

(No Model.)

3 Sheets—Sheet 1.

J. B. G. A. CANET.
HYDRAULIC BRAKE APPARATUS.

No. 442,014.

Patented Dec. 2, 1890.

Fig. 2.

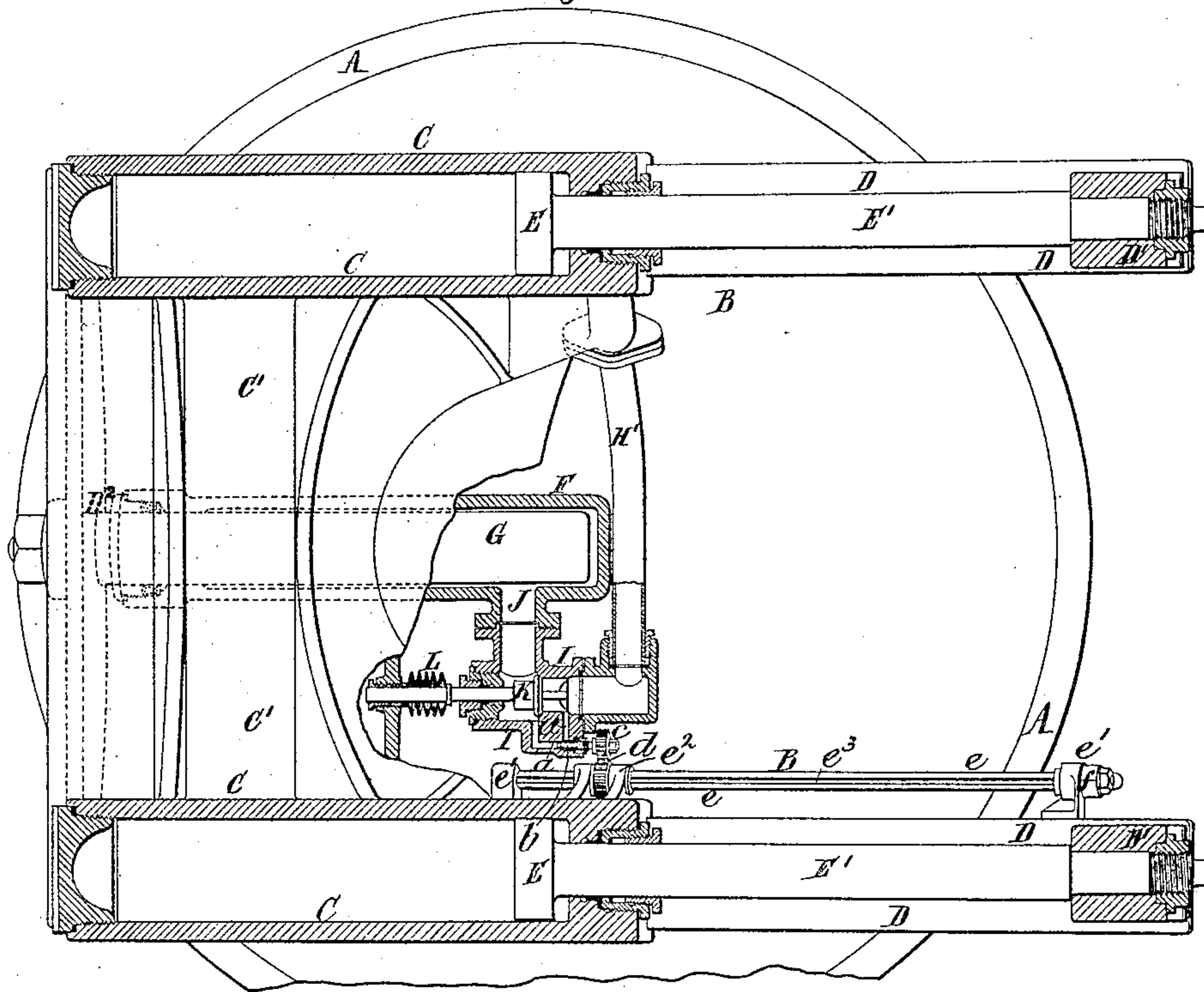
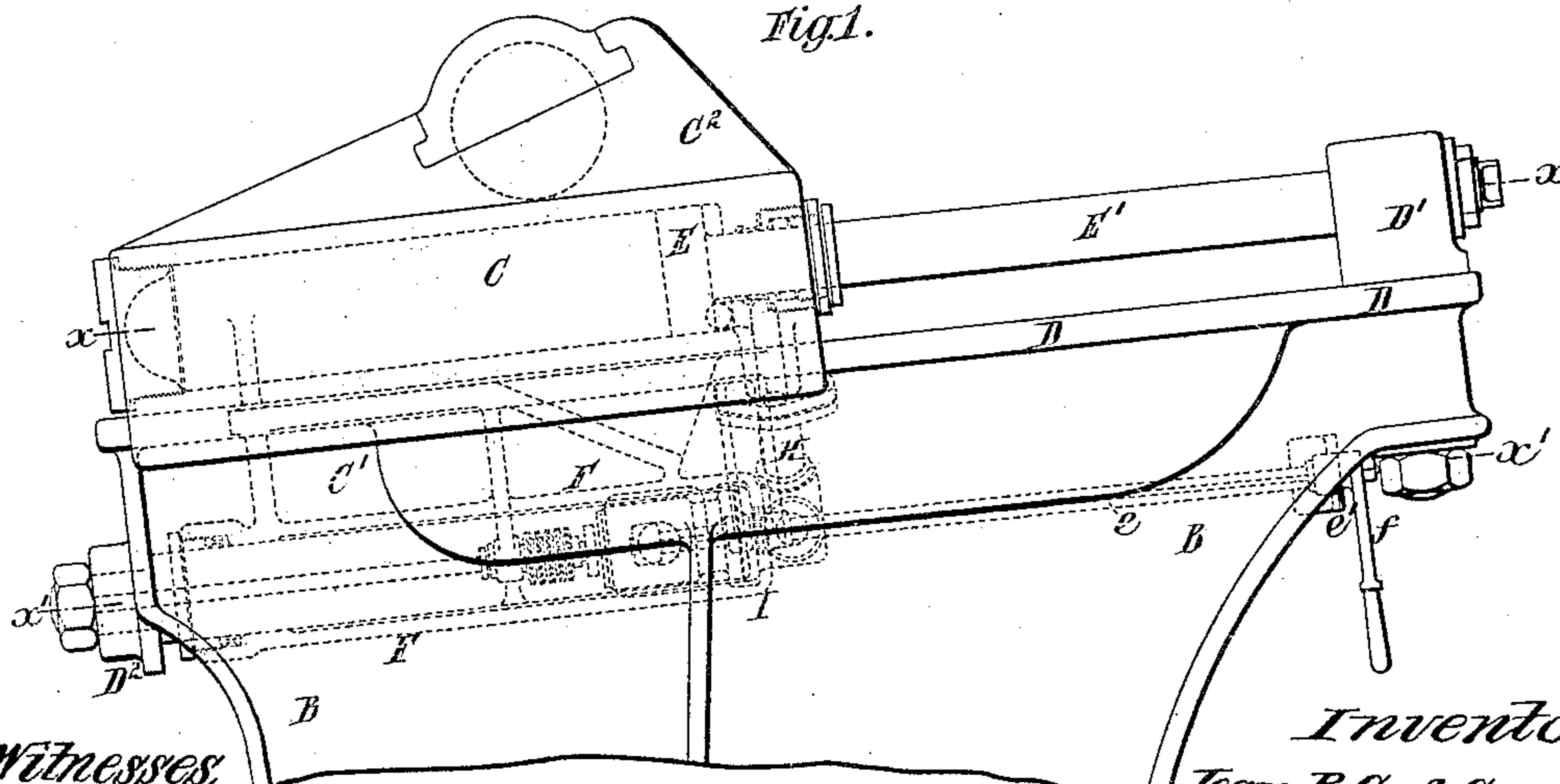


