Nov. 2, 1943. J. C. TROTTER ET AL 2,333,398

RECOIL DAMPENER

Filed May 20, 1940 3 Sheets-Sheet 1

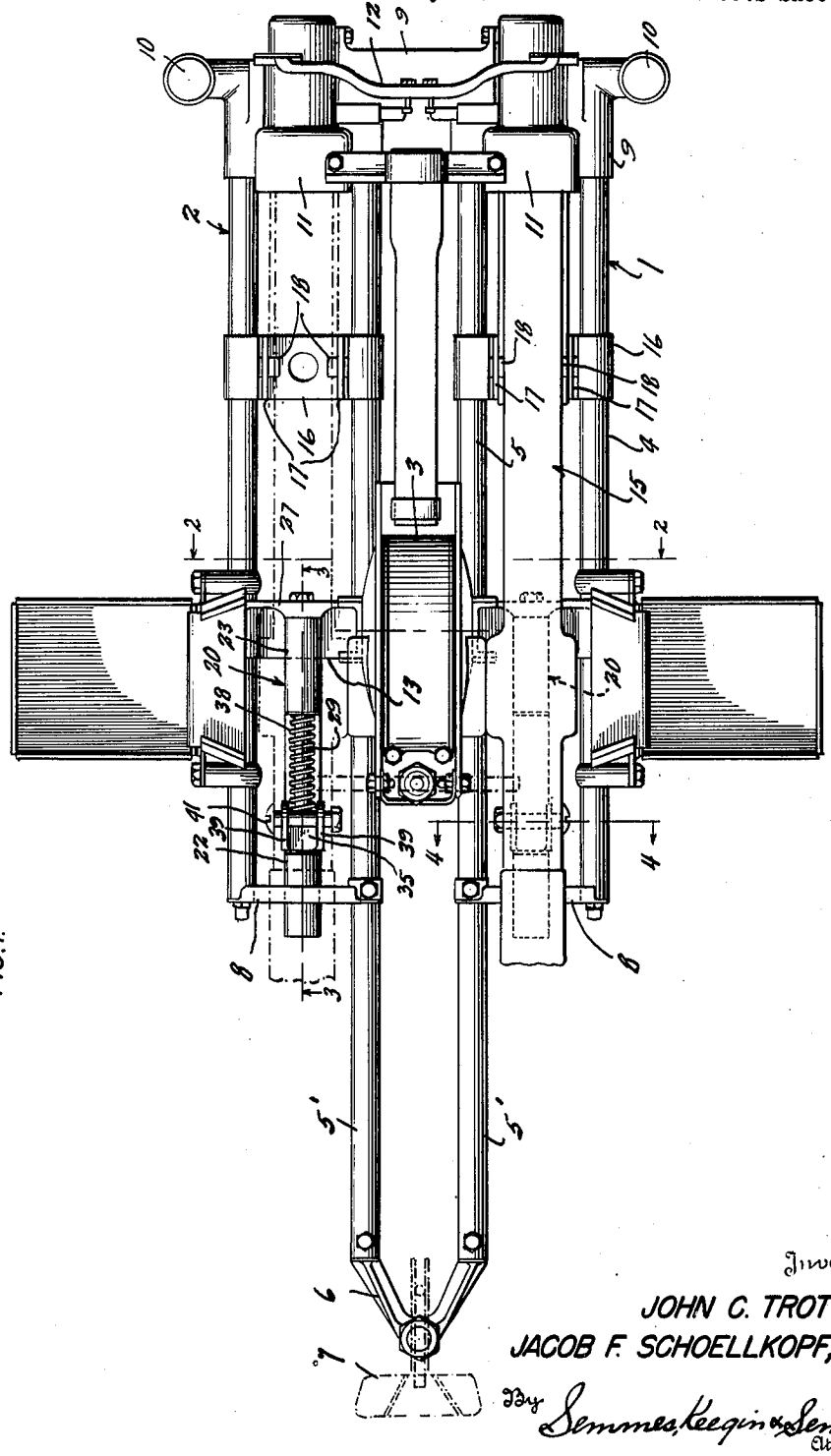


FIG. 1.

