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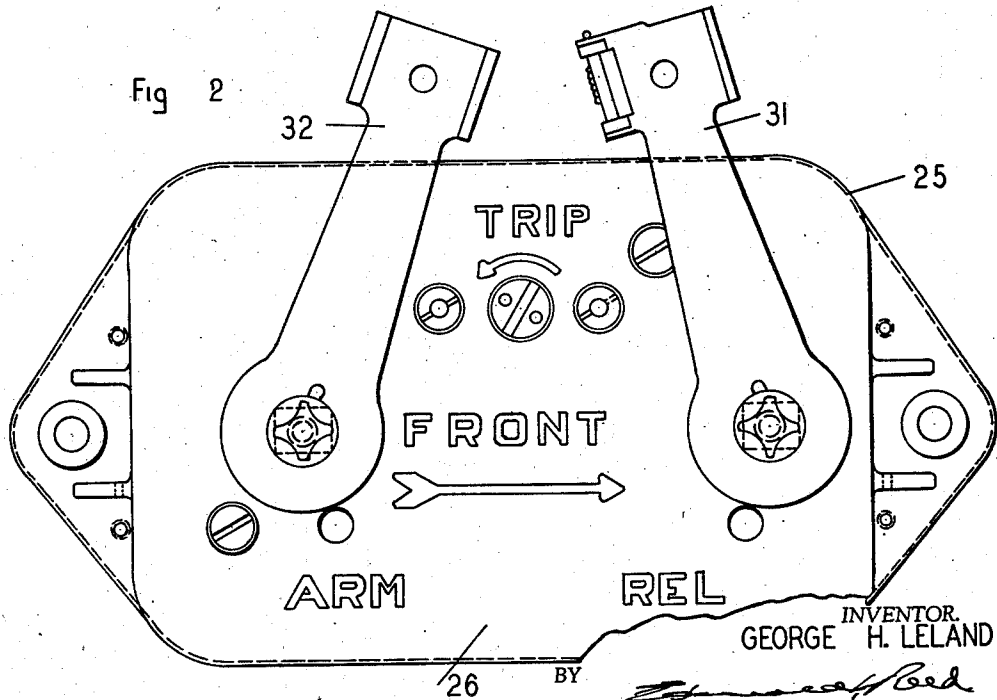
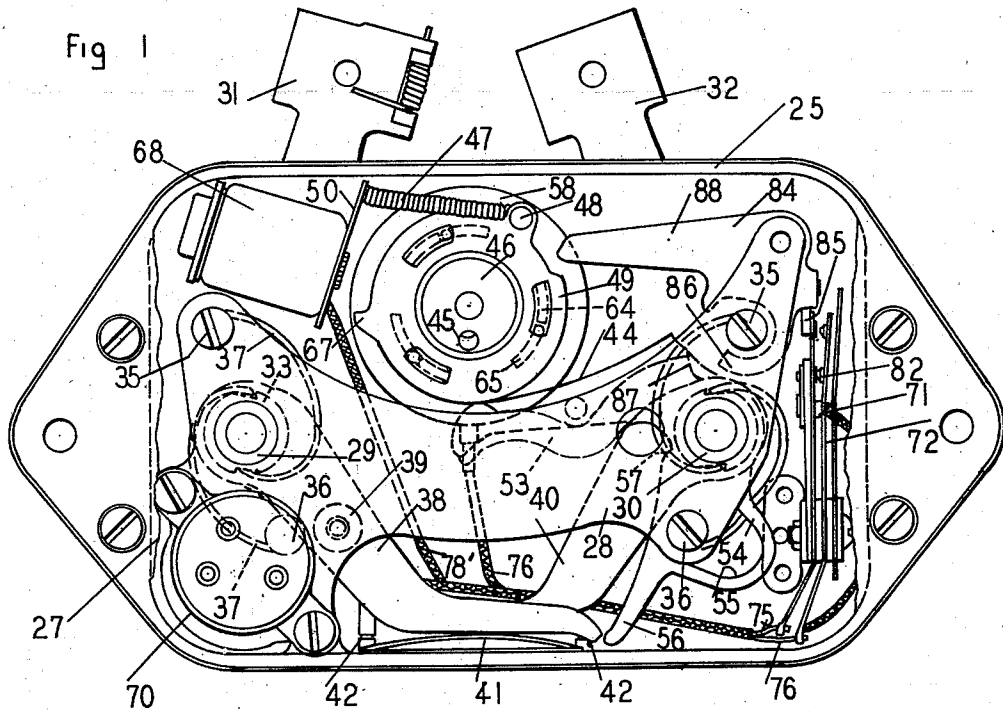
G. H. LELAND