Fig.1.



Witnesses,

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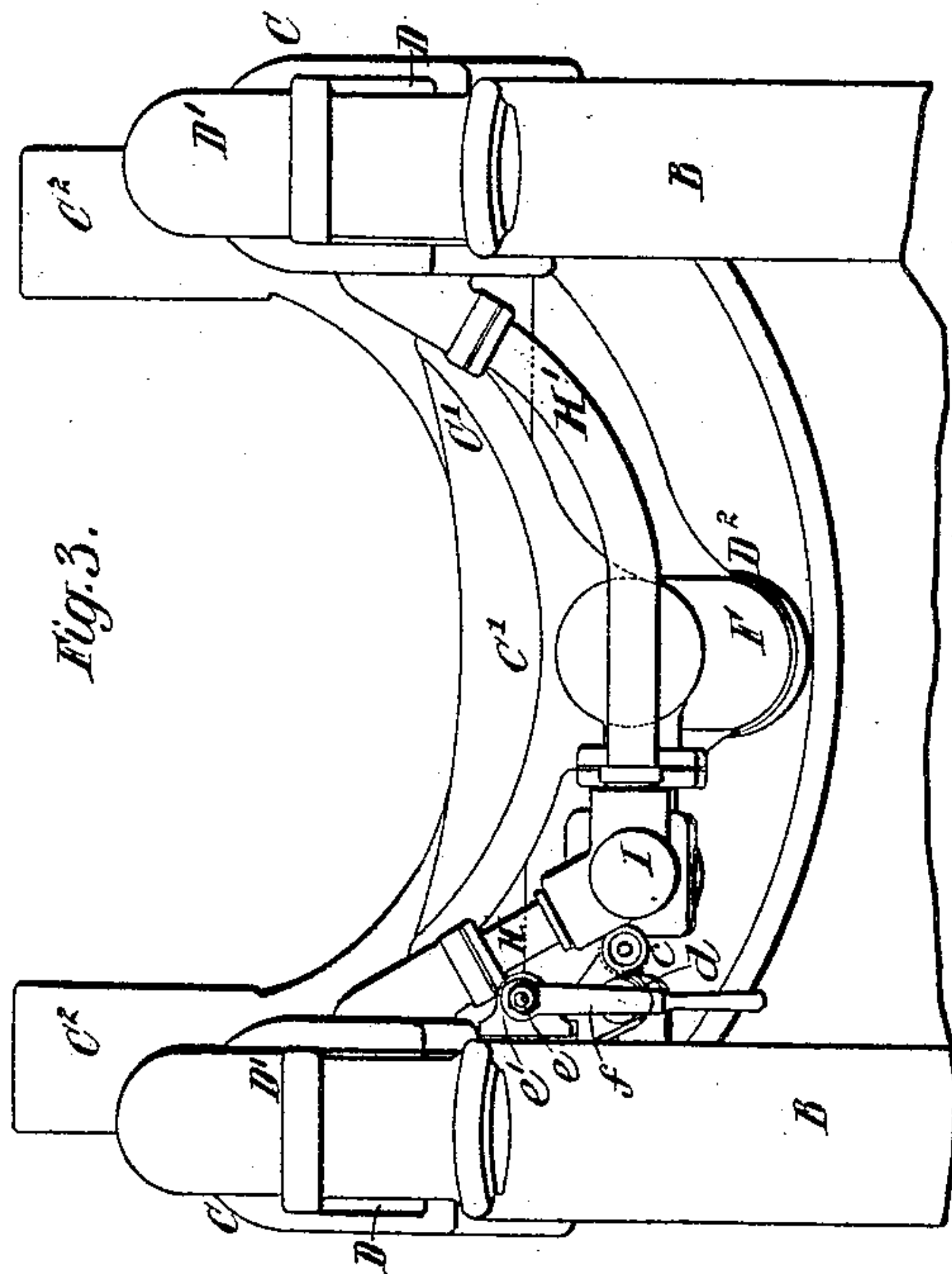
(No Model.)

3 Sheets—Sheet 2.

J. B. G. A. CANET.
HYDRAULIC BRAKE APPARATUS.

No. 442,014.

Patented Dec. 2, 1890.



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(No Model.)

