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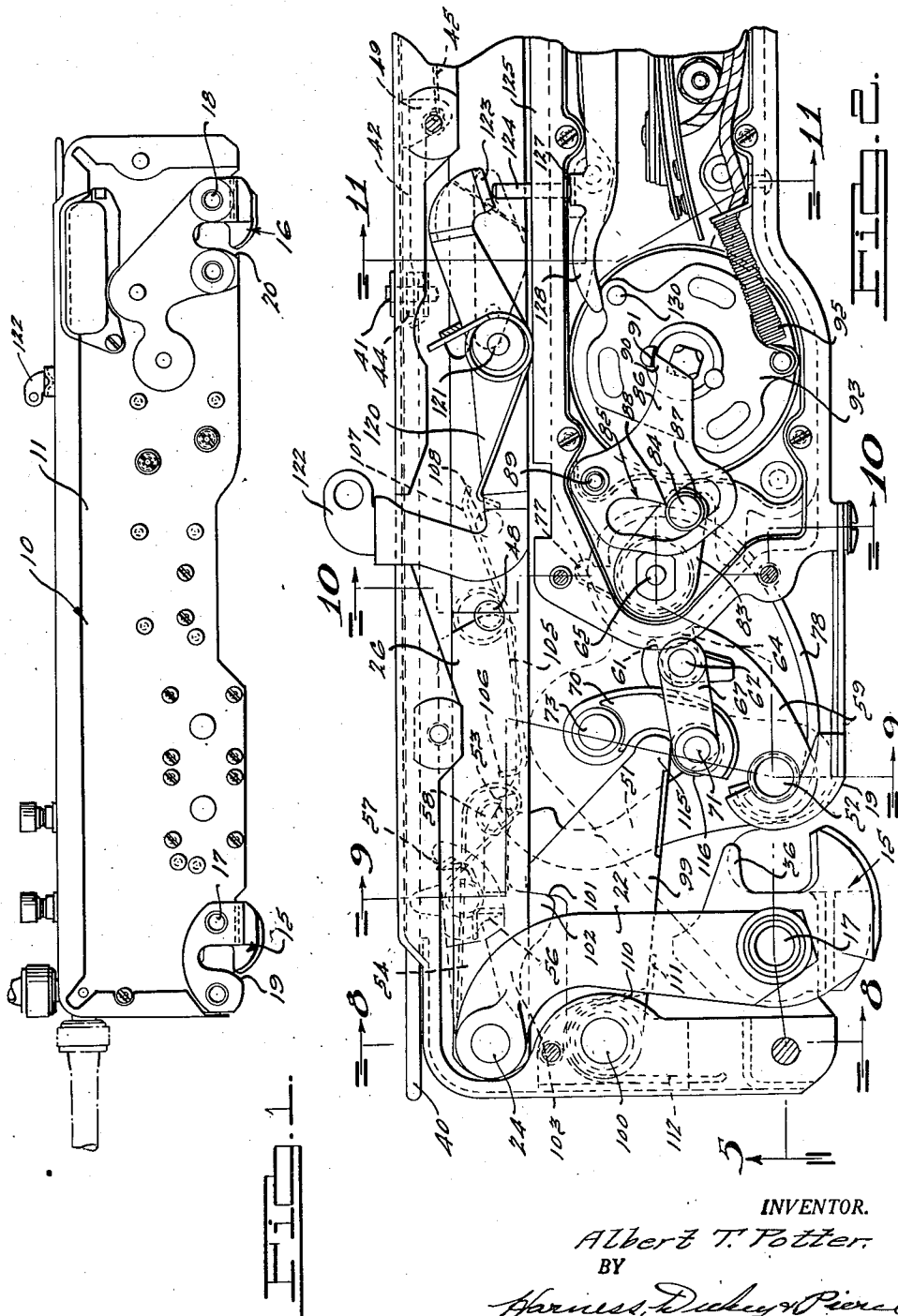
A. T. POTTER

2,571,381

BOMB RELEASE MECHANISM

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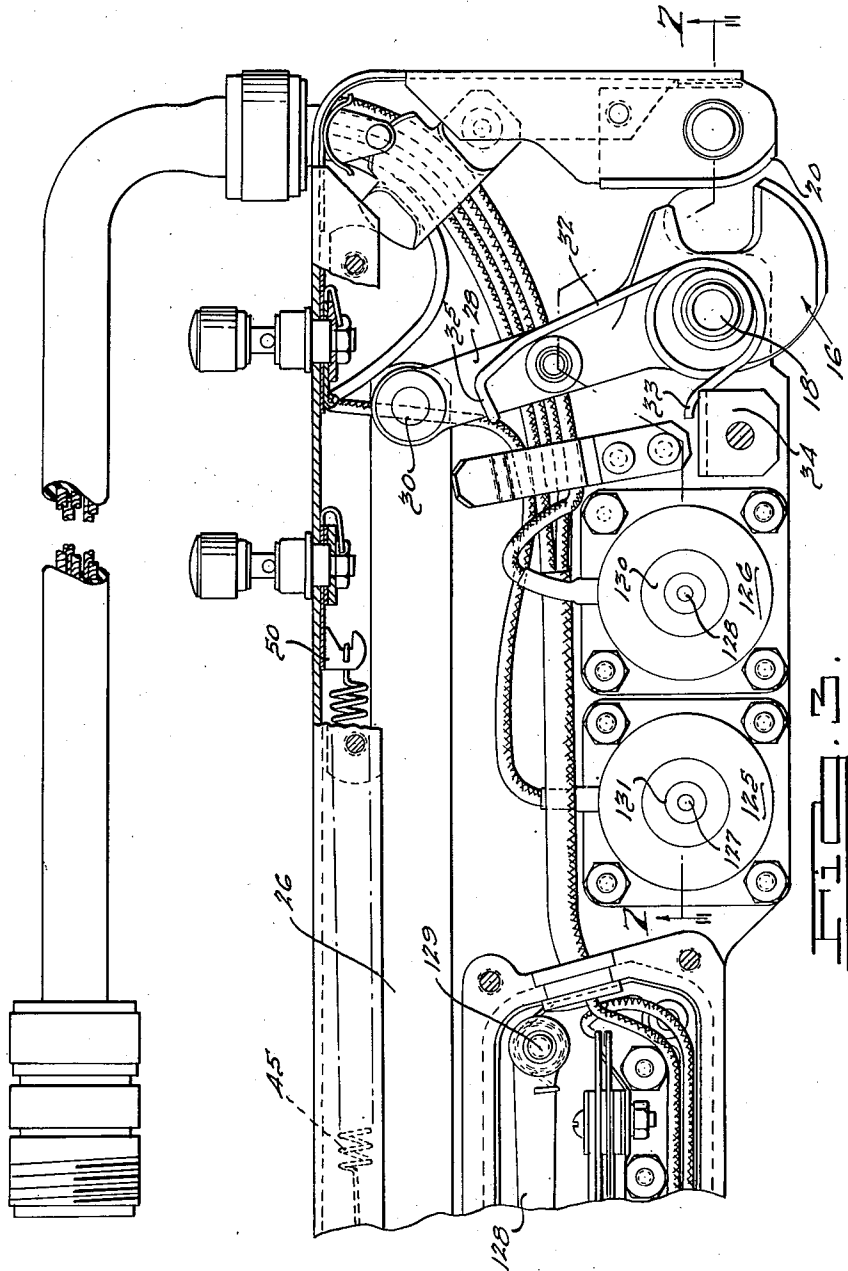
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BOMB RELEASE MECHANISM

