April 24, 1962 R. SIMMEN ET AL 3,030,887

MECHANICAL TIME FUZES, PARTICULARLY FOR A SUBMARINE EXPLOSIVE CHARGE

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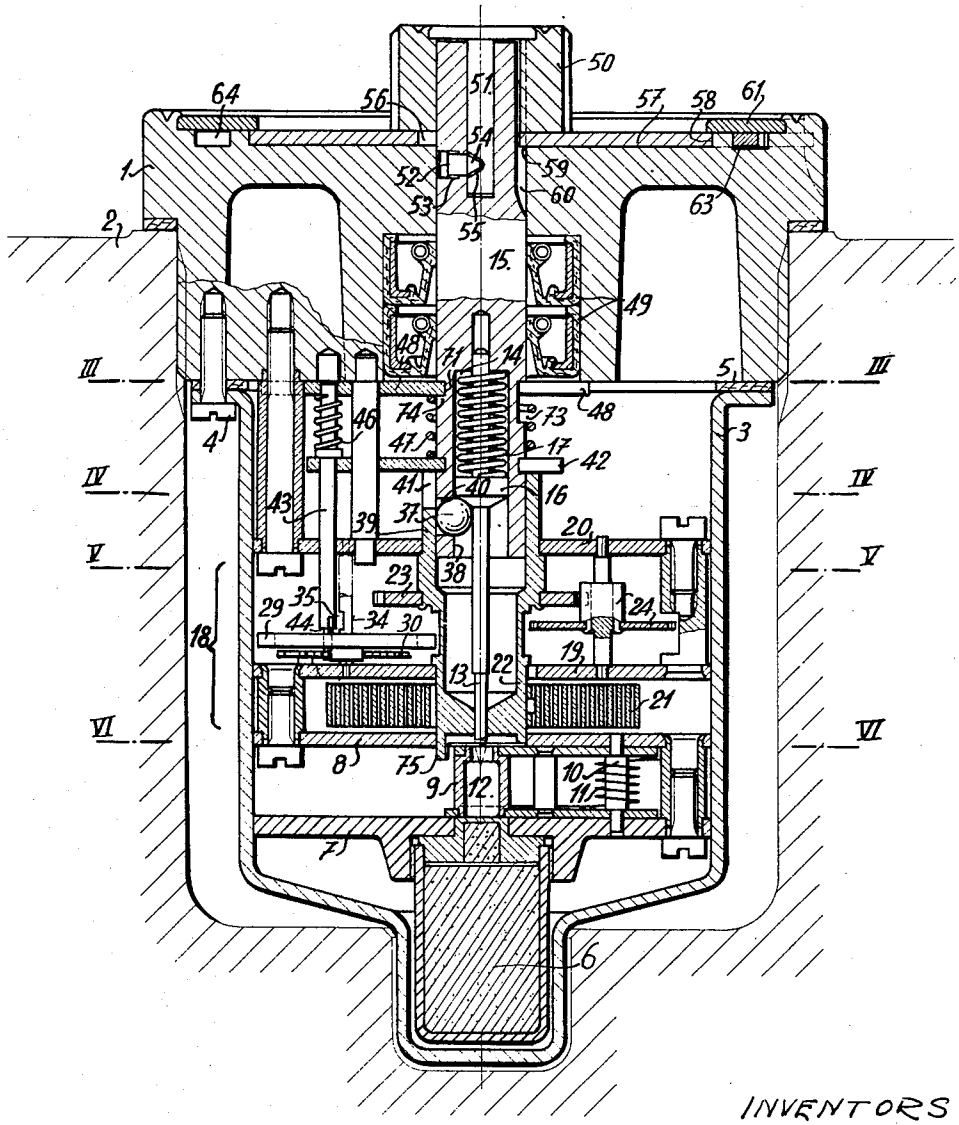
FIG. 1



