May 1, 1945. Z. A. M. BURRESON 2,374,978

BOMB RELEASE SYSTEM

Filed Jan. 16, 1942 2 Sheets-Sheet 1

Fig. 1

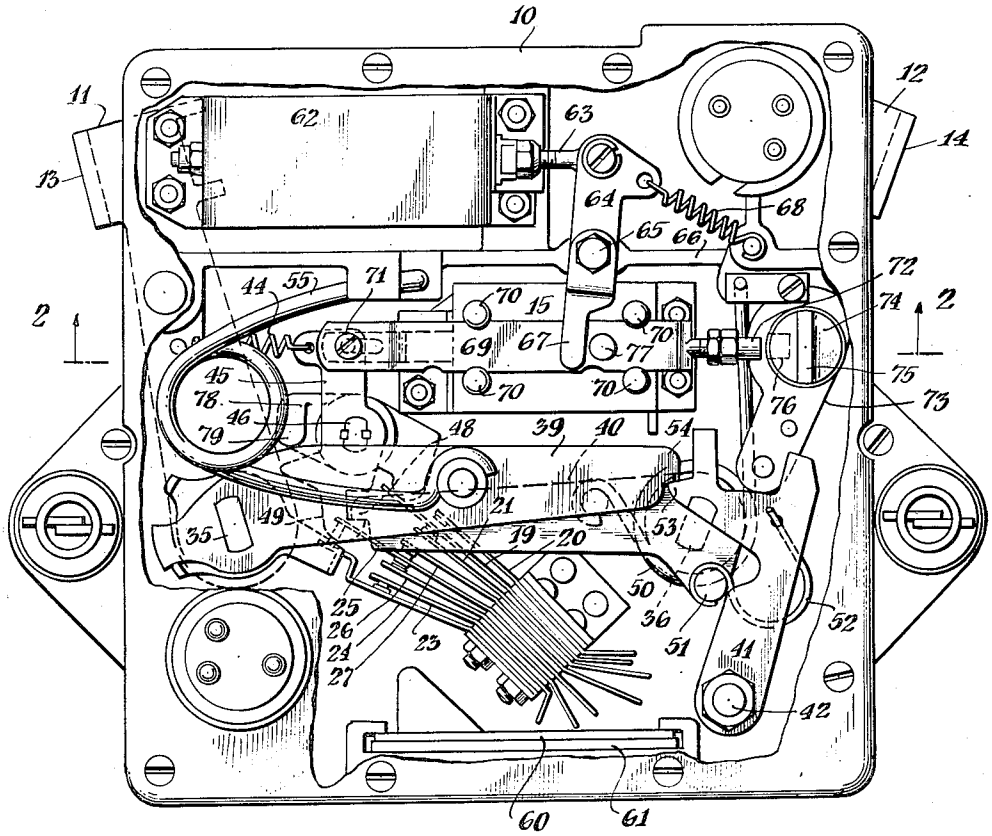
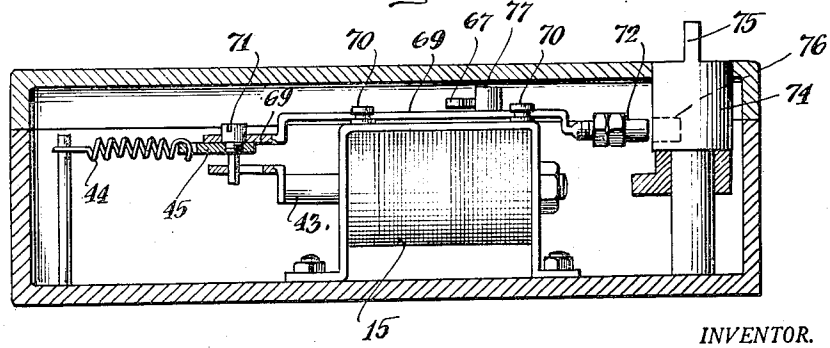


