Jan. 14, 1941. F. W. BOLD 2,228,905

TIME FUSE

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Fig. 1.

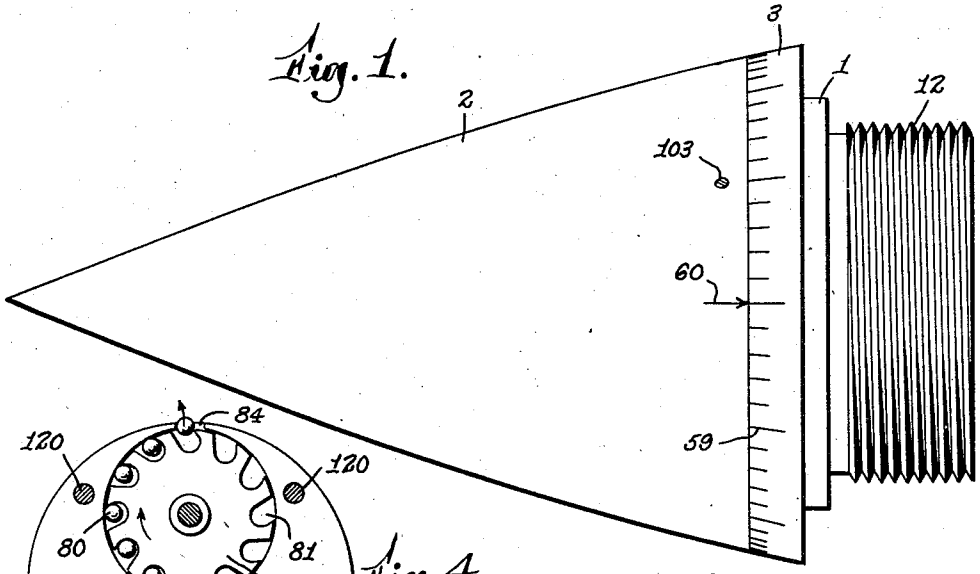


Fig. 4.

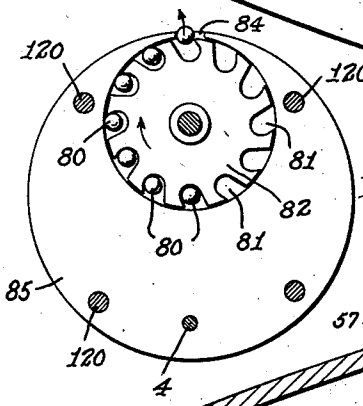


Fig. 2.

Fig. 3.

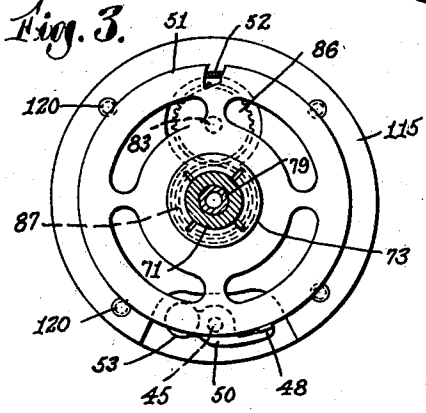
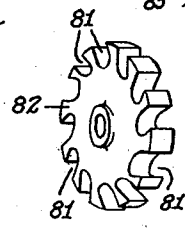


Fig. 5.



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Fig. 6.

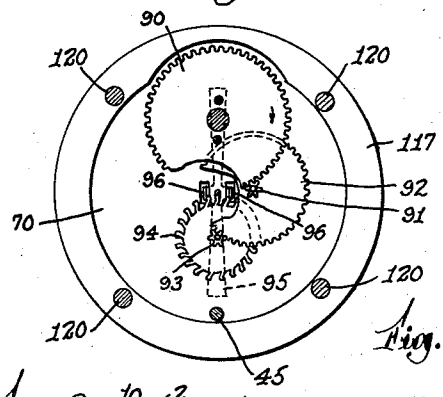


Fig. 7.

