Aug. 7, 1945. W. F. BOLDT 2,381,332

ATTACK WEAPON FOR AIRPLANES

Filed June 27, 1940 3 Sheets-Sheet 1

FIG. 1.

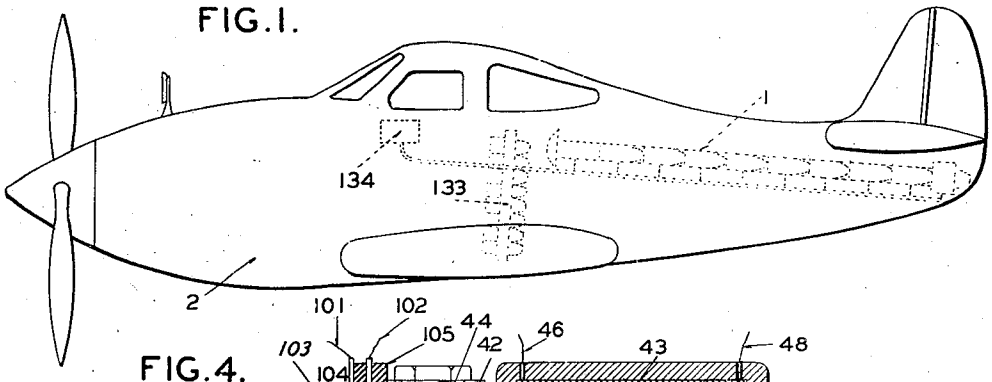


FIG. 4.

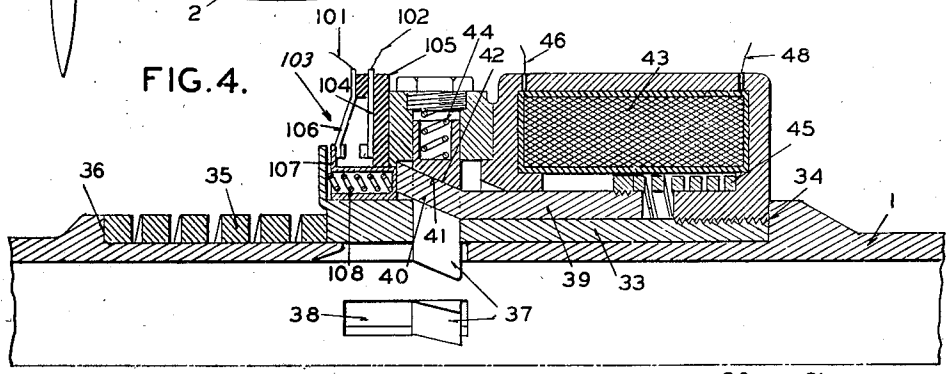


FIG. 6.

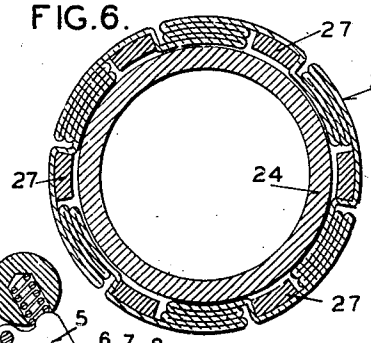


FIG. 7.

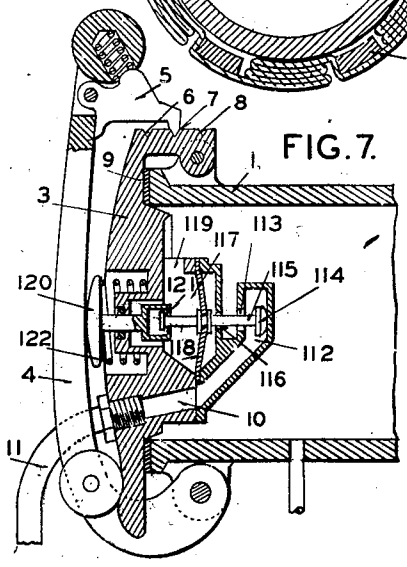
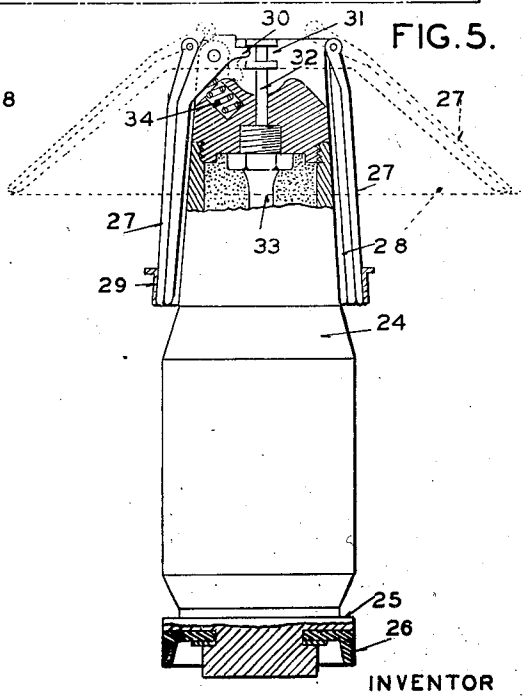


FIG. 5.



INVENTOR
W. F. BOLDT
BY
ATTORNEY

Aug. 7, 1945. W. F. BOLDT 2,381,332

ATTACK WEAPON FOR AIRPLANES

Filed June 27, 1940 3 Sheets-Sheet 2

FIG. 2.

