Nov. 11, 1947. LA VERN E. QUINNELL ET AL 2,430,617

SELECTIVE CONTROL FOR ARMING BOMBS AND THE LIKE

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FIG. 1.

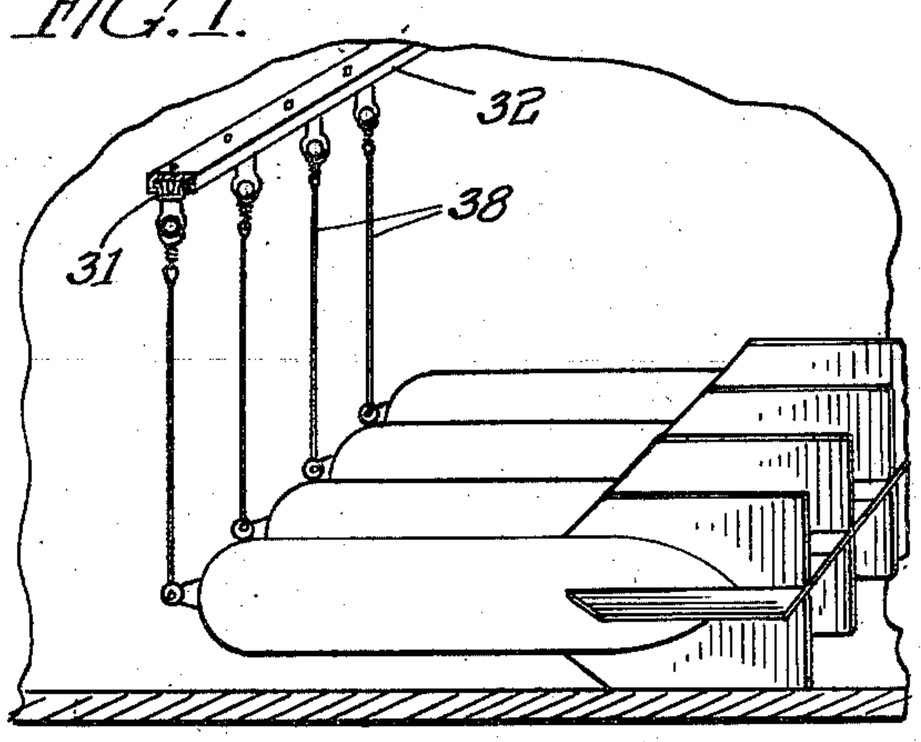

FIG. 2.

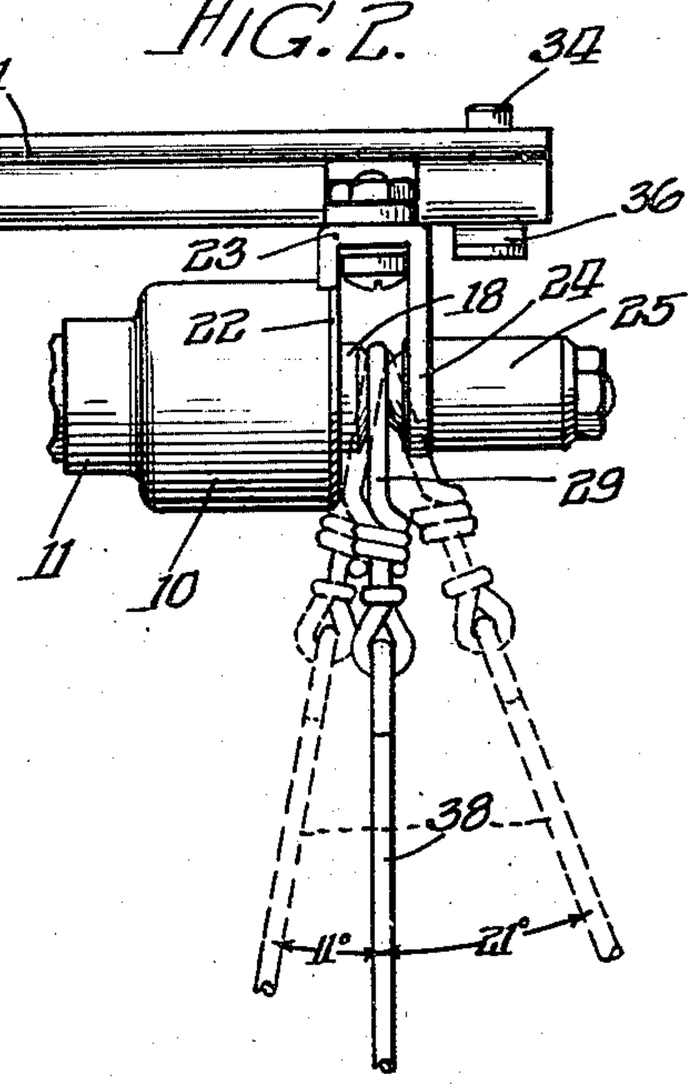

FIG. 3.