Fig. 2



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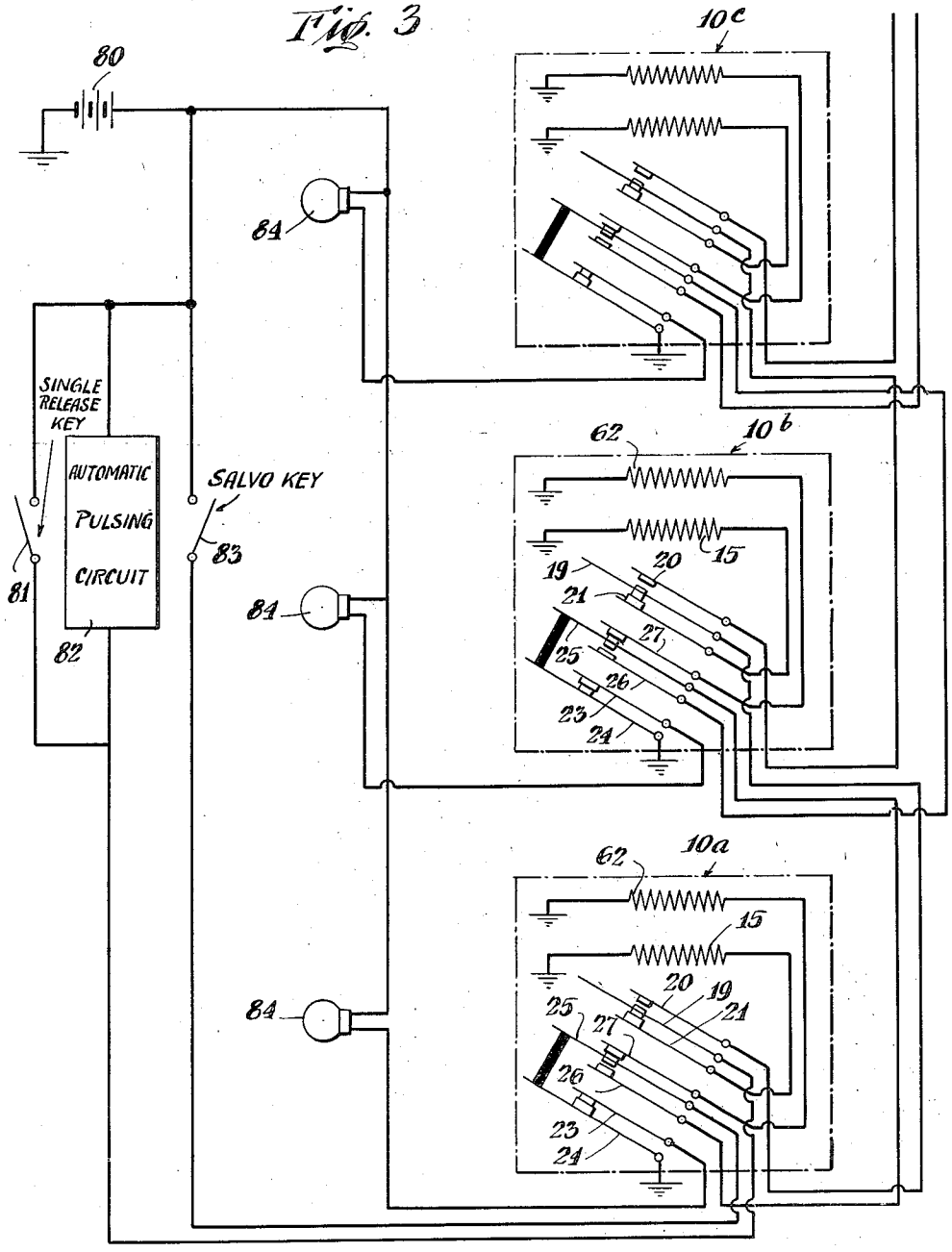
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Fig. 3



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2,374,978

BOMB RELEASE SYSTEM

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Application January 16, 1942, Serial No. 426,976

3 Claims. (Cl. 89—1.5)

This invention relates to bomb dropping circuits and mechanisms and more particularly to systems and mechanisms for dropping bombs from aircraft under control of electrical means.