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Filed May 20, 1940 3 Sheets-Sheet 2

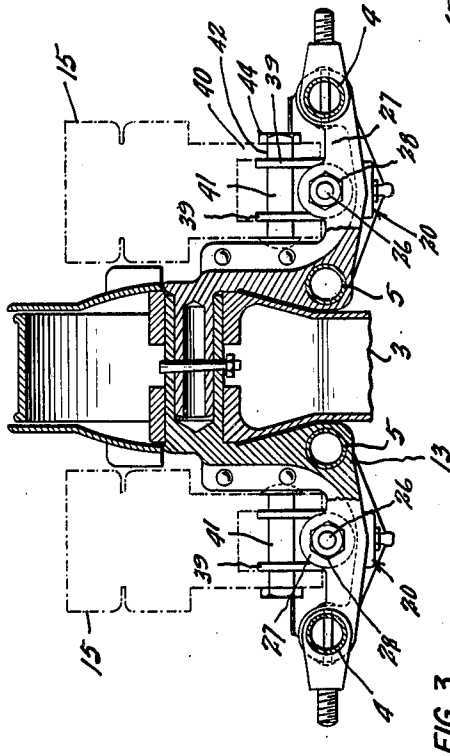


FIG. 2.

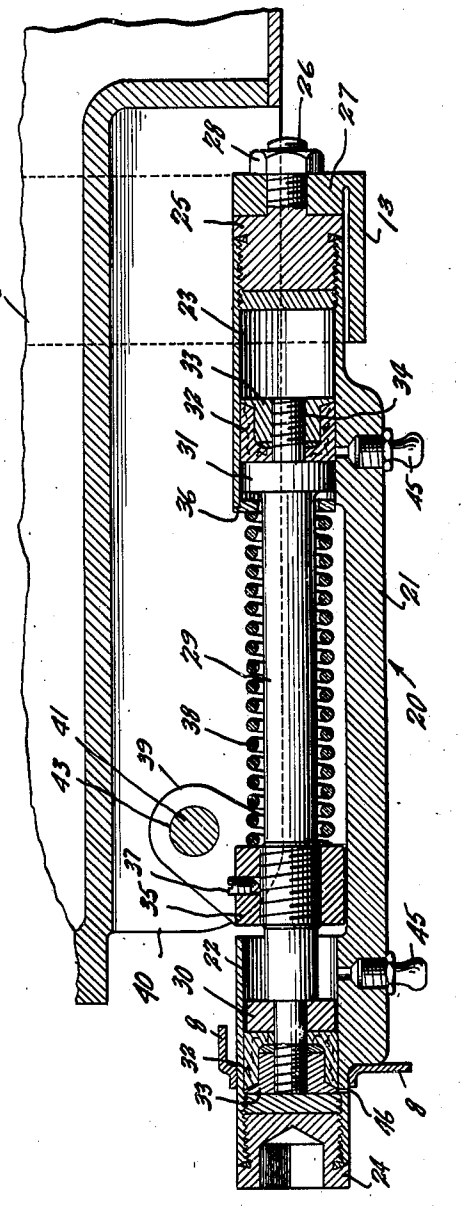


FIG. 3.

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Filed May 20, 1940 3 Sheets-Sheet 3

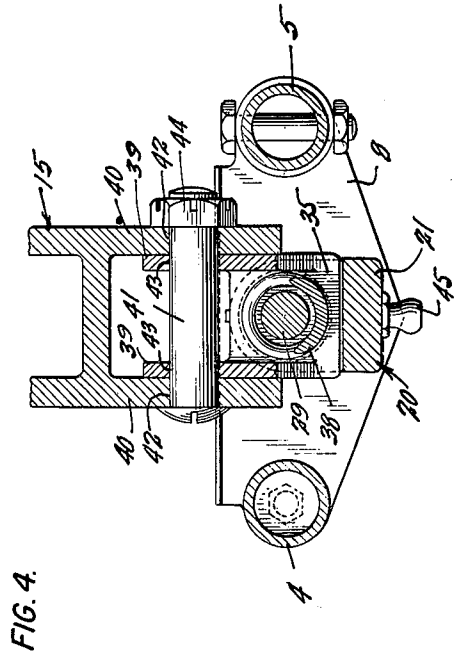


FIG. 4.

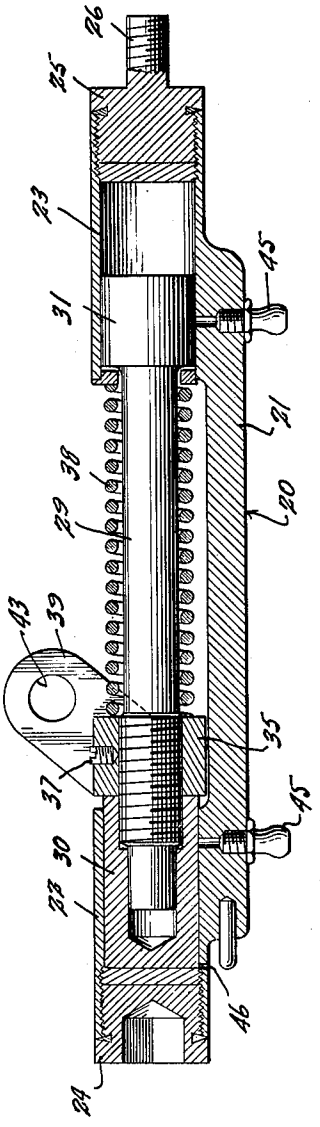


FIG. 5.

