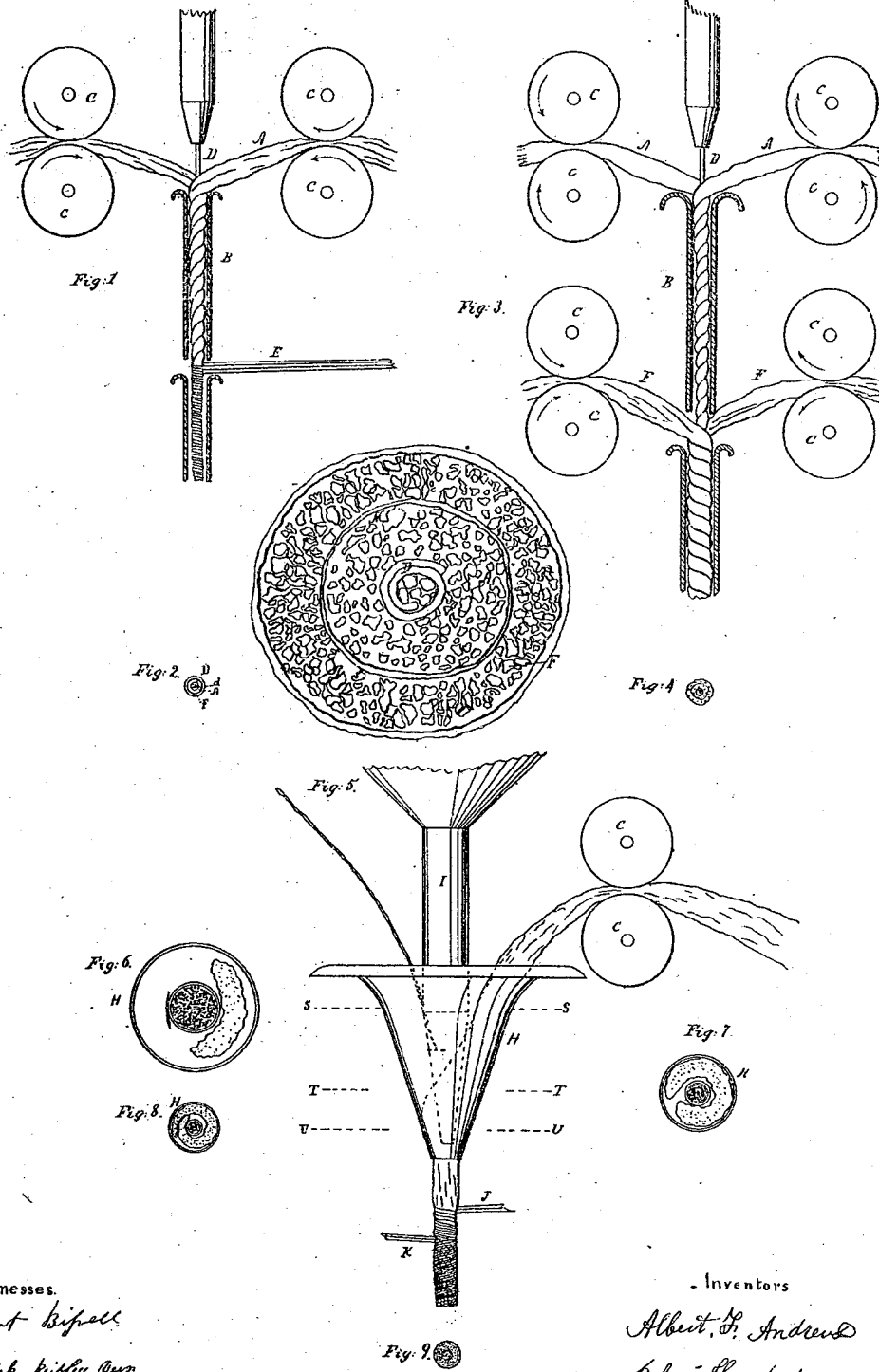


A. F. & J. H. Andrews

Safety Fuse

N^o 51679

Patented Dec. 26. 1865



Witnesses.
Albert Kipell
Francis Kiply Jun

Inventors
Albert F. Andrews
John H. Andrews

UNITED STATES PATENT OFFICE.

ALBERT F. ANDREWS AND JOHN H. ANDREWS, OF AVON, CONNECTICUT.

IMPROVED SAFETY-FUSE.

Specification forming part of Letters Patent No. 51,679, dated December 26, 1865.

To all whom it may concern:

Be it known that we, ALBERT F. ANDREWS and JOHN H. ANDREWS, of Avon, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in Safety-Fuses for Blasting and Analogous Purposes; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Figure 1 represents one form of our fuse-body, with a portion of the apparatus employed in its manufacture. Fig. 2 is a cross-section of this form of our fuse-body when completed. Fig. 3 represents another form of our fuse-body, with a portion of the apparatus employed in its manufacture. Fig. 4 is a cross-section of this form of our fuse-body when completed. Fig. 5 represents another form of our fuse-body, with a portion of the apparatus employed in its manufacture. Fig. 6 is a cross-section through the apparatus on the line S S in Fig. 5. Fig. 7 is a cross-section on the line T T in Fig. 5. Fig. 8 is a cross-section on the line U U in Fig. 5. Fig. 9 is a cross-section of this form of our fuse-body when completed.

Similar letters of reference indicate like parts in all the drawings.

Our invention is applicable to fuse for blasting and other like purposes, whether made specially water-proof by extra coatings or not. It is cheaper and better than ordinary fuse.

The ordinary article known as "safety-fuse," used for blasting purposes, &c., incloses the powder within several strands of yarn which are wound spirally around it. This, after being wound with finer yarns to retain them in place and properly varnished, forms the body of the fuse, and is distinct from the covering of tape or other material applied outside thereof.