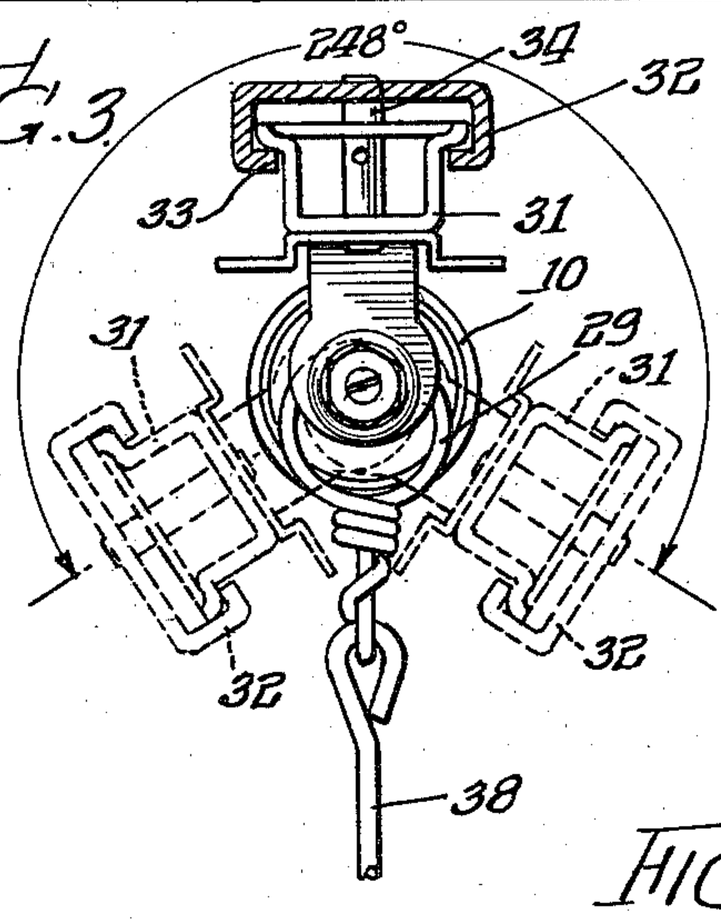

FIG. 9.

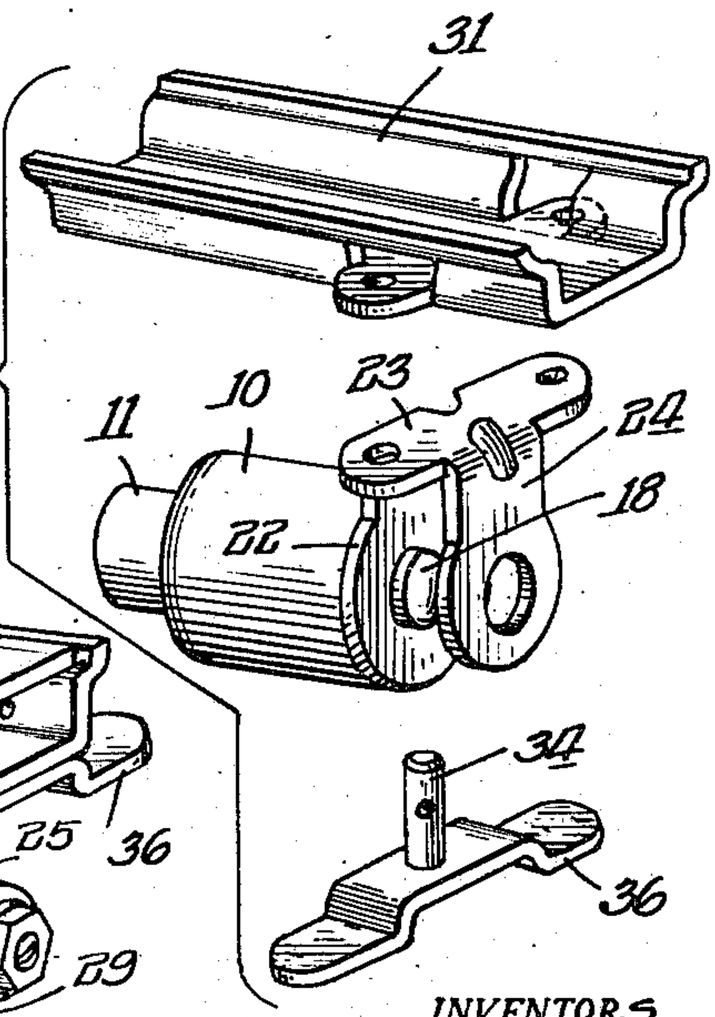

FIG. 4.