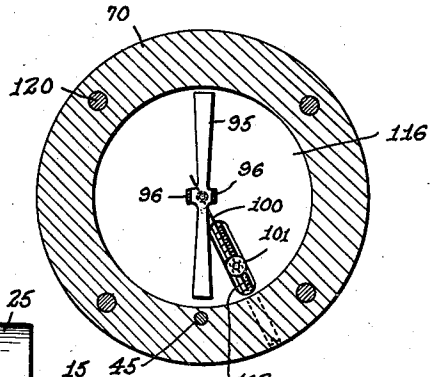


Fig. 9.

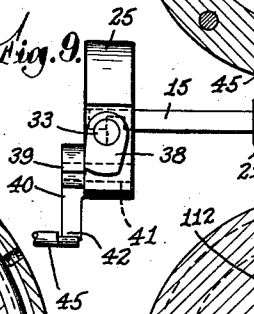


Fig. 8.

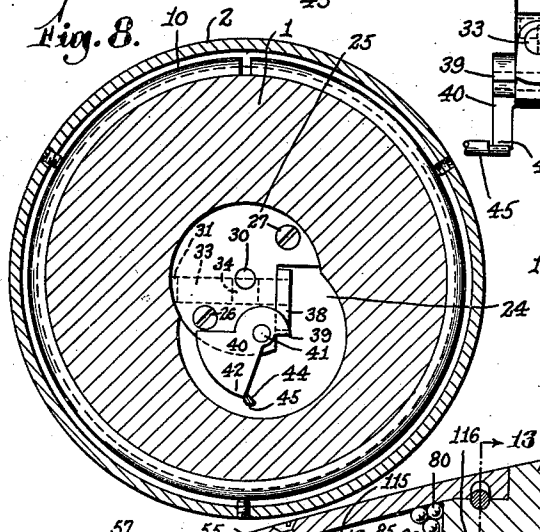
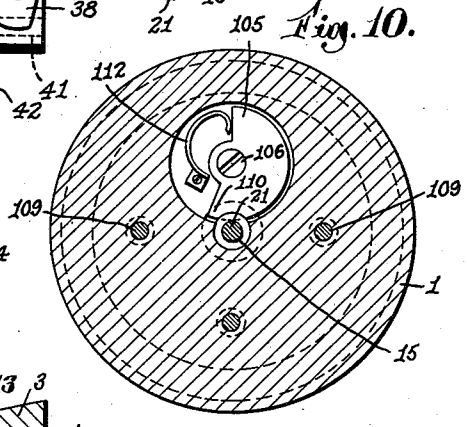


Fig. 10.



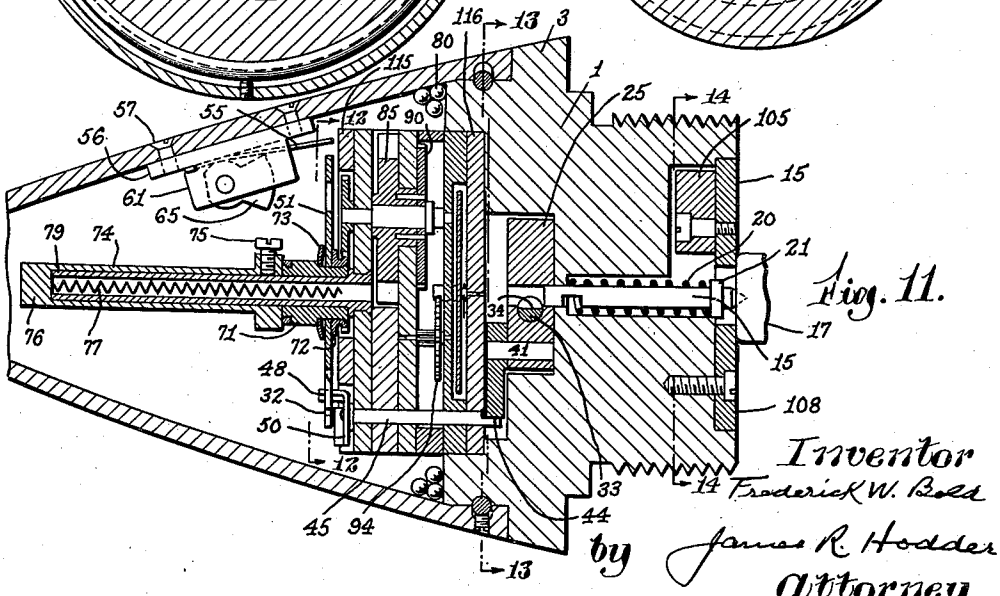


Fig. 11.