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BOMB RELEASE

Filed June 29, 1945

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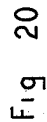
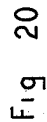
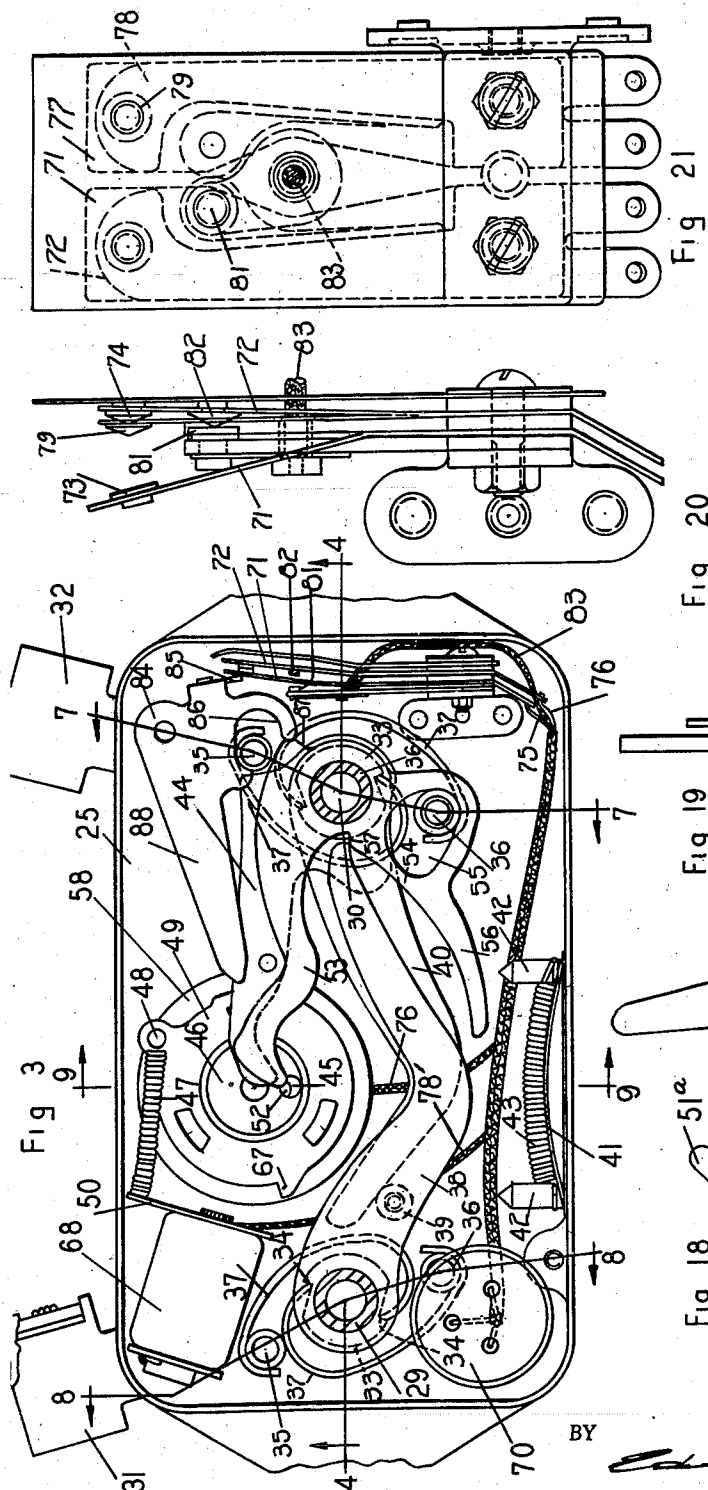
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Nov. 18, 1947.

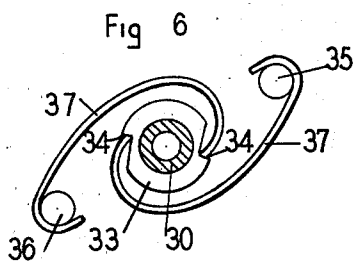
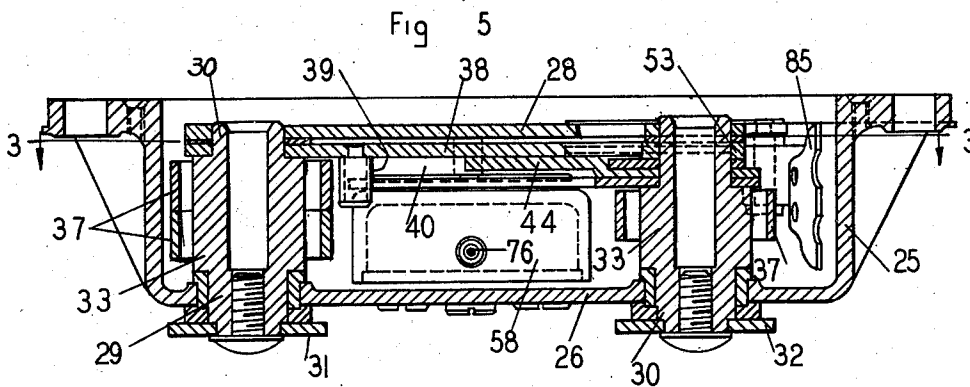
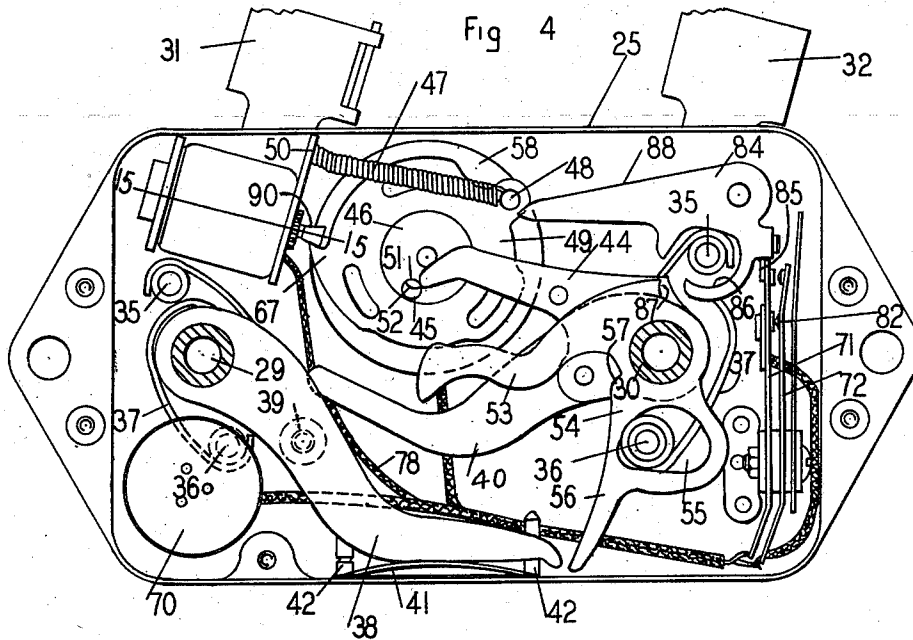
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BOMB RELEASE

