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(No Model.)

F. L. & H. TIRMANN.  
PERCUSSION FUSE FOR BLASTING.

No. 414,662.

Patented Nov. 5, 1889.

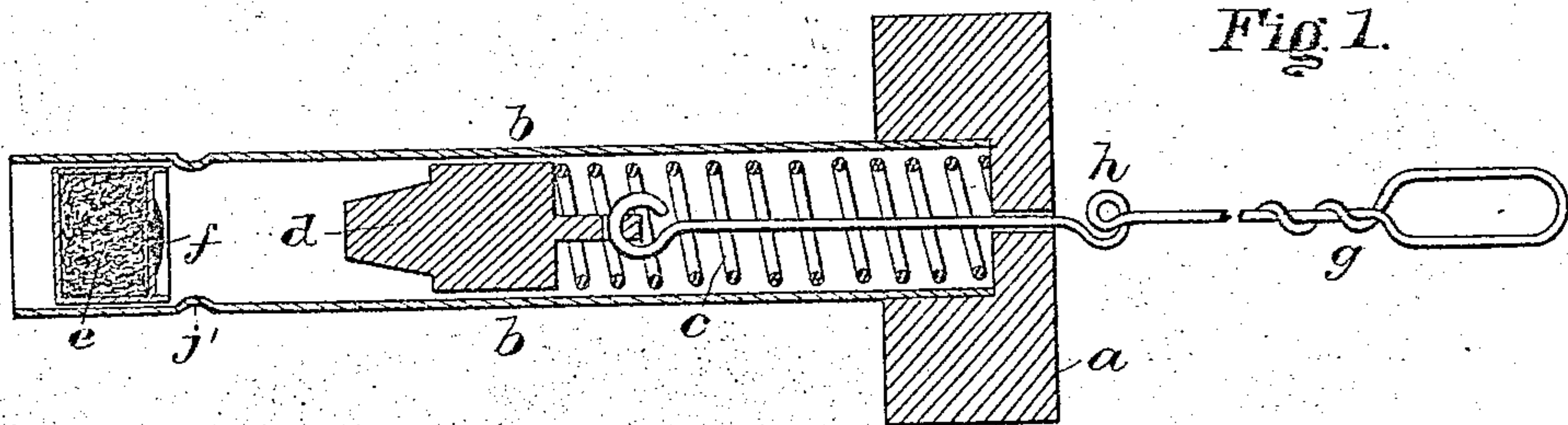


Fig. 1.

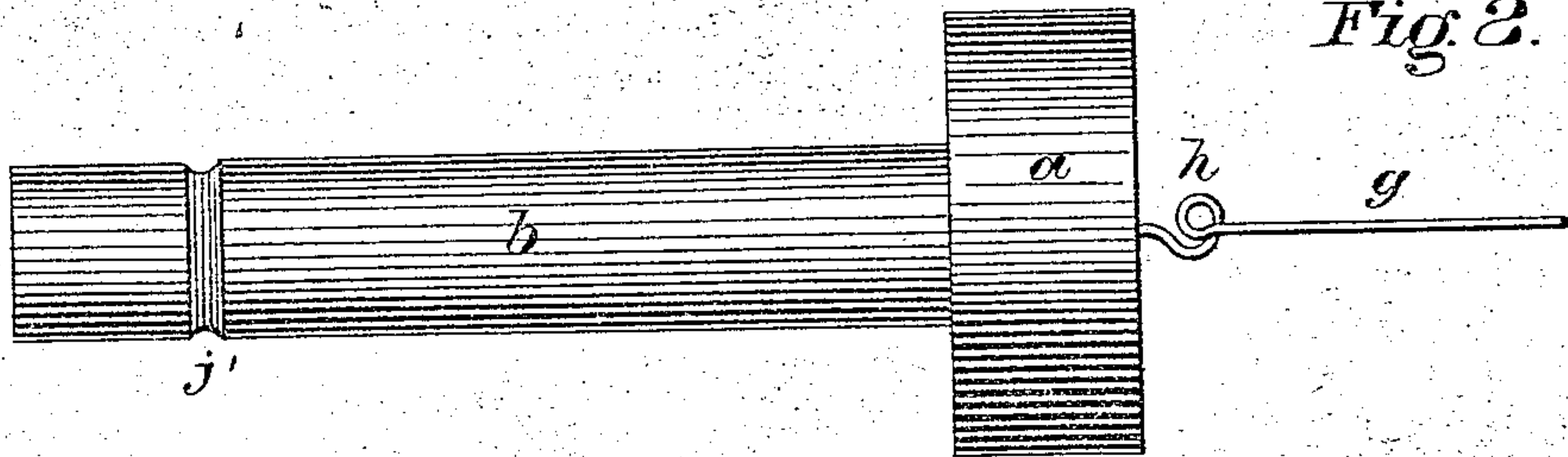


Fig. 2.

