UNITED STATES PATENT OFFICE.

ISADORE NIDITCH, OF DORCHESTER, MASSACHUSETTS.

COMPOUND FOR RAILWAY TIME SIGNAL-FUSEES.

1,029,884. Specification of Letters Patent. Patented June 18, 1912.

No Drawing. Application filed March 25, 1912. Serial No. 686,142.

To all whom it may concern:

Be it known that I, ISADORE NIDITCH, a citizen of the United States, residing at Dorchester, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Compounds for Railway Time Signal-Fusees, of which the following is a specification.

This invention relates to improvements in compounds for railway time signal fusees, having such novel chemical combination and characteristics, that it will meet all of the complex requirements of rough usage; burning in all kinds of weather conditions; burning a predetermined specified time in all kinds of weather; burning with brilliancy and force of flame; consuming the tough fiber tube in which the compound is packed uniformly with the burning of the compound to prevent "chimneying"; withstanding the shock of being thrown from a fast running train without breaking or being extinguished; capable of being readily kindled; capable of free burning at the lowest practical temperature, and at the same time will not be subject to spontaneous combustion irrespective of its age.

Several types of railway signal fusees have been heretofore produced, and they may be classified as the type which has been commonly referred to by those skilled in the art as chlorate fusees. This type of fusee comprises essentially a nitrate, sulfur, a corbohydrate, and potassium chlorate. A fusee of this character was manufactured and sold to railways and used by them exclusively for twenty or more years, although it was well known to the manufacturers and railways that it was subject to spontaneous combustion under the conditions of heat and moisture to which fusees are necessarily subjected in the transportation and storage thereof, and that disastrous fires had been caused by the spontaneous combustion of this type of fusees. For years, the manufacturers of railway time signal fusees sought to overcome the defect of spontaneous combustion, and they were urged on in these efforts by the chemists of railways, the Bureau for the Safe Transportation of Explosives, and others. A cure for this defect was sought for years by the manufacturers, the chemists of railways, the latter seeking the assistance of some of the best known American chemists. It was ascertained that sulfur in the presence of heat and moisture produced sulfurous and sulfuric acid and that this was the prime cause of the spontaneous combustion when in contact with potassium chlorate, and in my investigations of the cause of spontaneous combustion in railway time signal fusees, I discovered that it was the formation of sulfurous and sulfuric acid that was primarily responsible for spontaneous combustion in railway signal fusees. Having reached this conclusion in my investigations, I began to work with the end in view of producing a railway time signal fusee compound which would meet all of the complex requirements of such an article, and yet would not be subject to the foregoing recognized defect. Having found that the presence of sulfur in the compound was the prime cause of spontaneous combustion in railway time signal fusees, I sought to produce a compound which did not contain this chemical element, and worked along that line. In this investigation I discovered that sulfur was necessary to maintain the kind of combustion required to consume the tough fiber tube uniformly with the burning of the composition to prevent "chimneying," one of the many complex conditions which must be avoided in such fusees to prevent so obscuring the light that it is not visible for sufficient distances under all weather conditions, and in all positions to act as a reliable railway time signal fusee.

The formation of sulfurous and sulfuric acid by reason of the necessary presence of sulfur in the composition being primarily responsible for the spontaneous combustion in railway time signal fusees, I took up the problem of trying to control or prevent the formation of this acid. In these efforts I used a chemical agent which would absorb and neutralize the acid which was generated by the sulfur in the presence of moisture and heat. The neutralizing chemical agent used by me was calcium carbonate. I discovered that while this chemical would neutralize the acid as generated to a limited extent, it also had the characteristic of seriously retarding combustion, and if used in any appreciable quantity would practically or wholly stop combustion. My investigation with this neutralizing agent also convinced me that a small quantity of it can be used without seriously retarding or otherwise seriously affecting the compound. I carried on my investigation in this line very thoroughly, and I discovered that the maxi-