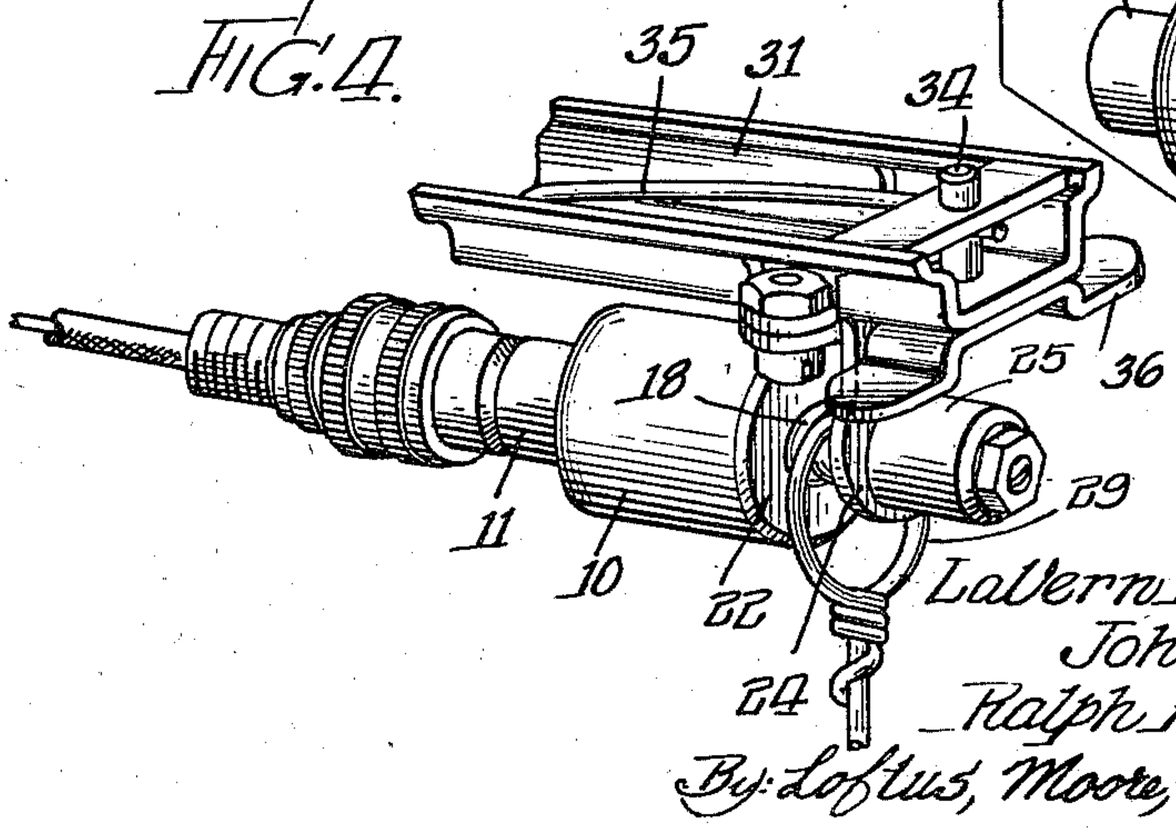

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FIG. 5.