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2,333,398

UNITED STATES PATENT OFFICE

2,333,398

RECOIL DAMPENER

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Application May 20, 1940, Serial No. 336,286

10 Claims. (Cl. 89—42)

Generally, this invention relates to recoil dampening, and more particularly to the dampening of recoil in machine guns to be used in aircraft or other structures which are limited in space. Specifically, it covers a mount for machine guns that is provided with a recoil dampening unit that will give a cushioning effect regardless of the angle at which the guns are being fired.

Heretofore, the devices which have been provided to absorb the recoil of machine guns in aircraft have not been especially practical. These prior mounts have been quite large and cumbersome and as a consequence, the operator of the gun had difficulty in obtaining maximum accuracy in firing. Moreover, no recoil control units have been provided that would afford a cushioning result when the load is augmented or diminished by the weight of the gun at high and low angles of firing.

An object of this invention is to provide a machine gun mount for aircraft having a recoil dampening unit which is simple in construction and operation and which can be cheaply manufactured.

Another object of the present invention is to provide a recoil control unit for machine gun mounts which will afford a cushioning effect when the load is increased or decreased by the weight of the gun at high and low angles of firing.

Yet another object of this invention is to provide a recoil unit or machine gun mounts having a spring which absorbs the principal amount of recoil and in which pneumatic means is included for taking care of increased loads.

A still further object of this invention is to provide a novel recoil dampener for machine gun mounts which will not be affected by temperature changes.

To effect the foregoing and other advantageous objects, this invention comprises supporting a machine gun or a pair of machine guns upon a light weight cradle or cradles which is mounted for horizontal movement in the fuselage of an airplane. A recoil dampening device is attached at its rearward end to the cradle, and the forward end to the machine gun.

The dampening unit comprises a spring that compensates for the recoil when the gun is firing in a substantially horizontal plane or in planes slightly above or below the horizontal. As the angle of upward fire is increased, the weight of the gun adds to the recoil load, thereby increasing the distance of recoil travel. As a consequence, it is necessary to limit this travel as much as possible, and we accomplish the desired results by associating with the spring, pneumatic means to supplement the action of the spring to take care of increased loads. In addition, the pneumatic means will eliminate "hammering" when the gun is firing downwardly.

In the drawings in which like numerals indicate the same or similar parts:

Figure 1 is a top plan view of our machine gun cradle provided with the novel recoil dampening unit.

Figure 2 is a transverse sectional view taken along the line 2—2 of Figure 1 looking in the direction of the arrows.

Figure 3 is a longitudinal sectional view taken along the line 3—3 of Figure 1 looking in the direction of the arrows.

Figure 4 is a transverse sectional view taken along the line 4—4 of Figure 1 looking in the direction of the arrows.

Figure 5 is a longitudinal sectional view of the elements constituting the recoil dampener.

In Figure 1, we have shown a pair of light weight cradles 1 and 2 supported by a vertical member 3, the lower end of which is swiveled in the fuselage of an airplane so that the cradles may be moved in a horizontal plane.

The cradles 1 and 2 are identical in construction, and it can be seen that each one comprises a pair of parallel hollow tubes 4 and 5. Each tube 5 is longer than the tube 4 so as to provide an extension 5' that carries a bracket 6 for supporting a sight 7. A strap 8 bridges the tubes 4 and 5 and is adapted to close the forward end of the tube 4, and the rear ends of the tubes are closed by a bracket 9 which supports one of the operating handles 10. A back plate construction and firing trigger 11 and 12, respectively, are provided at the rear extremity of the cradles.

The cradles 1 and 2 are attached to the support 3 for rotatable movement by a saddle 13, the structural details of which have been described in Trotter application Serial No. 334,932, filed May 13, 1940. It can be seen in Figure 2 that the saddles are formed with longitudinal bores through which extend the tubes 4 and 5.