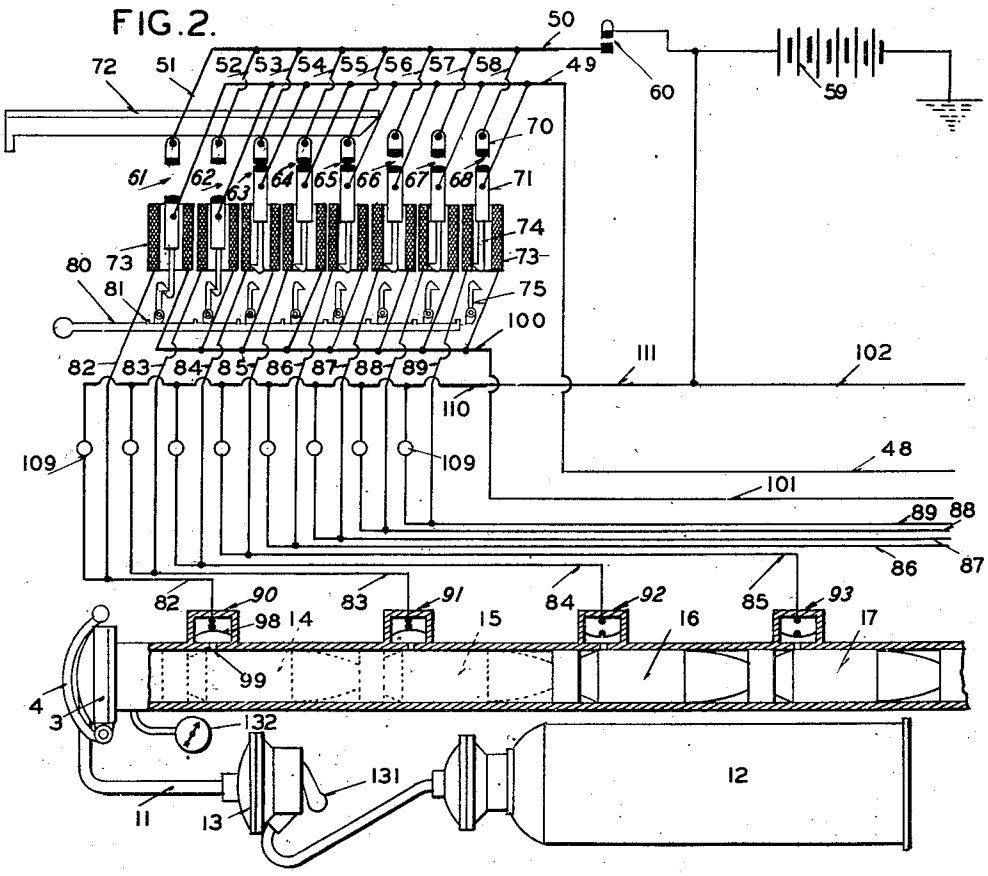
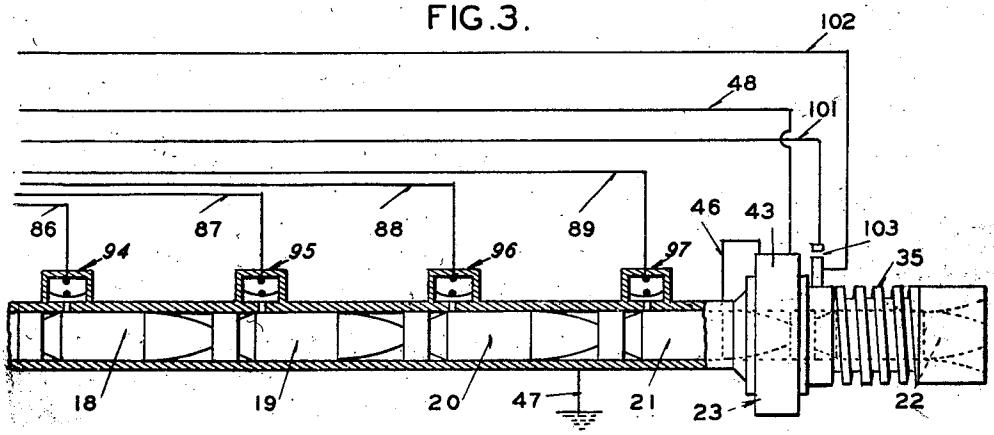


FIG. 3.



INVENTOR
W. F. BOLDT

BY

ATTORNEY

Aug. 7, 1945. W. F. BOLDT 2,381,332

ATTACK WEAPON FOR AIRPLANES

Filed June 27, 1940 3 Sheets-Sheet 3

FIG. 10.

