O. OHLSON.

TIME FUSE FOR ARTILLERY PROJECTILES.

APPLICATION FILED JUNE 19, 1916.

1,312,803.

Patented Aug. 12, 1919.

2 SHEETS—SHEET 1.

FIG. 1

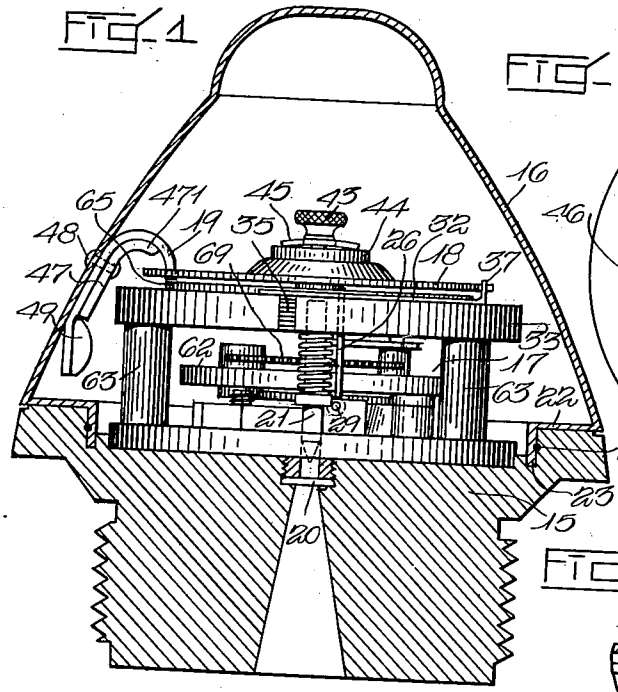


FIG. 2.

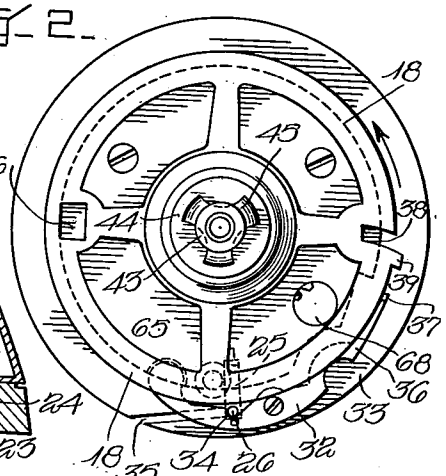


FIG. 4.

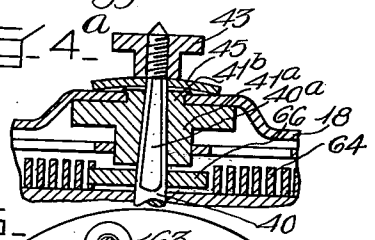


FIG. 3.

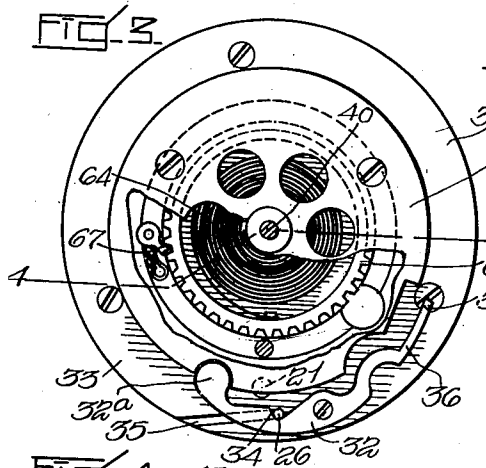


FIG. 5.

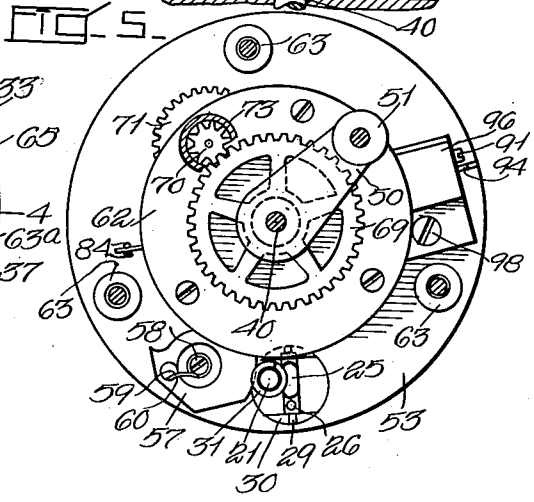
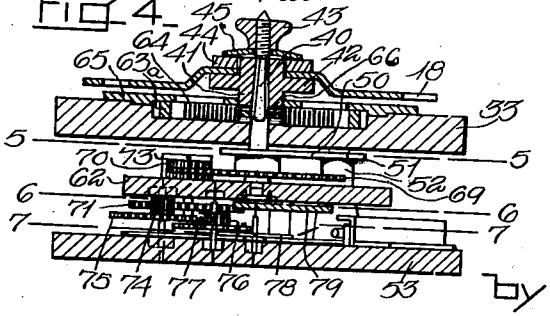