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8 Sheets-Sheet 2



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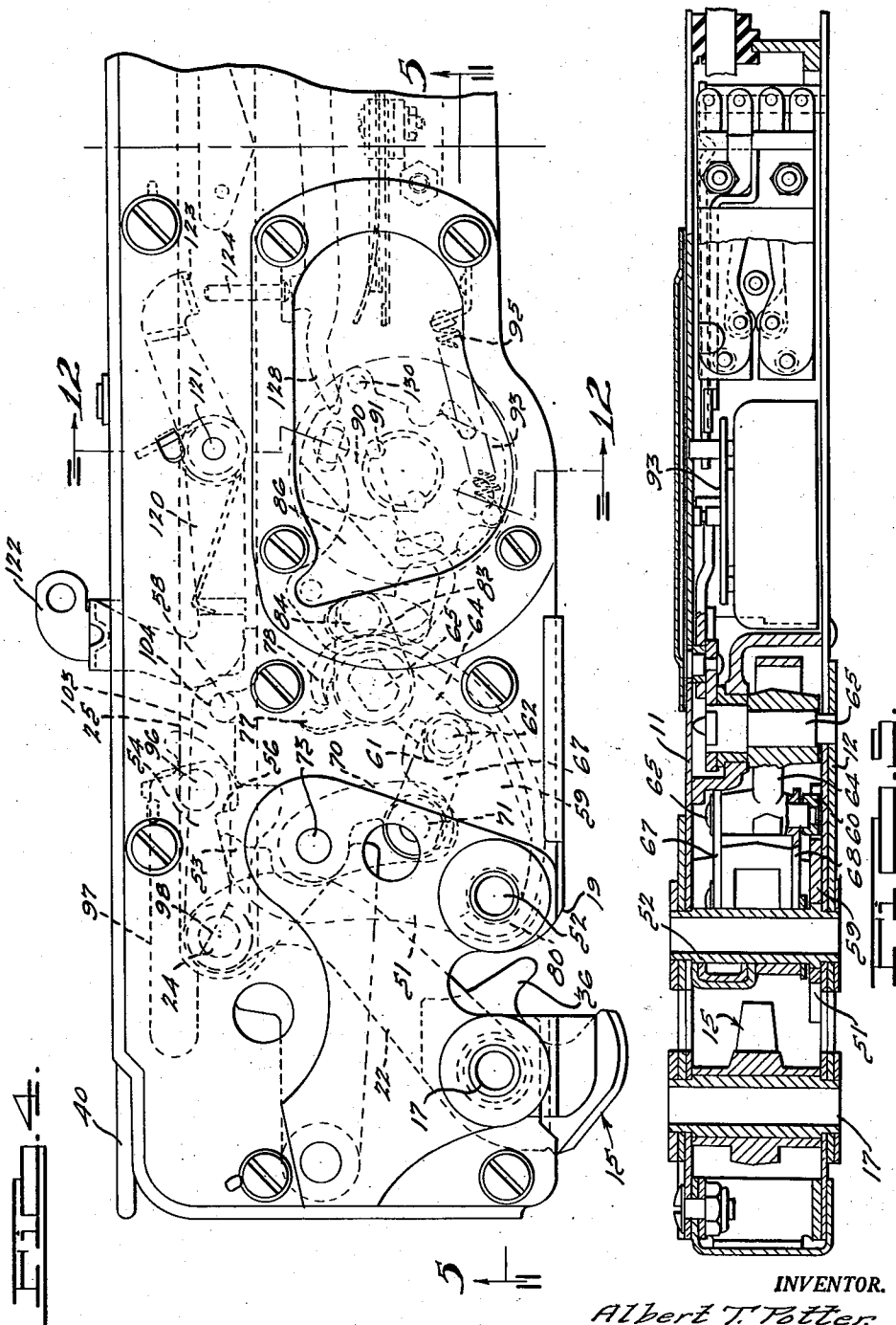
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BOMB RELEASE MECHANISM

