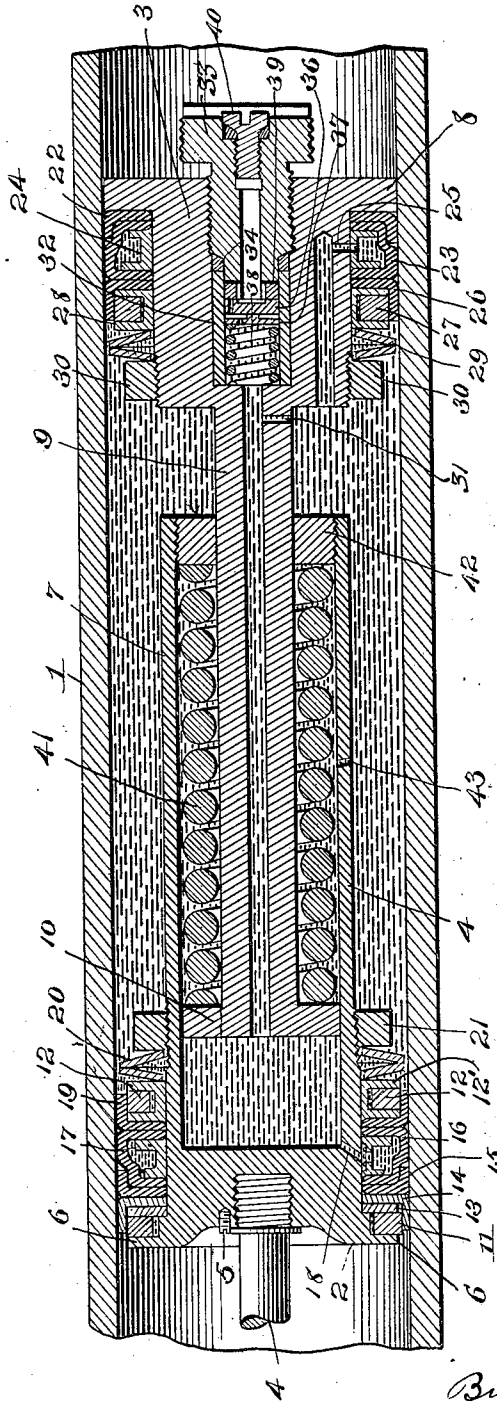
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FLOATING PISTON FOR RECOIL MECHANISM.

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FLOATING PISTON FOR RECOIL MECHANISM.

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To all whom it may concern:

Be it known that I, BRADFORD B. HOLMES, major, Coast Artillery, United States Army, a citizen of the United States, stationed at Washington, D. C., have invented an Improvement in Floating Pistons for Recoil Mechanism, 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 of any royalty thereon.

This invention relates to improvements in recoil mechanism for guns and has special reference to recuperator mechanism of the hydropneumatic type and more particularly to the means employed for separating the liquid from the gas.

The object of this invention is to provide a means in connection with the floating piston of a recuperator mechanism which is effectively sealed against the leakage of oil or air, and to accomplish this result by means which will exert a greater pressure on the bearing surface than the corresponding pressure on the oil or air.

In the following specification, reference will be made to the accompanying drawing which is a vertical section of the preferred embodiment of my invention.

A cylinder 1 is part of the recuperator mechanism and communicates at one end with the recoil cylinder by means of a passage controlled by the usual throttle mechanism (not shown). The liquid contained in the recoil cylinder is forced through this valve controlled passage during the recoil and counter-recoil of the gun. The opposite end of the cylinder 1 communicates with air under pressure which is employed to return the gun to battery position. A floating piston is located in the cylinder 1 to separate the oil from the air and as stated above, the invention consists primarily of the means employed to prevent the leakage of either of these fluids.

The floating piston comprises the piston heads 2 and 3, the piston head 2 being bored and threaded centrally for the reception of the usual counter-recoil buffer 4, which is held in fixed position by the locking screw 5. The piston head 2 is formed with the annular flange 6 and a longitudinal sleeve extension 7. The piston head 3 is, in like manner, formed with the annular flange 8 and a centrally bored longitudinally extending shank 9 terminating in a flange 10 which is adapted to be slidably received within the sleeve 7.