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Fig. 12.

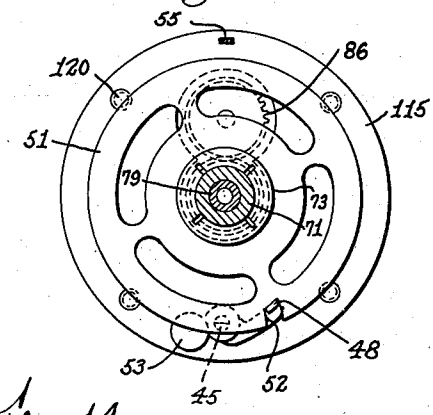


Fig. 13.

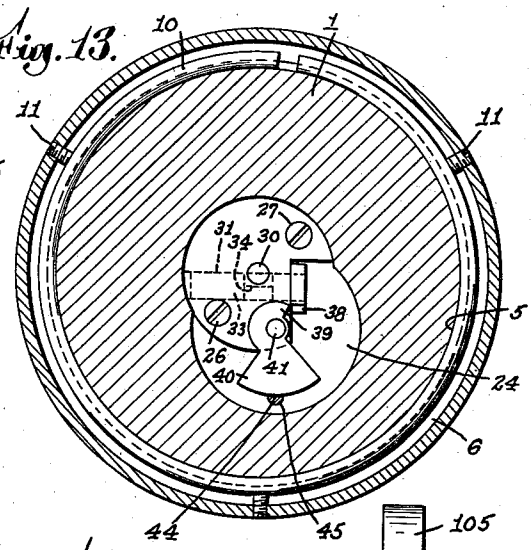


Fig. 14.

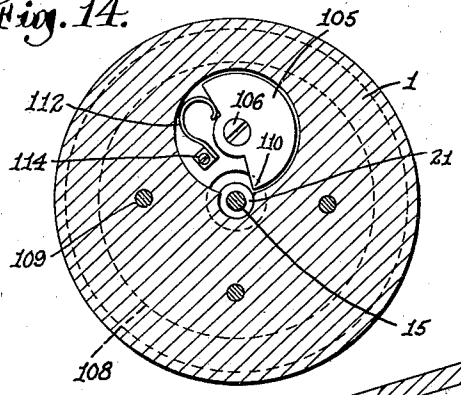
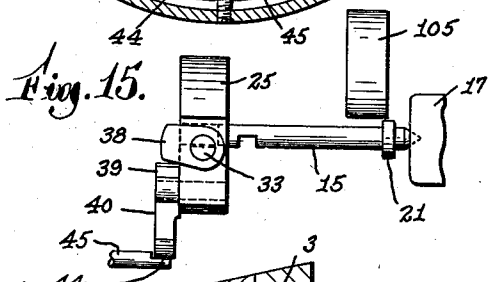


Fig. 15.



