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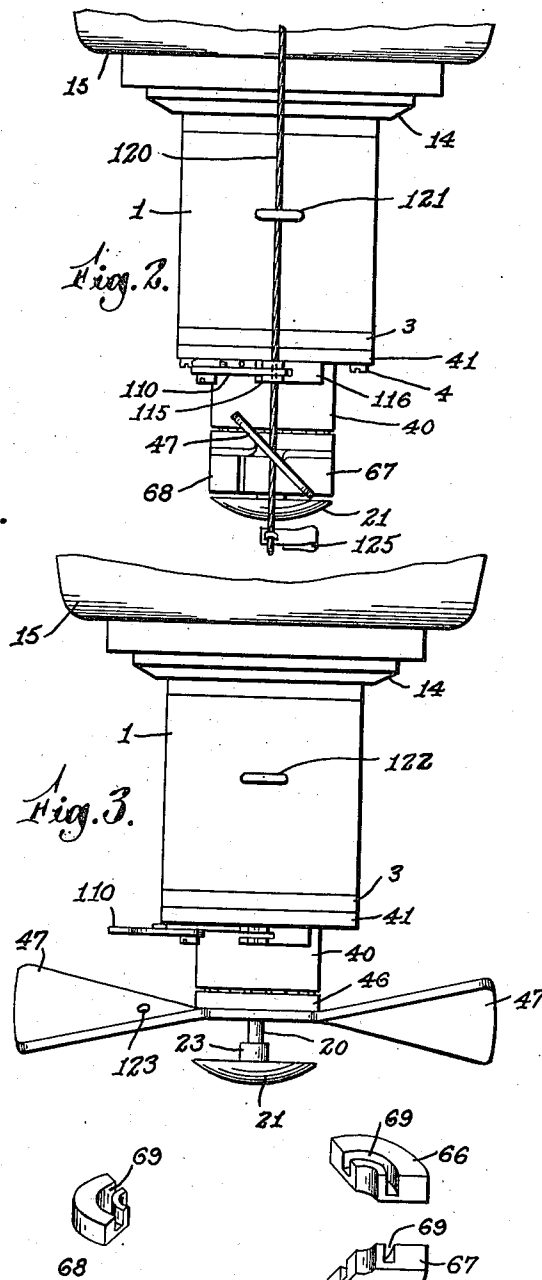
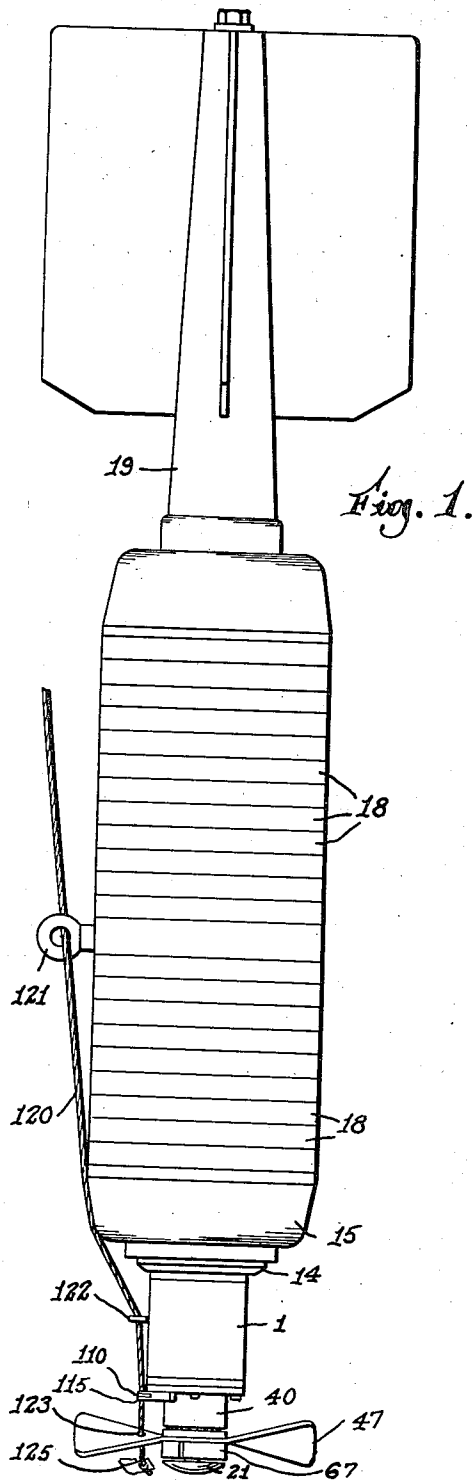
F. W. BOLD ET AL

2,190,374

AERIAL BOMB FUSE

Filed Dec. 22, 1937

5 Sheets-Sheet 1



Inventors
 Frederick W. Bold
 Arthur W. Bold
 by James R. Hodder
 Attorney

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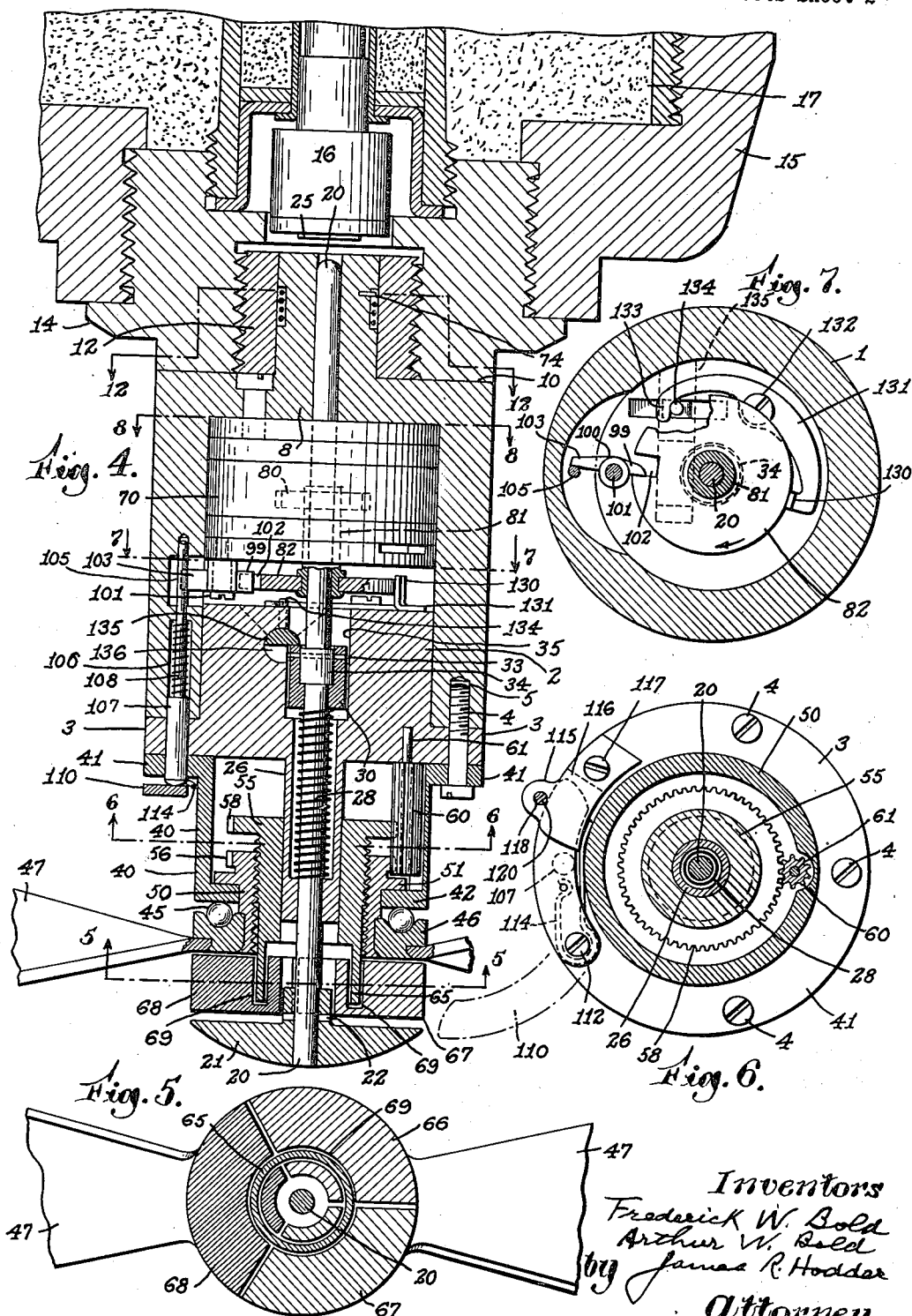
F. W. BOLD ET AL