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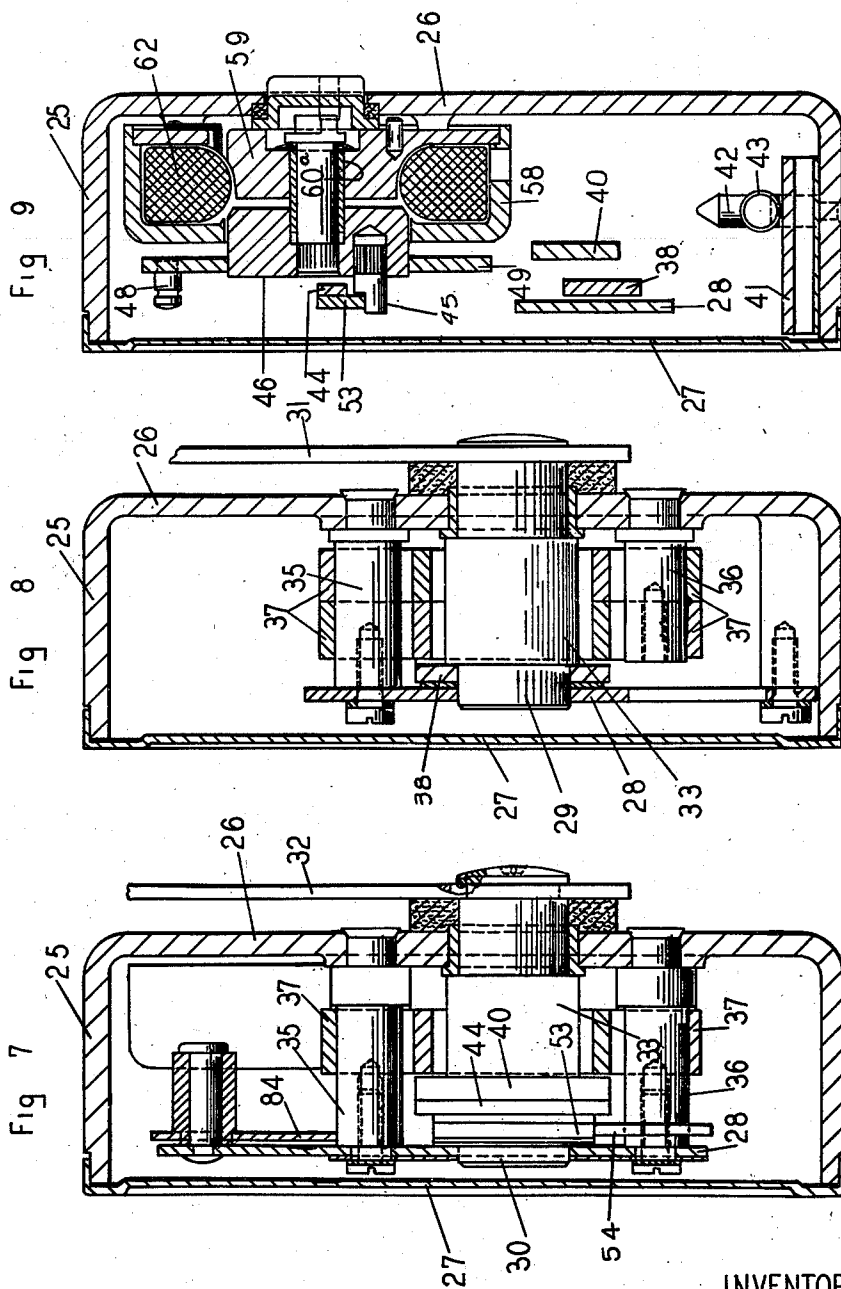
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Nov. 18, 1947.

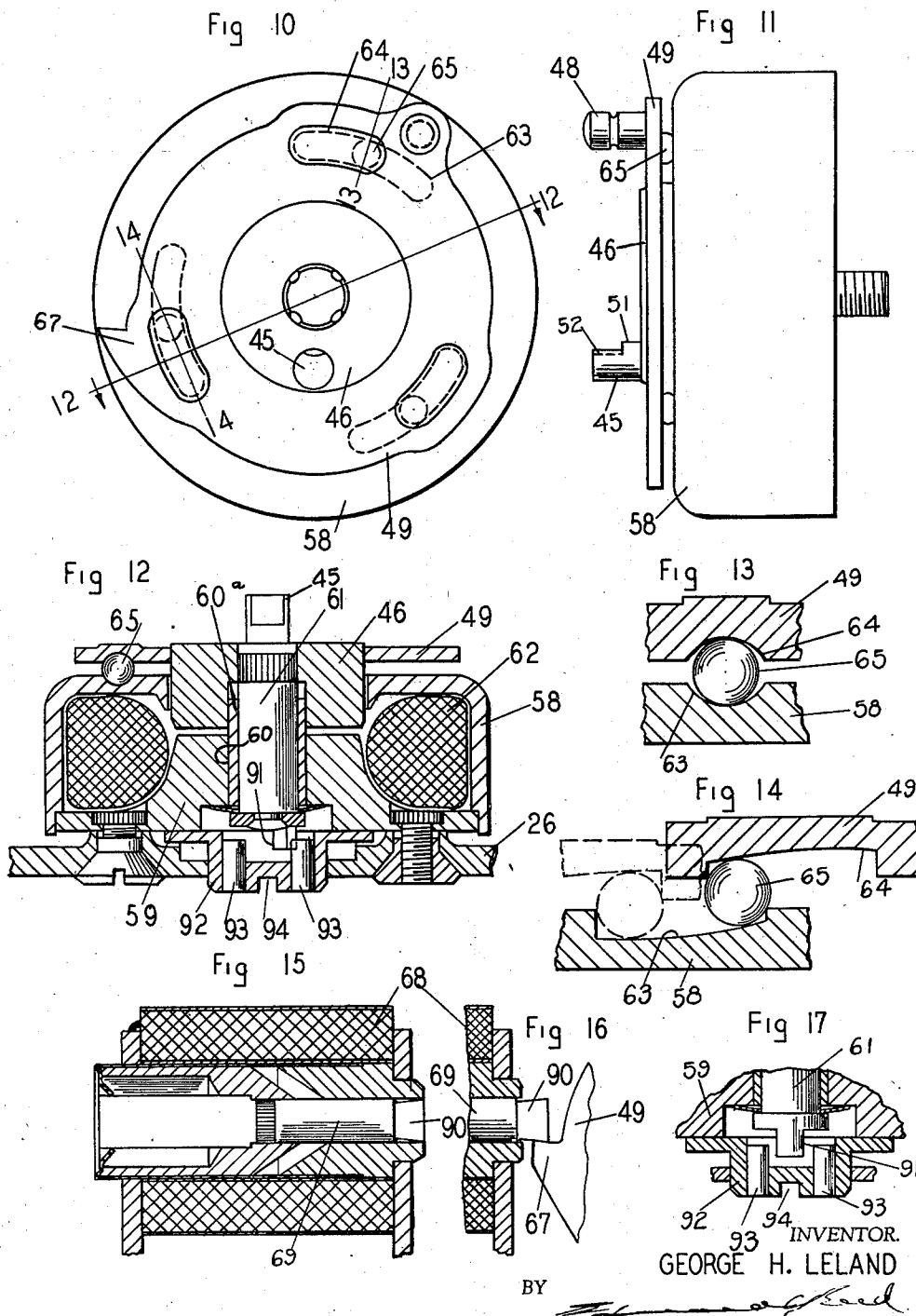
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BOMB RELEASE

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UNITED STATES PATENT OFFICE

2,430,940

BOMB RELEASE

George H. Leland, Dayton, Ohio

Application June 29, 1945, Serial No. 602,291

11 Claims. (Cl. 89—1.5)

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This invention relates to a bomb release for use on military aircraft.