3 Sheets—Sheet 3.

J. B. G. A. CANET.
HYDRAULIC BRAKE APPARATUS.

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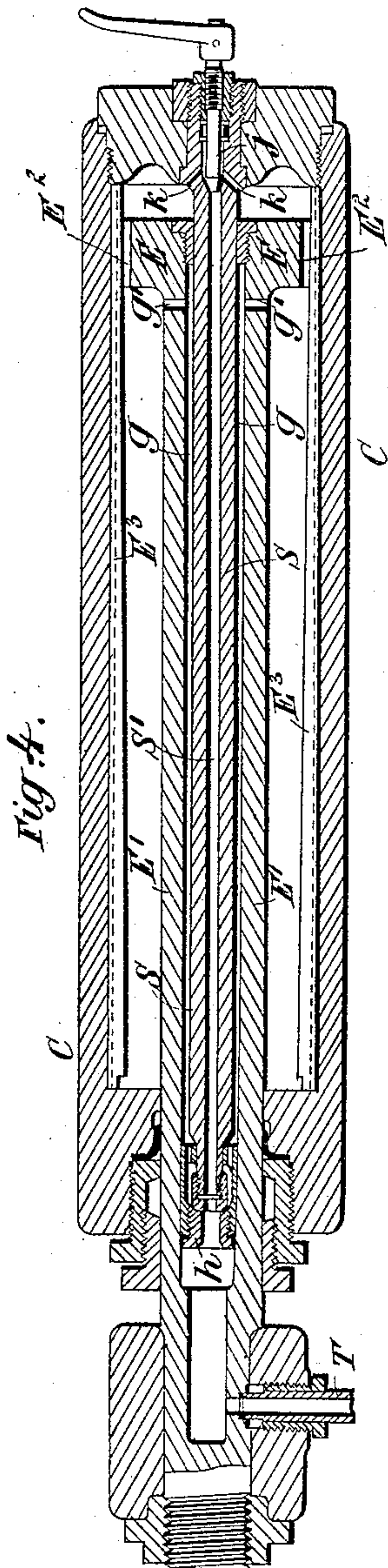
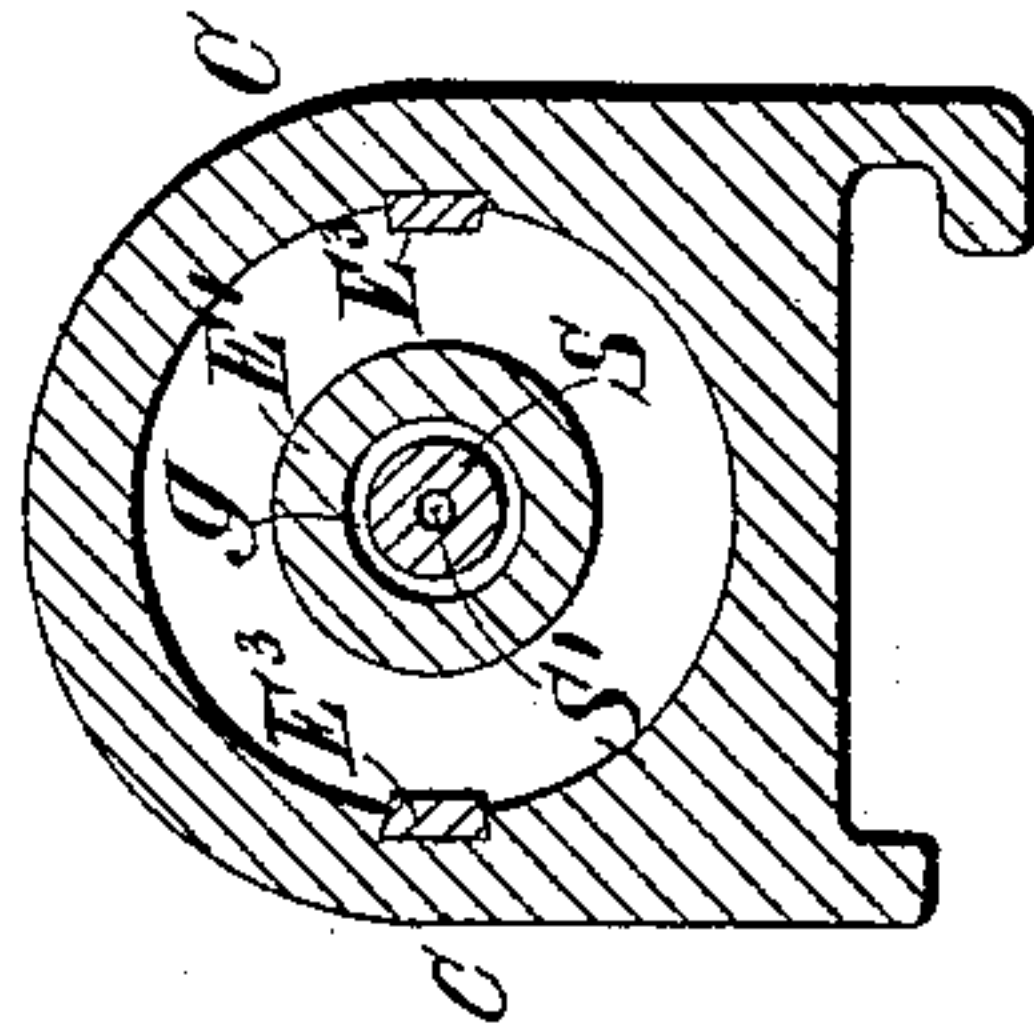


