UNITED STATES PATENT OFFICE.

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EXPLOSIVE.

990,036. Specification of Letters Patent. Patented Apr. 18, 1911.

No Drawing. Application filed April 18, 1907. Serial No. 368,964.

To all whom it may concern:

Be it known that I, GIOANNI CORNARO, a subject of the King of Italy, residing at Turin, in Italy, have invented certain new and useful Improvements in the Manufacture of Explosives, of which the following is a specification.

This invention relates to improvements in the manufacture of explosives.

Common metals have under certain physical conditions the property of becoming oxidized with so much violence, and with the development of so much thermal energy, that they constitute explosives of great power if mixed with suitable quantities of oxids or oxidized salts. The physical state required for this purpose is that of very fine division obtained by means of mechanical pulverization, or preferably by the electrolysis of the oxids or salts of the metals.

I have ascertained that very much greater explosive force is obtained by using a mixture of different metals than by using the metals singly, if the mixture is an intimate one and consists of suitable proportions of two or more metals which begin to oxidize at different temperatures, and the successively formed oxygen compounds of which develop, during their formation, increasing quantities of heat, so that the oxidation of one of them induces, by the heat developed, the more rapid and complete oxidation of the other metal or metals, of which the oxidation takes place at a higher temperature.

This process constitutes an improvement of great importance and allows of obtaining explosive forces considerably greater than those obtained by means of the most powerful nitrogen compounds. Aluminium and antimony used singly constitute the combustible of explosives when mixed with an oxid or highly oxidized salt which is stable at ordinary temperatures but is adapted, when its temperature is raised by ignition, to yield the oxygen required for the combustion of the metal, as for example manganese dioxid, chlorates, perchlorates and nitrates. For the mixture aluminium and manganese dioxid the formula 20 per cent. of aluminium and 80 per cent. of manganese dioxid may be used. If, however, these two metals, aluminium and antimony, are mixed with each other in suitable proportions, together with a suitable quantity of oxid or highly oxidized salt, as for example 8 per cent. of aluminium, 8 per cent. of antimony and 84 per cent. of manganese dioxid, the oxidation of one of the metals develops heat by which the oxidation of the other metal is caused to take place with more completeness and with the development of a greater amount of heat and consequently of explosive force. During the first phase of the explosion there is produced trioxid of antimony Sb_2O_3, the heat of formation of which assists and accelerates the formation of aluminium oxid Al_2O_3. The heat of formation of the latter added to that of the antimony oxid raises the temperature to the temperature at which antimony pentoxid Sb_2O_5 is formed, and this compound in turn raises the temperature to that at which a peroxid of aluminium is formed, which may be the hitherto unobtainable pentoxid Al_2O_5. The unknown heat of molecular constitution of this peroxid must be exceedingly great, since the explosive produced in the manner described explodes with a force approximately nine times as great as that of the best black powder, that is to say, twice as great as that of the most powerful nitrogen compounds known. This high explosive force cannot be due to the heat of formation of the aluminium oxid and antimony pentoxid, and can only be explained by assuming the formation of aluminium pentoxid, with the enormous development of heat due thereto.

For igniting an explosive of this nature there may be used any flame of a match, wick, or the like without the use of a powerful detonator.

It is necessary that the explosion of an explosive of this nature takes place in a projectile, mine, torpedo, or the like, to prevent the expansion and cooling of the gases in course of formation. If the metallic explosives manufactured by the method described are formed with nitrate of potash, explosion does not take place below a temperature of approximately 300 degrees centigrade, and is not readily produced by the action of impact or friction.

The composition of these explosives resembles in its character that of black powder, the carbon and sulfur in the latter being replaced by aluminium and antimony.

By altering the proportions of the metals mixed with each other in the same way as carbon and sulfur vary in black powder, different explosive forces or rapidities of explosion are obtained, according to the pur-

pose for which the explosive is required. As examples:—10 per cent. of aluminium, 10 per cent. of antimony and 80 per cent. of perchlorate of potash give an explosive of high disruptive power. 12½ per cent. of aluminium, 12½ per cent. of antimony and 75 per cent. of nitrate of potash give a lower disruptive power.

The explosive is compounded in the same way as black powder.

At the very high temperatures of explosion the oxids and metallic anhydrids are believed to be gaseous, but immediately after the explosion and consequent expansion and cooling of the gases the latter rapidly become condensed and solidified, but remain in a state of fine division, so that they remain suspended in the atmosphere and form a thick and slowly dispersing smoke, visible at a considerable distance.

The explosives produced in the manner described therefore have the following advantages:—1. High power. 2. Production of thick, slowly dispersing smoke, enabling the location of the explosion to be detected at a distance. 3. Insensitiveness to impact and friction within the gun and on impact with highly resistant bodies such as armor-plates, cement or concrete walls and the like, so that the explosives are suitable for charging projectiles and in general for all purposes for which explosive agents are required.

Certain metals are, more particularly when finely pulverized, liable to become oxidized at ordinary temperatures. To prevent this, such metals may be coated with a protective varnish of materials which are perfectly stable at ordinary temperatures, and constitute an explosive when in contact with the oxid or salt mixed with the metal. A varnish suitable for this purpose may be produced by mixing in equal proportions, soot, boiled linseed oil and oil of turpentine to form a paste. The percentage of soot, however, may be varied to give to the paste the required fluidity. This varnish is applied to the metallic powders of the explosives in the proportion of 2 to 4 per cent. in weight. With 4 per cent. or more of such varnish the explosive will not explode in the open air or if closed in a receiver of weak resistance.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. An explosive comprising a mixture of aluminium and antimony in finely divided condition with a solid inorganic oxidizing agent.

2. An explosive consisting of a mixture of aluminium and antimony in a finely divided condition, a solid inorganic oxidizing agent, and a varnish applied to said metals consisting of soot, boiled linseed oil and oil of turpentine, said varnish forming with the oxidizing agent an oxidizable explosive constituent.

In witness whereof I have signed this specification in the presence of two witnesses.

GIOANNI CORNARO.

Witnesses:
CARLO TONTA,
LOUIS ALLAN.