

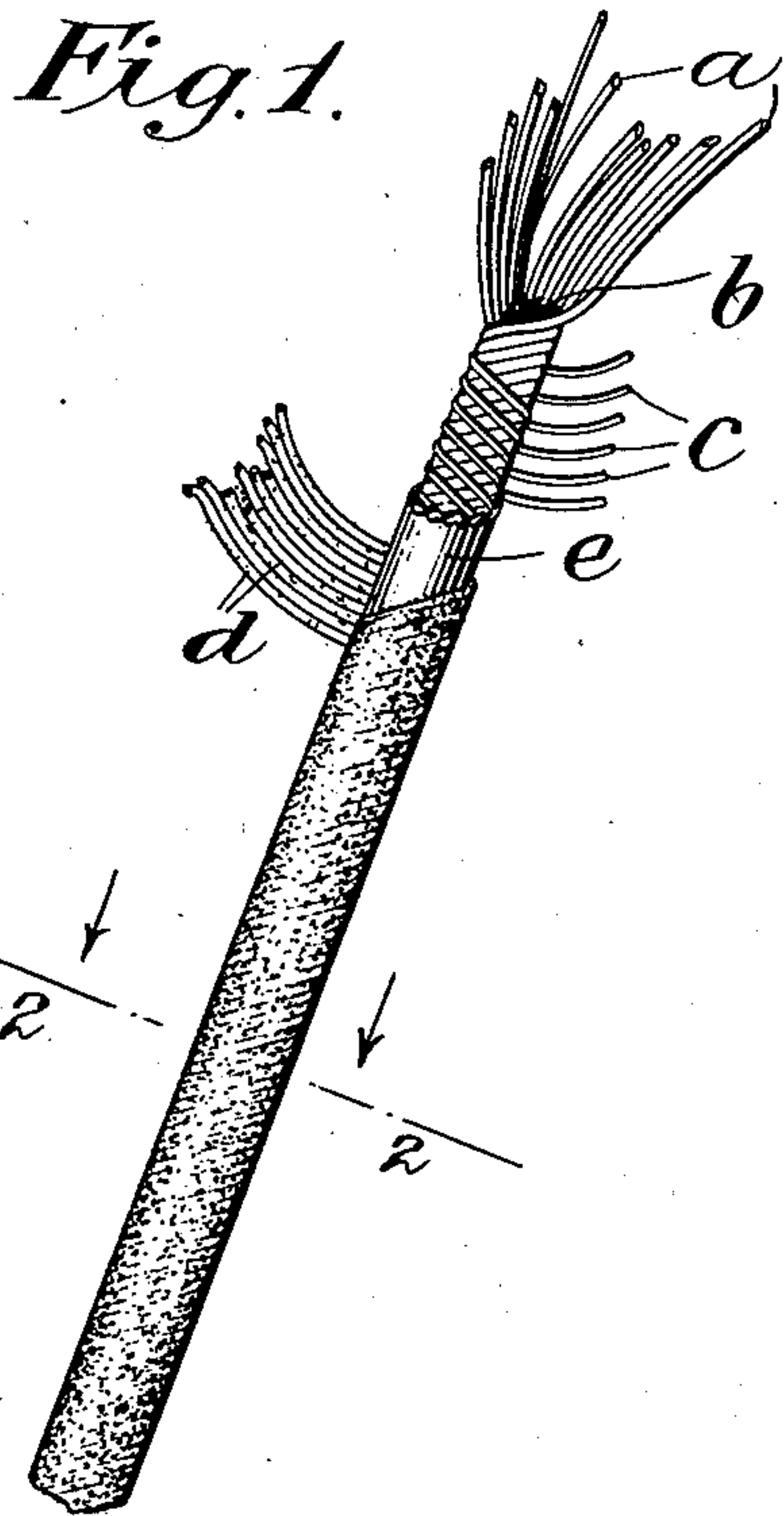
H. E. ELLSWORTH.

FUSE.

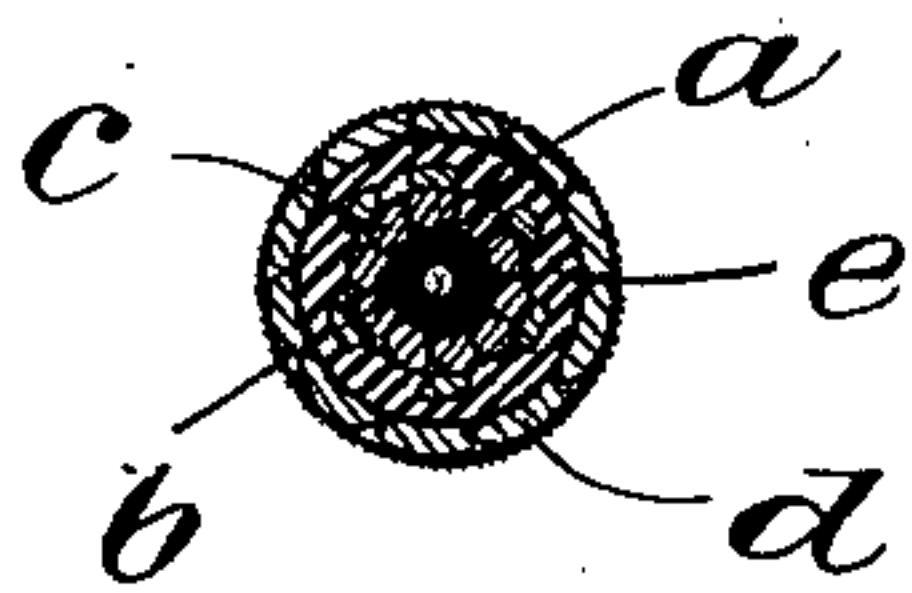
APPLICATION FILED MAY 4, 1908.

