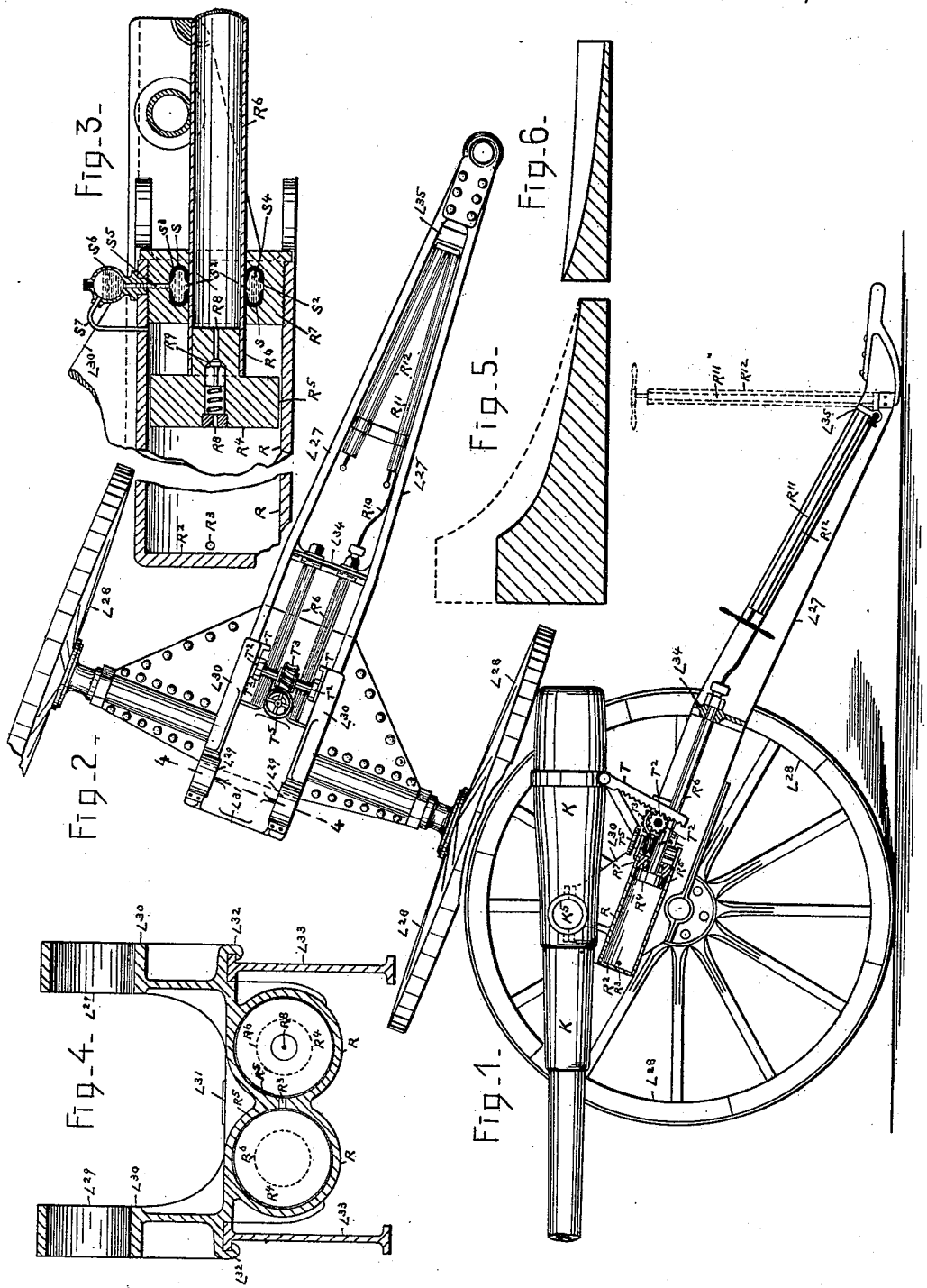
(No Model.)

H. A. SPILLER.

PNEUMATIC RECOIL CHECK FOR GUN CARRIAGES.

No. 463,462. Patented Nov. 17, 1891.



WITNESSES

Henry F. McKeever.
O. Schaefer

INVENTOR.
Harry A. Spiller
by
R. S. Dyrenforth,
his attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HARRY A. SPILLER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE PNEUMATIC GUN CARRIAGE AND POWER COMPANY, OF WHEELING, WEST VIRGINIA.

