

June 21, 1949.

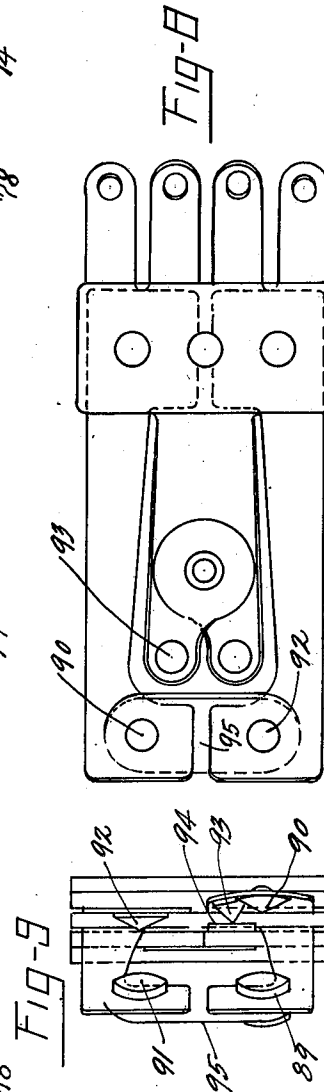
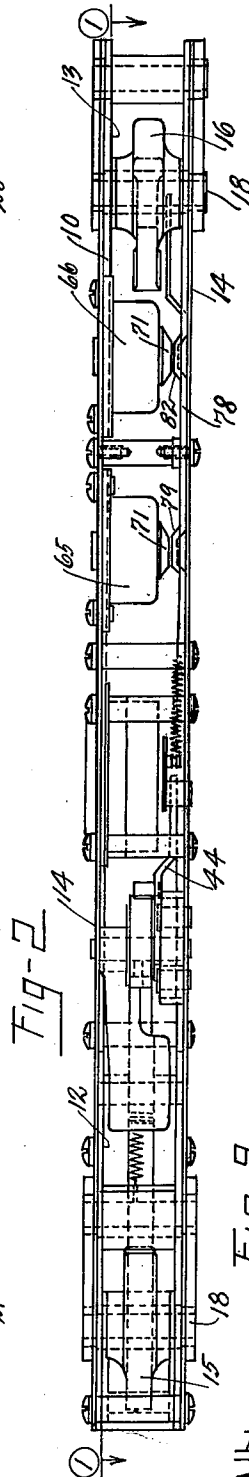
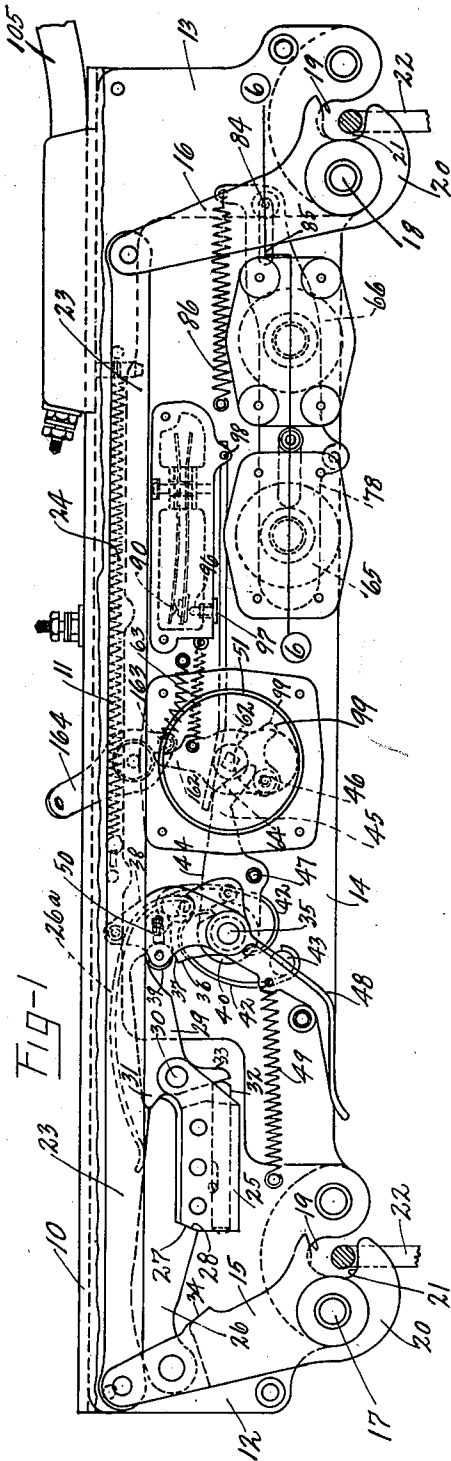
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2,473,597

