B. F. DE CASANOVAS & R. RUBIO Y ROGER.

TIME FUSE.

APPLICATION FILED MAY 27, 1916.

1,253,947. Patented Jan. 15, 1918.

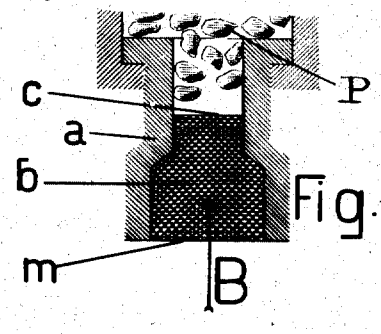


Fig. 1.

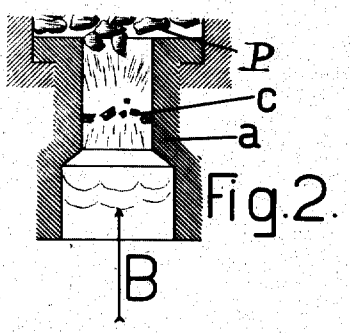


Fig. 2.

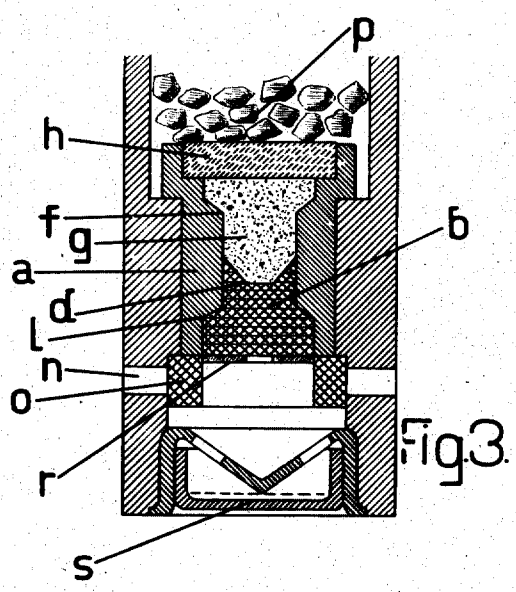


Fig. 3.

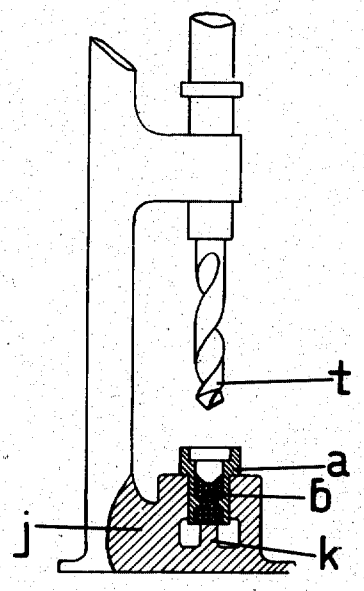


Fig. 5.

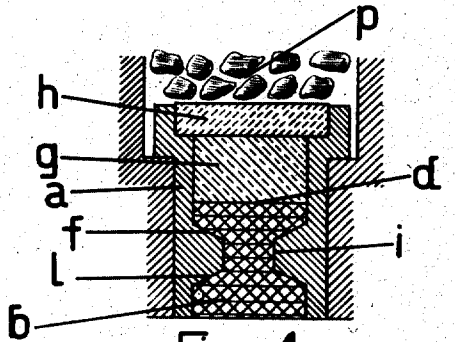


Fig. 4.

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UNITED STATES PATENT OFFICE.

BALTASAR FARGAS DE CASANOVAS AND RAMON RUBIÓ Y ROGER, OF BARCELONA, SPAIN.

TIME-FUSE.

1,253,947. Specification of Letters Patent. Patented Jan. 15, 1918.

Application filed May 27, 1916. Serial No. 100,374.

To all whom it may concern:

Be it known that we BALTASAR FARGAS DE CASANOVAS and RAMON RUBIÓ Y ROGER, subjects of the King of Spain, residing at Barcelona, Kingdom of Spain, have invented certain new and useful Improvements in Time-Fuses, of which the following is a specification.

The object of the present invention is the construction of time fuses of high precision with elimination of the delays in the ignition of the fuse mixture and in the communication of the ignition to the charge in the projectile, allowing at the same time of the construction of fuses of very short duration and great uniformity such as are indispensable for many purposes and, above all, in shrapnel for sporting guns. For these very short time fuses are needed, such as $\frac{1}{10}$th of a second, and consequently the permissible errors may not exceed $\frac{1}{100}$th of a second. With the ordinary construction this is found to be impossible because the error attains 100%.