PNEUMATIC RECOIL-CHECK FOR GUN-CARRIAGES.

SPECIFICATION forming part of Letters Patent No. 463,462, dated November 17, 1891.

Application filed October 3, 1889. Serial No. 325,861. (No model.)

To all whom it may concern:

Be it known that I, HARRY A. SPILLER, a citizen of the United States of America, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Automatic Pneumatic Recoil-Checks for Gun-Carriages, of which the following is a full, clear, and exact description.

This invention relates to recoil-checks for guns, and particularly to that class in which aeriform fluid under pressure is utilized to act as a cushion to take up the recoil and counter-recoil.

The object of the invention is to produce a recoil-check particularly designed for field-carriages, whereby the recoil and counter-recoil of a gun shall be taken up without shock to the carriage or its appurtenances and the gun automatically returned after each discharge to its normal position ready for firing.

With this object in view the invention resides, essentially, in a field-gun carriage having a sliding portion upon which the gun is to be mounted and one or more cylinders attached to the sliding portion and having their piston-rods attached to the main portion of the carriage.

Furthermore, the invention resides in a field-gun carriage having a portion upon which the gun is mounted capable of movement during the recoil and counter-recoil of the gun and to bring the gun to position for firing, a cylinder or cylinders attached to this moving portion and having their piston-rods attached to the main portion of the carriage, and one or more air-pumps located on the carrige and communicating with the cylinders, whereby compressed air may be supplied to cylinders.

Furthermore, the invention resides in a field-gun carriage comprising a moving portion on which the gun is to be mounted, a cylinder or cylinders attached to the moving part and having their piston-rods hollow and attached to the main portion of the carriage, and an air-pump or air-pumps pivoted to the main portion of the carriage to facilitate their use and communicating with the piston rod or rods.

Furthermore, the invention resides in a field-gun carriage comprising a moving portion upon which the gun is to be mounted, an air cylinder or cylinders connected to the moving portion and having their piston-rods connected with the main portion of the carriage, the pistons having a passage through them provided with a check-valve, and an air pump or pumps mounted on the main portion of the carriage and communicating with the pistons.

Furthermore, the invention consists in the combination, with a gun-carriage constructed as above outlined, of a leather packing of cup shape held on the cylinder, an oil-cup held on the cylinder, a passage connecting the oil-cup and the cup-shaped packing, and a passage from the air-cylinder, whereby compressed air may be admitted to force the cup-shaped packing into contact with the piston.

Furthermore, the invention resides in various novel details of construction whereby the object of the invention is attained.

I have illustrated the invention in the accompanying drawings, in which—

Figure 1 is a central longitudinal vertical section of a gun-carriage and of an air-cylinder of the mechanism of this invention and a side elevation of the gun and other parts, the gun and air-cylinder both being in position for firing the gun. Fig. 2 is a plan view made in accordance with my invention. Fig. 3 is an enlarged central longitudinal vertical section of air-cylinder, piston-head, and piston-rod. Fig. 4 is an enlarged transverse section on the line 4 4 of Fig. 2. Figs. 5 and 6 are views in diagram. Fig. 5 shows by dotted lines a curving line in illustration of increase of air-pressure in the air-cylinder at the front of the piston-head under the recoil of the gun if the air thereof is not allowed as thereby compressed to pass or to communicate its then increased pressure to the air at the back of the piston-head, and by full line a curving line in illustration of increase of air-pressure in the cylinder at the front of the piston-head under the recoil of the gun when the air as thereby compressed is allowed to pass or to communicate its then increased pressure to the air at the back of the piston-head; and Fig. 6 shows by full lines a curv-

ing line in illustration of increase of air-pressure under the recoil of the gun and under the conditions of air-pressure shown by full lines, Fig. 5, at the back of the piston-head.

In the drawings, K represents the gun. The carriage is shown as consisting of a trail L^{27} and supporting-wheels both of the construction ordinarily employed in field-gun carriages. The gun has trunnions K^5 on its opposite sides, and by these it is suspended in bearings L^{29} L^{29} of the opposite parallel sides L^{30}, which form parts of a frame, the other part of which is the cross-piece L^{31}, by which the sides are connected. The frame lies under and extends across and beyond the sides of the gun and is provided with parallel guideways L^{32}, fitting over and held on the opposite and parallel rails L^{33} L^{33}, fixed to the trail L^{27} of the gun-carriage. The guideways are preferably arranged obliquely to the axis of the gun and inclined downward from a point just in advance of and below the trunnions of the gun toward a point below and forward of the breech of the gun, and all so that the frame, carrying the gun with it, can slide forward and backward on said guideways L^{32}, traveling in its forward movement upward and its backward movement downward on the guideways.