Located in back of the flange 6, of piston head 2 and surrounding the body portion thereof and a portion of the sleeve 7, are the expansible metal rings 11 and 12. Abutting the ring 11 is a metal washer 13. The expansible ring 11 abuts against one arm of an annular leather washer 14 of L-shaped section, and by its tendency to expand holds this arm of the washer in contact with the interior of the cylinder 1. The other arm of L-shaped leather washer 14 is located against a similar shaped leather washer 15 having its lateral arm extending in the opposite direction from the corresponding arm of washer 14.

A ring of leather packing 16 of substantially U-shape abuts the washer 15. The closed end of the U-shaped packing 16 bears against the interior wall of the cylinder 1 and the spacing ring 17 holds the arms of the U-shaped packing in spaced position thereby forming a receptacle for fluid, preferably grease, as will hereinafter appear. The spacing ring 17 is apertured and is in position to register with a diagonal aperture 18 through the sleeve extension 7.

Abutting the U-shaped packing is an L-shaped washer or packing ring 19, the short arm of which overlies, and is held in position against the interior of the cylinder by means of an expansible ring 12 and ring retainer 12′. This assembly, of packing rings and washers, is held in compact position by means of the Belleville springs 20 against which bears a retaining nut 21, screw-threaded on the exterior of the sleeve 7.

The piston 3 is in like manner provided with means for making an oil and gas tight joint, which consists of the L-shaped leather washer 22 having its long arm located against the flange 8 and having its short arm bearing against the interior wall of the cylinder. Next to the washer 22 is placed a U-shaped packing ring 23 having its closed end abutting the interior wall of the cylin-

der and the short arm or washer 22, and having its open end maintained in open position by means of the spacer 24.

The spacer 24 is apertured so as to register with a recess 25, which communicates with a longitudinal hole bored through the body of the head 3 so that the open portion of the U-shaped washer 23 will be in communication with the interior of the cylinder which contains a supply of grease as will hereinafter appear.

Abutting the U-shaped packing 23 is an L-shaped leather packing ring 26, the short arm of which is maintained against the interior of the cylinder by means of the expansible ring 27, which is held in position by retaining member 28. The members constituting the piston packing are retained securely in position by means of the Belleville washers 29 and the retaining nut 30 screwed on threads formed on one end of the body of piston head 3. The piston shank 9 has a passage 31 formed therein for connecting the interior of the cylinder with its central bore.

The piston head 3 is centrally bored to a diameter greater than the bore of its shank extension and in this enlarged bore is inserted a valve sleeve member 32, which is held in place by means of the screw plug 33 which bears against the packing ring 34 of suitable material. Located within the sleeve 32 is a spring-pressed valve comprising the apertured disk 36 and apertured valve follower 37, against which bears the spring 38. The valve disk 36 bears against a suitable valve seat 39, which is so formed as to provide a leakproof closure. The screw-plug 33 is centrally bored and threaded at one end for the reception of a closing screw 40 which may be removed in order that access may be had to the interior of the cylinder for the purpose of inserting the proper fluid under pressure.

To assemble the floating piston, the shank 9 is inserted within the sleeve 7, flange 10 contacting with the interior of said sleeve and acting as a guide for the shank and also as an abutment for one end of the spring 41, which is compressed between the flange 10 and the annular ring nut 42. The nut 42 fits over the shank 9 and acts as a closure for one end of the sleeve 7. The sleeve 7, is provided with a passage 43 for permitting passage of the grease from the interior to the exterior of the sleeve.

In previous devices of this character, it has been necessary to grind the interior of the cylinder 1, and also to finish it to a very accurate and smooth surface by lapping. In connection with such a smooth surface, a piston packing was employed of complicated structure and very difficult to manufacture. This packing affords a constant resistance to the passage of the fluids and therefore when the fluid pressure on either side of the floating piston exceeds the constant pressure on the packing there is a tendency for fluid leakage. This leakage is very detrimental to the proper action and continued service of the recoil mechanism.

It will be noted that the packing ring 14 is bent laterally and is forced into contact with the interior wall of the cylinder under the radial pressure exerted by expansible ring 11. The function of this lateral portion which extends peripherally around the piston head 2, is to wipe off the oil which may adhere to the cylinder wall. This prevents oil from accumulating between the U-shaped washer 16 and the interior wall of the cylinder where it may prevent actual contact between packing ring 16 and the cylinder. This lack of contact would interfere with the proper functioning of the mechanism and lead eventually to leakage of oil.