Fig. 5.



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UNITED STATES PATENT OFFICE.

JEAN BAPTISTE GUSTAVE ADOLPHE CANET, OF PARIS, FRANCE, ASSIGNOR
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MANCHESTER, ENGLAND.

HYDRAULIC BRAKE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 442,014, dated December 2, 1890.

Application filed July 19, 1888. Serial No. 280,353. (No model.) Patented in France January 29, 1884, No. 160,004, and in England July 9, 1887, No. 9,688.

To all whom it may concern:

Be it known that I, JEAN BAPTISTE GUSTAVE ADOLPHE CANET, engineer, a citizen of the Republic of France, and a resident of Paris, France, have invented new and useful Improvements in Hydraulic Brake Apparatus for Ordnance, (for which I have obtained patents in the following countries: in Great Britain, No. 9,688, dated July 9, 1887, and in France, No. 160,004, dated January 29, 1884, and (addition) No. 178,422, dated September 9, 1886,) of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to hydraulic brake apparatus for checking the recoil of guns and regulating or controlling their return to the firing position.

The said invention is chiefly designed to improve the construction and increase the efficiency of brake apparatus of the kind or class described in the specification accompanying my application for Letters Patent of the United States filed February 27, 1889, Serial No. 301,378.

To provide for controlling the running out of the gun according to the present invention, I combine with the brake-cylinders a device, which I will hereinafter term the "compensating" device. In this device liquid displaced from the brake-cylinders in the recoil by the progressive immersion of the piston-rods is received and retained until its return to the brake-cylinders or its discharge or escape is permitted by opening a valve. The running out or return of the gun to the firing position will then take place under the action of gravity or otherwise, its velocity being regulated by the extent of opening of the said valve.

My said invention, moreover, comprises other improvements hereinafter set forth.

In the accompanying drawings, Figure 1 is a side elevation of part of a gun-mounting provided with brake apparatus constructed in accordance with the present invention. Fig. 2 is a plan, partly in section, on the lines $x x$ and $x' x'$, Fig. 1. Fig. 3 is a rear elevation of

the said gun-mounting. Fig. 4 is a longitudinal central section, and Fig. 5 a transverse section, illustrating a further modification of the said invention.

Like letters indicate corresponding parts throughout the drawings.

A is the base-plate or racer, and B the turntable or under carriage.

C C are the brake-cylinders, which are united by a transom C', and form therewith the cradle or top carriage of the gun-mounting. This cradle or top carriage is formed with bearings C², in which the gun is mounted by means of its trunnions, and the said cradle or carriage is arranged to move longitudinally upon slides D on the under carriage B of the said gun-mounting.

E E are the pistons of the hydraulic brakes, the rods E' of which are firmly fixed in brackets or bosses D' at the rear ends of the slides D.

F is the cylinder of the compensating device, which is formed on or firmly attached to the top carriage. This cylinder is provided with a ram or plunger G, which is firmly secured at D² in a transom at the forward end of the chassis, frame, or under carriage B. Pipes H H' are provided for communication between the brake-cylinders C and the compensating cylinder F. These pipes connect the cylinders C with a valve-box I, which is connected by a short pipe J with the compensating cylinder F. The valve-box I contains a valve K, loaded by a so-called "Belleville" spring L or by other suitable means.