R R are two air-cylinders immovably held on the sliding frame and arranged side by side between the guide-rails L^{33} of the gun-carriage L, with their axes in parallel vertical planes, also vertically parallel with the vertical planes of the parallel guide-rails and extending obliquely in lines parallel to the oblique lines of direction of the guide-rails. Both air-cylinders are closed at their forward or front heads R^2 R^2, and they have communication with each other through an air-port R^3, leading between and opening to both, in order that the pressure of air in the two may be equalized.

R^4 R^4 are the piston-heads of the cylinders, each being of a corresponding diameter of its air-cylinder, so that when concentrically located in the air-cylinders there is an open annular space R^5 between each piston-head and the wall of the cylinder in which it is placed.

R^6 R^6 represent two piston-rods, each concentrically held on its piston-head and extending therefrom through the head R^7 of the air-cylinder and axially coincident with the axis of the cylinder and rigidly held on a rigid cross-head L^{34} of the trail L^{27} of the gun-carriage. Each air-cylinder in operation is to move forward and backward on its piston-rod, and both rods held on the trail of the gun-carriage, as has been described, are of suitable length and arrangement with relation to the air-cylinders moving on them to permit of the backward and forward movement of the air-cylinders a distance nearly equal to the full length of the air-cylinders.

I have shown one of the piston-rods as provided with a passage or way R^8, extending from end to end through the piston-head of the rod, permitting the introduction of air into the air-cylinder to which the rod belongs at the front end of the piston-head, and thence into the adjoining air-cylinder through the air-port R^3, making communication between the two air-cylinders, as has been explained, to secure the charging of both cylinders with air at and in front of the piston-head of each. The air-passage R^8 has a check-valve R^9 to open against and to close with the air-pressure in the air-cylinders. The rear end of the air-passage in the piston-rod is connected through a pipe R^{10} with an air-pump R^{11} of any suitable construction and capable of pumping air at a high pressure, and this air-pump in turn is connected with another air-pump R^{12}, lying alongside of it, and which is of any suitable construction and capable of pumping air at a low pressure. The air-pumps are held on a cross-piece L^{35}, and are preferably hinged, so that the pumps when not in use may be laid on the trail and for use placed in an upright position, as shown, Fig. 1, dotted lines.

The air-cylinders are charged with air under a high pressure by means of the air-pumps, first using the one of low pressure and then the one of high pressure, and this air-pressure is to be such as on the discharge of the gun, which still further increases its pressure, to offer proper resistance to the recoil and counter-recoil of the gun and to secure the return of the gun to its normal position automatically, as will hereinafter more fully appear. The air-cylinder charged with air under pressure, as above described, the air-cylinders being then at their forward and normal positions and the piston-heads at the rear ends of the air-cylinders, will, upon discharge of the gun, be thrown backward, forcing the piston-rods against the pressure of the confined air of the air-cylinders. The air further compressed thereby in resistance to the recoil of the gun and air-cylinders is forced through the annular space around the piston-heads to the rear side of the piston-head, which being also compressed on the counter-recoil of the gun, carrying the air-cylinders with it, acts in resistance thereto until finally the gun and air-cylinders from the action of the compressed air within the air-cylinders come to a rest at their respective normal positions and the piston-heads to a rest at the rear heads of the air-cylinders.

In the arrangement of air-cylinders and piston-heads and piston-rods described the forward head of each air-cylinder presents a superficial area of air-pressure greater than that presented by the rear head of the cylinder and to an extent equal to the superficial area transversely of the piston-rod, thereby securing for resistance to the recoil of the gun the maximum pressure of air in the air-cylinder and for resistance to the counter-recoil of the gun the minimum pressure of the air in the air-cylinders. In both instances

the normal air-pressure is increased by the compression of the air by the backward movement or recoil of the gun and air-cylinders, allowed on the recoil to communicate with the air-cylinders at the back of the piston-heads because of the open annular space surrounding each piston-head, and on the counter-recoil of the gun and air-cylinders which follows to similarly communicate with the air-cylinders at the front of the piston-heads when, because of the greater pressure of air on the forward heads of the air-cylinders, owing to their greater superficial area as compared with that of the rear heads of the air-cylinders, the air-cylinders and gun are returned to their forward and normal positions of rest in readiness for firing the gun.

