(No Model.)

J. VAVASSEUR.

GUN CARRIAGE.

No. 342,403. Patented May 25, 1886.

Fig. 1.

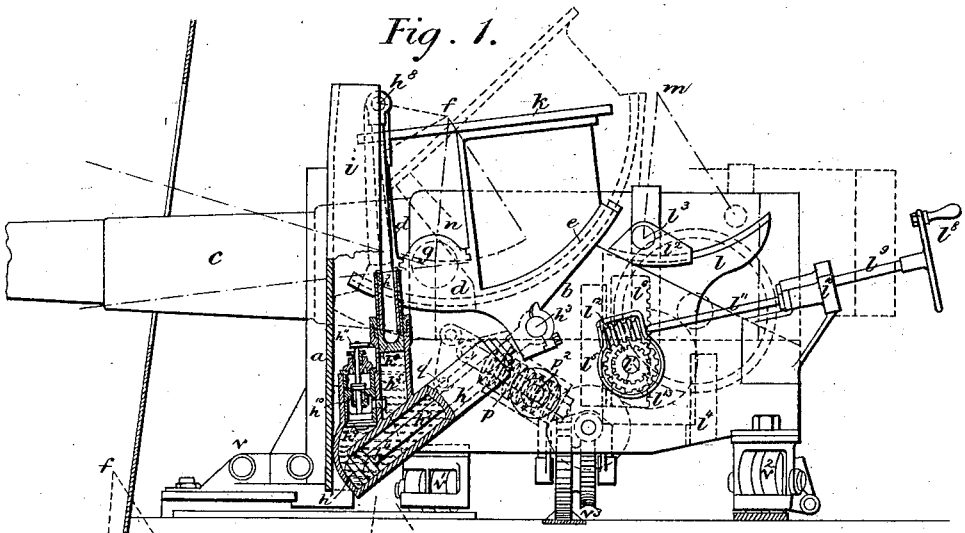


Fig. 3.

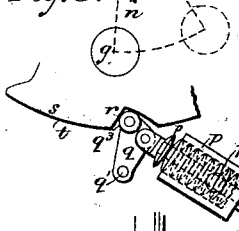


Fig. 4.

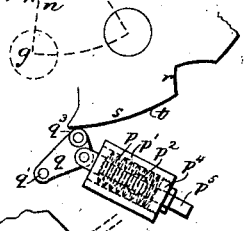


Fig. 5.

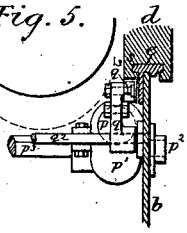
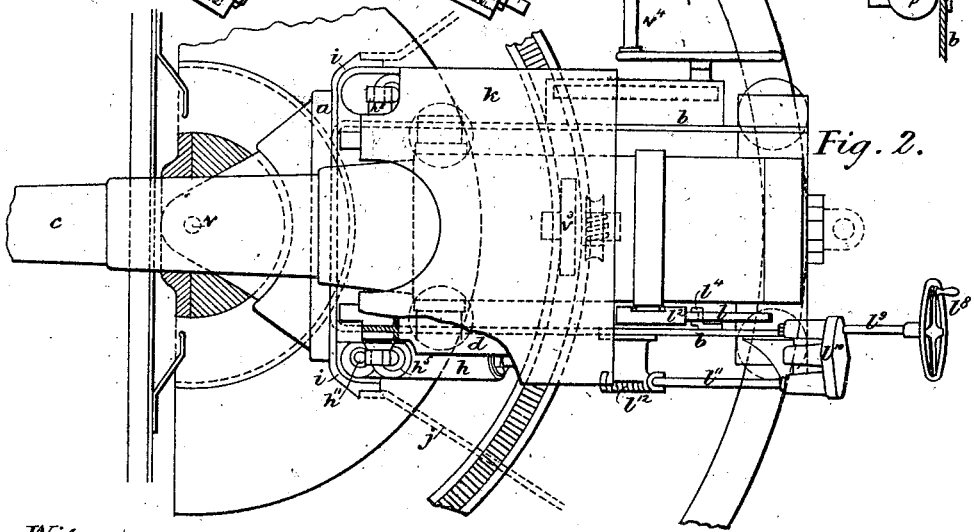


Fig. 2.



