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DASHPOT

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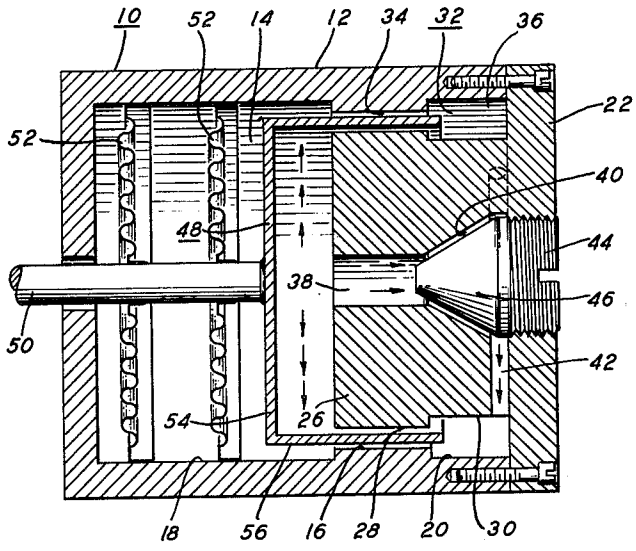

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DASHPOT

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This invention relates to dashpots and particularly to dashpots providing constant damping resistance throughout the strokes of their pistons.

An object of this invention is to provide a constant damping resistance dashpot that because of its novel construction is appreciably reduced in size and weight for any given damping resistance requirement.

Another object of this invention is to provide a constant damping resistance dashpot that does not require close tolerances on critical dimensions and thereby has a relatively low manufacturing cost.

These and other objects of this invention are achieved in an illustrative embodiment thereof wherein the dashpot comprises a housing having a piston chamber therein. A protrusion extends into the chamber from one end of the housing and the outside surface of the protrusion is spaced from the inside surface of the housing to define a continuous slot having a resistance portion of uniform cross section and a terminus portion of larger cross section than the resistance portion. A cup shaped piston is movably positioned in the chamber with the skirt of the piston situated within the resistance portion of the slot throughout the stroke of the piston. Movement of the piston toward the protrusion forces fluid trapped between the piston and the protrusion to flow along the inside surface of the skirt around the edge of the skirt and then along the outside surface of the skirt. A central aperture extends axially through the protrusion and communicates through a plurality of radially extending apertures with the slot to provide a path that shunts the path along the inside surface of the skirt. A plug movably mounted in the central aperture adjusts the amount of fluid flowing through the shunt path.

A feature of this invention resides in a construction that utilizes both the inner and outer surfaces of a cup shaped piston to provide a folded resistance path, thereby decreasing the over-all size and weight of the dashpot.

Another feature of this invention resides in having means for shunting a portion of the resistance path with an adjustable leakage path, thereby providing an adjustment for manufacturing uniformity and reducing the need for close tolerances on critical dimensions.

A complete understanding of the invention and of these and other features and advantages thereby may be gained from consideration of the following detailed description taken in conjunction with the accompanying drawing wherein one embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawing is for the purposes of illustration and description and is not to be construed as defining the limits of the invention.

In the drawing a schematic cross sectional view of the dashpot of this invention is shown.

Referring to the drawing, the dashpot comprises a housing **10** that includes a hollow casing **12** having a piston chamber **14** therewithin. One end of the casing **12** is open, and the inside surface of the casing extending from the open end thereof includes a surface **16** that circumscribes a volume that is uniform in cross section along the length of the surface. Advantageously the surface **16** is cylindrical. The inside surface of the casing **12** further includes surfaces **18** and **20** on opposite sides of the surface **16** that respectively circumscribe volumes of larger cross section than that circumscribed by the surface **16**, the volume circumscribed by the surface **16** being in series with the volumes circumscribed by the surfaces **18** and **20**.

