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DEVICE FOR ABSORBING TRANSIENT PRESSURE FLUCTUATIONS

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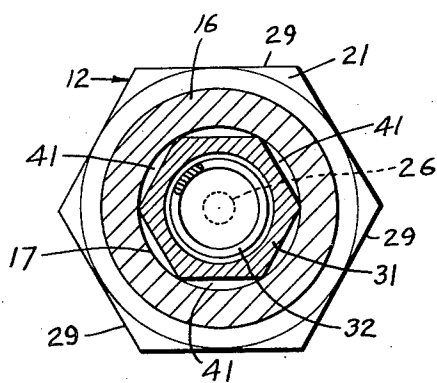
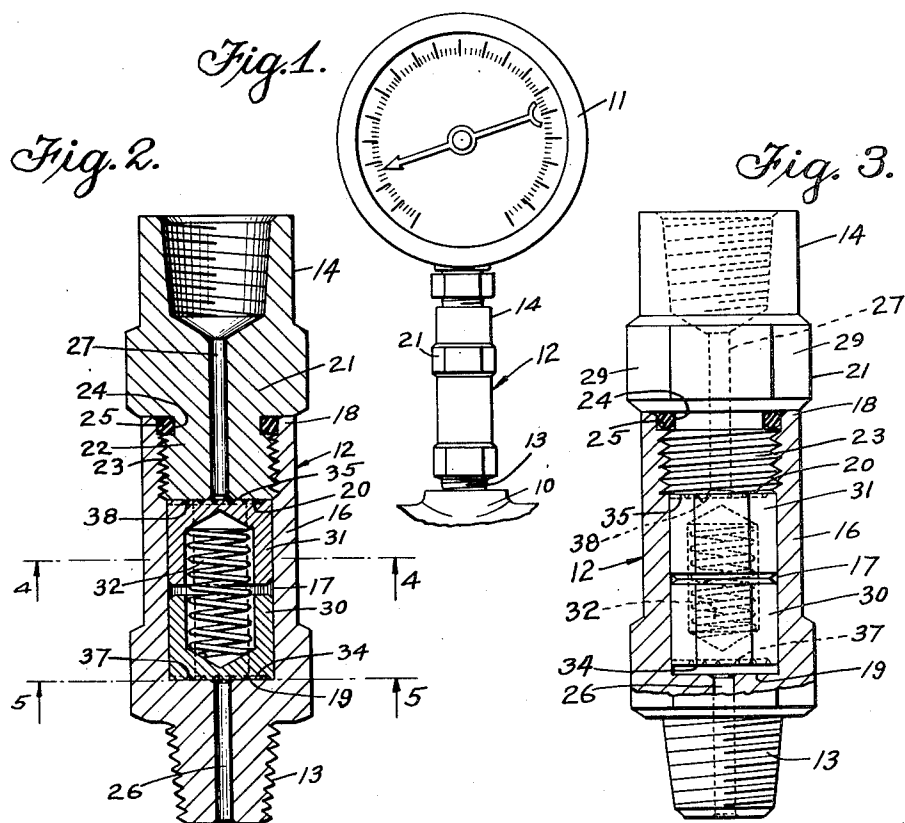


Fig. 4.

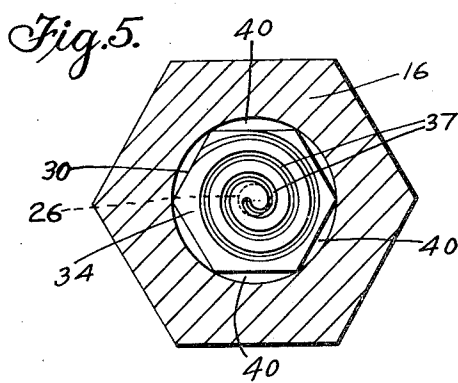


Fig. 5.