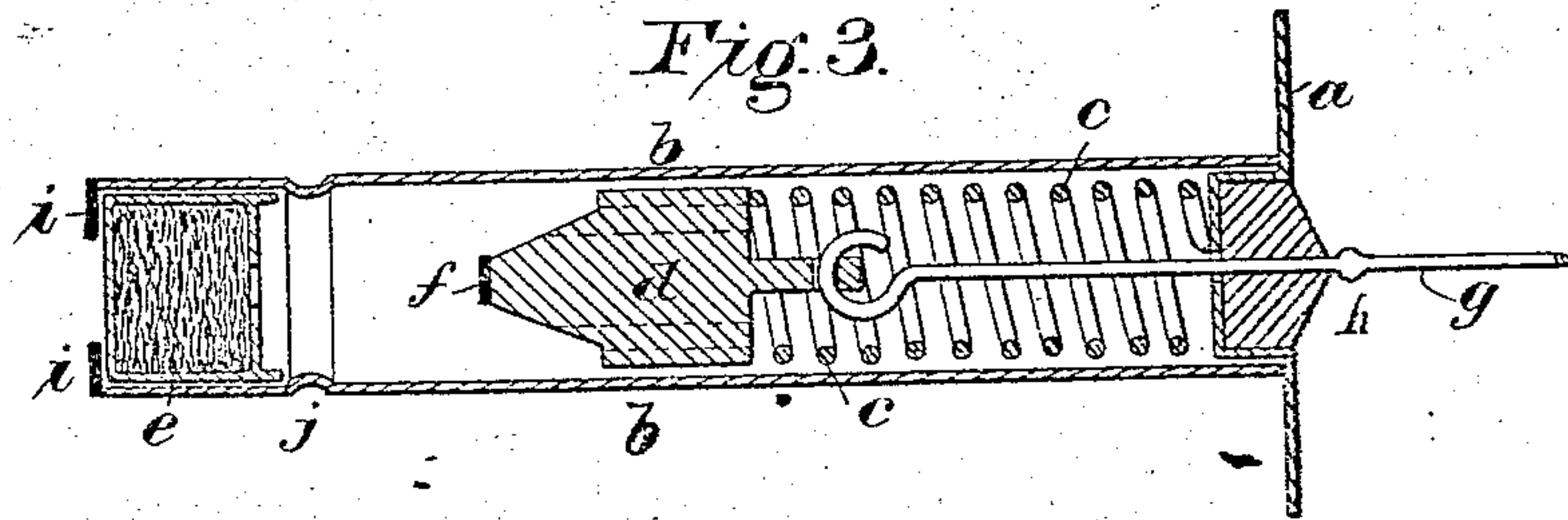


Fig. 3.

