

Feb. 28, 1967

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3,306,009

COMPENSATORS FOR PNEUMATIC-HYDRAULIC SYSTEMS

Filed May 13, 1964

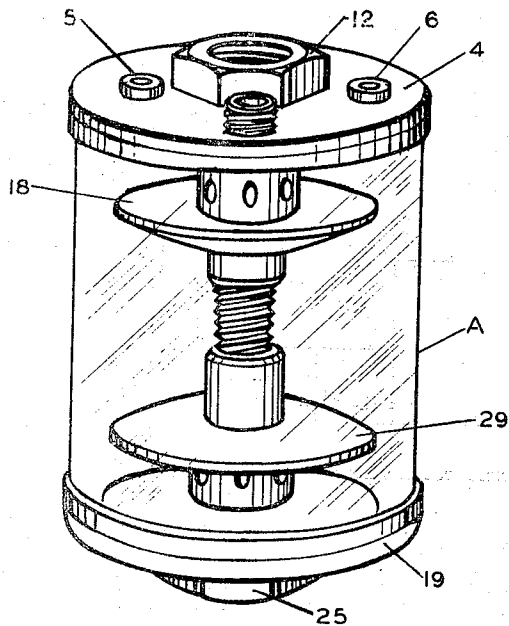


FIG. 1

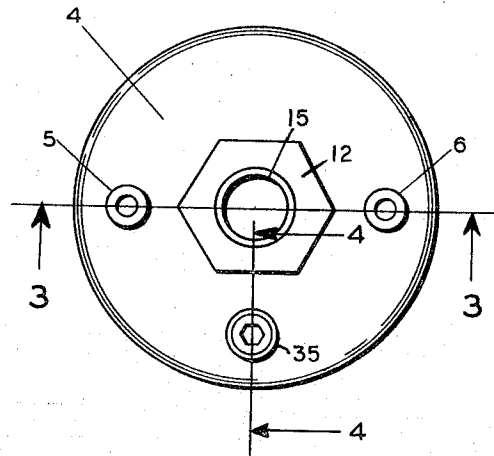


FIG. 2

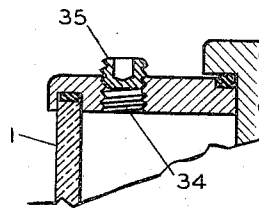


FIG. 4

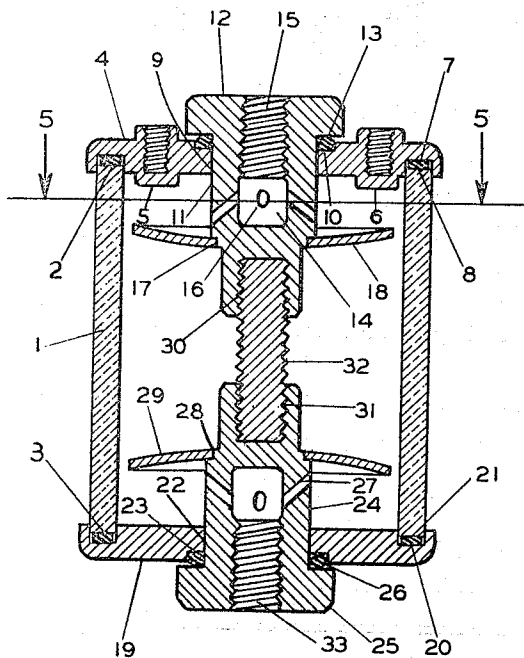


FIG. 3

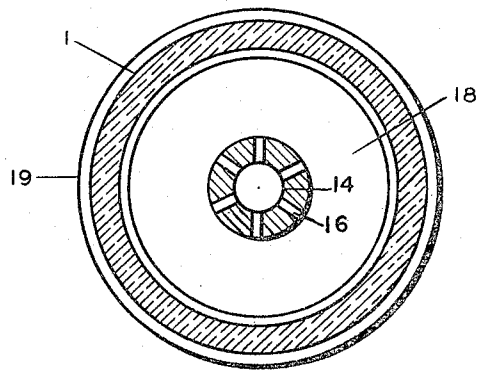


FIG. 5

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3,306,009

COMPENSATORS FOR PNEUMATIC-HYDRAULIC SYSTEMS

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Filed May 13, 1964, Ser. No. 367,146
5 Claims. (Cl. 55—201)

This invention relates in general to certain new and useful improvements in compensators for pneumatic-hydraulic systems.

