March 18, 1924. 1,486,902

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REGUPERATOR MECHANISM FOR GUNS

Filed Oct. 9, 1922 2 Sheets-Sheet 1

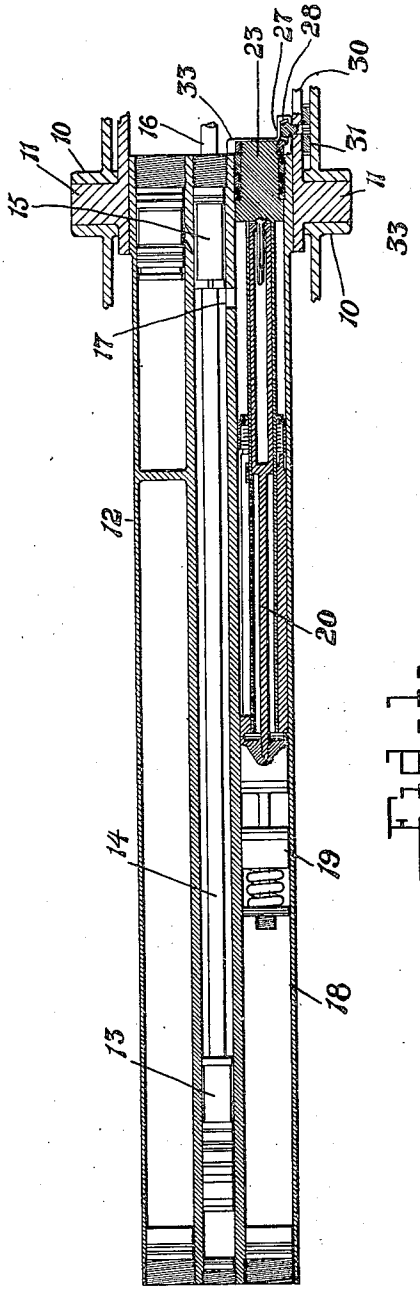

Fig. 1.

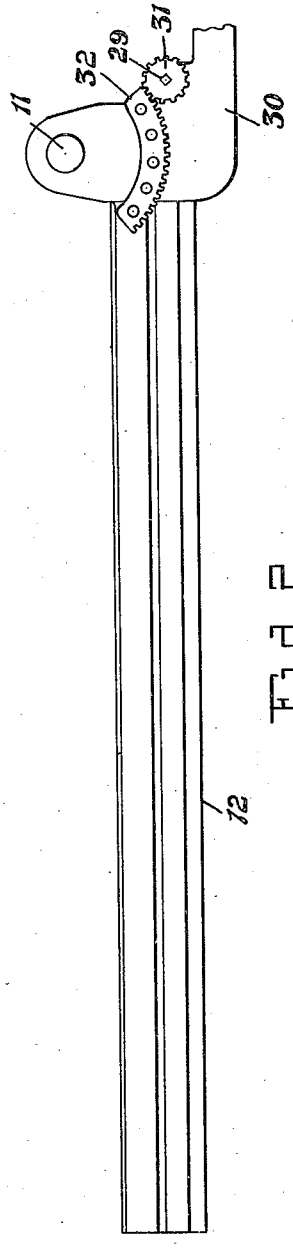

Fig. 2.

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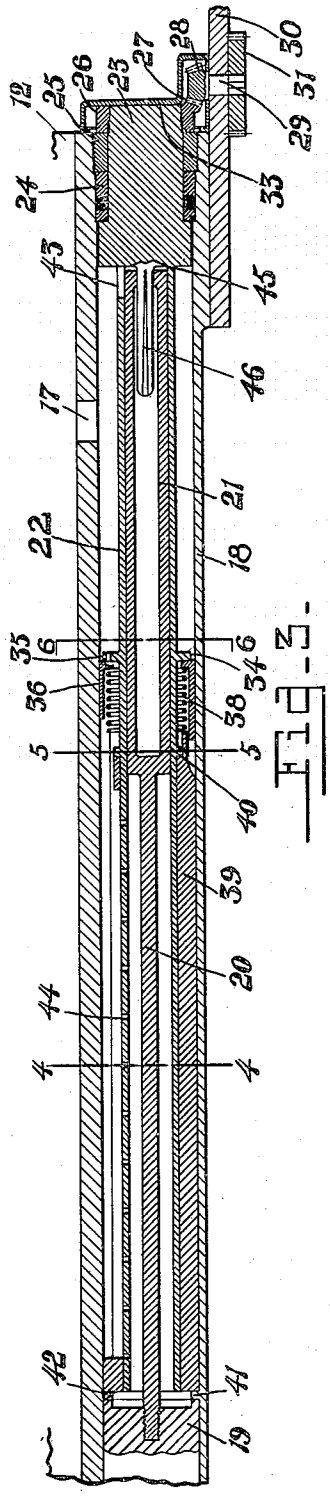