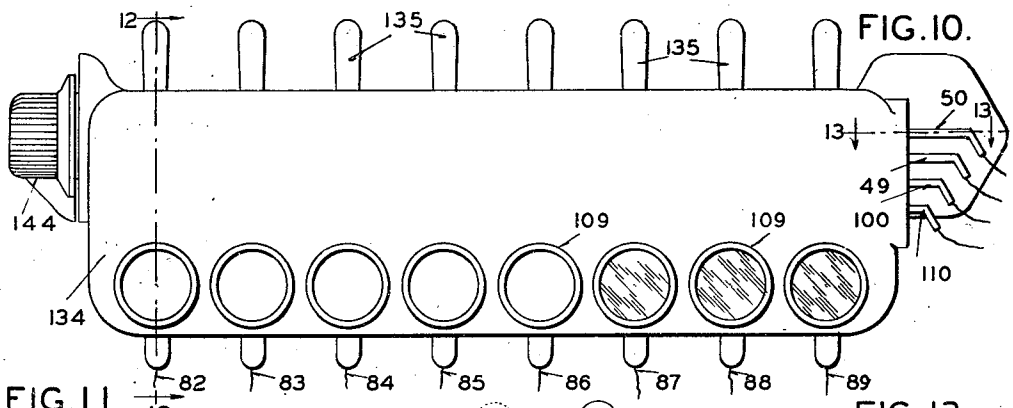


FIG. 11.

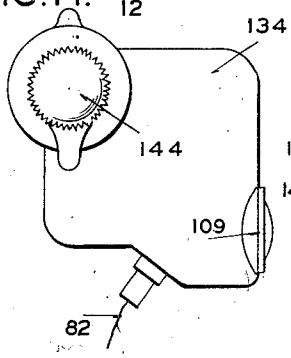


FIG. 12.

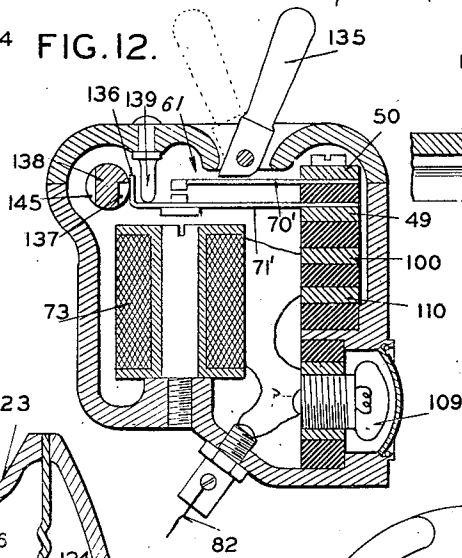


FIG. 13.

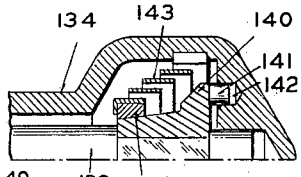


FIG. 8.

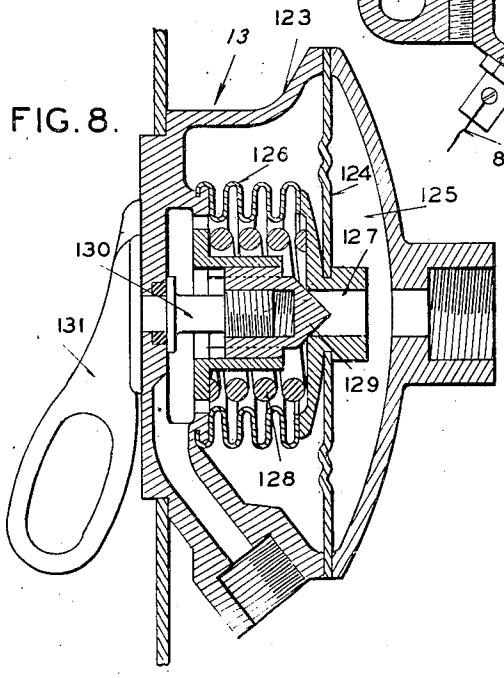
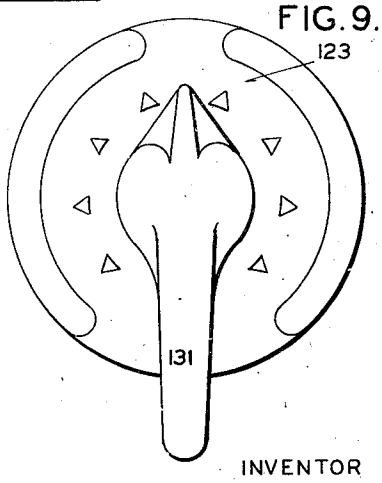


FIG. 9.



INVENTOR
W. F. BOLDT
BY E. C. Huffman
ATTORNEY

Patented Aug. 7, 1945 2,381,332

UNITED STATES PATENT OFFICE

2,381,332

ATTACK WEAPON FOR AIRPLANES

Werner F. Boldt, Clayton, Mo.

Application June 27, 1940, Serial No. 342,647

12 Claims. (Cl. 89—1.5)

My invention relates to an improved attack weapon for airplanes.

In accordance with present methods of aerial warfare the defense against bomber airplanes is anti-aircraft guns and pursuit or interceptor planes. Anti-aircraft guns are inefficient as a defense weapon because of the height of the bombers above the ground, the difficulty of properly timing of the explosion of the shell so as it will occur at the desired height and also the difficulty of aiming the shell so that it will be at or near the bomber when it explodes. When pursuit or interceptor planes are employed the pilot must depend on a machine gun or a small cannon to disable the bomber which is very difficult because of the high speeds of the planes and the few seconds in which the pilot of the pursuit plane has to accomplish his firing while at the same time maneuvering his plane.

One of the objects of my invention is to provide a new weapon for planes such as pursuit planes or light bombers which can be easily operated by the pilot above the object to be destroyed or damaged and when operated results in the releasing of explosive shells that are free to be carried earthward by gravity and so timed as to explode on or around the object.