In normal bombing operations it may be desirable when over the target, to release a single bomb or to release a plurality of bombs successively and at properly spaced intervals. Under abnormal conditions it is sometimes necessary, for the safety of the aircraft and its crew, to salvo, or jettison, the entire bomb load, that is, to release all the bombs in rapid succession. Due to the fact that the salvo may take place over friendly territory, or for other reasons, it is desirable that the bombs shall be released in an unarmed condition so that they will not explode. The bombs are supported in the bomb bay of the aircraft in an unarmed condition, that is, the mechanism which controls the firing of the bomb is locked against operation, and the ordinary bomb release includes separate devices for releasing the bomb from its supporting shackle and for arming the same. Usually the arming of the bombs is controlled by an arming wire, one end portion of which extends through the bomb in the path of a movable part of the firing mechanism and the other end of which is adapted to be connected with the shackle which supports the bombs so that the downward movement of the released bomb will disengage it from the wire and thus release the firing mechanism for operation. The arming wire is normally disconnected from the shackle and must be connected therewith prior to or substantially simultaneously with the release of the bomb. When the bomb is to fall in an unarmed condition the releasing device is operated without operating the arming device so that the arming wire is unconnected with the shackle and will fall with the bomb. Bomb releases have heretofore been provided with electrically controlled means for releasing the bombs and for arming the same, whereby the bombardier could selectively release and arm the bombs, but the salvo, or release of all the bombs in an unarmed condition, involved an elaborate system of mechanical linkage.

One object of the invention is to provide a bomb release having separately operable electrically controlled means for releasing and arming the bomb and for releasing the bomb in an unarmed condition.

A further object of the invention is to provide such a bomb release which upon the release of the bomb unarmed will be electrically connected with another bomb release to release the unarmed bomb of the latter, thereby enabling a plurality of unarmed bombs to be released in

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rapid succession, and which upon the release of the bomb in an armed condition will not be connected with said other bomb release until the electrically controlled means for releasing the bomb has been deenergized, thereby enabling a plurality of armed bombs to be released at intervals determined by the bombardier.

A further object of the invention is to provide such a bomb release in which the releasing of the bomb and the arming thereof are controlled by an electrically controlled member the movement of which normally effects both release and arming, but may be so limited by separately operable electrically controlled means as to effect release without arming.

A further object of the invention is to provide such a bomb release in which the switch for connecting the same with another bomb release will be prevented from closing after the bomb has been released in an armed condition until the electrically controlled means for effecting such release is deenergized but will be closed while the said electrically controlled means is energized when the bomb is released in an unarmed condition.

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

In the accompanying drawings Fig. 1 is a rear elevation of a bomb release embodying the invention, with the back plate broken away and with the mechanism in its normally uncocked position; Fig. 2 is a front elevation of the bomb release; Fig. 3 is a rear elevation of the operating mechanism showing the same in its operative or cocked position, with the rear frame member removed; Fig. 4 is a view similar to Fig. 3 showing the parts in the position which they occupy when the bomb is released in an unarmed condition; Fig. 5 is a longitudinal section taken on the line 4—4 of Fig. 3; Fig. 6 is a detail view of one of the spring means for actuating the releasing and arming members; Fig. 7 is a transverse section taken on the line 7—7 of Fig. 3; Fig. 8 is a transverse section taken on the line 8—8 of Fig. 3; Fig. 9 is a transverse section taken on the line 9—9 of Fig. 3; Fig. 10 is a front elevation of the rotary solenoid; Fig. 11 is a side elevation of the rotary solenoid; Fig. 12 is a section taken on the line 12—12 of Fig. 10; Fig. 13 is a section taken on the line 13—13 of Fig. 10; Fig. 14 is a section taken on the line 14—14 of Fig. 10; Fig. 15 is a longitudinal section of the salvo solenoid; Fig. 16 is a fractional section showing the plunger of the salvo solenoid in engagement with the rotatable part of the rotary solenoid; Fig. 17 is a sectional

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detail showing the manually operated means for releasing the bomb; Fig. 18 is a detail view of one of the controlling levers and its trip arm; Fig. 19 is an edge view of the device shown in Fig. 18; Fig. 20 is an edge view of the switch mechanism showing the parts thereof in the positions which they occupy when the releasing and arming members are in their uncocked positions; Fig. 21 is a front elevation of the switch mechanism; and Fig. 22 is a top end view of the same.

In these drawings I have illustrated one embodiment of the invention showing the same in the form which has been approved by the United States Army Air Corps, but it will be understood that the mechanism may take various forms and may be assembled in various ways without departing from the spirit of the invention.

As here shown, the bomb release comprises a casing 25, the side and end walls of which are integral with the front wall 26 thereof and the rear side of which is closed by the removable rear wall 27. Mounted in the casing adjacent the rear wall 27 is a longitudinal frame member 28 which is rigidly secured to the frame. Rotatably mounted in the front wall of the casing and in the frame member 28 near the respective ends of the casing are shafts 29 and 30, the ends of which extend through and beyond the front wall 26 of the casing. Rigidly mounted on the projecting end of the shaft 29 is a lever 31 having means for actuating the bomb releasing devices on the bomb supporting shackle, not here shown, this lever being herein designated as the releasing lever. Rigidly secured to the projecting end of the shaft 30 is a lever 32 having means whereby it may be connected with the arming device of the bomb shackle, and herein referred to as the arming lever. Each of the shafts 29 and 30 has an enlarged intermediate portion 33 provided on opposite sides thereof with recesses forming shoulders or ratchet teeth 34. Mounted above and below each shaft are studs 35 and 36 and mounted on each stud is a leaf spring 37 which extends across the shaft with which it is associated and engages the ratchet tooth 34 on that side of the shaft opposite the stud on which the spring is mounted. Thus the two springs act upon each shaft to exert balanced force thereon to rotate the shaft and actuate the lever connected therewith. The ratchet teeth and spring means are so arranged that the springs tend to move the shaft 29 in a clockwise direction and to thereby move the releasing lever 31 toward the arming lever 32, this being its releasing movement, and to rotate the shaft 30 in a counterclockwise direction and thereby move the arming lever 32 toward the releasing lever, this being its arming movement.