After the floating piston, with the packing assembled, has been positioned within the cylinder the piston is brought to one end of the cylinder 1, the screw 40 removed and an adapter, or a suitable grease feeding device, is placed in its stead and heavy grease is forced through the valve 36 and the bore of the shank extension 9 into the interior of the sleeve 7 and interior of the cylinder 1. This grease is forced through the apertures 18 and 25 and into the open portion of the U-shaped packing ring 16 and 23. The grease is forced into the cylinder between the piston heads until its space is completely filled with grease under the desired pressure when the adapter is removed and the plug 40 replaced. The piston is then placed in its proper position in the recuperator system. On account of the fact that the exposed area of the outer face of flange 10 is greater than the area of the inner face the grease will exert an unbalanced force which compresses the spring 41 under a certain initial tension. The pressure on the interior of the packing rings 16 and 23 will therefore always exceed the external pressure of the oil or air by the spring tension.

On recoil of the gun, the oil is forced out of the recoil cylinder through the usual throttle openings and into cylinder 1 where it contacts against the piston head 2. The pressure on the oil, upon firing of the gun due to the reaction from the force of discharge, will be very high and this pressure will act through the oil on the piston head 2 which through the grease under pressure transmits the same to the piston head 3 thereby compressing the air to a higher degree as the piston as a whole moves under the pressure of the oil. The pressure of the oil will tend to force the oil through the packing arrangement above described, but

it will be noted that the packing ring 16 will be forced against the interior wall of the cylinder with a pressure exceeding the pressure on the oil by the initial tension on spring 7. Therefore in no case will the pressure of the oil or air be sufficient to cause leakage around the packing rings arranged according to my invention. At the end of the recoil of the gun, the air under pressure will tend to expand and force the gun back to battery position and the oil back to the recoil cylinder.

The counter-recoil buffer 4 functions in the usual manner to prevent the return of the gun to battery position too rapidly.

By employing my invention as above described, the complicated packing arrangement previously used is eliminated as well as the necessity for a highly polished interior cylindrical surface. The packing arrangement also functions effectively when the cylinder is ground to the usual surface resulting from such a finishing operation.

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

1. The combination with a cylinder, a piston head having an annular flange and packing for said piston-head comprising a packing ring of L-shaped section in contact with said flange, having its lateral wall bearing against the interior of the cylinder, a U-shaped packing ring of flexible material having its closed wall contacting with said lateral wall and cylinder, an apertured spacer for maintaining the open side of said U-shaped packing ring distended, a second L-shaped annular packing ring having a laterally projecting wall, an expansible washer for maintaining said wall in contact with the cylinder, and means for maintaining said packing in position on said piston-head.

2. In a hydrapneumatic recuperator system, a floating piston comprising spaced piston-heads contacting on recoil, one with the liquid and the other with the gas under pressure, a passage formed through one of said piston heads, a spring pressed valve for controlling said passage, yieldable for permitting the insertion of a fluid under pressure in the space between said piston-heads, a spring compressed between said piston-heads by said fluid under pressure, and a U-shaped packing ring extending peripherally around each piston-head forced into contact with said cylinder by the pressure of said spring as transmitted by the fluid contained between said piston-heads.

3. A device for separating fluids under pressure, including a floating piston head, a packing ring for said piston head, a spacing ring associated with the packing ring and means for forcing fluid between the spacing ring and the interior of the packing ring to exert pressure on the packing ring in excess of the fluid pressure upon the exterior of the piston head.

4. A device for separating fluids under pressure, including a piston head, a packing ring for said piston head, a spacing ring associated with the packing ring and forming therewith an annular chamber and means for forcing fluid into the annular chamber.

5. A device for separating fluids under pressure, including a piston head, a packing ring for said piston head, a spacing ring associated with the packing ring and forming therewith an annular chamber, there being means in the piston head and spacing ring establishing communication with the annular chamber whereby fluid pressure is applied to the interior for the packing ring.

BRADFORD B. HOLMES.