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8 Sheets-Sheet 3



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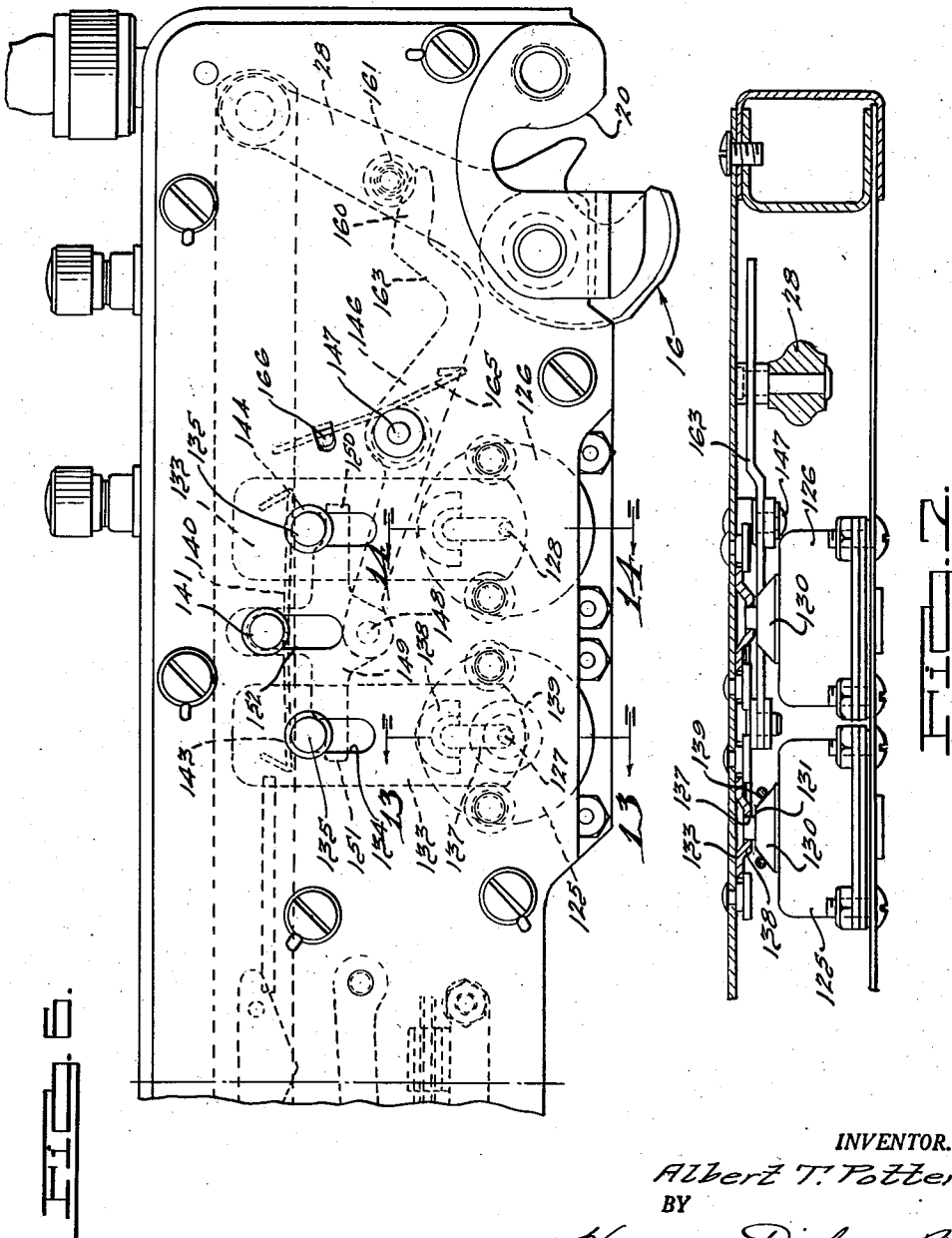
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BOMB RELEASE MECHANISM

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8 Sheets-Sheet 4



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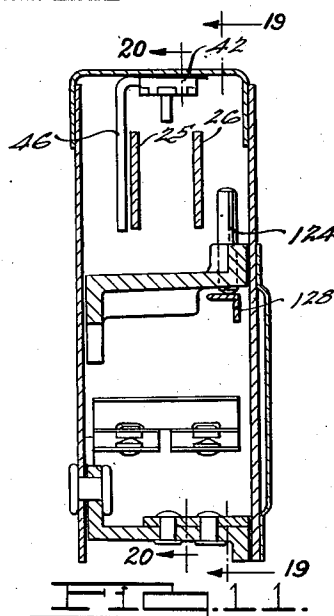
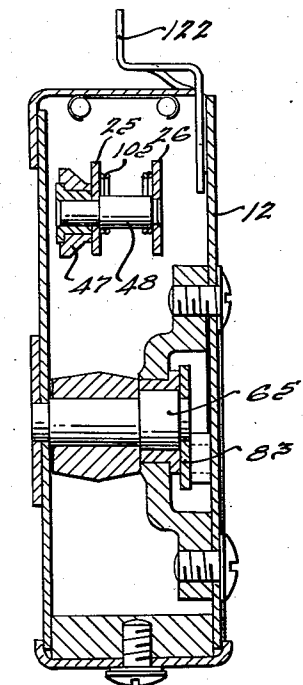
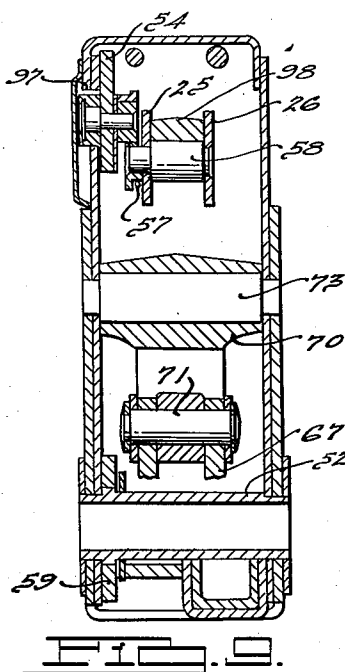
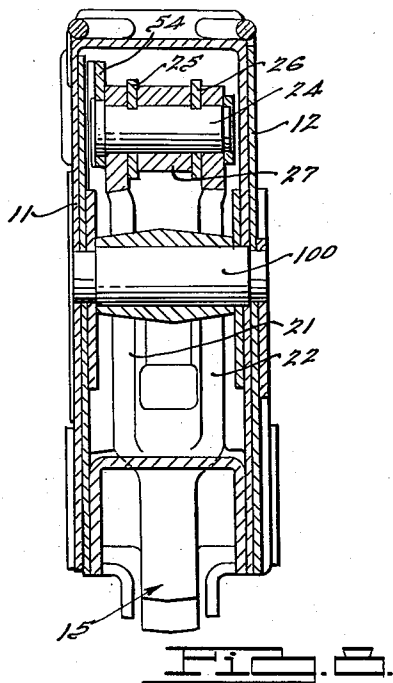
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BOMB RELEASE MECHANISM