920,118.

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*Fig. 2.*



Attest:  
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# UNITED STATES PATENT OFFICE.

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## FUSE.

No. 920,118.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, HENRY E. ELLSWORTH, a citizen of the United States, and a resident of the town of Simsbury, in the State of Connecticut, have invented certain new and useful Improvements in Fuses, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

10 In the use of fuse, and in particular of safety fuse or fuse employed in continuous lengths, it is desirable that it shall not fire through or spit, that is, that it shall not burn through its outer casing, whatever that casing may be, or render the same hot enough to ignite any inflammable substance which may for the time being surround the same or be in contact therewith. In mining, for instance, where powder is placed in holes 20 which have been drilled say from six to eight feet in depth and where such charges are fired by leading a fuse down through five or six feet of powder in order to ignite a cap near the bottom of the charge, it is impracticable to employ a fuse which, while it is conducting the fire to the cap, permits the fire to issue from its sides or whose periphery becomes heated to such an extent as to set fire to the powder before the fuse has communicated the fire to the cap. Where the powder is thus ignited before the cap is fired it burns and does not explode, and the burning of the powder produces a great deal of smoke; so that in such cases the effect of 35 the blast is not only lost, but the workings, at the operating point, are filled with gas and smoke which it takes a considerable time to clear away, before the operating point can again be approached.

40 To obviate such objectionable results and to produce a fuse which will not spit through or heat up excessively, is the object of the present invention. The latter, moreover, may be carried out in several ways, and 45 offers a particular advantage in that fuse embodying the improvements may be manufactured by spinning and countering the same as heretofore. In describing the invention a fuse thus spun and countered is 50 made use of for purposes of illustration and explanation, although it will be understood that such a structure constitutes merely one embodiment of which the invention is capable.

In the drawings where such fuse is illus-

trated, Figure 1 is a perspective view of a 55 short length thereof with one end laid open to show the different parts, and, Fig. 2 is a view in transverse section on a large scale.

In constructing this fuse the longitudinal strands or threads *a* are spun in any convenient manner while gun-powder (indicated at *b*) or any other suitable medium for transmitting or conveying the fire through the fuse, is fed between the strands so as to lie substantially along the center of the finished 65 fuse. The spun threads or strands *a* are covered or countered by being wound with counter strands *c* which bind the strands *a* rather tightly and maintain them in their spun position with the powder between 70 them. A double set of counter strands is preferably provided, the outer set of counter strands being indicated by the letter *d*, and in fact as many sets of counter strands may be provided as is desirable in any particular 75 case. In manufacturing fuse in this way, special machinery is generally provided to spin the longitudinal strands and wind the counter strands, all of which is old and well understood in the art and therefore requires 80 no particular description herein.

In accordance with the present invention the material of the fuse which is immediately associated with the powder is either substantially fire proof or rendered so before the fuse 85 is completed. I have discovered that in this way the objectionable spitting-through of the fire as the fuse burns may be entirely obviated, and that the periphery of the fuse does not become heated by the burning to any excessive extent. The reason for this, as it seems to me, is that as the fuse burns, the combustion is confined to the powder alone and does not extend in any substantial degree to the material of the fuse, whereby a 95 great deal less gas and smoke is produced in the interior of the fuse and consequently the pressure developed in the interior of the fuse during the burning thereof is greatly reduced. Besides this reduction in pressure, there is no 100 weakening of what may be referred to as the walls of the fuse which in other cases would be caused by the burning of these walls; so that it will be easy to see that the liability of the gases developed in the interior of the fuse 105 to project the flame, so to speak, through the sides of the fuse will be greatly decreased. Moreover the presence of a fire proof material



or medium around the burning powder not only lessens the power of the fuse to conduct the heat of combustion to the exterior thereof but also, by remaining unburned, keeps the  
 5 actual burning or combustion at a greater distance from the periphery. Thus the periphery is much less liable to become excessively heated.