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UNITED STATES PATENT OFFICE.

JOSIAH VAVASSEUR, OF SOUTHWARK, COUNTY OF SURREY, ENGLAND.

GUN-CARRIAGE.

SPECIFICATION forming part of Letters Patent No. 342,403, dated May 25, 1886.

Application filed February 26, 1885. Serial No. 193,290. (No model.)

To all whom it may concern:

Be it known that I, JOSIAH VAVASSEUR, of the London Ordnance Works, Southwark, in the county of Surrey, England, engineer, a subject of the Queen of Great Britain, have invented certain new and useful Improvements in Gun-Carriages, of which the following is a specification.

This invention relates to improvements in gun-carriages.

When armor plates or shields are employed for the protection of the mounting and men working the gun, they are usually attached to some part of the mounting as an addition, and in most cases form no part of the mounting itself. In place of this arrangement I propose to form the front end of the mounting out of armor-plate two or more inches thick, (according to the amount of protection required,) extending as close as practicable to the deck. A port cut out of this plate allows the gun to project through it. To this plate I attach the girders forming the slide along which the gun and its carriage recoils.

In order to enable the gun to run out by gravity after recoil, and at the same time to diminish the heavy strain on the deck or other support which is experienced when ordinary upwardly-inclined slides are employed, I make the guide-surfaces on the slide-girders curved on the face to the arc of a circle, and the under side of the gun-carriage I form to a corresponding curve. This arrangement admits of the gun at the commencement of the recoil receding in a horizontal line, or even downward, if desired, the direction of motion gradually changing as the gun comes in, so that by the time the recoil is completed the gun attains a position which enables it to run out by gravity.

In order to limit the amount of recoil within convenient limits, I attach one or more hydraulic compressor-cylinders to the mounting, so arranged as to offer the necessary resistance and arrest the recoil of the gun as desired. These compressor-cylinders I arrange, by preference, one on each side of the slide, the cylinders of the compressor being attached by trunnion-bearings to the slide or armor-plate forming the end of the mounting and the piston-rod of the compressor to the carriage, which recoils with the gun. The gun after recoil is prevented running out by gravity by causing water or liquid to be forced, by a plunger connected with the gun-carriage, into the compressor-cylinder to fill the space vacated by the piston-rod during recoil. When the gun is required to run out, this liquid is allowed to escape from the cylinder.

For the purpose of regulating the elevation of the gun, and in order that the recoil may take place independently of the elevating-gear, so that this gear may be worked up to the moment of firing, I cause the rear part of the gun to be supported upon a table of similar curvature to that of the guide-faces of the slide-girders which support the gun-carriage, and I provide elevating-gear by means of which this table can be raised or lowered, if desired, while the gun is being fired. With this arrangement the gun recoils parallel to itself, and the same elevation is maintained throughout the recoil. The table may rise and fall vertically; or, if great accuracy be required, the movement may be caused to take place in a path of similar curvature to that of the attachment to the gun.

When the gun and its carriage are in the firing position, the center of the trunnions may be forward of a line falling perpendicular from the center or point from which the curved part of slide is described, or it may be under this point. To maintain the gun and carriage in this position, I provide springs, which are compressed during the first part of the recoil, and which remain compressed until the gun runs out, when their elasticity is exerted to insure the gun being in the right position for firing and in maintaining it there during the rolling of the ship. These springs may be applied in connection with levers abutting against cam-like surfaces upon the sides of the gun-carriage. The cam-like surface is so formed that it forces back the lever compressing the spring in the earlier part of the recoil, and during the remainder of the recoil the lever remains stationary, or nearly so. The ends of the levers may be provided with rollers to bear against the cam-surface. As the gun runs out, the springs are inoperative so long as the gun is upon a steep portion of the incline; but when it is on the flatter or rising portion the springs,

acting against the cam-surfaces, assist the gun and carriage to reach the firing position, and also in maintaining it there against the rolling of the ship.

