H. MAXIM.

TIME FUSE FOR PROJECTILES.

APPLICATION FILED SEPT. 27, 1905.

904,492. Patented Nov. 17, 1908.

Fig. 1.

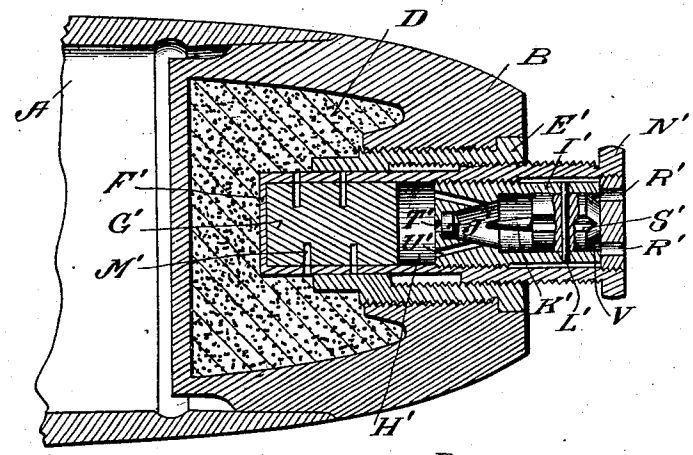


Fig. 2.

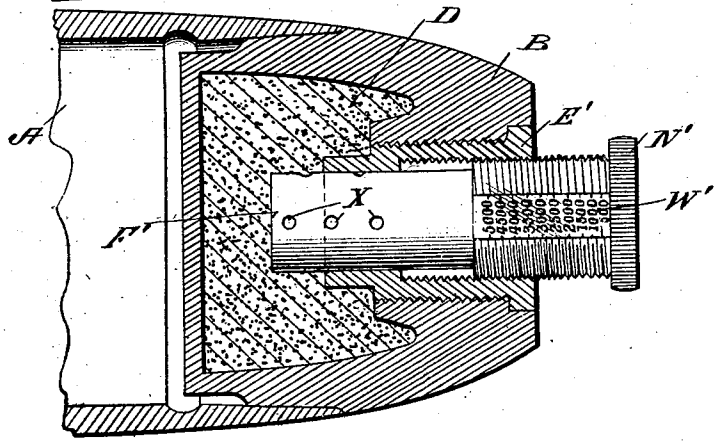
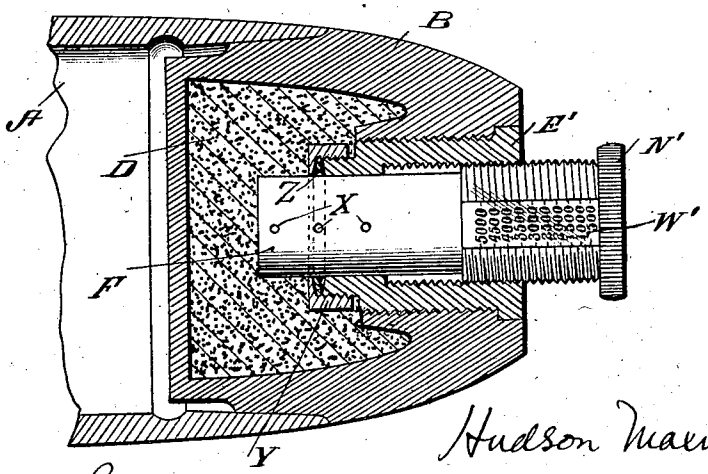


Fig. 3.



Witnesses

Gustave R. Thompson.

Frederick A. Holden.

Inventor

Hudson Maxim.

By Mauro, Cameron, Lewis & Massie

Attorneys

UNITED STATES PATENT OFFICE.

HUDSON MAXIM, OF NEW YORK, N. Y.

TIME-FUSE FOR PROJECTILES.

No. 904,492. Specification of Letters Patent. Patented Nov. 17, 1908.

Original application filed January 29, 1903, Serial No. 141,066. Divided and this application filed September 27, 1905. Serial No. 280,353.

To all whom it may concern:

Be it known that I, HUDSON MAXIM, a resident of the borough of Brooklyn, city and State of New York, have invented a new and useful Improvement in Time-Fuses for Projectiles, which invention is fully set forth in the following specification.

The present invention relates to improvements in time fuses for projectiles, and especially those adapted for use in shrapnel and field shell.

The object of the invention is to provide a fuse which may be so set that the ignition of the bursting charge of the projectile may be timed to take place with the greatest possible degree of accuracy, while the fuse shall, at the same time, consist of but few parts and those simple of construction and inexpensive of manufacture.