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AERIAL BOMB FUSE

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Inventors
 Frederick W. Bold
 Arthur W. Bold
 by James R. Hodder
 Attorney

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Fig. 8.

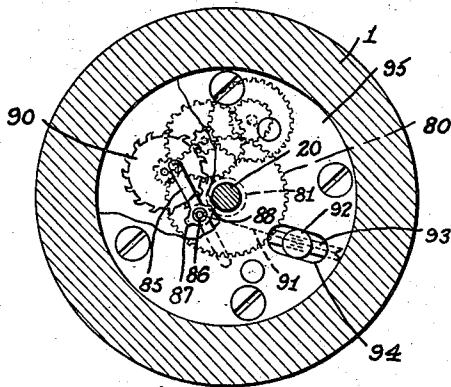


Fig. 10.

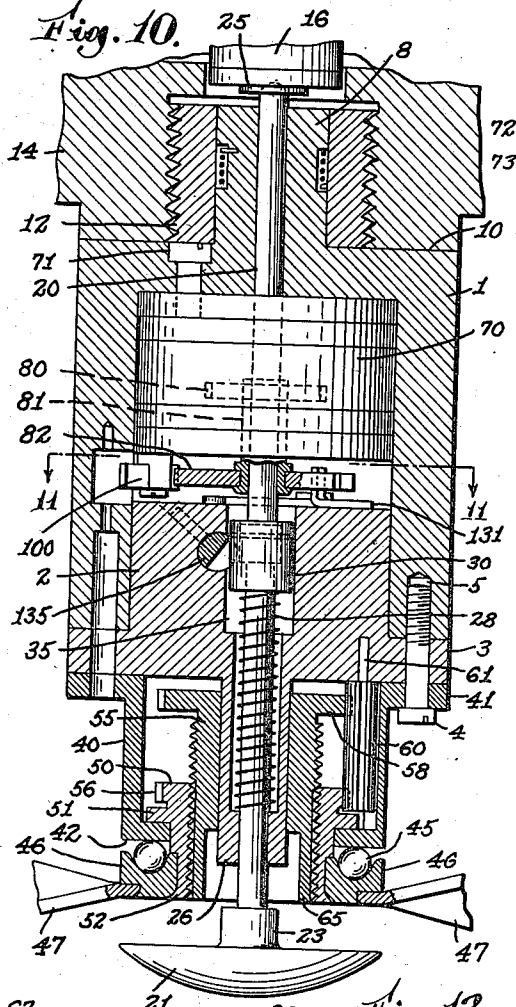


Fig. 9.

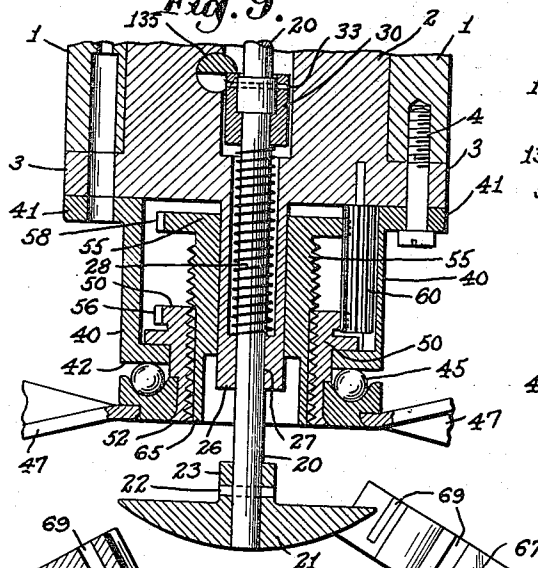


Fig. 12.

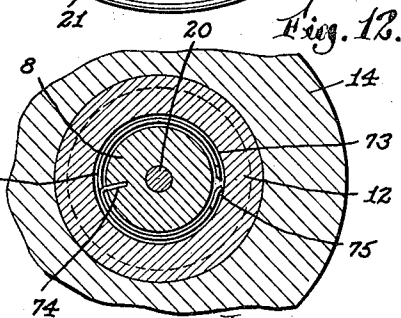


Fig. 11.

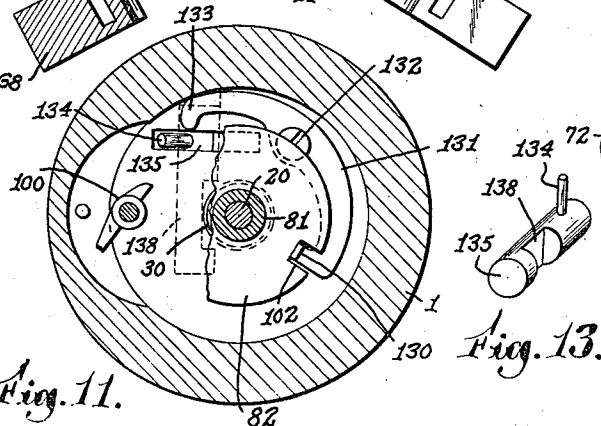
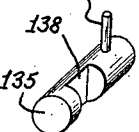


Fig. 13.