FIG-3-

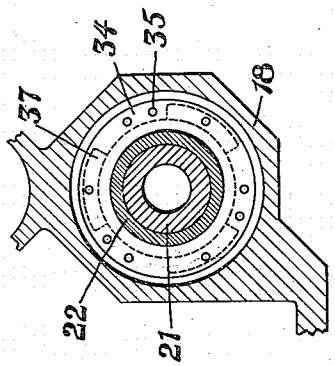

FIG-6-

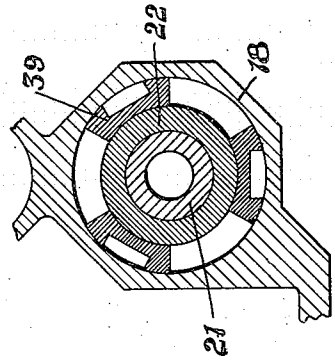

FIG-5-

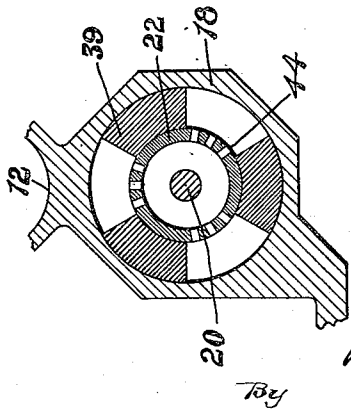

FIG-4-

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UNITED STATES PATENT OFFICE.

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RECUPERATOR MECHANISM FOR GUNS.

Application filed October 9, 1922. Serial No. 593,363.

(FILED UNDER THE ACT OF MARCH 3, 1883, 22 STAT. L., 625.)

To all whom it may concern:

Be it known that I, BRYAN P. JOYCE, a citizen of the United States, and a resident of Davenport, State of Iowa, have invented an Improvement in Recuperator Mechanism for Guns, of which the following is a specification.

The invention described herein may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without payment to me of any royalty thereon, in accordance with the act of March 3, 1883.

The subject of this invention is a recuperator mechanism for guns.

The main object of the invention is the provision of a recuperator mechanism which may be automatically varied for recoil or counter recoil or both in accordance with the elevation of the gun.

Modern guns are of comparatively great length and weight and, largely because of the introduction of aircraft in warfare, must be susceptible of high degrees of elevation. Because of these factors it becomes desirable that the resistance to recoil be greater when the gun is in elevation than when it is horizontal or nearly so and that the recuperative force be similarly increased under such circumstances.

The present invention accomplishes these purposes by the provision of means, operated by the elevation of the guns for varying the resistance to recoil and the force of counter recoil.

With these and other objects in view, my invention resides in the novel arrangement and combination of parts and in the details of construction hereainfter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A practical embodient of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a longitudinal section of a recoil mechanism constructed in accordance with the invention;

Fig. 2 is a side elevation of the same;

Fig. 3 is an enlarged longitudinal section of the recuperator mechanism; and

Figs. 4, 5 and 6 are cross sections taken on the lines 4—4, 5—5 and 6—6, respectively, of Fig. 3.

Referring to the drawings by numerals of reference:

A fragment of the top carriage of a gun mount is indicated at 10 in which are journaled the trunnions 11 rigid with the recoil mechanism.

Recoil casing 12 is formed into cylinders in one of which the recoil piston 13 is slidably mounted and to the piston is attached a piston rod 14 which works through a stuffing box 15 situated at the rear end of the cylinder. The gun is connected to the protruding end 16 of the piston rod in any usual and well known manner.

The recoil cylinder is in communication through a port 17 with cylinder 18, known as the recuperator cylinder, in which is mounted the recuperator mechanism. The recuperator mechanism consists of a floating piston 19 slidable in the cylinder 18 and comprising a piston rod 20 connected thereto which rod terminates at its rear free end in a hollow cylindrical plunger 21, slidable in a tubular member 22 carried by and extending from a cylindrical block 23 which closes the rear end of the cylinder 18. The block 23 may be packed with a suitable packing 24 confined between an annular shoulder formed on the block and a retaining ring 25 which is threaded into the rear end of the cylinder. Encircling the rear end of the block 23 is a ring 26, which is attached to the block so as to be constrained to rotate therewith, and the ring is formed with a segmental rack 27 thereon, which is in mesh with a bevelled pinion 28 carried on one end of a stub shaft 29 journaled in the trunnion plate 30, on the other end of which shaft is secured a pinion 31 in mesh with a rack 32 secured to the top carriage. The rear end of the block 23 and the pinion 28 may be housed in a suitable casing 33 to protect the parts from dust or other foreign substances.

From the foregoing it is evident that the liquid which normally fills the recoil cylinder in the rear of the recoil piston 13, flows from such cylinder through the ports 17 and into the cylinder 18 when the gun recoils. I provide for control of this flow of liquid by placing in the cylinder a suit-

able valve mechanism. Specifically, I form an annular flange 34 on the tubular member 22, which flange is provided with series of spaced apart ports 35. This flange forms a seat for a valve 36, having grooves 37 formed therein each of which are adapted to selectively register with one or more ports of a series. The valve may be held normally on its seat by a coiled spring 38 confined betwen the valve head and the rear end of a cage 39.

