UNITED STATES PATENT OFFICE.

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BLASTING AGENT.

SPECIFICATION forming part of Letters Patent No. 689,577, dated December 24, 1901.

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To all whom it may concern:

Be it known that I, HANS VON DAHMEN, of Vienna, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Blasting Agents, of which the following is a specification.

It is a well-known fact that the expansion of the gases on firing explosives stands in a certain relation to the rise of temperature. The expansion of the gases is greatest at very high temperatures, and great expansion naturally signifies a large amount of work done. Recent research has shown that in the reduction of aluminium oxid to metallic aluminium seven thousand one hundred and forty calories are rendered latent, and, conversely, in the conversion of metallic aluminium into its oxid the same quantity of heat is liberated. This caloric effect I utilize to raise the temperature of the gases arising on firing blasting agents in order to obtain increased mechanical effect. Exhaustive experiments made with various kinds of blasting agents have yielded surprising results. Thus picric acid tested in Trautzel's cylinder yielded a volume of about ten hundred and fifty cubic centimeters, whereas the addition of twenty per cent. of aluminium increased the volume to thirteen hundred and seventy cubic centimeters. This example shows the immense increase in mechanical effect which can be obtained. This is all the more striking in the case of picric acid, since this acid is poor in oxygen, and on the experiment with a twenty-gram charge a large amount of undecomposed carbon was found remaining. It will be clear that there must be an increase of the mechanical work done in the case of all blasting agents the firing-point of which is below the temperature at which aluminium oxid is formed, as numerous experiments with compounds containing nitroglycerin, nitrocelluiose, chlorate, and perchlorate powders and the like have shown. Furthermore, it is obvious that the effect of the heat liberated must be greater the lower the firing-point of the blasting agent. For the purpose in view ammonium nitrate appears to be the substance best suited. Even with the strongest fulminating agents nitrate of ammonia cannot be perfectly converted into its gaseous condition, though it is estimated by means of the Trautzel-cylinder test that a charge of twenty grams yields a volume of about eight hundred cubic centimeters. The ammonium nitrate combined with aluminium according to the formula:

$$3(NH_4NO_3)+2Al=3N_2+6(H_2O)+Al_2O_3,$$

as shown by means of a Trautzel-cylinder test, yields a volume of two thousand cubic centimeters for a twenty-gram charge.

If this blasting agent is closely examined, we find that apart from the extraordinary strength it possesses still other remarkable advantages.

The after fumes (the aluminium oxid being reckoned as a solid) consist of steam, fifty per cent.; nitrogen, fifty per cent.; total, one hundred per cent., which may be considered as a very favorable composition.

The manufacture of the blasting agent is simple and safe, the intimate mixing of the two components being unattended with danger. Its application is likewise safe.

Aluminium is almost altogether proof against the action of nitrate of ammonium, a point of much importance as regards storage of the blasting agent. The thin layer of oxid which may form protects the metal from further oxidation and renders it extremely durable. It may be assumed that at the high temperatures at which explosion occurs a layer of oxid at the moment of firing, due to the presence of carbon, will be reduced to metallic aluminium, wherefore the following composition is to be recommended:

$$4(NH_4NO_3)+Al_2+C=4N_2+8(H_2O)+Al_2O_3+CO.$$

This composition, tested in a Trautzel cylinder, yielded for a charge of twenty grams a volume of two thousand cubic centimeters.

The transformation into a gaseous state may be effected by preparations of fulminate of mercury, similarly as is the case with all nitrate-of-ammonium blasting agents. Similar but not such satisfactory results may also

be obtained by means of other light metals, magnesium being, however, probably the only one likely to prove practically valuable.

I claim—

1. The herein-described composition of matter consisting of a light metal in a finely-divided state and nitrate of ammonium, substantially as described.

2. The herein-described composition of matter consisting of metallic aluminium in a finely-divided state and nitrate of ammonium, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

HANS VON DAHMEN.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.