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8 Sheets-Sheet 5



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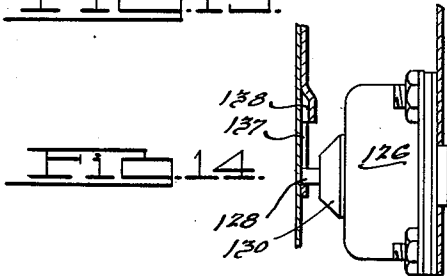
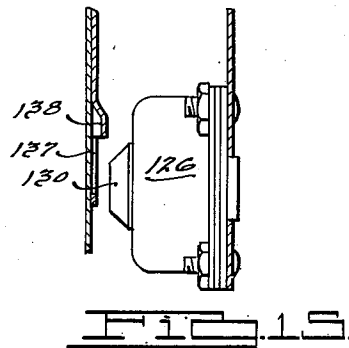
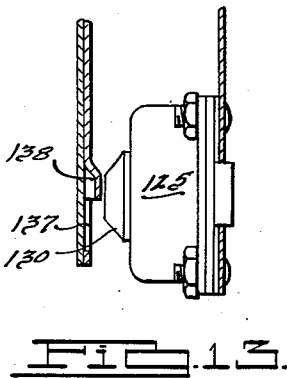
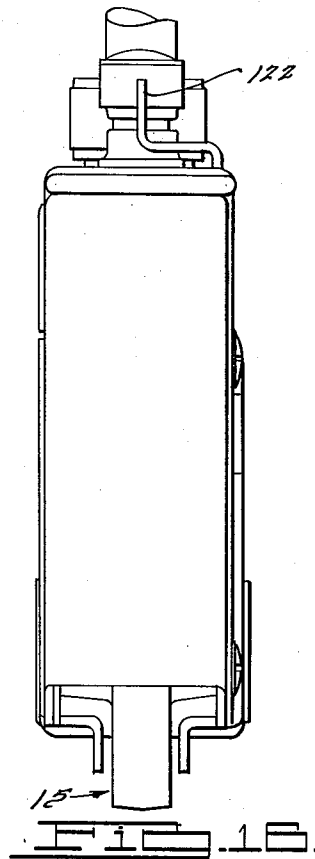
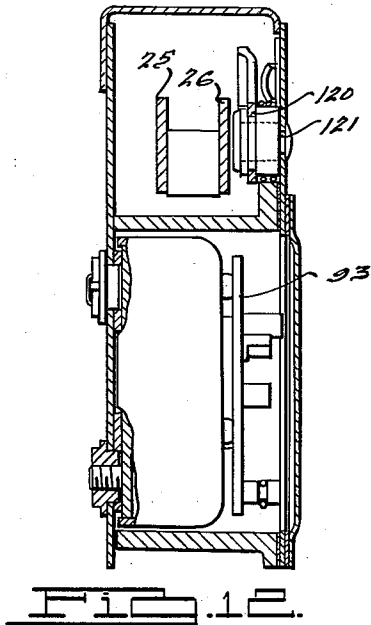
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BOMB RELEASE MECHANISM

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BOMB RELEASE MECHANISM

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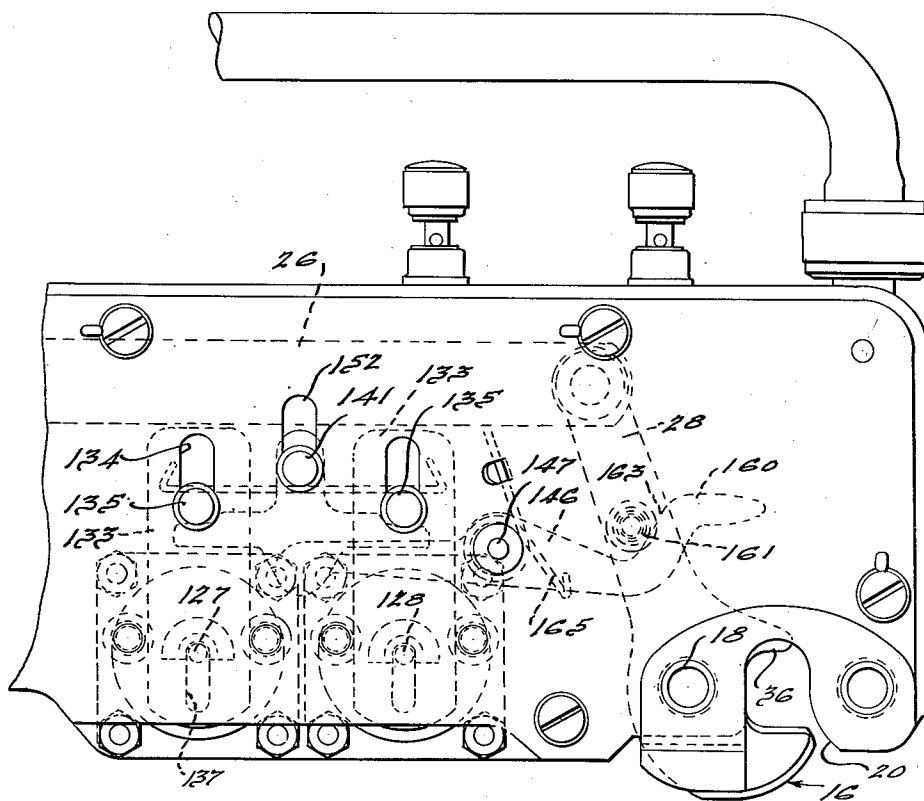
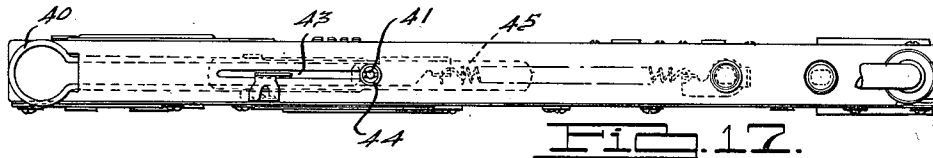


FIG. 18.

