UNITED STATES PATENT OFFICE.

DEMITRY MINDELEFF, OF SAN FRANCISCO, CALIFORNIA.

EXPLOSIVE.

SPECIFICATION forming part of Letters Patent No. 440,921, dated November 18, 1890.

Application filed August 19, 1890. Serial No. 362,441. (No specimens.)

To all whom it may concern:

Be it known that I, DEMITRY MINDELEFF, of San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Explosives; and I do hereby declare that the following is a full, clear, and exact description thereof.

This invention is an improvement in explosives, and its object is to provide an explosive insensible to concussion that can be handled with more safety and will yet have a greater explosive force than the ordinary high-power explosives.

The improved explosive consists, essentially, of a combination of nitrate of ethyl, nitrate of methyl, pyroxyline, and nitro-glycerine, and in combination of such elements with nitro-benzine, xyloidine, and penta nitro-cellulose, which substances are combined and prepared substantially in the proportions and manner hereinafter clearly set forth and claimed.

For the purpose of clearness and conciseness in the description, I will refer to some of the sub-combinations of elements employed in compounding my explosives by letters, as occasion may arise hereinafter.

In order to produce the most perfect results, I prefer to produce or treat some of the substances used in the explosive in a particular manner to purify them and facilitate their intermingling and coalescence in the explosive, and shall herein specify which of the substances I so prepare and the manner of preparing them, but do not herein claim such methods.

With these observations I will proceed to describe the preparation of the explosive. One of the principal ingredients in my explosive is nitro-glycerine; but the common nitro-glycerine employed in the manufacture of dynamite and made by ordinary processes contains impurities in considerable quantities and is objectionable or unfit for my purpose, and I therefore purify this common nitro-glycerine as follows: Common nitro-glycerine contains, as shown by analysis, one or more or all of the following impurities: Sulphate of lead (plumbic sulphate Pb,SO_4) and such as are produced by the chemical action of the nitric and sulphuric acids on the leaden vessels generally employed in the manufacture of nitro-glycerine. The lead salts are insoluble in water and are not separated from the common nitro-glycerine during the process of washing, but remain mechanically suspended therein. Another impurity is proto-sulphate of iron (Fe,SO_4,Aq) resulting from the action of acids on the iron vessels employed in making the common nitro-glycerine. While such salt is soluble in water, yet it is oxidized thereby during the process of washing common nitro-glycerine, and deposits a portion of oxide of iron, (Fe_2,O_3,) which remains mechanically suspended in the common nitro-glycerine. Again, the common nitro-glycerine generally contains fatty acids derived from the crude glycerine, such as stearic, margaric, oleic acids, &c., and more or less water. The presence of these impurities in common nitro-glycerine is evidenced by its impure cloudy color, as when thoroughly purified it is transparent. To get rid of these various impurities in the nitro-glycerine to be used in compounding my explosive, I take about seventy-five, eighty, or even eighty-five parts of common nitro-glycerine and add thereto sufficent ethyl alcohol to make one hundred parts in volume of the mixture. The stronger and purer the alcohol the less it is necessary to add, or a larger percentage of nitro-glycerine can be used. This mixture is gently agitated until the ingredients are thoroughly commingled, and is then left to settle. In two or three hours the mixture will separate into two distinct layers, each transparent and of a light yellow color. The upper layer of the mixture will be the ethyl alcohol, and contains in solution fatty acids and water derived from the common nitro-glycerine, and perhaps a small quantity of such nitro-glycerine. This upper layer should be removed by siphonage or decantation, as the ethyl alcohol does not enter into the composition of my explosive, and is used merely as a means of purifying the common nitro-glycerine, and must be entirely removed, since its presence will interfere with the union of the purified nitro-glycerine and other ingredients. The lower layer of such mixture consists of nitro-glycerine containing a small quantity of sulphate of lead and oxide of iron; but these

impurities will gradually precipitate themselves to the bottom, or could be separated from the nitro-glycerine by filtration. This leaves the nitro-glycerine pure and colorless, and I will distinguish it from common nitro-glycerine hereinafter by naming it "purified nitro-glycerine." Again, I take one part of nitrate of ethyl (nitro-ethyl C_2H_5,NO_3) and one part of nitrate of methyl (nitro-methylen CH_3,NO_3) and mix these together and dissolve therein about ten per cent. of pyroxyline. All three of these substances are highly explosive, both separately and in combination. This combination of ingredients I will refer to hereinafter as "mixture B." Again, I take one part of nitro-benzine (C_6H_4,NO_2) or di-nitro-benzine (C_6H_4,NO_2) and mix with it an equal volume of methyl alcohol, and dissolve in this mixture pyroxyline up to the point of saturation. This mixture of ingredients I will hereinafter call "mixture C."

The combination of purified nitro-glycerine and mixture B produces a powerful explosive, the proportions being about thirty-five parts of purified nitro-glycerine to fifteen parts of mixture B. Again, combining thirty-five parts of purified nitro-glycerine with fifteen parts of mixture C will afford a powerful non-sensitive explosive; but to make the most powerful explosive I take about seventy parts of purified nitro-glycerine, fifteen parts of mixture B, and about fifteen parts of mixture C and thoroughly incorporate the same. This final product constitutes a most powerful explosive, and is the base and body of my improved explosive compound, and it has a semi-fluid consistency. I may add to this compound powdered pyroxyline, commonly known as "pressed pyroxyline" or "xyloidine," (as ordinarily prepared.) Either of these will thicken this compound and make it plastic, and I use either as may be found most convenient and economical, according to the location of the factory and the purpose for which the explosive is to be employed. The addition of nitro-benzine, methyl alcohol, and pyroxyline (mixture C) is valuable in producing my explosive, as they render it non-sensitive to concussion. It is extremely dangerous to incorporate pyroxyline with ordinary nitro-glycerine; but the purified nitro-glycerine and compounds above described will readily and safely dissolve a considerable quantity of the soluble pyroxyline.

To increase the explosive force of my compound, I use, instead of pressed pyroxyline or xyloidine, an expressly-prepared form of pyroxyline, which is produced as follows: I take strong nitric acid, heat it to boiling, and add thereto as much soluble pyroxyline as the acid will dissolve. I subsequently pour this solution into five or six volumes of cold water. The pyroxyline is separated from the acid and is precipitated in a finely-divided powder, which is subsequently thoroughly washed from the acid and dried. This precipitated pyroxyline I call "penta nitro-cellulose," and add as much of it to the compound as is necessary to make it plastic. The compound described is transparent and might adhere to the exterior of vessels without being noticed.

To prevent accidents, I preferably stain it with aniline, cochineal, or other pigment that would not affect the compound or any of its constituents.

This improved explosive will not explode on concussion. Ignited in the open air it will burn slowly until it reaches a temperature of about 280° centigrade, when it explodes. It can be loaded into shells for artillery and safely fired from a cannon, and is also useful for torpedoes and other appliances of war, and is practically a safe explosive for industrial purposes.

To explode the compound, I use a detonator of fulminate.

Having described my invention, what I claim as new, and desire to secure by Letters Patent thereon, is—

1. An explosive compound consisting of nitrate of ethyl, nitrate of methyl, pyroxyline, nitro-glycerine, and a non-sensitizing mixture, substantially as described.

2. An explosive compound consisting of nitrate of ethyl, nitrate of methyl, nitro-benzine, methyl alcohol, pyroxyline, and nitro-glycerine, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

DELITRY MINDELEFF.

Witnesses:
ARTHUR E. DOWELL,
PERCY L. BROOKS.