The movement of the arming lever 32 and of the releasing lever 31 to their retracted or cocked positions causes the same to be locked in those positions, the locking means being movable and being of such a character that its movement may be so controlled as to release the arming lever and the releasing lever for substantially simultaneous operation to release the bomb in an armed condition, or to release the releasing lever only, retaining the arming lever in its retracted position, thus preventing the arming of the bomb and causing the latter to be released in an unarmed condition. In the particular mechanism here illustrated a controlling lever 38 is rigidly secured to the shaft 29 for the releasing lever between the enlarged portion of that shaft and the frame member 28. This lever is of curved or

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angular shape so that it extends downwardly from the shaft 29 and then longitudinally of the casing, and rigidly secured to this lever, adjacent the shaft 29, is a stud or a roller 39.

Rigidly secured to the shaft 30 for the arming lever 32 is a second controlling lever 40 also of a curved or angular form which extends downwardly from the shaft and then lengthwise of the casing in a direction opposite the direction in which the controlling lever 38 extends. When the mechanism is in its idle or uncocked position the longitudinally extending portions of these levers are in overlapping relation, as shown in Fig. 1, their movement by the spring means being limited by the bottom wall of the casing and inasmuch as these levers are moved downwardly under considerable force I have provided cushioning means which comprises a curved spring plate 41 supported at its ends on the bottom wall of the casing and having its ends notched to receive vertical studs 42 and which is retained in operative position by a coiled spring 43 connected at its ends with the studs 42 and extending across the plate adjacent the front wall of the casing.

Rigidly connected with the controlling lever 40 and thus rigidly connected with the shaft 30 is a trip arm 44 which extends lengthwise of the controlling lever 40 above and in spaced relation thereto. The movement of the arming lever 32, thus moves the trip arm 44 about the axis of the shaft 30 and into locking engagement with a movable supporting member or stud 45. Preferably this supporting member is carried by a rotatable member and is spaced from the axis of that member. In the present instance the rotatable member is a part of a rotary solenoid, which will be hereinafter described, and the supporting member or stud 45 is carried by the armature 46 of the solenoid and is yieldably retained in its normal operative position by a spring 47 connected at one end with a stud 43 carried by an annular member 49 rigidly secured to the armature 46, and connected at its other end with a part 50 fixed with relation to the casing. The free end of the trip arm is inclined or rounded, as shown at 51a in Fig. 13, and as the trip arm moves upwardly about the shaft 30 the rounded end of the arm engages the stud 45 with a cam action and moves the same about the axis of the armature against the action of the spring 47 and as soon as the end of the trip arm has passed the stud 45 the latter is returned to its normal position beneath the trip arm by the spring 47. When the pressure exerted on the shaft 30 to rotate the same against the action of its operating springs 37 is relieved the spring will move the end of the trip arm into engagement with the supporting member or stud 45. This supporting stud 45 comprises a cylindrical portion 51 adjacent the armature and a flattened or slightly recessed portion 52 adjacent its outer end and the cylindrical portion 51 lies in the path of and is engaged by the trip arm 44, thus locking the shaft 30 against operation by its spring and retaining the arming lever in its retracted position.

Rotatably mounted on the shaft 30 between the controlling lever 40 and the frame member 28 is a second trip arm 53 which is rigidly connected with, and is preferably formed integral with, a member 54 which extends downwardly from the axis of the shaft 30 and is provided with an opening 55 to receive the adjacent end portion of the corresponding stud 36, the opening being of such size that the trip arm 53 can move freely with relation to the stud. The lower end por-

tion of this downwardly extending part is in the form of a finger 56. The trip arm 53 and the downwardly extending member 54 are arranged in the vertical plane of the controlling lever 38 and the forward edge of the member 54 is curved to conform substantially to the path of travel of the free end of the lever 38. At its upper end the part 54 is provided with a shoulder 57 adjacent to the shaft 30. The trip arm 53 and member 54 being rotatably supported on the shaft 30 do not rotate with that shaft when the arming lever 32 is moved to its retracted or cocked position. When the releasing lever 31 is moved to its retracted or cocked position the controlling lever 38 moves upwardly about the axis of the shaft 29 and the free end portion thereof engages the trip arm 53 and rotates that arm and the member 54 connected therewith about the axis of the shaft 30. The free end of the trip arm 53 is inclined and is so arranged that its upward movement will cause the inclined edge thereof to engage the supporting stud 45 and move the latter against the action of the spring 47 to permit the end of the trip arm to move past the same, the trip arm being so positioned that when the supporting stud is returned to its normal position the flattened portion 52 thereof will lie in the path of the trip arm 53. However, at the time the movement of the controlling member 38 begins the trip arm 44 is in contact with the supporting stud 45 and is pressed against the same by the actuating springs for the shaft 30 and a very considerable force would be required to enable the trip arm 53 to move the stud out of engagement with the trip arm 44. Therefore the controlling lever 38 is provided with the roller 39 which engages the lower edge of the free end portion of the controlling lever 40 and moves the latter upwardly, thereby moving the trip arm 44 out of engagement with the supporting stud and permitting the latter to be moved by the contact of the inclined edge of the trip arm 53. When the controlling lever 38 contacts the trip arm 53 the free end of the lever 38 is positioned adjacent to and just above the shoulder 57 adjacent the shaft 30 and the movement of the trip arm 53 by the controlling lever 38 to its uppermost position moves the shoulder 57 into the path of the downward movement of the free end of the controlling lever 38. When the lifting pressure on the shaft 29 has been relieved the operating springs 37 move the lever 38 downwardly into supporting engagement with the shoulder 57 and this movement permits the trip arm 53 to move into supporting engagement with the flattened portion of the supporting stud 45. The trip arm thus locks the shoulder 57 in supporting relation to the controlling lever 38 and retains the releasing lever 31 in its retracted position, as shown in Fig. 3. Only a slight downward movement of the lever 38 is required to bring it into supporting contact with the shoulder 57 and when in its locked position it supports the trip arm 44 out of contact with the supporting stud 45. The shoulder 57 being close to the axis of the trip arm 53 and the roller 49 being close to the axis of the controlling lever 38 the leverage is so compounded that the trip arm 53 exerts only a light pressure on the supporting stud and the stud can be easily moved out of engagement therewith. With the several parts in the positions shown in Fig. 3 the contact of the trip arm 53 with the supporting stud locks both spring operated shafts 29 and 30 against movement by their springs and the move-

ment of the supporting stud out of engagement with the trip arm 53 and out of the path of the trip arm 44 will release both the shafts for movement by their springs and thus actuate both the releasing lever and the arming lever to release the bomb in an armed condition. If the movement of the supporting stud is interrupted after the trip arm 53 has been released and before it has been moved out of the path of the trip arm 44 the shaft 29 only will be operated and the bomb will be released in an unarmed condition. In the present instance the movement of the supporting stud 45 by the rotary solenoid is interrupted in a predetermined position in which the trip arm 53 is permitted to pass the same but the trip arm 44 engages the stud and is prevented from moving to releasing position.