Another object of my invention is to provide on an airplane a mechanism for releasing selectively either one or more explosive shells and when operated to release more than one to release them at predetermined intervals.

Still another and more specific object of my invention is to provide on an airplane a means for releasing a plurality of explosive shells from a tube by compressed fluid along with means for controlling the number and rapidity of release.

Another object of my invention is to produce a new explosive shell for discharge from a tube on an airplane which is so constructed that its exploding will take place at a predetermined time after the discharge from the tube.

Yet another object of my invention is to produce a new explosive shell which when dropped from an airplane will have its speed with respect to the earth considerably decreased in order to permit the airplane to move away from the shell in the same direction in which both are traveling.

Other objects of my invention will become apparent from the following description taken in connection with the accompanying drawings in which Figure 1 is a perspective view of an airplane equipped with my improved weapon; Figures 2 and 3 taken together are a combined schematic and diagrammatic view of the weapon showing the discharge tube, the shells therein, the fluid pressure system for releasing said shells and the electrical means for controlling the release; Figure 4 is an enlarged sectional view of the electro-magnetically actuated releasing mechanism at the end of the discharge tube; Figure 5 is a view partly in section of the shell; Figure 6 is a sectional view of the shell showing the manner in which its umbrella is folded thereabout; Figure 7 is an enlarged sectional view of the loading end of the tube; Figure 8 is a sectional view of the control valve for predetermining the fluid pressure acting on the shell; Figure 9 is a front view of the setting mechanism for the control valve of Figure 8; Figure 10 is a view of a particular switch control box that can be employed for preselecting the number of shells that are to be released; Figure 11 is an end view of the box; Figures 12 and 13 are sectional views taken on the lines 12—12 and 13—13 of Figure 8 showing details of construction.

Referring first to Figures 1 to 9 and particularly to Figure 1 there is shown a shell receiving tube 1 which is built into the airplane 2 along the fuselage from a point adjacent the pilot's compartment toward the rear of the plane. If desired the plane may be provided with more than one tube and the rear ends of the tubes may be on opposite sides of the pilot so that they can be easily reloaded in a manner to be later described.

As shown in detail in Figure 7 the tube at its rear end has hinged thereto a door 3 and is held closed by a hand lever 4 pivoted to the opposite side of the tube. The end of the lever carries a spring biased detent 5 to hold the lever in door locking position by engagement with any of three notches 6, 7 and 8. The door carries a gasket 9 so that it will be sealed tight with the end of the tube. The door is provided with an inlet 10 for admitting fluid under pressure to the rear of the tube, said inlet being connected with a conduit 11 leading from a source of compressed fluid stored in a tank 12 (Figure 2). Interposed in the conduit is a pressure regulating valve 13 for predetermining the fluid pressure effective in the tube. This valve is shown in detail in Figures 8 and 9 and will be later described.

The tube may be made of any length to contain the desired number of shells which are to be discharged therefrom. As shown it is of a length to be loaded with nine shells, 14, 15, 16, 17, 18, 19, 20, 21 and 22. The shells are held in

the tube by a catch mechanism which cooperates only with the forward shell 22. The forward end of each shell after the first abuts the shell ahead of it in the manner shown in Figures 2 and 3. Fluid pressure from the storage tank acts on the rear shell.

The shells are of special construction but may be of either the shrapnel type or high explosive type. Each shell as shown in Figures 5 and 6 comprises a casing 24 having an annular shoulder 25 at its base end and a sealing cup 26 of rubber or like material which will prevent leakage of compressed fluid past the shell. The rear shell in the tube is the only one that requires the sealing cup but in order to permit the shells to be loaded in any order they are all equipped with cups. The forward end of the shell casing has pivoted thereto a plurality of arms 27 which with fabric or other material 28 secured thereto form a parachute. The arms and the fabric when suitably folded, snugly surround the forward end of the shell as shown in Figure 6, and are normally held in such position by a safety ring 29 which is pushed off when the shell is inserted in the rear end of the tube. These arms 27 are provided with projections 30 which engage in a groove 31 of a pin 32 which controls the timing fuse 33 for setting off the usual charges in the shell (not shown) such as the igniting charge, the detonating charge and finally the explosive charge. All of the arms 27 of the parachute are acted upon by springs 34 (only one being shown) for opening the parachute when the shell is released out of the end of the tube. The movement of the levers to parachute open position moves the pin 32 and operates the fuse.

The catch mechanism 23 for holding the front shell in the tube and for controlling the release of the shells is shown in detail in Figure 4. Positioned on the tube 1 is a slidable sleeve 33' biased into engagement with a shoulder 34' by a strong coil spring 35 surrounding the tube and interposed between the sleeve and a second shoulder 36. Carried by the sleeve are a plurality of detents 37 circumferentially spaced and positioned to slide at right angles to the tube. These detents project into the tube through longitudinal slots 38 and cooperate with the shoulder 25 on a shell to hold the shell and also those rearward thereof in the tube. Slidably mounted on the sleeve 33' is a second sleeve 39 having projections 40 provided with cam surfaces 41 for cooperating with cam surfaces 42 on the detents. The sleeve 39 is surrounded by a magnetic coil 43 which when energized moves the sleeve longitudinally toward the rear of the tube and thus pulls the detents radially outward so as to no longer hold a shell from being pushed out of the tube by the fluid pressure acting thereon. Each detent is biased inwardly by a spring 44 and a spring 45 biases the sleeve 39 to a position where the detents are free to extend into the tube.