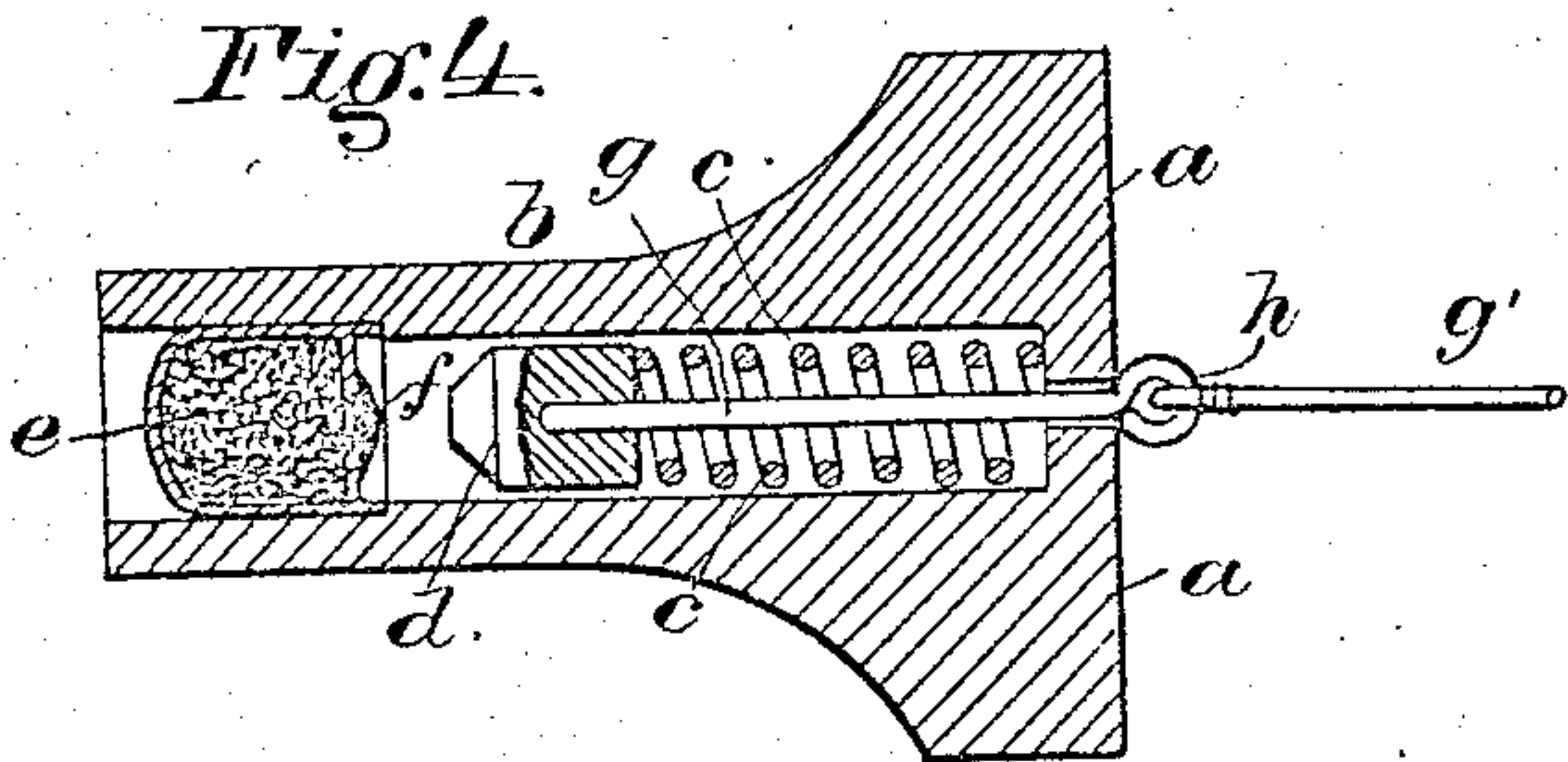


Fig. 4.

