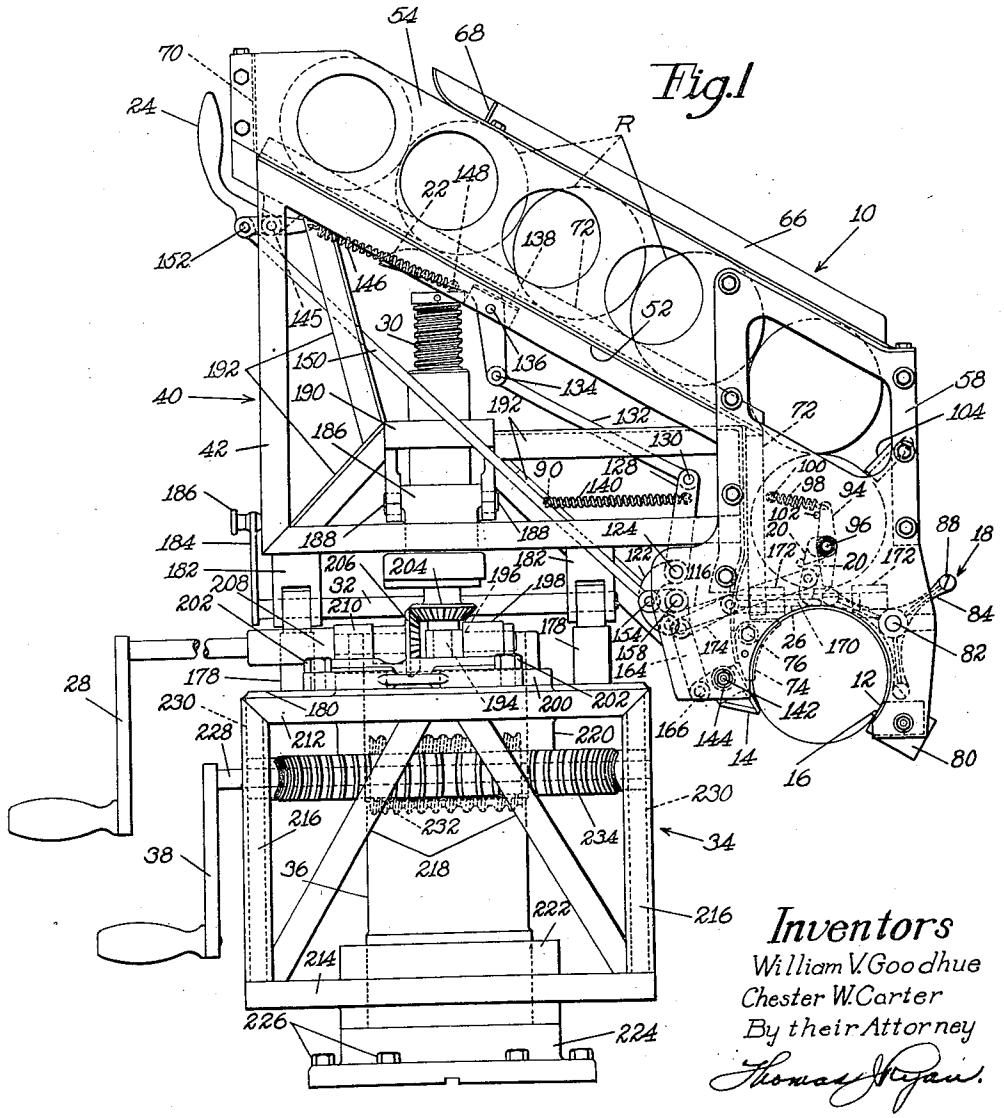
Oct. 12, 1948. W. V. GOODHUE ET AL 2,450,951

