

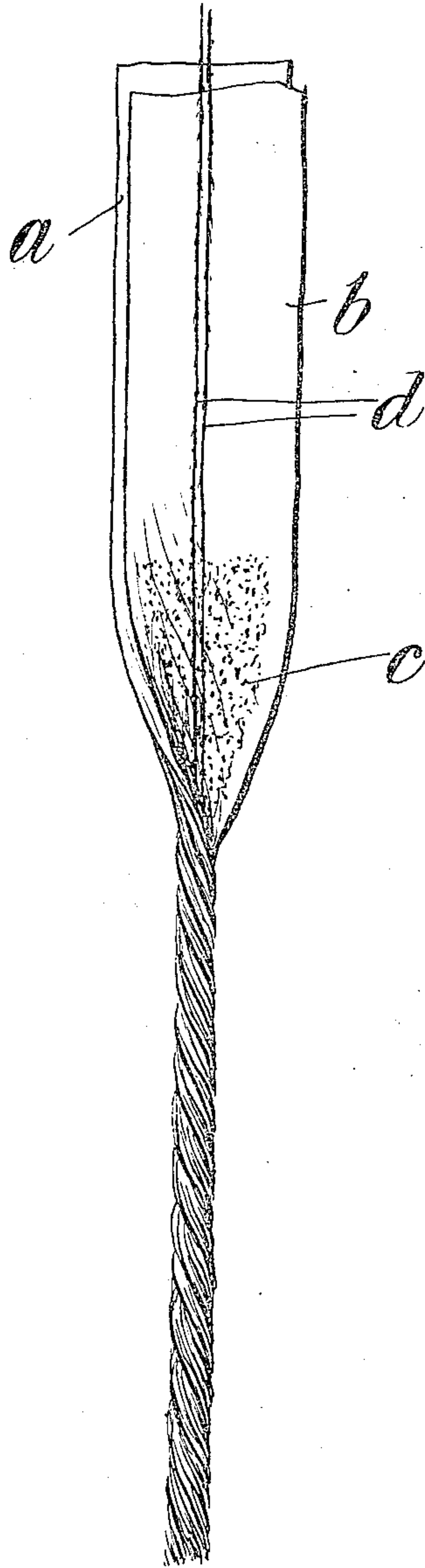
L. & J. SCHULMAN.

FUSE.

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922,343.

Patented May 18, 1909.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

LOUIS SCHULMAN AND JOSEPH SCHULMAN, OF NEW YORK, N. Y., ASSIGNORS TO AMERICAN FIRECRACKER MFG. COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## FUSE.

No. 922,343.

Specification of Letters Patent.

Patented May 18, 1909.

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To all whom it may concern:

Be it known that we, LOUIS SCHULMAN, a citizen of the United States of America, and a resident of Brooklyn, county of Kings, city and State of New York, and JOSEPH SCHULMAN, a citizen of the United States of America, and a resident of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Fuses, of which the following is specification, reference being had to the accompanying drawings, forming a part thereof.

Our invention relates to an improved fuse, such as is particularly adapted for use in connection with fire-works, and for blasting, and for similar purposes.

A fuse constructed in accordance with our invention comprises one or more strips of paper twisted tightly into rope-like form, and an explosive compound contained within the same and within the folds formed by the twisting. The paper is preferably impregnated with a solution containing combustible or explosive elements so that the paper itself becomes a part of the fuse proper, and is not a mere wrapping for the same. The explosive compound employed comprises such ingredients as will be but little affected by moisture, and the paper itself being impregnated will also be little affected by moisture, so that the entire fuse is substantially damp proof. One or more cotton threads may be employed through the center of the fuse, if preferred.

The main objects of the invention are, first, to provide a cheap and easily manufactured fuse; second, to provide a fuse which shall burn with a visible flame; third, to provide a slow burning fuse; and fourth, to provide a fuse which, while not covered with any water-proof envelop, shall not be materially affected by dampness or moisture.

The drawing herewith illustrates a fuse constituting the embodiment of our invention.

The paper element of the fuse may comprise one or more strips, the drawing showing two such strips, *a*, *b*. These strips may conveniently be in the form of tape from one-half an inch to five-eighths of an inch in width and of an indefinite length. In the manufacture of the fuse this tape or these tapes are twisted lengthwise while the explosive compound *c* is fed thereto. The result is that the compound is not only enveloped

by the paper, but the said compound is substantially distributed throughout the same, being contained in the twists or convolutions of the paper as it is formed into the finished fuse.