Inventors
 Frederick W. Bold
 Arthur W. Bold
 by James R. Hodder
 Attorney

Feb. 13, 1940.

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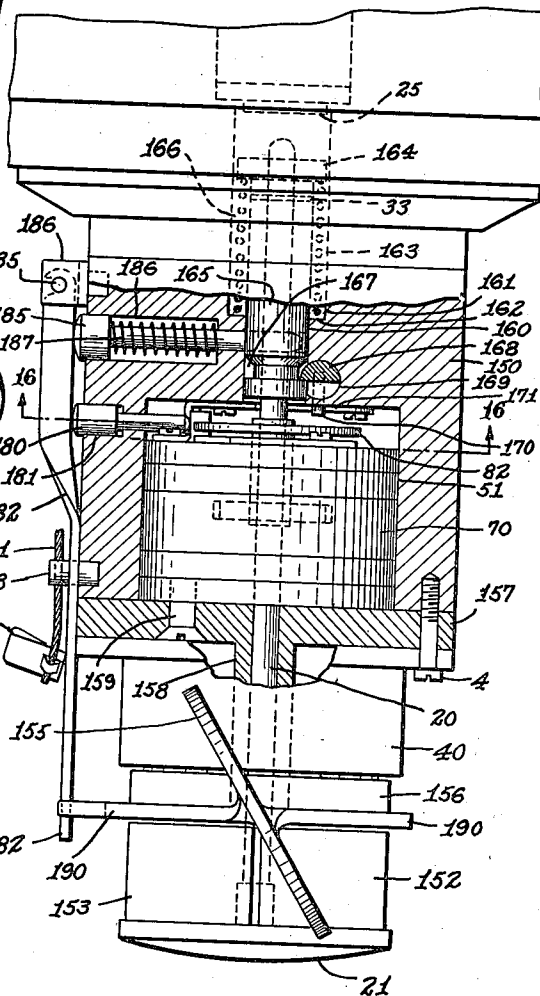
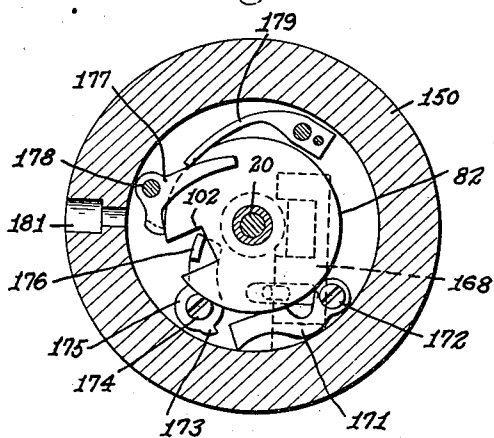
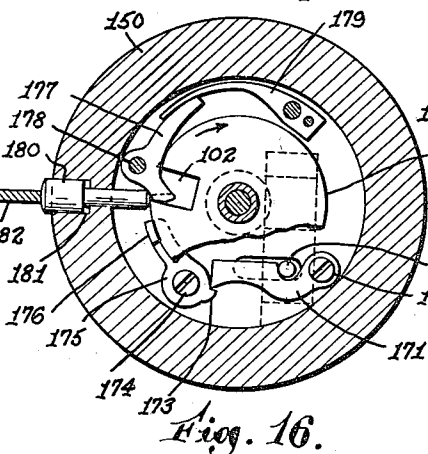
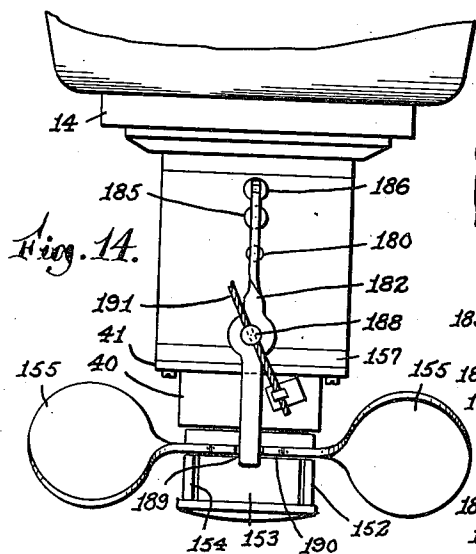


Fig. 15.

Fig. 17.

Inventors
 Frederick W. Bold
 Arthur W. Bold
 by James R. Hodder
 Attorney

Feb. 13, 1940.