Referring to Figures 2 and 3, the electric control for the magnetic coil will now be described whereby the detents 37 may be withdrawn to release either one shell or any other number. One end of the coil 43 is connected to the tube by a conductor 46 and then to ground by a conductor 47. The other end of the coil is connected to a conductor 48 which in turn is connected to a conductor bar 49. This bar is connected to another bar 50 by a plurality of parallel circuits 51, 52, 53, 54, 55, 56, 57 and 58. The bar is connected with a grounded battery 59 through a manual push button switch 60. Interposed in the parallel circuits are switches 61, 62, 63, 64, 65, 66, 67 and 68 each comprising movable contact elements 70 and 71 which are normally open. The switches are shown as being movable to closed position by a manual slide bar 72 which cooperates with the movable contact element 70 of each switch in succession. Thus any number of switches can be closed as desired.

The movable element 71 of each switch is moved by a solenoid 73 whereby the switch, if closed by the slide bar, can be opened notwithstanding said bar is in a switch closing position. Also each movable contact element 71 carries a catch element 74 for engaging a pivoted hook 75 to thus hold the element 71 in its opened position after being moved by the solenoid. The catches 74 can be released from the hooks by a slide rod 80 having lugs 81 for swinging the hooks.

The solenoids are connected in parallel circuits 82, 83, 84, 85, 86, 87, 88 and 89 grounded through the tube and provided with switches 90, 91, 92, 93, 94, 95, 96 and 97 mounted in longitudinal spaced relation on the tube. Each of these switches has a contact element carried by a diaphragm 98 which can be acted on by the compressed fluid in the tube through a port 99. The switches are normally open when shells are in the tube since no fluid pressure can act on the diaphragms. Whenever a shell is released out of the end of the tube and the shells move forward a switch will be closed. Thus the switch 90 will be closed when the first shell is released. When a second shell is released the switch 91 will be closed and so on. All the switches will be caused to be closed when eight shells are released. The parallel circuits containing the solenoids are connected to a common conductor bar 100. This bar is connected by conductors 101 and 102 and a switch 103 to the battery in the manner shown.

The switch 103 is adapted to be closed by the withdrawal of the detents 37 at the forward end of the tube and as shown in Figure 4 the switch is preferably so mounted as to be controlled by the sleeve 39. One element 104 of the switch is fixed to an insulation member 105 mounted on the sleeve 33'. The other element 106 is yieldable and is engaged by a slidable member 107 which is acted on by a spring 108 for holding it in engagement with a projection 40. Thus when the sleeve 39 is moved by the energization of coil 43 to withdraw the detents the spring 108 will move the slidable member 107 and cause the element 106 to contact element 104 and close the switch after the detents are completely withdrawn from the tube.

Each of the parallel circuits 82, 83, 84, etc., have associated therewith lamps 109, one terminal of which is connected to a parallel circuit and the other terminal of which is connected to a conductor bar 110 which in turn is connected by a conductor 111 to the conductor 102 connected to the battery. Thus whenever a parallel circuit is energized to energize a solenoid a lamp will be lighted to show that such circuit has been closed. This indicates the number of shells which have been released because the parallel circuits and solenoids cannot be energized until shells have been released to close the switches 90, 91, and 92, etc.

Referring again to Figure 7 there is shown as-

sociated with the door 3 of the tube a valve mechanism for controlling the flow of fluid under pressure from the tank to the tube. The inlet 10 leads into a chamber 112 having a port 113 connecting it to the tube. Cooperating with the port is a valve element 114 carried on a stem 115 which extends through a slightly oversize hole 116 and into a chamber 117 where it is secured to a diaphragm 118 dividing the chamber 117 into two compartments. The left side of the chamber is in direct communication with the tube by a port hole 119. The stem is manually controlled by a push button 120 projecting through the door and connected to the stem by a lost motion connection 121. The button is adapted to be engaged by the lever 4 and is biased outwardly by a spring 122.

When the lever is in a position to open the door the spring 122 acting through the push button will seat valve element 114 thus cutting off communication between the tank and tube. The same condition is present if the door is closed and the lever is in a position where detent 5 on the lever engages notch 6. If the lever is in a position where detent 5 engages notch 8 then the valve element 114 will be positively held off its seat and fluid under pressure can flow into the tube continuously.

If the lever, after having the detent set in notch 8, is withdrawn after a short period of time and the detent placed in the central notch 7 then the valve element will be so conditioned that it will close automatically if the pressure in the tube should suddenly drop to atmospheric pressure as when the last shell is discharged out of the tube. With the valve element open and fluid pressure in the tube there will be equal pressure on each side of diaphragm 118 due to the leak hole 116. When the fluid pressure in the tube drops suddenly to atmospheric value the pressure on the left side of the diaphragm will drop also to atmospheric value but pressure will be partially sustained on the right side of the diaphragm due to the smallness of the hole 116. The diaphragm will thus be thrown to the left thereby closing the valve element. The pressure acting on the head of said valve element will maintain it closed.