On the 27th of December, 1864, Letters Patent were issued to one of us, John H. Andrews, for substituting paper in the place of tape to serve as coverings in the manufacture of water-proof fuse, and also for inclosing the powder in a tube of paper or like material coated with rubber or other material. In the course of the same year Letters Patent issued to Messrs. Chase and Foy set forth a construction of fuse in which sliver was laid in a certain manner on the exterior as a covering; but in those and in all fuses heretofore patented or publicly

known or used the material used to form the body of the fuse was in the form of yarns.

The nature of our invention consists, first, in substituting sliver in the body in lieu of yarn; second, in a combination and arrangement of an impervious tube relatively thereto; and, third, in a certain covering for the body of fuse, formed of fine and unsized sliver wound spirally about the body and saturated with fuse-varnish.

We use for our sliver the untwisted or very slightly twisted fibers of cotton, jute, flax, or other suitable fibrous material, preferring cotton.

To enable others skilled in the art to make and use our invention, we will proceed to describe it by the aid of the drawings and the letters of reference marked thereon.

Figures 1 and 2: We pass the sliver A into a suitable fuse-manufacturing tube, B, (shown in section,) from suitable cans (not represented) placed around the tube, and revolve the cans and tubes in a similar manner to the present mode of manufacturing with yarns, assisting the sliver to rise from the cans by means of the feeding-rolls C C, if necessary, so that the unspun fiber in the form of soft roving or sliver shall be wound spirally around the slender paper tube D, which contains the powder *d*, and shall completely and softly envelop it. We then cross-wind the entire mass or body with fine yarn E, in the ordinary manner, as shown in Fig. 1, and subsequently varnish it. To make a more substantial article we omit the winding on of the small yarns E at this stage, and wind on other sliver, F, (see Fig. 2,) in a similar manner to the first covering, but in an opposite direction, so that the inclination of one layer of sliver, A, to unwind is counteracted by that of the other layer, F, to unwind in the opposite direction. If there are three slivers A in the first layer, there should be four or more slivers F in the second layer. The whole may be wound with the small yarns E before varnishing, if desired.

Another means of producing our fuse is to pass the fibers in the form of sliver longitudinally through a funnel-shaped tube, H, (see Figs. 5 to 8,) which surrounds a similar tube, I, containing the powder *d*, the powder passing into the fiber just before it emerges from the tube H, after which the whole is immedi-

ately wound with fine yarns J, and again cross-wound with another set of yarns, K, to bind the mass firmly and permanently together.

Another mode which might serve in some cases would be, as the fiber inclosing the powder emerges from the tube, as above described, to twist it after the usual method of cotton-spinning, and subsequently wind with the fine yarns J and K.

In the above-described modes we would not confine ourselves to the longitudinal fibers in the form of any particular kind of roving or sliver, the purpose being to use them in a promiscuous condition, after the manner in which fibers are used for spinning or felting, or for forming hats, bats, &c.

We may apply more than two separate layers of such roving or sliver. This may be accomplished by the modes above described, winding on one, two, or more layers of fibers in the manner above described, and interspersing the same with as many coats of varnish as are necessary to render it sufficiently water-proof.

The diagram near the center of the sheet of drawings shows a highly-magnified section, and indicates the presence of the tarry compound or fuse-varnish by the letter M and by a red tint. The fact that the fibers in A and F are in the condition of loose roving or sliver allows the mass to be saturated through its entire depth, while the presence of the paper D, either highly sized or coated with rubber or the like, prevents the varnish from actually touching and disturbing the rate of burning of the powder.

Some of the advantages due to certain features of our invention may be separately enumerated as follows:

First, by reason of the fact that the body of the fuse is composed, as above described, of loose fibers lying parallel or slightly crossed, and felted or twisted by the ordinary processes of forming sliver or roving, without the necessity for spinning, we are able to produce a body which is softer and tougher than usual and less liable to cut or to crack, and to secure an elastic condition in the mass which will prevent the formation of a crack or open place, even if the strands are not evenly laid, and will fill any such crack or open place if one tends to form in any exigency. We are

also able from this cause to secure a uniform and successful body or covering for the powder at a less expense for material than when the same has to be first manufactured into yarns.

Second, by reason of the fact that our fuse is composed of a body of sliver combined and arranged, as represented, around a tube, D, of paper or analogous material, and subsequently varnished, as above described, we are able to insure that the body of the fuse will absorb the varnish M more readily and deeply and more uniformly, without affecting the powder, than will fuse-bodies made up in any other manner heretofore known.

Third, by reason of the fact that our sliver is wound spirally around the interior body of a fuse in the manner heretofore described, we are able to bind together and hold the interior fibers of the body in place, and by the aid of the varnish to successfully complete the fuse, with or without subsequent water-proof envelopment, and at less expense for material than when the same is effected with yarns.

We do not claim anything shown in the patents of Chase and Foy, dated June 30, 1863, and November 23, 1864; but,

Having now fully described our invention, what we claim as our invention, and desire to secure by Letters Patent, is—

1. Employing in the body of safety-fuses sliver of cotton or other suitable fiber, substantially in the manner and for the purpose herein set forth.

2. The combination of the tubular powder-casing D, the sliver A, and the equivalent saturating material M, the latter being allowed to permeate through the sliver A by reason of its loose condition, and to stop near the powder by reason of its impermeability, all substantially as and for the purpose herein set forth.

3. The spiral position of the covering of sliver F, adapted to closely but softly envelop and bind together the inner body of a safety-fuse, substantially in the manner and for the purpose herein set forth.

ALBERT T. ANDREWS,
JOHN H. ANDREWS.

Witnesses:

FREDERICK BIRLEY, Jr.,
ALBERT BISSELL.