(No Model.)

2 Sheets—Sheet 1.

S. SEABURY.

GUN CARRIAGE.

No. 420,170. Patented Jan. 28, 1890.

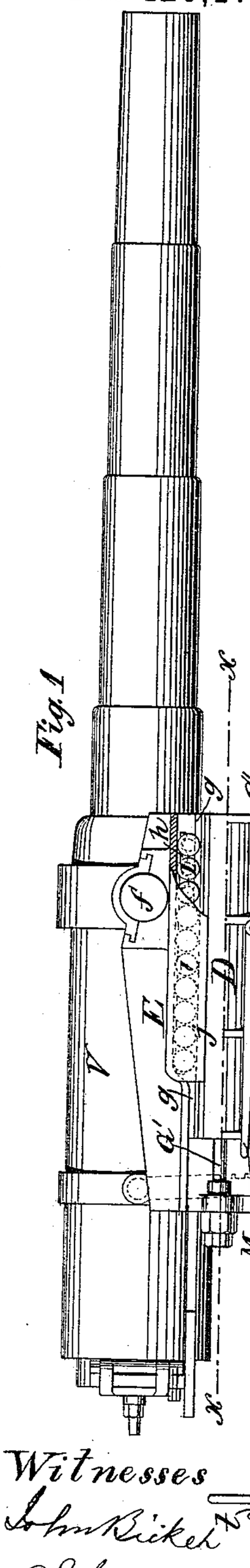

Fig. 1

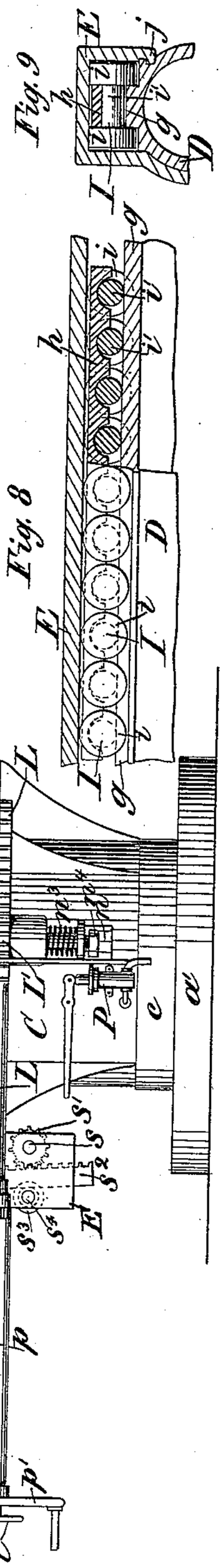