As previously mentioned the pressure of the fluid admitted to the tube is regulated by the valve 13. This pressure determines the rapidity at which the shells are released, that is, the time interval between the discharge of the shells when more than one is released by maintaining the detents of the catch mechanism withdrawn. If a high pressure is employed more shells will be ejected in a given period of time than if a lower pressure is employed. As shown in Figures 8 and 9, the valve mechanism comprises a casing 123 provided with a diaphragm 124. The chamber 125 on the right side of the diaphragm is connected to the conduit leading to the tube. On the other side of the diaphragm there is provided a bellows 126 connected to the diaphragm and the casing and communicating with the conduit leading from the storage tank. A port hole 127 connects the bellows with chamber 125. A spring 128 acts on the diaphragm and biases it to the right. Within the bellows is a guide support for a valve element 129 associated with the port hole and which is held against rotative movement but is free to move axially. This valve element has a threaded bore for cooperation with a threaded stem 130 rotatably mounted in the casing and having secured to its outer end a lever 131. Suitable indicia can be placed on the casing for indicating positions of the lever corresponding to certain pressures which determine the time intervals between the shells being discharged. By rotating the stem the axial position of the valve element can be changed relative to the port in the diaphragm.

With the valve structure just described it is apparent that with a high pressure in the tank a reduced presssure can be maintained in the tube. As soon as a predetermined pressure builds up in the tube and the chamber 125 the diaphragm will be moved to the left and engage the valve element so that no more pressure can build up. The predetermined pressure is determined by the spring 128 and the position of the valve element. By changing the position of the valve element (turning the lever) the pressure necessary to move the diaphragm against the spring and to a position where the port hole will be closed can be changed. If desired the tube can be provided with a pressure gauge 132 (Figure 2).

In operation of the attack weapon just described the tube is first loaded with the nine shells which will be held in the tube by the detents of the catch mechanism engaging the shoulder 25 on the forward shell. The door to the tube is closed and the detent placed in the notch 8. Fluid under pressure determined by the rotating valve 13 will now be admitted to the tube. The lever is now moved back so that the detent is in notch 7 whereby the valve element 114 can automatically close and cut off the air when all the shells have been released. When it is desired to release the shells the number of shells to be released is first preselected. This is done by moving the slide 72 so as to close the desired number of switches 61, 62, 63, etc. If eight shells are to be released all the switches are closed. As shown in Figure 2 the slide is set to release five shells. All that is necessary now is to close the push button switch 60 which may be positioned at any point desired as for example on a control element of the airplane. The coil 43 of the releasing mechanism is now energized and the detents 37 withdrawn. The fluid pressure behind the shells now forces the shells out, the speed of release (the number of shells released in a given period of time) being determined by the fluid pressure in the tube. If the push button is held down the five preselected shells will be discharged.

As the first shell is discharged and the remaining shells move forward in the tube the port hole 99 of switch 90 will be uncovered and fluid pressure will close the switch thus energizing the solenoid 73 in the parallel circuit 82, the switch 103 already having been closed by the withdrawal of the detents. The element 71 of switch 61 will now be moved downward and locked and said switch opened. The lamp 109 associated with parallel circuit 81 will also be lighted to indicate that one shell has been released. As shown in Figures 2 and 3 two shells have been released of the five preselected. When all five preselected shells have been released the coil 43 will be no longer energized and therefore the spring 45 will act on the sleeve and permit the detents to again extend into the tube. These detents will now engage the shoulder on the sixth shell and retain it, and the remaining shells not preselected, in the tube. The spring 35 will absorb the shock of the shell being engaged by the detents, and the recoil

is dampened by the air pressure acting on the rear shell.

When a shell is released the parachute thereof is immediately opened by the springs **34** and as the umbrella reaches full open position under influence of the air drag it sets off the time fuse. The shell also immediately begins to fall under the influence of gravity, the distance of fall, neglecting air friction, being approximately 16 feet at the end of the first second, 64 feet at the end of the second, 144 feet at the end of the third second, etc. as is well known. If the time fuse is set for three seconds the shell will have dropped about 200 feet at the time it explodes. The opening of the parachute results in added area acted upon by the air and therefore the rate of speed in the direction of the plane will be reduced, thus permitting the airplane to draw away from the shell as well as being above the shell at the time it explodes.

When an airplane, especially a pursuit plane is equipped with the weapon just described it is possible to attack a bomber with almost certainty of either destroying or damaging it and with minimum danger to the pursuit plane and pilot. Since it is possible with the device to release the eight shells in about one second a barrage can be laid down in such a manner that at least one shell should be effective. The short time in which the shells are released does not permit the bomber to maneuver away from the barrage. All the pursuit plane pilot need do is dive down from above either ahead or behind the bomber at a very high speed, such as 400 to 600 miles per hour and then level off above the bomber at say about 200 feet, provided the time fuse of each shell is set so as to explode the shell in three and one-half seconds or by the time the shell has fallen groundward about 200 feet. If the pursuit plane is coming from the rear of the bomber the pilot will select the number of shells he wishes to release and at the proper time before he gets directly over the bomber presses the push button switch **60** and holds it closed. The selected number of shells will then be released in succession and fall groundward. At the same time they will continue to move in the direction of flight of the plane but at a slower speed due to the parachute acting as a decelerator. Since bombers only travel about 250 miles an hour whereas pursuit planes can travel as high as 600 miles per hour when coming out of a power dive the released shells at the time of their explosion will be at or near the bomber. If the first shell explodes at the rear of the bomber the next one will explode forward of said first shell because it is released after the first shell. Since the effective range of each shell when exploded is around a radius of approximately two hundred feet, depending on the burst pattern, one or more of the released shells will be bound to do damage to the bomber. The exploding of the shells cannot do damage to the pursuit plane because as previously stated the plane will be both above and ahead of the shell a good distance when it explodes. If all eight shells are released the distance between the first and last exploded shell will be approximately fifteen hundred feet or somewhere near a quarter of a mile. If it is desired to have a smaller range a fewer number of shells will be released successively. Thus it is seen it will be almost impossible for the bomber to escape undamaged.