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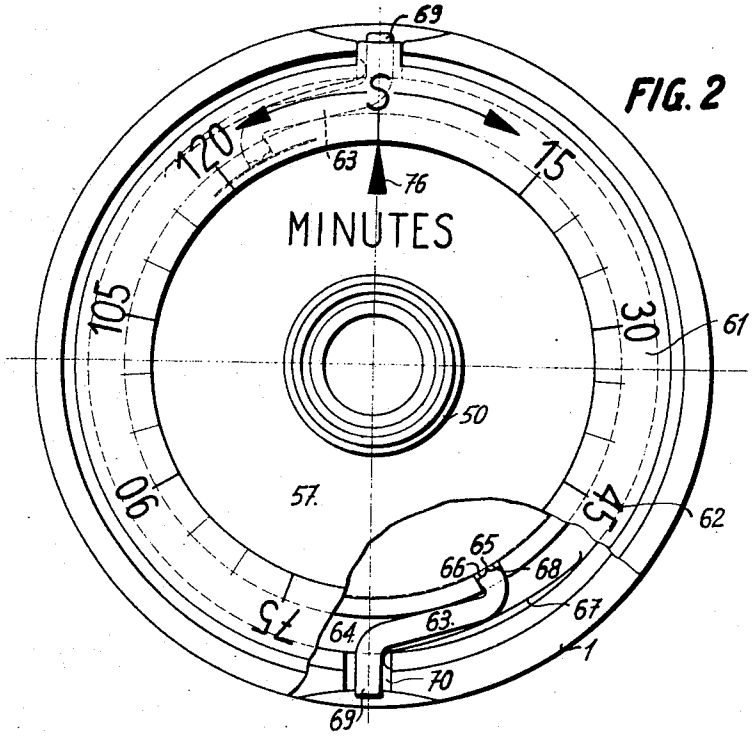