An object of the invention is to improve bomb dropping mechanisms.

Another object is to improve the means whereby bombs may be dropped in timed succession or in a salvo under control of the bombardier.

Other objects of the invention will be apparent from the following description and accompaying drawings taken in connection with the appended claims.

The invention comprises the features of construction, combination of elements, arrangement of parts, and methods of manufacture and operation referred to above or which will be brought out and exemplified in the disclosure hereinafter set forth, including the illustration in the drawings.

In the drawings:

Figure 1 is a side view of a bomb dropping mechanism embodying features of the present invention, with the cover removed;

Figure 2 is a section on the line 2—2 of Figure 1; and

Figure 3 is a circuit diagram for a bomb dropping system.

The present invention comprises an improvement on the bomb dropper shown and described in Frederick J. Hooven application for Letters Patent, Serial No. 381,218 filed March 1, 1941 (Patent No. 2,332,795, granted Oct. 26, 1943).

According to the present invention additional circuit and mechanical means are added to enable bombs to be dropped either in timed succession under manual control or under control of an automatic pulsing circuit or dropped in a salvo as desired. This renders the bomb dropping means applicable to the bombing of areas where it may be desired to drop a series of bombs over a considerable area as well as of concentrated targets such as enemy battleships where it is desired to drop a salvo of several bombs on a concentrated target area.

For the most part, the circuit and mechanism is similar to that described in the above mentioned Hooven application. This part of the mechanism will be described briefly, after which the further improvements will be described.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the construction of parts without departing from the spirit of the invention. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to the drawings Figures 1 and 2 show a bomb dropping control mechanism in a box 10 having a pair of external levers 11 and 12 provided with channel-shaped ends 13 and 14 respectively for engaging the releasing arm and arming arm respectively of a bomb shackle carrying a bomb. Control box 10 contains a system of power multiplying levers associated with levers 11 and 12 and adapted to actuate said levers under control of an electrically operated solenoid 15 as will be described more in detail later. Control box 10 also contains a system of electric contacts under control of the solenoid and the levers for transferring the control of the electric control circuits to a succeeding bomb dropping control box mechanism after a given mechanism has operated. The electric contacts also control the circuits for tell-tale lamps located in the bombardier's compartment to indicate the condition of the bomb dropping mechanisms.

The box 10 may comprise a die casting of light metal with upper and lower sections. A suitable cover may be attached to the box. Bomb release lever 11 and arming lever 12 are secured respectively to shafts 35 and 36 pivoted in pressed-in bearings in the wall of box 10. Inside the box a latch lever 39 is secured to shaft 35 and a latch lever 40 to shaft 36. A third latch arm 41 is pivoted on a bolt 42 so as to swing in and out of latching engagement with latch arm 39.

Solenoid 15 is mounted horizontally near the top of the lower box section as shown in Figure 1 and has an axially sliding armature 43 normally held by coil tension spring 44 in unactuated position. Armature 43 through the adjustable link controls a latch lever 45 pivoted on a bolt 46.

Latch levers 39, 40, 41 and 45 comprise a system of power multiplying levers whereby the relatively weak pull of solenoid 15 may be utilized to control levers 11 and 12 which must be actuated with the strong force necessary to perform their required functions. When the device is in cocked position as shown in Figure 1, arming lever 12 is at the right-hand end of its travel and hence its associated latch lever 40 within box 10 is raised to a position where its latching end 48 is latched with the hook 49 on the end of solenoid-controlled lever 45. A spring 50 having one end attached to box 10 and the other end to lever 40

urges lever 40 downward against the restraint of hook 49.

Lever 40 carries an eccentric pin 51 and latch arm 41 has attached to it a hairpin loop spring 52 doubled around pin 51. This places arm 41 under control of lever 40 through the resilient connection furnished by spring 52 and hence when lever 40 is latched up as described, arm 41 is drawn to the left, as shown in Figure 1, by pin 51. This brings latching edge 53 of lever 41 within the path of travel of latch lever 39 so that when lever 39 is raised to the cocked position its latching end 54 rests on latching edge 53, thereby holding lever 39 in latched position. Strong safety pin type spring 55 attached at one end to box 10 and at the other end to latch lever 39 urges lever 39 downward against the restraint of latching edge 53.