FIG. 4.



INVENTOR:
OLOF OHLSON

by Wright, Brown, Quinby & Shay
ATTORNEYS

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2 SHEETS—SHEET 2.

FIG. 6.

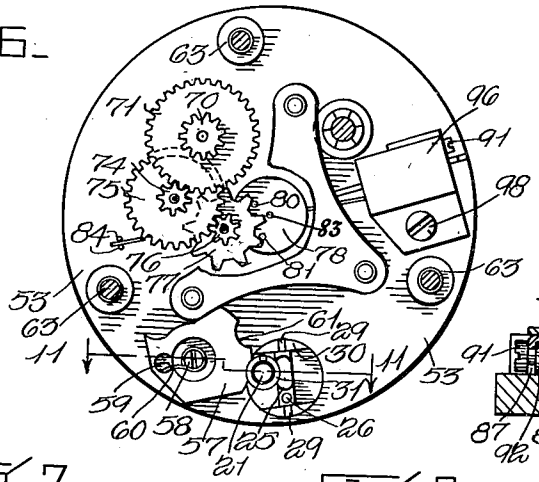


FIG. 9.

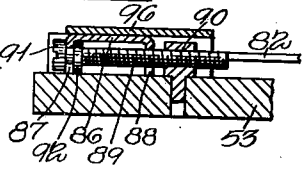


FIG. 7.

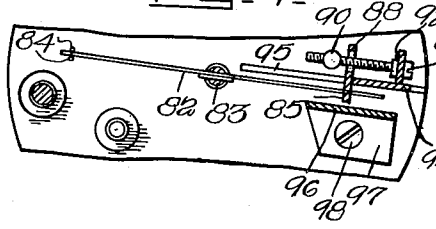


FIG. 8.

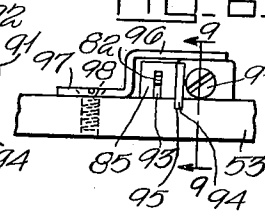


FIG. 10.

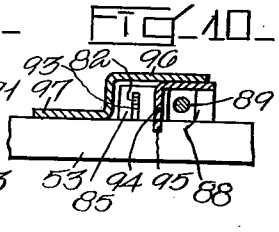


FIG. 11.

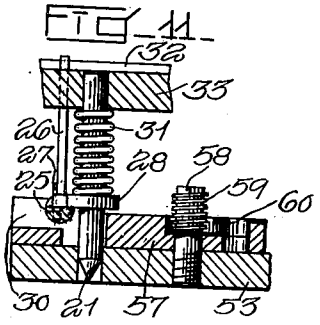


FIG. 12.

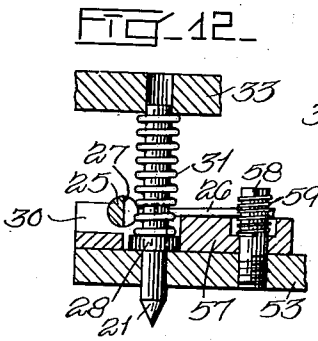


FIG. 13.

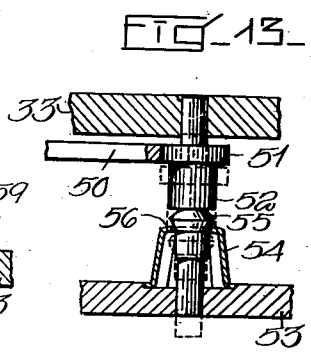
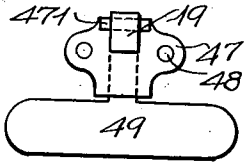


FIG. 14.