The rotary solenoid which actuates the supporting member 45 for the trip arms to release the latter is fully shown and described in my pending application for patent filed June 26, 1944, Serial No. 542,188, and forms no part of the present invention except in so far as it enters into combination with the other parts of the mechanism herein described. As shown in Figs. 10 to 14 the rotary solenoid comprises a casing 58 which is rigidly secured to the front wall 26 of the main casing. Rigidly connected with and extending into the casing 58 is a core 59 having a longitudinal bore 60. Rotatably and slidably mounted in the bore is a shaft 61 on the rear end of which is rigidly mounted the armature 46 for the solenoid, the armature being circular in form and extending into and being rotatable in an opening in the rear wall of the solenoid casing 58. In order to provide a long bearing for the shaft a bushing 60a is mounted in the bore 60 and extends into a recess in the armature 46, which is rotatable with relation to the bushing. An annular magnetic coil 62 is mounted in the casing and extends about the core 59 and the armature 46. The annular member 49 is rigidly secured to the armature and is spaced a short distance from the rear wall of the solenoid casing. The casing wall and the annular member 49 are provided with a plurality of pairs of opposed grooves 63 and 64, see Fig. 14, the bottom walls or bases of the grooves being inclined in opposite directions. The grooves of each pair are so arranged that when the solenoid is deenergized and the armature is in its normal position the shallower ends of the grooves will overlap and will receive between them a ball 65. When the solenoid is energized the magnetic flux will move the armature axially toward the core 59 and the pressure exerted by the part 49 on the balls will cause the part 49 and therefore the armature to rotate on the balls and to move over the same as the balls travel in the slots in the casing wall, until the balls contact with the ends of the grooves of the respective pairs at the deeper ends thereof, thus imparting a predetermined rotation to the armature upon each energization of the solenoid, unless that rotation is interrupted as hereinafter described. Thus the energization of the rotary solenoid will move the supporting stud 45, which is carried by the armature, out of the paths of both the trip arm 44 and the trip arm 53, thereby releasing the shafts 29 and 30 for rotation and causing the spring means to actuate the two shafts, and therefore the releasing lever and the arming lever, substantially simultaneously and cause the bomb to be released in an armed condition. When it is desired to release the bomb in an unarmed condi-

tion the rotation of the armature 46 is interrupted when the stud 45 has been moved out of the path of the trip arm 53 but is still in the path of the trip arm 54, so that the trip arm 53 will be released and the releasing lever 31 operated while the trip arm 44 will be held against movement and the arming lever retained in its retracted position. Means for so interrupting the rotation of the armature may take various forms but preferably the annular member 49 which is carried by the armature is provided with a radially extending lug 67 and a second solenoid 68, herein referred to as a salvo solenoid, when energized, moves a stop 90 into the path of the lug 67. In the particular arrangement here shown, see Figs. 15 and 16, the solenoid 68 is provided with a reciprocatory core or plunger 69 the end portion of which constitutes the stop 90 and which is so arranged that, when energized, the plunger 69 will be projected into the path of the lug 67, the parts being so positioned that the lug will engage the plunger or stop 69 when the supporting stud 45 has been moved out of the path of the trip arm 53, but is still in the path of the trip arm 54. As has been stated, when the releasing and arming levers are in their retracted or cocked positions the end of the trip arm 53 rests upon the flattened portion of the supporting stud 45, see Figs. 3 and 9, and the trip arm 44 is positioned above and out of contact with the cylindrical portion of the stud, it being held in that position by contact of the roller 39 with the controlling lever 40. When the bomb is to be released unarmed the salvo solenoid is energized prior to the energization of the rotary solenoid so that the end 90 of the plunger 69 thereof lies in the path of the lug 67 connected with the armature of the rotary solenoid. Thus when the rotary solenoid is energized the supporting stud 45 is moved to and stopped in the position shown in Fig. 4, where the trip arm 53 has been released and the releasing lever operated but the end portion of the trip arm 44 is in engagement with the cylindrical portion of the stud and the arming lever is still retained in its retracted position.

The rotary solenoid and the salvo solenoid are controlled primarily by exterior circuits, not here shown, but which are adapted to be connected with circuits within the casing by a connector 70 and which are separately controlled by switches adjacent the bombardier's station. The internal circuits are controlled by switch mechanism within the casing which in turn is controlled by the operation of the releasing mechanism. As shown in Figs. 20 to 22 this switch mechanism comprises a pair of resilient switch arms 71 and 72 provided with contact members 73 and 74, the contact arm 71 being connected by a conductor 75 with one of the terminals of the connector 70 and the switch arm 72 being connected by a conductor 76 with the rotary solenoid 58, which is grounded. The switch mechanism also includes a second pair of resilient arms 77 and 78 provided, respectively, with contact members 79 and 80, the arm 77 being connected through a conductor, not here shown, with the second terminal of the connector 70 and the arm 78 being connected by a conductor 78' with the salvo solenoid, which is grounded. The switch mechanism also includes a fixed contact member 81 adapted to be engaged by a second contact member 82 on the resilient arm 72. The resilient arms are so arranged that when the mechanism is in its idle or inoperative positions, as shown in Figs. 1 and 20, the contacts 73 and 74 and 79 and 80 will be out of engagement so that

the interior circuits will be opened through both solenoids and the second contact 82 on the arm 72 will be in engagement with the fixed contact member 81. This fixed contact member is connected by a conductor 83 with the third terminal of the connector 70 which terminal is connected with an exterior circuit leading to another bomb release. Pivotaly mounted within the casing and above the shaft 30 is a switch actuating device 84 having connected therewith below its pivotal axis a member 85 arranged to contact the upper end portions of the resilient switch arms 71 and 77 and to move them rearwardly to the position shown in Fig. 3, in which the two solenoid circuits are closed and the circuit leading to the succeeding bomb release, herein referred to as a transfer circuit, is open. To effect this movement the switch actuating device is provided with a downwardly extending curved arm 86 arranged in the path of a shoulder 87 on the hub portion of the trip arm 53 so that when the trip arm is moved to its upper or locking position to cock the releasing lever 31 the shoulder 87 will engage the arm 86 and move the device 84 to the position shown in Fig. 3. The switch actuating device also includes an arm 88 extending therefrom toward the rotary solenoid and having its free end portion arranged in the path of a stud carried by the rotatable member of the rotary solenoid, this being in the present instance the stud 48 with which the spring 47 is connected.