FIG. 2

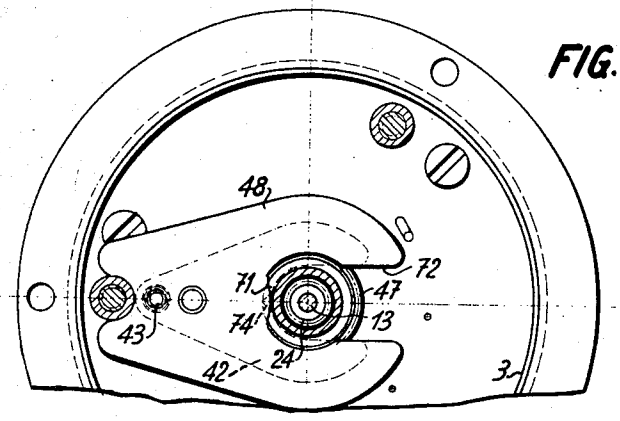

FIG. 3

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FIG. 4

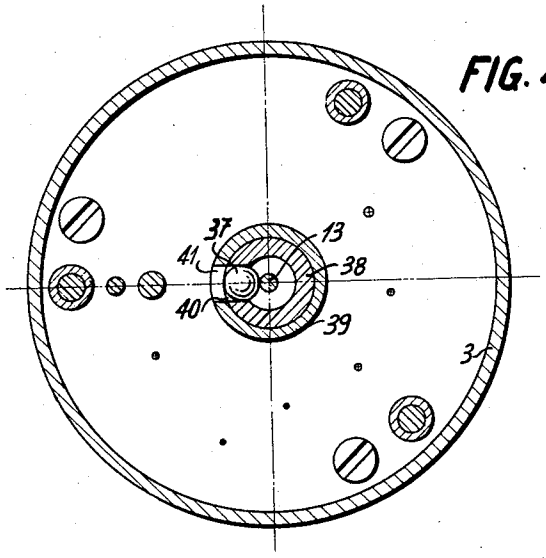

FIG. 5

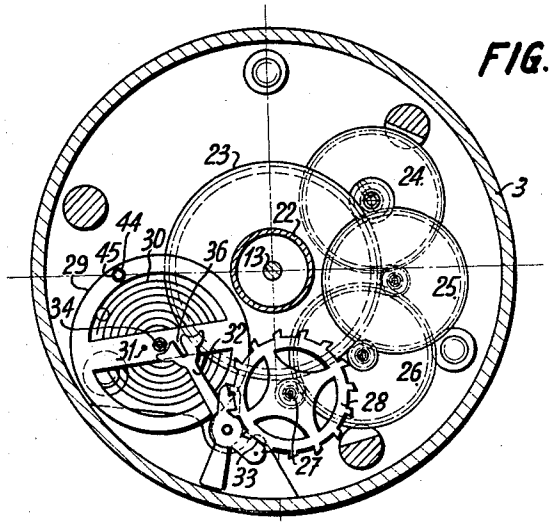

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FIG. 6

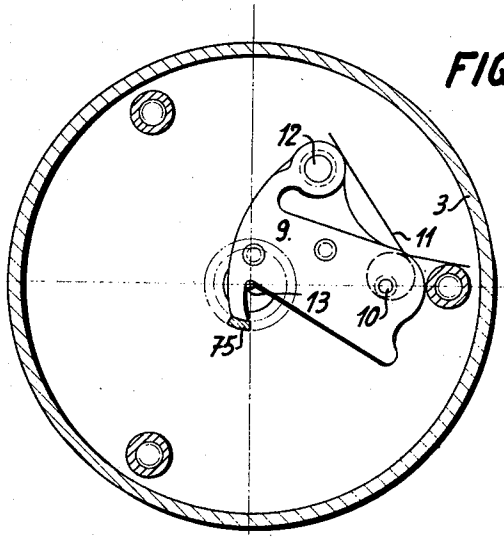
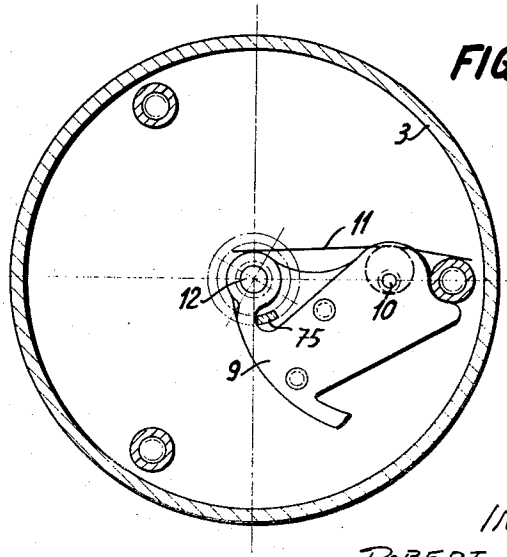


FIG. 7



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3,030,887

MECHANICAL TIME FUZES, PARTICULARLY FOR A SUBMARINE EXPLOSIVE CHARGE

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8 Claims. (Cl. 102—84)

The present invention has for its object a mechanical time fuze, particularly for a submarine explosive charge, comprising a detonator capable of being fired by a striker loaded by a spring, said striker being maintained in a safe position by a locking device of which the release is controlled by a clockwork movement after timing the fuze.

The mechanical time fuze according to the invention is characterised in that the locking device comprises a bolt located in the interior of two independent coaxial parts, each having an opening, said openings being displaced in safe position for preventing the release of the bolt, the clockwork movement controlling one of the two independent coaxial parts for bringing the said openings in coincidence after a time given by the timing, one of these two coaxial parts being secured to a timing shaft capable of being moved angularly and axially and of which one end carries an operating member, a device for locking the clockwork movement being controlled by said timing shaft, a safety device preventing axial movement of the said shaft in view of the unlocking of the clockwork movement only after an angular movement of this determining a predetermined timing.

One form of construction of the fuze according to the invention is shown diagrammatically and by way of example in the accompanying drawings, wherein:

FIG. 1 is a view in axial section of said fuze.

FIG. 2 is a plan-view.

FIG. 3 is a section on the line III—III of FIG. 1.