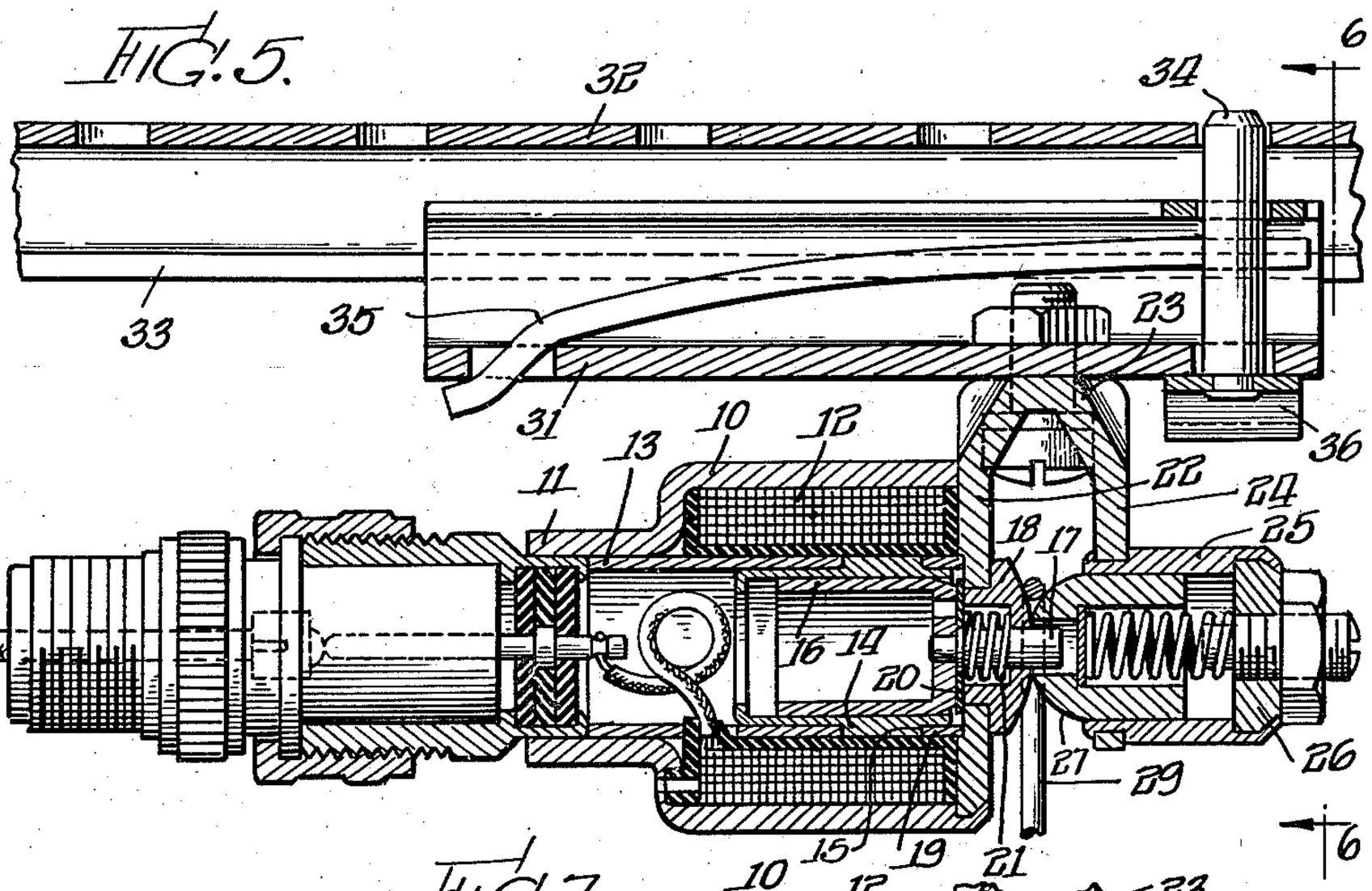


FIG. 7.

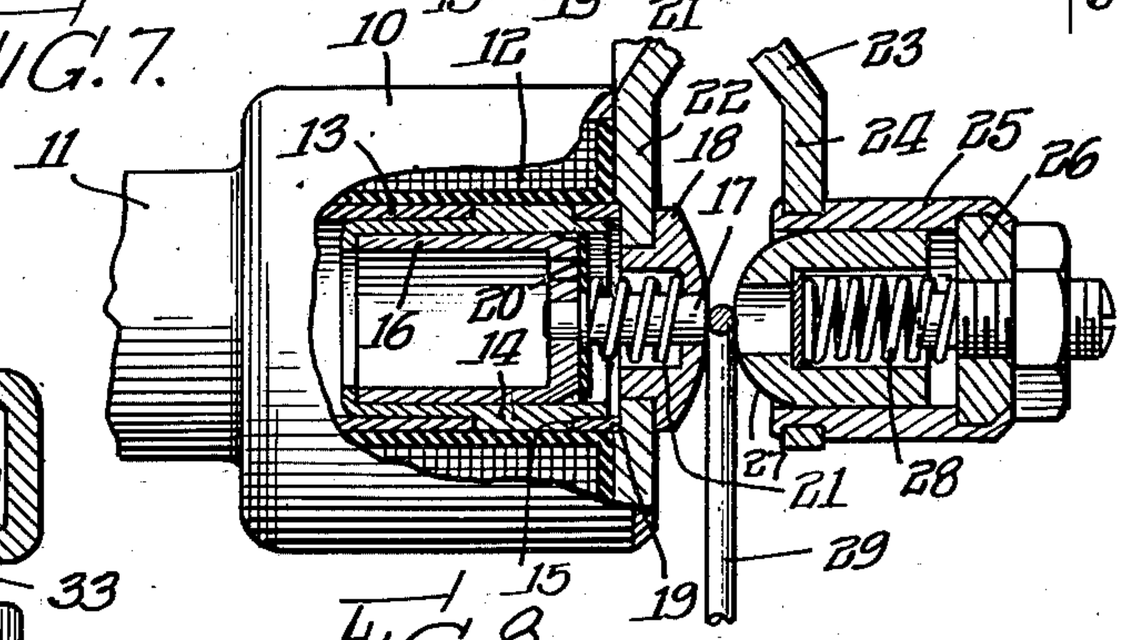


FIG. 6.