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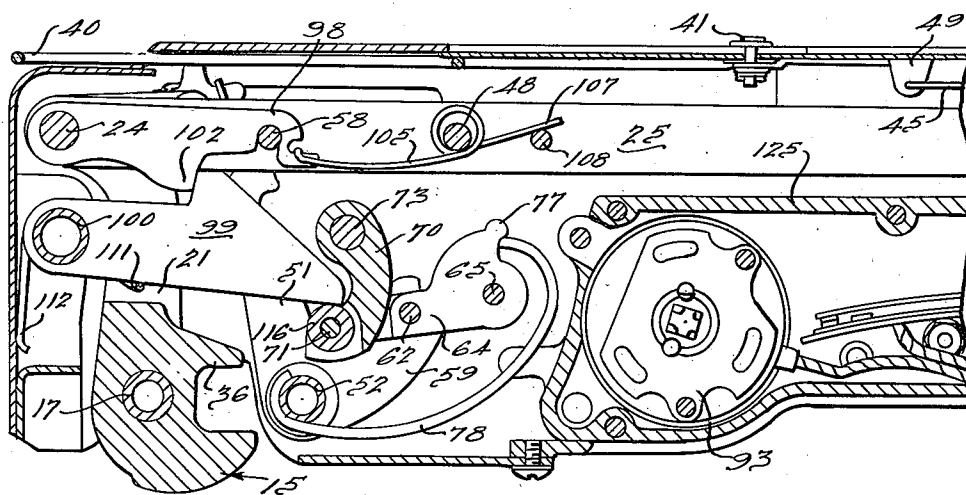
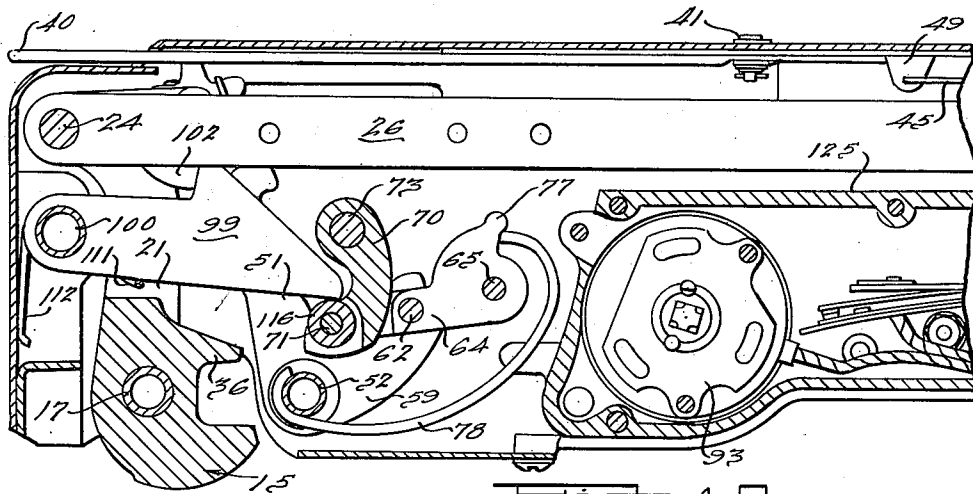
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BOMB RELEASE MECHANISM

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UNITED STATES PATENT OFFICE

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BOMB RELEASE MECHANISM

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6 Claims. (Cl. 89—1.5)

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The invention relates to bomb equipment for airplanes and it has particular relation to a shackle for releasably supporting bombs.

It is generally appreciated that a bomb shackle should be of such character that the bomb may be released instantaneously as otherwise it would be difficult to attain accuracy in the dropping of bombs. It is also realized that the shackle must be capable of supporting heavy bombs while still permitting this instantaneous release. The present invention is concerned with providing a bomb shackle for accomplishing these results and furthermore in providing a shackle which will occupy a very small space in the plane.

An object of the invention therefore is to provide a compact bomb supporting shackle which is extremely strong so as to support heavy bombs while still being releasable instantaneously.

Another object of the invention is to provide a shackle of this character which may be loaded easily and quickly to the end that the bombs may be placed in the plane and suspended by the shackle in an efficient manner.

Another object of the invention is to provide an improved means of pulling the firing pins from the bomb when it is released or for allowing the pin to remain in the bomb, depending upon whether or not the operator desires the bomb to explode or to fall without exploding.

Other objects of the invention will become apparent from the following specification, from the drawings relating thereto, and from the claims hereinafter set forth.

For a better understanding of the invention reference may be had to the drawings wherein:

Figure 1 is a side elevational view of a bomb shackle as constructed according to one form of the invention.

Figure 2 is a fragmentary view on a larger scale showing interior working parts of the shackle generally of the right half thereof as viewed from the underside of Figure 1.

Figure 3 is a view similar to Figure 2 but illustrating the mechanism in the opposite end of the shackle.

Figure 4 is a view similar to Figure 2 showing the shackle in a released condition.

Figure 5 is a cross sectional view taken substantially along the line 5—5 of Figure 4.

Figure 6 is a view similar to Figure 4 showing the shackle in a bomb released condition.

Figure 7 is a cross sectional view taken substantially along the line 7—7 of Figure 3.

Figure 8 is a cross sectional view taken substantially along the line 8—8 of Figure 2.

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Figure 9 is a cross sectional view taken substantially along the line 9—9 in Figure 2.

Figure 10 is a cross sectional view taken substantially along the line 10—10 of Figure 2.

Figure 11 is a cross sectional view taken substantially along the line 11—11 of Figure 2.

Figure 12 is a cross sectional view taken substantially along the line 12—12 of Figure 4.

Figure 13 is a cross sectional view taken substantially along the line 13—13 of Figure 6.

Figure 14 is a cross sectional view taken substantially along the line 14—14 of Figure 6 but showing the pin releasing mechanism in another position.

Figure 15 is a view similar to Figure 14 showing the pin removing means in a condition where the pin is allowed to stay in the bomb.

Figure 16 is an end elevation of the shackle as seen from the right hand end of Figure 1.

Figure 17 is a plan of the structure shown in Figure 1;

Figure 18 is a side view similar to Figure 6 but showing the right hand end of the shackle in a bomb holding condition;

Figure 19 is a sectional view of the structure illustrated in Fig. 11, taken on the line 19—19 thereof, and

Figure 20 is a sectional view of the structure illustrated in Fig. 11, taken on the line 20—20 thereof.

The shackle shown in Figure 1 comprises a casing 10 having side walls 11 and 12 as seen for instance in Figure 5 and this casing is adapted to be mounted in an airplane for supporting bombs. The bombs are suspended from hooks 15 and 16 pivotally mounted on pins 17 and 18 extending through the casing and the edge of the casing is notched as indicated at 19 and 20 for accommodating eyes on the bombs which are engaged by the hooks 15 and 16. When the hooks 15 and 16 are swung counterclockwise about pivots 17 and 18, the bomb will be released. It generally might be said that the invention is concerned with a means for moving the hooks 15 and 16 into bomb supporting positions as seen in Figure 1, an extremely sensitive means for holding the hooks in such position and an instantaneously operable means for releasing the hooks.