mum quantity of carbonate or neutralizing agent that could be used without seriously retarding combustion was very small as compared with the quantity of sulfur and potassium chlorate that must be used to make a compound that would meet all the complex requirements of a railway time signal fusee. I also discovered by this thorough investigation with the neutralizing agent in sulfur and chlorate fusees, that when the sulfurous and sulfuric acid was generated, they would react preferably with the carbonate and there would not be any spontaneous ignitible gases generated, but that in the course of a relatively short time the neutralizing medium would be entirely used up, while the sulfur which is present in so much larger quantity would continue to evolve the sulfurous and sulfuric acids. These acids not having any more neutralizing chemical to react with, will now attack the potassium chlorate causing spontaneous ignition. I continued my work seeking a remedy for the said defect in railway signal fusees and discovered that the manufacture of time railway signal fusees using my compound as defined in my Patent 954,330 of April 5th 1910, was an absolute cure of the defect of spontaneous combustion in railway time signal fusees. This new perchlorate compound was presented to the Bureau for the Safe Transportation of Explosives and considered by the bureau to be such a step forward in the art, and of so much importance, that it caused to be issued specifications for fusees and in many ways urged the railroads of the country to adopt the new fusee. These specifications read in part as follows:

"Composition must not contain a mixture of a chlorate and sulfur, or of a chlorate and an ammonia salt. Temperature of ignition of compositions must not be less than 250° C."

My patented perchlorate railway time signal compound will not ignite at a temperature of less than 310° C., which is considerably higher than the 250° C. required by the specifications of the Bureau for the Safe Transportation of Explosives, and by reason of its high ignition temperature, it requires a high temperature for easy kindling and free burning. A compound which would light and burn freely at a lower temperature than the perchlorate compound (but above the specification requirements) and yet not subject to spontaneous combustion, would be a decided improvement upon my patented perchlorate compound, for it would have all the advantages thereof, with greater ease of kindling and freer burning.

Working with the end in view of producing an improved railway signal fusee compound as compared with the prior art herein set forth, I have discovered that by adding a relatively large amount of perchlorate and a relatively small amount of chlorate to a fusee compound which contains sulfur, the composition will not be subject to spontaneous combustion, even in the presence of sulfurous and sulfuric acid generated by the sulfur; will be of a considerably lower temperature of ignition; possess the highly desirable qualities of easy kindling and free burning, and that the composition will meet all of the complex requirements of a railway time burning signal fusee, and will comply with the specifications of the Bureau for the Safe Transportation of Explosives, as to temperature of ignition of compound and freedom from spontaneous ignition. I have discovered that to carry out my present improvement, it is essential that the quantity of perchlorate be much larger than the quantity of chlorate in order to prevent spontaneous ignition, and at the same time meet all of the complex requirements of a railway time signal compound as hereinbefore set forth.

The proportions of the ingredients of my improved compound may be varied within certain limits, but the preferred quantities of the essential ingredients are about 65 parts of nitrate; 13 parts of sulfur; carbohydrate (preferably greased sawdust) 6 parts; 11 to 13 parts of perchlorate, preferably potassium perchlorate, and from 1 to 3 parts of chlorate, preferably potassium chlorate. In practice it is usual to add to these ingredients, charcoal and antimony in small quantities, generally 1 part of each.

Having thus described my improved railway time burning signal fusee compound, and what I consider the best manner of practising it, what I claim and desire to secure by Letters Patent is:

1. An improved time burning railway signal fusee, comprising a metallic nitrate, a carbohydrate, sulfur, perchlorate, and a small quantity of chlorate, producing a readily ignitible and free burning railway time signal fusee compound having brilliancy and force of flame, and which is not subject to spontaneous combustion.

2. An improved time burning railway signal fusee, comprising a metallic nitrate, a carbohydrate, sulfur, perchlorate, and a small quantity of potassium chlorate, producing a readily ignitible and free burning railway time signal fusee compound having brilliancy and force of flame, and which is not subject to spontaneous combustion.

3. An improved time burning railway signal fusee, comprising a metallic nitrate, a carbohydrate, a perchlorate, sulfur, and a percentage of potassium chlorate less than the perchlorate, producing a readily ignitible and free burning railway signal fusee compound having brilliancy and force of flame and which is not subject to spontaneous combustion.

4. An improved time burning railway signal fusee, comprising a metallic nitrate, a carbohydrate, sulfur, a perchlorate, and a percentage of potassium chlorate less than the percentage of either the nitrate, sulfur, or perchlorate, producing a readily ignitible and free burning railway signal fusee compound having brilliancy and force of flame, and which is not subject to spontaneous combustion.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

ISADORE NIDITCH.

Witnesses:

CADWALADER J. CLARK,

WILLIAM A. CONLEY.