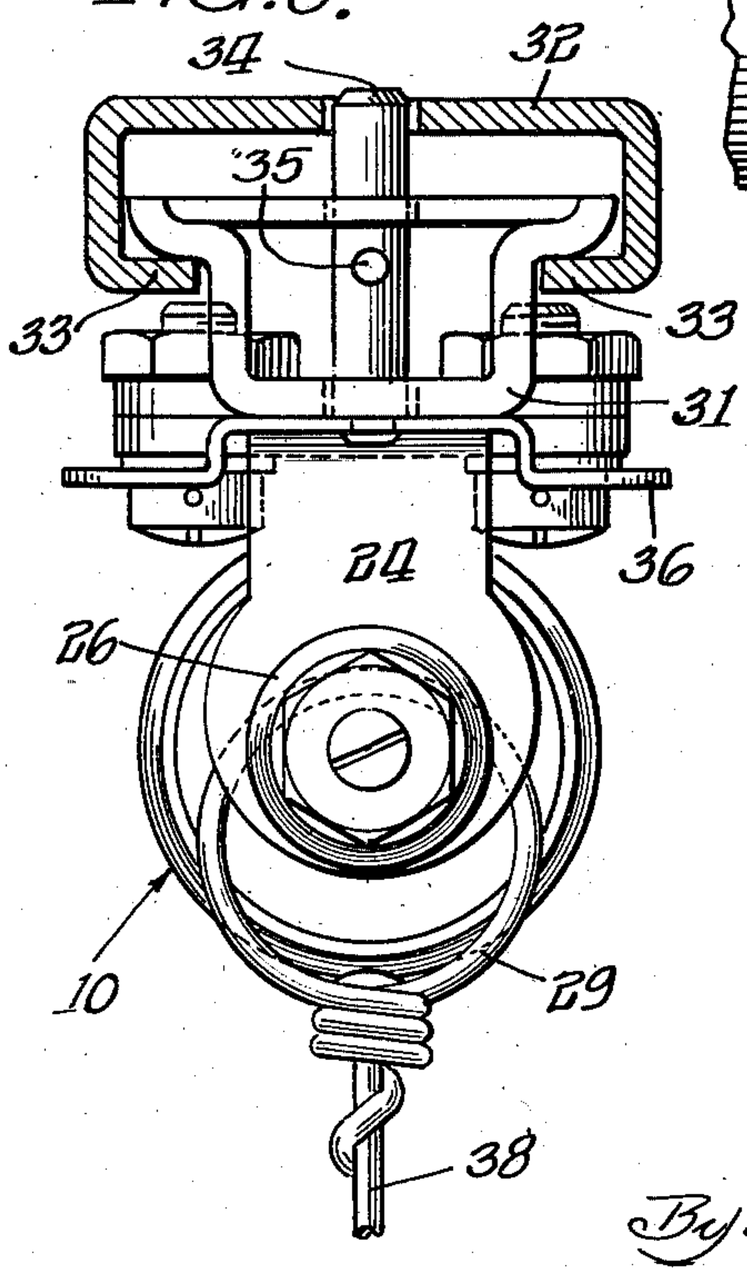
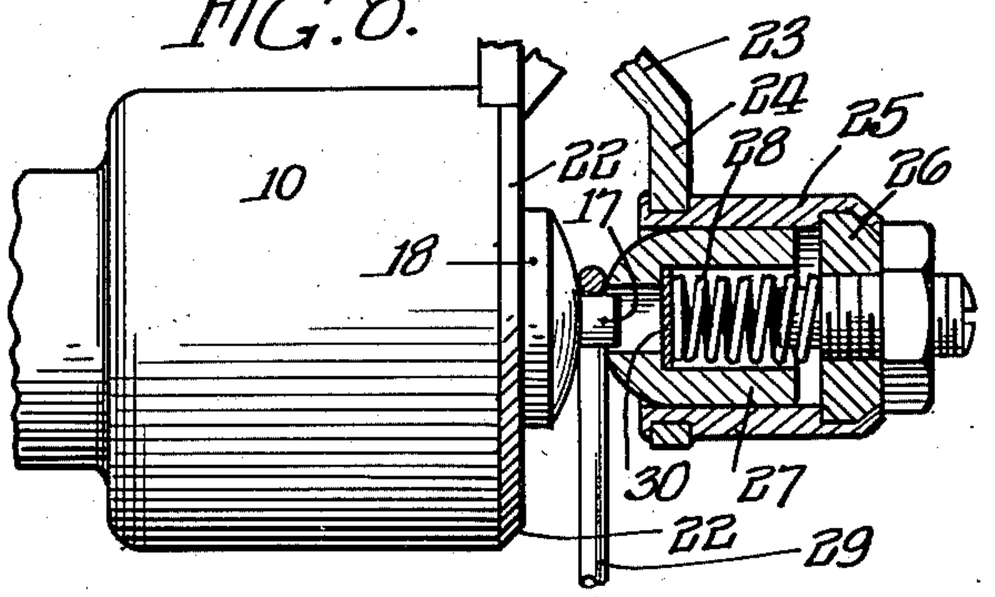


FIG. 8.



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UNITED STATES PATENT OFFICE

2,430,617

SELECTIVE CONTROL FOR ARMING BOMBS AND THE LIKE

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Application January 25, 1943, Serial No. 473,478

12 Claims. (Cl. 89—1.5)

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Our invention relates to a device particularly useful in connection with aircraft for selectively arming bombs when released or dropped from the craft.

It is an object of our invention to provide an improved solenoid-operated device of this character adapted to hold the arming ring of the bomb, but which will selectively permit its withdrawal, when the bomb is released to drop, without arming the bomb, or will retain the ring and arm the bomb as desired.

It is a further object of our invention to provide a device of this type which is produceable by high production methods, which eliminates the use of critical materials, which radically reduces the weight of such structures, and is simple in construction, having only one moving part.

A further object of our invention is to provide such a device which permits the arming ring to be withdrawn at any point throughout approximately a 250° arc, as compared with the approximate 90° arc on the controls heretofore known.

In the drawings:

Fig. 1 is a diagrammatic view illustrating a series of aerial bombs showing lines leading from the detonation cap of the bomb to the arming ring held in position by our selective bomb arming device.

Fig. 2 is a side elevational view of our selective bomb arming device showing the ring and connection leading from the ring to the arming pin on a bomb, flare, or other device, in different positions.

Fig. 3 is an end view of our device showing the range through which it satisfactorily operates during the shifting of the aircraft from one banking position to another or when the control is mounted at different angles in the plane.