With the mechanism and switch in the position shown in Fig. 3 the closing of the exterior circuit for the rotary solenoid will cause that solenoid to be energized to release both trip arms and at the end of the movement of the rotary member 49 the stud 48 will contact with or be close to the free end of the lever 88 and will be held in that position so long as the rotary solenoid is energized, thus retaining the switch elements in the positions shown in Fig. 3, with the transfer circuit open. As soon as the exterior circuit is opened and the rotary solenoid deenergized the resiliency of the switch elements will return the same to their normal positions, as shown in Figs. 1 and 20, thereby opening the interior solenoid circuits and closing the transfer circuit, that is, causing the contact 82 to engage the contact 81 and the closing of this transfer circuit connects the same with a succeeding bomb release. Thus a series of bomb releases may be successively operated by repeated closings of the bombardier's switch in the exterior circuit but due to the fact that the transfer circuit is held open until the exterior circuit has been opened to deenergize the rotary solenoid the succeeding bomb release cannot be operated until the preceding bomb release has completed its operation. When the bombs are to be salvoed the bombardier closes the exterior circuit for the salvo solenoid 68 before he closes the exterior circuit for the rotary solenoid, thereby causing the stop 90 to be projected into the path of the lug on the rotary member of the rotary solenoid and interrupting the rotation of that member in a position to cause the operation of the releasing lever and prevent the operation of the arming lever. In this position of the rotary member of the solenoid the stud 43 is spaced from the arm 88 of the switch actuating device such a distance that the latter and the switch elements are free to return to their normal positions while the exterior circuit for the rotary solenoid is closed. Thus the transfer circuit is closed as soon as the bomb has been released and the current passes immediately to the succeeding bomb release. By main-

taining the exterior circuits closed the series of bomb releases can be operated to release their bombs successively and in very rapid succession.

Means are also provided for manually releasing the bomb releasing lever and the arming lever in the event the electrically controlled means should be inoperative. For this purpose the armature shaft 61 for the rotary solenoid is provided at its front end with a projection or rib 91, see Figs. 12 and 17, and a device 92 rotatably mounted in the front wall 26 of the main casing, in line with the shaft 61, carries studs 93 arranged on opposite sides of the projection 91 and spaced therefrom to permit the normal movement of the shaft. The device 92 has in its outer surface a kerf 94 to receive the bit of a screw driver or the like by which the device may be rotated to cause one of the studs to engage the projection 91 and rotate the shaft and armature to move the supporting stud 45 out of the paths of the trip arms and thus release the latter for operation.

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.

Having now fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a bomb release, a releasing lever, an arming lever, spring means for separately actuating said levers, means including a movable member to retain both levers in retracted positions against the action of said spring means, electrically controlled means for actuating said movable member to release said levers in rapid succession, and separately controlled electrical means for interrupting the movement of said movable member after said releasing member has been released and before said arming lever has been released.

2. In a bomb release, a releasing lever, and an arming lever, spring means for separately actuating said levers, separately movable trip arms for the respective levers, a rotatable device having a member spaced from the axis thereof and arranged normally in the paths of both trip arms to retain said levers in their retracted positions, electrically controlled means to rotate said device and move said member out of the paths of both trip arms and thereby release both levers, and separately operable electrically controlled means to interrupt the movement of said rotatable device after said member has moved out of the path of the trip arm for said releasing lever and before said member has moved out of the path of the trip arm for said arming lever.

3. In a bomb release, a releasing lever, an arming lever, spring means for separately actuating said levers, trip arms to retain the respective levers in their retracted positions against the action of said spring means, a movable member to support both trip arms in retaining positions, one of said trip arms being connected with one of said levers for movement therewith, means actuated by the other of said levers to move the other trip arm to retaining position and to support the last mentioned lever in its retracted position, means for moving said movable member out of supporting relation to both trip arms, and separately operable means for interrupting the movement of said movable member after it has been moved out of supporting relation to one of

said trip arms and while it is in supporting relation to the other trip arms.

4. In a bomb release, two parallel shafts, a releasing lever and an arming lever rigidly connected with the respective shafts, spring means for separately actuating said levers, controlling levers rigidly connected with the respective shafts, a trip arm rigidly connected with the shaft of said arming lever to retain the latter in its retracted position, a second trip arm movable about the axis of the shaft for said arming lever and arranged to be actuated by the controlling lever for said releasing lever as the latter is moved to its retracted position and to retain said releasing lever in said retracted position, a rotatable device having a member spaced from the axis thereof to support both trip arms in retaining positions, electrically controlled means to rotate said device and release both trip arms and separately operable electrically controlled means to interrupt the rotation of said rotatable device after the trip arm for said releasing lever has been released and before the trip arm for said arming lever has been released.

5. In a bomb release, two parallel shafts, a releasing lever and an arming lever rigidly connected with the respective shafts, spring means for separately actuating said levers, controlling levers rigidly connected with the respective shafts, a trip arm rigidly connected with the shaft of said arming lever to retain the latter in its retracted position, a second trip arm movable about the axis of the shaft for said arming lever and arranged to be actuated by the controlling lever for said releasing lever as the latter is moved to its retracted position and to retain said releasing lever in said retracted position, a rotatable device having a member spaced from the axis thereof and yieldably held in a position to support both trip arms in retaining positions, said trip arms having cam surfaces to move said member out of the paths thereof as they move to retaining positions, a controlling lever for said releasing lever having means to move the trip arm for said arming lever out of engagement with said supporting member and to retain the same out of engagement therewith while the trip arm for said releasing lever is supported by said member, electrically controlled means to rotate said device and release both of said trip arms, and separately operable electrically controlled means for interrupting the movement of said rotatable device after the trip arm for said releasing lever has moved past said supporting member and before the trip arm for said arming lever has moved past said supporting member.