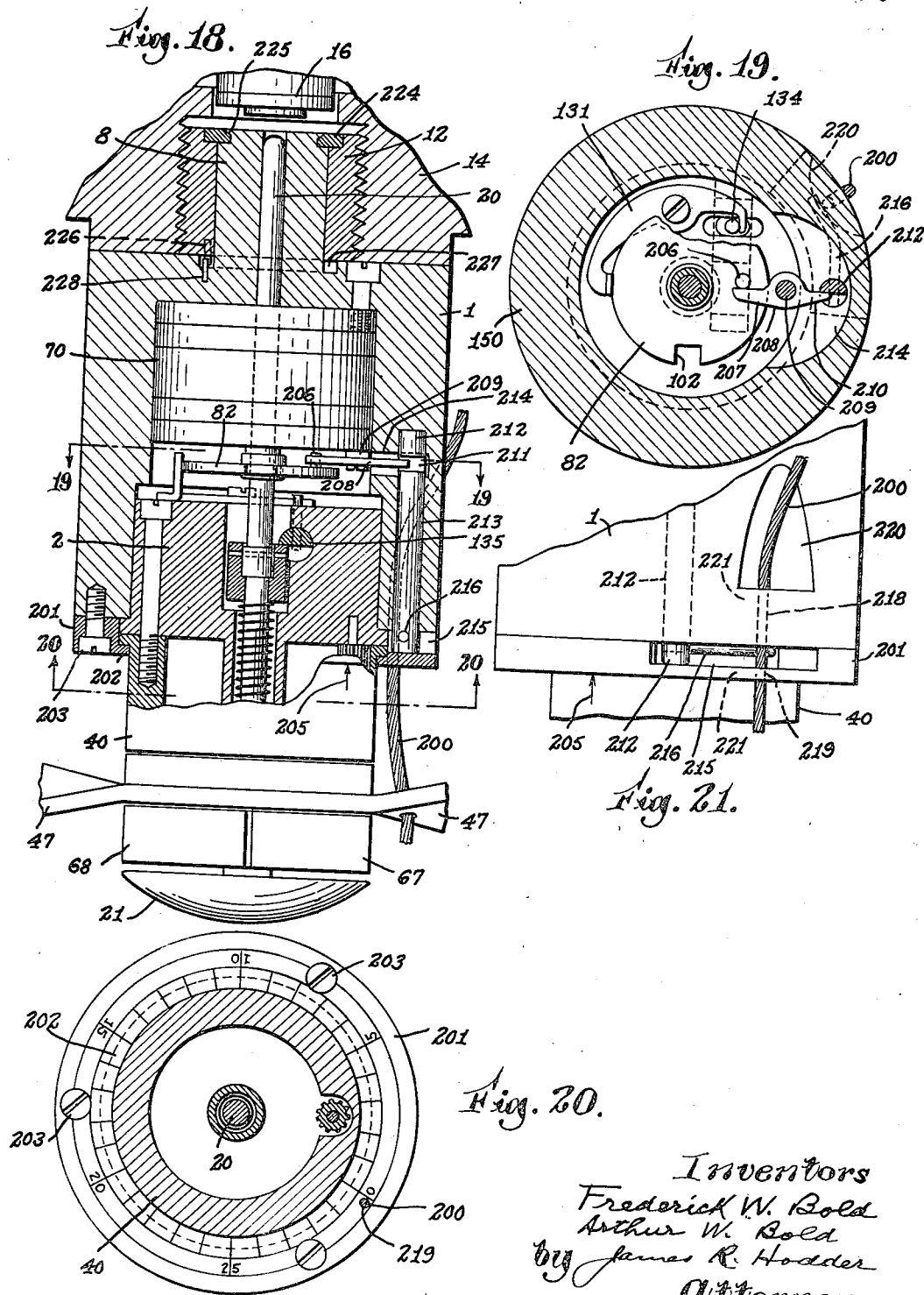
F. W. BOLD ET AL

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AERIAL BOMB FUSE

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Inventors
 Frederick W. Bold
 Arthur W. Bold
 by James R. Hodder
 Attorney

UNITED STATES PATENT OFFICE

2,190,374

AERIAL BOMB FUSE

Frederick W. Bold and Arthur W. Bold, Chelsea,
Mass., assignors to Waltham Horological
Manufacturing Company, Waltham, Mass.

Application December 22, 1937, Serial No. 181,175

2 Claims. (Cl. 102—37)

Our present invention is directed to the construction of firing and safety mechanisms intended for use primarily with aerial bombs.

Important features of our present invention comprise novel, efficient, and compact mechanism whereby the firing pin and the timing mechanism are arranged concentrically, permitting the firing pin to pass thru the timing mechanism and thereby arranging the timing mechanism in a central location and concentric with the firing pin, with the releasing controlled by the timing mechanism also concentrically arranged.

Further important features consist in the provision of novel and efficient safety devices preventing premature or accidental discharge of the bomb by the operation of the fuse even though it is subjected to a heavy impact on the firing pin.

A further and important feature consists in the provision of a plurality of safety factors which are released only during the flight of the bomb after it is dropped from an aeroplane, dirigible, or the like, thereby effecting the setting of the fuse and the starting of the timing mechanism to fire the same.

A further feature consists in the provision of means which will permit the fuse to fire the explosive to which it is attached either by impact or by the timing mechanism, whichever operates first. Thus if the timing mechanism is set for eleven seconds and the fuse strikes the earth or an object in ten seconds, it will function even though the timing mechanism has not yet completed its cycle for release of the firing pin.

A further important and novel feature consists in the provision of a differential movement effected by a rotative action of the propeller shaft operative when the bomb is dropped, which is one of the primary safety features to prevent premature explosion but which will release the safety locking devices and permit the firing pin to become operative by either the timing mechanism or impact.

In carrying out our invention we provide a fuse construction with the firing pin adapted to extend centrally thru the firing mechanism and with the several safety devices operable only after the bomb has been dropped from the aerial vessel carrying the same by the withdrawal of a lanyard, or arming wire, which has one end attached to the vessel from which the bomb is dropped.

In the preferred embodiment and as herein

shown we arrange this lanyard to lock a propeller on the head of the fuse as well as to lock also one or more of the other safety devices which are only released when the bomb and fuse drop below the length of the lanyard and the lanyard is thus withdrawn from locking engagement with the propeller and such other of the safety devices as it controls. Thereupon, the propeller will rotate during the further falling of the fuse, releasing certain of the locking blocks or devices, and permitting the timing mechanism also to operate, as will be hereinafter described and explained.

Further details, novel combinations, improvements, and advantages will be hereinafter more fully described and claimed.

Referring to the drawings illustrating preferred embodiments:

Fig. 1 is a plan view of an aerial bomb equipped with our improved fuse;

Fig. 2 is an enlarged side view of the fuse before the releasing lanyard is drawn;

Fig. 3 is a fragmentary side view after the release of the lanyard;

Fig. 4 is an enlarged cross-sectional view of our improved fuse construction;

Fig. 5 is a fragmentary view on the line 5—5 of Fig. 4;

Fig. 6 is a cross-sectional view on the line 6—6 of Fig. 4;

Fig. 7 is a cross-sectional view on the line 7—7 of Fig. 4;

Fig. 8 is a cross-sectional view on the line 8—8 of Fig. 4;

Fig. 9 is a fragmentary cross-sectional view after the propeller has rotated from the start of the position shown in Fig. 4 and illustrates the completion of the operation with the firing pin in position to strike the primer either by impact or by the releasing of the timing mechanism, whichever will occur first;

Fig. 10 is a further cross-sectional view illustrating the firing pin in firing action;

Fig. 11 is a cross-sectional view on the line 11—11 of Fig. 10;

Fig. 12 is a cross-sectional view on the line 12—12 of Fig. 4;

Fig. 13 is an enlarged perspective view of one of the releasing elements;

Fig. 14 is a fragmentary side view of a modification;

Fig. 15 is an enlarged view partly in longitudinal cross-sectional view of this modification;

Fig. 16 is a cross-sectional view on the line

16—16 of Fig. 15 prior to release of the operating devices shown therein;

Fig. 17 is a view illustrating the release of the devices of Fig. 16 permitting the firing pin to act;

Fig. 18 is a still further modification illustrating the same in partly longitudinal cross-section;

Fig. 19 is a cross-sectional view on the line 19—19 of Fig. 18;

Fig. 20 is a cross-sectional view on the line 20—20 of Fig. 18, and

Fig. 21 is a partial fragmentary view of this modification looking from the right of Fig. 18.

Referring to the drawings, Figs. 1 to 13, illustrating one preferred embodiment of the invention, 1 designates the main casing of our improved fuse and timing construction which is of cylindrical form with the lower open end closed by a hollow plug 2 fitting within the interior diameter of the cylindrical casing 1, and having an outwardly extending flange 3 which is united to the casing 1 by three or more bolts 4 threaded into correspondingly tapped recesses 5, as best shown in Figs. 4, 9, and 10. The opposite or upper end of the casing 1, viewed in the drawings, is formed with a projecting stem 8 arranged centrally of the casing 1 and of lesser diameter, thus providing an annular shoulder 10. A threaded collar 12 is fitted around the stem 8 and has the outer circumference formed with threads adapted to fit into the correspondingly threaded recess in the cap 14, which in turn is secured to a shell 15 of the body portion of the bomb. The main structure of the bomb may be of any suitable or desired contour and, as herein shown, has a centrally arranged primer 16 against which the firing pin 20 strikes to explode the bomb.