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DEVICE FOR ABSORBING TRANSIENT PRESSURE FLUCTUATIONS

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2 Claims. (Cl. 138—26)

This invention relates to improvements in devices commonly referred to as shock absorbers or snubbers for absorbing or smoothing out momentary pressure surges in fluid pressure lines.

The invention is especially useful with pressure gages or pressure responsive instruments and it is an object of this invention to provide a new and improved device of the above-mentioned character which, when connected to a pressure gage, for example, will serve to dampen or throttle fluctuations of brief duration in the hydraulic or pneumatic pressure being measured so as to steady the movement of the gage indicator, or other pressure responsive instrument.

A further object of the invention is to provide a device of the above-mentioned character having restricted passage means which serve to damp momentary pressure fluctuations and which are adapted, if they become clogged, to open against the pressure of a resilient means and thereby permit passage and removal of the clogging substance from the restricted passage.

A snubber constructed according to my invention includes a body defining an internal chamber that has an opening at each end connecting the chamber to fluid passages. Reciprocable means in the form of one piston, or preferably two opposed pistons, are disposed in the chamber between the two openings. The reciprocable means move toward and away from at least one of the openings, one piston being associated with each opening to move toward or away from it and to abut against the wall of the chamber around the associated opening. A restricted passage is formed by a groove, preferably of spiral configuration, cut in either the end of the piston on the abutting portion of the chamber wall, said passage being defined in only the abutting surfaces of the piston and the chamber wall in the vicinity of the associated opening. With two pistons there are two passages, of which each one acts to restrict fluid flow through the snubber in one direction so that together they provide a snubbing action to fluid flow in both directions through the snubber.

Other objects and advantages of the invention will become apparent during the course of the following descriptive part of this specification wherein details of construction and mode of operation of a now preferred embodiment of the invention are described with references to the accompanying drawing, in which:

Fig. 1 is a front elevation of a conventional pressure gage attached to a pressure line with a snubber embodying my invention interposed between the gage and the pressure line;

Fig. 2 is a median vertical longitudinal section of the snubber on an enlarged scale;

Fig. 3 is an elevation of the snubber on the same scale as Fig. 2 and with a portion of the housing broken away and with certain internal parts shown in elevation;

Fig. 4 is an enlarged transverse section taken substantially on line 4—4 of Fig. 2; and

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Fig. 5 is an enlarged transverse section substantially on line 5—5 of Fig. 2.

In the drawing, reference numeral 10 designates a fluid flow line, such for example, as an air pipe, to which a pressure gage 11 of conventional design is attached for measuring fluid pressures in the pipe. Fitted between the gage 11 and the pipe 10 is a snubber 12 constructed according to this invention and which, in the embodiment shown, has one end 13 thereof threaded externally to fit into a tapped opening in the pipe 10 while its opposite end 14 is internally threaded for receiving a threaded nipple on the gage 11. Of course both ends may be threaded alike to receive a tubing fitting or, may be otherwise shaped for connection to any desired apparatus.

The snubber 12 includes a housing 16 formed in two parts, body 16 and cap 21. Body 16 has a longitudinally extending cylindrical chamber 17 therein, which may be formed as by drilling from open end 18 into the body to a depth terminating short of the other end of the body to form one end wall 19 for the chamber. The other end wall 20 of the chamber 17 is constituted by the inside face of plug or cap 21 for closing the open end of chamber 17, and such cap has a reduced diameter portion 22 externally threaded as shown at 23 to engage complementary internal threads in the open end 18 of the body. An annular groove 24 is formed in the base of the reduced diameter portion 22 and is adapted to receive a ring gasket 25 for sealing the cap 21 in the end 18 of the body.

End portion 13 of the housing has an axial bore 26 opening through the end wall 19 into chamber 17, and the cap 21 is provided with an axial bore 27 which opens through end wall 20 into the chamber. Thus the chamber 17 is open at all times to fluid flow through bores 26 and 27. Since the snubber serves as a fitting between pressure line 10 and gage 11, it is desirable to provide it externally with a plurality of flat surfaces which may be engaged by a wrench for tightening the snubber to the gage and to the pressure line 10. This may be done conveniently by forming both the body 16 and its cap 21 from stock of hexagonal cross-section so as to provide external flat surfaces which are designated in Fig. 3 by the numeral 29.