Fig. 4 is a perspective view of our device.

Fig. 5 is a vertical sectional view of our device including the mounting bracket.

Fig. 6 is an end view on the line 6—6 of Fig. 5 looking in the direction indicated by the arrows.

Fig. 7 is a view of the solenoid partly in section, showing the position of the parts for selectively retaining the arming ring to arm the bomb or yieldingly release it without arming the bomb.

Fig. 8 is an elevational view of the solenoid and cooperating parts, the latter in section, showing the position of parts for retaining the arming ring when the bomb is released, and thereby removing the arming pin.

Fig. 9 is a perspective, disassembled, detailed view of parts of our device.

Referring to the drawings in detail:

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The magnetically susceptible steel case 10 of the solenoid is integrally formed with a restricted neck portion 11, best shown in Fig. 5. Suitably mounted within the case is a field coil 12. Inside the coil and neck of the case is positioned a steel sleeve 13. Adjacent to and within the forward portion of the sleeve 13 is mounted a brass sleeve guide 14 provided with a peripheral rim 15 which abuts against the forward end of the sleeve 13. Within the brass sleeve guide 14 is reciprocally mounted a solenoid plunger 16. Fixed to or integral with the plunger is a forward extending plunger pin 17 adapted to extend forward through and substantially beyond the end plug 18 when the solenoid is energized. The end plug 18 is made of non-magnetic stainless steel.

Fitted over the forward end of the brass sleeve guide 14 and abutting against its rim is a shallow sleeve or rim 19. Adjacent the forward end of the plunger and surrounding the plunger pin 17 is a brass washer 20 adapted to reciprocate within the brass sleeve guide 14. Interposed between this washer and the bottom of the well or bore in the end plug 18 and surrounding the plunger pin 17 is a coil compression spring 21 which returns the plunger and pin to the position shown in Fig. 7, where it is maintained at all times except when the solenoid is energized. The exposed face of the plug 18 is spherical in contour, as best shown in Figs. 5, 7 and 8. The magnetically susceptible front plate 22 of the solenoid casing is fixed to the case in any suitable manner, for example by swedging as shown in Figs. 5, 7 and 8. This front plate is provided with an opening in line with the plunger in which opening the end plug 18 is secured in any suitable manner. This front plate is integrally provided with an inverted U-shaped bracket 23, having a depending leg 24 spaced therefrom. This depending leg in its lower portion is provided with an opening substantially in line with the opening in the front plate of the solenoid casing. Fixed in the opening in this leg in any suitable manner, for example by swedging as shown in Figs. 5, 7 and 8, is a cylindrical case 25 having an end plate 26 swedged into fixed position with relation to the case. Mounted in this case and in opposed relation to the end plug 18 is a reciprocating retainer 27. Its outer face is spherical in contour. This retainer is provided with a central opening to receive the plunger pin 17 when the pin is moved forward upon energizing the solenoid. This opening terminates at one end in a larger bore or well formed in the retainer. Interposed in this well and between the shoulder formed

therein and the end of the retainer case is a compression spring 28 which constantly presses the retainer out of its case toward and yieldingly against the end plug 18 for yieldingly holding the arming ring 29 or like between the opposed faces of the retainer and end plug of the solenoid. Screw-threaded into and through a hex nut and the end 26 of the retainer case is a dog point set screw whose inner end extends into the coiled compression spring as shown in Figs. 5, 7 and 8. Interposed between the coil compression spring and the shoulders of the retainer is a shim 30.

The bracket which is formed integrally with the front plate of the solenoid and the leg which supports the retainer case is secured by a bolt or other suitable means as best shown in Fig. 5 to a mounting bracket 31. This mounting bracket, as best shown in Figs. 3, 4, 6 and 9, is U-shaped in cross section and provided with longitudinally outward extending flanges. Secured to the aircraft by any suitable means is a rack 32 which may be generally described as being in the form of an inverted U in cross section, and is provided at its longitudinal edges with opposed, inwardly-extending, longitudinal flanges 33 for engaging beneath the flanges on the mounting bracket assembly and thus slidably supporting the mounting bracket within the rack.

The rack, as best shown in Figs. 5 and 6, is provided with a series of aligned openings. The mounting bracket is provided with a spring-pressed pin 34, adapted to register with any one of the openings as the bracket is moved along the rack. There is provided a spring rod 35, one end of which is secured to the assembly bracket, and the opposite end to the pin 34. This spring exerts a constant upward pressure on this pin causing it to snap into any one of the openings in the rack. Secured to the lower end of this pin outside the bracket is a hand operating member 36 which, when moved downward by the thumb or finger of the operator, releases the pin and permits the bracket assembly to be moved along the rack as desired for adjusting the solenoid with respect to the bombs or rack.

Suitably secured to the reduced neck 11 of the casing 10 is a connector plug which, when the solenoid is mounted for use in the field, leads to a suitable source of power, in practice as heretofore used by us in aircraft, to a 24-volt battery.