As herein shown, the explosive material 17 is contained within the bomb structure, which may comprise a series of rings 18 and the tail and rudder portion 19 for steering the bomb in its flight. Our improved fuse structure is attached to the aerial bomb by constituting the fuse as a complete unit capable of being handled and threaded into the bomb structure with the various safety devices which we have devised in position to prevent the actuation of the firing pin 20 until released by the timing train or by the impact.

The firing pin 20 projects slightly beyond the length of the fuses and timing elements and is rigidly secured to a mushroom head 21 either by a pin 22 passing thru a hub 23 formed integral with the mushroom head 21 or by threading the hub on the pin 20. The firing pin 20 extends thru a central recess in the plug 2 and stem 8 within striking distance of the primer 16, a central cap 25 being in alignment with the inner end of the firing pin 20 to set off the primer and explode the charge in the bomb when the firing pin is actuated to strike the same.

We provide the central cap 2 with a depending stem 26 closed at its lower end except for a bored recess 27 to receive the stem 20 in a closely sliding fit and with a central recess substantially larger than the diameter of the firing pin 20 to receive a coiled spring 28 encircling the firing pin 20 and bearing between the closed end portion and a collar 30 fitted around the firing pin 20 and constituting the means for projecting the firing pin 20 against the cap 25 and exploding the charge when the timing mechanism releases the firing pin or when the mushroom head 21 strikes against the earth or other sufficiently solid im-

pact to shear the pin 33, which passes thru the collar 30 and the shank of the firing pin 20. Preferably we provide a firm interlocking construction between the collar 30 and the firing pin by forming on the shank of the firing pin a hub 34, thus providing a shouldered connection between the collar 30 and the hub, insuring a positive action by the spring 28 when the timing mechanism releases the firing pin.

In order to allow for the hub 30 we enlarge the recess in the plug 2, as shown at 35, which recess is of sufficient diameter and length to allow for a free lengthwise movement of the collar 34 throughout the length necessary for the firing pin 20 to strike against the cap 25 or from the position of Fig. 4 to that of Fig. 10.

Secured to the flange 3 of the cap 2 by the bolts 4 is a depending hollow cap-shaped member 40 provided with a circular flange 41 thru which the bolts 4 pass to secure the member 40 to the cap 2 and with the inturned annular flange 42. The flange 42 constitutes on its outer surface a ball-bearing raceway for a series of balls 45—45 which cooperate with the grooved raceway formed in a ring 46 carrying the pair of aerial propellers 47—47, said ring 46 being secured to a rotatable sleeve 50 which extends within the cup-shaped member 40 and has an exterior ring 51 extending from the sleeve 50 and overlapping the inner surface of the inturned flange 42 of said cup-shaped member.

In order to assemble and secure the ring 46 carrying the propeller blades 47 to the sleeve 50, we form the outer portion of the sleeve 50 of slightly less diameter, providing a shouldered construction around which the inner surface of the ring 46 fits and then swage over said ring 46 the end portion of the sleeve 50, as best shown at 52, Fig. 10, thus firmly securing the ring 46 and sleeve 50 together.

The inner diameter of the sleeve 50 is threaded to receive the correspondingly threaded exterior portion of an inner hub 55, which hub slidably fits around the exterior of the depending hub 26 of the plug 2. The threads on the exterior of the hub 55 extend only part way along the length of the same so that relative rotative movement between the hub 55 and sleeve 50 from the position shown in Fig. 4 and in a direction to lift or raise the hub 55 as it slides on the stem 26 will serve to lift said hub to the position shown in Figs. 8 and 9; and thereupon continued rotation of the sleeve 50 caused by the action of the propeller blades 47 will have no further effect on the relative movement between the hub 55 and the sleeve 50.

To cause such relative movement between the hub and sleeve we provide a gear 56 and on the exterior of the hub 55 a similar gear 58 but having a differential in the number of teeth. Thus, for example, we form the gear teeth 56 on the sleeve 50 with sixty-five teeth and the gear teeth 58 on the hub 55 with sixty-four teeth. In order to arrange for the actuation and, hence, the unthreading of the hub 55 from the sleeve 50 we arrange a barrel pinion 60 with its axle 61 fitted in a corresponding recess in the plug 2, and with the barrel pinion 60 extending into the cup-shaped member 40 in alignment to engage the gear teeth 56 and 58, and continue such engagement throughout the relative lengthwise movement provided between the hub 55 and sleeve 5 as long as their cooperating external and internal gear teeth are in mesh.

Rotation of the sleeve 50 is effected by the action

of the propeller blades 47—47 when the bomb is dropped, the pressure of the air during the downward flight of the bomb on the propeller blades acting to rotate the sleeve 50 on the ball bearings 55. The set of the blades 47 and the rotation of the sleeve 50 relatively with the threads on the interior of the sleeve 50 and the exterior of the hub 55 operating thru the differential in the number of gear teeth 56 on the sleeve and 58 on the hub thru the engagement of the idler pinion 60 acts to move, lift, or raise the hub 55 within the cup-shaped member 40 from its threaded position of Fig. 4 to the unthreaded position of Figs. 9 and 10, whereupon continued rotation of the hub 55 will have no further effect in moving the hub 55.

The operation just described is to lift or remove the projecting rim portion 65 of the hub 55 from immediate proximity of the mushroom head 51, thereby permitting the firing pin 20 to be thrown against the cap 25.

Referring to the position shown in Fig. 4, it will be seen that the projecting rim 65 extends within close proximity of the inner face of the head 21 and this might be so extended as to actually bear against the inner face of the head 21 and, hence, prevent any movement of the firing pin 20 by its spring 28 until the lifting of the hub 55 by the differential action above explained.

However, we prefer to provide in addition to the rim 65 a set of locking blocks as a further safety feature and which blocks can be quickly and readily removed by falling or dropping out of position when the hub 55 has been raised sufficiently to permit said blocks to drop out.

For this purpose we form a set of three or more blocks 66, 67, and 68, forming the same as circular segments adapted to fit around the hub 23 of the head 21 and between the head 21 and the shaft 46 carrying the propeller blades. These segments are also formed with the inner deep-seated grooved portion, as indicated at 69—69, to fit around the projecting rim 65 of the hub 55. Therefore in assembling the apparatus and with the sleeve 50 threaded on to the hub 55 and substantially in position, as shown in Fig. 4, the safety blocks 66, 67, and 68 are fitted over the projecting rim 65, the mushroom head 21 fitted on the firing pin 20 and united by slipping in the locking pin 22 thru the hub 23 of the head 21. Thus, and in this position, the locking blocks 66, 67, and 68 constitute an effective positive stop against longitudinal movement of the firing pin. Only after a substantial time has elapsed during the flight of the bomb downwardly and the rotation of the sleeve 50 by the propellers 47, producing a relative movement of the hub 55 thru the differential in rotative movement caused by the lesser number of gear teeth 58 from that of the number of gears 56 thru rotation on the pinion 60, the blocks 66, 67, and 68 drop or fall out when the rim 65 holding them has been lifted from the groove 69, as shown in Fig. 9.