Referring to Figures 2 and 8 jointly, the hook 15 above its pivot 17 has bifurcations 21 and 22 and these have openings at their upper ends which receive a pivot pin 24. Between the bifurcations, a pair of links 25 and 26 are pivotally connected to the pin 24 and maintained in spaced relation by the hub 27 of an arm presently to be described

and these links extend substantially the full length of the casing. Directing attention to Figure 3, the links 25 and 26 at their opposite ends are pivotally connected to the upper end of the shackle hook 16. In this instance the hook 16 has a singular extension 28 which is disposed between the ends of the links 25 and 26 and a pivot pin 30 connects the parts together. It follows that both hooks will move in the same manner simultaneously.

Still directing attention to Figure 3, the hook 16 is urged in a clockwise direction by a spring 32 encircling the pivot 18 and having one end 33 engaging a bracket 34 fastened in the casing and having its other end indicated at 35 hooked over the extension 28. This spring serves to help move the hooks into bomb releasing position and to hold them in released positions until the bombs are to be connected to the shackle.

In connection with the loading of the bombs, it should be understood that the bombs have eyes engageable with the hooks and when the bomb is raised to loading position, the eyes first press against lips or projections 36 on the hook. This causes the hooks to swing counterclockwise and the lower ends of the hooks to enter the eyes. As will be seen presently, this counterclockwise movement of the hooks acts to cock the shackle also so that the hooks may be released instantaneously when the bombs are to be released. The automatic movement of the hooks to bomb engagement positions when the bombs are raised and also automatic cocking of the shackle at the same time is very important because the persons loading the bombs need only to elevate them so as to cause the eyes to engage projections 36 and move the hooks. It is to be observed that the guiding slots 19 and 20 guide the eyes on the bombs into engagement with the projections and into such positions that the hook ends of the hooks will enter the eyes.

The hooks also may be manually cocked for testing principally by a wire loop 40, shown in Figs. 2 and 17, extending into the casing and fastened by a pin 41 to a slide 42. This pin, as seen in Figure 17, projects through a slot 43 in the casing wall and at opposite sides of the wall the pin has washers 44 so that the slide is guided along the wall. Such slide 42 as shown by Figure 11 particularly has an inwardly directed projection 46 extending past the link 25 and this projection is adapted to engage a roller 47 shown in Figure 10 which is mounted on a pin 48 extending through links 25 and 26. It should be evident that if the loop 40 is pulled, the projection 46 will engage the roller 47 and pull the links 25 and 26 and hence move both hooks. The parts as seen in Figures 2 and 3 have already been moved such as by pulling the loop 40 and the slide has returned to its original position. This return movement of the slide is effected by coil spring 45 shown by Figures 2, 3, and 17 particularly and such spring has one end hooked about a projection 49 on the slide and its other end hooked about a projection 50 on the casing wall.

Now referring to Figures 2, 4 and 5 which show the retaining and cocking means in better detail, it may be noted first that an arm 51 is pivoted on a pin 52 in the casing and this arm has an end 53 disposed along the links. Adjacent to this arm a pawl 54 is pivotally mounted on one end of the pin 24 and this pawl has a shoulder 56 adapted to engage the end 53 of the arm 51. The pawl 54 is normally urged clockwise as seen in Figures 2 and 4 by a spring 57 hooked over an end portion of the pawl and looped about one end of a

pin 58 extending through the links 25 and 26. Hence the pawl normally is urged into a position where the shoulder 56 will engage or pick up the end 53 of arm 51 when the loop 40 is pulled.

The arm 51 is in the form of a bell crank and it has a second arm 59 beyond the pivot 52 and this second arm has a slot 61 which receives a roller 60 on one end of a pin 62. The pin 62 extends through one arm 64 of a second bell crank pivoted or a pin 65 mounted in the casing and the end of arm 64 is disposed between a pair of links 67 and 68 also pivoted on pin 62 as shown by Figure 5. The links 67 and 68 at their other ends straddle a link 70 and a pin 71 pivotally connects such ends of the links. Link 70 in turn at its other end is pivoted on a pin 73 mounted in the casing wall.

The second bell crank has a projection 77 adapt to engage one end of a bowed spring 78 and this spring has its other end indicated at 80 extending partially around the pivot 52. A second arm on the bell crank indicated at 83 has a pin 84 on its free end and this pin projects upwardly into a slot 85 formed in a latch 86 and has a sleeve roller 87 for contacting the sides of the slot. It will be noted that the slot has two portions angled towards each other and that the walls of the slot at their junction form a V-shaped shoulder 88 as shown best by Figure 2. The latch 86 is pivoted to the casing as indicated at 89 and the free end of the latch has a projection 90 which is adapted to engage a flat sided pin 91 projecting upwardly from a turnable type solenoid 93. The solenoid is urged counterclockwise to the position shown by a spring 95 and when energized it turns sufficiently the other way to move the pin 91 past the end 90 of the latch so as to release the latter. It will be seen later that the solenoid can be moved mechanically also if desired.

It may be generally stated now that when the two links 25 and 26 are moved to the left by swinging hooks 15 and 16 counterclockwise as seen in Figure 4, the shoulder 56 will engage the end 53 of arm 51 and cause it to turn counterclockwise about the pivot 52. In turn, the slotted end 61 of arm 59 will move the pin 62 and movement of the pin 62 will cause the arm 64 to move about the pivot 65 and also cause the pin 71 and arm 70 to swing about the pivot 73. Movement of the arm 64 about pivot 65 will cause the pin 84 to move in the slot 85 and due to the shape of the slot the pin will move the latch 86 in such manner as to cause the end 90 to move towards the center of solenoid 93 and shift pin 91 clockwise of the solenoid until it clears the pin. Then spring 95 returns the pin to the position it had before and the pin will then retain the latch in position as seen in Figure 2. This movement of the parts will load the bowed inner end of spring 78 and once the pin 91 moves into a retaining position with respect to the latch 86 the spring will act to release the parts and force the latch end 90 against the straight side of pin 91.