BOMB SHACKLE AND RELEASE

Filed Sept. 27, 1945

5 Sheets-Sheet 1



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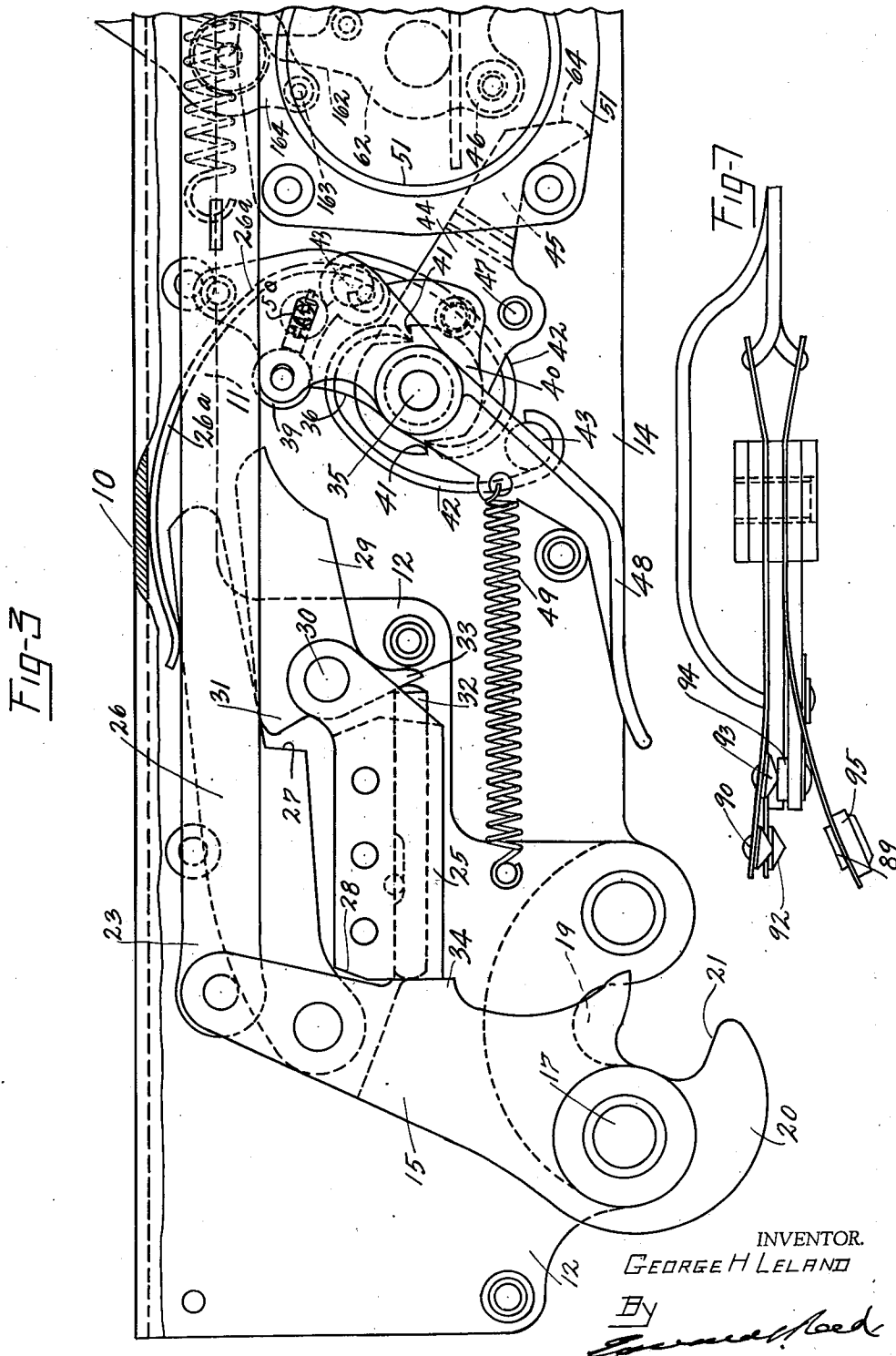
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BOMB SHACKLE AND RELEASE

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June 21, 1949.

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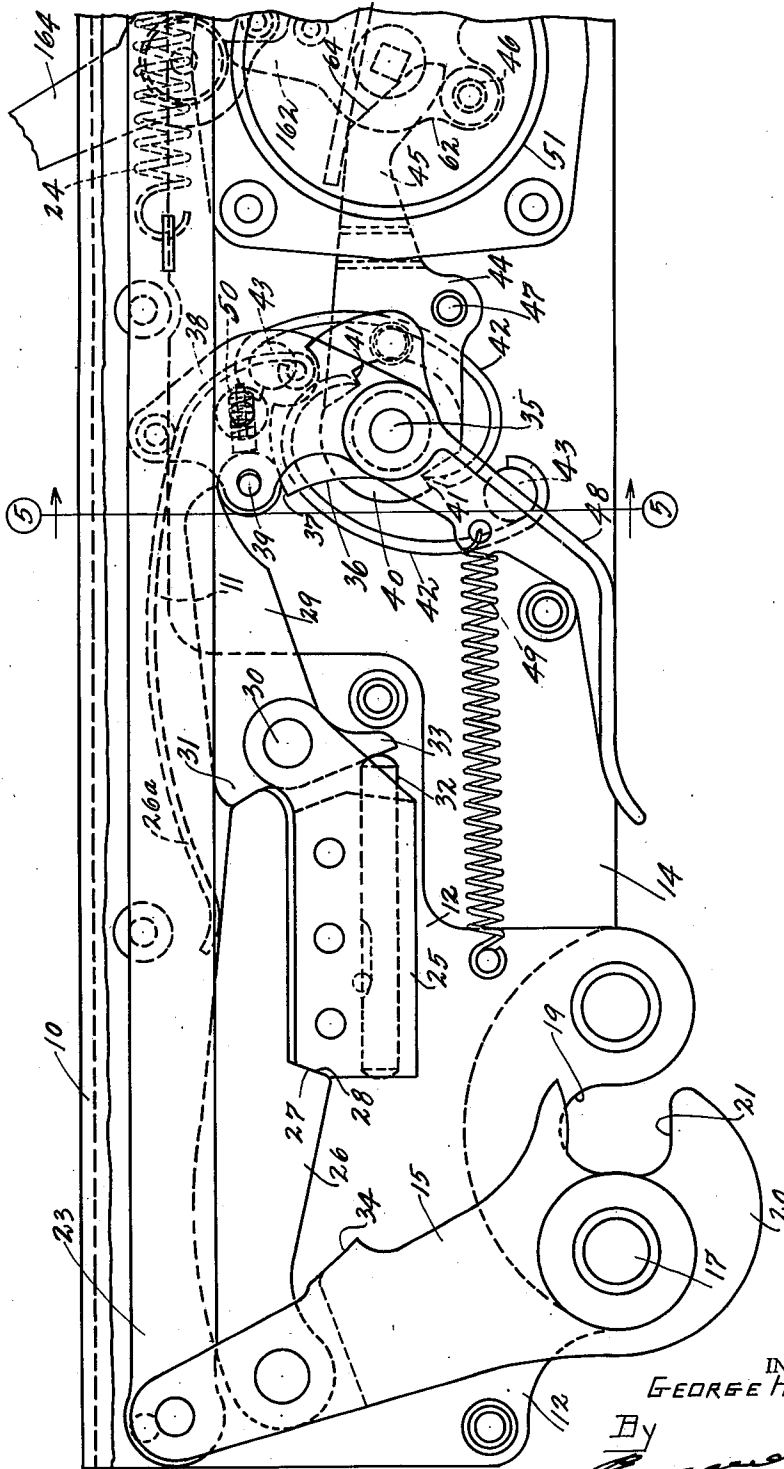
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BOMB SHACKLE AND RELEASE