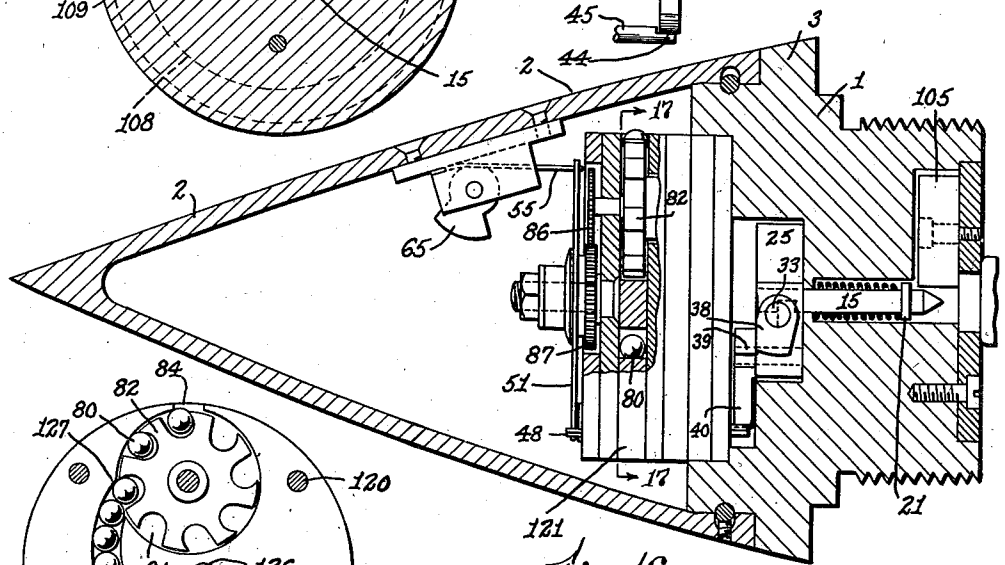


Fig. 16.

Fig. 17.

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2,228,905

UNITED STATES PATENT OFFICE

2,228,905

TIME FUSE

Frederick W. Bold, Chelsea, Mass., assignor to Waltham Horological Manufacturing Company, Waltham, Mass., a corporation of Massachusetts

Application June 21, 1938, Serial No. 214,875

2 Claims. (Cl. 102—36)

My present invention is a novel and improved time fuse.

In the construction of time-operated fuses, such for example as that of my prior Patent No. 1,946,668, dated February 13, 1934, it has heretofore been customary to rely upon the clock mechanism driven by a spring to operate the timing elements to release the firing pin controlled thereby.

My present invention has for one of its objects the elimination of such a spring, and to rely upon freely movable and positively acting weighted elements as the driving means for a clock-like mechanism to be driven during the time for which it is set to release the firing pin.

By means of my present invention, wherein I eliminate entirely the necessity of use of a wound spring and, hence, eliminate also the difficulties incident to the use of such a spring, I am enabled to rely entirely upon the centrifugal action imparted to the fuse, and shell to which it is attached, by the rifling in the gun from which the same is fired to operate the timing mechanism.

I also rely upon this centrifugal action to release various of the safety devices, and preferably also I provide a still further safety release actuated by the set-back action operated by the shock of firing.

Thus, my present invention enables a time fuse to operate only and solely when and during the actual firing of the fuse and shell to which it is attached from a rifled gun, thus entirely eliminating any danger of the release of the safety devices, or the starting of the timing mechanism during the ordinary assembling and handling operations. The timing mechanism cannot operate except from centrifugal action during firing.

In carrying out my present invention, wherein I eliminate entirely a spring, or springs, to drive the timing mechanism, I utilize a driving member operated by a plurality or series of freely movable weighted elements, such for example as small steel balls engaging in suitable teeth or recesses in the perimeter of the driving member, which balls may be fed to such member and positively act to drive the same thru the action of centrifugal force, and thereupon are released from said driving member, which feature is a distinct novelty in this art, so far as I am informed, and I therefore wish to claim the same herein broadly.

Other objects of the invention are to improve and simplify the construction of the timing fuse, provide improved and more definitely-acting safety devices, arrange a control or escapement of the weight-driving element actuating the timing means, and to facilitate the construction, assembling, and operation of such a timing fuse.

Other features, details, and novel combinations will be hereinafter more fully pointed out and claimed.

Referring to the drawings illustrating preferred embodiments,

Fig. 1 is a side view of a fuse;

Fig. 2 is a longitudinal cross-sectional view;

Fig. 3 is a cross-sectional view on the line 3—3 of Fig. 2;

Fig. 4 is a cross-sectional view on the line 4—4 of Fig. 2;

Fig. 5 is a detailed perspective view of the driving element;

Fig. 6 is a cross-sectional view on the line 6—6 of Fig. 2;

Fig. 7 is a cross-sectional view on the line 7—7 of Fig. 2;

Fig. 8 is a cross-sectional view on the line 8—8 of Fig. 2;

Fig. 9 is a detailed view of the firing pin and certain of its immediately associated parts;

Fig. 10 is a cross-sectional view on the line 10—10 of Fig. 2;

Fig. 11 is a cross-sectional view corresponding to Fig. 2 but illustrating the firing pin released and certain of the driving weighted elements freed from their operation on the driving element shown in Fig. 5;

Fig. 12 is a cross-sectional view corresponding to that of Fig. 3 after the setting disc has been moved to its time-releasing position;

Fig. 13 is a view corresponding to the showing of Fig. 8 after release;

Fig. 14 is a view corresponding to Fig. 10 after release;

Fig. 15 being a detailed view of the firing pin and immediately associated parts, corresponding to Fig. 9 after the firing pin has been released, and

Figs. 16 and 17 are side and a cross-sectional view, respectively, illustrating a modification.