The range covered by the exploding shells of course will vary according to speed of the pursuit plane and the time interval between release of the shells. The time interval however can be varied by increasing or decreasing the fluid pressure acting on the rear shell.

If a frontal attack is made on the bomber the beginning of the release of the shells must be made when the plane is farther away from the bomber than when a rear attack is made because the pursuit plane and bomber are traveling toward each other.

In making the attack the pursuit plane pilot need only make two estimates and these need not be accurate. He must first judge by his sights the distance that he must keep above the bomber and the time at which he must begin to release the shells. To operate the weapon he need only push a button thus leaving himself practically free to maneuver his plane. In a frontal attack the shells will be all released before he gets directly above the bomber thus he is free to climb above and away from the bomber before the guns carried by said bomber can be fully effective. In a rear attack the shells will all be released by about the time the pursuit plane is just over the bomber thus also giving the pilot a chance to get quickly out of the range of the bomber's guns.

A plane using the attack weapon described can make a very successful frontal attack which was heretofore practically impossible with any degree of success. Also the weapon gives the pilot the means to obtain the fire power of an extremely large caliber gun and continue with the fire rapidity of a smaller caliber gun such as a machine gun, since the eight shells can if desired be all discharged in approximately one second. The attack weapon is also very efficient in strafing troops at a low altitude as the plane can release the shells and be away before the shells explode. If shrapnel shells are used, terrific damage can be inflicted over a considerable area.

Only eight shells or a lesser number can be released successively in the described nine shell tube. The ninth shell remains in the tube for defense purposes in case of an attack on the pursuit plane. This shell, however, can be released by resetting the switch **61** after releasing the hooks. All that is necessary then to release the shell is to push the button switch **60**.

In equipping the plane with the attack weapon, it is also advisable to permit the tube to be reloaded by the pilot in flight. This can be accomplished by employing a shell rack **133** (Figure 1) at the rear end of the tube. This rack is preferably built so that the extra shells are one above each other, with the upper one directly behind the door of the tube. The door can then be opened and the shells pushed directly into the tube by using only one hand. A spring arrangement (not shown) can be employed to move the shells up in the rack as the top shell is pushed into the tube. With these extra shells the pilot after making an attack can climb up above the bomber again, reload with one hand and come back again for another attack on the same or a different bomber. If each pursuit plane has two tubes and two extra load racks, the pilot can make four attacks with eight shells or even more attacks if fewer shells are released at one time. If less than all the shells are released, the pilot can reload before releasing the remaining shells if he so desires.

In Figures 10, 11, 12 and 13, there is shown a

control box which may be used for the diagrammatic arrangement shown in Figure 2. The casing 134 contains all the preselecting means for closing the switches 61, 62, 63, etc., the solenoids 73 for opening the switches, and the lamps for indicating the number of shells released. Extending into the casing are the conductor bars 49, 50, 100 and 110, suitably insulated. Each of the switch constructions are identical, switch 61 being shown in section in Figure 12. The contact elements 70' and 71' are in the form of leaf springs attached respectively to the bars 50 and 49. Each switch is closed by a lever 135 pivoted in the top of casing 134. Within the casing are the solenoids 73, one being positioned under each leaf spring 17'. Also at the side of the casing are the lamps 109 connected in the same manner as in the diagrammatic showing. Each leaf spring contact element 71' has a turned up portion 136 for engaging in a recess 137 of a rotatable shaft 138 journaled in the casing. When the leaf spring is pulled down by the solenoid, the portion 136 will snap into the recess to positively hold the switch open in the same manner as is done by the hooks 75 in Figure 2. A stop 139 limits the upward movement of the leaf spring 71'.

The operation of the control box is the same as the control arrangement shown diagrammatically. The switches 61, 62, 63, etc., are closed by the levers 135. The number of shells desired to be released in succession are preselected by moving the levers from right to left as viewed in Figure 12. As the shells are released, the solenoids 73 are energized and the switch opened and the lamp lighted.

The rotatable shaft 138 has secured to its end a collar 140 carrying a projection 141 which fits into a recess 142. A coil spring 143 is connected to the shaft by a friction ring 143' and biases it to a given position. The spring also acts axially on the shaft to hold the projection in the recess. The outer end of the shaft has a knurled button 144 thereon for rotating the shaft. The construction permits the switches 61, 62, 63, etc., to be reset. To accomplish this the shaft 138 is pulled longitudinally to release the projection 141 and then rotated counter-clockwise (Figure 11) 360 degrees. The recesses 145 in the opposite side of the shaft from the recesses 137 permit the leaf spring 71' to again assume its position engaging stop 139. To release the ninth shell the control shaft is turned only 180 degrees in a counter-clockwise direction. This again closes the switches so that when the button 60 is pressed, the detents will release the shell.