In the accompanying drawings,

Figure 1 is a sectional elevation of an ordinary time fuse;

Fig. 2 is a view similar to Fig. 1, showing the condition of an ordinary time fuse at the end of the combustion of the timing composition;

Fig. 3 is a sectional elevation of a time fuse embodying this invention;

Fig. 4 is a sectional elevation of a modified embodiment of this invention, and

Fig. 5 illustrates diagrammatically a process of gaging a fuse of the type shown in Fig. 3.

For greater clearness we illustrate in Figs. 1 and 2 the mode of operation of an ordinary fixed time fuse.

In these figures *a* is the body of the fuse, and *b* the composition, the combustion of which is to produce the ignition of the charge *p*. The direction of combustion of the timing composition is that indicated by the arrow B. In this fuse there is a slight retardation and uncertainty in the ignition of the timing composition which takes place in the layer *m*. The combustion occurs by layers until on arriving near the final one, the pressure due to the discharge of the combustion gases produces the breakage of the last layers *c* (Fig. 2). This is the cause of a new irregularity because the thickness of these last layers of timing composition broken by the pressure of the gases is different in each case. Besides this there is still another cause of irregularity which produces the greatest variations, and that is the delayed ignition of the charge *p* of the projectile.

It is evident that these errors are small, but if it be remembered that each one-tenth of a second, with the speed of the projectile of 350 meters, represents 35 meters error in distance, the importance of avoiding them will at once be understood.

In order to do away with the delay in ignition of the timing composition and insure the said ignition, we cover the timing composition with a light layer of a detonating substance and also surround it with a ring of a readily inflammable substance, as for instance, black powder, or still better, a mixture of the same with a small amount of amorphous phosphorus.

To avoid the irregularity due to the breaking of the last layer of timing composition and the variable retardation of ignition of the charge in the projectile, we arrange in direct contact with the timing composition a charge of a detonating explosive which may be a powder either more or less lightly compressed or else in a well compressed compact mass. In the former case we give the upper end of the timing composition the shape of an arch or truncated cone in order to strengthen the last layers and avoid their breakage. If however the charge of detonating explosive is in a compressed mass there is no need to give the end of the timing composition a special form because the last layers are strengthened by the detonating explosive and consequently cannot break, but burn regularly to the end, though there is of course no objection to using the arched shape for the end of the timing composition here too. As some detonating explosives which may be used lose their sensitiveness by compression (for instance fulminate of mercury), and detonation must be insured, we provide the fuse internally with a narrowed and a widened part in succession, and cause the timing composition to occupy part of the wider portion so that the point of meeting of the said composition and the detonator lies in the said wide portion. In this way we prevent compression of the detonating explosive by the inertia of the explosive charge at the moment of firing; furthermore the emergence of the

gases of combustion of the composition is made somewhat difficult, thus increasing its pressure and insuring the detonation of the fulminating charge. At the same time the explosion is directed in that direction which is favorable to the sure and complete ignition of the charge of the projectile.

For greater clearness we show in Fig. 3 a fuse constructed along these lines. The said figure represents a fixed time fuse for shrapnel for sporting guns and is provided with the system of internal ignition in which the inertia of the projectile is utilized. The sliding piston *s* serves to ignite the composition by means of the ring *o* of a readily inflammable substance and the light layer of detonating explosive *r*. The ring *o* covers the gas vents *n* and is made so that it can easily break. The body of the fuse, *a* has a thickened portion *l* to consolidate the timing composition *b* which at its end *d* is arched or truncated cone shaped, the advantages of which we have explained. At *g* there is a charge of detonating explosive (fulminate of mercury, nitrid of lead, sulfid of nitrogen, or the like), in the form of a slightly compressed powder which is held in place by a sheet of tin or still better as shown in Fig. 3, by a disk of gun cotton *h* to insure the instant ignition of the charge *p* of the projectile. To insure further the said ignition we make the detonating explosive to fill the space above the thickened portion *f* because by this means the explosion is directed toward the charge *p* of the projectile.

In Fig. 4 there is shown the modification above referred to which consists in using the detonating charge in the form of a compact mass. As before *a* is the body of the fuse with thickened portion *l* forming a narrow neck *i* to consolidate the timing composition *b*. The fuse must in addition be provided with the means for insuring the ignition indicated in Fig. 3 (ring *o* and covering *r*) which are not shown on this figure. The timing composition *b* occupies part of the space above the thickened portion *f* to insure the detonation of the charge *g* which is in a compressed mass, and consequently the end *d* of the composition may be either flat as shown or arched, inasmuch as the top layers of *b* are strengthened by the compact mass of the charge *g* pressed down upon it. A disk of gun cotton *h* is also provided to insure the ignition of the charge *p*.