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Fig-4



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2,473,597

BOMB SHACKLE AND RELEASE

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Fig-6

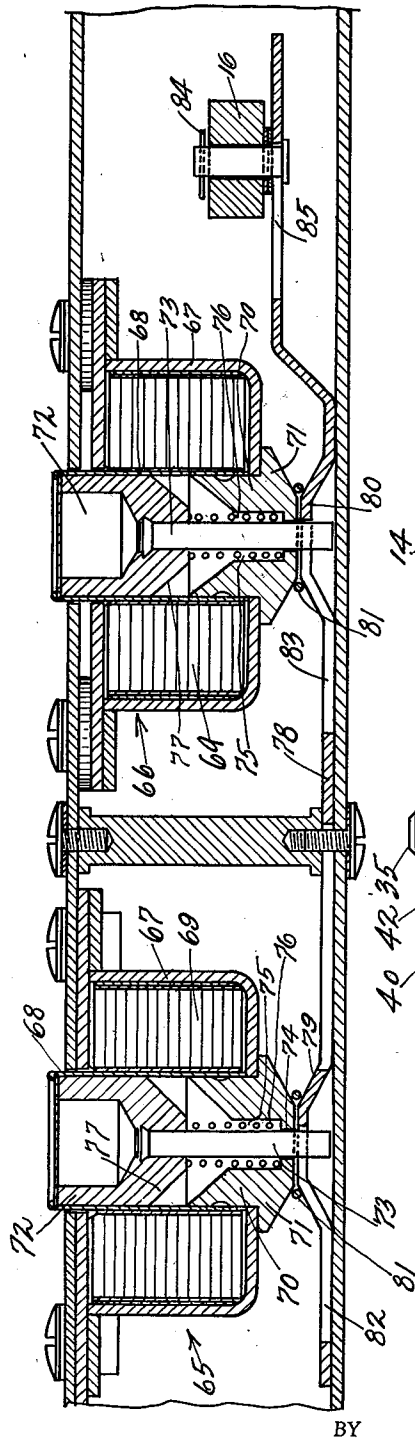
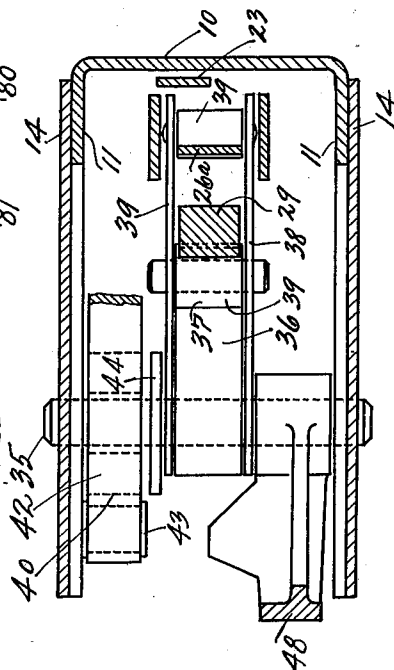


Fig-5



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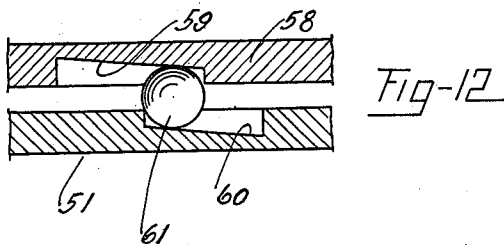
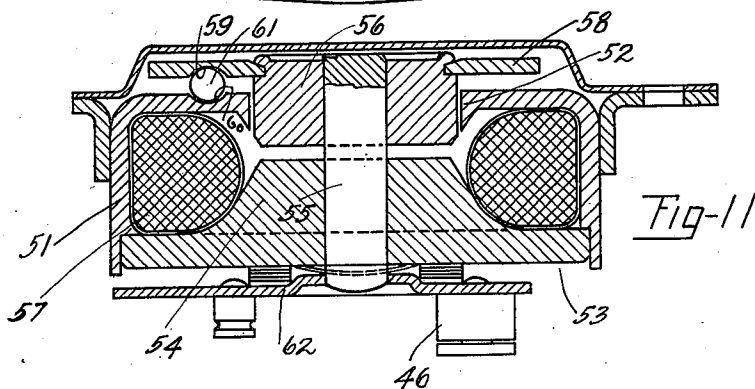
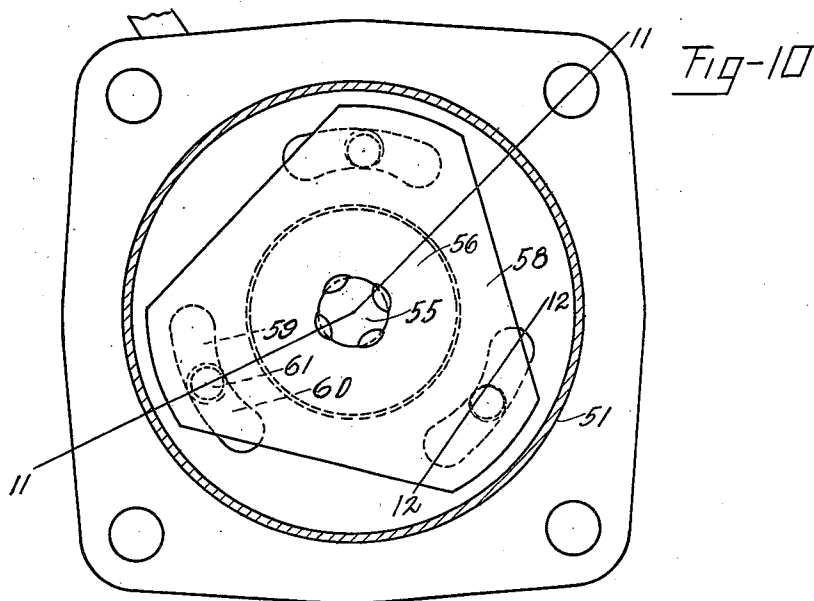
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BOMB SHACKLE AND RELEASE