In the present case the material immediately associated with the powder is represented by the longitudinal strands *a*, and while these strands may be made of any fire proof material, I prefer to make them of cotton and render them fire proof in any convenient manner, as by applying a chemical  
 15 solution. I have found, for instance, that by immersing cotton strands, before the spinning process, in a solution of sodium silicate diluted to about 25° Baumé and then, before  
 20 thoroughly drying the strands, immersing them again in a solution of aluminum and copper sulfates (composed of one part of each of the sulfates to ten parts of water) and finally drying the strands slowly in the air, a  
 25 very satisfactory material is provided for my purpose. I do not limit myself however to the employment of any particular chemical solution for the purpose of rendering the longitudinal strands fire proof, nor do I confine  
 30 myself to the employment of longitudinal strands which require treatment to render them fire proof, for, as I stated above, I may employ longitudinal strands made of material which is fire proof by nature. And I  
 35 also wish it to be particularly understood that I do not limit myself to the employment of longitudinal strands as the only form of the material which is immediately associated with the gun-powder, as such material may  
 40 obviously be in some other form than longitudinal strands.

In using my improved fuse, it is often necessary to run the same through water so that it is desirable to render it waterproof in some  
 45 suitable manner. For this purpose, after the longitudinal strands have been spun and the counter strands *c* have been wound thereon, I apply a layer of gutta percha which thoroughly permeates and unites the counter  
 50 strands *c* and forms a gum-like coating over the same. Of course, other materials such as varnish and the like may be employed for this purpose but I find that gutta percha works particularly well. I also preferably  
 55 apply asphaltum to the strands *c* which assists in uniting them together and adds to the water proof qualities of the fuse. Over the layer of gutta percha the strands *d* heretofore referred to, are wound, and then the fuse is  
 60 finished by applying thereto a mixture of china clay or some other finishing substance, which can be done by causing the fuse to be passed through such a mixture. In this way the body portion of the fuse which consists  
 65 of the gun-powder and its vehicle, preferably

of spun strands as above set forth, is provided with an impervious cover consisting of the two sets of counter strands *c* and *d* and the layer *e* of gutta percha.

It will be understood that many departures may be made from the structure herein shown and described without avoiding the spirit of my invention.

I claim as my invention:

1. Fuse having a medium for conveying the fire, and a fire proof material associated with said medium in the core of the fuse. 75
2. Fuse having a medium for conveying the fire, a fire proof material associated with said medium, and a covering around the fire proof material. 80
3. Fuse having a medium for conveying the fire, and a fire proof material spun about said medium.
4. Fuse having a medium for conveying the fire, a fire proof material spun about said medium, and a covering around the fire proof material. 85
5. Fuse having a medium for conveying the fire, longitudinal fire proof strands spun about the material, and a covering around the fire proof material. 90
6. Fuse having a medium for conveying the fire, and a vehicle for the said medium forming therewith the core of the fuse, the said vehicle being treated to render the same fire proof. 95
7. Fuse having a medium for conveying the fire, and a vehicle for the said medium forming therewith the core of the fuse, the said vehicle being treated with a fire proofing solution. 100
8. Fuse having a medium for conveying the fire, a vehicle for the said medium, the said vehicle having been treated to render the same fire proof, and a cover around the said vehicle. 105
9. Fuse having a medium for conveying the fire, and a vehicle for said medium consisting of longitudinal strands treated with a fire proofing solution. 110
10. Fuse having a medium for conveying the fire, a vehicle for the said medium, the said vehicle consisting of longitudinal strands treated to render the same fire proof, and a cover around the said vehicle. 115
11. Fuse having a medium for conveying the fire, and a vehicle for the said medium consisting of strands of thread spun into a cord about the said medium, the said vehicle having been treated with a fire proofing solution. 120
12. Fuse having a medium for conveying the fire, a vehicle for the said medium consisting of strands of thread which have been treated to render the same fire proof, and a cover consisting of untreated strands of thread. 125
13. Fuse having a medium for conveying the fire, a vehicle for the said medium consisting of untreated strands of thread. 130



sisting of strands of thread which have been treated to render the same fire proof, and a cover consisting of untreated strands of thread and a water proofing substance.

5 14. Fuse containing gun-powder, and fire proof material associated therewith in the core of the fuse.

15. Fuse containing gun-powder, and fire proof strands spun about the gun-powder.

10 16. Fuse containing gun-powder, and strands of thread treated to render the same fire proof and spun about said gun-powder.

15 17. Fuse containing gun-powder, fire proof strands spun about the gun-powder, and a covering of strands wound around the spun strands.

18. Fuse containing gun-powder, fire proof strands associated with the gun-powder and a water proof cover.

20 19. Fuse containing gun-powder, fire proof strands associated with the gun-powder, strands wound around the fire proof strands, a layer of gutta percha around the wound

strands, and other strands wound around the layer of gutta percha.

25 20. Fuse containing gun-powder, strands of thread spun about the gun-powder, the said strands having been treated with a solution of sodium silicate and a solution of the sulfates of aluminum and copper to render 30 the same fire proof, and counter strands of thread forming a cover.

21. Fuse containing gun powder, strands of thread spun about the gun powder, the said strands having been treated with a solu- 35 tion of sodium silicate and a solution of the sulfates of aluminum and copper to render the same fire proof, and counter strands of thread and a coating of asphaltum forming 40 a cover.

This specification signed and witnessed this 28th day of April, A. D., 1908.

HENRY E. ELLSWORTH.

Signed in the presence of—

L. S. ELLSWORTH,

JOSEPH R. ENSIGN.