In order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

In the drawings, Figure 1 is a side elevation of the mounting with compressor-cylinder and control apparatus in section. Fig. 2 is a plan view of the mounting. Fig. 3 shows the spring for maintaining the gun-carriage in firing position. Fig. 4 shows the position of the spring when the gun is back after recoil. Fig. 5 is a transverse section of a part of the mounting, showing the spring and supports for same.

I form the front end of the mounting out of armor-plate two or more inches thick, according to the amount of protection required, as shown at *a*. The armor-plate extends down as closely as practicable to the deck or platform constituting the support on which the mounting is fitted. A port is cut in this plate to allow the gun to project.

To the plate *a*, I attach the girders *b*, forming the slide, on the upper part of which the gun *c*, with its carriage *d*, recoils.

In order that the gun may run out by gravity after recoil, and at the same time to diminish the heavy strain caused on the deck or other support when the gun recoils on slides uniformly inclined upward to the rear, I make the guiding or slide surfaces on the slide-girders curved on the face concave upward, as shown at *e*, to the arc of a circle struck from a center at *f*, and the under side of the gun-carriage I make to a corresponding curve. The slides of the girders and the engaging surfaces of the gun-carriage are curved upwardly from near their front ends to their elevated rear ends. By this arrangement the gun recedes at the commencement of the recoil in a horizontal direction or even slightly downward, according to the position of the center *g* of the trunnions of the gun with respect to the center *f* of the curve. As the recoil continues, the direction of motion of the gun gradually changes, so that at the end of the recoil the gun is raised sufficiently to run out again by gravity.

In order to keep the recoil within convenient limits, I arrange hydraulic compressor-cylinders *h*, by preference in the position shown, one on either side of the slide. The cylinders are attached by trunnion-bearings *h'* to the slide, and to the side protective plates, *i*, secured to the armor-plate *a*, forming the end of the mounting. The piston-rods h^2 of the cylinders are attached at h^3 to the carriage, which recoils with the gun. The pistons *h'*, I make with their valves for controlling the recoil. I cause these valves on the pistons to be progressively closed during recoil by rifle-grooves in the cylinders, according to my system, now well understood. The piston-rods during recoil are drawn out of the cylinders, causing a void in the cylinders. I provide means to force liquid into the cylinders during recoil to fill this void, so that the cylinders are kept practically full throughout recoil, thus: I make or fit on the cylinders a second vertical cylinder, h^5, in which works a plunger, h^6, connected to the carriage by means of the connecting-rod h^7 and pivot h^8. At the commencement of recoil the plunger is at the upper part of its cylinder, and descends proportionately as the recoil increases. The diameter and stroke of the plunger is so proportioned as to correspond to the diameter and stroke of the piston-rod of the compressor-cylinders. As the plunger is forced during recoil into its cylinder, it forces liquid into the compressor-cylinder past the valve h^9. A light spring, h^{10}, tends to keep this valve on its seat. At the end of recoil the gun tends to run out and reverse the flow of liquid by the entry of the piston-rod into its cylinder. This action, combined with that of the spring h^{10}, will shut the valve h^9 and hold the gun in. To allow it to run out, the valve h^9 is forced from its seat by means of the screw h^{11}, so that liquid can pass into the plunger cylinder. If kept off its seat by the screw before firing, the gun will run out automatically.

Instead of employing the screw h^{11} and acting on the valve h^9, a small connecting-passage may be made between the chambers above and below the valve h^9, and this passage closed by a plug or small valve, the latter only being worked as required to control the run-out of the gun, the larger valve h^9 acting automatically without requiring any attention. I prefer to fit plungers on both cylinders; but it is not necessary to fit the control-valve and regulating-screw on more than one.

To give more side protection, wing-shields *j* may be attached to the plate *i*, as shown by dotted lines.

In order to form a connection between the two sides of the gun-carriage, I prefer to carry them up to a sufficient height, so that they may be coupled together by the plate K passing over the gun. This plate also serves as a further protection to the gun's crew.

To elevate the gun, and in order that the recoil may take place independently of the elevating-gear, so that this gear may be worked up to the moment of firing, I support the rear part of the gun upon a table, *l*, of similar curvature to that of the slide-faces on which the carriage recoils. A sliding block l^2, connected to the gun by a pivot, l^3, works on the top of this table. The radius of curvature of the table is so arranged that from the center of the pivot l^3 to the center *m* is equal to that from the center of trunnions *g* to the center *f*.