In pneumatic-hydraulic systems, the hydraulic fluid, which is usually oil, is caused to flow through the system as a result of pressure imposed upon it by the pneumatic fluid which is usually air. Consequently, in such systems, there is an interface between the liquid and gaseous media, at which intermixture can, and ordinarily does, occur, with the attendant production of froth, and the dispersion of gas-bubbles within the body of the liquid. Obviously, the presence, in a hydraulic liquid, of gas-bubbles, will produce various malfunctions in the system. Therefore, many efforts have been made to eliminate frothing and aeration of the liquid by the use of relatively large gas-liquid pressure chambers or tanks, but this expedient is costly and space-consuming. In an effort to reduce the size of the gas-liquid pressure chamber, various types of flat-surfaced baffles have been employed, some of which are stationary, and some of which are rotatable, but even these structures are relatively large, and are not entirely effective. The structures employing flat baffles are dimensionally critical, and the structures employing rotatable baffles include moving parts which can become inoperative and are adversely affected by changes in viscosity, temperature, and flow-rate.

It is, therefore, the primary object of the present invention to provide a compensator for pneumatic-hydraulic systems which eliminates frothing and aeration of the liquid.

It is another object of the present invention to provide a device of the type stated which is relatively compact in size and economical in cost of construction.

It is a further object of the present invention to provide a device of the type stated which has a transparent housing or shell, so that the interface between the gas and the liquid can always be visually observed.

It is an additional object of the present invention to provide a device of the type stated which not only prevents frothing and aeration at the interface between the gas and the liquid, but also serves to eliminate bubbles which may have entered the liquid at some other point in the system.

It is also an object of the present invention to provide a device of the type stated which will prevent aeration of the liquid, irrespective of the velocity of the air or liquid.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (one sheet):

FIG. 1 is a perspective view of a compensator constructed in accordance with and embodying the present invention;

FIG. 2 is a top planned view of a compensator;

FIG. 3 is a longitudinal sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 2; and

FIG. 5 is a transverse sectional view taken along line 5—5 of FIG. 3.

Referring now in more detail and by reference characters to the drawings, which illustrate a preferred embodiment of the present invention, A designates a compensator for pneumatic-hydraulic systems which com-

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prises an initially open-ended cylindrical housing or shell 1 formed preferably of heavy-gauge transparent material, such as, for example, a methyl methacrylate synthetic resin. The shell 1 is cut off or otherwise formed in the provision of relatively smooth parallel upper and lower faces 2, 3.

Provided for closure-forming disposition across the upper end face 2 is a circular head-plate 4 having two diametrically opposite bosses 5, 6, which are axially drilled and tapped for the reception of conventional mounting screws (not shown). On its downwardly presented face, the head-plate 4 is provided with an annular groove 7 which is of substantially the same diameter as the shell 1, but is slightly wider than the wall-thickness thereof. Seated snugly within the groove 7 is an annular gasket 8 adapted for seal-forming engagement with the end face 2 of the housing or shell 1. The head-plate 4 is centrally bored in the provision of an axial opening 9 which is externally counterbored in the provision of a narrow annular groove 10.

Snugly fitted within the axial opening 9 is a tubular sleeve 11 integrally provided at its external end with a nut-shaped collar 12, the under face of which bears tightly against an O-ring 13 seated in and projecting annularly upwardly from the groove 10. The sleeve 11 is internally provided with an axial bore or duct 14 which is, in turn, provided at its upper end with a series of internal threads 15 for the reception of a conventional pipe or conduit (not shown). Intermediate its ends, the bore 14 is provided with an annularly spaced series of downwardly and outwardly inclined ports 16 through which air can enter into the interior of the shell 1.