The improvements indicated, particularly the use of a detonating charge in direct contact with the timing composition, are likewise applicable to fuses with variable timing including those used in artillery. It is only necessary to arrange the shape of the end of the channel containing the timing composition as is shown in Figs. 3 and 4, placing the detonating charge *g* in direct contact with the timing composition.

The time of fuses depends on the character and dimensions of the timing composition, so that it is really difficult to produce in large quantities the fuses required for sporting shrapnel, which must be of great uniformity. For this purpose we have contrived a method which consists in compressing an excess of timing composition exerting always the same pressure in order to produce equal density, and afterward taking away the excess of timing composition by a cutting implement.

The compression of the timing composition may be done by a punch with a spring or else by hydraulic or compressed air pressure. The fuses are made all alike by a machine such as that shown in diagram in Fig. 5 which consists essentially in a jig *j* in which is mounted the fuse *a* resting with one end of the timing composition *b* on the boss *k* so that on lowering the cutting tool *t* there is obtained at the same time as the arched shaped end of the priming composition and exact equality in length, so that it is possible to obtain fuses of great precision. This operation can be carried out automatically.

With these improvements it has been possible for us to construct fuses for sporting shrapnels of one-tenth of a second of time, with an average error of one-fourth hundredth of a second, thus insuring the bursting of the said shrapnel within a zone of 1 to 2 meters' length. This proves the value of these improvements, which, as we have said, are also applicable to artillery.

We claim:

1. In a time fuse, a mass of timing composition, a charge of detonating explosive in immediate contact with the timing composition, said charge of detonating explosive being so arranged as to be interposed between said timing composition and the explosive charge of the projectile when the fuse is secured thereto, and means to prevent delay in the ignition of the timing composition.

2. In a time fuse, a mass of timing composition, a charge of detonating explosive adjacent the timing composition and so arranged as to be interposed between the timing composition and the explosive charge of the projectile when the fuse is secured thereto, means to prevent delay in the ignition of the timing composition, and means to prevent compression of the detonating explosive by the inertia of the explosive charge at the moment of firing and a consequent loss of sensibility on the part of said detonating explosive.

3. In a time fuse, a mass of timing composition, ending in a concave truncated cone-shaped surface, a charge of detonating explosive fitted within the concave portion of

the timing composition, a disk of gun cotton adjacent the charge of detonating explosive and so arranged as to be interposed between the detonating explosive and the explosive charge of the projectile when the fuse is secured thereto, and a ring made of a readily inflammable material positioned under the timing composition to facilitate its ignition.

4. In a time fuse, a casing having gas vents, said casing containing a timing composition, a charge of detonating explosive in direct contact with the timing composition, a disk of gun cotton adjacent the charge of detonating explosive and adapted to bear against the explosive charge of the projectile when the fuse is secured thereto, and a ring of a readily inflammable material positioned under the timing composition to facilitate its ignition, said ring being placed in such a way that its inner surface corresponds to the lower end of the timing composition and its side walls cover the gas vents in the casing.

5. In a time fuse, a hollow body comprising two enlarged portions connected by a narrow neck, a mass of timing composition in the lower part of said body, a charge of detonating explosive in the upper part of said body and arranged so as to contact with the explosive charge of the projectile when the fuse is secured thereto, and means to prevent delay in the ignition of the timing composition, the arrangement being such as to prevent compression of the detonating explosive by the inertia of the charge of powder at the instant of firing and a consequent loss of sensibility on the part of said detonating explosive.

6. In a time fuse, a casing having gas vents, said casing containing a hollow body comprising two enlarged portions connected by a narrow neck, a mass of timing composition filling the lower portion of said body and a part of the narrow neck, a charge of detonating explosive filling the remaining part of said narrow neck and the greater part of the upper portion of said body, a disk of gun cotton arranged in the upper portion of said body on top of said charge of detonating explosive, and a ring of a readily inflammable material positioned under the timing composition to facilitate its ignition, said ring being disposed in such a way that its inner edge corresponds to the lower end of the timing composition and its lateral walls cover the gas vents in said casing.

In testimony whereof we affix our signatures.

BALTASAR FARGAS DE CASANOVAS.
RAMON RUBIÓ Y ROGER.