The firing pin 20 is now free to be either moved by the spring 28 when released by the timing mechanism or to be moved by impact of the head 21, shearing the pin 33 in case impact comes before the timing mechanism releases the spring 28.

The timing mechanism is contained within the casing 70, fitting closely within the interior of the casing 1 and secured at the topmost portion of the casing, viewing the drawings, by a threaded bolt 71 which is fitted thru a recess in the casing 1 around the shouldered portion 10 and with the head countersunk so as to be flush with said

shouldered surface 10, the securing bolt 71 being covered by the threaded collar 12 fitting around the stem 8. Any suitable interlocking connection between the threaded collar 12 and the stem 8 may be provided, but as herein shown we arrange a coiled spring 72 adapted to fit within a circular recess 73 formed on the inner diameter of the collar 12 approximately midway of the length of said collar. One end of the spring 72 is bent, as shown at 74, to fit within a bored recess in the stem 8 and with the opposite end of the spring 72 inclined outwardly, as shown at 75, to form a point or corner engaging the walls of the collar 12 and holding the same in engagement.

The timing mechanism contained within the casing 70 is illustrated diagrammatically and contains suitable spring-actuated clock mechanism to rotate the driving gear 80, which is keyed to a sleeve 81 encircling the firing pin 20 and thru which sleeve the firing pin 20 may slide.

The sleeve 81 extends beyond the casing 70 and carries a setting disc 82, as best shown in Figs. 4, 7, and 10. This setting disc is positioned in a space between the timing mechanism and the inner portion of the plug 2, as clearly shown in Figs. 4 and 10.

In order to arrange for the novel construction of the firing pin extending centrally thru the timing elements, as well as thru the driving gear and setting disc, we have devised a novel escapement for the timing train. For this purpose (see Fig. 8) we have mounted a lever 85 on a pivot 86 at one side of the firing pin 20 to a plate shown in fragmentary lines, Fig. 8, with a pair of depending members 87 and 88 adapted to rock and engage the teeth of the escapement wheel 90, thus constituting an escapement construction. The hair spring 91 operating the oscillations of the lever 85 may be adjusted by attaching the same to a movable threaded block 92 operating on a screw 93 and accessible thru an opening 94—94 thru a plate 95 in the clock mechanism, as also shown in Fig. 8.

The timing elements or clock mechanism are under the tension of a wound spring (not shown), as is usual, to exert a rotative action on the gear 80, sleeve 81, and setting disc 82, which setting disc is normally held from rotation by engagement of an arm 99 of a latch 100 pivoted on a stud 101, with said arm 99 engaging a notch 102 in the disc, as shown in Fig. 7. The opposite arm 103 is held against a pin 105.

This pin 105 (see Fig. 4) is fitted to slide within a recess 106 provided therefor in the walls of the casing 1 in alignment to contact with said arm 103 of the latch 100, and with the lower portion of the stem formed as an enlarged plunger 107 extending thru an opening in the flange 41 in alignment with said recess 106, and is provided with a coiled spring 108 encircling that portion of the pin 105 between the enlarged end of the plunger portion 107 and the opposite walls of the recess 106, see Fig. 4, which spring exerts an expansible action on the pin and plunger to throw out the same and release the arm 103 of the latch 100 upon withdrawal of a toggle arm 110, against which the plunger end bears. This toggle arm is pivoted at 112 to the under surface of the flange 41 and is moved against the tension of a spring 114 to engage between a pair of projecting lugs 115 on an arm 116 also secured to the flange 41 by a screw 117. When the toggle 110 is swung into position between the lugs 115, a lanyard 120 is threaded thru holes 118 in the lugs 115 and thus holds the toggle

110 in position and underneath the lugs 115 until the lanyard is withdrawn. This lanyard extends lengthwise of the bomb and fuse thru a guiding eyelet 121 secured to one of the rings 18 (see Fig. 1) thru a second guiding eyelet 122 on the casing 1, thru the recess 118 in the lugs 115 to hold the latch 110 and thence thru a hole 123 in one of the propeller blades 47 and is engaged by a clip 125 below the propeller.

10 The opposite end of the lanyard 120 is secured to the aerial vessel from which the bomb is released with a sufficient length of line to permit the bomb to be well clear of the vessel from which it is dropped so that the bomb will be a substantial distance therefrom when the continued flight of the bomb will draw the lanyard 120 thru the propeller 47, snapping off the clip 125 thru the recesses 118 and the guiding eyelets, thus freeing the toggle 110, which swings outwardly to the dotted line position of Fig. 6 thru the influence of its spring 114, thereby permitting the pin 105 to be forced outwardly by the action of the spring 108 and thereby releasing the arm 103 of the latch 100 and permitting the clock mechanism to 25 actuate the setting disc 82 in the direction of the arrow, Fig. 7.

Bearing on the edge of the setting disc 82 is an upstanding flange 130 on a rocker arm 131 pivoted at 132 on the top of the plug 2, having its opposite end 133 in the form of a hook to engage an upstanding stud 134 on a barrel 135, which is fitted in a circular recess 136 formed in the plug 2 and opening into the central recess 35 thru which the firing pin 20 and its attached 35 collar 30 are adapted to pass. A V-shaped slot, shown in dotted lines in Fig. 4, from the circular recess 136 permits the pin 134 to rock when released by the hook 133 on the rocking arm 131.

This hook 133, however, is not released until 40 the notch 102 in the setting disc 82 reaches the upstanding flange 130; whereupon said flange will be forced into said notch as the arm 131 is rocked on its pivot by the pin 134 sliding off the hooked end 133 by the tension of the spring 28 around 45 the firing pin, as will be readily understood in viewing Fig. 4. The engagement between the rocking toggle 135 and the upper end of the collar 30 is arranged by having said collar bearing against the walls of a notch 138 at one side of 50 the axle center of the barrel 135, which thus releases the action of the firing pin which is forced against the cap 25 and explodes the charge in the bomb. The previous removal of the blocks 66, 67, and 68 permit this lengthwise movement of 55 the firing pin 20, as previously explained.

The time between which the setting disc 82 leaves its latch 100 and reaches a position to register with the upstanding flange 130 of the rocking arm 131 determines the time of firing from 60 the withdrawal of the lanyard at the starting of the mechanism. Usually this timing element is fixed at eleven seconds although any time can be fixed, as desired. Meanwhile the rotation of the propellers 47 will have acted to move the hub 55 65 upwardly, freeing the locking blocks 66, 67, and 68, which will fall to the ground and the fuse will be ready for firing by impact or actuation of the timing element. Should impact occur first before the flange 130 has engaged the notch 102, 70 then the pin 33 will be sheared off by the firing pin 20 and the cap and primer ignited.