In my application filed January 29, 1903, Serial Number 141,066, for time fuses for projectiles, of which this is a division, I have described and claimed a time fuse in which the period of time during which an impervious body of self-combustible material confined in a casing burns is determined by increasing or decreasing the pressure of the escaping products of combustion upon the surface of the combustive material and in illustration thereof I have described a fuse in which a body of self-combustive material like a colloidal smokeless powder compound is solidly incased in a tube or receptacle having one or more apertures communicating with the bursting charge of the projectile, and other apertures for the escape of the products of combustion controlled by means of a spring-pressed valve, the tension of whose spring is increased or decreased to regulate the escape of gases during the flight of the projectile, and thereby regulating the pressure and duration of the combustion of the self-combustive material. The body of the self-combustive material is impervious to the flame of ignition so that the body is consumed with a definite and uniform rate of combustion through its entire depth or length.

The present invention has for its object to provide a time fuse in which the self-combustive material will burn through any desired length with a uniform rate of combustion while the products of combustion escape at a uniform pressure, the time of ignition of the bursting charge being regulated by the distance through which the material will have to burn in order for the flame to reach the bursting charge.

To effect the above objects and secure the advantages of this invention, it is essential that the self-combustive material be impervious to the products of its own combustion, thereby enabling combustion to be confined to the surface of the body and further that the products of combustion should be permitted to escape as formed so that the pressure on the burning surface be kept uniform, thereby enabling the self-combustive material to burn at a uniform rate whereby such a body having uniform cross-section will burn through equal lengths in equal times.

In carrying out the invention a body of self-combustive material such as colloidal smokeless gun-powder material or a mixture of smokeless powder material or other colloidal or agglutinating material with a small quantity of black gun-powder incorporated therewith and impervious to the flame or products of its own combustion, is incased in a tube or receptacle and sealed therein in such manner as to preclude the possibility of flame or the products of combustion passing between the body of self-combustive material and the walls of the containing tube or casing. The walls of the tube or casing are provided with holes and corresponding holes concentric therewith are provided in the body of the self-combustive material, and are so arranged and spaced that the distance between the planes of successive holes, taken on the line of the longitudinal axis of the projectile, is such as will be burned through while the projectile is traveling a predetermined distance, such for example as 500 yards. The length through which the self-combustive body burns before reaching any particular hole is regulated by opening or closing the desired number of holes in the tube or casing communicating with the powder charge in the shell. The rate at which the self-combustive material burns is controlled by maintaining a uniform pressure on the burning surface which is effected by providing the tube or casing containing the combustive material with passages opening into the atmosphere, and of such area as will permit the products of combustion from the burning self-combustive material to escape at such rate as will thereby maintain the desired uniform pressure.

Means are also provided for determining the adjustment of the tube or casing contain-

ing the self-combustive to secure the explosion of the shell after it has traveled the desired distance.

By a self-combustive material as herein used is meant a compound capable of supporting its own combustion in a confined space.

To better explain the nature of the invention, reference is had to the accompanying drawings which are designed merely as illustrations to assist in the description of the invention.

Referring to the drawings Figure 1 is a longitudinal central section of the fuse with adjacent parts of the projectile; Fig. 2 is a longitudinal view of the fuse, partly in elevation and partly in section; and Fig. 3 is a view, showing the use of a stuffing box in combination with the fuse tube or thimble and fuse casing.

In the form of fuse shown in Fig. 1, the fuse tube or casing E′ is provided with a screw-thread upon its outer surface, and is adapted to screw into the forward end of the projectile B, while on its inner surface is another screw-thread into which is screwed the thimble or fuse tube N′. The rearward portion F′ of the thimble N′ is made to fit closely to the inner surface of the casing E′, and to form therewith a gas-tight joint. In the portion F′ of the thimble N′ is provided a body of self-combustive material G′, which is sealed into the tube or thimble in such wise as to preclude the possibility of flame or the products of combustion passing between the body of self-combustive material and the walls of the tube or thimble. Holes X are cut through the walls of the thimble and corresponding holes M′ concentric therewith are cut in the body of the self-combustive material. The holes X and M′ are cut in a direction which lies in a plane lying at right angles to the longitudinal axis of the projectile, and the distance between the plane of each hole is such, taken on the line of the longitudinal axis of the projectile, that the holes form a series having a distance between them, of say, about a sixteenth of an inch, or such a distance as will be burned through, or be caused to be burned through, while the projectile is traveling through a distance of 500 yards. The holes are so arranged, however, with respect to one another, that each hole which lies nearest its neighbor with respect to a plane transverse to the longitudinal axis of the projectile shall be opposite or at as great a distance as possible apart in other directions.

By turning the thimble N′, only one of the holes may be caused to communicate with the powder chamber and powder charge D, while the openings to all the other holes will be closed by the inner surface of the casing E′, in which position the self-combustive compound will require to be burned through its whole length or depth before communication can be established between its products of combustion and the powder charge D. If, however, the thimble N′ be screwed far in until all of the holes communicate with the powder chamber D, it is obvious that it will be necessary for combustion to proceed to a depth of only about a sixteenth of an inch before access will be had by the flame through the forward hole of the tube into the powder chamber D. By this arrangement of holes, it is obvious that the time during flight when explosion shall be made to take place, may be adjusted to a nicety. It is obvious, furthermore, that any desired number of holes X may be provided, so that, instead of a thickness of a sixteenth of an inch intervening between the planes of the holes, as above described, the thickness may be reduced to a thirty-second, or to a sixty-fourth of an inch, and this adjustment enables the timing of the fuse to a very great nicety. A special advantage of the arrangement of the holes M′ already explained is that although the distance between them on a given plane may be very small, the actual distance separating the holes provides a thickness of material incapable of being disrupted or broken through by pressure of the products of combustion in the chamber H′.