Fig. 8

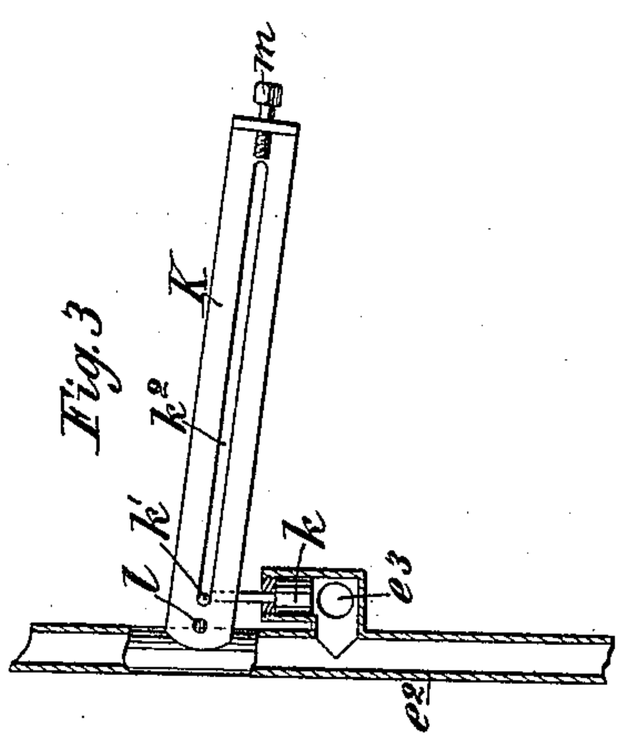

Fig. 3

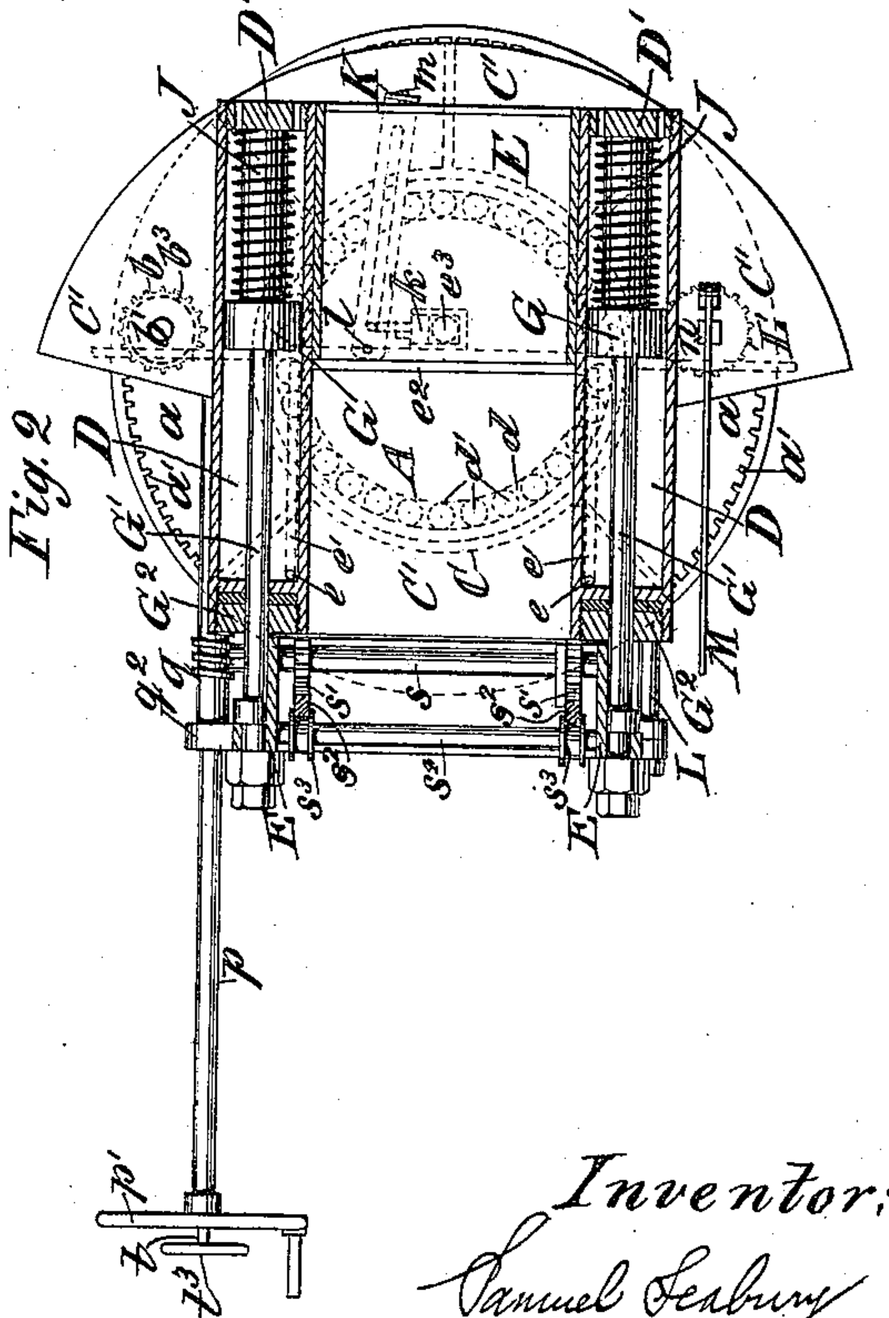

Fig. 2

Witnesses
John Ricker
C. L. Sundgren

Inventor:
Samuel Seabury
by attorneys