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5 Sheets-Sheet 5



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2,473,597

BOMB SHACKLE AND RELEASE

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Application September 27, 1945, Serial No. 618,823

11 Claims. (Cl. 89-1.5)

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This invention relates to a device for supporting a bomb on an aircraft and for releasing the same, commonly called a bomb shackle.

One object of the invention is to provide a bomb shackle having embodied therein electrically controlled means for releasing the bomb.

A further object of the invention is to provide a bomb shackle in which the connections between the bomb supporting elements and the releasing means are such that only a small force is required to actuate the releasing device.

A further object of the invention is to provide a bomb shackle in which the releasing device is spring operated and its movement is controlled by an electrically operated device.

A further object of the invention is to provide a bomb shackle having electrically controlled means for supporting and releasing the bomb and electrically controlled means for arming the bomb.

A further object of the invention is to provide a bomb shackle having electrically controlled means for supporting and releasing the bomb and a plurality of electrically controlled and selectively operable arming devices.

Other objects of the invention may appear as the shackle is described in detail.

In the accompanying drawings, Fig. 1 is a longitudinal section taken through the shackle on the line 1-1 of Fig. 2 and showing the controlling mechanism in elevation; Fig. 2 is a bottom plan view of the shackle; Fig. 3 is a side view of one end portion of the shackle, with the front wall broken away, on a larger scale and showing the locking mechanism in its released position; Fig. 4 is a view similar to Fig. 3 showing the locking mechanism in locking position; Fig. 5 is a transverse section taken on the line 5-5 of Fig. 4; Fig. 6 is a section taken on the line 6-6 of Fig. 1; Fig. 7 is a side elevation of the switch unit; Fig. 8 is a plan view of the switch unit; Fig. 9 is an end view of the switch unit; Fig. 10 is a rear elevation of the rotary solenoid; Fig. 11 is a section taken on the line 11-11 of Fig. 10; and Fig. 12 is a section on the line 12-12 of Fig. 10.

In these drawings I have illustrated a preferred embodiment of the invention and have shown the same as comprising a supporting structure which in the present instance is in the form of a housing comprising a longitudinal member 10 U-shaped in cross section, as best shown in Fig. 5, and having the intermediate portions of its side walls cut away to provide the same with relatively narrow flanges 11 at the top thereof, the end portions 12 and 13 extending for substantially the full width of the shackle. Rigidly secured to the respective

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sides of the U-shaped structure are reinforcing plates 14 which serve both to re-enforce the end portions 12 and 13 and to enclose the mechanism within the cut away portion of the U-shaped structure. Mounted on the supporting structure near the respective ends thereof are bomb supporting elements 15 and 16 which are movable into and out of bomb supporting positions. As here shown, the supporting elements are in the nature of levers arranged between the side walls of the housing and pivotally mounted on studs 17 and 18 mounted in the side walls of the housing. The housing is provided adjacent the axis of each lever with a recess 19. The lower portion of each lever is enlarged as shown at 20 so that it extends radially for substantially the full width of the adjacent recess 19, and the enlarged portion is provided with a recess 21 so arranged that when the lever is in bomb releasing, or non-supporting, position, as shown in Fig. 3, the recess will face the open lower end of the recess 19 and will be spaced from the walls thereof far enough to permit the attaching device or eye 22 which is carried by the bomb to be inserted in or removed from the recess 21. When the lever is in its locked or bomb supporting position, as shown in Figs. 1 and 4, the lower wall of the recess 21 is approximately horizontal so as to substantially close the recess 19 and retain the attaching device 22 on the lever. Preferably the levers are moved to supporting positions by inserting the attaching devices 22 in the recesses of respective levers and moving the bomb upwardly to cause the attaching devices to engage the upper walls of the recesses 21 and thus move the levers about their axes to supporting positions, in which they are locked by means to be hereinafter described. The levers 15 and 16 are connected one with the other by a bar 23 to cause them to move in unison, and in the present instance the bar 23 is connected with a fixed part of the supporting structure by a spring 24 which tends to hold the supporting levers in their non-supporting positions.