When our selective bomb arming device is suitably mounted on an aircraft and it is desired to be used for selectively arming bombs, the bombs indicated in Fig. 1 are suitably arranged in what is known as the bomb bay. Secured to the arming pin of each bomb is a string or line leading to a ring 29. This ring is positioned in our device as shown in the drawings between the opposed oval surfaces of the plug mounted in the end of the solenoid and the spring-pressed retainer. If it is desired to drop a bomb in an armed condition, the solenoid is energized by pressing a button or switch on the craft, not shown, mounted at some suitable, readily accessible place, energizing the solenoid, attracting the plunger 16 toward the plate 22 and thus causing the solenoid pin to move into the bore in the opposed spring-pressed retainer, as shown in Fig. 5, a distance considerably greater than the width of the ring, thus holding and preventing release of the ring until the solenoid is intentionally de-energized, as a result of which the firing pin of the bomb is operated.

However, should the pilot be over territory or in a position where he desires to release the bombs

without arming, he simply releases the bombs and, as they drop, the initial load on the connection to the arming ring pulls the ring downwardly between the opposed oval surfaces and forces the spring-pressed retainer away from the plug of the solenoid sufficiently to allow the ring to pass through without operating the arming pin on the bomb.

The operation of the spring-actuated retainer is such that it is pressed against the spherical surface of the end plug 18 with sufficient force to yieldingly retain the arming ring 29 or the like at all times against accidental misplacement, but at the same time will, when pressure is applied thereto by a pull on the ring, move sufficiently to release the ring 29 before the requisite strain is imposed upon the line leading from the ring to the cap of the bomb to operate the arming pin of the bomb being dropped. However, the arrangement and movement of the retainer is such that the arming ring cannot be released when the solenoid is energized and the plunger pin driven into the central bore of the retainer. Thus, by energizing the solenoid, the bomb can be selectively armed as desired.

As shown in the drawings, it will be noted that the end plug of the solenoid and the opposed surface of the retainer are spherical or oval in contour so that when the surface of the retainer is in direct contact with the surface of the end plug the arming ring 29 rests between the opposed oval surfaces in the valley formed therebetween. It will be further noted that the oval surface on the end plug of the solenoid extends out a substantial distance beyond the end plate of the solenoid, and that the oval surface of the retainer extends a substantial distance beyond the end plate or leg which supports the case of the retainer so that the ring is permitted a wide range of movement, as best illustrated in Fig. 2, to permit the proper release of the bombs when the craft is in different positions.

Furthermore, with our device, the arming ring can be readily withdrawn at any point throughout a very substantial arc, as shown in Fig. 3, throughout an arc of approximately 250° as the craft banks or shifts from one position to another or when the control is mounted at different angles in the plane, as compared to approximately 90° on the present control.

While we have shown and described a mounting bracket for slidably positioning the solenoid in a rail or rack which, in turn, is secured to the craft, the solenoid or solenoids may be secured directly to the craft by any suitable means.

Having thus described our invention, we claim:

1. A selective device for arming an aircraft bomb or the like having an arming member secured to the bomb, said device comprising in combination a solenoid having a movable plunger, retainer means having a yieldable element opposed to said plunger in longitudinal alignment therewith engaging said arming member and yielding to release said member on dropping of a bomb when the solenoid is deenergized, a longitudinally extending plunger pin opposed to the yieldable element of said retainer means constructed and arranged to engage and hold the member against release on dropping of a bomb when the solenoid is energized.

2. A device of the class described comprising in combination a solenoid having a movably mounted plunger and a movably mounted pin connected to the plunger for actuation thereby when the solenoid is energized, and means for

moving the plunger and pin in the opposite direction when the solenoid is deenergized, a pair of relatively shiftable, opposed retainer members constructed and arranged when in normal position to retain an element between the retainer members and arranged for relative shifting in a recessive direction to release such element, when the solenoid is deenergized, upon the application of pressure to one of said members, said pin being mounted for projection into the space existing between said members when pressure is applied to one of said members, thereby to prevent the release of said element when the solenoid is energized.

3. In a device of the class described, comprising in combination a solenoid having an end plate, an end plug mounted in said plate and having an oval outer surface, a plunger, and a plunger pin projectable by said plunger beyond said surface of the plug, a retainer case mounted forward and spaced substantially from said end plug, a spring-actuated retainer mounted in said retainer case having an oval outer surface in opposed relation to and arranged to normally press yieldingly against the oval surface of said end plug, said retainer being constructed and arranged to receive the pin when the solenoid is energized.

4. A selective device for arming an aircraft bomb or the like having an arming ring, said device comprising in combination a solenoid having an end plate, an end plug in said plate and having an outer oval bearing surface, a plunger, and a plunger actuated pin passing through and extending beyond said plate to hold the arming ring when the solenoid is energized, means for withdrawing said plunger and pin when the solenoid is deenergized, a retainer case mounted forward of and spaced from said end plug, a spring actuated retainer mounted in said retainer case and having an outer oval surface arranged to engage said end plug for normally retaining an arming ring between said end plug and retainer and release the arming ring when pressure is applied thereto while the solenoid is deenergized, said spring actuated retainer being provided with an opening for receiving one end of the plunger actuated pin when the solenoid is energized.