In the apparatus shown in Figs. 1, 2, and 3 a small by-pass or branch passage a is formed in the valve-box I, and is provided with a regulating-valve b . The stem of this valve has fixed thereon a pinion c , which is geared with a pinion d upon a shaft e , carried in bearings e' , formed with or attached to the chassis or under carriage B and extending through bearings e^2 , formed or fixed on the cradle or top carriage. The pinion d is secured upon the shaft e by means of a key fitted to slide in a long keyway e^3 in the said shaft, so that, although the said pinion must rotate with the

shaft, it is free to slide longitudinally thereon in the to-and-fro movement of the gun upon the slides D. Therefore whatever may be the position of the gun on the said slides the valve *b* can be controlled by turning the shaft *e*, which is provided for this purpose with a lever *f*. By these means the said valve can be adjusted while the gun is moving upon its slides. Other suitable means may, if desired, be provided for effecting the adjustment of the said valve, whatever may be the position of the gun on its slides. For instance, an arm may be keyed upon the shaft *e* and connected by a link with an arm or lever on the valve-stem.

The cylinders C F and the pipes and passages connecting the same are filled with liquid. By and during the recoil the liquid in the brake-cylinders C in front of the pistons E is forced to the rear of the latter, as in other well-known hydraulic recoil-brakes, and a volume of liquid is displaced from the said cylinders by reason of the progressive immersion of the piston-rods E'. The liquid thus displaced is forced through the pipes H H', and, lifting the valve K, passes through the pipe J into the compensating cylinder F.

The transverse sectional area of the ram or plunger G is equal to that of the two piston-rods E' of the recoil-brakes. Therefore during the recoil the volume of liquid which, as above described, passes from the brake-cylinders C into the compensating cylinder F will completely fill the void produced in the latter by its rearward movement, because the said cylinder will have been by such rearward movement displaced relatively to the ram or plunger G through a distance equal to that through which the brake-cylinders are displaced relatively to their pistons. The brake-cylinders and the compensating cylinder are therefore always full of liquid, whatever may be the position of the gun and top carriage on the slides D. At the termination of the recoil the valve K closes under the action of its spring L (the strength of which is suitably calculated) and interrupts the communication between the brake-cylinders and the compensating cylinder, whatever may be the position of the gun and top carriage when they come to rest upon the slides D. The liquid in the compensating cylinder being retained therein will then prevent displacement of the said cylinder. Consequently the gun and top carriage will be held in their recoiled position, and cannot run out or return to the firing position until communication is established between the brake-cylinders C and the compensating cylinder F by opening the valve *b*. When this valve is opened, liquid can flow from the compensating cylinder into the brake-cylinders through the by-pass *a*, and the gun and top carriage will therefore return to the firing position under the action of gravity. The speed of this return movement can be regulated or controlled at will by the adjustment of the valve *b*, so that no shock or

jar will be imparted to the gun-mounting at the termination of the return movement.

My invention is applicable to gun-mountings wherein the gun and top carriage are placed upon an inclined chassis, frame, or under carriage and run out or return to the firing position under the action of gravity, as above described, and also to gun-mountings wherein this running out or return is effected by the reaction of springs or by the introduction into the brake-cylinders of liquid under pressure supplied by an accumulator or pump.

My present improvements are also applicable to gun-mountings wherein the gun recoils upon a pivoted beam or slide which can be raised and lowered to effect the vertical pointing or elevation of the gun, and to other gun-mountings, whether the gun be supported by trunnions or otherwise. Moreover, although I have in Figs. 1 to 3 shown a gun-mounting so constructed that the piston-rods will be in compression during the recoil, I wish it understood that my invention can, in some instances, be adapted to gun-mountings wherein the piston-rods of the recoil-brakes are in tension during the recoil.

One peculiar feature of my invention consists in securing one part of the compensating device—viz., the cylinder or the plunger to the under carriage—and the other part to the top carriage, so that in the movement of the said top carriage upon the slides the one part will be moved or displaced relatively to the other, for the purpose above specified.