So far this arrangement will not act to hold the hooks 15 and 16 and links 25 and 26 in the positions shown by Figure 2 and such links and hooks will tend to return although the latching mechanism from arm 51 to solenoid 93 will remain in a cocked position. The latching of member 86 by the solenoid pin 91 is accomplished prior to final movement of the hooks 15 and 16 to bomb retaining positions and consequently further movement of the hooks to and locking them in such positions is required. It is necessary now, however, that the pawl 54 clear the end 53 of arm 51 and

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this is accomplished by providing a roller 96 on the pawl which projects into a slot 97 in the adjacent casing wall as seen in Figure 4. Such slot has an inclined edge 98 adapted to engage the roller when the pawl is moved sufficiently and when such engagement occurs, the roller runs over such inclined edge and moves the pawl counterclockwise and out of engagement with the end 53 of the arm 51. With the pawl now out of the way, the hooks are moved to their final positions.

Now in order to hold the hooks 15 and 16 and links 25 and 26 in the final positions shown in Figure 2, a pivoted holding member 99 is provided which is pivoted on a pin 100 in the casing and this holding member has a shoulder 101 engageable with a shoulder 102 formed on an arm 103 fastened to the spacing hub 27. The arm 103, as perhaps best shown by Figure 4, is limited in its downward movement as seen in this figure by a groove 104 in the arm engageable with the pin 58 extending through the links 25 and 26. The arm is resiliently urged into this position by a spring 105 shown in Figure 2 which has a portion 106 looped about the end of the arm 103, an intermediate portion coiled about pin 48 and an end 107 engaging a pin 108 connected to links 25 and 26. Arm 99 is normally urged into the position shown in Figure 2 by a spring 110 looped about the pivot 100 and having one end 111 engaging the lower side of the arm and its other end 112 fastened to the casing. The shoulder 102 cannot move to the right when arm 99 is in the position shown in Figure 2, but it can move into this position due to the fact that spring 105 will allow the arm 103 to cam or pivot counterclockwise until it clears the shoulder 101 and then shoulder 102 snaps downwardly to engage shoulder 101.

From this description it should be understood that the pawl 54 will move arm 51 to cock the mechanism between arm 51 and solenoid 93 and then continued movement of links 25 and 26 will cause pawl 54 to ride over the end 53 of arm 51. Further movement of the links after the cocking operation will cause the arm 103 to ride over the shoulder 101 of arm 99 until it can snap behind such shoulder and then the two hooks 15 and 16 and links 25 and 26 are prevented from returning. It should be noted at this point that the arm 99 is locked against releasing or counterclockwise movement as shown in Figure 2 by the fact that an end portion 115 of the arm engages a roller 116 on pin 71. It follows that if the pin 71 is moved to the right sufficiently to allow arm 99 to move the weight of the bombs acting through the hooks and shoulder 102 will instantaneously throw arm 99 in a clockwise direction and both hooks 15 and 16 and links 25 and 26 will instantaneously move to the right to bomb releasing positions. The cocking and positioning mechanism having been described, it only remains so far as releasing is concerned, to provide a circuit to include solenoid 95 which when completed would cause the solenoid to swing pin 91 sufficiently to release the latch 86 or to provide a mechanical means for positively removing the rotary part of the solenoid.

Referring to Figure 2, mechanical means for releasing the latch includes a lever 120 pivoted on a pin 121 in the casing and having an end 122 extending through the casing wall for manual operation. The opposite end of the arm has a shoulder 123 engageable with a pin 124 which is slidable through a wall 125 in the casing. This pin engages a shoulder 127 on a swingable lever

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128 which is pivoted in the casing on a pin 129 seen in Figure 3. One end of lever 128 extends over a pin 130 on the solenoid rotor and consequently when the end 122 of arm 120 is pulled, the pin 124 swings lever 128 and will cause the solenoid rotor to move sufficiently to release latch 86.

In general it should be understood now that the hooks are urged to open positions by spring 32 so that the hooks will always be ready to receive the bombs although the spring does assist in moving the hooks to release positions when the bombs are to be dropped particularly if small bombs are used. Loading of the bombs is effected by elevating them and causing the eyes thereon to enter the open hooks and guiding slots 19 and 20 in the casing walls so as to cause the eyes to press against the projections 36 on the hooks. As the hooks move counterclockwise by this procedure, the arm 51 is first moved to cock the latching roller 116 over arm 99 and it is to be observed that the arrangement permits using a long arm 51 and consequently considerable movement of its end 53 so as to reduce the cocking forces required while still securing that condition where instantaneous uncocking is attainable when the bomb is to be released. Then during the final movement of the hooks, they are locked automatically in position subject to release by displacement of roller 116 and this final movement is independent of the earlier cocking movement.

Attention is directed to the fact that the overall length of the shackle is only slightly greater than the distance required for positioning the hooks and that all parts are housed in a casing which is also narrow and shallow. Therefore, the space required for the shackle is practically at a minimum and this is manifestly important in airplanes. An important characteristic therefore is the compactness of the device.

Now referring to Figures 6, 7, 18 the means for controlling the firing pins of the bombs includes a pair of solenoids 125 and 126 having pin armatures 127 and 128. These armatures will normally be retracted into the solenoid, but if the solenoids are energized, they will project upwardly as viewed in Figure 7. A cone shaped element 130 is provided on each solenoid around the armature and this cone shaped element terminates in a flat face 131 above each solenoid. A slide 133 for each solenoid is mounted on the inner side of the casing wall by means of a slot 134 in the wall and a pin 135 connected to the slide and disposed in the slot. This slide has a slot 137 overlying the armature 127 and a depressed position 138 which, when moved over the face 131 of the solenoid, substantially contacts such face so as to hold a firing pin releasing device engaging the cone 130. Such pin releasing device on bombs may usually compose a wire ring such as shown at 139 which will fit over the cone 130 and this can be released when the depressed portion 138 of the slide is above moved upwardly as seen in Figure 6. If it is desired to hold the ring so that the pin will be pulled from the bomb, the solenoid can be energized so as to project the armature upwardly through the ring and then the latter will not be released.