A machine gun 15 is adapted to be supported by each of the cradles. In Figure 1, it will be noted that a strap 16 bridges the tubes 4 and 5 and is formed with bores at each end to enable the strap to reciprocate on the tubes. Intermediate the extremities of the strap 16 there is formed vertical members 17 which carry lugs 18 that extend into apertures formed in the gun casing for attaching the gun to the cradle.

At the forward end of each cradle, there is attached a recoil dampening unit which we indicate generally by the numeral 20. This unit comprises a base 21 which is fixed at its forward end in any suitable manner to the strap 8. Opposed cylinders 22 and 23 are provided at the front and rear portions of the base 21, and threaded plugs 24 and 25 close the ends of the cylinders 22 and 23, respectively. In Figures 2 and 3, it can be seen that the plug 25 has a threaded extension 26 which is adapted to be received in an aperture formed in a flange 27 which forms a part of the saddle 13. A nut 28 is threaded onto the extension 26 whereby the rear section of the base 21 is secured to the flange 27, and consequently, the rear portion of the recoil unit 20 is anchored to the cradle.

A piston rod 29 carries opposed piston heads 30 and 31 which move in the cylinders 22 and 23, respectively. Each piston head comprises a leather cup 32 and a flanged metal plug 33 which is screwed onto an extension 34 of the piston rod.

Adjacent to the cylinder 22, the piston rod 29 is provided with a collar 35 which is held thereto by pin 37, and a washer 36 closes the inner end of the cylinder 23. A helical spring 38 encircles the piston rod 29 and one end bears against the collar 35 and the other end bears against the washer 36. The spring 29 tends to hold normally the piston rod and the piston heads in the position shown in Figure 3.

The collar 35 is formed with a pair of upstanding lugs 39. The forward portion of the machine gun casing is of course provided with bottom flanges 40 and a bolt 41 extends through apertures 42 and 43 provided in the flanges 40 and lugs 39, respectively, whereby the gun is attached to the forward end of the piston 29. A nut 44 is threaded onto the end of the bolt 41 for locking the parts in position.

It will be appreciated therefore that by reason of the strap 16 and the lugs 39 and the bolt 41 that the gun 15 is mounted in each cradle for forward and rearward movement during firing.

Nipples 45 are provided in the base 21 for permitting the pistons 30 and 31 to be lubricated, and a vent 46 is formed in the cylinder 22 adjacent to the inner face of the plug 24, the function of which will later become apparent.

In operation, when the gun is fired, the piston rod 29 will move toward the right in Figure 3 and the spring 38 will compensate for most of the recoil. However, between the bottom of the piston head 31 and the base of the cylinder 23, there will be an air space by virtue of air which will leak into the cylinder between the outer periphery of the piston head and the cylinder, and this air will afford a cushion to assist the spring. When the gun ceases firing, the spring 38 will move the piston rod towards the left and the air space between the closed end of the cylinder 22 and the piston head 30 will prevent the head from striking the base of the cylinder until the air leaks out of the vent 46, or in other words, the construction functions as a dashpot.

On the other hand, when the guns are firing at a relatively high angle, it is necessary to take care of in addition to the actual recoil of the gun the added weight of the gun, and the sudden compression of air in the cylinder 23 will give a large increase in dampening to compensate for this increased load. Also, when the guns are firing downwardly, we will have the air space between the piston head 30 and the base of the cylinder 22, thus preventing mechanical contact between the piston head and the cylinder base thereby eliminating "hammering."

From the above description, it is believed readily apparent that we have provided a novel recoil dampening unit for use in light weight mounts for machine guns which is highly efficient, simple to manufacture, and which consists of a limited number of essential working members. Furthermore, there is incorporated in the unit pneumatic means which will assist the principal recoil dampening member to take care of any additional loads which may be encountered in the firing of the guns. Furthermore, the unit is cheaper to maintain than the usual hydraulic dampeners and is not affected in any way by changing temperature conditions. By having the air cushions provided in each end of the unit we have been able to eliminate mechanical "hammering."

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not confine ourselves to the precise details of construction herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

We claim:

1. A machine gun assembly comprising, a cradle freely movable from the horizontal, a machine gun mounted in the cradle for forward and rearward movement during firing thereof, a recoil absorbing unit comprising spring means supported by the cradle at one end and operatively connected to the gun at the other end whereby the spring means will be compressed during the rearward travel of the gun to dampen the recoil of the gun, and an air cushion cooperating with the spring means to increasingly supplement the action thereof as the firing angle of the gun above the horizontal is progressively increased.