ROCKET LAUNCHER

Filed Sept. 25, 1946

4 Sheets-Sheet 1

Fig. 1



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ROCKET LAUNCHER

Filed Sept. 25, 1946 4 Sheets-Sheet 2

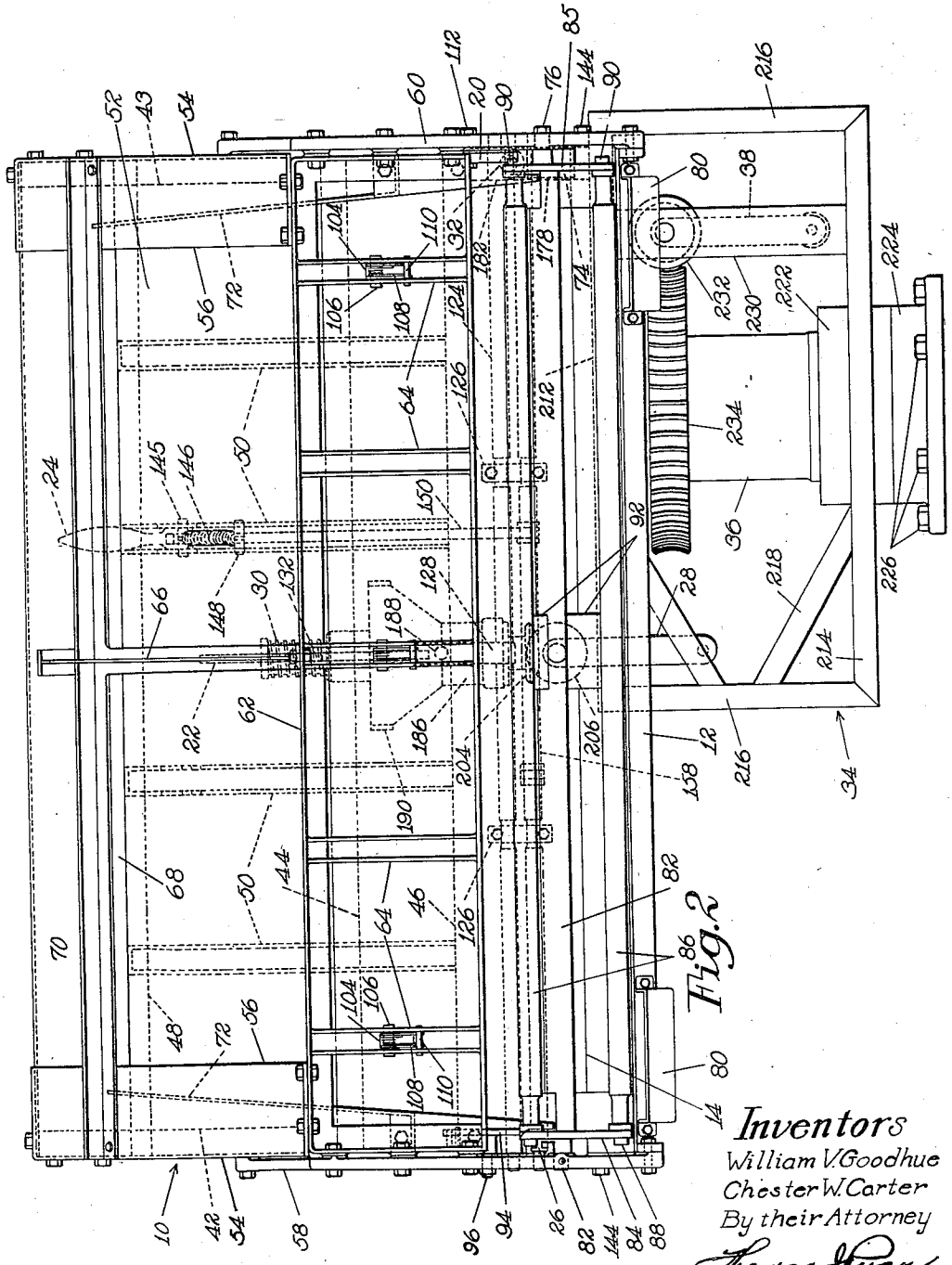

Fig. 2

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ROCKET LAUNCHER

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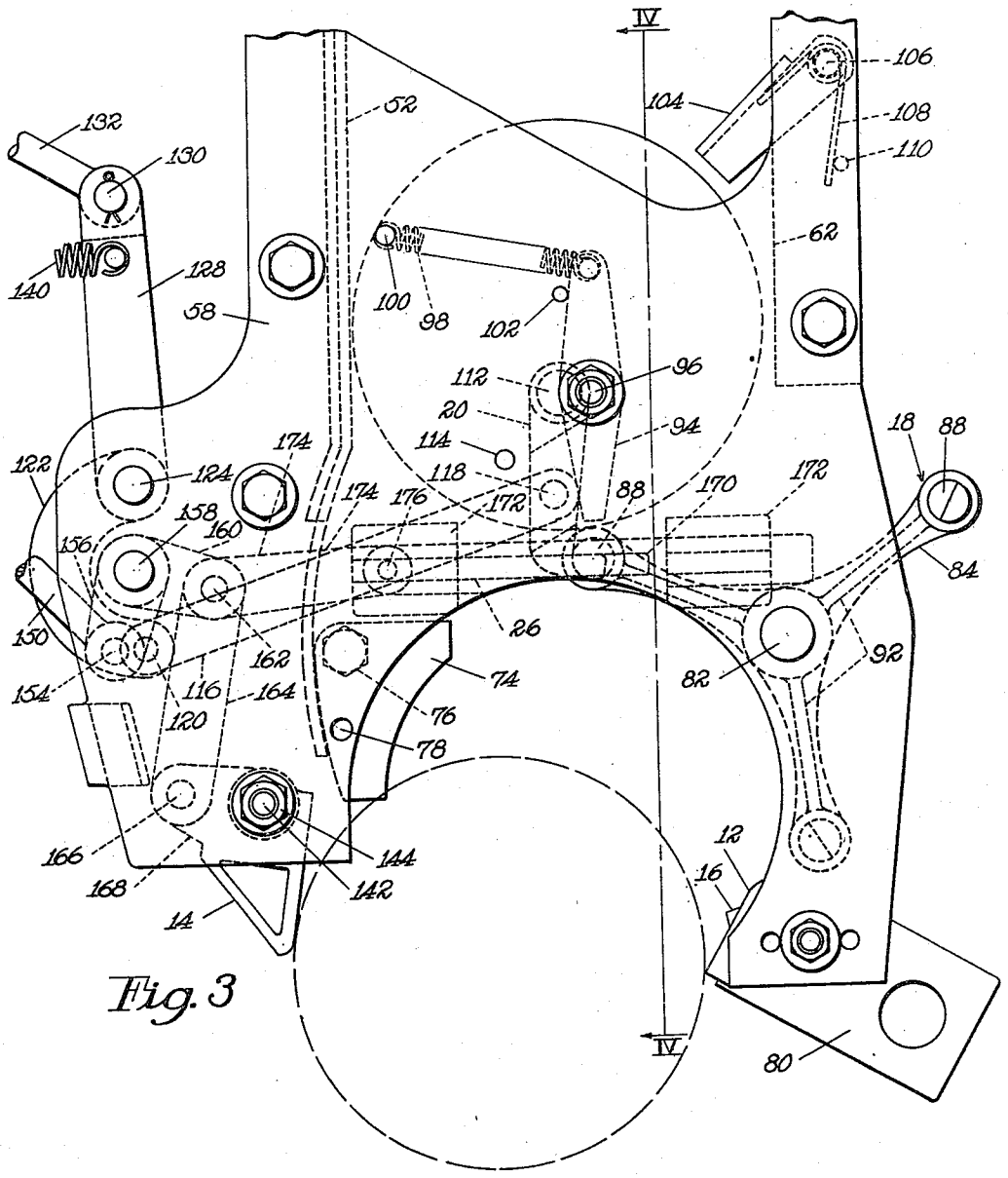