The housing **10** further comprises a closure **22** fastened to the open end of the casing **12**, the closure having a protrusion **26** that extends into the chamber **14**. The protrusion **26** includes an outside surface **28** that circumscribes a volume, the cross section of which is uniform along the length of the surface **28**, the cross section having substantially the same shape as but being smaller than the cross section of the volume circumscribed by the surface **16** of the casing **12**. The protrusion **26** also includes an outside surface **30** that is intermediate the surface **28** and the end of the closure **22** closing the chamber **14**. The surface **30** circumscribes a volume of smaller cross section than that circumscribed by the surface **28**, and the volume circumscribed by the surface **30** is in series with the volume circumscribed by the surface **28**.

The surfaces **28** and **30** of the protrusion **26** respectively have the same length as and are in juxtaposition with the surfaces **16** and **20** of the casing **12**, and because of the above-recited relationships between these surfaces, they define a continuous slot **32** having a resistance portion **34** of uniform cross section and a terminus portion **36** of greater cross section than and in series with the resistance portion.

The closure **22** has a central aperture **38** extending therethrough that is generally coaxial with the slot **32**. The aperture **38** includes a conical portion **40** intermediate the ends thereof that tapers toward the protrusion end of the closure **22**, and a plurality of lateral apertures **42** extend laterally from the enlarged end of the conical portion to the terminus portion **36** of the slot **32**. A plug **44** is threaded into the end of the closure **22** remote to the protrusion **26**, closing that end of the aperture **38**, and the plug includes a conical portion **46** that has substantially the same shape as and extends into the conical portion **40** of the aperture. By screwing the plug **44** into or out of the aperture **38**, the distance between the conical portion **46** of the plug and the surface defining the conical portion **40** of the aperture is respectively decreased or increased and the width of the passageway therebetween is thereby decreased or increased.

A cup shaped piston **48** is positioned within the chamber **14**, the piston being secured to a shaft **50** that is supported by a pair of corrugated spring members **52** secured to the casing **12**. The spring members **52** are of a stiffness to permit the shaft **50** to move axially but to prevent the shaft from moving transverse to its axis. The piston **48** has a base portion **54** and a skirt portion **56**, and it is positioned with the skirt portion thereof situated within the slot **32**. The skirt portion **56**, when viewed on end, has substantially the same shape as the resistance portion **34** of the slot **32**, and the thickness of the skirt portion is uniform and a little smaller than the width of the resistance portion of the slot. Thus, there are narrow concentric passageways on both sides of the skirt portion **56**.

The chamber **14** is filled with a fluid, such as air, and when the piston **48** is moved toward the end of the chamber into which the protrusion **26** extends, the fluid trapped between the base portion **54** of the piston **48** and the end of the protrusion is forced to flow through one of two paths. The first path is through the passageway between the outside surface **28** of the protrusion **26** and the inside surface of the skirt portion **56** of the piston **48**, through the passageway between the outside surface **30** of the protrusion and the inside surface of the skirt portion, around the edge of the skirt portion, through the passageway between the outside surface of the skirt portion and the inside surface **20** of the casing **12** and through the passageway between the outside surface of the skirt portion and the inside surface **16** of the casing. This path is a folded

one, and it permits a reduction in size and weight of the dashpot.

The second path is through the protrusion end of the aperture **38**, through the passageway between the outside surface of the conical portion **46** of the plug **44** and the inside surface of the closure **22** defining the conical portion **40** of the aperture, through the lateral apertures **42**, through the passageway between the outside surface of the skirt portion **56** of the piston **48** and the inside surface **20** of the casing **12**, and then through the passageway between the outside surface of the skirt portion and the inside surface **16** of the casing. Of course when the piston **48** is moved in the opposite direction, the fluid also flows through both of these paths in the opposite direction.

The passageways between the outside surface **28** of the protrusion **26** and the inside surface of the skirt portion **56** of the piston **48**, between the outside surface of the skirt portion and the inside surface **16** of the casing **12**, and between the outside surface of the conical portion **46** of the plug **44** and the inside surface of the closure **22** defining the conical portion **46** of the aperture **38** essentially provide the entire resistance to the flow of the fluid. This is so because the resistance to the flow of the fluid is directly proportional to both the circumferential and longitudinal length of the passageways and inversely proportional to the cube of the width of the passageways, the latter being of greater consequence than the former because it involves a cube. The passageways other than the previously specified ones are significantly wider than the specified passageways, and therefore the resistance to fluid flowing through the other passageways is negligible.