INVENTOR:
OLOF OHLSON

by Wright, Brown, Quinby & Craig
ATTORNEYS

UNITED STATES PATENT OFFICE.

OLOF OHLSON, OF WEST NEWTON, MASSACHUSETTS, ASSIGNOR TO WALTHAM WATCH COMPANY, OF WALTHAM, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

TIME-FUSE FOR ARTILLERY-PROJECTILES.

1,312,803. Specification of Letters Patent. Patented Aug. 12, 1919.

Application filed June 19, 1916. Serial No. 104,416.

To all whom it may concern:

Be it known, that I, OLOF OHLSON, a citizen of the United States, residing at West Newton, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Time-Fuses for Artillery-Projectiles, of which the following is a specification.

The present invention relates to time fuses adapted to be applied to ordnance shells for detonating the charge therein after a predetermined interval of time from the discharge of the shell from the gun. The type of fuse to which the invention particularly relates is that wherein the time of detonation is controlled by a chronometric motor or clock work. My main objects are to provide in connection with such a fuse, means by which the clock work and the timing element controlled thereby may be set in operation at the instant of discharge of the gun; a safety stop for insuring against premature ignition of the charge in the shell, that is insuring that such charge will not be detonated until after the gun has been fired; and in other ways to improve fuses of this nature to produce an efficient mechanism of the greatest possible simplicity. The precise nature of the invention and the principles embodied therein appear fully from the following detailed description of one embodiment of the invention, in connection with the appended claims. In the drawings,

Figure 1 is a longitudinal section of a fuse head having my improved fuse associated therewith.

Fig. 2 is a plan view of the fuse mechanism.

Fig. 3 is a similar view of the parts lying beneath the timing disk, a portion of such parts being broken away.

Fig. 4 is a vertical section of the fuse taken approximately on the line 4—4 of Fig. 3.

Fig. 4ª is a sectional view of a modified detail.

Figs. 5, 6, and 7 are plan views of parts lying below the lines 5—5, 6—6, and 7—7, respectively of Fig. 4.

Figs. 8, 9, and 10 are detail views of a regulator which I have devised in connection with the clock movement or chronometric motor which forms the operating part of the fuse.

Figs. 11 and 12 are detail views of the firing pin and its release mechanism showing the same respectively in the cocked and in the discharged position.

Fig. 13 is a detail view of the lock for holding the clock movement inoperative prior to the firing of the gun.

Fig. 14 is a detail elevation of the coupling between the setting cap and the timing member of the fuse mechanism.

The same reference characters indicate the same parts in all the figures.

Referring first to Fig. 1 which shows the entire fuse, 15 represents the base of the fuse, 16 the setting cap, 17 the clock movement which times the detonation of the shell, 18 the adjustable timing disk, and 19 the coupling by which said timing disk is coupled to the setting cap. It is to be understood that the fuse body is adapted to be screwed into the head of the shell prior to the loading of the same into the gun, and is provided with a primer 20 or percussion cap which is ignited by the impact of the firing pin 21 when the latter is released by the timing disk. The setting cap may be of sheet metal of a form common in articles of this sort, which incloses and protects the clock movement. Its base portion is inwardly offset at 22 and provided with a flange 23 which is set into a recess in the fuse body and is secured therein by any suitable means which will permit its rotation but prevent its removal, such means being conveniently a ring or wire 24 contained partly in a groove in the flange 23 and partly in the adjacent portion of the fuse body.

The firing pin is held in the cocked position, represented in Figs. 1 and 11, by a trigger consisting of a bar 25 and an arm or pin 26, the bar being mounted in a horizontal position close beside the firing pin and having a flat side 27 underlying a collar or flange 28 on the pin. Said bar 25 has trunnions 29 mounted in bearings 30 and the surface 27 is approximately in a plane containing the axis of said trunnions, whereby rotation of the bar withdraws the surface from the collar and allows the latter to slip past the same under the influence of its powerful coil spring 31, as shown in Fig. 12. When the pin is cocked, the force applied by the collar on the locking bar is at one side of the axis of the bar, whereby a constant tendency exists to turn the bar, which tendency is resisted by a lock for the trigger arm 26; release of said lock under the control of the

timing mechanism permitting the trigger to release the firing pin.