Fig. 3

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ROCKET LAUNCHER

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4 Sheets-Sheet 4

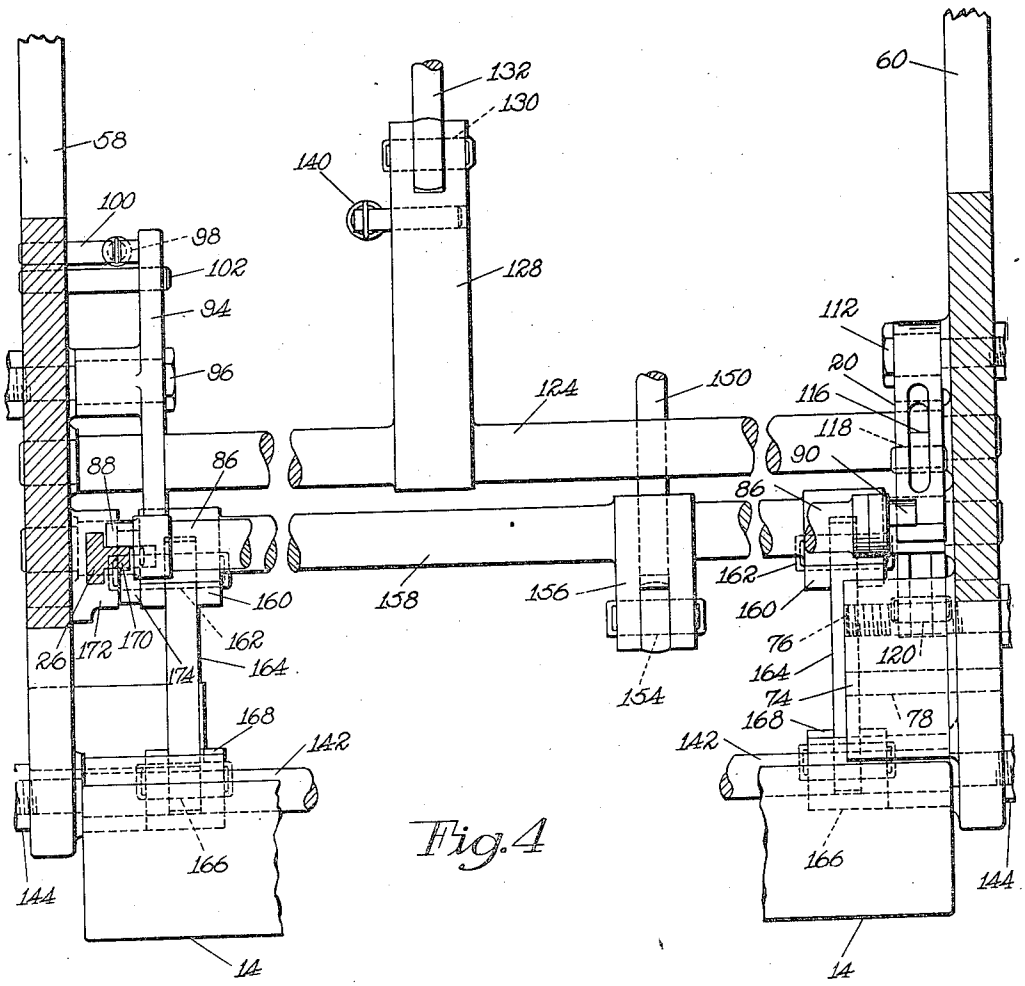

Fig. 4

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UNITED STATES PATENT OFFICE

2,450,951

ROCKET LAUNCHER

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Application September 25, 1946, Serial No. 699,294

3 Claims. (Cl. 89—1.7)

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This invention relates to rocket launchers and more particularly to a launcher of the type disclosed in application for United States Letters Patent Serial No. 683,674, filed on July 15, 1946, in the name of W. V. Goodhue.

In the operation of the launcher referred to above, rockets are advanced by gravity from a magazine into firing position on a launching way from which they are automatically fired upon engaging the terminals of an electrical firing circuit, assuming the circuit to be closed. Firing is interrupted by opening the firing circuit, in which case the advance of all the rockets in the magazine is stopped by the rocket in firing position. Firing is resumed immediately merely by closing the firing circuit, since a rocket is always in firing position unless the supply of rockets in the magazine has been exhausted. Firing by single fire with this launcher is effected by closing the firing circuit and then opening it immediately, before the rocket next to be fired can reach the firing position.

The presence of a rocket always in firing position, as well as the quick action required at the firing switch for firing by single fire, gives rise to an element of danger in the use of the prior launcher which it is an object of the present invention to avoid, without detracting from desirable features of operation such as a high rate of continuous fire as well as easily controlled and quick firing by single fire.

In view of the foregoing, the present invention provides an improved rocket launcher in which provision is made, upon cessation of firing, for stopping the advance of the rocket next to be fired just short of the firing position, whereby the firing position is unoccupied by a rocket whenever it is intended not to fire.

As in the prior launcher, the advance of rockets toward the firing position is under the control of a gate which is operated by that movement of the rocket in firing position immediately preceding its arrival in firing position.

In the present launcher, however, there is novel means, constituting a feature of the invention, for immobilizing the gate, and hence preventing the advance of a rocket into firing position, whenever the supply of rockets in the magazine is depleted to a certain number. As herein illustrated, this means includes a trigger which is operated by a certain rocket in the succession of rockets behind that in firing position to render the above-mentioned means inoperative so long as the launcher is loaded with a speed equal to its own

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inherent speed of firing. In this case, the launcher fires continuously by rapid fire.

However, firing is quickly interrupted by any slackening in the speed of loading since the trigger is released if no rocket engages it. Consequently, in the latter event the gate is immobilized and holds the rocket next to be fired out of but closely adjacent to the firing position.

From this point, single fire may be effected either by loading the launcher at the desired speed of single fire leaving the firing circuit closed, or by manually operating the trigger to permit the rockets to advance, one by one, to the firing position.

