

UNITED STATES PATENT OFFICE.

LOUIS S. ROSS, OF NEWTONVILLE, MASSACHUSETTS.

TIME-BURNING RAILWAY SIGNAL-FUSEE.

1,059,767.

Specification of Letters Patent.

Patented Apr. 22, 1913.

No Drawing.

Application filed October 11, 1912. Serial No. 725,343.

To all whom it may concern:

Be it known that I, LOUIS S. ROSS, a citizen of the United States, and a resident of Newtonville, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Time-Burning Railway Signal-Fusees, of which the following description is a specification.

This invention relates to improvements in time burning railway signal fusees, the primary object thereof being to produce a fusee for such purpose that will not spontaneously ignite under conditions to which it is necessarily subjected, which will not be extinguished when thrown from a moving train or otherwise subjected to severe shock, which insures continuity and tenacity of the flame after lighting, and which insures depth and intensity of color and a greater brilliancy and more force of flame than any fusee heretofore produced containing either chlorate or perchlorate, or both.

In most compositions for railway signal fusees produced prior to my invention, there have been certain recognized characteristics of the ingredients contained in the fusees that render the latter extremely susceptible to spontaneous ignition, particularly in the presence of heat or moisture.

The railways of the United States for a number of years past have maintained a bureau for the safe transportation of explosives and other dangerous articles. This bureau employs chemists to investigate questions relating to the manufacture of explosives and other dangerous articles, and from time to time makes regulations and issues specifications prescribing the inherent characteristics of time burning railway signal fusees. These regulations must be passed upon and approved by the Interstate Commerce Commission to render them legally binding and effective. In accordance with the requirements of the said bureau, railway signal fusees usually comprise a paper tube of heavy, tough fiber, in which the composition is packed, carrying at one end a spike adapted to penetrate the railway ties or bed and having at its opposite end means for igniting the fusee. Railway signal fusees are usually thrown from the rear of a moving train and are necessarily therefore subjected to rough usage. It is therefore necessary to have the paper tube

of sufficient strength to withstand this usage without breakage. These fusee paper tubes are therefore made of heavy, tough fiber, as stated, and the railroads require that the finished fusee must stand a specified, relatively heavy weight at its center when supported at its ends. One of the tests of the said bureau is that the fusee after burning a number of seconds in air must burn a specified time when completely submerged in water. It is further required by the said bureau that the fusee must burn a predetermined specified length of time. It must burn with brilliancy and force of flame and it must burn under either favorable or unfavorable weather conditions. In other words, the railway signal fusee must burn in strong winds or storms or even in pools of water or snowbanks.

By reason of the necessity of burning the tube in uniformity with the burning of the composition and also of the necessity that the composition burn with force and brilliancy, all successful compositions for railway signal fusees heretofore employed have contained sulfur and potassium chlorate as fundamental ingredients, with the single exception that a perchlorate, preferably perchlorate of potassium, has been substituted for the chlorate in a composition containing sulfur.

For many years it has been known that time burning railway signal fusees containing sulfur and potassium chlorate as heretofore combined were subject to spontaneous ignition and combustion due to climatic conditions of heat and moisture and age, because of the presence of said ingredients in the composition, and attempts have been made for many years by railway chemists and others to overcome this serious defect. This objection has been overcome by me by the use of an acid neutralizing agent, as set forth in my Patent No. 1,019,190, dated March 5, 1912. Such spontaneous ignition has been attributed to the production from sulfur in the presence of heat and moisture of sulfurous and sulfuric acids, which in the presence of potassium chlorate decompose the latter and generate chlorine peroxid. The formation of sulfuric acid from sulfur requires the presence of oxygen, which is readily obtained in the breaking up of the potassium chlorate, whereby heat is generated, accelerating and helping to continue

the reaction until a condition is reached that produces spontaneous combustion. The so-called chlorate time burning railway signal fusee is composed of chlorate, sulfur, carbohydrate and metallic nitrate in suitable proportions. In order to overcome the tendency to spontaneous ignition characteristic of the chlorate fusee, a so-called perchlorate fusee has been made by substituting perchlorate of potassium for the chlorate of potassium.

A fusee made of mixtures containing a perchlorate, such as perchlorate of potassium, is recognized to be harder to ignite and more easily extinguished when thrown from a moving train than a fusee of the so-called chlorate type. The so-called perchlorate fusee, in spite of this objection, is used because of its substantial freedom from spontaneous ignition.