In the form or modification of my apparatus hereinbefore described the brake-cylinders C and compensating cylinder F are connected with the top carriage and are movable therewith. My improvements are, however, applicable with equal advantage in cases where the cylinders are fixed and the pistons or plungers movable, and also to various other combinations for insuring the inverse relative motions of the cylinders or pistons of the brake and the cylinder or plunger of the compensating device.

In some instances provision is made for the passage of the liquid from the brake cylinder or cylinders into the compensating cylinder or cylinders, and vice versa, through the interior of fixed hollow or tubular piston-rods or plungers.

It is obvious that more than one compensating cylinder may be used, if necessary or desirable.

When the above-described improvements are applied to gun-mountings for use on a ship or vessel, the automatic action of the spring-loaded valve K insures the retention of the gun and top carriage in position at the termination of the recoil, notwithstanding the inclination of the apparatus by reason of the rolling motion of the vessel. To insure this result the force of the spring L must be greater than the pressure transmitted by the liquid to the valve K during such rolling motion, whatever may be the extent of the latter.

In the modification of my invention illustrated in Figs. 4 and 5 the hydraulic brake apparatus is provided with the devices hereinafter described, whereby the gun will be re-
 5 tained in its recoiled position, and the velocity of its running out or return to the firing position can be effectually regulated or controlled—that is to say, the piston E is formed with slots E², through which extend taper
 10 bars E³, fixed in the cylinder C, or the said piston may be otherwise so constructed as to permit and control the flow of liquid from one side to the other side thereof. The piston-rod E' is made hollow or tubular, and in
 15 this rod is inclosed another hollow or tubular rod S, firmly secured in the rear end of the cylinder C. The cylinder C and the annular space or cavity g between the rod E' and the rod S are in communication through aper-
 20 tures or passages g' in the said rod E'. A valve h is provided for controlling the communication between the said annular space g and the chamber, cavity, or passage S' in the rod S. This valve is fitted to slide upon
 25 a reduced part of the rod S. An adjustable valve j is, moreover, provided, which closes the chamber or passage S', and whereby communication may be established through suitable orifices at k between the said chamber
 30 or passage S' and the space in the cylinder C at the rear of the piston E. During the recoil liquid from the cylinder C, passing through the apertures g' into the annular space g between the two rods, lifts the valve
 35 h from its seat and enters the central chamber or space S' within the rod S. Liquid also passes the piston E into the space behind the said piston. At the termination of the recoil the valve h closes, so that the liquid is retained
 40 in the chamber or space S' under pressure due to the weight of the gun and top carriage or to force applied to effect the return of the gun to the firing position by springs or otherwise. Therefore the gun and top carriage
 45 cannot move unless or until the controlling-valve j is opened to permit the liquid to escape from the said chamber S' into the space in the cylinder at the rear of the piston. The opening of this valve j can be regulated at
 50 will, so that the return of the gun to the firing position can be controlled as desired. It will be seen that the rod S and hollow piston-rod E' constitute a controlling device, acting for the same purpose as the compensating de-
 55 vice hereinbefore described.

The hollow rod E' may, if desired, be connected by a pipe T with an accumulator or pump to permit the running in of the gun without firing the same.

60 Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I wish it understood that I am aware that various forms of apparatus have been
 65 devised for use in combination with hydraulic recoil-brakes for ordnance for the purpose of regulating or controlling the running out

or return of the gun to its firing position after its recoil. I therefore do not claim, generally or apart from my improvements herein
 70 specified, the provision or use of means for accomplishing this result; but

I claim—

1. In a gun-mounting, the combination, with a hydraulic brake-cylinder, of a compensating
 75 or equalizing device which is connected with the said cylinder and is adapted to receive the liquid displaced therefrom in the recoil, and which comprises a cylinder or chamber, a piston or plunger working therein, a non-
 80 return valve for retaining the liquid in the compensating cylinder, and a valve for permitting and controlling the return of the said liquid to the brake-cylinder, for the purposes above specified.