Referring to the drawings, 1 indicates the base of my improved fuse, and 2 the setting cap which is adapted to fit over and upon the rim 3 on the base 1, having a shouldered bearing, as indicated at 4, into which the open edge of the cap 2 is adapted to fit, as best shown in Figs. 2 and 11. Cooperating grooves 5 in the base and 6 in the cap 2, in alignment with each other, are arranged to receive a circular locking spring 10, which will firmly lock the cap and base together while permitting relative rotative movement therebetween.

A series of thrusting screws 11, see Fig. 13, are arranged to be threaded thru correspondingly tapped recesses in the rim of the cap 2 opening into the groove 6 and bearing against the locking spring 10 to force the same partially into the groove 5 in the base and thus lock the cap and base together. The spring 10 being normally

expansible will, when the thrusting screws 11 are released, expand into the groove 6 in the cap, which latter is of slightly greater depth than the diameter of the locking spring 10 and, hence, will be completely housed therein and permit either the application of or removal from the base and cap.

The base 1 is provided with a circumferentially threaded portion 12 adapted to secure the entire fuse to the shell, and said base is formed with a central recess 14 in which the firing pin 15 is adapted to reciprocate. This firing pin has a point 16 in alignment to impinge upon a cap or primer 17 for firing the shell, said firing pin, when released by the firing mechanism, being actuated by a coiled spring 20 surrounding the same and bearing between the bottom of the recess 14 and a circular flange 21 on the firing pin. At the base of the recess 14 is an opening 22 of appropriate diameter to provide a sliding fit for the firing pin 15 into a counter-recess 24, wherein a block 25 is secured by screws 26 and 27, the heel of the firing pin 15 extending thru a central recess 30 in the block 25; and also thru said block 25 at right angles to the recess 30 and opening laterally thereinto is a right-angled recess 31.

A shaft 33 fits in the recess 31, having a cut-away portion 34 adapted to engage a notch 35 in the upper portion of the firing pin 15 and hold the firing pin against the tension of its spring 20, as shown in Fig. 2. A partially rotative movement of the shaft 33 to the position shown in Fig. 11 is effected by the operation of the timing mechanism, to be described, and hence the release of the firing pin 15 and its impact against the primer firing the charge.

The shaft 33 has secured to an end extending outside the block 25 an arm 38 so positioned that a cut-away portion 34 acts to hold the same and the shaft 33 in locking position with the firing pin when arranged horizontally, or as shown in Figs. 2, 8, and 9, and said arm 38 is so held and, hence, against the tension of the action of the spring 20 by the overhanging portion 39 of a lever 40, which lever is mounted upon a pivot 41 in the block 25 and has a larger mass area and weight, as shown at 42, opposite to the overhanging portion 39 and hence, arranged for swinging when released thru the centrifugal action of the whirling given to the shell by the twisting of the rifling during firing. This counterbalanced lever 40 is held against swinging on its pivot by the lower portion of a depending shaft 45, said lower portion being cut away as shown at 44, until the same is partially rotated by the top plate 50, keyed or secured to the shaft 45, having its upstanding edge portion 48, which bears against the setting disc 51, snap into the notch 52 on said setting disc 51, thus effecting a partial rotation of the shaft 45, release of the arm 38, and hence release of the firing pin 15.

In order to insure the swinging action of the top plate 50, I provide same with an overbalanced weight 53 opposite the upstanding edge portion 48 so as to swing the same on the shaft 45 as a pivot when the notch 52 comes into registry with said arm 48 during the rotative action of the setting disc 51.