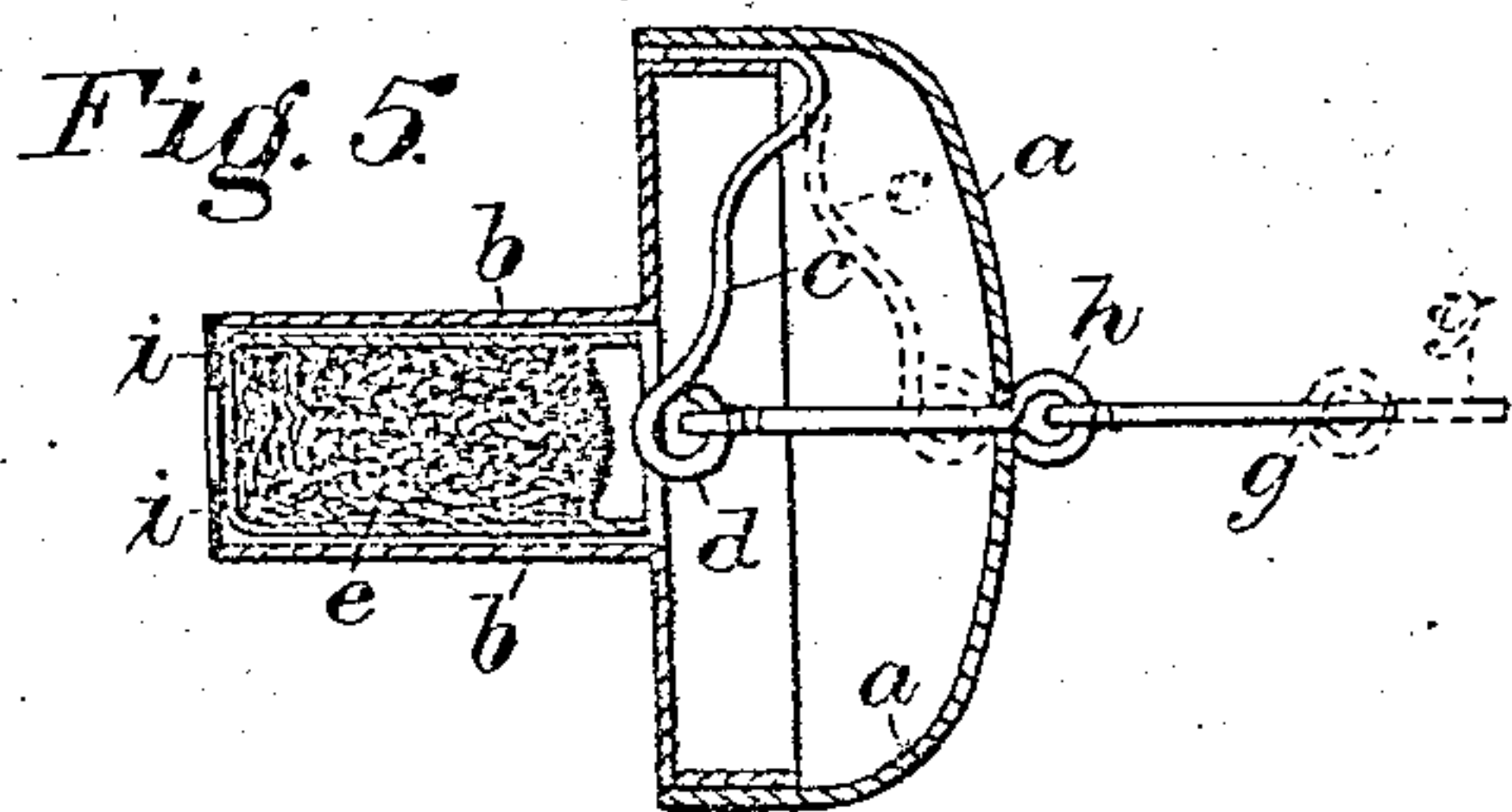


Fig. 5.

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# UNITED STATES PATENT OFFICE.

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## PERCUSSION-FUSE FOR BLASTING.

SPECIFICATION forming part of Letters Patent No. 414,662, dated November 5, 1889.

Application filed December 13, 1887. Serial No. 257,784. (No model.)

*To all whom it may concern:*

Be it known that we, FRANZ L. TIRMANN, mining engineer, and HANS TIRMANN, mechanic, citizens of Austria, and residents of Vienna, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Blasting-Fuses, of which the following is a specification.

This invention relates to fuses for blasting and analogous purposes, (such as the firing of cannon,) of the class known as "percussion" fuses, or those wherein the primer or explosive is exploded by being struck by a hammer. Fuses of this class have been made with a spring tending to throw the hammer forward, and with a detent to release the hammer, the detent being withdrawn by pulling a wire or lanyard. Such fuses are dangerous to handle and use because of the liability that the hammer may be released prematurely. According to another construction the hammer is normally pressed against the primer by the spring, and a pull wire or cord is connected to the hammer, which, when pulled, draws it back and compresses the spring, and on the pull being increased the wire or cord breaks or disconnects itself from the hammer, so that the latter is released and is permitted to fly forward under the impulse of the spring and explode the primer. This construction is liable to premature explosion by the accidental pulling and release of the wire.

Our present invention provides a percussion-fuse which can be safely transported, handled, and used. The hammer is normally partly retracted, being so held against the tension of its spring by a safety-stop, which prevents its moving forward far enough to reach the primer. When the pull-wire is pulled, the hammer is drawn fully back, the spring fully compressed, and on increasing the pull the wire is disconnected, so that the hammer is released and flies fully forward against the primer. Thus this extraordinary pull is necessary to release the hammer and cause it to strike the primer.