The assembling of the various parts, as well as the operation of the same, will be readily appreciated from the foregoing description. The mechanism when assembled is under a positive safety

lock by the interposition of the blocks 66, 67, and 68, preventing any impact on the head 21 from causing a premature explosion after the fuse is fitted to the bomb. All previous assembling and setting of the mechanism is accomplished when 5 the fuse is separate from the bomb. Then the same is attached and with the locking blocks 66, 67, and 68 in positive control of the firing pin, which blocks can only be removed by the action of the propellers 47 and rotation thereof during 10 flight and after release from the aerial vehicle carrying same and the movement of the hub 55 upwardly, withdrawing its rim from holding the blocks in position.

Referring to the modification shown in Figs. 14 15 to 17 inclusive, we have herein illustrated an arrangement of the firing pin passing concentrically thru the timing and setting elements but with a somewhat different releasing arrangement. In this form, the main casting 150 has an enlarged 20 central recess 151 to receive the timing element contained in its casing 70 and thru which the firing pin 20 passes. The head 21 on the firing pin 20 is locked against operation by blocks 152, 153, and 154 similar to the locking blocks 66, 67, 25 and 68 previously described.

In this form, we have arranged the propeller blades 155 attached to the ring 156 and operating the relative movement of the hub 55 from this sleeve 50 within the cup-shaped member 40, as 30 previously described, to drop out the locking blocks 152 and 153. In this form the casing 150 is closed by a plate 157 and the timing mechanism is secured directly to the plate 157 by one or more screws 159 passing thru the plate 157, which 35 screws will be covered and protected by the assembling of the cup-shaped member 40 thru the bolts 4, attaching the flange 41 to the casing 150. The plate 157 is provided with a depending hollow stem 158 thru which the firing pin 20 passes 40 and the mechanism for controlling and releasing the locking blocks by rotation of the propeller blades is identical to that previously described in connection with Figs. 1 to 13. In the present 45 form, wherein the arrangement and fuse mechanism is more compact, we have also devised novel releasing means as well as providing an additional safety locking pin.

In the form as shown in Figs. 14 to 17 the casing 150 has an enlarged bored recess thru the 50 upper part, as shown at 160, which recess is enlarged by a counterbored opening 161 providing a shoulder 162 against which the firing spring 163 bears, the opposite end bearing against a shoulder 164 formed on or secured to the firing pin 20. 55 Surrounding that portion of the firing pin 20 within the opening 160 and the counterbored portion 161 is a sleeve 165 attached to the firing pin 20 by a shearing pin 166, as shown in dotted lines, Fig. 15.

This sleeve 165 has an annular recess 167 which 60 is engaged by a cut-away portion of a barrel 168 identical in construction and function with the barrel 135 previously described which, however, is fitted in a cylindrical recess 169 with a pin 65 170 depending from the barrel to be engaged by a latch 171 pivotally secured by a screw 172 (see Fig. 16) threaded into the casing 150. The free end of the latch 171 is caught by an extension 173 on a pivoted trigger 175, which trigger 70 has an upstanding flange 17 adapted to engage the rim of the setting disc 82 and to drop into the notch 102 in the setting disc, as shown in Fig. 17, whereupon the trigger 175, pivotally mounted on a screw 174, releases the 75

free arm of the lever 171, thus freeing also the pin 170, permitting the barrel 168 to be rotated, which is under the tension of the firing pin spring 163, and releasing the firing pin.

5 The setting disc 82 is normally in position as shown in Fig. 16, being locked against rotative movement or unwinding under the influence of the timing mechanism by one arm of a bell crank lever 177 pivotally mounted at 178, and
10 having the other arm of said lever engaged by a spring 179 adapted to depress the spring engaged arm of the bell crank and throw out the notch-engaging arm, thus freeing the disc to rotate in the direction of the arrow and holding
15 the trigger 175 against release of the lever 171 until the notch 102 reaches the flange 176, as will be readily understood.

The locking end of the bell crank 177 is, however, held in engagement with the walls of the notch 102 by one end of a pin 180 fitting thru a bored and counterbored recess 181 in the wall
20 of the casing 150, and is held in this position by the locking lever 182, to be described.

An additional safety locking element is provided in this form of the invention consisting in a headed pin 185 fitted in a bored and counterbored recess 186 radially in the wall of the casing 150 and preferably in alignment with the recess 181 and the pin 180, to be also engaged
25 by the locking lever 182, which pin 185 is of sufficient length to extend thru a hole bored thru the sleeve 160 and firing pin 20 to positively engage both, as shown in dotted lines, Fig. 15. In the counterbored portion of the recess 186
30 a spring 187 encircles the stem of this pin bearing against the head, and with its opposite end against the shoulder formed by the counterboring and also held in position against the tension of the encircling spring 187 by the locking lever 182.
40

This lever has its upper end in the form of a hook to fit around a pin 188 held by a lock 186 threaded into the side of a tapped recess in the casing 150. The lever 182 extends downwardly from its hooked engagement and over a stud 188 to hold and guide said lever, and with a further extension arranged to engage a notch 189 on the rim 190 of the ring 156 carrying the propeller blades 155.
45

Thru the stud 188 is a bored opening to receive an arming wire 191 to which a clip 192 is secured at the lower end, the upper end being attached to the aerial vessel carrying the bomb. During the flight of the bomb after it is dropped
50 from its carrying vessel and when it reaches the end of the arming wire 191, the latter is pulled thru the recess thru the stud 188 during the downward flight of the bomb; and thereupon the locking lever 182 is thrown out, being disengaged
55 from its hook and dropping free of the bomb thru the force of the spring 187, which also simultaneously throws out the locking pin 185, releasing the pin 186 and frees the propellers 155.