Combustion of the self-combustive material G′ is started at the time of discharge of the projectile from the gun by igniting means, preferably of the form illustrated in Fig. 1, which comprises a thimble I′ having external screw-threads adapting it to be screwed into the end of thimble N′, and is provided with end closures having vent passages U′, R′ for escape of the products of combustion, the size of which passages determines the rate of escape of the products of combustion of the self-combustive material G′, and these are therefore made of suitable size to secure a uniform pressure in the chamber H′ during the combustion of the body G′.

Over the opening T′ is located the percussion cap J′ which is exploded at the time of discharge of the gun by means of a striker V, having a firing point K′, and temporarily held in place by means of a shear-pin L′ which by reason of the inertia of the striker is ruptured, permitting the firing-point and cap to impinge upon and explode the latter. The flame passing through passage T′ ignites the surface of the self-combustive material G′, which may be facilitated by means of a small quantity of granular powder placed in the chamber H′ Thereupon combustion of the self-combustive G′ progresses uniformly at the end surface thus ignited because the body of the material is impervious to the flame of combustion, and further because of the provi-

sion of means for maintaining a uniform pressure of the gases escaping through the firing plug by way of passages U′, grooves S′ in striker V and openings R′ in the end of the thimble I′.

Means are also provided consisting of a scale W′ whereby the time required for the consumption through the predetermined depth of the self-combustive material to the bursting charge of the projectile may be determined with great nicety.

To provide against the possibility of communication being established between the chamber H′ through any of the holes X to the powder chamber D, between the outer surfaces of the tubes N′ and the casing E′, a stuffing box may be provided, consisting of a ring Y and packing Z, whereby any such escape of gases may be obviated.

What is claimed is:

1. In a fuse for projectiles, the combination of a fuse casing, a thimble or chamber longitudinally adjustable therein and having lateral perforations in its walls, a self-combustive body impervious to the products of its own combustion in said thimble or chamber, means for igniting said self-combustive body, and passages or vents permitting the escape of the products of combustion as formed.

2. In a fuse for projectiles, a casing having an imperforate wall, a container adjustably mounted therein and having a series of progressively arranged perforations, a self-combustive material impervious to the products of its own combustion in said container, and means for adjusting said container to uncover any desired perforation to expose the bursting charge of the projectile to ignition through said perforation.

3. In a fuse for projectiles, a casing having an imperforate wall, a container adjustably mounted therein, and having a series of perforations in its walls, a self-combustive material impervious to the products of its own combustion in said container, means for adjusting said container to uncover any desired perforation to expose the bursting charge of the projectile to ignition through said perforation, and means igniting said self-combustive material at a point unexposed to said bursting charge.

4. In a fuse for projectiles, the combination of a fuse casing, a thimble or chamber longitudinally adjustable therein, lateral perforations in the walls of said chamber or thimble and at graduated distances from the end thereof, a self-combustive body in said chamber and exposed to said perforations, means for igniting said self-combustive body, and passages or vents permitting the escape of the products of combustion as formed.

5. In a fuse for projectiles, the combination of a thimble or chamber having perforations at graduated distances in its walls, means for adjusting said chamber longitudinally with relation to the firing charge of the shell, a self-combustive material impervious to the products of its own combustion in said chamber, means for igniting said material, and means for maintaining uniform gas pressure in said chamber when said combustive material is ignited.

6. In a fuse for projectiles in which a self-combustive material is interposed between the bursting charge and igniting means, the combination of a fuse casing, a container, a self-combustive material therein provided with holes, one part of said container telescopes in said casing and is provided with side openings for registering with holes in the self-combustive material, a thimble in said container provided with vent passages, and igniting means carried by said thimble and operative on the discharge of the projectile to start surface combustion on the end face of the self-combustive material.

7. In a fuse for projectiles in which a self-combustive material is interposed between the bursting charge and igniting means, the combination of a fuse casing, a container, a self-combustive material therein provided with holes, said container being adjustably mounted in said casing and having side openings for registering with corresponding holes in the self-combustive material, and igniting means operative on the discharge of the projectile to start surface combustion on the end face of the self-combustive material.

8. In a fuse for projectiles in which a self-combustive material is interposed between the bursting charge and igniting means, the combination of a fuse casing, a self-combustive container mounted in said casing having side openings, means for imparting longitudinal movement to said container to expose the bursting charge through any desired opening to ignition by the self-combustive material in the container, and igniting means to start surface combustion at one end only of the self-combustive material.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HUDSON MAXIM.

Witnesses:
WALTER O. GRAHAM,
EDW. D. NEIGHBOUR.