UNITED STATES PATENT OFFICE.

HUDSON MAXIM, OF HOPATCONG, NEW JERSEY, ASSIGNOR TO E. I. DU PONT DE NEMOURS POWDER COMPANY, A CORPORATION OF NEW JERSEY.

EXPLOSIVE CHARGE FOR ORDNANCE.

1,015,814. Specification of Letters Patent. Patented Jan. 30, 1912.

No Drawing. Application filed February 14, 1908. Serial No. 415,961.

To all whom it may concern:

Be it known that I, HUDSON MAXIM, of the borough of Hopatcong, county of Sussex, State of New Jersey, have invented a new and useful Improvement in Explosive Charges for Ordnance, which invention is fully set forth in the following specification.

The present invention relates to improvements in gunpowder charges, particularly for heavy ordnance.

The object of the invention is to provide a gunpowder charge which shall at once serve to secure the best ballistic results, that is to say the highest velocity of the projectile, with the lowest pressure, obviate flareback, and minimize the erosive action of the gases upon the bore of the gun.

In carrying out the invention I employ, in conjunction with the self-combustible or explosive smokeless gunpowder material or charge, another or independent and non-combustible or non-explosive or only partially combustible or partially explosive, and preferably smokeless material or materials or charge, adapted to be volatilized or decomposed into gaseous constituents or products by heat absorbed from the products of combustion of the explosive smokeless powder charge. Many different substances may be employed to advantage as the main ingredient or ingredients of the cooling or non-explosive material, and it will not be necessary for me to name them all here. Suffice it to mention a few of them, and those which I esteem particularly adapted to the purpose. I have found carbonate of ammonia to be a material well suited as a heat absorbing agent. I have also found acid carbonate of ammonia an ingredient well suited to the purpose; or I may employ oxalic acid, which serves the purpose admirably; or nitrate of sodium, nitrate of potassium, nitrate of barium, nitrate of ammonia, or other nitrate or oxidizing salt may be used. Also sulfate of ammonia is admirably adapted as a cooling agent or ingredient of my non-explosive gunpowder.

I prepare my non-explosive material or ingredient in granular form or the form of strips, bars, or pellets, called "grains" in the smokeless powder art, or in any suitable shape that may be desired, in the same or similar manner and shapes that ordinary smokeless gunpowder is formed. And my non-explosive grains may be so made as to be consumed, decomposed or volatilized with either an accelerating or decreasing rate as may be desired. And the grains may be made so that they may be completely decomposed with the complete combustion of the explosive smokeless gunpowder charge, or so that they will be completely decomposed a little later, and after the complete consumption of the explosive charge; or in advance of the complete consumption of the explosive charge, all as may be desired, according to circumstances. I may make the cooling grains entirely of a heat absorbing material, or materials, such as sulfate of ammonia or oxalic acid, by subjecting the material to high compression in molds of suitable form, but in order to facilitate manufacture and to improve the character and strength of the grains, I preferably employ an adhesive material or agglutinating agent to render the grains more cohesive and less friable. The cooling material in the form above described may be intermingled with the explosive or may constitute a separate charge to be associated with the explosive charge.

I have found that a small percentage of sulfur used in its allotropic, amorphous and plastic state serves very well as an agglutinating agent for some materials, or I may use glue or starch, sugar, glucose, or a gum or resin or hydrocarbon, such as paraffin or other hydro-carbon, as an agglutinating agent, especially when oxalic acid is employed as a heat-absorbing agent or ingredient. When, however, employing a substance or material as a heat-absorbing agent or ingredient which does not attack or tend to decompose pyroxylin or nitroglycerin, I preferably employ as an agglutinating agent pyroxylin, either alone or in combination with nitroglycerin. When pyroxylin alone is employed, it is dissolved or gelatinated with either a volatile or non-volatile solvent; and when with a volatile solvent such as acetone, the solvent is evaporated from the grains before use. I have found a very good agglutinating compound to consist of a mixture of forty parts by weight of tri-nitro-cellulose and ten parts by weight of gelatin nitro-cellulose, and fifty parts by weight of nitroglycerin. From five to ten per cent. of the total weight of the grains of such an agglutinating agent is sufficient to

bind or agglutinate the particles of the grains and give to the grains the proper strength or cohesive property. I may, however, and sometimes do employ a much larger percentage of such agglutinating agent. An agglutinating agent consisting of pyroxylin or a compound of pyroxylin and nitroglycerin possesses the advantage that the combustion of the agglutinating agent facilitates and increases the rapidity of the decomposition of the cooling agent or agents or ingredients with which it is combined, or for which it is used as a binder.