The setting disc 51 is mounted for rotative movement, to be described later, and is assembled with the notch 52 held in engagement by a spring arm 55 depending from a plate 56, which is secured to the setting cap by screws 57—57. Thus, rotation of the setting disc 2 on the base 1 in accordance with the scale or gauge 59, on the rim 3 of the base 1, and the index arrow 60 on the setting disc, will determine the time in which the setting disc 51 will be rotated when released and, hence, the time when 48 will fall into the notch 52 and release the other devices to free the firing pin 15.

I prefer to arrange to have this arm 55 removed from the notch 52 and, hence, to release the rotative movement of the setting disc upon the shock of firing; and for this purpose I form a flange 61 on the plate 56, to which is pivoted at 62 a counterbalanced weight 65 which will be moved by the set-back action of the shock of firing and will throw the arm 55 out of engagement with the notch 52 and thus permit the setting disc 51 to be free to rotate.

In order to hold the arm 65 in upward position, as shown in Fig. 2, I form the back or rear part flattened slightly, as shown at 66, which bears against the arm 55, said arm being normally set as a spring to hold its lower end into engagement with the notch 52. Upon the shock of firing the weighted portion will cause the arm 65 to rock and the flat surface thus throws out the arm 55, the parts being in the position shown in Fig. 11.

The weighted elements and the means to effect rotation of the disc 51, after it has been released, will now be described. Fitted above and secured to the base 1 and within the cap 2 are a plurality of plates 68, 69, and 70 which are rigidly secured to said base 1 and thru which the shaft 45 passes freely to permit rotation, as previously described. Mounted centrally on the plate 68 is a hollow tube 79, and rotatably mounted on said tube is a hub 71 on which the setting disc 51 pivots, being held between flanges 72 and a down-turned spring washer 73. A cap 74 encircles the tube 79 being held by a set screw 75 in adjusted position thereon, and having a closed end 76 to act as a bearing for the spring 77 contained within said tube, which bears against a plurality of weighted elements, here shown as steel balls 80.

These balls are sufficient in number and weight so that when fed downwardly by the force of the spring 77 they will be forced out of the open mouth of the tube 79 into notches 81 on a driving wheel 82, said driving wheel being arranged for rotative action on an axle 83 mounted on extensions fitting in suitable recesses in alignment therewith in the plates 68 and 70 Centrifugal action will cause the weighted elements 80 to thus turn the driving wheel 82 in the direction on the arrow, Fig 4, exerting a maximum, even, and uniform driving tension proportional with the weight of the elements 80 and the force of the centrifugal action, which driving elements are released at or before completing a half-rotation of the wheel 82, said elements being thrown out through an opening or gate 84 in the surrounding guard plate 85

Thus I secure a positive driving action on the wheel 82 independently of any spring, or springs, and I mount on the axle 83 of this wheel a gear 86 which meshes with a pinion 87 on the hub 71 and thus turns the setting disc 51 as soon as it is released by the removal of the spring arm 55 The turning of the setting disc 51 continues until the upstanding arm 48 falls into the notch 52, as above explained. Thereupon, the shaft 45 is directed to release the counterbalanced lever 40, which in turn frees the arm 38 and, hence, permits the firing pin 15 to be driven downwardly by the influence of its coiled spring 20 and to ignite the charge.

In order to provide a steady and uniform ac-

tion of the power wheel 82, I provide an escapement consisting of a gear wheel 99 mounted also upon the axle 83 and meshing thru a pinion and gear (not shown), with a second pinion 93, and an escapement wheel 94 which is regulated by an oscillator 95, having a pair of upstanding teeth 96—96 to engage and regulate the speed of the escapement wheel 94. The speed of the action of this oscillator 95 is dependent upon the impulse of a hair-trigger 100, secured on a stud 101, which in turn is movable on a threaded screw 102 and can be adjusted by rotation of the screw by an ordinary screwdriver reaching thru a hole 103 in the cap 2, thus adjusting the speed of the driving impulse of the wheel 82.