These and other features of the invention will be readily understood from the accompanying drawings and description and will be set forth in the claims.

In the drawings,

Fig. 1 is a front elevation of an illustrative launcher embodying the invention, the launcher being shown as set at an elevation of zero degrees and fully loaded, the lowermost rocket being in firing position;

Fig. 2 is a side elevation of the launcher as viewed from the right in Fig. 1;

Fig. 3 is a fragmentary front elevation of the launcher showing the mechanism for locking the rotor and for operating the launching way to jettison a misfired rocket from the firing position; and

Fig. 4 is a sectional side elevation of the structure shown in Fig. 3, the section being taken along the line IV—IV in Fig. 3.

The illustrated launcher comprises a magazine 10 (Fig. 1) adapted to hold seven rockets R at a time, the rockets being advanced by gravity one by one into firing position where they are supported by a launching way consisting of a fixed rail 12 and a pivoted rail 14. A rocket upon arriving in the firing position (that occupied by the lowermost rocket in Fig. 1) engages a terminal 16 in an electrical firing circuit which, by this contact, is completed through the propellant in the rocket causing the latter to be fired immediately.

Each rocket in falling into firing position rotates a gate 18 through one-third of a revolution. If, after a rocket has been fired, there remain only four rockets in the magazine, a latch 20 (Figs. 1 and 3) is swung to immobilize the gate 18 and hence to prevent the advance of the succeeding rocket into firing position. Upon loading another rocket into the magazine that rocket engages a trigger 22 (Figs. 1 and 2) which,

through connections with the latch 20, disengages the latch from the gate 18, allowing a rocket to advance to the firing position. At any time when there are four or less rockets in the magazine the rockets may be fired by manually depressing the trigger 22. These rockets may be fired by rapid-fire or single-fire depending upon whether the trigger is held down or actuated once for each round fired. Rapid-fire is automatically obtained by loading a launcher at a speed at least equal to its inherent speed of firing. Similarly, single-fire at any desired speed is obtained by loading the launcher at the desired frequency of firing.

If a rocket in firing position misfires it may be jettisoned by operating a lever 24 which causes the pivoted rail 14 to be swung away from the fixed rail 12 far enough to allow the rocket to fall out of the launcher. In this case, the gate 18 is again immobilized by a sliding key 26 until the rail 14 has been returned to its original position.

For aiming purposes, the launcher may be adjusted in elevation by turning a crank 28. The crank operates a screw 30 which when rotated causes the launcher to pivot about a shaft 32 mounted on a carriage 34. To allow the launcher to be trained, the carriage is mounted for rotation in azimuth on a pedestal 36 and is turned by operating another crank 38.

The construction and operation of the illustrated launcher having been briefly outlined, they will now be described in detail.

The magazine 10 is carried by a frame 40 (Fig. 1) composed of steel angles, channels and plates which are connected by welding except as will be otherwise noted.

A trapezoidal end section 42 of the frame and a similar section 43 at the rear end of the launcher are connected at their right hand corners (Fig. 1) by angles 44, 46 (Fig. 2) extending lengthwise of the launcher, the angle 44 being disposed vertically above the other. The sections 42, 43 near their uppermost corners are connected to the ends of an angle 48. A series of channels 50 parallel to each other and the end sections 42, 43 extend from the angle 48 to the angle 46, conforming to the change in direction of the upper and outer sides of the end sections at the angle 44.

The magazine 10 has a bottom 52 which is fixed to and is supported by all the above mentioned angles and channels providing a rocket supporting surface which first is downwardly inclined, then vertical, and finally concave adjacent to the firing position as shown in Figs. 1 and 3.

Perforated ends 54 for the magazine are channel-shaped in cross section, their lower flanges being connected to the bottom 52 and their upper flanges 56 partially overlying the end-margins of the bottom. End plates 58, 60, on which the gate 18 and rails 12, 14 are mounted, are bolted to the end sections 42, 43 of the frame and to the lower parts of the ends 54 of the magazine.

The magazine is bounded at its outer vertical side by a rectangular grill 62 (Fig. 2) having a series of vertically disposed channels 64 connecting the upper and lower members of the grill. The grill is bolted to the end plates 58, 60 just far enough from the vertical portion of the bottom 52 to permit a rocket to fall freely toward the rails 12, 14.