Being aware of the possibility of modifications in the particular structure herein described without departing from the fundamental principles of my invention, I do not intend that its scope be limited except as set forth by the appended claims.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A discharge mechanism for explosive shells comprising a tube to contain the shells, a catch mechanism cooperating with the forward shell for holding the shells in the tube, means for placing fluid under pressure behind the last shell, and means for so controlling the catch mechanism that any number of the shells in the tube can be released successively, said last named means comprising means for preselecting the number of shells to be released, and means for releasing the catch mechanism and holding it released while said preselected number of shells is released.

2. A discharge mechanism for explosive shells comprising a tube to contain the shells, a catch mechanism cooperating with the forward shell for holding the shells in the tube, means for placing fluid under pressure behind the last shell, a solenoid for releasing the catch mechanism, a plurality of parallel electrical circuits for the solenoid, a switch for each circuit, manually-controlled means for closing the switches, and automatically-controlled means for opening the circuits successively upon the release of the shells.

3. A discharge mechanism for explosive shells comprising a tube to contain the shells, a catch mechanism cooperating with the forward shell for holding the shells in the tube, means for placing fluid under pressure behind the last shell, a solenoid for releasing the catch mechanism, a plurality of parallel electrical circuits for the solenoid, a switch for each circuit, manually-controlled means for closing the switches, electrically-controlled means for automatically opening the circuits successively upon the release of the shells, and means for positively holding said switches open.

4. A discharge mechanism for explosive shells comprising a tube to contain the shells, a catch mechanism cooperating with the forward shell for holding the shells in the tube, means for placing fluid under presure behind the last shell, a solenoid for releasing the catch mechanism, a plurality of parallel electrical circuits for the solenoid, a switch for each circuit, manually-controlled means for closing each switch, a solenoid for opening each switch, electrical circuits for each of the last named solenoids including a switch, and means for closing the last named switches successively in accordance with release of the shells.

5. A discharge mechanism for explosive shells comprising a tube to contain the shells, a catch mechanism cooperating with the forward shell for holding the shells in the tube, means for placing fluid under pressure behind the last shell, a solenoid for releasing the catch mechanism, a plurality of parallel electrical circuits for the solenoid, a switch for each circuit, manually-controlled means for closing each switch, and means controlled by fluid pressure for opening a circuit each time a shell is released.

6. In a discharge device for explosive shells comprising a tube to contain the shells, a source of fluid pressure connected to the rear of the tube and acting directly against and on the rear shell, catch mechanism for the forward shell, control means for the catch mechanism to release the shells, valve means for closing the connection between the source of fluid pressure and the tube, and means for automatically closing said valve means when the last shell is forced out of the tube, said last named means comprising a movable member subjected on opposed sides thereof to fluid pressure from the source when the tube is not empty and arranged to have the fluid pressure on one side rapidly reduced to atmospheric pressure when the tube is emptied.

7. A discharge device for explosive shells comprising a tube to contain the shells, a door for the rear of the tube, a source of fluid pressure connected to the rear of the tube and acting on the rear shell, catch mechanism for the forward shell, control means for the catch mechanism

to release the shells either individually or in groups, valve means for closing the connection between the source of pressure and the tube, and means for automatically causing the valve means to be closed when the door is open and open when the door is closed.

8. A discharge device for explosive shells comprising a tube to contain the shells, a catch mechanism for engaging the forward shell, means for operating the catch mechanism to release the shells either individually or in groups, said catch mechanism when releasing a group of shells being held in an inoperative position until said group is released, fluid pressure means acting on the rear shell for forcing the shells out of the tube in successive order when the catch mechanism so permits, and pre-settable means associated with the last named means for varying the fluid pressure and the time interval between release of the shells when the catch mechanism is controlled to permit release of more than one shell.

9. A discharge mechanism for explosive shells comprising a tube to contain the shells, each provided with means for cooperation with a catch mechanism, a catch mechanism for cooperating with the forward shell for holding the shells in the tube, means for placing fluid under pressure behind the last shell, means for operating the catch mechanism to release the forward shell, and spring means associated with the catch mechanism and permitting the mechanism to move relatively to the tube for absorbing shock when the catch mechanism cooperates with a succeeding shell to hold it in the tube after release of the forward shell.

10. A discharge mechanism for explosive shells comprising a tube to contain the shells, a catch mechanism cooperating with the forward shell for holding the shells in the tube, means for placing fluid under pressure behind the last shell, means for controlling the catch mechanism so as to release said shells either individually or in groups, and means for varying at will the fluid pressure acting on the last shell so as to vary the interval of time between the shells when released in groups.

11. A discharge mechanism for explosive shells comprising a tube to contain the shells in end-to-end relation, a catch mechanism capable of cooperating with each of the shells but engaging the forward shell only for holding the shells in the tube, means for producing a pressure acting on the rear end of the rear shell for forcing the shells out of the tube, and control means for the catch mechanism, said control means comprising means for preselecting the number of shells to be released and means for releasing the catch mechanism and holding it released while said preselected number of shells is released and means controlled by the number of shells released for causing the catch mechanism to again become operative.

12. A releasing mechanism for a plurality of explosive members, said releasing mechanism comprising settable means having definite settable parts for preselecting any number of explosive members to be released other than at least one, and means for releasing said preselected number of explosive members and also the explosive member which cannot be preselected, said last named means embodying means for releasing of the one member which cannot be preselected but only in the event of a resetting of a part of the settable means of preselecting means to a position corresponding to a preselection of a member which has been previously released.

WERNER F. BOLDT.