Brown & Prestwood

(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

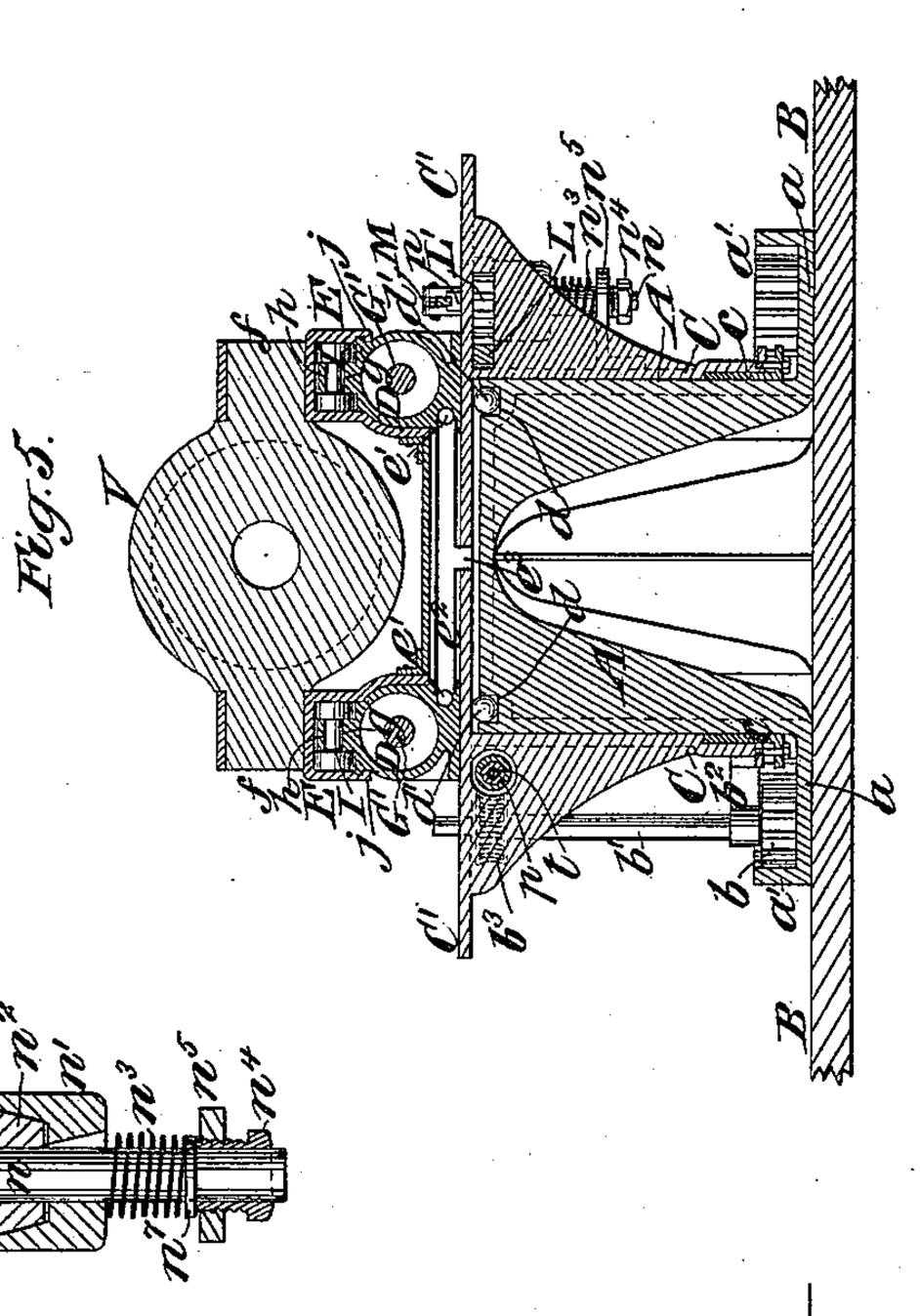


Fig. 6.

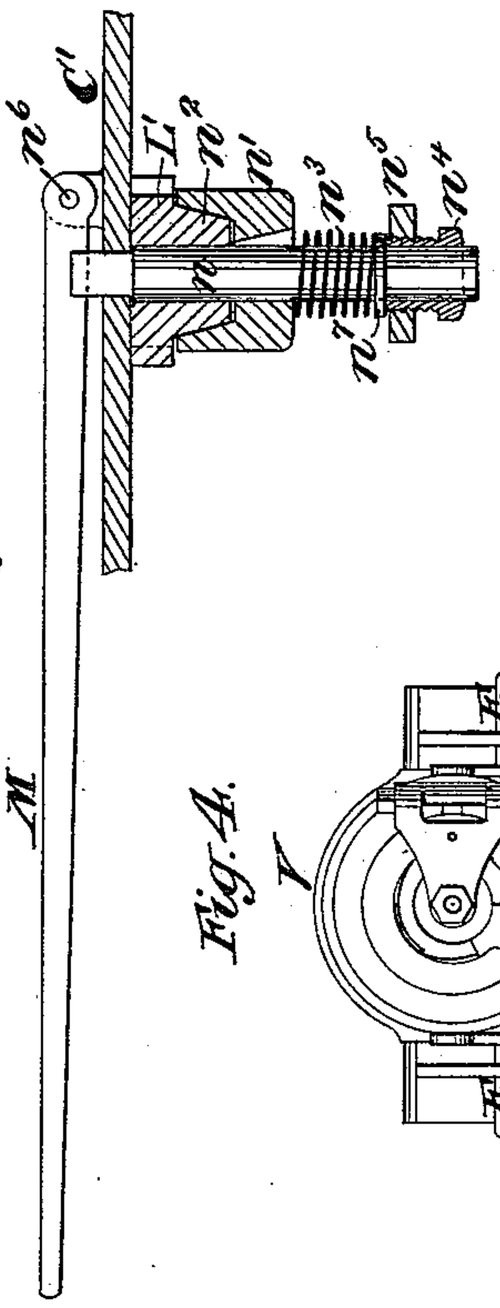


Fig. 4.