At its lower end, the sleeve 11 is externally turned down in the provision of an annular shoulder 17, and snugly press-fitted or otherwise rigidly mounted thereon, is a circular dish-shaped or concave baffle 18, the concave face of which faces the inwardly presented surface of head plate 4, while its outer peripheral rim is spaced inwardly by a short distance from the interior cylindrical face of the housing or shell 1. The outer circumferential size and curvature of the baffle 18 is such, in relation to the angularity of the ports 16, that the center lines of the latter will intersect the upwardly presented arcuate face of the baffle 18 inwardly and downwardly from the peripheral edge of the baffle 18 substantially as shown in FIG. 3.

Similarly provided for closure-forming disposition across the lower end of the housing or shell 1 is a lower head-plate 19 provided upon its upwardly presented face with an annular groove 20, similar in size and shape to the previously described groove 7, and also provided internally with an annular gasket 21 for snug-fitting seated engagement with the end face 3 of the shell 1. The head-plate 19 is centrally bored in the provision of an axial opening 22, which is counterbored at its lower or external end in the provision of an annular groove 23. The opening 22 is concentrically aligned with the opening 9 and adapted for snugly receiving a tubular sleeve 24 which is substantially identical in all respects with the previously described sleeve 11, and is axially aligned therewith. At its outer or lower end, the sleeve 24 is integrally provided with a nut-shaped collar 25 adapted for snug-fitting seated engagement against an O-ring 26 disposed within and projecting annularly outwardly from the groove 23. Intermediate its ends, the sleeve 24 is provided with an annularly spaced series of upwardly and outwardly inclined ports 27, which are identical with the ports 16 of the sleeve 11. At its upper interior end, the sleeve 24 is turned down in the provision of an annular shoulder 28 and press-fitted or otherwise rigidly secured thereon, is a circular dish-shaped or concave baffle 29, which has its concave face presented toward lower head plate 19

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and, moreover, is of substantially the same circumferential size and curvature as the previously described baffle 18. Moreover, the size and curvature of the baffle 29 is such, in relation to the inclination of the ports 27, that the center lines of the latter will intersect the downwardly presented arcuate face of the baffle 29 inwardly and upwardly from the peripheral edge thereof, all as best seen in FIG. 3.

At their lower and upper internal ends, respectively, the sleeves 11 and 24 are internally threaded for retentive engagement with the complementarily threaded upper and lower ends 30, 31, of a connector-stud 32, which is of such axial length that it will draw the sleeves 11, 24, and their associated head-plates 4, 19, down into tightly assembled relation to the shell 1. The grooves 7, 20, will thus be pulled into tightly sealed engagement against the gaskets 8, 21, and the under faces of the nut-shaped collars 12, 25, are pulled into tightly sealed engagement against the O-rings 13, 26, respectively.

At its lower end, the sleeve 24 is interiorly provided with a series of threads 33 for reception of a conventional conduit or pipe (not shown). Finally, the upper head-plate 4 is preferably, through not necessarily, provided with an internally threaded aperture 34 which is provided with a removable screw-plug 35, which affords access to the interior of the shell 1, or to permit release of pressure, addition of oil, or for any other suitable purpose.

In use, the compensator A may be connected into a pneumatic-hydraulic system by means of conduits or pipes threaded into the upper and lower ends respectively of the sleeves 11, 24, as previously indicated. Thereupon, as air goes into the ports 16, it will be deflected against the arcuate surface of the baffle 18, and any turbulence-producing jet effect thereof will be completely dissipated. Similarly, whenever oil or other hydraulic fluid flows through the ports 27, it will initially be deflected against the downwardly presented arcuate surface of the baffle 29 and any turbulence-producing jet effects will also be completely dissipated. It has, therefore, been found in connection with the compensator A, that the combination of the inclined ports 16, 27, and arcuately curved baffles 18, 29, will effectively prevent foaming, frothing, and aeration of the oil or other hydraulic fluid, as the latter flows into and out of the compensator A. Moreover, the use of a transparent material for the shell 1 in combination with the shape of the baffles 18, 29, affords clear visibility on the interface, between the air and oil, inside the compensator A. Consequently, it is possible to maintain surveillance over the condition of the oil or other hydraulic fluid within the system.