A shock absorbing bumper 60 backed up by bumper pad 61 is mounted at the bottom of the box to serve as a bumper for the ends of levers 39 and 40 when they are released and driven downward by their associated springs.

According to the present invention a second solenoid 62 is mounted within box 10 in the upper section of the box. Solenoid 62 has a sliding plunger 63 connected to one end of a lever 64 which is pivoted on a bolt 65 in the partition partially separating the upper and loyer portions of box 10. The lower end 67 of lever 64 extends downward to a position adjacent to solenoid 15. A coil spring 68 secured at one end to the upper end of lever 64 and at the other to box 10, normally pulls the upper end of lever 64 to the right (as shown in Figure 1) and hence draws plunger 63 to the outward extreme of its travel in solenoid 62.

A sliding bar 69 is mounted to slide on a series of grooved rollers 70 mounted on the outside of the frame of solenoid 15 whereby bar 69 is permitted to slide parallel to plunger 43 of solenoid 15. The left-hand end of plunger 43 and sliding bar 69 are bent toward each other and fit over opposite ends of screw 71 on control lever 45 so that both control lever 45 separately.

The right-hand end of bar 69 terminates in a pin 72. A disarming and safe arm 73 is pivoted on a bolt 74 in box 10. Bolt 74 has attached to it a tongue 75 extending out of box 10 and when the box is mounted in an aircraft this tongue is engaged by control means in the aircraft for effecting release of the bomb in unarmed condition, or for safe holding of the bomb. Upon rotation of bolt 74 in a clockwise direction, arm 73 prevents the release of lever 39 and hence positively prevents the dropping of a bomb. If arm 73 is rotated in a counterclockwise direction, it will effect the unarmed release of the bomb. Bolt 74 contains a counter-sunk recess 76 normally registering with pin 72 on the end of sliding bar 69 so that bar 69 may freely slide to release latch 49. However, when bolt 74 is rotated to either the "safe" or "unarmed release" position, recess 76 is moved out of registry with pin 72 and hence the surface of bolt 74 prevents the travel of bar 69 to the right and thus prevents release of arming lever 40.

Bar 69 carries a pin 77 on its outer face in a position to be engaged by lower end 67 of lever 64 when solenoid 62 is operated. It will thus be evident that the bomb may be released in armed condition upon operation of either of solenoids 15 or 62.

The circuit arrangement for three of such control boxes 10*a*, 10*b* and 10*c* is shown in Figure 3. The circuit comprises a battery 80 for supplying the electric energy necessary to operate the solenoids and suitable control switch means for connecting the battery to the solenoids in the manner and at the time desired. These may comprise a manual switch or key 81 for dropping a single bomb, an automatic pulsing circuit 82 for sending a series of battery pulses to drop a corresponding series of bombs and a salvo key 83 for dropping several bombs in a salvo. Pilot lights 84 are under control of contacts 23, 24 in the respective bomb dropping mechanisms 10 to indicate the loaded or unloaded condition of each of the mechanisms, thus showing whether or not the bomb carried by that particular position has been dropped.

Referring again to Figure 1, it will be noted that contact spring 25 is under control of bomb release lever 39 along with pilot light control spring 24. Thus when release lever 39 is cocked, contact spring 25 is held in engagement with cooperating contact 27, but immediately upon release of lever 39, contact 25 moves into engagement with contact 26 and opens its circuit with contact 27. Contact spring 19, however, is controlled in a different manner. This spring is controlled by a small lever 78 pivoted on shaft 46 and having a cam projection 79 at one end engaging the upper edge of lever 39 when lever 39 is cocked. The other end of lever 78 holds contact spring 19 down against contact 21 whenever arm 39 is cocked. Cam 79 is also in a position to engage a projection 98 on lever 45 whenever lever 45 is rotated in a clockwise direction by either solenoid 15 or solenoid 62. By this arrangement, spring 19 is held in contact with contact 21 not only when lever 39 is cocked but also as long as one of the solenoids remains energized with current from battery 80. It will thus be evident that while contact spring 25 transfers its contact connections the moment release lever 39 drops, contact 19 does not transfer its connections until release lever 39 has dropped and the actuating solenoid has been released. The function of the contacts and bomb dropping mechanism will be clear from the following description of their operation.