FIG. 4 is a section on the line IV—IV of FIG. 1.

FIG. 5 is a section on the line V—V of FIG. 1.

FIG. 6 is a section on the line VI—VI of FIG. 1, showing a primer safety with which the fuze is provided, said primer safety being shown in the safe position.

FIG. 7 is a view similar to the preceding one, said primer safety being released.

This mechanical time fuze, particularly for a submarine explosive charge, comprises a fuze body 1 adapted to be screwed into the shell 2 of the explosive charge. This fuze body 1 carries a fuze sheath 3 held thereon by means of screws 4 and with the interposition of a fluid-tight lining 5. Said fuze body and sheath 3 constitute a casing which encloses the whole mechanism thereof.

In proximity to the primary explosive charge in shell 2, there is formed a well in which is located the detonator 6 secured to a first plate 7. Between this plate 7 and a second plate 8 is located a safety device constituted by a movable support 9 hinged about a spindle 10 disposed eccentric to the axis of the casing and subjected to the action of a spring 11. Said support 9 carries a primer 12 (see FIGS. 1, 6 and 7) adapted to be maintained spaced from the detonator 6 and from the trajectory of the point of a firing pin 13 located in the axis of the casing, while the fuze has not been timed and released.

This pin 13 is disposed in a central socket portion 14 of a time setting shaft 15 which is angularly and axially movable. As shown, this pin 13 has a medial collar 16 and a spring 17 is coiled about the portion of the stem of the pin in the socket and is confined between the botton of the socket portion 14 and the collar 16 to bias the pin to firing position.

The pin 13 is held in a safe position, notwithstanding the load of its spring 17, by a detent or locking device whose release is controlled by a clockwork movement indicated generally by the reference 18. This clockwork movement 18 is secured to three plates, namely the second plate 8, a third plate 19 and a fourth plate 20.

Between the plates 8 and 19 is disposed the spiral motor spring 21 of the clockwork. This spring has its outer end anchored to the plates 8 and 19, while the inner end is adapted to entrain a hollow shaft 22. This hollow shaft 22 is extended upwardly in such a manner as to telescope the lower end of the manually manipulatable time setting shaft 15. Thus it may be said that 15 and 22 constitute a two-part timing shaft assembly, the outer part, or selectively settable section, being capable of manual rotation and axial movement while the inner clock controlled section 22 is fixed against axial movement because it is mounted between the third and fourth plates 19 and 20 only to be driven by the clockwork.

The hollow clock shaft 22 carries a principal toothed wheel 23 driving, through the medium of a gear train 24 to 27, an escapement wheel 28 (see FIGS. 1 and 5). The movements of said escapement wheel 28 are controlled by a balance 29 provided with a spiral spring 30, the balance carrying a pin 31 cooperating with a fork 32 controlling the movements of the anchor 33. The spindle 34 of the balance 29 is provided with a notch 35 for the passage of the end of the fork 32 during each of its movements of oscillation produced by the entrance of the pin 31 into the slot 36 of the fork 32.

The locking device of the firing pin 13 comprises a bolt formed, in the particular case, by a ball 37 located in the interior of two independent coaxial parts 38 and 39. The internal part 38 is constituted by the inner end of the timing shaft 15, whilst the external part 39 is constituted by the adjacent end of the hollow shaft 22 which surrounds the time setting shaft 15 over a predetermined portion of its length. The part 38 has an opening 40, in which is engaged the ball 37. As regards the part 39, this has an opening 41, displaced axially relatively to the opening 40 in the safe position of the fuze, for preventing the release of the firing pin 13 by radial escape of the ball through the openings 40 and 41.

To the time setting shaft 15 is secured a cross bar 42 carrying a rod 43 constituting means for locking and releasing the balance 29. In fact, in the safe position of the fuze the end 44 of said rod 43 engages in a hole 45 provided in the balance 29. A spring 46 fitted around the rod 43 tends to repel this in such a manner as to maintain the end 44 in the hole 45 of the balance 29. Further, a spring 47, confined between the cross bar 42 and a fifth plate 48 bearing against the body 1, tends to maintain the time setting shaft 15 in the safe position.