One or more cotton threads *d* may be employed centrally along the fuse, if preferred, such cotton threads being useful for the purpose of assisting the feeding of the explosive compound to the paper strips.

Prior to the twisting operation the paper is preferably impregnated with a solution containing paste, sulfur, and saltpeter. This solution may be prepared by taking the ingredients in the proportion of about one pound of commercial starch paste and mixing therewith about four ounces of saltpeter. The result of thus treating the paper is, first, to render it pliable so that it may be easily handled and twisted without breaking; second, because the twist, once formed, to be maintained when the paper is dried; third, the paste element has the effect of cementing the different parts together; and fourth, the saltpeter and sulfur render the paper so readily inflammable that it actually becomes one of the combustible elements of the fuse as a whole.

The explosive compound is composed of a mixture of one of the metallic chlorates, one of the metallic nitrates, sulfur, and carbon; the particular ingredients we have so far employed with good results being potassium chlorate, potassium nitrate, sulfur flour, and powdered charcoal. We have combined these ingredients with good success in the following proportions: 38%  $\text{KClO}_3$ , 26%  $\text{KNO}_3$ , 17% S, 19% C. Of course, it will be understood that these proportions may be varied within certain limits. In practice we have found that variations may be made within a limit of about ten per cent. without materially affecting the result.

It will, of course, be understood that other chlorates and nitrates besides potassium chlorate and potassium nitrate may be employed, and that the carbon element may be introduced in other forms besides in the form of charcoal.

It will be readily understood that a fuse constructed in accordance with the foregoing will be very cheap, because the ingredients are all inexpensive and in manufacturing may be readily and quickly carried out. The paper becoming one of the com-



bustible elements causes the fuse to burn with a visible flame, and this is highly desirable in some work,—particularly in fire-work fuses. The fuse is a slow burning one 5 moreover and the speed at which it will burn may be readily regulated by the tightness of the twist,—the tighter the twist in the paper the slower the burning, and the looser the twist, the quicker. In practice it is 10 found that because of the incorporation of the compound in the twists of the paper the burning takes place along a spiral path, and this tends to make a slower burning fuse with regard to the damp proof qualities.

15 We have found in actual practice that a fuse made in accordance with the foregoing will, if once lighted, continue to burn even though it be plunged directly and entirely into water and retained there. Moreover, 20 we find that if a fuse so prepared be partially immersed in water with merely an end left exposed above the water, and such end lighted, the fuse will then burn continuously from end to end.

25 What we claim is:

1. A fuse composed of one or more strips of twisted paper, and an explosive compound contained therein, the explosive compound being contained within and between the 30 twisted folds of the strip or strips, thereby forming a substantially spiral fuse of rope like form.

2. A fuse composed of one or more strips of twisted paper, an explosive compound 35 contained therein, and one or more threads of cotton as a central bore, the explosive compound being contained within and between the twisted folds of the strip or strips, thereby forming a substantially spiral fuse 40 of rope like form.

3. A fuse comprising one or more strips of twisted paper, and an explosive compound contained within and between the twisted folds thereof, the paper of which the strip 45 or strips are composed having been impregnated with a solution containing explosive elements, and paste.

4. A fuse comprising one or more strips of twisted paper, and an explosive compound

contained in the twisted folds thereof, the 50 paper of which the strip or strips are composed having been impregnated with a solution containing potassium nitrate, sulfur, and paste.

5. A fuse comprising one or more strips 55 of twisted paper, and an explosive compound contained therein comprising a metallic chlorate, a metallic nitrate, sulfur, and carbon.

6. A fuse comprising one or more strips of 60 twisted paper, and an explosive compound contained therein comprising about 38% of a metallic chlorate, about 26% of a metallic nitrate, about 17% sulfur, and about 19% carbon. 65

7. A fuse comprising one or more strips of twisted paper, and an explosive compound contained therein comprising about 38% of potassium chlorate, about 26% of potassium nitrate, 17% sulfur, and about 19% 70 charcoal.

8. A fuse composed of one or more strips of twisted paper, and an explosive compound contained therein, the paper of which the 75 strip or strips are composed having been impregnated with a solution containing combustible elements, and the explosive compound comprising a metallic chlorate, a metallic nitrate, sulfur, and carbon.

9. A fuse comprising one or more strips of 80 twisted paper, and an explosive compound contained in the twisted folds thereof, the paper of which the strip or strips are composed having been impregnated with a solution containing potassium nitrate and sulfur, 85 and an explosive compound comprising about 38% potassium chlorate, about 26% potassium nitrate, about 17% sulfur, and about 19% charcoal.

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