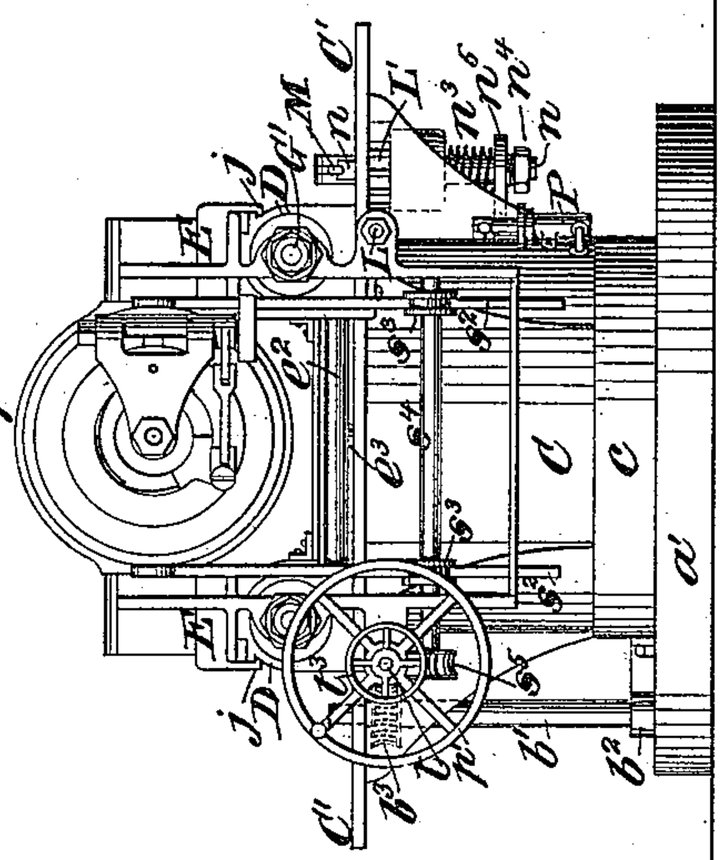
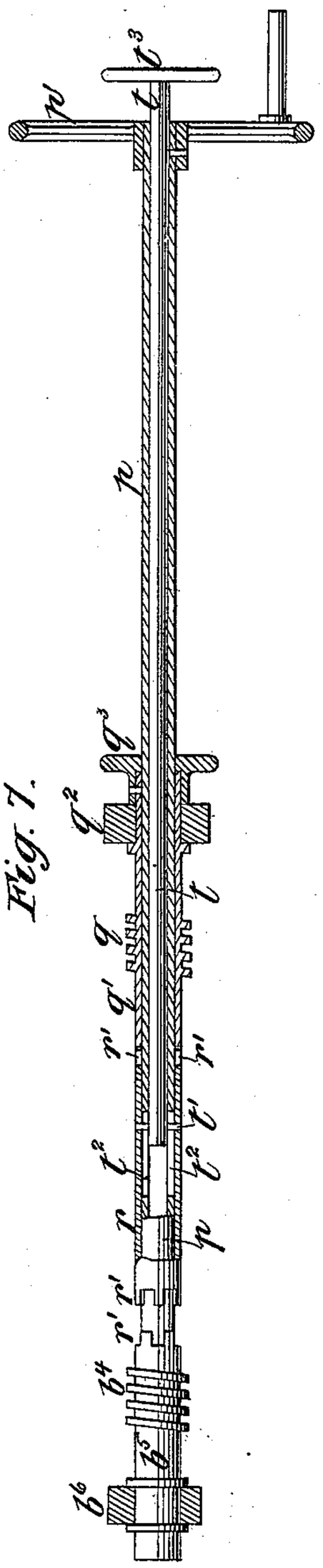


Fig. 7.



Witnesses
Colin Ricker
O. L. Sundgren

Inventor
Samuel Seabury
by attorneys
Brown & Griswold

UNITED STATES PATENT OFFICE.

SAMUEL SEABURY, OF BERGEN POINT, NEW JERSEY.

GUN-CARRIAGE.

SPECIFICATION forming part of Letters Patent No. 420,170, dated January 28, 1890.