Axially slidable in the chamber 17 are two cup-like, oppositely disposed pistons 30 and 31, each of which is adapted to receive one end of a resilient member such as coil spring 32. Spring 32 between the pistons serves to urge the pistons away from each other so that the outer end face 34 of piston 30 abuts against the end wall 19 of the chamber 17, and outer end face 35 of piston 31 abuts against end wall 20 of chamber 17. The abutting faces are all preferably flat as they can be made most easily and accurately when of this shape. However, other shapes may be used if desired as long as the two faces of an abutting pair, e. g., faces 35 and 20, are of complementary shapes so that the faces are in full contact over their abutting areas, except for the grooves 37 and 38.

Each of the faces 34 and 35 is provided with a groove, designated at 37 and 38 respectively, which extends between the perimeter of the associated piston and its center where the groove registers with one of bores 26 or 27. Each groove 37 and 38 is preferably made of spiral configuration in order to obtain a longer passage, and a proportionately greater restriction upon fluid flow, than if the passage were straight or radial. The passage length can be varied as desired by changing the pitch of the spiral; and as an extreme case (infinite pitch) may become straight. Another factor to be considered in design is the cross sectional area of the grooves. This varies with the viscosity of the fluid—larger for oil than for air—and with the pressure—smaller for higher pressures—to obtain the desired restriction on fluid flow.

From a practical standpoint, it is preferred to place the

grooves in piston faces 34 and 35; but they serve the same purpose if, and therefore may be, formed in end walls 19 and 20 of the housing chamber. These grooves in combination with the covering portion of an end wall 19 or 20 constitute restricted passages defined in abutting surfaces of the pistons and the chamber end walls providing for fluid flow between the inner ends of the axial bores 26 and 27 the side walls of the chamber 17. As is best shown in Figs. 4 and 5 of the drawing, the pistons 30 and 31 are preferably hexagonal in cross-section to form fluid passageways at 40 and 41 respectively, between the flat side walls of the pistons and the side walls of the chamber 17. The longitudinally extending ridges formed by intersecting flat side walls of the polygonal pistons, serve to position the pistons centrally of the chamber 17 and provide for easy movement of the pistons. The invention is not limited to hexagonal or polygonal pistons since other non-circular shapes may be used.

When the snubber is connected between a pressure line and a pressure gage, as shown in Fig. 1, or other instrument, a small quantity of air or other fluid in the pressure line 10 passes through the snubber, as a result of a pressure increase, and into the gage 11 where it causes a deflection of the indicator needle on the gage. Movement of fluid into the snubber raises piston 30 off end wall 34, as shown in Fig. 3. The path of flow through the snubber 12 from the pressure line 10 is now as follows: bore 26, lower end of chamber 17, side passageways 40 and 41, restricted passage 38, and bore 27. Passage 38 is now effective to restrict the flow of fluid toward gage 11. Fluid pressure holds piston 31 against end wall 35. When pressure drops in the line 10, pressure built up in the gage 11 is released through the snubber 12 causing fluid to flow out of the snubber in the opposite direction. Reverse flow from bore 27 causes piston 31 to move away from end wall 35 and seats piston 30 against end wall 19. During this reverse flow passage 37 is effective to restrict fluid flow. Momentary fluctuations in the pressure being measured become absorbed by one of the restricted passages 37 and 38 which attenuate the momentary surges, and thus reduce the amplitudes of such surges. One of passages 37 and 38 is effective at all times, depending on the direction of fluid flow. In this way the indicator needle of the gage 11 does not receive the full impact of transient pressure fluctuations and its movement is therefore a relatively steady movement.