6. In a bomb release, two parallel shafts, a releasing lever and an arming lever rigidly connected with the respective shafts, spring means for separately actuating said levers, controlling levers rigidly connected with the respective shafts, a trip arm rigidly connected with the shaft of said arming lever to retain the latter in its retracted position, a second trip arm movable about the axis of the shaft for said arming lever and arranged to be actuated by the controlling lever for said releasing lever as the latter is moved to its retracted position and to retain said releasing lever in said retracted position, a rotatable device having a member spaced from the axis thereof and yieldably held in a position to support both trip arms in retaining positions, said trip arms having cam surfaces to move said members out of the paths thereof as they move to retaining positions, said supporting member hav-

ing a cylindrical surface in the path of the trip arm for said arming lever, and a substantially flat surface in the path of the trip arm for said releasing lever, the controlling lever for said releasing lever having a part to engage the controlling lever for said arming lever and move the trip arm for the latter out of engagement with said supporting member as the trip arm for said releasing lever approaches said supporting member and to retain the same out of engagement therewith while said trip arm for said releasing lever is in engagement with said supporting member, electrically controlled means to actuate said rotatable device to move said supporting member out of the paths of both trip arms, and separately operable electrically controlled means to interrupt the movement of said rotatable device after the flat surface of said supporting member has moved out of the path of the trip arm for said releasing lever and while the cylindrical surface of said supporting member is in the path of the trip arm for said arming lever.

7. In a bomb release, two parallel shafts, a releasing lever and an arming lever rigidly connected with the respective shafts, spring means for separately actuating said levers, a controlling lever rigidly secured to each shaft and extending toward the other shaft, a trip arm rigidly connected with the shaft of said arming lever to retain the latter in its retracted position, a second trip arm rotatably mounted on the shaft of said arming lever and having a part to be engaged by the controlling lever for said releasing lever as the latter is moved to its retracted position and to be moved thereby to a position to retain said releasing lever in its retracted position, said second trip arm having adjacent its axis a part to engage the free end portion of the controlling lever for said releasing lever and support the same while said second trip arm is in retaining position, a rotatable device having a member spaced from the axis thereof and yieldably held in a position to support both trip arms in retaining positions, said trip arms having cam surfaces to move said member out of the paths thereof as they move to retaining positions, the controlling lever for said releasing lever having adjacent the axis thereof a part to engage the free end portion of the controlling lever for said arming lever and move the trip arm for the latter out of engagement with said supporting member and to retain said lever in such engagement while the free end of said controlling member is in engagement with the supporting part of said second trip arm, electrically controlled means to actuate said rotatable device and move said supporting member out of the paths of both trip arms, and separately operable electrically controlled means to interrupt the rotation of said rotatable device after said supporting member has been moved out of the path of the trip arm for said releasing lever and while said supporting member is in the path of the trip arm for said arming lever.

8. In a bomb release, a releasing lever, an arming lever, spring means for separately actuating said levers, separately movable trip arms to retain the respective levers in their retracted positions against the action of said spring means, a rotary solenoid including a rotary armature and a member carried by said armature and spaced from the axis thereof, means for retaining said member in the paths of said trip arms to support the latter in their retaining positions, whereby the energization of said solenoid will move said member out of the paths of said trip

arms and release both levers, and a second and separately energizable solenoid having means to interrupt the movement of said supporting member after it has moved out of the path of the trip arm for said releasing lever and before it has moved out of the path of the trip arm for said arming lever.

9. In a bomb release, a releasing lever, an arming lever, spring means for separately actuating said levers, separately movable trip arms to retain the respective levers in their retracted positions against the action of said spring means, a rotary solenoid including a rotary armature and a member carried by said armature and spaced from the axis thereof, means for retaining said member in the paths of said trip arms to support the latter in their retaining positions, whereby the energization of said solenoid will move said member out of the paths of said trip arms and release both levers, a second and separately energizable solenoid having means to interrupt the movement of said supporting member after it has moved out of the path of the trip arm for said releasing lever and before it has moved out of the path of the trip arm for said arming lever, means including a switch to connect the electric circuit of said bomb release with the corresponding circuit of another bomb release, and means for preventing the closing of said switch while said rotary solenoid remains energized after both trip arms have been released and for closing said switch while said rotary solenoid remains energized after its movement has been interrupted to prevent the release of said trip arm for said arming lever.

10. In a bomb release, a releasing lever, an arming lever, spring means for separately actuating said levers, a movable member to retain both levers in retracted positions against the action of said spring means, electrically controlled means for actuating said movable member to release said levers in rapid succession, separately controlled electrical means for interrupting the movement of said movable member after said releasing member has been released and before said arming lever has been released, normally open switch means for connecting the first mentioned electrically controlled means in an exteriorly controlled circuit, normally open switch means for connecting the last mentioned electrically controlled means in a second exteriorly controlled circuit, normally closed switch means for connecting the first mentioned circuit with another bomb release, means controlled by the movement of said releasing lever to close both normally open switch means and to open said normally closed switch means when said releasing lever is moved to its retracted position, and to restore said switch means to their normal positions when said releasing lever is released.

11. In a bomb release, a releasing lever, an arming lever, spring means for separately actuating said levers, separately movable trip arms to retain the respective levers in their retracted positions against the action of said spring means, a rotary solenoid including a rotary armature and a member carried by said armature and spaced from the axis thereof, means for retaining said member in the paths of said trip arms to support the latter in their retaining positions, whereby the energization of said solenoid will move said member out of the path of said trip arms and release both levers, a second and separately energizable solenoid having means to in-

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interrupt the movement of said supporting member after it has moved out of the path of the trip arm for said releasing lever and before it has moved out of the path of the trip arm for said arming lever, normally open switch means to connect said rotary solenoid in an externally controlled circuit, normally open switch means to connect said second solenoid in a separate externally controlled circuit, normally closed switch means to connect the first mentioned circuit with the corresponding circuit of another bomb release, means controlled by the trip arm for said releasing lever to close the normally open switch means and to open the normally closed switch means when said releasing lever is moved to its retracted position and to

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restore said switch means to their normal positions when said releasing lever is released, and means for preventing the restoring of said normally closed switch means to its closed position while the energization of said rotary solenoid is maintained after both levers have been released.

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REFERENCES CITED

The following references are of record in the file of this patent:

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