Flexible linings 49 ensure fluidtightness between the body 1 and the time setting shaft 15. Said latter carries at its outer end an operating member or knob 50. This operating member 50 is secured preferably in a detachable manner to the outer end of the time setting shaft 15 in such a manner as to be separated from said shaft once the timing has been effected and after the shaft has been pulled axially towards the outside. For this purpose, the operating member 50 includes a button B whose shank 51 is engaged axially in the time setting shaft 15. A detent 52 is fitted in a radial bore 53 of the shaft 15, in such a manner that its inner end 54, which is conical, penetrates into a notch 55 of the shank 51 so as to render this solid with the time setting shaft 15. After axial movement of the shaft 15 towards the outside, by traction applied to the operating knob 50 after a predetermined, angular movement has been imparted thereto, the detent 52 is adapted to be withdrawn radially so as to release the stem 51 and thus the operating member 50. The detent 52 then engages with a notch 56 in such a manner as to lock the time setting shaft 15 in the cocked position.

The time setting shaft 15 is also angularly secured to

a timing disc 57 engaging in a recess 58 of the body 1. Said disc 57 is provided with a projection 59 penetrating into a longitudinal groove 60 of the shaft 15, in such a manner as to provide for completely free axial movement of said shaft 15. The timing disc 57 is maintained against the body 1 by means of a washer 61 embedded into the body 1. Said washer 61 carries time graduations 62 (see FIG. 2).

The timing disc 57 is maintained in a safe position by two locking levers 63 located partly in a circular groove 64 of the body 1. The inner end 65 of each lever 63 passes through an opening 66 and engages under the action of a spring 67, with fine teeth 68 provided at the periphery of the disc 57. The outer end 69 of each lever 63 passes to the outside of the body 1 through an opening 70. The release of the timing disc 57 is thus effected by pressing the extremities 69 of the two levers 63 in such a manner as to disengage the extremities 65 from the teeth 68 of the disc 57.

Said fuze also comprises a safety device only permitting of axial movement of the time setting shaft 15 for the purpose of releasing the clockwork movement 18 after an angular displacement has been imparted to the said shaft, which displacement determines a predetermined timing. This safety device is constituted by the offset safety lip or edge 72 at the inner bight of a U-shaped slot 72 provided in the fixed fifth plate 48, through which U-shaped slot 72 passes the time setting shaft 15. A groove 73 is cut around the shaft 15, in such a manner as to form a projection or shoulder 74 to subsist. Said projection 74 cooperates with the lip edge 71 of the fifth plate for maintaining the time setting shaft 15 in safe axial position. However, it will be readily understood from a study of FIG. 3 that any angular movement of about 30° of the shaft 15 in opposite directions from its central position, permits of it moving axially, the lip or edge 71 only retaining the shoulder 74 over a relatively small angle.

The maintenance of the movable support 9 of the primer 12 in the safe position against the action of its spring 11 is obtained by a restraining tooth 75 which is provided at the end of the hollow shaft 22 opposite to that in which the time setting shaft 15 is engaged (see FIGS. 1 and 6).

The functioning of the mechanical time fuze hereinbefore described with reference to the accompanying drawing, takes place in the following manner:

In the safe position the members of the fuze are located in the position shown in FIGS. 1 to 6, that is to say the ball 37 locks the firing pin 13, the rod 43 locks the balance 29, the tooth 75 retains the movable primer support 9 in the position shown in FIG. 6, and the levers 63 maintain the timing disc 57 in the position shown in FIG. 2.

When it is desired to time the fuze, the ends 69 of the levers 63 are pressed between two fingers for releasing the timing disc 57. It is then possible to rotate said disc 57 by means of the operating knob 50 and to bring the mark 76 opposite any point of the graduation 62, according to the desired interval of retardation of the explosion of the charge controlled by the fuze. The graduation 62 indicates, by way of example, in minutes, the time of retardation which it is possible to select between 15 and 120 minutes. By setting the operating knob 50 in rotation, the internal part 38 is displaced angularly relatively to the coaxial part 39, which spaces the openings 40 and 41 by a predetermined angle, namely an angle corresponding to the degree of timing indicated on the scale 62.