The means for locking the bomb supporting elements or levers in supporting positions may take various forms but the locking means here shown is simple in construction and is of such a character that only a small force is required to release the same when the bomb is to be dropped. As here shown, the locking mechanism comprises a fixed locking member 25 in the form of a block rigidly secured to the side walls of the supporting structure. A movable locking member 26, preferably in the form of an elongate arm, is pivotally mounted on the bomb supporting lever at

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one end of the shackle, in the present instance the lever 15, and is longitudinally movable thereby lengthwise of the shackle. This arm is provided with a part, such as the shoulder 27, to engage the fixed stop 25, and the shoulder 27 and the part 28 of the fixed stop with which it contacts are provided with inclined surfaces so arranged that when the movement of the arm 26 about its axis is unrestrained the weight of the bomb on the lever will cause the shoulder 27 to ride over the surface 28 of the fixed stop and thereby release the supporting lever for movement to a non-supporting position. A movable member is provided for preventing the pivotal movement of the arm 26 and thus retaining the shoulder 27 in locking engagement with the fixed stop, the force exerted on the supporting lever by the weight of the bomb being thus exerted very largely upon the fixed stop. The movable member is preferably in the form of a lever 29 pivotally mounted on the housing at 30 and having at one end a nose 31 the lower surface of which is inclined upwardly and toward the arm 26 and is adapted to overhang the end of the arm 26 and thus restrain the pivotal movement of the latter. The lever 29 is releasably retained in locking position, that is in a position in which the nose 31 overhangs the end of the arm 26, and when the lever is released it offers no substantial resistance to the movement of the arm 26 and the weight of the load on the supporting lever 15 will cause the shoulder 27 to ride up the inclined surface of the fixed stop and the end of the arm will rock the lever 29 about its axis and thus permit the arm to move upwardly and inwardly above the lever as shown in Fig. 3. When the supporting lever 15 is again moved to supporting position the end of arm 26 will move outwardly beyond the nose 31 of lever 29 and then downwardly and inwardly beneath that nose. To insure the prompt downward movement of the arm a spring 26a is arranged to exert a light pressure on the upper edge thereof. It is desirable that the locking lever 29 shall be returned to its initial position immediately following the release of the bomb so that the releasing device may be moved into supporting engagement with the lever while the bomb supporting lever 15 and its arm 26 are in non-supporting positions. For this purpose the stop block 25 is provided with a longitudinal bore in which is slidably mounted a rod 32 the inner end of which contacts with a finger 33 extending downwardly from the axis of the locking lever 29. When the locking lever is in locking position the rod projects forwardly beyond the stop block 25 into engagement with the finger 33. When the locking lever is released and moved downwardly by the action of the arm 26 the finger 33 projects the other end of the rod beyond the outer end of the stop block and into the path of a land 34 on the supporting lever 15. This movement of the rod takes place during the initial portion of the releasing movement of lever 15 and during the final portion of that movement of the lever engages the rod and positively moves the locking lever to its initial position.

The releasing device which releasably supports the locking lever 29 in locking position is preferably pivotally mounted in the housing and is manually moved to its supporting or locking position and is retained in that position by electrically controlled means which may be energized from a point remote from the shackle to permit the releasing device to be moved by its actuating means to releasing position and thus permit the

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locking mechanism to operate to release the bomb. In the construction here shown this releasing device is supported on a shaft 35 extending transversely to the supporting structure or housing, and mounted on that shaft for movement about the axis thereof is a strong rigid member 36 having an arcuate upper end surface 37. Rigidly secured to this rigid member are plates 38, see Fig. 5, which extend above the upper end of the member 36, and mounted between the plates 38 is a roller 39 which has rolling support on the arcuate edge of the member 36. Rigidly connected with the rigid member 36 is a disk 40 having on diametrically opposite sides thereof notches 41. Springs 42 are mounted on studs 43 on opposite sides of the disk 40, one end of each spring is curved about the disk and its free end is seated in the notch 41 in that side of the disk opposite the stud on which the spring is mounted. Thus the springs act on the disk 40 and the parts secured thereto to rotate the same in clockwise direction, in Fig. 1, which is releasing direction.

Rigidly connected with the rigid member 36 and the disk 40 is an arm 44 the end portion 45 of which is offset, as shown in Fig. 2, to engage a retaining member 46, and mounted on this arm is a stud 47. Rotatably mounted on the shaft 35 is a hand lever 48 arranged to engage the stud 47 and move the releasing device against the action of the springs, in a counter-clockwise direction, to move the roller 39 to a position between the rigid member 36 and the locking lever 29 so that such force as is transmitted from the locking arm 26 to the locking lever 29 is exerted on the rigid member 36 of the releasing device. The hand lever 48 is preferably returned to its initial position immediately upon its release, as by a spring 49. When the retaining member 46 is moved out of engagement with the arm 45 the springs 42 rotate the releasing device in the clockwise direction to move the roller 39 out of supporting engagement with the locking lever 29. The rolling movement of the roller on the arcuate edge of the rigid member 36 permits this movement to be easily effected by the springs 42 and the end of the lever 29 moves freely over the surface of the roller as the latter moves beyond the same. Preferably the roller has a limited bodily movement with relation to the plates in which it is mounted and is held normally in its outermost position by a light spring 50. Thus the roller can yield slightly and can absorb any force exerted thereon by the lever 29 which would otherwise be transmitted to the arm 44 and increase the pressure thereof on the retaining member 46.

The member 46 which acts on the arm 44 to retain the releasing device in supporting engagement with the locking lever may be actuated in any suitable manner to release the arm 44 and thus permit the releasing device to be rotated by the springs and preferably the means for so moving the retaining member is electrical so that it may be energized from a point remote from the shackle. In the present instance this means comprises a rotary solenoid of the type shown and described in my application for patent Ser. No. 542,188, filed June 26, 1944, and forms no part of the present invention except as it enters into combination of the other parts of the apparatus. As shown in Figs. 10, 11, 12, the solenoid comprises a casing 51 cup shaped in form and having in its rear wall an opening 52, and the front wall of the casing is closed by a plate 53 to which a core 54 is secured, and preferably