The cage 39 encircles the tubular member 22 forwardly of the flange 34 and may be held against rectilinear movement by having an annular shoulder formed interiorly adjacent its rear end which abuts against an annular flange 40 formed exteriorly of the tubular member 32, and its forward end abutting against an annular flange 41 formed interiorly of the cylinder. The cage is held against rotation with respect to the cylinder by a lug or key 42 which projects into a recess formed in the flange 41.

The interior of the tubular member 22 is in communication with the interior of the cylinder 18 through a port 43 positioned adjacent its rear end and through spaced apart ports 44 provided in that portion of the member forward of the valve 36 and encircled by the cage 39. The cylindrical stem 21 is also in communication with the interior of the cylinder 18 and tubular member 22 through notches 45 formed in the periphery of its open end and into such rear end projects a spear shaped buffer 46 preferably formed on and extending forwardly of the block 23.

The operation on recoil and counter recoil is as follows:

When the gun is in horizontal position the parts are in the relation shown in the figures of the drawings with one port 35 of each group of ports in register with a groove 37 of the valve 36 and the ports 44 all clear of the strips or bars of the cage 39.

When the gun is fired, recoil draws the recoil piston 13 rearwardly, forcing the oil from the recoil cylinder through ports 17 into cylinder 18. The oil entering cylinder 18 under pressure will force the valves 36 from its seat and enter the member 22 through ports 44 in which position it is free to act upon the rear face of the piston 19. The piston 19 will, consequently, be forced forwardly, compressing the resilient fluid, conveniently air, in front of it until the parts gradually come to rest. At the same time some oil will be forced through the port 43 and will enter the tubular stem 21.

When the parts have come to rest counter recoil takes place and the resilient fluid expanding and forcing the piston 19 rearwardly will force the coil through the ports 44 and seat the valve 36, causing the oil to throttle through the groove 37 and ports 35 and return to its original position through ports 17. At the same time the tubular stem 21 will move rearwardly forcing oil through port 43, the expelled oil being gradually throttled in a progessively increasing manner through the spear like member 46 entering the rear end of the stem 21.

When the gun is elvated the block 23 with its tubular extension 45 will be rotated through the gears and segmental rack 32 causing the bars 39 of the cage to cover some of the ports 44 and, when the elevation has attained sufficient height to bring more ports 35 into register with the groove 37. This will cause greater throttling of the oil through ports 44 and so shorten recoil and will relieve to some extent throttling through the ports 35 to compensate for the increase weight component of the recoil parts.

I claim—

1. The combination with a gun carriage and a recoil cylinder pivotally mounted thereon, of a recuperator cylinder communicating with the recoil cylinder, a floating piston in the recuperator cylinder, a tubular stem carried by the piston, a cage within the recuperator cylinder, a block closing the rear end of the recuperator cylinder and rotatable therein, a tubular member extending from the block provided with ports adapted to be successively closed by the bars of the cage when the parts are rotated, a flange on the member provided with a series of ports, a valve normally seated on the flange provided with grooves each adapted to register with ports of a series, a spear shaped buffer adapted to enter the tubular stem, a rack on the carriage and gearing between the rack and block, operating to rotate the block and tubular member as the cylinders are elevated or depressed.

2. A recuperator, including a cylinder, a floating piston within the cylinder, a tubular stem carried by the piston, a cage within the cylinder, a block closing the rear end of the cylinder and rotatable therein, a tubular member extending from the block and within the cage, said member having ports adapted to be successively covered by the bars of the cage as the member is rotated, a flange formed on the member having a series of ports, a valve normally seated on the flange and adapted to throttle liquid on return flow through the ports, means for throttling the escape of fluid from the stem upon movement of the piston to normal position and means operating on elevation of the cylinder to rotate the block and tubular member to bring ports of the member into position to be covered by the bars of the cage.

3. A recuperator, including a cylinder, a floating piston within the cylinder, a cylindrical stem carried by the piston, a cage within the cylinder, a tubular member within which the stem reciprocates, said member provided with ports adapted to be successively closed by the bars of the cage as the member is rotated and means for rotating the member.

4. A recuperator, including a cylinder provided with a port, a floating piston within the cylinder and removed from the port, a rotatable valve seat within the cylinder between the port and piston, said seat provided with apertures and a valve normally resting on the seat and formed with grooves to successively register with ports as the seat is rotated whereby throttling of fluid upon movement of the piston to normal position is increased or diminished.

5. A recuperator, including a cylinder provided with a port, a floating piston within the cylinder, a valve within the cylinder between the port and piston operable to throttle the flow of fluid upon movement of the piston toward normal position and means for varying throttling action of the valve.

6. A recuperator, including a cylinder, a floating piston within the cylinder, means within the cylinder for controlling the flow of fluid to and from the piston and mechanism actuated by the elevation of the cylinder for operating the controlling means.

7. A recuperator, including a cylinder, a floating piston within the cylinder, means within the cylinder for controlling the flow of fluid therein and gearing including a stationary rack and a pinion meshing therewith for actuating the controlling means upon elevation of the cylinder.

BRYAN P. JOYCE.