When the timing has thus been effected, the operator applies an axial pull on the operating knob 50, thus moving the time setting shaft 15 towards the outside, whereby the rod 43 is moved therewith, the end 44 thereof leaving the hole 45 and releasing the balance 29. As a result the clockwork movement 18 is set in operation. The axial movement which has been imparted to the shaft 15 has brought into the same plane the openings 40 and 41 of the two coaxial parts 38 and 39. At the end of this axial movement of the shaft 15, the detent 52 releases the shank 51 of the button B which detaches itself from the shaft 15 and this detent 52 locks the shaft 15 in the armed position. By reason of the separation of the operating knob 50, the operator takes fully into account that the fuze is armed and is in operation for firing the explosive charge which it controls. The operator therefore moves away from the charge.

After a period of operation of the clockwork movement 18 permitting of a rotation of about 30° of the hollow shaft 22, the retaining tooth 75 releases the movable support 9 and the spring 11 moves the primer 12 into proximity of the detonator 6 on the trajectory of the striker 13. When the complete time setting has expired, the opening 41 of the part 39 is brought into coincidence with the opening 40 of the coaxial part 38. The ball 37, under the action of the collar 16 with a conical edge, collar urged by the spring 17, is forced radially through the openings 40 and 41 and releases the striker 13. The striker 13, urged by its spring 17, fires the primer 12 and consequently the detonator 6, as also the complete explosive charge.

The foregoing description shows that this mechanical time fuze is of a particularly safe manipulation, which is very advantageous in the painful conditions under which the operators must manipulate them, particularly when these operators must manipulate them under water.

It is to be observed that the driving in rotation of the timing disc 57 may be effected either in one direction or the other. Thus a timing of 120 minutes, for example, may be effected very rapidly, also as rapidly as a timing of 15 minutes.

Numerous variations in construction of the fuze hereinbefore described may be imagined. Thus, the operating knob 50 need not be made detachable from the shaft 15. Further, this fuze need not be provided with the primer safety device 9 to 12. As regards the coaxial parts 38 and 39, instead of forming an integral part of the timing shaft 15 and the motor shaft 22 of the clockwork movement respectively, they may form part of parts controlled by these two shafts 15 and 22.

Another advantage of the fuze hereinbefore described resides in the fact that the conditions of operation of the driving spring 21 of the clockwork movement 18 are independent of the frictional forces which may exist between the timing shaft 15 and fluidtight linings 49, for example, in view of the fact that this spring 21 does not drive said shaft 15 used solely for the timing and the setting in operation of the clockwork movement 18.

We claim:

1. A mechanical timing fuze for an explosive submarine charge, comprising, in combination, a casing, a time scale disc centered on the longitudinal axis of said casing, a detonator charge in the casing, a primer support pivoted eccentrically relative to the axis of the casing and spring urged toward said axis, a detonator charge in the casing to be activated by the primer, a clockwork in the casing; a timing shaft assembly in the casing and including a clock-driven member mounted for rotation only and a time setting member also mounted co-axially with said clock driven member and movable manually in both an angular and an axial direction with respect to said clock driven member; a spring loaded firing pin in the time setting member, and cooperating means on said time setting member and the clock driven member to lock the firing pin in a safe position and to release it after the expiration of a selected interval of time operation by the clockwork to explode the primer.

2. A mechanical timing fuze according to claim 1, wherein the time scale disc has peripheral teeth, and opposite spring biased levers having toothed inner portions normally engage said teeth, and the outer ends of

said levers are exposed for manual squeezing to release the disc to be turned by said time setting member.