formed integrally therewith. A shaft 55 is mounted in the core 54 for both rotary movement and axial movement and projects beyond the core, and an armature 56 is rigidly secured thereto. The armature extends through the opening 52 into the casing and an energizing coil 57 is mounted in the casing about the adjacent portions of the armature and the core. Rigidly secured to the armature is a plate 58 which overlaps the rear wall of the casing. Formed respectively in the rear wall of the casing and in the plate 58 are a plurality of pairs of opposed recesses 59 and 60. The recesses are arcuate in form and the bottom walls or bases thereof are inclined in opposite directions, and mounted in each pair of recesses is a ball 61. When the armature is in its normal or unenergized position the balls will be in the shallow overlapping parts of the recesses, as shown in Fig. 12. When the solenoid is energized the magnetic flux will move the armature axially and the pressure thus exerted by the plate 58 on the balls will cause the plate and therefore the armature and shaft to rotate through an arc, the length of which is determined by the length of the grooves. The retaining device 46 is connected with the armature of the solenoid for rotary movement therewith and in the present arrangement it is carried by a plate 62 rigidly secured to the end of the shaft 55 which projects beyond the front wall 53 of the casing. The retaining member is yieldably held in retaining position by a spring 63 which connects the plate with a fixed part of the supporting structure and the arrangement of the recesses 59 and 60 is such that the energization of the magnet will rotate the armature and therefore the plate 62 counter-clockwise against the action of the spring. The arm 44 of the releasing device has an inclined end surface 64 so arranged that when the arm is moved upwardly by the lever 48 this inclined surface will engage the retaining member 46 and move the same in a counter-clockwise direction, against the action of the spring 63, until the end of the arm has passed the retaining member, which is then moved beneath the end of the arm by the action of the spring. No part of the weight of the bomb load is exerted on this retaining member and the force necessary to move the same out of engagement with the arm 44 need only be sufficient to overcome the pressure due to the action of the relatively light springs 42. Therefore, the energization of the magnet will move the retaining member out of engagement with the arm, thereby permitting the releasing device to be moved by its springs out of supporting relation to the locking lever and permitting the latter to move to a position to release the bomb supporting levers. In order that the bomb may be manually released the plate 62 is provided with an upwardly extending finger 162 arranged to be engaged and actuated by a pin 163 on a trip lever 164.

It is also desirable that the shackle shall include an arming device which is electrically operated to permit it to be controlled from a point remote from the shaft. Some bombs are provided with two firing mechanisms, one at the nose of the bomb and the other at the tail of the bomb, and it is desirable to provide separate arming devices for such a bomb so that the bombardier can determine which firing mechanism is to be released and select the proper arming device prior to releasing the bomb. The explosion of the bomb is controlled by an arming wire which ex-

tends through a part of the bomb in the path of a movable part of the firing mechanism to lock the latter against operation. This arming wire is releasably connected with the aircraft and when the bomb is to be dropped in an armed condition the connection between the arming wire and the aircraft is maintained and as the bomb falls it is pulled off of the wire and the firing mechanism thus released for operation. When the bomb is to be dropped unarmed the wire is disconnected from the aircraft so that it will fall with the bomb and the firing mechanism will not be released. When the bomb is provided with two firing mechanisms there are, of course, two arming wires. Therefore, I have provided the present shackle with two arming devices so that the latter can be used with a bomb having a single firing device or with a bomb having two firing devices.

The two arming devices are mounted side by side within the housing and on the front wall thereof, as indicated at 65 and 66. Each arming device comprises a solenoid including a casing 67, a sleeve 68 arranged centrally of the casing, and an energizing winding mounted in the casing about the sleeve. The rear wall of the casing is provided with an opening in line with the sleeve and mounted in this opening is a closure or a plug 70 having at its outer end a head 71 which engages the outer surface of the end wall of the casing, this head being preferably frusto-conical in form. Mounted in the forward portion of the sleeve is a movable core 72 to which is secured a plunger 73 which extends through a bore 74 in the closure 70. The bore 74 is provided with an enlarged portion 75 and a spring 76 is supported in this enlarged portion and confined between the shoulder at the lower end thereof and the core 72, so that the spring tends to urge the core and plunger rearwardly. The core is provided with a tapered rear portion 77 adapted to extend into a correspondingly shaped recess in the forward end of the closure 70 when the solenoid is energized. Slidably mounted on the rear wall of the housing is a bar 78 which is provided with two forwardly extending projections 79 and 80 which are so arranged that they will be line with and close to the frusto-conical portion of the solenoid when the bar is in its normal position. The sides of each projection 79 and 80 converge toward the solenoid so as to provide between the projection and the end of the solenoid a V-shaped annular groove adapted to receive the loop shaped end of an arming wire 81. The bar 78 has two longitudinal slots 82 and 83, one end portion of each slot being in the path of the plunger 73 of the corresponding solenoid. The bar 78 is connected at one end with the adjacent bomb supporting lever 16 by means of a pin 84 extending through a slot 85 in the bar. A spring 86 holds the bar normally in a position with the ends of the slots in line with the plungers. When the bombardier has determined which firing device is to be armed he closes the circuit for the solenoid of the corresponding arming device, thus causing the plunger 73 thereof to be projected through the corresponding slot in the bar 78 and to a point close to the wall of the housing, so that it extends through the looped end of the arming wire, the plunger being retained in this position until the bomb has been released. As the bomb supporting levers move to releasing positions the lever 16 moves the bar 78 to withdraw the projections 79 and 80 thereof from the small diameter ends of the respective solenoids, thus disengaging the arming wires from the bar and the solenoid cas-

ings, but the plunger of the selected arming device having been projected through the looped end of the arming wire the latter is still connected with the shackle and is prevented from falling with the bomb. The plunger of the other solenoid not having been projected the withdrawal of the bar projection releases that arming wire so that it may fall with the bomb.