The trigger lock comprises a lever 32 (Fig. 3) pivoted to the top plate 33 of the movement and having on one arm a shoulder or abutment 34 which engages the trigger arm 26. The latter is adapted to enter and travel in a slot 35 in the plate 33, such slot being provided simply to enable said arm to move freely in its appointed path. The other arm 36 of the lever has an upstanding finger 37 which bears against the rim of the timing disk 18 as best shown in Figs. 1 and 2. When engaged as shown, the lever stands with its shoulder 34 across the path of the arm 26. Said shoulder is somewhat inclined to this path, whereby the force applied by the arm through the action of the spring 31 already described, tends to swing the abutment out of the way of the arm and to hold the finger 37 in contact with the disk 18. This lever is of light stock, preferably of thin sheet metal so as to be easily moved, and is so designed that its arms have such masses and lengths that centrifugal force acting on such arms is equalized on opposite sides of the pivot. That is, the product of the mass multiplied by the distance of the arm from the fulcrum of the lever is the same as to both arms, whereby the turning moment of centrifugal force on either arm is substantially balanced by that on the other, and there is no appreciable resultant unbalanced force either pressing the finger 37 against the timing disk, with production of friction, or pressing the other arm against the pin 26. Also the lever lies against the face of the plate 33 which supports it against the shock of firing and prevents it from being bent by its inertia under such shock. The disk 18 has a notch 38 extending inwardly from its periphery which is brought by the rotation of the disk opposite to said finger, and is adapted to be entered by the finger when thus placed. At one side of the notch 38 is a shoulder 39 projecting from the periphery of the disk, and adapted by engaging the finger 37 to limit rotation of the disk. Said disk is frictionally connected with the center staff 40 of the clock movement, as shown in Fig. 4, being mounted on a sleeve 41 which fits a tapered part of the staff 40, said sleeve having a flange 42 on which the central part of the disk is pressed by a nut 43 screwed upon the staff and an intermediate washer 44 and spring spider 45. A part of the sleeve 41 passes through a hole in the center of the timing disk, and such part of the sleeve, and the hole, are preferably of corresponding non-circular outline. Said disk also has a recessed notch or aperture 46 which is entered by one end of the coupling 19. It will be apparent from the foregoing that the timing disk may be turned by the setting cap so as to adjust the angle between the finger 37 and the notch 38. The maximum value of this angle is slightly less than 360°, and the adjustment may be made to any angle less than the maximum.

One important feature of the invention relates to means for disconnecting the coupling 19 when the projectile is fired from the gun, in order to permit the rotation of the timing disk with the clock movement. For this purpose the coupling is so made as to be dislodged and withdrawn from the recess 46 by its inertia under the shock of firing. It is constructed as a curved strip, bar, or rod, which passes between the setting cap 16 and a bridge 47 (Figs. 1 and 14), said bridge being secured to the cap by rivets 48 and the coupling passing between these rivets. The outer end 471 of the bridge is curved, and the coupling bar is similarly curved, its length and curvature being carried far enough to enter its end into the notch 46. The opposite end of the lock carries a weight 49 designed with such mass that its inertia when the gun is fired is sufficient to move the coupling endwise along the bridge, thus withdrawing the end of the coupling from the timing disk. The material of which the coupling is made is sufficiently ductile to permit of its being bent enough to straighten out that part of its curved end which passes between the bridge and the cap when withdrawn as above described, while at the same time it is sufficiently stiff to transmit the slight force needed to turn the setting disk, and to maintain exact registry between the disk and the cap, such registry being of course essential in order accurately to time the bursting of the shell. I have found that sheet brass is suitable material for this purpose.

The shock of discharge also drives the sleeve 41 carrying the timing disk into tight frictional engagement with the staff 40 of the movement, thereby assuring exact timing of the fuse.

The clock movement is normally prevented from running by a locking arm 50 secured to the staff 40 and having a notch in its end which is entered by a head 51 on the sliding pin 52 (see particularly Fig. 13). Said pin is guided at its ends in the top and bottom plates 33 and 53 of the movement, and is adapted to be held in either the locking position shown by full lines in Fig. 13, or in the releasing position shown dotted in said figure by a clutch 54 which coöperates with a double cone 55 on the pin 52. Said clutch is a sleeve secured at its base on the plate 53 and having an inwardly turned lip 56 engaging the cone 55, the sleeve being divided by longitudinal cuts into a number of tongues which are resilient. Said tongues by pressing against the lower bevel of the cone 55 hold the locking head firmly in the locking position, but are adapted to yield

to permit the enlarged part of the cone to pass when a sufficiently powerful force is exerted downwardly on the locking stud. This force is provided by the inertia of the stud under the shock of firing. When once brought into the unlocking position, the stud is retained by the grip of the clutch jaws on the upper bevel of the cone 55. The force so applied by inertia upon firing is so much greater than any force which can be applied in handling either the fuse or the shell with the fuse attached, that the clutch 54 may be made sufficiently powerful to prevent any accidental displacement of the lock, and at the same time yielding enough to make certain its displacement at the time of discharge.