Application filed March 16, 1889. Serial No. 303,599. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL SEABURY, lieutenant United States Navy, residing at Bergen Point, in the county of Hudson and State of New Jersey, have invented a new and useful Improvement in Gun-Carriages, of which the following is a specification, reference being had to the accompanying drawings.

My invention is more especially intended for naval guns, but may be applied wholly or in part for guns for fortifications. Its principal objects are, first, to reduce the dimensions of the carriage and the space occupied in working it to a minimum; second, to reduce the strain produced on the platform by the recoil; third, to provide for a more perfect control of the gun under all circumstances; fourth, to simplify the mechanism for training and elevating the gun.

The first of these objects I accomplish by supporting the lower carriage in the manner hereinafter described entirely on a pivot which not only bears all the weight, but affords resistance to recoil, and which thereby dispenses with the cumbrous training-tracks commonly employed.

The second object I attain by means of a novel hydraulic recoil-resisting apparatus and by the use of roller-beds of novel construction between the upper and lower carriages, whereby I am enabled to employ on the lower carriage a level instead of an inclined slide or track for the upper carriage and gun to recoil upon.

The third object I accomplish in part by a valve which forms part of the hydraulic recoil-resisting apparatus above mentioned, and which is operated by the gun in its recoil and in part by a novel friction apparatus hereinafter described.

The fourth object I accomplish by combinations of mechanism in which a single shaft is made to operate both the mechanism for training and the mechanism for elevating.

I will now proceed to describe my invention with reference to the accompanying drawings, and afterward point out its novelty in claims.

Figure 1 is a side view of a gun and a gun-carriage embodying my invention. Fig. 2 represents a horizontal section of the carriage, taken below the gun in the line *x x* of Fig. 1. Fig. 3 is a plan, partly in section, of the valve hereinabove mentioned as part of the hydraulic recoil apparatus and of the means of adjusting its operation. Fig. 4 is a rear view of the gun and carriage. Fig. 5 represents a transverse vertical section taken through the center of the carriage-pivot and through the trunnions of the gun. Fig. 6 is a vertical sectional view of the friction apparatus by which the position of the gun is in part controlled. Fig. 7 represents a longitudinal section of part of the mechanism for training and elevating the gun. Fig. 8 represents a side view, partly in section, of one of the roller-beds by which the upper sliding or longitudinally-moving carriage is supported on the lower training-carriage thereof. Fig. 9 represents a transverse section of one of the said roller-beds and the parts of the carriage supporting and supported by it. Figs. 3, 6, 7, 8, and 9 are on a scale about double that of Figs. 1, 2, 4, and 5.

Similar letters of reference designate corresponding parts in all the figures.

A designates the pivot, on which the gun is entirely supported, consisting of an upright cylinder of large diameter—say five or six times that of the caliber of the gun. This cylinder is provided at the bottom with a broad circular flange *a*, through which to bolt it to the deck B of a vessel or other foundation, and around this flange is provided an internally-toothed upwardly-projecting rim *a'*, which is concentric with the cylinder and which constitutes a stationary gear in which works a pinion *b*, to be hereinafter more fully described, for the purpose of training the gun.

C C′ designate the lower or training carriage, and E the upper sliding or longitudinally-moving carriage running on ways provided on the lower one. The lower carriage consists of a cylinder C, which fits over the cylindrical pivot A, and the head of which is extended to form a table C′. The said cylinder is provided at the bottom around the pivot A with a stuffing-box *c*, which is packed to confine within the upper part of the cylinder above the pivot a quantity of water, oil, or other liquid which is employed to resist the recoil of the gun. In the upper end of the cylindrical pivot is a concentric circular

groove *d* to receive a number of balls *d'*, which constitute a ball-bearing upon which the weight of all the movable portions of the carriage is supported.

D D designate two hydraulic cylinders arranged upon and firmly bolted to the table C', parallel with each other and at equal distances from a vertical plane passing through the axes of the pivot and of the bore of the gun. These cylinders are fitted with pistons G G, connected by rods G' G' with the upper carriage E, the said rods passing through stuffing-boxes G^2 in the rear ends of the cylinders D, which are in other respects closed. The said cylinders are, however, provided near their rear ends with small lateral openings *e*, (see Fig. 2,) which communicate with the space between the top of the pivot A and the head of the cylinder C through longitudinal passages *e'* in the walls of the cylinders and a transverse pipe or passage e^2 and vertical passage e^3, provided in the table C'. These passages may be understood by reference to Figs. 2, 3, and 5.

I have shown in Fig. 1 attached to the cylinder C a hand-pump P, for filling the space in the upper part of said cylinder and in the back parts of the cylinders D with water, oil, or other liquid.