The several solenoids are connected in exterior switches which enter the shackle through a cable 105 and are respectively controlled by remote switches located adjacent the bombardier's station not here shown. The rotary solenoid is grounded on the frame of the shackle and is connected with the exterior circuit by switch means on the shackle and so controlled by the releasing device that it will be closed when the releasing device is moved to its locking or "cocked" position and will be opened after the releasing device has been actuated to release the bomb. In the present construction the switch means on the shackle comprises a single switch unit having three pairs of contacts, as shown in Figs. 7 to 9, the contacts 89 and 90 being in circuit with the rotary solenoid, 51 and the contacts 91 and 92 being in circuit with a signal lamp, not shown. The contacts 89 and 91 are normally spaced from the co-operating contacts 90 and 92 and the resilient arm which supports the contact 89 is also provided with a second contact 94 which is in engagement with the fixed contact 94 when the contacts 89 and 90 are in their normal separated positions. The movement of the contact 89 continues after it engages contact 90 and moves the supporting arm for the latter rearwardly and thus separates the contacts 93 and 94 and retains that circuit open until contacts 89 and 90 have been again separated. The contacts 93 and 94 control a transverse circuit, that is, they serve to connect the exterior circuit with a second bomb shackle after the bomb has been released from the first shackle, so that successive closings of the exterior circuit will cause a plurality of shackles to release their bombs successively. Means are provided for closing the contacts 89 and 90 and 91 and 92 and separating contacts 93 and 94 when the releasing device is moved into supporting engagement with the locking lever 29. For this purpose the contacts 89 and 91 are connected by a bar 95 and a movable actuating member or pin 96 engages the lower surface of the bar. Extending beneath and engaging the pin 96 is a lever 97 which is pivoted at one end, at 93, and has its other end arranged above the end portion 45 of the arm 44, so that when that arm is actuated to move the releasing device to its supporting position the lever 97 will be moved upwardly and the contacts 89 and 90 and 91 and 92 closed. The bombardier's switch being open at this time, the rotary solenoid is not energized but the contacts 89 and 90 remain closed and when the bombardier's switch is closed the rotary solenoid is energized to retract the retaining member 46 and thus permit the bomb supporting levers to move to releasing positions. The rotation of the plate 62, which carries the retaining member, moves a projection 99 thereon into engagement with the lever 97 and retains the contacts 89 and 90 closed so long as the rotary solenoid is energized. When the bombardier's switch is opened the rotary solenoid is de-energized, the plate 62 returns to its normal position, the lever 97 drops and the contacts 89 and 90 and 91 and 92 separate. The movement of the contact 90 to its normal position moves contact 93 into engagement with fixed contact

94, thus connecting the exterior circuit with the switch of the second bomb release, so that the bomb carried by the later will be released upon the next closing of the bombardier's switch.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

I claim:

1. A bomb shackle comprising a supporting structure, bomb supporting elements mounted on said structure for movement into and out of supporting positions, means including a movable member for locking said supporting elements in supporting positions, a releasing device to retain said movable member in locking position, spring means for moving said releasing device to releasing position, an arm connected with said releasing device to move the same against action of said spring means to locking position, a retaining member to engage said arm and hold said releasing device against movement by said spring means, and electrically controlled means to move said retaining member out of engagement with said arm and thus permit the movement of said releasing device by said spring means.

2. A bomb shackle comprising a supporting structure, bomb supporting elements mounted on said structure for movement into and out of supporting positions, means including a movable member for locking said supporting elements in supporting positions, a releasing device to retain said movable member in locking position, spring means for moving said releasing device to releasing position, an arm connected with said releasing device to move the same against action of said spring means to locking position, a retaining member to engage said arm and hold said releasing device against movement by said spring means, and a solenoid having a rotary armature so connected with said retaining member that the energization of said solenoid will move said retaining member out of engagement with said arm and release said releasing device for movement by said spring means.

3. A bomb shackle comprising a supporting structure, bomb supporting elements mounted on said structure for movement into and out of supporting positions, means including a movable member for locking said supporting elements in supporting positions, a releasing device mounted on said structure for movement about a fixed axis and including a rigid member having an arcuate end surface, a roller spaced outwardly beyond said arcuate surface, spring means for actuating said device, means for moving said releasing device against the action of said spring means to position said roller between said rigid member and said movable locking member, a movable member to retain said releasing device in said position, and means for retracting said retaining member to release said device for movement by said spring means.

4. A bomb shackle comprising a supporting structure, bomb supporting elements mounted on said structure for movement into and out of supporting positions, means including a movable member for locking said supporting elements in supporting positions, a shaft supported on said structure, a releasing device including a rigid member mounted on said shaft for movement about the axis thereof and having an arcuate end

surface, a plate secured to said rigid member and extending beyond said arcuate surface, a roller supported by said plate in contact with said arcuate surface and capable of a limited bodily movement with relation to said plate, spring means for actuating said device, an arm connected with said rigid member and having a lateral projection, a lever movable about the axis of said shaft and arranged to engage said projection and move said device against the action of said spring means to position in said roller between the arcuate surface of said rigid member and said movable member of the locking means, a movable member to engage said arm and retain said roller in said position, and means for retracting said retaining member to release said device for movement by said spring means.

5. A bomb shackle comprising a supporting structure, bomb supporting elements pivotally mounted on said structure and connected one with the other for simultaneous movement into and out of supporting positions, means for locking said supporting elements in said supporting positions including a fixed locking member carried by said structure, an arm connected with one of said supporting elements for movement thereby and having a part arranged to have locking engagement with said fixed locking member when said supporting element is in supporting position, and a member movably supported on said structure and having a part to engage said arm and retain the same in locking engagement with said fixed locking member, a releasing device movably supported on said structure and including a part to engage said movable member and retain the same in engagement with said arm, means for actuating said device to move said part thereof out of engagement with said movable member, and releasable means for preventing the movement of said device by said actuating means.