Because of the fact that a perchlorate fusee is substantially free from danger of spontaneous ignition or combustion, I have conducted a series of experiments in order to produce if possible a perchlorate fusee which will not be readily extinguished by sudden shock, and the flame of which will burn with increased depth and intensity of color and with greater brilliancy and more force of flame than the so-called perchlorate fusee. I have as the result of said experiments discovered that if in addition to a suitable quantity of potassium or other suitable perchlorate, such, for example, as barium, sodium or ammonium perchlorate, I employ a small quantity of peroxid, such, for example, as barium peroxid, strontium peroxid, sodium peroxid or any other suitable peroxid, I not only produce a time burning railway signal fusee not liable to spontaneous ignition or combustion, but I obtain a fusee the temperature of ignition of which is maintained at the desired high point of 250° C. or higher. In addition I increase the inflammability of the fusee compound, increase the tenacity and force of flame of the fusee composition and increase the depth and intensity of the color and the brilliancy of the flame. This fusee is not readily extinguished under adverse conditions. Moreover the stability of the perchlorate (by reason of the employment of which the so-called perchlorate fusee is readily extinguished when thrown from a train or upon receiving a sudden shock) is modified by the peroxid, so that the modified fusee is not readily extinguished by sudden shock or when thrown from a train.

In addition to the ingredients enumerated, I may employ a small quantity of chlorate, preferably chlorate of potassium, barium, sodium or ammonium, not exceeding substantially five per cent. of the entire composition. The said chlorate is advantageous when combined with a perchlorate

in a time burning railway signal fusee, inasmuch as such modified perchlorate fusee will not be readily extinguished by sudden shock and the flame thereof will burn with continuity. Chlorate when used as set forth with perchlorate in a perchlorate fusee will not, however, produce increased depth and intensity of color of the flame. Moreover, as far as possible mixtures of chlorate and sulfur should be avoided unless an acid neutralizing agent be employed. These characteristics, namely, the increased depth and intensity of color and the greater brilliancy and more force of flame are imparted thereto, as I have found by my experiments, by the employment of peroxid as described. Moreover, the said peroxid not only imparts the said characteristics, but when combined with perchlorate the fusee is not readily extinguishable by sudden shock, and imparts continuity and tenacity to the flame of the fusee.

Perchlorate fusees as heretofore manufactured usually contain from five or six to twenty per cent. of potassium or other perchlorate combined with which are nitrate, sulfur and carbohydrate with charcoal and antimony, if desired, in substantially the following proportions: metallic nitrate 50 to 95%, sulfur 3 to 23%, carbohydrate 1 to 11%, charcoal 1%, antimony 1%.

In accordance with my invention, I preferably provide as customary in the so-called perchlorate fusee, a suitable mixture of perchlorate (preferably perchlorate of potassium, though I may employ any suitable perchlorate, such for example as barium, sodium or ammonium perchlorate), sulfur, carbohydrate, hydrocarbon or any other suitable carbonaceous material, and a metallic salt, such as metallic nitrate or oxid to which if desired I may add charcoal and antimony. The perchlorate of potassium is used to furnish the principal supply of oxygen, the sulfur mainly to increase combustion, the carbohydrate and the hydrocarbons or carbonaceous material to furnish carbon and hydrogen to aid combustion and to smooth and deepen the flame, and the metallic salt, preferably that of strontium, barium or sodium, to constitute the base or color ingredient. While the proportions of these ingredients may be varied, they may be those previously stated with the admixture of a suitable quantity of peroxid, such, for example, as barium peroxid, strontium peroxid or sodium peroxid or any other suitable peroxid, in a small quantity, preferably not exceeding substantially eight per cent. of the entire mixture. The carbonaceous material preferably employed by me consists of rosin or red gum, charcoal and sawdust and grease in suitable proportions. The red gum employed is the powdered bark of the red gum (*Eucalyptus rostrata*).

In addition, I may employ a small quantity of chlorate, such, for example, as chlorate of potassium, barium or sodium or ammonium. It will be understood that I may employ one or more carbohydrates, hydrocarbons or carbons, either alone or in any suitable mixture, or that any two of such or other carbonaceous materials may be employed.

I have obtained excellent results by employing the following formula, wherein the ingredients are specified in percentages: metallic nitrate 50 to 80%, peroxid (of barium, of strontium or of sodium) 1 to 8%, sulfur 10 to 15%, carbohydrate 2 to 7%, hydrocarbon, such as petroleum, paraffin, naphthalene or benzene 1 to 3%, perchlorate of potassium, of barium, of sodium or of ammonium 5 to 20%. In addition I may employ a small quantity of chlorate (of potassium, of barium, of sodium or of ammonium) not exceeding substantially five per cent. of the entire mixture.