It should be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the compensators for pneumatic-hydraulic systems may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

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

1. A device for use with pneumatic-hydraulic systems in which a body of hydraulic liquid and a body of pneumatic fluid are in mechanically interactive contact, said device comprising a chamber of circular cross-sectional shape in which the hydraulic liquid and pneumatic fluid are in contact across an interface, a first conduit extending axially into the upper portion of said chamber and having orifice means opening into said chamber, a second conduit extending axially into the lower portion of the chamber and having orifice means opening into said chamber, a first concave baffle-member disposed in the upper portion of the chamber below the orifice means of the first conduit and having its concaved surface presented toward the orifice means of the first conduit, and a second concave baffle-member disposed in the lower portion of the chamber above the orifice means of the

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second conduit and having its concaved surface presented toward the orifice means of the second conduit, said orifice means of the first conduit being presented obliquely with respect to the axis of the first conduit and being oriented so that fluid issuing therefrom is directed toward the concaved surface of the first concave baffle-member, said orifice means of the second conduit being presented obliquely with respect to the axis of the second conduit and being oriented so that fluid issuing therefrom is directed toward the concaved surface of the second concave baffle-member.

2. A device for use with pneumatic-hydraulic systems in which a body of hydraulic liquid and a body of pneumatic fluid are in mechanically interactive contact, said device comprising a chamber in which the hydraulic liquid and pneumatic fluids are in contact across an interface, a first conduit extending into the upper portion of said chamber and having orifice means opening into said chamber, a second conduit extending into the lower portion of the chamber and having orifice means opening into said chamber, a first concave baffle-member disposed in the upper portion of the chamber with its concave face presented toward the orifice means of the first conduit, and a second concave baffle-member disposed in the lower portion of the chamber with its concave face presented toward the orifice means of the second conduit, the orifice means of the first conduit being disposed at an oblique angle with respect to the axis of said first conduit so that the flow-line of the pneumatic fluid issuing therefrom will impinge against the surface of such baffle-member at an angle to a plane which is tangent to such surface at point of impingement.

3. A device for use with pneumatic-hydraulic systems in which a body of hydraulic liquid and a body of pneumatic fluid are in mechanically interactive contact, said device comprising a chamber in which the hydraulic liquid and pneumatic fluid are in contact across an interface, a first conduit extending into the upper portion of said chamber and having orifice means opening into said chamber, a second conduit extending into the lower portion of the chamber and having orifice means opening into said chamber, a first concave baffle-member disposed in the upper portion of the chamber below the orifice means of the first conduit and having its concave face presented toward the orifice means of the first conduit, and a second concave baffle-member disposed in the lower portion of the chamber above the orifice means of the second conduit and having its concave face presented toward the orifice means of the second conduit, the orifice means of the second conduit being disposed at an oblique angle with respect to the axis of the second conduit so that the flow-line of hydraulic liquid issuing therefrom will impinge against the surface of such baffle-member at an angle to a plane which is tangent to such surface at point of impingement.

4. A device for use with pneumatic-hydraulic systems in which a body of hydraulic liquid and a body of pneumatic fluid are in mechanically interactive contact, said device comprising a chamber in which the hydraulic liquid and pneumatic fluid are in contact across an interface, a first conduit extending into the upper portion of said chamber and having orifice means opening into said chamber, a second conduit extending into the lower portion of the chamber and having orifice means opening into said chamber, a first concave baffle-member disposed in the upper portion of the chamber below the orifice means of the first conduit and having its concave face presented toward the orifice means of the first conduit, and a second concave baffle-member disposed in the lower portion of the chamber above the orifice means of the second conduit and having its concave face presented toward the orifice means of the second conduit, the orifice means of the first conduit being disposed at an oblique angle with respect to the axis of the first conduit so that the flow-line of the pneumatic fluid issu-

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ing therefrom will impinge against the surface of such baffle-member at an angle to a plane which is tangent to such surface at point of impingement, the orifice means of the second conduit being disposed at an oblique angle with respect to the axis of the second conduit so that the flow-line of hydraulic liquid issuing therefrom will impinge against the surface of such baffle-member at an angle to a plane which is tangent to such surface at point of impingement.

5. A device according to claim 1 in which the conduits are of circular cross-section and the orifice means are a plurality of circumferentially spaced inclined ports formed in the walls of their respective conduits.

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