The upper carriage E, which contains the bearings for the trunnions *f* of the gun V, does not slide directly on ways on the lower carriage or on trucks fixed relatively to one carriage or the other, as is usual, but is supported on roller-beds, which run on parallel horizontal ways *g*, supported or provided on the table C' of the lower carriage. These ways are represented as constructed on the tops of the hydraulic cylinders D. The roller-beds consist each of rollers I and a saddle-piece *h*. The rollers are constructed as best shown in Figs. 8 and 9, each with two circular heads *i* of uniform diameter and a connecting-journal *i'* of a diameter half that of the heads *i*. The journals *i'* bear upon the ways *g* on the lower carriage, and the upper carriage is supported on the heads *i*. The saddle-pieces consist of bars fitted between the heads *i* of the rollers, and have on their under sides bearings for the journals *i'*. These saddles serve the purpose of keeping the rollers properly spaced and prevent them from fouling or interfering with each other. As the upper carriage and the gun move backward with the recoil and move forward again after the recoil, the journals of the rollers roll on the ways *g*, and the upper carriage runs on the heads *i* of the rollers; but, owing to the difference of diameter between the heads of the rollers and their connecting-journals, the rods only run back half the distance that the gun and the carriage E run back, and hence I am enabled to use a larger number of rollers and a longer bearing or roller-bed for the upper carriage than would be possible with simply cylindrical rollers without having the roller-bed run beyond the ways *g* at each end. In order to hold the upper carriage down, it is provided with inwardly-turned flanges *j*, which run under rabbets on the lower carriage.

Within the cylinders D, in front of the pistons, are arranged springs J, for the purpose of checking the rebound after the recoil and of serving as buffers to prevent a too violent forward movement of the gun. These springs may be of any suitable kind, and are represented as composed of cylinders of india-rubber surrounded by coils of steel. The front heads D' of the cylinders, against which the springs J abut, are provided with openings to allow free access of the atmosphere to the cylinder in front of the pistons.

The action of the carriage under the recoil is as follows: As the upper carriage C runs back, the pistons G connected with it are met by the resistance of the water, oil, or other fluid behind them in the cylinders D, which runs out slowly from the said cylinders through the passages *e e' e² e³* into the upper part of the cylinder C of the lower carriage. By this action of the liquid the lower carriage is slowly raised on the pivot, so that the final resistance of the recoil is that due to the sum of the weights of the gun and the upper and lower carriages. This weight serves to produce the rebound or final movement of the gun by causing the liquid to be forced back from the upright cylinder C into the horizontal cylinders D, behind the pistons G. In order to better control the recoil, I employ a piston-valve *k*, for the purpose of more or less contracting the opening of the passage e^3, as shown in the sectional view, Fig. 3, and also shown in dotted outline in Fig. 2. I connect the stem of this valve with a horizontal slideway K, which is attached to the gun-carriage by arranging the head *k'* of said stem in a slot k^2 in the said slideway K, which is secured to the bottom of the upper carriage E. The slot k^2 in this slideway being arranged obliquely in a lateral direction to the ways *g*, the valve *k* is caused to move over the opening of the passage e^3 as the gun recoils, and so to contract the communication between the horizontal cylinders and the vertical cylinder, so that as the recoil is gradually checked the freedom with which the liquid leaves the recoil-cylinders D is also checked. In order to regulate the degree of contraction of the opening in the passage e^3 by the valve *k*, the slideway K is made adjustable at different degrees of obliquity to the ways *g* to produce a greater or less movement of the valve. For this purpose the said slideway is pivoted at its rear end by a pin *l* to the carriage E, and at its front end is movable laterally and capable of being secured in different positions to the front end of the said carriage by means of a set-screw *m*, with which the slideway is fitted and which may be screwed up against the front end of the said carriage.

In order to hold the gun and its upper car-

riage in any position upon the lower carriage, a horizontal toothed rack L is connected with the upper carriage on one side thereof (see Figs. 1 and 5) and gears with a toothed wheel L′, which is arranged on an upright axle n, carried by the lower carriage. This wheel has applied to it a friction-brake n' n^2, to which pressure is applied to produce the friction by means of a spiral spring n^3. The axle n is fitted with a square to an opening of corresponding form in the table C′ in such manner that it may move vertically, but is prevented from turning, and it has one member n' of the friction-brake firmly secured to it, the other member n^2 being secured to the wheel L′, and both it and the said wheel being capable of turning on the axle n. The lower end of the axle n passes through a hollow screw n^4, which screws through a fixed bearing n^5, secured to the outside of the cylinder C of the lower carriage. The upper end of this screw n^4 serves as a bearing for the spiral spring n^3, the upper end of which presses against the lower member n' of the friction-brake. A washer n^7 is shown interposed between the screw n^4 and the spring. By screwing the screw n^4 upward or downward the pressure of the spring upon the friction-brake and the degree of friction produced are adjusted. In the normal conditon of the carriage the spring presses the lower member n' of the brake against the upper member n^2 and presses the upper face of the wheel L′ against the under side of the table C′ in the lower carriage. The friction thus produced prevents the wheel L′ from turning, and so causes the pinion to hold the rack and prevent the upper carriage from moving on the lower one. For the purpose of liberating the upper carriage when necessary a hand-lever M is provided, working on a fulcrum-pin n^6, secured to the table C′ of the lower carriage, the said lever bearing upon the top of the axle n. By applying manual pressure to the rear end of this lever the axle n is depressed and the lower member n' of the friction-brake is pushed down from the upper member n^2, leaving the latter and the pinion L′ entirely free to be turned by the rack.

