomposition. Such salts are, for instance, nitrates, chlorates, perchlorates, manganates, permanganates, chromates, perchromates of the alkalis, earth alkalies, or metals. One may also use any suitable oxygen-yielding oxid—for instance, peroxid. One may use a single salt or oxid or a mixture of several salts or oxids or peroxids and even a mixture of salts and oxids.

Of the nitrates one may preferably use nitrate of ammonia. One may, however, use any other nitrate, organic or inorganic.

If nitrous acid may be evolved in the explosion, it is suitable to use more cyanamid (dicyandiamid, tricyantriamid) than may be oxidized by the oxygen evolved. One employs such amount of cyanamid (dicyandiamid, tricyantriamid) that diazo compounds may be formed by the action of the nitrous acid on the cyanamid (dicyandiamid, tricyantriamid) may act as a cyanogen guanidin, which is converted by combining with water into guanylures 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 of explosion. One uses with ammonium nitrate as oxidizing agent a larger amount of cyanamid

than may be oxidized according to the following equation:



5 The skilled workman will select the oxygen-yielding compound and the proportions of the components according to the desired properties of the explosives. One may use, for instance, the following proportions: five to fifteen parts cyanamid, (or dicyandiamid, tri-
10 cyantriamid,) ninety-five to eighty-five parts nitrate of ammonium, (or appropriate proportions of potassium, sodium, barium, calcium,
15 aluminium, magnesium, strontium, lead,) or chlorate or perchlorate of potassium, (or sodium, ammonium, barium, strontium, calcium, aluminium, magnesium, lead, &c.)

The manufacture of the explosives according to the present invention is carried out in a similar manner to the manufacture of the explosives of the class in question. One mixes, for instance, the comminuted components either in a dry state or after having
25 been moistened and comminutes the mixture, if required, more completely during or after the mixing. The resulting mixtures, if required, after having been dried may be pressed to blocks or any suitable form or may be
30 brought in a loose state into cartridges.

One may use, preferably, the cyanamid obtained by lixiviating or treating a suitable metal cyanamid—for instance, calcium cyanamid—with hot water and evaporating the resulting liquid to dryness. One obtains in
35 this manner a mixture of cyanamid, dicyandiamid, and tricyantriamid. One may mix the aqueous liquid obtained by the said lixiviation of the metal cyanamids with the oxygen-yielding compound and then evaporate the water
40 before or during the decomposition or mixing of the components.

One may add the explosives according to the present invention containing oxygen-yielding
45 compounds to other explosives and use the explosives together. For instance, one may use the said explosives as so-called "additional powder" to dynamite, gelignite, blasting-gelatin, or such like.

50 The employment of the explosives is made in the usual way. The detonation is carried out according to the nature of the oxygen-yielding substance—for instance, by a detonator, a fuse, &c.

55 One may add to the explosive other oxidizable or combustible organic or inorganic substances in order to control the properties of

the explosives, as the velocity of detonation or combustion, the power of the explosive, the safety against water, &c.

60 One may add to the explosives according to the present invention easily-oxidizable metals, as the metals of the earth-alkalies, aluminium, magnesium, &c., in the form of powder, chips, &c. One may also use animal, vegeta-
65 ble, and mineral fats; also, oils, fatty acids, lycopodium, resins, varnishes, lacs. The skilled workman will select the additions suitable for his special purposes. The manufacture of the explosives is carried out even with the said
70 additions in the usual manner, especially as adapted for the so-called "safety" explosives that are detonated by detonators, as mercury-fulminate capsules and such like.

The explosives according to the present invention have when compared with other explosives of the same kind the advantage of
75 liberating a very high percentage of nitrogen, which does not evolve the formation of heat, but absorbs a part of the heat liberated by
80 the detonation or combustion. One obtains in this way a lowering of the temperature of the combustion or of the gases formed by the detonation, whereas at the same time an increasing of the explosive power is reached.
85 In the place of the cyanamids also the salts of the cyanamids, with acids or bases, may be used either alone or mixed with the uncombined cyanamids. One may use a single salt or a mixture of several salts either with acids
90 or bases. By the word "cyanamid" according to the present invention one has to understand cyanamid, dicyandiamids, tricyantriamids, or the salts with acids or bases.

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

1. Explosives containing oxygen-yielding compounds and cyanamid.

2. Explosives containing ammonium nitrate and cyanamid.

3. Explosives containing oxygen-yielding compounds, cyanamid and oxidizable substances.

4. Explosives containing ammonium nitrate 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.