In addition to the several safety devices above described and explained, I provide a still further safety device which must be actuated by centrifugal force before the firing pin can be released. This safety factor includes a counterbalanced member 105 pivoted at 106 to a screw-threaded stud carried by a bottom plate 107 which fits in a corresponding recess in the bottom of the plate 1 and is held by one or more screws 109. This recess is a part of or opens into the cut-away portion 14 thru which the firing pin 15 is driven into the cap or primer 17, as above explained.

The pivoted member 105 is normally positioned with a corner 110 fitting under the circular flange 21 on the firing pin 15, the member 105 being normally held in this locking position (see Fig. 10) by the influence of a spring 112 secured by a screw to the plate 108. Upon firing of the shell the centrifugal action will force the member 105 to swing on its pivot 106 against the tension of the spring 112, and thus free the corner 110 from its safety locking position under the circular flange 21, thus permitting the firing pin 15 to be driven upon its subsequent release by the timing mechanism.

In addition to the plates 68, 69, and 70 above described, for holding the driving wheel and accompanying gears and pinions, I provide a top plate 115, a ring 117, shown in Figs. 2 and 11, and a bottom plate 116, all held together by a series of screws 120 tapped into the base 1 and constituting the rigid supporting means for the movable parts of the mechanism above described.

Referring to Figs. 16 and 17, I have illustrated a modification wherein a plate 121 takes the place of the plate 85 wherein the driving wheel 82 is mounted. In this form, I eliminate the tube 79 and spring 77, but in place thereof I provide a spiral groove 125 formed in the plate 121 and adapted to contain the series of weighted members 80 which are fed into the notches 81 of the driving wheel 82. The groove 125 is arranged outwardly from a central position so that the centrifugal action on the fuse will automatically force and feed the balls 80 lengthwise from the head 126 of the groove 125 to a delivery opening 127 from said groove into the notches 81 in the driving wheel 82, whereupon, said weighted members by the continued force of centrifugal action will turn the wheel 82 and escape from the gate 84 in a manner similar to that already described in connection with the first or preferred form.

The operation of my improved fuse structure, employing a driving wheel to actuate the timing mechanism by means of positive direct-acting weighted members, which members are fed automatically to the driving wheel and after performing their driving function thru centrifugal force are released or freed from the driving wheel, thus provides a positive, uniform operation. By eliminating a drive spring, or springs, for the timing mechanism, I also eliminate many difficulties in the construction and operation of such time fuses. My fuse structure maintains its driving efficiency even thru months or years of service, whereas a spring under such conditions might not function.

Furthermore, my improved construction employs and relies entirely upon centrifugal action of the fuse, which necessarily is set up by the firing of the shell to which the fuse is attached for release of the safety locks and for the driving of the timing gear, together with the set-back action from the shock of firing to release the timing disc. These factors, releasing the safety catches, cannot possibly occur except during the actual operation of firing and, hence, eliminate entirely the danger of accidental discharge.

Furthermore, the use of freely movable weighted members as the driving means by reason of the centrifugal force exerted upon them, which members are fed successively to and thru the driving wheel, is a most important novelty and insures constant, steady, and uniform driving action, also operable by centrifugal force resulting from the firing action.

I claim:

1. In a fuse of the kind described, a rotatable setting disc normally held against rotation until released after firing, a tubular member positioned in alignment with the axis of said disc and extending therethru, a plurality of separate weighted members, each independently movable, stored in said tube, driving mechanism mounted eccentrically with said setting disc and including a rotatable toothed member, having its said teeth successively movable substantially in alignment with the tube and said separate weighted members, the release of the setting disc after firing providing for the travel of said weighted members individually and successively to said toothed member to cause rotation of same thru centrifugal force on said weights.

2. In a fuse of the kind described, a rotatable setting disc normally held against rotation until released after firing, a tubular member positioned in alignment with the axis of said disc and extending therethru, a plurality of separate weighted members, each independently movable, stored in said tube, driving mechanism mounted eccentrically with said setting disc and including a rotatable toothed member, having its said teeth successively movable substantially in alignment with the tube and said separate weighted members, the release of the setting disc after firing providing for the travel of said weighted members individually and successively to said toothed member to cause rotation of same thru centrifugal force on said weights, and means permitting said weighted members to travel free of said toothed member after they have exerted a rotatable action thereon.

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