Although a certain amount of heat is necessarily evolved by the burning of the binder, still, when a small or moderate percentage of such binder is employed, as, for example, from five to twenty-five per cent., the total heat evolved by the combustion of the binder or agglutinating agent is far less than is required for the complete decomposition of the cooling agent or agents with which it is combined to gasify the cooling agent and in the necessary expansion of the gases, so that such a compound still serves very largely as a cooling material for lowering the temperature of the products of combustion of the regular explosive smokeless gunpowder charge with which it is employed. While I preferably employ such limited quantity of an explosive material as an agglutinating agent as will evolve less heat than will be absorbed by the cooling agents agglutinated by it while the projectile is being thrown from the gun, still I may employ, and sometimes do employ still larger percentages of an explosive material as a binder, such as that named. For example, I may employ as the explosive smokeless powder charge a composition consisting of from thirty to fifty per cent. nitroglycerin and from fifty to seventy per cent. pyroxylin, and in conjunction with such explosive charge, I may employ as much as fifty per cent. or more of the explosive agglutinating agent or binder, and by so proportioning the charge with respect to the quantity of explosive and non-explosive materials employed, so regulate the temperature of the products of combustion as to approximate those of a pure nitro-cellulose powder; or I may so regulate the ingredients of the cooling charge and the explosive charge and the proportions of the one to the other as to produce products of combustion even considerably lower in temperature than the products of combustion of a pure nitro-cellulose powder. Furthermore, I may employ and sometimes do employ, according as may be required, a blended or graded charge, consisting of a highly or more highly explosive or combustible smokeless powder charge, in conjunction with two or more mixed charges of explosive and heat-absorbing materials, each varying in its degree of explosiveness or combustible qualities and in the degree of its heat-absorbing properties. For example, I may employ as a portion of the complete charge a compound consisting of fifty per cent. nitroglycerin and fifty per cent pyroxylin, and another portion consisting of twenty-five per cent. nitroglycerin and seventy-five per cent. pyroxylin, and an other portion consisting of pure nitro-cellulose, and another portion consisting of a cooling ingredient or ingredients agglutinated with anywhere from ten per cent. to twenty-five per cent. explosive material, and another portion of the charge consisting of a cooling ingredient or ingredients either agglutinated with a non-explosive material or without any agglutinating agent.

What is claimed is:—

1. A charge for guns consisting of grains of explosive material commingled with grains of heat-absorbing material progressively decomposable by the heat of combustion of the explosive material and at substantially the same rate as the rate of combustion of the latter.

2. A charge for guns consisting of grains of explosive material commingled with grains formed of a heat-absorbing material and an agglutinating agent, said heat-absorbing material being progressively decomposable by the heat of combustion of the explosive material and at substantially the same rate as the rate of combustion of the latter.

3. A charge for guns consisting of grains of explosive material commingled with grains formed of a heat-absorbing material and an explosive agglutinating agent, said heat-absorbing material being progressively decomposable by the heat of explosion of the explosive material and at substantially the same rate as the rate of combustion of the latter.

4. A charge for guns consisting of grains of smokeless powder and grains of a heat-absorbing material progressively decomposable by the heat of combustion of the smokeless powder and at substantially the same rate as the rate of combustion of the latter.

5. A charge for guns consisting of smokeless powder commingled with a heat-absorbing material, said powder and heat-absorbing material each existing as distinct and independent bodies having rates of combustion and decomposition substantially the same.

6. In a charge for ordnance, a cooling ingredient decomposable by heat and an explosive agglutinating agent, the heat required to decompose the cooling ingredient being greater than the heat of combustion of the explosive.

7. A charge for ordnance consisting of a plurality of gunpowders of different rates of combustion, and a non-explosive cooling ma-

terial decomposable by the heat of the products of combustion of said gunpowders and having a rate of decomposition substantially the same as the rate of combustion of said powder.

8. A charge for ordnance containing an explosive and a cooling material decomposable by heat, said cooling material consisting of sulfate of ammonia and a combustible agglutinating agent said cooling agent and explosive having rates of decomposition and combustion substantially the same.

9. A charge for ordnance containing an explosive and a cooling material decomposable by heat, said cooling material consisting of sulfate of ammonia and an agglutinating agent said cooling agent and explosive having rates of decomposition and combustion substantially the same.

10. A charge for ordnance comprising an explosive material and a non-explosive cooling material, said cooling material in the form of grains containing an ingredient decomposable by the heat developed by explosion of said first-named material, said explosive and cooling agent having rates of combustion and decomposition substantially the same.

11. A charge for ordnance comprising an explosive material and a non-explosive cooling material, the latter in the form of grains containing a non-explosive ingredient and an explosive agglutinating material, said grains being decomposable by the heat developed by explosion of the explosive in said charge and having a rate of decomposition substantially the same as that of the combustion of said explosive.

12. A charge for ordnance comprising an explosive charge consisting of a plurality of gunpowders of different rates of combustion and a non-explosive cooling charge in the form of grains containing an ingredient decomposable by the heat developed by explosion of said gunpowders and having a rate of decomposition substantially that of said blended explosive.

13. A powder charge for ordnance, consisting of two or more gunpowders of different rates of combustion, and a non-explosive cooling charge, decomposable by the heat of the products of combustion of said gunpowders and having a rate of decomposition substantially that of said blended explosive.

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

HUDSON MAXIM.

Witnesses:
T. CAMERON,
W. B. KERKAM.