Figure 1 of the accompanying drawings is a longitudinal mid-section of our improved fuse constructed for blasting purposes. Fig.

2 is a side elevation thereof. Fig. 3 is a sectional view illustrating a modified construction. Figs. 4 and 5 show other modifications.

We will first describe the construction shown in Figs. 1 and 2, wherein *a* designates the head of the fuse, which may be made of wood or metal, and *b* designates a tube forming the body of the fuse, and which may be made of wood, metal, or paper. Within the tube *b* are placed a spiral spring *c* and a hammer or plunger *d*. The rear end of this hammer is formed with an eye, with which engages the hooked end of a wire *g*. This wire extends out through a hole formed in the center of the head *a*, is made of any suitable length, and is preferably bent into a loop or eye at its other end. A cap *e*, containing detonating material—such as fulminate, dynamite, or other explosive compound suitable for effecting the firing of the blasting-charge—is fixed in the front end of the tube *b* by means of suitable cement or otherwise. The displacement of this cap toward the hammer *d* is prevented by means of a bead *j*, formed in the tube *b*, and projecting internally, so as to constitute a flange or shoulder against which the cap may rest. The cap *e* consists of a metallic cup partly filled with the detonating material, and into the open end of which is placed a small metal disk perforated at its center. Against this plate is gummed or cemented a primer *f*, which may be a common paper cap, such as is used with toy pistols.

In putting together our percussion-fuse we first pass the wire *g* through the hole in the head *a*, then slip the spiral spring *c* over it, then bend the end of the wire into a hook and engage it with the eye on the hammer *d*, and then pull back the wire until the hammer is drawn back to about the position shown in Fig. 1, whereby the hammer compresses the spring to some extent. We then form a loop *h* in the wire *g*, which loop comes against the surface of the head *a* and forms a safety-stop, which prevents the wire being drawn forward by the tension of the spring *c*. The tube *b* is then slipped over the hammer and spring and its end is fastened into the recess in the head *a* by means of putty or



other suitable cement. The cap *e* is then inserted into the opposite end of the tube and fastened therein by putty or other cement, the primer *f* having been previously affixed to the cap. The loop *h* in the wire *g* prevents the accidental throwing forward of the hammer against the cap, whereby accidental or premature explosion of the primer is avoided.

Our percussion-fuse is operated as follows:

10 The head *a* being suitably fixed in place, the wire *g* is pulled, either by taking hold of it directly, if it be long enough, or by pulling a cord attached to its looped end. The first effect of this pull is to draw back the hammer *d* until the spring *c* becomes fully compressed, whereupon the force of the pull is increased sufficiently to open out the hook on the end of the wire until it disengages itself from the ear of the hammer, whereupon the latter is set free and is instantly and violently thrown forward against the primer *f*, thereby exploding the cap, which in turn fires the charge in the mine. The resistance of the wire should be such that the pull necessary to effect the explosion of the percussion-fuse shall amount to about ten or eleven kilograms.

The transportation and handling of our percussion-fuse is unattended with danger, since the power necessary to pull out the wire is so considerable that no manipulation to which the fuse is ever subjected can effect a pull sufficient to prematurely discharge the fuse. By using a wire of larger diameter this factor of safety can be increased to any desired extent.

The use of our fuse requires no special accessories, such as pulleys, rings, and the like, which are necessary in the use of frictional fuses, and the connecting of wires, which is essential with electric fuses, is avoided.

Our percussion-fuses can be made at a less cost than frictional fuses.

In the modification shown in Fig. 3 the head *a* is made of metal and has its central part projecting so that it fits into the tube *b*. The primer *f* in this construction is affixed to the front end of the hammer *d*, which produces the same effect as if it were affixed to the cap *e*. The cap is fastened in place in the tube *b* by bending down ears *i i*, formed on the end of the tube. The hammer *d* is not made a close fit with the tube *b*, but is sufficiently smaller than the tube to permit the air to pass freely around it during its forward motion, so that the force of its blow is not materially reduced by its being cushioned by a mass of confined air. This end may be accomplished by making the hammer of polygonal cross-section, or by forming holes longitudinally through it, as shown in dotted lines in Fig. 3. The hammer may be of greater or less weight, according to the force of the blow necessary to explode the primer and according to the strength of the spring. It may even be made practicable to dispense entirely with any distinct hammer,

properly so called, provided that some equivalent part be substituted which shall perform the same function. Thus any part or element which, upon the expansion of the spring, shall strike the primer with sufficient force will serve the purpose. For example, the end of the spring may be made to strike the primer, thus combining in one part the functions of both the spring and the hammer.