By forming the grooves 37 and 38 of a spiral configuration, the restricted passages for damping the momentary surges in pressure are of relatively long effective length thereby improving the damping action of these fluid passages. Should one of these restricted passages become clogged by a foreign substance in the fluid flowing through the snubber, the passage will be automatically flushed clean the next time that a pressure change causes the associated piston to be shifted inwardly away from the end wall of the chamber against the action of spring 32. Unseating the piston allows the clogging substance to be removed by the fluid flow.

In this connection it should be noted that fluid pressure acting against one of the pistons to remove it from its seat causes the other of the two pistons to become more tightly seated against its respective end wall, the forces on the pistons insuring the maintenance at all times of one restricted passage for absorbing the shock of the pressure surge. One piston acts as a snubber for pressure surges in one direction and the other piston acts similarly for pressure surges in the opposite direction. Obviously, one piston can be omitted, making the snubber effective to check surges in one direction only, as may be desired in order to obtain quick return of a pressure indicating mechanism after a temporary rise in pressure. Omission of one piston may be viewed as a limiting case of making one restricted passage larger than the other in order to obtain a differential snubbing effect.

It should be noted too that since the pistons of the

snubber of this invention are seated by a spring and are not dependent upon their weight alone to seat them, the snubber may be arranged in any position and it will operate or function just as well in a horizontal position, for example, as in a vertical position. It can also be turned end-for-end and function as well so that it cannot be made ineffective by incorrectly installing it.

It is to be understood that the form of my invention, herein shown and described, is a practical and preferred example of the same, and that changes may be resorted to within the scope of my invention, which is not necessarily limited to the details disclosed herein but is to be accorded the full scope of the claims so as to include any and all equivalent structures.

I claim:

1. In a device for reducing the amplitude of momentary fluctuations in fluid pressure and facilitating removal of foreign particulate material, the combination comprising: a housing having a cylindrical internal chamber extending longitudinally thereof, said chamber being provided at its ends with parallel valve seat means each of which has an axially disposed opening for fluid flow therethrough, a pair of similar reciprocable elements complementary to the respective valve seats and movable longitudinally in said chamber toward and away from said respective valve seats to open and close said fluid flow openings, said valve seats and said reciprocable elements including substantially planar mating flow-controlling seating surfaces and having non-cylindrical side walls providing interrupted guide means for cooperation with the longitudinal wall of said chamber, and resilient means normally interacting between said reciprocable elements and serving normally to bias said elements toward said valve seats, said reciprocable elements forming in cooperation with the wall of said chamber a first fluid passageway of multiple flow passage form, and each of said reciprocable elements being provided with a spiral depression in its seat-contacting end and extending from the center thereof to its periphery, said spiral depressions permitting in conjunction with said first fluid passageway finite fluid flow between said seat openings through said chamber when said reciprocable elements are in seating engagement with said valve seats.

2. In a device for reducing the amplitude of momentary fluctuations in fluid pressure and facilitating removal of foreign particulate material, the combination comprising: a housing having a cylindrical internal chamber extending longitudinally thereof, said chamber being provided at each end with an opening for fluid flow therethrough, at least one of said openings being surrounded by valve seat means, a reciprocable element complementary to said valve seat and movable longitudinally in said chamber toward and away from the valve seat to open and close the fluid flow opening associated therewith, said valve seat and said reciprocable element including substantially planar mating flow-controlling seating surfaces and said element having non-cylindrical side walls providing interrupted guide means for cooperation with the longitudinal wall of said chamber, and resilient means bearing against said reciprocable element and serving normally to bias said element toward said valve seat, said reciprocable element forming in cooperation with the wall of said chamber a first fluid passageway of multiple flow passage form and said reciprocable element being provided with a spiral depression in its seat-contacting surface extending from the center thereof to the periphery of the element, said spiral depression permitting in conjunction with said first fluid passageway finite fluid flow through said chamber between said openings when said reciprocable element is in seating engagement with said valve seat.

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