March 5, 1968 R. L. CARLSON 3,371,442

DAMPED SPRING MEANS

Filed March 24 1966

Fig. 1

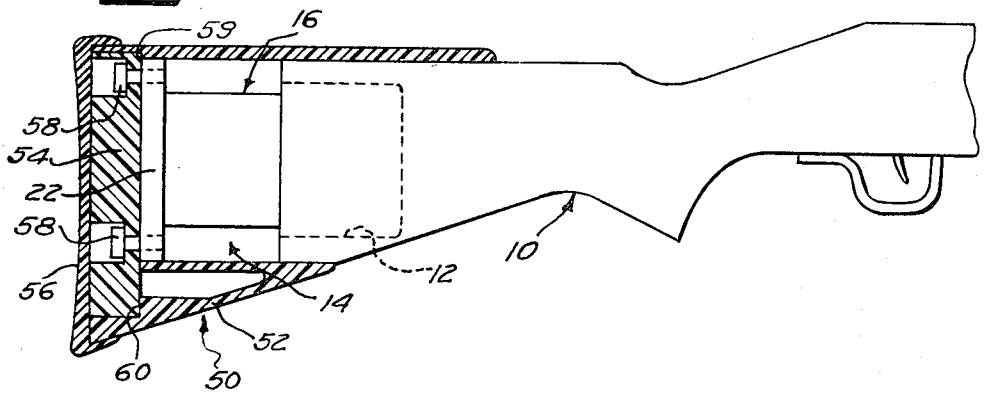


Fig. 2

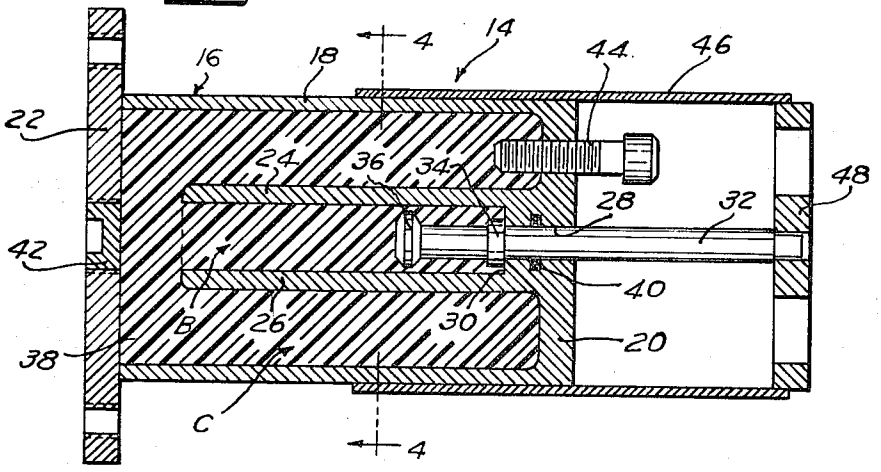


Fig. 3

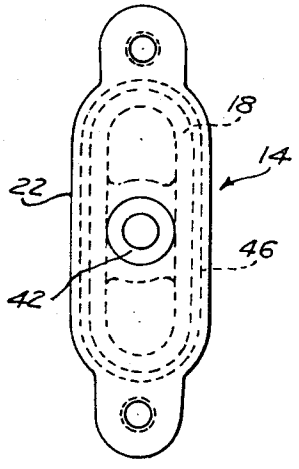
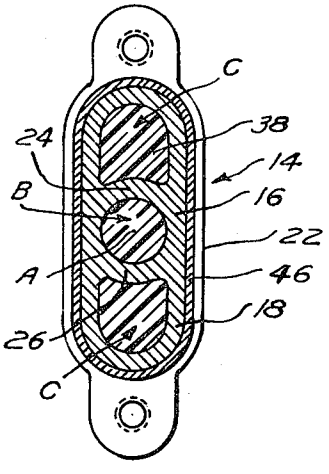


Fig. 4



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DAMPED SPRING MEANS

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ABSTRACT OF THE DISCLOSURE

A normally extended damped spring operably connected between the relatively movable stock and buttstock boot of a shotgun or the like to absorb and dissipate the shock of recoil with the damped spring having a closed chamber filled with a compressible solid fixed to one of the relatively movable members and a piston rod fixed to the other and having a piston provided with orifice means disposed in the closed chamber, the compressible solid providing a damping and spring force on the piston as the rod moves into the chamber and reduces the volume of the compressible solid while forcing same through the orifice means with the expansion of the compressible solid after each recoil serving as the sole force for returning the damped spring to its normally extended condition.

My present invention relates generally to damped springs means and more particularly to damped spring means adapted to be incorporated in shotguns, rifles and the like for absorbing recoil shock forces.

As is well known, when a firearm, such as a shotgun or rifle is discharged, the energy released in igniting the cartridge not only sends the bullet out of the barrel but also drives the gun sharply rearward. This recoil thrust passes through the gun and slams into the shooter's shoulder and cheek, often causing injury or discomfort to the shooter. Prior efforts to absorb recoil shock have consisted of providing the butt end of the gun with rubber pads or spring arrangements. These devices have often resulted in clumsy stock structures and have not proved very effective. Most recently, hydraulic shock absorber arrangements have been installed inside the gun stock. In the main, such devices are complex in design, are difficult to seal, and require constant maintenance.