Fig. 4 illustrates a modified construction wherein the tube or inclosing-case is formed of a block of wood, suitably bored out, with the cap *e* fixed in its front end. The hammer *d* is made of soft metal and cast upon the end of a wire or pin *g*, which passes out through a hole in the head of the case, and its outer end is bent into an eye *h*, which under the tension of the spring *c* is drawn against the end of the case and prevents the pressing forward of the hammer against the primer. To this eye *h* is attached the wire or cord *d'*, by pulling which the fuse is exploded. This view is introduced to illustrate a modification of the destructible or separable connection between the hammer and the wire *g*, which in the previous figures consists of the hooked end of the wire. In this construction this destructible connection consists of the casting of the plain end of the wire into the hammer in such manner that upon a sufficient pull being exerted—say, for example, of ten kilograms—the wire is pulled out of the hammer and the latter thereby freed. The cohesion of the wire and hammer is sufficient to resist a pressure that will fully compress the spring, so that the fuse cannot be fired by anything short of an extraordinary pull.

Instead of casting the hammer onto the wire, the latter may be cemented into the hammer, or may be driven tightly therein, or otherwise joined thereto by a connection which shall be destructible or separable under the conditions stated.

Fig. 5 shows a construction wherein the end of the spring serves as the hammer. The spring *c* here shown is a leaf-spring instead of a spiral spring, and is arranged radially in the head *a*, which is hollow, forming an inclosing-case for the spring. The outer end of the spring is fastened securely in this case, and its inner end is arranged at the center of the tube *b*, where it can strike the primer *f* of the cap *e*. The free end of the spring (lettered *d*) serves the purpose of the hammer, and is bent into an eye, with which engages the hooked end of the wire *g*. This wire passes out through a hole in the center of the head and has formed upon it an enlargement *h*, which may be a bent eye, as shown, or a drop of solder, or a winding of thread cemented to it by varnish, and which serves, as the safety-stop *h*, to prevent the forward movement of the hammer into contact with the primer.

Fig. 3 shows the safety-stop *h*, formed by means of an enlargement on the wire *g*, as



clearly shown, which may be made by a drop of solder or otherwise.

Any suitable mechanical equivalent of a spring may be substituted for it as a means for throwing the hammer against the primer or explosive.

We claim as our invention the improvements in fuses, substantially as hereinbefore set forth, and defined as follows, namely:

10 1. In a percussion-fuse, the combination of a spring-pressed hammer tending to fly forward and normally partly retracted, with a safety-stop to hold the hammer so retracted and prevent its flying fully forward to explode the primer, and a pull-wire connected  
15 to the hammer and constructed to be disconnected by a sufficient pull and thereby to release the hammer and explode the primer.

20 2. A fuse consisting of the combination, with an inclosing-case, of a spring-pressed hammer within said case, tending to fly forward, and normally partly retracted, a pull-wire connected to said hammer, a safety-stop on said wire arranged to be drawn by  
25 the spring-tension into abutment against the case and thereby to hold the hammer partly retracted and prevent its movement toward the primer, and a separable connection between said wire and hammer, whereby on the

pulling of the wire the hammer is first drawn fully back, and upon increasing the pull the connection between the wire and hammer is severed and the hammer released and permitted to fly against the primer.

3. A fuse consisting of the combination, with an inclosing-case, of a spring-pressed hammer within said case, tending to fly forward, and normally partly retracted, a pull-wire connected to said hammer, a safety-stop on said wire, consisting of a loop or bend therein arranged to be drawn by the spring-tension into abutment against the case and thereby to prevent the forward movement of the hammer beyond said partly-retracted position, and said wire constructed to disengage the hammer by a sufficient pull, whereby on  
45 the pulling of the wire the hammer is first drawn fully back, and upon increasing the pull the connection between the wire and hammer is severed and the hammer released  
50 and permitted to fly against the primer.

Signed at Vienna, in the Empire of Austria, this 21st day of October, 1887.

FRZ. L. TIRMANN.  
HANS TIRMANN.

Witnesses:

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