5. A selective device for arming an aircraft bomb or the like having an arming ring, said device comprising in combination a solenoid having an end plate, an end plug in said plate and having an outer oval bearing surface, a plunger, and a plunger actuated pin passing through and extending beyond said plate to hold the arming ring when the solenoid is energized, means for withdrawing said plunger and pin when the solenoid is deenergized, a retainer case mounted forward of and spaced from said end plug, a spring actuated retainer mounted in said retainer case and having an outer oval surface arranged to engage said end plug for normally retaining an arming ring between said end plug and retainer and release the arming ring when pressure is applied thereto while the solenoid is deenergized, said spring actuated retainer having an opening therein to receive said pin when the solenoid is energized.

6. A selective device for arming an aircraft bomb or the like having an arming member, said device comprising a solenoid having an end plate, a plunger, and a plunger actuated pin extending through and beyond said end plate when the solenoid is energized, and means for withdrawing said plunger and pin when the solenoid is deenergized, mounting means for said solenoid, a

spring pressed retainer mounted on said mounting means in spaced relation to said end plate constructed and arranged to hold said arming member between said retainer and solenoid end plate and to yield and release said member on the application of force to said arming member, said retainer having an opening therein to receive said plunger actuated pin to prevent the release of said arming member by yielding of said retainer while the solenoid is energized.

7. In an aircraft having a bomb bay and arming means, means for adjustably supporting the arming means comprising in combination a longitudinally extending U-shaped support fixed to the aircraft, an adjustable support for the arming rings mounted in said longitudinally extending fixed support, bomb arming means connected to said adjustable support, and means carried by said adjustable support for readily and quickly adjusting it to different positions on said fixed support, substantially as and for the purposes set forth.

8. A selective device for arming an aircraft bomb or the like having an arming ring, said device comprising in combination mounting means having depending spaced legs, a solenoid mounted on one of said depending legs, said solenoid having a plunger, a pin connected to said plunger for movement therewith, an apertured plug mounted on the same depending leg as the solenoid and having an aperture therein permitting passage of the pin therethrough to a position projecting therebeyond to engage and prevent release of the arming ring when the solenoid is energized, means for withdrawing the pin when the solenoid is deenergized, a spring actuated retainer slidably mounted on the other of said depending legs in opposed relation to said plug and constructed and arranged to engage said end plug to hold said arming ring therebetween and to yield and permit the arming ring to be withdrawn at any angle of inclination of said depending legs within the range of an arc of substantially 250 degrees.

9. In a device of the class described, a solenoid comprising a case, a coil in said case, a sleeve in said coil, a plunger slidably mounted within the sleeve, means for mounting said sleeve in place in said case, said case having an apertured end plate, an end plug mounted on said end plate and provided with an opening concentric to the aperture in the end plate an arming ring, a pin connected to the plunger and slidably mounted in said plug to extend through the opening in said end plug and beyond said end plug and through the arming ring to hold the same when the solenoid is energized, and means mounted within said plug and bearing on said pin for returning said pin to normal position when the solenoid is deenergized, a retainer for an arming ring or the like, means yieldably mounting said retainer in opposed relation to said end plug to retain said ring or the like against said plug, said retainer being constructed and arranged to yield and release said ring or the like on application of pressure thereto, said pin holding said ring or the like against release by projection beyond the end plug when the solenoid is energized.

10. A selective device for arming a bomb having an arming ring or the like, said device comprising in combination a solenoid having a plunger and a pin projectable by the plunger on energization of the solenoid, means for withdrawing the pin when the solenoid is deenergized, a spring actuated retainer for said ring or the like

constructed and arranged to yield and release the arming ring or the like when the solenoid is deenergized, said pin being mounted and arranged to engage and hold the ring or the like against release on yielding of the retainer when the solenoid is energized and the pin projected.

11. In a device for retaining and releasing an arming ring or the like, a pair of opposed retainer members arranged to retain the arming ring or the like between them and mounted to shift relatively to release the same upon application of pressure to one of said members, a solenoid having a plunger, a pin movable with the plunger, an electromagnet for moving the plunger and pin to one position when the electromagnet is energized, and means for moving the plunger and pin to another position when the electromagnet is deenergized, said pin being mounted to project, when in one of said positions, into and close the space between said retainer members when said members are relatively shifted thereby to hold the arming ring or the like against release, and to be withdrawn, when in the other of said positions, from said space to permit release of the arming ring or the like from said retainer members.

12. In a device for retaining and releasing a hollow member, a pair of opposed retainers, means for mounting one of said retainers for movement toward and away from the other retainer, said adjustably mounted retainer being constructed and formed to project into the hollow member to retain said member against the opposed retainer and to yield and release said member on application of force to said member,

a solenoid having a plunger, a pin connected to the plunger for movement therewith, an electromagnet for moving the plunger in one direction and projecting the pin when the electromagnet is energized, and means for moving the plunger in the opposite direction and withdrawing the pin when the electromagnet is deenergized, said pin being mounted to extend, when projected, into the hollow member while held between said opposed retainers thereby to hold said member against release by shifting of one of said retainers while the solenoid is energized.

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(Blueprints of the above drawings can be found in Div. 22 of the Patent Office.)