Cooperating with the flanges 56 of the magazine, to prevent rockets therein from being dislodged upwardly, is a bar 66 which is bolted to the upper edge of the grill 62 at its mid-point and is also connected to a strut 68, the strut spanning and being bolted to the flanges 56. A plate 70 extends vertically upward from the upper edge of the bottom 52 and has flanged ends which are bolted to the ends 54 of the magazine.

Rockets are loaded into the magazine through the space between the plate 70 and the strut 68 and are advanced by gravity toward the firing position as they are fired, one by one. During this movement they are guided by the engagement of their tail portions with a rail 72 which is fastened to the bottom 52 at a slight angle to the direction of the rolling motion of the rockets. Since the launcher will almost invariably be elevated to some extent the rockets will slide axially maintaining their engagement with the rail 72 as they roll down the magazine. Just below the lower end of the rail 72 is a rocket-stop 74 which is secured by a bolt 76 and stud 78 to the end plate 60. This stop when engaged by a rocket in firing position locates the latter axially thereof so that the terminal 16 engages a contact band on the periphery of the rocket. In accordance with known practice in this art, the contact band is insulated from the rocket case but is electrically connected to the primer for detonating the propellant charge. The rocket case provides a conductor for completing the other side of the circuit to the primer. Similarly, one lead of the firing circuit (not shown) for the launcher is connected to the terminal 16 through a junction box 80 fixed to the rail 12, while the other lead is grounded on the frame of the launcher.

The rail 72 and junction box 80 are provided and shown in duplicate, one being at each end of the launcher, for the purpose of adapting the launcher for either a port-side or starboard-side mounting on a landing barge or similar vehicle. The rocket stop 74 and terminal 16 are shown as mounted only at one end (rear) of the launcher but are adapted to be removed and remounted at the other end for the above mentioned purpose.

The gate 18 has a central shaft 82 the ends of which are mounted to rotate in the end plates 58 and 60. On this shaft just inside of the end plates are fixed two three-armed spiders 84, 85 to the outer ends of which are fixed three parallel bars 86. The bars extend through the spider 84 and terminate in short, flattened nibs 88, which are adapted to be engaged by the key 26. A similar set of nibs 90 extend outwardly from the spider 85 and are adapted to be engaged by the latch 20. The bars 86 are reinforced at their mid-points by webs 92 which connect the bars with the shaft 82. Assuming that the magazine is kept fully loaded as illustrated in Fig. 1, the gate 18, following the firing of the rocket in firing position, is rotated a third of a revolution by the movement of the next rocket into the firing position. However, if the magazine is not loaded with a speed equal to that of firing, the supply of rockets in the magazine will be depleted to the point when the trigger 22 rises through the bottom 52 owing to the lack of any rocket over it to hold it down. This action of the trigger, as will presently be described, causes the latch 20 to be swung into the path of the nibs 90, as a result of which the gate 18 is immobilized. When under these conditions firing ceases, there is no rocket in the firing position and the next rocket to be fired is supported by the gate just above the firing position.

Any retrograde movement of the gate 18 is prevented by a pawl 94 (Figs. 1 and 3) which pivots on a stud 96 fixed to the end plate 58. The pawl is urged in a counterclockwise direction by a spring 98 which is stretched between the upper end of the pawl and a pin 100 extending from the

inner side of the end plate 58. The movement of the pawl 94 in this direction is limited by a stop 102 which is fixed to the end plate 58 in such a position that the lower end of the pawl is normally disposed directly over the end of that arm of the spider 84 which is in the path of the rockets. That rocket directly above the gate 18 is prevented from being dislodged upwardly by the blast of a fired rocket, or for any other reason, by a series of pawls 104 which are mounted to swing between the flanges of the channels 64 on pins 106. Each of the pawls is urged in a clockwise direction into the path of the rockets, where they descend vertically into the firing position, by a coil spring 108. These springs, as illustrated in Fig. 3, encircle the pins 106, one end of each spring engaging its pawl 104, the other end being arranged to engage a stop 110 fixed to the channel 64.

