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PROCESSES AND DEVICES FOR THE COMPENSATION OF UNEQUAL EXPANSION OF A FLUID AND OF A VESSEL CONTAINING SAME

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Fig. 1

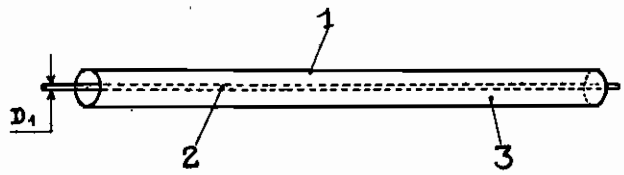
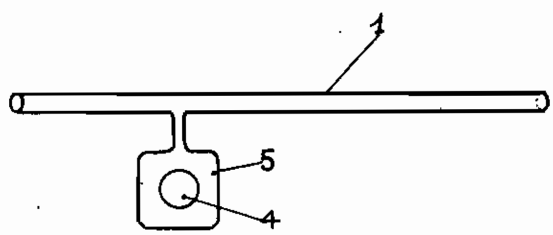


Fig. 2



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ALIEN PROPERTY CUSTODIAN

PROCESSES AND DEVICES FOR THE COMPENSATION OF UNEQUAL EXPANSION OF A FLUID AND OF A VESSEL CONTAINING SAME

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The present invention, relates to a device which permits of eliminating, in a hydraulic transmission, the drawback due to the difference in the expansion of the conduit itself and of the fluid contained in the same. Numerous devices have already been conceived in order to obviate this state of affairs which is most troublesome as concerns the reliability of the apparatus comprising such transmissions, at varying temperatures, and chiefly when the stresses to be transmitted take place in both directions. Use has been hitherto made of very complicated devices, such as expansion vessels, capillary tubes for braking, elastic diaphragms, etc . . .

The problem is usually posited in this manner, in the greater part of the cases of application. The piping has a coefficient of cubic expansion of $\alpha>\beta$, the coefficient of cubic expansion of the fluid contained in the same.

We will assume, that at a temperature t_0 for which the piping is filled with liquid:

V_0 is the volume of the piping.

L_0 is the volume of the liquid.

This affords:

$$V_0=L_0$$

and at a temperature of $t>t_0$, we have:

$$V<L, \text{ since } \alpha \text{ is less than } \beta$$

V and L being the respective volumes of the piping and the liquid at the temperature t.

The invention consists in introducing into the piping a body having the volume C_0 at the temperature t_0 having a coefficient of expansion γ which is so chosen as to afford the two following equations:

$$V_0=L_0+C_0$$
$$V_0(l+\alpha t)=L_0(l+\beta t)+C_0(l+\gamma t)$$

whence

$$C_0=V_0\frac{\alpha-\beta}{\gamma-\beta}$$

as α is less than β, and as C_0 must be less than V_0, it will be observed that γ must be less than α in order that the system shall operate.

The optimum conditions for this operating, i. e., the conditions in which C_0 will be a minimum, are obviously given for a negative value of γ, which is chiefly the case for rubber.

It is evident that in practice, the expansion coefficients of solids or liquids are not constant when the temperature varies, and the difference in expansion of the liquid and its container will come nearer to zero according as one has more carefully taken account of the exact law of these expansions.

This correcting device according to the invention may be realized in different ways, a certain number of which are shown in the accompanying drawing. One may, for example, as represented in Fig. 1, place in the interior of the pipe 1 a wire 2 having a diameter of D_1, and a chosen coefficient of expansion. The system is thus corrected at all points, and when the piping is lengthened or shortened, it is always corrected.

Or otherwise, one may also, as shown in Fig. 2, find by calculation or by experiment, the volume C_0 of a body 4 having an expansion coefficient γ, which is placed in the interior of a chamber 5 connected with the piping 1. It is evident that in the calculation or the determination of the body C_0, the chamber must be considered as forming part of the conduit. Moreover, it is evident that in this case of application, instead of using a solid body 2, it will be sufficient to use a hollow body whose external volume is C_0, such as a sphere, for instance.

Moreover, in order to take account of the fact that the piping will attain its thermal equilibrium more rapidly than the fluid which it contains, one may place upon this piping a heat-protecting covering (of rubber for example).

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