The diagrams Figs. 5 and 6 illustrate by full lines the compression of air at the front and rear of the piston-heads under the recoil of the gun and substantially how the compression is divided in the air-cylinders as between the front and the rear of the piston-heads and the reduction in air-pressure at the front of the piston-heads from what it would there be (shown in dotted lines, Fig. 5) under the recoil of the gun if the air as it is compressed by the recoil at the front of the piston-heads had no communication with the air-cylinders at the back of the piston-heads.

Although two air-cylinders and two piston-heads and two piston-rods—one of each for each air-cylinder—have been described, only one air-cylinder with its piston-head and piston, substantially as explained, may be used, and again three or more cylinders with a piston head and rod for each, as explained, may be used, and therefore the invention is not to be limited in these regards.

As has been before stated, the extension of each piston-rod through the heads of its air-cylinder is packed and under this invention as follows: The packing is of leather in two annular sections S S, placed alongside of each other, edge opposite edge, with an open space S^2 between and within a groove S^3 at top and bottom of section of suitable shape of the cylinder-head. Each leather ring-section surrounds and rests on the piston-rod, and the two line the walls of the groove in the cylinder-head, and together placed, as stated, they make a chamber S^4, open at the spaces S^2 to the piston-rod and to a passage S^5, leading radially through the piston-head and into a closed cup S^6 containing oil, and from which oil is conducted through said passage S^5 to fill the chamber S^4 of the leather packing-ring sections S. S^7 is an air-passage connecting the air-cylinder and oil-cup S^6 and securing air-pressure on the oil in the cup and chamber of the leather packing to hold the packing to its work, while at the same time to keep the rod and cylinder-head lubricated, and the leather, because of the presence and contact of oil with it, as stated, being always in a moist condition for its practical and efficient action. There is also shown in the drawings a mechanism well known and which is carried in most of its parts by the sliding frame L^{30} L^{31}, carrying the gun, by which it elevates and depresses the same. This mechanism consists, essentially, of depending toothed rack-bars T T, pivoted at their upper ends on opposite sides of the gun, and pinion gear-wheels T^2 T^2 on a shaft meshing the rack-bars T and adapted by meshing worm-gears T^3 T^4, one T^3 held by the pinions T^2 and the other having an operating hand-wheel T^5, all as well known, to secure by turning the hand-wheel in one direction an elevation and in the other direction a depression of the muzzle of the gun.

Preferably the air-cylinder is held on the gun and the piston-rod is held on the gun-support, all as has been herein particularly described; but obviously the air-cylinder and piston-head and its rod may be reversed in position—that is, the air-cylinder held on the gun-support and the piston-head and its rod held on the gun without material or substantial changes either in construction or relative arrangement of the parts—and I do not wish to be understood as limiting myself in this respect. With the parts reversed and with the gun at rest the piston-head would of course be at the upper head of the air-cylinder instead of at its lower end.

In conclusion, it will be observed that, while air is the fluid specially mentioned as used for the operation of the mechanism of this invention, as herein described, the invention is not limited in this regard.

While I have particularly herein described a peculiar piston-rod packing, I do not wish to be understood as herein claiming the same, as it will form the subject-matter of another application for patent.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A field-gun carriage comprising a moving portion on which the gun is to be mounted, a cylinder or cylinders attached to the moving part and having their piston-rods hollow and attached to the main portion of the carriage, and an air-pump or air-pumps mounted on the main portion of the carriage and connected with the piston-rods, substantially as described.

2. In a field-gun carriage, the moving portion on which the carriage is to be mounted, an air-cylinder or air-cylinders connected with the moving portion and having their piston-rods hollow and attached to the main portion of the carriage, and a pneumatic pump or pneumatic pumps pivoted to the main portion of the carriage and connected with the hollow piston-rods, substantially as described.

3. In a field-gun carriage, a moving portion upon which the gun is to be mounted, an air-cylinder or air-cylinders connected with the

moving portion and having their piston-rods hollow, provided with check-valves and attached to the main portion of the carriage, and a pneumatic pump or pneumatic pumps mounted on the front portion of the carriage and connected with the hollow piston-rods, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HARRY A. SPILLER.

Witnesses:
ALBERT W. BROWN,
HENRY F. MCKEEVER.