It is an object of my present invention to provide damped spring means between the gun stock and a relatively movable buttstock boot for absorbing recoil forces. In general, damped spring means comprises casing means with a primary chamber therein, a piston rod extending outwardly of the primary chamber for receiving shock forces, and a piston at the end of the piston rod within the primary chamber. The piston provides axial orifice means, and the primary chamber is filled with a compressible solid. Preferably, the casing means is secured to the buttstock boot and the piston rod is secured to the gun stock. As the piston rod moves into the primary chamber in response to recoil forces, the reduction in volume of the compressible solid, and the throttling effect produced by the compressible solid being forced through the orifice means, impose a damping and spring force on the piston rod and piston. Damped spring means of this type are easily sealed and require minimum maintenance.

It is another object of my present invention to provide a firearm construction, as described, wherein the buttstock boot slidably receives the gun stock and serves to enclose the damped spring means.

It is a further object of my present invention to provide damped spring means which is compact in construction and relatively simple in design. In this connection, the damped spring means of my present invention preferably has an elongated body portion of generally oblong cross section with the axis of the primary chamber coinciding

with the longitudinal axis of the casing. Additionally, the primary chamber communicates with an auxiliary chamber which is generally C-shaped in configuration. The leg portions of the auxiliary chamber are arranged on opposite sides of the primary chamber and the axes thereof lie in the plane of the major cross sectional axis of the casing. Thus, for a given size of damped spring means, optimum damping and spring characteristics are afforded.

It is a still further object of my present invention to provide damped spring means, as described, which includes means for varying the initial pressure of the compressible solid in the primary and auxiliary chambers.

Now in order to acquaint those skilled in the art with the manner of constructing and using devices in accordance with the principles of my present invention, I shall describe in connection with the accompanying drawing a preferred embodiment of my invention.

In the drawing:

FIGURE 1 is a view, partly in elevation and partly in section, of a gun stock, a relatively movable buttstock boot and damped spring means, arranged in accordance with the principles of my present invention;

FIGURE 2 is a vertical longitudinal median sectional view, on an enlarged scale, of the damped spring means of my present invention;

FIGURE 3 is an elevational view of one end of the damped spring means of FIGURE 2; and

FIGURE 4 is a sectional view, taken substantially along the line 4—4 in FIGURE 2, looking in the direction indicated by the arrows.

Referring now to FIGURE 1, the stock of a shotgun is designated generally by the reference numeral **10**. The gun stock **10** has an internal recess or cavity **12** opening rearwardly thereof. The recess **12** is adapted to house a recoil shock absorbing damped spring unit which incorporates the principles of my present invention and which is indicated generally by the reference numeral **14**. The construction, mounting and operation of the damped spring unit **14** will be described in detail hereinafter. It will be appreciated that the unit **14** is shown incorporated in a shotgun for illustrative purposes only and that the principles of my present invention can be used with any firearm which is fired from the shoulder.

As shown in FIGURES 2, 3 and 4, the recoil shock absorbing damped spring unit **14** includes a casing **16** comprised of an elongated body portion **18** of generally oblong or flattened cross section, a forward wall **20** and a rear wall **22**. Viewing FIGURE 4, the dot A indicates the longitudinal axis of the body portion **18**, an imaginary horizontal line passing through the longitudinal axis corresponds to the minor cross sectional axis, and an imaginary vertical line passing through the longitudinal axis corresponds to the major cross sectional axis.

Projecting inwardly from the forward casing wall **20** are inner longitudinal web portions **24** and **26** which terminate short of the rear wall **22**. The web portions **24** and **26** serve to define with the other portions of the casing **16** and inner cylindrical primary chamber B and an auxiliary generally C-shaped chamber C. The axis of the primary chamber B coincides with the longitudinal axis A of the casing **16**, and the leg portions of the auxiliary chamber C are arranged on opposed sides of the primary chamber B with the axes thereof lying in the plane of the major cross sectional axis of the casing **16**.

The forward casing wall **20** is formed with an opening **28** which is coaxial of the longitudinal casing axis A, and an inwardly facing annular shoulder **30** is defined at the inner end of the opening **28**. Extending through the opening **28** and projecting into the chamber B is a piston rod **32**. The piston rod **32**, intermediate of its ends, is formed with a collar portion **34** that is engageable with the casing

shoulder **30** to limit movement of the piston rod **32** outwardly of the casing **16**. The piston rod **32** is also provided, at its inner end, with a piston **36**. The periphery of the piston **36** is spaced from the interior cylindrical surface of the chamber B to define therewith axial orifice means in the form of an annular orifice. Additionally, the inter-communicating chambers B and C are filled with a compressible solid or elastomer **38** such as silicone rubber. To prevent the escape of compressible solid past the piston rod **32**, an annular seal **40** is mounted in the forward wall **20**.