I will now proceed to describe the mechanism for training and elevating the gun, which operations may be both performed by power applied by hand to a horizontal shaft p, arranged on one side of the carriage parallel with the ways g, on which the upper carriage runs. This shaft p and its appurtenances, including a hand-wheel p' for turning it, are shown in Fig. 7, partly in section. The training is effected through the medium of an endless screw b^4 on the said shaft, and the elevation through the medium of an endless screw q thereon. These endless screws b^4 and q are neither of them fast to the said shaft, but are on sleeves b^5 and q', respectively, the said sleeves and the shaft being so fitted that the shaft may turn independently of the sleeves, but that either of the said sleeves may be thrown into gear with the shaft, so as to be compelled to turn with it by means of a third sleeve or clutch r, which is fitted to slide lengthwise upon the said shaft, but incapable of turning thereon, and which is provided at its opposite ends with clutch-teeth r', to gear with corresponding clutch-teeth at the ends of the sleeves b^5 and q', respectively. The clutch-teeth r', for gearing with the sleeve b^5, are fully shown in Fig. 7, in which the clutch r is out of gear with the sleeve b^5; but the clutch-teeth of the sleeve p' and those of corresponding ends of the clutch r are not so well shown, because the latter teeth are in gear. The sleeves b^5 and q' constitute the bearings in which the shaft p is supported, the sleeve b^5 being itself supported to turn, but confined lengthwise in a bearing b^6, secured to the lower carriage C C′, and the sleeve q' being supported to turn, but confined longitudinally in a bearing q^2, provided on the rear portion of the upper carriage E. The bearing q^2 is free to slide upon the shaft p, as the upper carriage runs back and forth on the lower one, so that the shaft is always properly supported.

The turning of the lower carriage for training the gun is effected by means of the pinion b, hereinbefore mentioned, gearing with the stationary circular toothed rack a'. The pinion b is fast on the lower end of the upright shaft b', which is carried by the lower carriage in a lower bearing b^2 in a bracket attached to the lower part of the cylinder C and an upper bearing in the table C′. This shaft b' has fast to it a worm-gear b^3, gearing with the endless screw b^4, carried by the horizontal shaft p, for the purpose of turning the shaft b' by the shaft p for training the gun.

The elevation of the gun is effected through a transversely-arranged shaft s, supported in bearings in the carriage E near the bottom of the rear portion thereof. This shaft s has fast upon it two pinions s', which gear with two toothed racks s^2, depending from the gun, the said racks being kept in gear with the said pinions by means of two guide-rollers s^3 on a shaft s^4, supported in the carriage E in rear of the shaft s. The shaft s is furnished at one end with a worm-gear s^5, which gears with the endless screw q on the sleeve q' of the shaft p.

In order to provide for the moving of the clutch r into gear with either the sleeve b^5 or that q', according as it is desired to train or to elevate the gun by means of said shaft, the said shaft is made hollow for the reception of a long rod t, the front end of which is connected with the clutch by a transverse pin t', which passes through longitudinal slots t^2, provided in the shaft, as shown in Fig. 7. The rear end of the said rod, which protrudes through the rear end of the shaft p, is furnished with a handle t^3, by which the said rod is moved longitudinally to bring the clutch r

either into gear with the sleeve b^5 and endless screw b^4 or into gear with the sleeve q' and endless screw q.

In order to provide for elevating the gun independently of the shaft p, the sleeve q' is provided with a crown-piece q^8 to serve as a handle for turning the said sleeve when the clutch r is out of gear with it. This permits the sleeve q' and the endless screw q to be turned for elevating the gun at the same time the gun is being trained by turning the shaft p, the clutch being then in gear with the sleeve b^5.