3. A mechanical timing fuze according to claim 1, wherein the primer support is held in safe position against the force of its spring by a restraining tooth on the clock driven member, said support having a primer charge which is brought into registry with the firing pin as the said tooth moves away from the primer support.

4. A mechanical timing fuze according to claim 1, wherein, the clock driven member is hollow and its upper end slidably and telescopically receives the lower end of the time setting member.

5. A mechanical timing fuze according to claim 1, wherein the clock driven member and the time setting member have telescopically interfitting parts each provided with an opening radially and axially spaced from one another, and a locking member in the form of a ball is trapped between the opening of the time setting member and the inner wall of the clock driven member until said clock driven member turns angularly so that its opening registers with the opening in the time setting member and the ball passes through both openings to release the firing pin into engagement with the primer.

6. A mechanical timing fuze according to claim 1, wherein the time setting member is provided with a cross bar, and a spring urged rod is controlled by said cross member to release the clockwork.

7. A mechanical timing fuze for an explosive submarine charge comprising, in combination, a casing, a two-part timing shaft assembly mounted in said casing for relative axial and rotary movement and including a sliding member and a rotatable member, a notched primer support normally spring urged to firing position, a firing pin disposed within the timing shaft and energized by a spring toward the primer, the point of said firing pin when the fuze is in the safe position resting in the notched portion of the support, releasable locking means between the two parts of the timing shaft assembly and normally inactive when the fuze is in a safe position and the firing pin is maintained out of contact with the primer, clock mechanism in the housing and including a balance wheel, cooperating safety locking means respectively on a portion of the casing and on the time setting shaft releasable upon the initial turning of said time setting shaft and manual means for rotating and axially moving said sliding member of said timing shaft, whereby, said clock mechanism will turn the rotatable member to release the primer support and the firing pin upon the expiration of a pre-set time interval.

8. A mechanical timing fuze for an explosive submarine charge, comprising, in combination, a fuze body having a central bore communicating with a recess on the exposed outer face of the body and also having an inner attaching edge, a timing disc in said recess and having a central opening registering with said bore, said opening having a radial notch, a fuze sheath having a side wall secured at one end to the said inner attaching edge of the fuze body and having a well at the other end, a detonator charge in said well, a first plate and a second plate disposed in spaced relation within the sheath and covering said well and providing a compartment, a spindle mounted between said plates eccentric to the axis of said bore, a primer support pivotally mounted on said spindle, a primer charge on the support, a spring normally urging the support to move the primer in alignment with the axis of the bore, a third plate spaced from said second plate and a fourth plate spaced from said third plate said last mentioned plates providing compartments respectively for the main spring, balance wheel and gear train of a clock mechanism, a timing shaft assembly including, an outer time setting section having an inner recessed end and fitted in said bore, a hollow inner clock driven section having a portion telescoping over the recessed end of the outer section, said sections having normally non-registering holes, a driving pinion on the hollow inner section meshing with said gear train, a U-shaped fifth plate having a safety lip and spaced from the fourth plate, a guide post between the fourth and fifth plates, a cross member between the fourth and fifth plate and carried by the time setting section of the timing shaft assembly, a spring confined between said cross member and the fifth plate, a downwardly spring biased rod operated by said cross member for engaging and releasing said balance wheel, a safety shoulder on the time setting shaft and normally engaged with said fifth plate, a firing pin having a collar slidably mounted in the recessed inner end of the time setting shaft and spring biased toward the primer, said collar having a beveled end portion, a ball normally confined in opening of time setting shaft and the inner wall of the hollow clock driven section, a knob keyed to the time setting shaft, a button having its head exposed at the top of the knob, and a notched shank, and a detent radially movable in said notch, whereby as the knob is rotated the shoulder on the time setting shaft will move from beneath the safety lip on the fifth plate and permit the time setting shaft to be pulled axially outward to lift the detent into the notch of disc and the cross member will lift said rod to release the clock mechanism, and upon the expiration of the selected time interval said openings will register and the ball will be projected therethrough from the bevel edge of the collar to release the firing pin and strike the primer.

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