Should the bombardier wish to drop a single bomb, he will actuate key 81, thereby connecting battery 80 through contacts 19, 21 of box 10*a* to solenoid 15, thereby effecting release of levers 40 and 39 thus arming and dropping the bomb associated with mechanism 10*a*. Contacts 19, 21 remain closed until key 81 is released and the circuit opened after which solenoid 15 releases its plunger and allows contact spring 19 to transfer its connection to contact 20, thereby connecting the control circuit through contacts 19, 20 of mechanism 10*a* and contacts 19, 21 of mechanism 10*b* to solenoid 15 of mechanism 10*b*, thus preparing mechanism 10*b* for operation upon the next closure of the key 81. It will be apparent that each operation of key 81 will thereby effect the release of only one bomb.

Automatic pulsing circuit 82 is connected in parallel with key 81 and performs the same functions automatically in timed sequence whereby it is possible to effect the timed release of a series of bombs at spaced intervals.

Should the bombardier desire to release a salvo of bombs he will operate salvo key 83, thereby connecting battery 80 to solenoid 62 of mechanism 10*a* through closed contacts 25, 27. This effects the armed release of the bomb associated with mechanism 10*a* and immediately upon the dropping of lever 39 which releases the bomb, contact 25 transfers its connection from contact

27 to contact 26, thereby connecting the battery to contact 25 of mechanism 10b. Since contact 25 of mechanism 10b is at this time in engagement with contact 27 this immediately completes a circuit for the operation of solenoid 62 in mechanism 10b, thereby releasing the bomb associated with mechanism 10b. The circuit is then transferred to mechanism 10c releasing the bomb associated with that station.

It will be apparent, therefore, that operation of salvo key 83 results in the release of all the bombs of the series, one immediately after the other so as to produce a salvo of bombs. It will be further evident, however, that should any bomb release mechanism fail to operate to release its bomb through some failure of the circuit, none of the succeeding bombs of the circuit will be released. This prevents one bomb from falling upon the one below it should the lower bomb fail to be released.

Two solenoids, namely 15 and 62, are used in order that the device may function to maximum perfection under all conditions. However, it is apparent that in some cases the apparatus can be simplified by using a single solenoid connected to both the solenoid energizing conductors.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. In a bomb release system, a series of bomb release mechanisms, each of said mechanisms comprising a bomb release lever, an energy storage spring for actuating said lever, latching means for holding said lever in cocked position and electromagnetic means for releasing said latching means, and two electric control circuits for said system, the first of said circuits comprising a source of energy, a control key, and a series of transfer switches, all in series, each of said switches having a common contact and two opposite side contacts cooperating therewith, said common contact being biased toward the second of said side contacts, one of said transfer switches being mounted in each of said release mechanisms, each said common contact being connected to said control key through all preceding transfer switches in said series, the first of said side contacts being connected to said electromagnetic means and the second of said side contacts being connected to the common contact of the next succeeding transfer switch in said series, cam means controlled by said release lever engaging the common contact of its respective transfer switch to hold said contact in engagement with the first of said side contacts to connect said first control circuit to the electromagnetic means of said mechanism when said lever is cocked and releasing said common contact to transfer said contact to said second side contact and thereby transfer the control circuit connection to the next succeeding cocked mechanism responsive to release of said lever, the second of said electric control circuits comprising said source of energy, a second control key, and a second series of transfer switches all in series, each of said switches having a common contact and two opposite side contacts cooperating therewith, said common contact being biased toward the second of said side contacts, one of said second transfer switches being mounted in each of said release mechanisms, each said common contact being connected to said control key through all preceding transfer switches in said series, the first of said side contacts being connected to said electromagnetic means and the second of said side contacts being connected to the common contact of the next succeeding transfer switch in said series, cam means controlled by said release lever engaging the common contact of its respective transfer switch to hold said contact in engagement with the first of said side contacts to connect said second control circuit to the electromagnetic means of said mechanism when said lever is cocked and releasing said common contact responsive to release of said lever, said cam means also being controlled by said electromagnetic means for holding said common contact of its respective transfer switch in engagement with the first of said side contacts during energization thereof, whereby said second control circuit connection is transferred to the next succeeding cocked mechanism responsive to de-energization of said electromagnetic means after its energization to release said lever.