2. In a gun-mounting, the combination, with a hydraulic brake-cylinder from which liquid is displaced during the recoil, of a compensating or equalizing device adapted to receive
 85 and retain the liquid displaced from the said brake-cylinder, and consisting, essentially, of a hydraulic cylinder and piston or plunger, one of which moves to and fro and the other of which is secured to the under carriage or
 90 frame of the said mounting, and a valve for permitting and controlling the return of the liquid from the said compensating or equalizing device to the brake-cylinder, for the purposes above specified.

3. In a gun-mounting, the combination, with
 100 a hydraulic brake-cylinder from which liquid is displaced during the recoil, of a compensating or equalizing device consisting, essentially, of a hydraulic cylinder and a piston or plunger, one of which moves to and fro and
 105 the other of which is secured to the under carriage or frame of the said mounting, a pipe or passage connecting the brake-cylinder with the cylinder of the compensating or equalizing device, a non-return valve in the
 110 said pipe or passage, and a valve for permitting and controlling the return of the liquid from the said compensating or equalizing device to the brake-cylinder, substantially as and for the purposes above specified.

4. In a gun-mounting, the combination, with a hydraulic brake-cylinder and a compensating or equalizing device consisting, essentially, of a piston or plunger working in a cylinder connected with the said brake-cylinder
 120 by a pipe or passage provided with a non-return valve for the purpose above specified, of a by-pass or branch passage connecting the said brake-cylinder with the compensating cylinder, and an adjustable valve for controlling the return of the liquid through the
 125 said by-pass or branch passage, substantially as set forth.

5. In a gun-mounting, the combination, with a hydraulic brake-cylinder and a com-
 130 pensating or equalizing device consisting, essentially, of a piston or plunger working in a cylinder connected with the brake-cylinder by a pipe or passage provided with a non-return

valve for the purpose above specified, of a by-pass or branch passage connecting the said brake-cylinder and compensating device, an adjustable valve for controlling the return
 5 of the liquid through the said by-pass or branch passage, and means, substantially such as above described, whereby the said valve may be adjusted from a fixed station, whatever may be the position of the gun on the
 10 chassis or under carriage.

6. In a gun-mounting, the combination, with the brake-cylinders C, of the compensating or equalizing device consisting, essentially, of the cylinder F and piston or plunger
 15 G, one of which moves to and fro and the other of which is secured to the under carriage or frame of the said mounting, pipes or passages H H' J, connecting the said brake-cylinders with the cylinder F, a non-return
 20 valve K in the pipe or passage J, and an adjustable valve for permitting and controlling the return of the liquid from the said cylinder F to the brake-cylinders, substantially as and for the purposes set forth.

7. In a gun-mounting, the combination, with the brake-cylinders C, of the compensating or equalizing device consisting, essentially, of the cylinder F and piston or plunger
 25 G, one of which moves to and fro and the other of which is secured to the under carriage or frame of the said mounting, pipes or passages H H' J, connecting the said brake-cylinders with the cylinder F, a non-return
 30 valve K in the pipe or passage J, the by-

pass or branch passage *a* around the said 35 valve, and an adjustable valve *b* in and governing the said by-pass or branch passage, substantially as and for the purposes set forth.

8. In a gun-mounting, the combination, with the brake-cylinders C, of the compensating or equalizing device consisting, essentially, of the cylinder F and piston or plunger
 40 G, one of which moves to and fro and the other of which is secured to the under carriage or frame of the said mounting, pipes or passages H H' J, connecting the said brake-cylinders with the cylinder F, a non-return
 45 valve K in the pipe or passage J, the by-pass or branch passage *a* around the said valve, an adjustable valve *b* in the said by-pass or
 50 branch passage, a pinion *c*, fixed on the stem of the valve *b*, a pinion *d*, geared with the said pinion *c* and arranged between lugs *e*² on the top carriage, a shaft *e*, fitted to rotate in bearings on the under carriage and extend-
 55 ing through the said pinion *d* and connected therewith, so that the pinion can slide to and fro on the said shaft but must rotate therewith, and a lever *f*, for operating the said shaft, all substantially as and for the pur-
 60 poses set forth.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JEAN BAPTISTE GUSTAVE ADOLPHE CANET.

Witnesses:

ROBT. M. HOOPER,

CH. F. THIRION.