To provide the desired constant resistance throughout the stroke of the piston **48**, the length of the skirt portion **56** of the piston **48** is greater than the length of the resistance portion **34** of the slot **32** plus the length of the stroke of the piston, the terminus portion **36** of the slot having a length that exceeds the length of the stroke. As a result, part of the skirt portion **56** of the piston **48** extends along the entire length of the resistance portion **34** of the slot **32** throughout the piston stroke, and the length of the resistance passageways on both sides of the skirt portion thereby remain constant throughout the stroke. In addition, with the spring members **52** directing the movement of the piston **48** generally parallel to the inside surface **16** of the casing **12** and the outside surface **28** of the protrusion **26** and with the width of the resistance portion **34** of the slot **32** being uniform along its length and the thickness of the skirt portion **56** of the piston **48** being uniform along its length, the width of the resistance passageway on both sides of the skirt portion remains substantially constant throughout the stroke of the piston.

Finally, the dimensions of the resistance passageway between the outside surface of the conical portion **46** of the plug **44** and the inside surface of the closure **22** defining the conical portion **46** of the aperture **38** are fixed by the position of the plug **44** and do not change during the stroke of the piston, and consequently the resistance of this passageway does not change. This resistance passageway, which in effect shunts the resistance passageway between the outside surface **28** of the protrusion **26** and the inside surface of the skirt portion **56** of the piston **48**, provides an adjustment that compensates for variations in dimensions in the other resistance passageways. Thus, a uniform resistance may be obtained from dashpot to dashpot without necessitating that the critical dimensions thereof be held to close tolerances. The plug **44** is merely screwed in or out to increase or decrease the width of the shunt passageway and thereby increase or decrease the resistance of the dashpot to the desired amount.

What is claimed is:

1. A dashpot comprising:

a housing having a piston chamber therein and a protrusion extending into the chamber, the protrusion having an outside surface spaced from an inside surface of the housing to define a continuous slot having a resistance portion uniform in cross section throughout its length and a terminus portion of larger cross section than the resistance portion in series with the resistance portion, the protrusion further having a central aperture extending therethrough that is generally coaxial with the slot, the central aperture having a contical portion intermediate the ends thereof that tapers toward the chamber end of the protrusion, and a plurality of lateral apertures extending radially from the central aperture joining the central aperture with the terminus portion of the slot;

a plug threaded into the housing end of the central aperture, the plug having a conical portion that has substantially the same shape as and extends into the conical portion of the central aperture; and

a cup shaped piston movably positioned within the chamber, the piston including a base portion and a skirt portion, the skirt portion being uniform in cross section throughout its length, which cross section is substantially the same as but smaller than the cross section of the resistance portion of the slot, the piston being positioned with the skirt portion thereof situated within the resistance portion of the slot throughout the stroke of the piston, the skirt portion being spaced a substantially constant distance from the surfaces defining the slot throughout the stroke of the piston.

2. A dashpot comprising:

a housing having a piston chamber therein and a protrusion extending into the chamber, the protrusion having an outside surface spaced from an inside surface of the housing to define a continuous slot having both a resistance portion uniform in cross section throughout its length and a terminus portion of larger cross section than the resistance portion, the terminus portion being in series with the resistance portion; and

a cup shaped piston movably positioned within the chamber, the piston including a base portion and a skirt portion, the skirt portion being uniform in cross section throughout a portion of its length, which cross section is smaller than the cross section of the resistance portion of the slot, the skirt portion of uniform cross section occupying the entire length of the resistance portion throughout the stroke of the piston and being spaced from the surfaces defining the slot throughout the stroke of the piston.

3. A dashpot as in claim 2 wherein the outside surface of the protrusion is relieved adjacent to the base of the protrusion to provide the terminus portion of the slot.

4. A dashpot as in claim 3 wherein the portion of the inside surface of the housing in juxtaposition with the relieved outside surface of the protrusion is also relieved to provide the terminus portion of the slot.

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