2. In a bomb release system, a series of bomb release mechanisms, at least one of said mechanisms comprising a release lever, latching means therefor and electromagnetic means for unlatching said means, and two control circuits for said mechanism both connected to a current source and each including a control switch, the first of said circuits including a transfer switch in said mechanism, said switch having a common contact and two opposite side contacts cooperating therewith, said common contact being biased toward the second of said side contacts, said common contact being connected to the first of said control switches, the first of said side contacts being connected to said electromagnetic means and the second of said side contacts being connected to the next succeeding bomb release mechanism of said series, cam means controlled by said release lever engaging said common contact to hold said contact in engagement with the first of said side contacts to connect said first control circuit to said electromagnetic means when said lever is cocked and releasing said common contact to transfer said circuit to said next bomb release mechanism responsive to release of said lever, the second of said circuits including a second transfer switch in said mechanism, said second switch having a common contact and two opposite side contacts cooperating therewith, said common contact being biased toward the second of said side contacts, said common contact being connected to the second of said control switches, the first of said side contacts being connected to said electromagnetic means and the second of said side contacts being connected to the next succeeding bomb release mechanism of said series, cam means controlled by said release lever engaging said common contact to hold said contact in engagement with the first of said side contacts to connect said second control circuit to said electromagnetic means when said lever is cocked and releasing said common contact responsive to release of said lever, said cam means also being controlled by said electromagnetic means for holding said common contact of said second switch in engagement with the first of said side contacts during energization thereof, whereby said second control circuit is transferred to the next bomb release mechanism responsive to de-energization of said electromagnetic means after its energization to release said lever.

3. A bomb release system comprising a series of

bomb release mechanisms, each of said mechanisms comprising a release lever, latching means therefor and a first and second release electromagnet alternatively individually controlling the unlatching of said latching means, a source of electric current, a first and second control switch external to said mechanism, a first and second control circuit leading through said series of mechanisms and connected respectively through said first and second control switches to said current source, and a first and second transfer switch in each of said mechanisms, each of said transfer switches having a common contact and two opposite side contacts cooperating therewith, said common contact being biased toward the second of said side contacts, the common contacts of said first and second transfer switches of each of said mechanisms being connected to said first and second control circuits, respectively, through the corresponding transfer switches of all preceding mechanisms in said series, the first of said side contacts of said first and second transfer switches of each of said mechanisms being connected to the first and second electromagnets respectively of their individual mechanisms, the second of said side contacts of said first and second transfer switches being connected to the respective common contacts of the next succeeding mechanism in said series, cam means controlled by the release lever of each mechanism engaging both its associated common contacts to hold said contacts in engagement with the first of said side contacts when said lever is cocked to connect the first and second electromagnets of its mechanism to said said first and second control circuits, respectively, leading through all preceding mechanisms of said series, and releasing said common contacts responsive to release of said lever, said cam means also being controlled by said second electromagnet of each mechanism for holding its associated second common contact in engagement with the first of said side contacts during energization thereof, and releasing said second common contact responsive to de-energization thereof, whereby said first control circuit is transferred to a succeeding mechanism immediately on release of a bomb and said second control circuit only on release of a bomb followed by de-energization of the releasing magnet.

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