Preferably in making a so-called green burning fusee, I employ barium peroxid; in making a so-called red burning fusee I employ strontium peroxid and in making a so-called yellow burning fusee I employ sodium peroxid.

Extensive experiments carried out by me have shown that a fusee composed as herein disclosed will successfully meet the high temperature of ignition test prescribed by the bureau for the safe transportation of explosives. Moreover, such fusee is found to be immune from spontaneous ignition. If I employ a chlorate as previously stated, I preferably introduce the chlorate to the extent of about two or two and a half per cent. of the entire composition, and I have ascertained that the fusee containing such quantity of chlorate is not liable to spontaneous ignition, as previously set forth. It will be observed that in the formula above set forth the quantity or proportion of metallic nitrate, of sulfur and of perchlorate exceed that of the peroxid, and with such relative proportions I have obtained the best results.

The time burning railway signal fusee compound embodying my invention contains as essential ingredients a perchlorate and a peroxid (any suitable perchlorate and any suitable peroxid being used) together with sulfur. To this composition I preferably add one or more of the other ingredients specified by me, and for the best results I add metallic nitrate and some suitable carbonaceous material.

I employ the term "carbonaceous material" to include hydrocarbons, carbohydrates, carbons and other suitable carbon containing material.

Having thus described one embodiment of my invention, I desire it to be understood that although specific terms are employed,

they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

Claims

1. A time burning railway signal fusee comprising a metallic nitrate, carbonaceous material, sulfur, perchlorate, and peroxid.

2. A time burning railway signal fusee comprising a metallic nitrate, carbonaceous material, sulfur, perchlorate and strontium peroxid.

3. A time burning railway signal fusee including sulfur, perchlorate and peroxid.

4. A time burning railway signal fusee including sulfur, perchlorate, and peroxid, the said ingredients being combined in such proportions as to produce a time burning railway signal fusee compound burning with brilliancy, tenacity, intensity and force of flame, and not liable to spontaneous ignition or combustion.

5. A time burning railway signal fusee including sulfur, perchlorate, carbonaceous material and peroxid.

6. A time burning railway signal fusee comprising metallic nitrate, carbonaceous material, sulfur, perchlorate and a quantity of peroxid less in amount than the sulfur.

7. A time burning railway signal fusee comprising metallic nitrate, carbonaceous material, sulfur, perchlorate and a quantity of peroxid less in amount than the metallic nitrate.

8. A time burning railway signal fusee comprising metallic nitrate, sulfur, carbohydrate, hydrocarbon, perchlorate and peroxid.

9. A time burning railway signal fusee comprising metallic nitrate, sulfur, carbonaceous material, perchlorate, and not to exceed eight per cent. of peroxid.

10. A time burning railway signal fusee comprising a metallic nitrate, carbonaceous material, sulfur, perchlorate and a small quantity of peroxid, not exceeding substantially eight per cent. of the entire composition, the ingredients being combined in such proportions as to produce a time burning railway signal fusee compound burning with brilliancy, tenacity, intensity and force of flame, and not liable to spontaneous ignition or combustion.

11. A time burning railway signal fusee comprising fifty to eighty per cent. metallic nitrate, ten to fifteen per cent. sulfur, three to ten per cent. carbonaceous material, five to twenty per cent. perchlorate and a quantity of peroxid not exceeding substantially eight per cent. of the entire composition.

12. A time burning railway signal fusee including sulfur, perchlorate and a small quantity of peroxid not exceeding substantially eight per cent. of the entire composition, thereby producing a time burning rail-

ray signal fusee compound burning with brilliancy, tenacity, intensity of color and force of flame, and not liable to spontaneous ignition or combustion.

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

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

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

16. A time burning railway signal fusee 30 comprising a metallic nitrate, a carbohydrate, sulfur, perchlorate, a percentage of potassium chlorate less than the percentage of either the nitrate, sulfur or perchlorate, and a small quantity of peroxid not exceeding 35 substantially eight per cent. of the entire composition, thereby producing a readily ignitable and free burning railway signal fusee compound having brilliancy and force of flame, and which is not sub- 40 ject to spontaneous combustion.

17. A time burning railway signal fusee including sulfur, perchlorate, carbonaceous material and peroxid, the ingredients being combined in such proportions as to pro- 45 duce a time burning railway signal fusee compound burning with brilliancy, tenacity, intensity and force of flame, and not liable to spontaneous ignition or combustion.

In testimony whereof, I have signed my 50 name to this specification, in the presence of two subscribing witnesses.

LOUIS S. ROSS.

Witnesses:

IRVING U. TOWNSEND,
ROBERT H. KAMMLER.