An additional safeguard, however, is provided to make absolutely certain that the shell will not be exploded in handling, or any time before firing the gun. This safeguard or safety lock is a block 57 pivoted upon a stud 58 set in the bottom plate 53, and having a portion underlying the collar 28, as shown best in Fig. 11. Said block is adapted to swing freely under the collar 28 when the latter is held back by the trigger bar 25, and is held in the normal position shown in Figs. 6 and 11 by a spring 59 which is wound around and fixed to the stud 58 and bears against a shoulder 60 on the block. Said block has a recess 61 at a point in its periphery between the firing pin and the axis of the fuse. After the shell has been discharged and is set to spinning by the rifling of the gun the block 57 is drawn outward by centrifugal force until the notch 61 is beside the firing pin, whereby there is no longer any obstruction but the trigger in the path of collar 28, and the pin may act as soon as the trigger is released by the mechanism previously described. The spring 59 is comparatively light and the lock 57 relatively massive, whereby such block is made certain to remain in the releasing position as long as the shell continues in flight.

The clock movement by which the timing disk is driven comprises first a frame consisting of the top plate 33, bottom or pillar plate 53, an intermediate plate 62, and a sufficient number of posts or pillars 63, all of sufficiently massive construction to withstand the shock of discharge without suffering damage. In the upper face of the top plate is a recess containing a winding wheel 63^a and a main spring 64 (Fig. 4). An adjustable plate 65 covers this recess and said wheel and spring. One end of the spring is connected to the winding wheel and the other to a collar 66 on the staff 40. The usual retaining click 67 is shown in Fig. 3. In the plate 65 is a hole 68 (Fig. 2) for insertion of a winding instrument so placed that such instrument may engage directly with the teeth of the winding wheel. The first or main wheel of the clock train is fastened to the staff 40 and lies between the plates 33 and 62, the lower pivot of the staff being in plate 62. The said first wheel 69 meshes with a pinion 70 on a staff which passes through the plate 62 and carries a wheel 71 between the plates 62 and 53. A housing 73 partly incloses the pinion 70. The remainder of the train consisting of pinion 74, wheel 75, pinion 76, escape wheel 77 and balance or pallet 78 lie between the plates 62 and 53 and are best shown in Fig. 6. The pallet or balance 78 is a disk mounted on a staff which is alined with the center staff 40 and the pivots of which have bearings in the pillar plate 53 and in a bridge 79 under the plate 62. It carries two pins 80, 81 which engage and are driven by the teeth of the escape wheel in a manner similar to the pallet of the ordinary lever escapements. The spring for returning the balance after each impulse imparted to it by the escape wheel is approximately straight and is shown at 82 in Fig. 7. It passes through the staff 83 of the balance and in which it is wedged and its opposite ends are confined, one end being confined between two fixed pins 84, and the other end by a regulator 85. This regulator is movable lengthwise of the spring so as to alter its effective length and thus vary the time of swing of the balance wheel in the manner well understood in watch making.

The construction of the regulator is a feature of the invention and comprises the following parts. That part to which I have applied the numeral 85 is a tongue projecting laterally from one end of what may be termed a bridge 86 (Fig. 9). Said bridge may be of sheet metal and has its ends 87 and 88 turned down to rest on the plate 53 and slotted to admit the shank of a regulator screw 89. The part 85 projects laterally from the turned down end 88. The screw is threaded through a stud 90 fixed in the plate 53, and its head bears against one side of the turned down part 87. A collar 92 bears on the other side of said part. Thus rotation of the screw in one or the other directions evidently moves the bridge in or out with respect to the balance, and shifts the regulator part 85 along the spring, which latter passes through a slot 93 in the regulator. For additionally and more accurately guiding the regulator at a given path, the bridge 86 is provided on one side with a tab 94 which is turned down and the edge of which enters a guide groove 95 in the plate. It is retained in said groove and the bridge in connection with the regulating screw and with the hair spring, by a cover plate 96 which overlies the bridge and has a lip 97 secured to the plate 53 by a screw 98.