To elevate the gun, the table *l*, provided with guides at l^4 l^5, is raised or lowered by means of the toothed rack l^6 formed on it, into which gears the pinion l^7, driven from the hand-wheel l^8 through the shaft l^9, intermediate wheels at l^{10}, shaft l^{11}, and worm l^{12}, gearing with wheel l^{13} on the axis of the pinion.

To prevent damage to the gear in consequence of any jump of the gun on firing, I prefer to connect the worm-wheel and the pinion by means of friction cones or disks, so as to allow the gear to slip. With this arrangement the gun recoils parallel to itself, the same elevation being maintained throughout the recoil. The guides l^1 l^2, for the rise and fall of the table, may be either straight, or, if considered necessary to have the utmost accuracy in the recoil movement of the pivot l^2 with respect to that of the trunnions, the guide is may be curved, to cause the table to move in path of similar curvature to that of the pivot.

When the gun and carriage are in the firing position, the center of the trunnions may be forward of a line n, falling perpendicular from center f, or exactly under that center, as may be found most convenient. To maintain the gun and carriage in this position, I fit springs p, preferably one set, on either side inside the slide, as shown by Figs. 1, 3, 4, and 5. The springs are inclosed in cases p', pivoted at p^2 on the slide-girders, and connected together by a plate, p^3. The bottoms p^4 of the cases are screwed in giving the means of regulating the pressure exerted by the springs. The spindles p^5 of the springs, against the heads of which the springs act, are connected to the levers q, also pivoted to the slide-girders at q', and fitted on the cross-shaft q^2. The upper part of each lever is arranged to bear, by means of a roller, q^3, fitted on it, against the face r of a slot formed on the inner cam-guide, s, of the carriage, and the pressure of the spring thus transmitted to the face r presses the gun out and maintains it in the firing position, as in Figs. 1 and 3. On the gun recoiling the lever q is forced down into the position shown in Fig. 4, compressing the springs, which then move nearly in the line of pivots p^2 q', and thus preventing the increased pressure having its effect against the carriage during recoil, the roller then bearing against the face t of the cam-guide S. On the gun running out the roller q^3 will, as soon as the face r reaches it, begin to press against it and urge the gun outward with increasing effect as the line of action of the springs becomes more direct.

The mounting shown by the drawings is front pivoted at v, with front and rear training-rollers v' v^2, training-gear v^3, worked from the hand-wheel v^4; but a similar arrangement of mounting as regards the armor-plate, the curved slide cylinder, with control-gear and elevating-gear, can also be made with the pivot in other positions—for example, a centrally-pivoted mounting—if required.

I claim—

1. The combination of the shield-plate, its support, the slide-girders of the shield-plate, and the gun-carriage sliding thereon, substantially as and for the purpose set forth.

2. The combination, substantially as set forth, of the gun-slide, curved upwardly in the arc of a circle from near its front to its rear, the gun-carriage, similarly curved on its under surface and moving on said slide, and the gun mounted by its trunnions in the gun-carriage near its front, whereby in recoiling the inclination of the gun increases as it approaches the position at which it comes to rest, for the purpose described.

3. The combination consisting of a gun-slide having curved guide-surfaces, a gun-carriage traversing along the slide and carrying the trunnions of the gun, a curved table supporting the gun behind the trunnions, and gear for raising and lowering this table to give the requisite elevation to the gun.

4. The combination of a gun-slide having guide-surfaces curved upwardly at the rear, a gun-carriage similarly curved on its under surface and traversing along the slide, a hydraulic compressor connecting the slide with the carriage, a plunger moved by the gun-carriage and forcing liquid into the compressor-cylinder when the gun recoils, and the valve for retarding or preventing the escape of this liquid and regulating the return of the gun to the firing position, substantially as and for the purpose set forth.

5. The combination of a gun-slide having curved guide-surfaces extending upwardly at the rear, a gun-carriage carrying the trunnions of the gun and traversing along the slide, the cam-guide of the carriage, and a spring supported by the gun-slide and acting on the cam-guide, substantially as and for the purpose set forth.

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