In order to provide for turning the gun-carriage more rapidly than it can be turned by the endless screw q, means may be provided by uncoupling the worm-wheel b^3 from the shaft p to permit the said shaft to be turned by any suitable appliance—as, for instance, a hand-wheel—upon it.

By combining both the mechanism for training the gun and for elevating it with a single shaft not only is the mechanism for training and elevating simplified, but the chances of the destruction of the mechanism by an enemy's shot are reduced. It may be understood by reference to Fig. 2 that the table C′ of the lower carriage is made wide enough to receive a shield for the protection of the upper part of the carriage and operating mechanism and of the men working the gun.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a gun-carriage, of a pivot, a lower carriage turning on the said pivot, a ball-bearing on the head of the pivot for the support of said carriage, and an upper carriage on which the gun is mounted and which is fitted to run backward and forward on the said lower carriage, substantially as herein described.

2. The combination, in a gun-carriage, of a cylindrical pivot, a lower turning carriage comprising an upright cylinder fitted to said pivot, an upper carriage fitted to run in the direction of its own length on said turning carriage, hydraulic cylinders on said turning carriage, each communicating at one end with a space for liquid between the head of the pivot and the head of said upright cylinder, and pistons connected with said sliding carriage and working in said hydraulic cylinders to force the liquid therefrom into the said vertical cylinder, substantially as and for the purpose herein described.

3. The combination, with the pivot A and the lower training carriage comprising an upright cylinder C, fitted to said pivot, of the hydraulic cylinders D D, placed on the said lower carriage and having a communication with the water-space within said upright cylinder, and a valve in said communication, substantially as herein set forth.

4. The combination, with the upper longitudinally-moving carriage and the lower carriage comprising an upright cylinder and ways upon which the longitudinal movement of the said upper carriage takes place, of horizontal cylinders on the said lower carriage, pistons working in said horizontal cylinders and connected with said upper carriage, communications between said upright and horizontal cylinders, a valve in said communications, a slideway on said upper carriage, arranged laterally oblique to the said ways, and a sliding connection between said valve and slideway, substantially as and for the purpose herein set forth.

5. The combination, with the upper longitudinally-moving carriage and the lower training-carriage comprising an upright cylinder, of horizontal cylinders on the said lower carriage, pistons working in said horizontal cylinders and connected with said upper carriage, communications between said upright and horizontal cylinders, a valve in said communications, a slideway pivoted at one end of said upper carriage and laterally adjustable thereto at its other end, and a sliding connection between the said valve and said slideway, substantially as herein described.

6. The combination, with the lower carriage provided with straight ways and the upper carriage adapted to run on said ways, of a series of rollers, each having a portion of its length of a smaller and portions thereof of a larger diameter, the portions of smaller diameter being fitted to the said ways and the portions of larger diameter supporting the upper carriage, and saddle-pieces containing bearings for the portions of said rollers of smaller diameter for spacing said rollers, all substantially as herein described.

7. The combination, with the lower carriage and the upper carriage capable of longitudinal movement thereon, of a toothed rack secured to the upper carriage, a pinion gearing with said rack to be rotated by the longitudinal movement of the said rack with the upper carriage, an axle for said pinion supported on the lower carriage, a friction-brake applied to said pinion, a spring applied to said brake to restrain the rotary movement of said pinion and the longitudinal movement of the upper carriage, and a lever for relieving said brake from the said spring and liberating said pinion, all substantially as and for the purpose herein set forth.

8. The combination, with a gun and a gun-carriage consisting of a lower carriage, a pivot upon which said carriage turns, and an upper carriage arranged to run lengthwise on said lower carriage, of a fixed circular rack surrounding the pivot, an upright shaft carried by said lower carriage and geared with said rack, racks attached to and dependent from the gun, a horizontal shaft and pinions carried by the upper carriage, arranged transversely thereto, and geared with said dependent racks, a third shaft supported in one bearing on the upper carriage and in another bearing on the lower carriage, sleeves on the said third shaft geared one with said

transversely-arranged shaft and the other with said upright shaft, and a clutch on the said third shaft for engaging with either of said sleeves, as may be desired, for training or elevating the gun, substantially as herein set forth.

9. The combination, with upper and lower carriages C, C′, and E, of the upright shaft b' and its pinion b and worm-wheel b^3, for training the gun, and the transverse shaft s and its pinions s' and worm-gear s^5, for elevating the gun, the hollow shaft p and its loose sleeves b^5 and q', having the endless screws b^4 and q thereon, and the clutch r between the said sleeves and the rod t, working within the said shaft and connecting with said clutch, substantially as and for the purpose herein described.

SAMUEL SEABURY.

Witnesses:
FREDK. HAYNES,
L. M. EGBERT.