It is intended that when the fuses are shipped ready for use the main spring of the

clock movement will be wound up, and the timing disk placed with its shoulder 39 in contact with the finger 37. Rotation of the disk and of the setting cap 16 is then possible in one direction only. In setting the fuse the cap is turned until the angle between the notch 38 and the finger 37 is that which will bring release of the trigger mechanism after the desired interval of time from firing. Ordinarily graduations will be provided on the exterior of the cap and the adjacent part of the fuse body to show what this angle is or what the time is in which the timing disk will rotate through such angle. The length of time required for rotating the disk through any specified angle may, of course, be determined by the value of the time train according to principles well understood in watch making. The lock for the movement is of course set in locked position and the trigger and the firing pin placed in the cocked position and held there by the release lever 32. When the gun is fired the shock of the explosion simultaneously disconnects the coupling 19 and releases the time train lock 51, allowing the clock movement to run and to rotate the disk 18. As soon as, or immediately after, the shell is set in motion, the safety lock 57 is thrown out of the way of the lock pin collar. When, after the release of the train, the notch 38 arrives opposite the finger 37, the trigger is released, which releases the firing pin, allowing the latter to explode the primer 20 and thereby to ignite the charge in the shell.

Fig. 4[a] shows a simpler means of attaching the timing disk or member to the sleeve 41, the principal feature of which consists in the elimination of the washer 44. In this construction the sleeve 41[a] has a short projection 41[b] which passes through the hole in the center of the timing disk and is headed over or staked on the disk. The spring spider or spring washer 45 and the nut 43 are substantially the same as previously described. The same figure illustrates more in detail the mode of associating the collar 66, to which one end of the main spring 64 is connected, to the staff 40. Said staff is flattened at one or more sides as indicated at 40[a], and the hole in the collar 66 is shaped to fit such contour of the staff. Said collar is evidently demountable from the staff, whereby assembling of the parts is permitted, while it is prevented from turning about the staff.

I desire to state that in the foregoing description the terms which I have used have been adopted solely for convenience of description and without intent to limit the protection which I claim to parts corresponding strictly to any specific definitions of the terms used. Thus, for instance, the term "disk" as applied to the timing member 18 is not intended as a limitation to the form of such member, nor are such terms as "lever", "arm", "pin", "collar", "finger", and other descriptive terms, intended as limitations in the form or construction of the parts to which they have been applied. Neither do I limit the invention to the precise relative positions of the parts as shown, but include within the claimed protection all arrangements of elements having the essential correlation set forth. The following claims are to be understood in the light of this explanation.

What I claim and desire to secure by Letters Patent is:

1. In a time fuse for shells, a motive mechanism, an arm connected with said mechanism to be moved by running thereof, detonating means controlled by said motive mechanism, a lock for preventing running of the motive mechanism prior to firing of the shell from a gun, said lock being normally in the path of said arm and being displaceable from said path by force acting when the shell is so fired, the lock having a protuberant part with oppositely inclined surfaces facing respectively toward and away from the direction of such displacement, and resilient separable holding jaws bearing against one of said faces in position to be spread apart thereby when the lock is so displaced, and to close against the other surface thereafter, whereby to retain the lock in the displaced position.

2. In a time fuse as set forth in claim 1, said surfaces being conical zones arranged base to base with their axes extending in the direction of displacement of the lock.

3. In a time fuse as set forth in claim 1, a lock having the characteristics pointed out in said claim and arranged for displacement in substantially the line of flight of the shell, whereby it is displaced by its inertia under the shock of firing.

4. In a time fuse for shells a motive mechanism having a staff, an arm connected to said staff, a lock adapted to lie in the path of a part of said arm and having an oppositely beveled protuberant cone portion, the lock being displaceable out of the locking position in a line substantially coincident with the axis of said cone portion and the line of flight of the shell, and resilient separable holding jaws bearing against the side of said cone portion toward which the latter moves in assuming its unlocked position, said jaws being located to bear on the oppositely beveled side of said cone portion after displacement of the lock.

In testimony whereof I have affixed my signature.

OLOF OHLSON.