A slide 133 is provided for each of the solenoids and they are spring pressed towards operative positions by means of a spring 140 looped at its center about a pin 141 located between the slides and having end loop positions 143 and 144 looped about the pins 135. The slides are posi-

tively moved by means of a lever 146 pivoted on a pin 147 in the casing and having an end pivotally connected as indicated at 148 to the center portion of a head 149 having end portions 150 and 151 pressing against the pins 135. The head 149 is secured to the pin 141 and the latter is slidable in a slot 152 in the casing wall and from this it follows that the head can move in the same manner that the slides move. When the lever 146 is swung counterclockwise it will move the slides into operative relation with the solenoids and when the lever 146 is swung clockwise it will release the rings 139 unless the armatures project through the rings through intentional energizing of the solenoids.

The lever 146 has an end 160 for engaging a roller 161 on the hook extension 28 and inwardly from the end, the lever has a cam portion 163. The latter portion allows counterclockwise movement of the lever when the hooks swing counterclockwise and cause clockwise movement thereof when the hooks swing clockwise. A spring 165 encircling pin 147 on the lever and having one end engaging a fixed projection 166 on the casing and its other end hooked over the arm normally urges the lever counterclockwise.

While loading of the bombs will automatically move the slides 133 to retaining relation to rings 139 if the latter are in place, such slides also may be shifted manually and independently if the rings are to be inserted after the bombs are loaded which usually may be the case. Assuming that the bombs are loaded and the slides 133 are positioned as in Figure 18, each ring 139 may be applied merely by pressing it against the edge of the depressed portion 138 of the slide and moving the slide against the action of the spring end 143 until the ring engages the cone 130. Then the slide automatically returns to a position over the ring.

The three solenoids 93, 125 and 126 may be connected in suitable circuits extending to any part of the plane so that the solenoids may be controlled as desired and the circuits may include contacts which are made and broken when the parts are moved so as to harmonize operations and also indicate to the operator what is occurring. Also, when the latch releasing solenoid is energized, the circuits may be arranged so that the pin releasing solenoids may be energized at the same time.

Although only one form of the invention has been illustrated and described in detail, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the claims.

What is claimed is:

1. A release assembly for a bomb including, in combination, a frame, spaced hook members pivoted on said frame for engaging and supporting a bomb, a link pivotally interconnecting said hook members for forming an assembly which produces the operation of the hook members in synchronism, a pivotal latch on said assembly, a pivoted latch arm on said frame engageable with the latch on said assembly, a spring for urging said latch arm to latched position, an arm pivoted on said frame for supporting an engaging element for the latch arm, a toggle mechanism for moving said element supporting arm to the position for securing said latch arm, an arm on said toggle mechanism projecting therefrom, a second latch engaging said toggle mechanism arm for retaining it in latch arm holding position, and a sole-

noid actuated mechanism for securing said second latch.

2. A release assembly for a bomb including, in combination, a frame, spaced hook members pivoted on said frame for engaging and supporting a bomb, a link pivotally interconnecting said hook members for forming an assembly which produces the operation of the hook members in synchronism, a pivotal latch on said assembly, a pivoted latch arm on said frame engageable with the latch on said assembly, a spring for urging said latch arm to latched position, an arm pivoted on said frame for supporting an engaging element for the latch arm, a toggle mechanism for moving said element supporting arm to the position for securing said latch arm, an arm on said toggle mechanism projecting therefrom, a second latch engaging said toggle mechanism arm for retaining it in latch arm holding position, a solenoid actuated mechanism for securing said second latch, a resetting arm pivoted on said frame, and a pawl carried by said assembly for actuating said resetting arm for resetting the toggle mechanism and securing said latch arm before said first latch on said assembly is moved into position to engage said latch arm.

3. A release assembly for a bomb including, in combination, a frame, spaced hook members pivoted on said frame for engaging and supporting a bomb, a link pivotally interconnecting said hook members for forming an assembly which produces the operation of the hook members in synchronism, a pivotal latch on said assembly, a pivoted latch arm on said frame engageable with the latch on said assembly, a spring for urging said latch arm to latched position, an arm pivoted on said frame for supporting an engaging element for the latch arm, a toggle mechanism for moving said element supporting arm to the position for securing said latch arm, an arm on said toggle mechanism projecting therefrom, a second latch engaging said toggle mechanism arm for retaining it in latch arm holding position, a solenoid actuated mechanism for securing said second latch, a resetting arm pivoted on said frame, a pawl carried by said assembly for actuating said resetting arm for resetting the toggle mechanism and securing said latch arm before said first latch on said assembly is moved into position to engage said latch arm, and means for disengaging said pawl from said resetting arm after said second latch is engaged by said solenoid actuated mechanism.

4. A release assembly for a bomb including, in combination, a frame, a pair of spaced hooks pivoted on said frame, a link interconnecting said hooks and forming an assembly for operating the hooks in synchronism, a latch pivoted on said assembly, a latch arm pivoted on said frame, a mechanism for supporting said latch arm in latching position, a resetting arm pivoted to said frame for resetting said mechanism before said latch engages said latch arm, and a pawl carried by said assembly for operating said resetting arm and for releasing said resetting arm after the mechanism has been reset.

5. A release assembly for a bomb including, in combination, a frame, a pair of spaced hooks pivoted on said frame, a link interconnecting said hooks and forming an assembly for operating the hooks in synchronism, a latch pivoted on said assembly, a latch arm pivoted on said frame, a mechanism for supporting said latch arm in latching position, a resetting arm pivoted to said

frame for resetting said mechanism before said latch engages said latch arm, a pawl carried by said assembly for operating said resetting arm and for releasing said resetting arm after the mechanism has been reset, and a solenoid actuated device for retaining said mechanism in reset position and for releasing said mechanism when the solenoid is energized.

6. A release assembly for a bomb including, in combination, a frame, a pair of spaced hooks pivoted on said frame, a link interconnecting said hooks and forming an assembly for operating the hooks in synchronism, a latch pivoted on said assembly, a latch arm pivoted on said frame, a mechanism for supporting said latch arm in latching position, a resetting arm pivoted to said frame for resetting said mechanism before said latch engages said latch arm, a pawl carried by said assembly for operating said resetting arm and for releasing said resetting arm after the mechanism has been reset, a solenoid actuated device for retaining said mechanism in reset position and for releasing said mechanism when

the solenoid is energized a manual cocking mechanism supported on said frame for actuating said assembly to bomb securing latched position, and a manual release mechanism supported by said frame for operating said solenoid actuated device for releasing said latch arm supporting mechanism.

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