6. A bomb shackle comprising a supporting structure, bomb supporting elements pivotally mounted on said structure and connected one with the other for simultaneous movement into and out of supporting positions, means for locking said supporting elements in locking positions including a fixed locking member carried by said structure and having a contact surface, an arm pivotally connected with one of said supporting elements for longitudinal movement thereby and having a contact surface to engage the contact surface of said fixed locking member when said supporting element is in supporting position, at least one of said contact surfaces being inclined, and a lever mounted on said structure and having adjacent one end thereof a part to engage the end portion of said arm and retain the contact surface of the latter in locking engagement with said fixed locking member, a device mounted on said structure for movement about a fixed axis and including a part movable into supporting engagement with the other end portion of said lever to retain the latter for engagement with said arm, means for actuating said device to move said part thereof out of supporting engagement with said lever, and releasable means for preventing the movement of said device by said actuating means.

7. A bomb shackle comprising a supporting structure, bomb supporting elements pivotally mounted on said structure and connected one with the other for simultaneous movement into and out of supporting positions, means for locking said supporting elements in locking positions including a fixed locking member carried by said

structure and having a contact surface, an arm pivotally connected with one of said supporting elements for longitudinal movement thereby and having a contact surface to engage the contact surface of said fixed locking member when said supporting element is in supporting position, at least one of said contact surfaces being inclined, and a lever mounted on said structure and having adjacent one end thereto a part to engage the end portion of said arm and retain the contact surface of the latter in locking engagement with said fixed locking member, a device mounted on said structure for movement about a fixed axis and including a part movable into supporting engagement with the other end portion of said lever to retain the latter in engagement with said arm, means for actuating said device to move said part thereof out of supporting engagement with said lever and thereby release said supporting element for movement to a non-supporting position, releasable means for preventing the movement of said device by said actuating means, and means controlled by the movement by said supporting element to said non-supporting position to return said lever to its initial position.

8. A bomb shackle comprising a supporting structure, bomb supporting elements pivotally mounted on said structure and connected one with the other for simultaneous movement into and out of supporting positions, means for locking said supporting elements in locking positions including a fixed locking member carried by said structure and having a contact surface, an arm pivotally connected with one of said supporting elements for longitudinal movement thereby and having a contact surface to engage the contact surface of said fixed locking member when said supporting element is in supporting position, at least one of said contact surfaces being inclined, and a lever mounted on said structure and having adjacent one end thereto a part to engage the end portion of said arm and retain the contact surface of the latter in locking engagement with said fixed locking member, a releasing device mounted on said structure for movement about a fixed axis and including a rigid member having an arcuate end surface, a part extending beyond said arcuate surface, a roller carried by said part and engaging said arcuate surface, and spring means to actuate said device, means for moving said releasing device against the action of said spring means to position said roller between said rigid member and said lever, a movable member to retain said releasing device in said position, and means for retracting said retaining member to release said device for movement by said spring means.

9. A bomb shackle comprising a supporting structure, bomb supporting elements pivotally mounted on said structure and connected one with the other for simultaneous movement into and out of supporting position, means for locking said supporting elements in locking positions including a fixed locking member carried by said structure and having a contact surface, an arm pivotally connected with one of said supporting elements for longitudinal movement thereby and having a contact surface to engage the contact surface of said fixed locking member when said supporting element is in supporting position, at least one of said contact surfaces being inclined, and a lever mounted on said structure and having adjacent one end thereto a part to engage the contact

surface of the latter in locking engagement with said fixed locking member, a shaft supported on said structure, a releasing device including a rigid member mounted on said shaft for movement about the axis thereof and having an arcuate end surface, a plate secured to said rigid member and extending beyond said arcuate surface, a roller supported by said plate in contact with said arcuate surface and capable of limited bodily movement with relation to said plate, and spring means for actuating said device, an arm connected with said rigid member and having a lateral projection, a lever movable about the axis of said shaft and arranged to engage said projection and move said device against the action of said spring means to position said roller between the arcuate surface of said rigid member and the lever of said locking means, a movable member to engage the last mentioned arm and retain said roller in said position, and means for retracting said retaining member to release said device for movement by said spring means.

10. A bomb shackle comprising a supporting structure, bomb supporting elements pivotally mounted on said structure and connected one with the other for simultaneous movement into and out of supporting positions, means for locking said supporting elements in locking positions including a fixed locking member carried by said structure and having a contact surface, an arm pivotally connected with one of said supporting elements for longitudinal movement thereby and having a contact surface to engage the contact surface of said fixed locking member when supporting element is in supporting position, at least one of said contact surfaces being inclined, and a lever mounted on said structure and having adjacent one end thereto a part to engage the end portion of said arm and retain the contact surface of the latter in locking engagement with said fixed locking member, a releasing device mounted on said structure for movement about a fixed axis and including a rigid member having an arcuate end surface, a part extending beyond said arcuate surface, a roller carried by said part and engaging said arcuate surface, and spring means to actuate said device, means for moving said releasing device against the action of said spring means to position said roller be-

tween said rigid member and said lever, a solenoid comprising a rotatable armature and means controlled by the energization thereof for rotating said armature, a retaining member connected with said armature for rotation therewith in spaced relation to the axis thereof, means for moving said retaining member to and yieldably retaining the same end in a position to prevent the movement of said releasing device by said spring means, whereby the energization of said solenoid will retract said retaining member and release said supporting elements for movement to non-supporting positions.

11. A bomb shackle comprising a supporting structure, bomb supporting elements mounted on said structure for movement into and out of supporting positions, means including a movable member for locking said supporting elements in supporting positions, a releasing device to retain said movable member in said locking position, spring means for moving said releasing device to a releasing position, an arm connected with said releasing device to move the same against the action of said spring means to locking position, a retaining member to engage said arm and hold said releasing device against movement by said spring means, an electrical device for moving said retaining member out of engagement with said arm, means including a switch to control the operation of said electrical device, and means actuated by said arm to close said switch as said releasing device moves against the action of said spring.

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