2. A machine gun assembly comprising, a cradle freely movable from the horizontal, a machine gun mounted in the cradle for forward and rearward movement during firing, a recoil absorbing unit comprising a cylinder attached to the cradle, a piston and rod movable in the cylinder, a spring surrounding the piston rod, means attached to the gun and cooperating with the spring to compress the spring during rearward travel of the gun when fired to dampen the recoil, and means to effect an air cushion in the cylinder to increasingly supplement the action of the spring as the firing angle of the gun above the horizontal is progressively increased.

3. A machine gun assembly comprising, a cradle freely movable from the horizontal, a machine gun mounted in the crade for forward and rearward movement during firing, a recoil absorbing unit comprising opposed cylinders attached to the cradle, pistons movable in each cylinder, a common piston rod for each piston, a spring surrounding the piston rod, means attached to the gun and cooperating with the spring to compress the spring during rearward travel of the gun to dampen the recoil, and an air cushion in one of said cylinders to increasingly supplement the action of the spring as the firing angle of the gun above the horizontal is progressively increased.

4. A machine gun assembly comprising, a cradle freely movable from the horizontal, a gun mounted in the cradle for forward and rearward movement during firing, a recoil absorbing unit

comprising opposed cylinders attached to the cradle, pistons movable in each cylinder, a common piston rod connecting each piston, a spring surrounding the piston rod, means attached to the gun and cooperating with the spring to compress the spring during rearward travel of the gun to dampen the recoil, an air cushion in one of the cylinders to increasingly supplement the action of the spring as the firing angle of the gun above the horizontal is progressively increased, and a vent in the other cylinder whereby the air cushion therein will be gradually diminished when the gun is firing at angles below the horizontal thus eliminating hammering.

5. A machine gun assembly comprising, a cradle freely movable from the horizontal, a gun mounted in the cradle for forward and rearward movement during firing, a recoil absorbing unit comprising a cylinder attached to the cradle at a point adjacent to the forward end of the machine gun, a piston movable in the cylinder, a spring surrounding the piston rod, means attached to the gun and cooperating with the spring to compress the spring during rearward travel of the gun to dampen the recoil, and an air cushion in the cylinder to increasingly supplement the action of the spring as the firing angle of the gun above the horizontal is progressively increased.

6. A machine gun assembly comprising, a cradle freely movable from the horizontal, a gun mounted in the cradle for forward and rearward movement during firing, a recoil absorbing unit comprising opposed cylinders attached to the cradle at a point adjacent to the forward end of the machine, a piston movable in each cylinder, a piston rod connecting each cylinder, a spring surrounding the piston rod, means attached to the gun and cooperating with the spring to compress the spring during rearward travel of the gun to dampen the recoil, an air cushion in one of the cylinders to increasingly supplement the action of the spring as the firing angle of the gun above the horizontal is progressively increased, and a vent in the other cylinder whereby the air cushion will be gradually diminished when the gun is firing downwardly thus eliminating hammering.

7. A machine gun assembly comprising, a cradle freely movable from the horizontal, a gun mounted in the cradle for forward and rearward movement during firing, a recoil absorbing unit comprising a cylinder attached to the cradle, a piston movable in the cylinder, a spring surrounding the piston rod, a collar on the piston rod against which one end of the spring bears, lugs secured to the collar and attached to the gun whereby rearward movement of the gun will compress the spring to dampen the recoil, and an air cushion in the cylinder to increasingly supplement the action of the spring as the firing angle of the gun above the horizontal is progressively increased.

8. A machine gun assembly comprising, a cradle freely movable from the horizontal, a machine gun mounted in the cradle for forward and rearward movement during firing, spring means connecting the cradle and the gun whereby the spring will be compressed during the rearward travel of the gun and thereby dampen recoil and compressible means to increasingly supplement the action of the spring means as the firing angle of the gun above the horizontal is progressively increased.

9. A machine gun assembly comprising, a cradle freely movable from the horizontal, a machine gun mounted in the cradle for forward and rearward movement during firing, spring means connecting the cradle and the gun whereby the spring will be compressed during the rearward travel of the gun and thereby dampen recoil, and a non-displaceable air cushion to increasingly supplement the action of the spring means as the firing angle of the gun above the horizontal is progressively increased.

10. A machine gun assembly comprising, a cradle freely movable from the horizontal, a machine gun mounted in the cradle for forward and rearward movement during firing, spring means connecting the cradle and the gun whereby the spring will be compressed during the rearward travel of the gun and thereby dampen recoil, a non-displaceable air cushion to increasingly supplement the action of the spring means as the firing angle of the gun above the horizontal is progressively increased, and a displaceable air cushion which will gradually decrease when the firing angle of the gun is below the horizontal.

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