The mechanism for engaging the latch 20 with or disengaging it from the gate 18 in response to the operation of the trigger 22 will now be described in detail. The latch 20 is mounted to swing on a stud 112 (Figs. 3 and 4) which is fixed to the end plate 60, this movement of the latch away from the gate being limited by a stop 114 which is also fixed to the end plate 60. One end of a link 116 is pivoted at 118 to the latch 20. The other end of the link is pivoted at 120 to an arcuate lever 122 which is fixed to a shaft 124, the shaft being arranged to extend between the end plates 58, 60 and being rotatably mounted in them. The shaft 124 is further supported between its ends by bearings 126 (Fig. 2) which are carried by the bottom 52 of the launcher. Fixed to the shaft 124 is a lever 128 (Figs. 1, 3 and 4) to the upper end of which at 130 is pivotally connected a link 132. This link is also pivoted at 134 (Fig. 1) to the lower end of the trigger 22, the trigger being pivoted on a pin 136 which is mounted in a pair of brackets 138 fixed to the lower side of the bottom 52. A spring 140 stretched between the lever 128 and a part of the frame 40 is arranged normally to swing the lever 128 in a counterclockwise direction. If, therefore, no rocket is above the trigger 22, the latter will rise through an opening in the bottom 52 of the magazine, and the latch 20 will be swung through the connections just described so as to engage that nib 90 which is approaching and is nearest to the latch.

It will now be apparent that so long as the magazine 10 is full of rockets the trigger 22 will continuously be depressed. Accordingly, the latch 20 will not interfere with the rotation of the gate 18 and the rockets will be fired as fast as they fall into firing position, the speed of firing being limited only by the time required for a rocket to leave the launcher after the firing circuit is closed plus the time required for the succeeding rocket to fall into the firing position. Firing may be quickly interrupted (without opening the firing switch) by not loading the launcher, in which case, assuming the launcher to be fully loaded when a decision to cease firing is made, two rockets will be fired automatically prior to the cessation of firing. From this point the remaining rockets in the magazine may be fired by single fire either by loading the magazine at the desired speed of single fire or by manually operating the trigger 22, once for each rocket to be fired.

In case of a misfire, the defective rocket can be jettisoned by swinging the rail 14 far enough away from the rail 12 to permit the rocket in firing position to fall by gravity out of the launcher. With this purpose in view, the rail 14 is rotatably mounted on a shaft 142 (Figs. 1, 2 and 3) which is secured by nuts 144 at its ends to the end plates 58, 60. The rail 14 is swung for the above mentioned purpose by moving the lever 24 downwardly. This lever is pivoted at 145 to a pair of lugs which are fixed to the lower side of the bottom 52. A spring 146, which is stretched between the lever and a pin 148 mounted in one of the channels 50, yieldingly urges the lever 24 in a clockwise direction toward its uppermost position. One end of a link 150 is pivoted at 152 to the lever 24, the lower end of this link being pivoted at 154 to a lever 156 (Figs. 3 and 4). This lever is fixed to a shaft 158 the ends of which are rotatably mounted at the end plates 58, 60. Fixed to the shaft 158 just inside the end plates are a pair of levers 160 to each of which is pivoted at 162 a link 164. The lower end of each link 164 is pivoted at 166 to one of a pair of bifurcated arms 168 which are integral with the rail 14.

It will now be apparent that the levers 160 and links 164 constitute toggles which are in a straightened conditioned when the lever 24 is in its uppermost position. Under this condition the rail 14 is in its normal operative position in which it cooperates with the rail 12 to support the rocket in firing position and to provide a launching way for directing the initial flight of a fired rocket. It is also evident from Fig. 3 that when the above mentioned toggles are collapsed (upon lowering the lever 24), the rail 14 will be swung away from the rail 12 so as to permit the rocket in firing position to fall out of the launcher between the rails. Before the rail 14 will have been swung far enough toward its jettisoning position to release the rocket in firing position, the key 26 will have been slid into the path of movement of the nibs 88 so as to immobilize the gate 18, and hence to hold the rocket succeeding that to be jettisoned above the firing position. The key 26 also is not disengaged from the gate 18 until the rail 14 has been returned near enough to its operative position to prevent a rocket from falling out of the launcher.

The key 26 as shown in Fig. 4 is T-shaped in cross section and has a flange 170 which is adapted to be engaged by the nibs 88. The key slides horizontally, to move the flange 170 into and out of the path of the nibs 88, in a pair of bearings 172 which protrude from the inner side of the end plate 58. The key 26 is operated in synchronism with the rail 14, in the manner described above, by a link 174 one end of which at 176 is pivoted to the key. The link 174 at its other end is pivoted at 162 to that lever 160 and link 164 which are adjacent to the end plate 58.