To permit the admission of compressible solid into the casing **16**, a filler plug **42** is provided in the rear wall **22**. Additionally, a screw **44** is threaded through the forward casing wall **20** for effecting preloading of the compressible solid **38**. As the screw **44** is threaded axially inwardly or outwardly, the initial pressure of the compressible solid is varied due to the change in the effective volume of the chambers B and C.

The casing **16** is slidably mounted within a sleeve member **46** having a forward end wall **48**. The forward end of the piston rod **32** is suitably secured, as by a threaded connection, to the forward end wall **48**. The sleeve **46** and the forward end wall **48** thereof are fixedly mounted in a conventional manner within the recess **12** of the gun stock **10**. During movement of the gun stock **10** relative to the casing **16**, corresponding movement is imparted to the piston rod **32** while the sleeve member **46** slidably guides the casing **16**.

As is evident from FIGURE 1, the rear portion of the casing **16** projects rearwardly out of the gun stock **10**. To house the above-mentioned projecting portion of the casing **16**, and also to provide a cheek protector, a buttstock boot **50** is provided for the gun. The buttstock boot **50** comprises a housing **52**, a spacer **54**, and a butt plate **56**. The housing **52**, which is preferably fabricated of a plastic material, is in the shape of a conventional buttstock boot and is arranged to slidably engage the rear portion of the gun stock **10** that extends into the housing. The spacer **54** is of the same material as the housing **52** and provides additional cushioning means for the shoulder of the gunner. The spacer **54** is secured to the rear casing wall **22** by means of bolts **58**, and bears against shoulders **59** and **60** formed in the housing **52**. The butt plate **56**, also of a plastic material, is adapted to fit over the rear end of the housing **52** and is removably snapped into position.

I shall now describe the operation of my recoil shock absorbing mechanism which is shown at rest in the drawing. When the gun is fired, the gun stock **10** is urged rearwardly and telescopes into the housing **52**. This telescoping action moves the piston rod **32** and piston **36** rearwardly within the primary chamber B. During such movement, the volume of chamber B is reduced to the extent of displacement by the piston rod **32**, thus increasing the pressure of the compressible solid **38** in both chambers B and C. Concurrently, the compressible solid **38** is forced through the annular orifice surrounding the piston **36** thereby producing a throttling effect. The described volume-pressure change of the compressible solid, and the attendant throttling effect, impose a damping and spring force on the piston and piston rod, and thereby serve to dissipate the energy of the recoil shock force resulting from firing of the gun. The damped spring unit **14** will absorb up to 90 percent of the recoil force.

When the recoil shock force is fully dissipated, the pressure of the compressible solid **38**, acting on the unbalanced area of the piston rod **32** within the chamber

B, causes the piston **36** and piston rod **32** to return to the position shown in FIGURE 2. During the return stroke of the piston rod **32**, the compressible solid flows back through the annular orifice surrounding the piston **36** to fill the space being vacated by the latter. Correspondingly, the pressure of the compressible solid **38** returns to the normal preload pressure. In this connection, engagement of the piston rod collar portion **34** with the casing shoulder **30** serves to establish the rest position of the piston rod **32**. Finally, by reason of the arrangement of the chambers B and C in a common plane, desirable damping and spring characteristics are afforded in a compact construction.

While I have shown and described what I believe to be a preferred embodiment of my present invention, it will be understood by those skilled in the art that various rearrangements and modifications may be made therein without departing from the spirit and scope of my invention.

I claim:

1. A gun stock and a relatively movable buttstock boot at the rear end thereof, a normally extended damped spring means acting between said gun stock and said buttstock boot for dissipating the energy of recoil forces imposed on said gun stock, said normally extended damped spring means comprising a casing secured to said buttstock boot and having a primary chamber therein, a piston rod extending outwardly of said chamber and connected to said gun stock, a piston at the end of said piston rod within said chamber and providing axial orifice means, and a compressible solid filling said chamber for providing a damping and spring force on said piston rod and said piston as said piston rod moves into said chamber and reduces the volume of said compressible solid while the latter is forced through said orifice means, said compressible solid expanding after each recoil and serving as the sole force for returning said damped spring means to its normally extended condition, and adjustable means for varying the initial pressure of said compressible solid.

2. The device of claim **1** wherein said primary chamber is cylindrical and wherein an auxiliary chamber is provided in said casing in communication with said primary chamber whereby to accommodate a greater volume of said compressible solid.

3. The device of claim **1** wherein said casing is provided with shoulder means adjacent one end of said primary chamber, and said piston rod is provided with a collar portion that is engageable with said shoulder means for limiting outward movement of said piston rod relative to said casing.

References Cited

UNITED STATES PATENTS

2,668,049	2/1954	Taylor	267—63 XR
2,846,211	8/1958	Taylor	267—63
2,994,524	8/1961	Jarret et al.	267—1
3,152,798	10/1964	Jarret et al.	267—1
837,601	12/1906	Behr	42—74
2,731,753	1/1956	Mathieu	42—74
3,001,312	9/1961	Campbell	42—74
3,176,424	4/1965	Hoge	42—74
3,209,482	10/1965	Kuzma et al.	42—74
3,300,889	1/1967	Baker	42—74

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