Consequently the spring 179 acts to rock the bell crank lever 177 on its pivot, thus freeing the opposite arm from engagement with the notch 102 in the setting disc 82 and permitting the clock mechanism in the timing train to start and rotate the setting disc, which rotation continues until the notch 102 is in register with the flange 176 of the trigger 175, which trigger thereupon swings on its pivot, permitting the flange 176 to fall into said notch with the parts as shown in Fig. 17 and, hence, releasing the lever
70 177 and, thereupon, the firing pin under the in-

fluence of its spring will rock the barrel 168 as the pin 170 is released by the lever 171. Continued impulse of the spring 166 impels the firing pin against the primer 25 and explodes the charge, meanwhile the rotation of the propeller blades having acted to free the blocks 152, 153, and 154.
5

Referring to the modification illustrated in Figs. 18, 19, and 20, a construction is shown permitting an adjustment of the setting disc relatively with its engaging members and particularly adjusting the position of the notch 102 on the disc 82 with regard to the time which it will reach the rim-engaging flange of the lever or trigger to release the firing pin.
10 15

In this form, also, a compact structure is arranged, together with a smooth exterior, eliminating projecting lugs, latches, flanges, or the like from the side of the fuse, which are objectionable. Substantially the same arrangement of casing 1 and block 2 is herein shown, utilizing the mushroom head 21 on the firing pin 20, together with locking blocks 67 and 68, and the means for freeing the same as described in connection with the preferred form shown in Figs. 1 to 13.
20 25

In this form the arming wire 200 is lead within the circumference of the casing 1 to hold and, hence, to release when withdrawing the timing mechanism. In this latter form the flanges on the block 2 and cup-shaped member 40 are shortened and are rotatably held by an encircling flanged ring 201, having an uncut flange 202 adapted to engage and hold the cup-shaped member 40 and the block 2 in their respective assembled positions with the casing 1, a series of bolts 203 passing thru the ring 201 and engaging tapped recesses in the rim of the casing 1, as shown in Fig. 18.
30 35

This construction thereby enables the entire plug 2 and its attached parts to be moved relatively with the setting disc 82 and, hence, to adjust the time of explosion; whereas in the former constructions the time of release by the clock mechanism was fixed although it could, of course, be originally fixed when desired to any time but could not thereafter be changed. In the present form the ring 201 has a dial on its lower face, as indicated in Fig. 20, which is used for adjustment, with a mark 205 on the side of the cup-shaped member 40 so that rotative movement is registered, thus producing a corresponding adjustment on the setting disc 82.
40 45 50

In order to hold the setting disc against rotation until released by the registering of the notch 102 with the flange of a trigger or lever, a pin 206 is set in the top of the disc 82 and is engaged by an arm 207 of a lever 208, pivotally mounted on a stud 209, and having its other arm 210 adapted to be held by the notched wheel 211 of a barrel 212. This barrel is fitted in a bored recess 213 in the side of the casing 1, as shown in Figs. 18 and 19, a crescent-shaped opening 214 from the center of the casing 1 being formed to permit the outer arm of the lever 208 to engage said barrel 212. The barrel 212 extends downwardly where a portion of the ring 210 is cut away, leaving an opening 215, and in alignment therewith at the lower end of the barrel 212 is fitted a pin 216 into the lower end of the barrel 212, the outer end of the pin being in position to be engaged and held by the arming wire 200 when the latter is threaded thru the bored recesses 218 above and 219 just below the opening 215, as shown in Figs. 19 and 21.
55 60 65 70 75

A recess 220 is also formed on the exterior of the casing 1 to facilitate the threading of the arming wire 200 thru the bored passages 218 and 219 and downwardly to the propeller blades 47.

5 In order to hold the mechanism after it has been set and for shipping purposes prior to fitting of the arming wire 200, a small bored opening 221 may be positioned parallel with the bored opening 218 and a wire threaded thru same and

10 wrapped around the pin 216, thus holding the mechanism when set and assembled until the arming wire 200 is applied; whereupon the temporary binding wire thru the opening 221 is removed.

15 In order to permit a rotative adjustment of the device when threaded into the cap of the bomb, the top stem of the casing 1 is formed with a slight shoulder around the top of the stem 8 and the corresponding part of the threaded collar 12 in which a washer 224 is applied and secured in position by heading over the adjacent metal in the stem 8, as indicated at 225. This gives a

20 frictional engagement between the stem 8 and collar 12, which is ordinarily sufficient to either thread in and tighten the entire fuse or to unthread the same. In order, however, to permit rotative movement between the stem 8 and collar 12 if the strain involved is greater than the frictional engagement afforded by the ring 224

25 and the heading of the rim 225 thereover, a positive stop is provided. This consists in a depending pin 226 projecting into a recess 227 formed in a casing 1 at the base of the stem 8 and the fitting of a similar pin 228 in said recess, thus providing substantially full circumferential rotation before the two pins strike a given

30 positive contact from then on in either direction.

The various modifications of the improved fuse constructions above described provide a unit capable of complete assembly with positive and absolute safety blocks interposed to keep the firing pin from any longitudinal movement entirely independent of the ordinary locking and releasing latches. In fact, this fuse construction permits

40 dropping of the entire bomb with the fuse attached and with the lanyard or arming wire detached from the aerial vessel carrying the same, so that it will not be withdrawn from the propeller and locking engagements with the starting devices without danger of discharging the bomb.

50 Tests of the same dropped from a height of eight thousand feet have established the efficiency of the assembly blocks.

This feature is of great importance as it enables an aerial vessel or bombing plane to carry a large number of bombs equipped with these fuses to drop only a part of the number, and then return to the landing field and release the lanyards and undropped fuses, which may be

60 dropped to the field before the plane lands and

at a sufficient distance from the landing point to eliminate all possible danger of explosion.

In actual use it is feasible to equip planes with these bombs and fuses set for a predetermined explosive time, such as eleven seconds as above noted, which will enable a plane to fly to a height above an object or place which can be reached by the flight of the bomb in eleven seconds, say, approximately two thousand feet, and thereupon releases the aerial bombs with these

10 fuses which will explode when approximately a drop of two thousand feet has occurred, or by impact, whichever occurs first.

Furthermore, it is found that the centrifugal action imparted to the blocks 66, 67, and 68 by the rotative action of the propeller blades and the retaining rim 65 effects a positive removal or throwing action as soon as the rim 65 is withdrawn from the grooves 69 in these blocks, thus positively removing them, preventing any accidental jamming or retaining of these safety

20 blocks in position to prevent longitudinal movement of the firing pin. This is an important feature as it acts positively and does not leave to chance the dropping out or removal of the

25 blocks.

Various additional modifications and variations in the invention other than those herein illustrated will readily occur to those skilled in the art, and are intended to be covered by the

30 appended claims.

We claim:

1. In a fuse, a casing, a cap on the casing rotatable during flight and comprising a sleeve and a hub threaded therein, said hub having gear

35 teeth, a firing pin passing thru the hub and having a head externally of the casing, removable blocks between the cap and the head of the firing pin and each having a recess in its rear face, said hub having a portion normally projecting

40 forwardly of the rotatable cap and disposed in the recesses of the blocks, said sleeve having a gear with a different number of teeth than the hub, and a pinion carried by the casing and meshing with both gears, and air-operated means

45 to rotate the cap.

2. In a fuse, a casing, a cap on the casing rotatable during flight, a firing pin passing thru the cap, and having a head externally of the casing, removable blocks between the cap and the head of the firing pin, a hub threaded in the cap and concentric with the firing pin and having a portion projecting outwardly of the cap and engaging the blocks to restrain them against radial displacement, and gearing between the cap and hub for rotating the hub to withdraw it into the casing and disengage it from the blocks, and air-operated means to rotate the cap.

FREDERICK W. BOLD.
ARTHUR W. BOLD.