As mentioned above, the launcher may be set at different angles of elevation by tilting it about the shaft 32 (Fig. 1). This shaft is received in the pair of lugs 178 which are fixed to a plate 180 at the top of the carriage 34. A similar pair of lugs 182 is fixed to the bottom side of each of the end sections 42 and 43, each pair of lugs being bored to receive the shaft 32. It is to be understood that only one pair of the lugs 182 is used at a time depending upon whether the launcher is to be arranged for a port-side or a starboard-side mounting. The shaft 32 is held in assembled relation with the lugs 178 and the appropriate pair of lugs 182 by an arm 184 which is fixed to the shaft and is bored at its upper end to receive a clamp screw 186. This screw is

threaded into that end frame 42 or 43 which is associated with the pair of lugs 182 being used.

The elevating screw 30 is threaded in a swivel block 186 having trunnions 188 on which the block is rotatably mounted within a support 190. This support is fixed to the frame 40 by a plurality of diagonal braces 192 which connect the support with the various corners of the frame 40. The lower end of the screw 30 is reduced to form a pintle 194 which is rotatably mounted in a bearing 196 mounted to swivel with changes in the inclination of the elevating screw 30 as the elevation of the magazine is changed. To permit this action of the bearing 196 its shank is rotatably mounted in a bearing 198 which is integral with a base 200. This base is fixed to the plate 180 by a series of bolts 202 which extend through elongated slots in the base 200 for the purpose of permitting such adjustment of the base as may be necessary to insure a free running connection between the screw 30 and the swivel block 186. The screw 30 is driven from the crank 28 by connections including a bevel gear 204 fixed to the lower end of the screw, a second bevel gear 206 which meshes with the gear 204, and a shaft 208 on one end of which the gear 206 is fixed. The other end of this shaft has a socket in which the crank 28 is received. The intermediate portion of the shaft 208 is rotatably mounted in a bearing 210 which is integral with the base 200 and coaxial with the bearing 198.

The carriage 34 is made of a number of steel angles which are welded together to form an open box-like structure having a rectangular top section 212 and a similar bottom section 214. These sections are connected by four corner posts 216 and a series of diagonal braces 218. A freely rotatable connection between the carriage 34 and the pedestal 36 is provided by a pair of hubs 220, 222 which are connected to the sections 212 and 214 respectively by a number of radially disposed braces (not shown). The hub 222 rests upon a flange 224 which is integral with the pedestal 36 and is bored to receive a number of bolts 226 for securing the pedestal to the deck of a craft or vehicle on which the launcher is to be mounted.

As stated above, the frame 34 is rotated on the pedestal 36, for the purpose of aiming the launcher in azimuth, by turning the crank 38. This crank is fixed to a shaft 228 which is rotatably mounted in a pair of struts 230 which extend vertically between the sections 212 and 214 of the carriage. Fixed to the shaft 228 is a worm 232 which meshes with a worm gear 234, the gear being fixed to the pedestal 36. It will now be evident that by turning the crank 38 the carriage 34, and hence the entire launcher, may be trained in any direction throughout a complete circle.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. In a rocket launcher, a launching way, a magazine through which rockets are advanced by gravity toward a firing position on said way, a gate for controlling the advance of the rockets into firing position, said gate being mounted to move in synchronism with the advance of the leading rocket into the firing position, means for immobilizing said gate to stop the leading rocket short of the firing position, and connections actuated by one rocket of a succession of rockets behind the leading rocket for rendering said means inoperative until the supply of rockets in said magazine has been reduced to a predetermined number.

2. In a rocket launcher, a launching way, a magazine through which rockets are advanced by gravity toward a firing position on said way, a gate for controlling the advance of the rockets into firing position, said gate being mounted to rotate in response to the movement of the leading rocket into firing position, locking means constructed and arranged normally to immobilize said gate with the leading rocket just short of the firing position, a trigger associated with said magazine and disposed in the path of the rockets in said magazine, and connections between said trigger and locking means for releasing said locking means from said gate in response to pressure against said trigger of one of the rockets in said magazine behind the leading rocket when the said leading rocket is just short of the firing position.

3. In a rocket launcher, a launching way, a magazine through which rockets are advanced toward a firing position on said way, a gate having a plurality of bars which are adapted in succession to support a rocket just short of the firing position, said gate being mounted to rotate idly in response to the weight of a rocket thereon, a pawl arranged to cooperate with said gate to prevent retrograde rotation thereof, and means for immobilizing said gate to support the leading rocket just short of the firing position, said means comprising a latch arranged to engage said gate, a trigger mounted on said magazine and arranged to extend into the path of one rocket of a succession of rockets in said magazine behind the leading rocket, and connections between said trigger and latch for retracting said latch from said gate when said trigger is actuated.

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No references cited.