

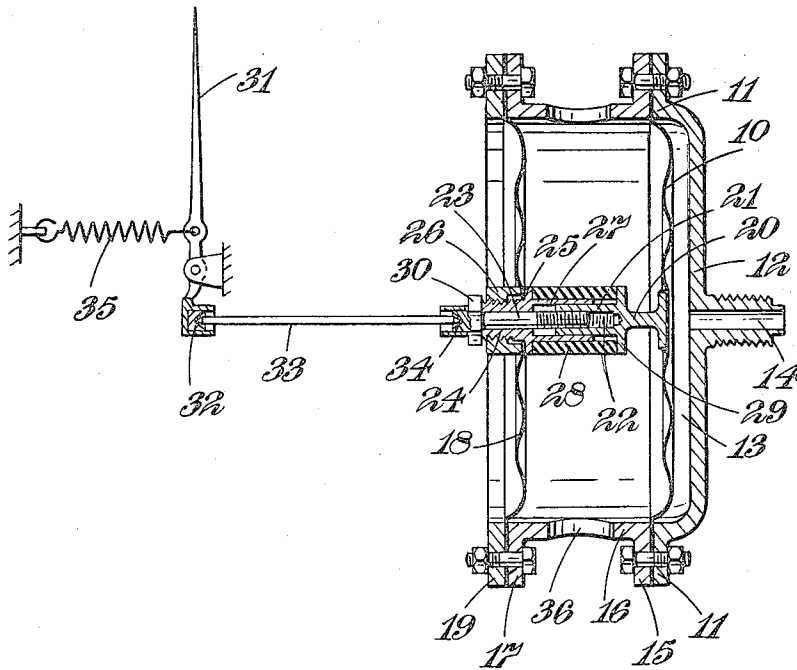
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RESILIENT DIAPHRAGM PRESSURE OPERATED DEVICE

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RESILIENT DIAPHRAGM PRESSURE
OPERATED DEVICE

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This invention relates to fluid pressure operated devices employing a resilient diaphragm for effecting an indication or control according to deflection of the diaphragm. Such devices are employed for example in air speed, rate of climb and altitude indicating and control apparatus for use in aircraft.

It is known that the curve showing the relationship between the fluid pressure applied to a diaphragm and the resultant deflection of the diaphragm is a cubic curve so that the response of the indicating or controlling part operated by the diaphragm is in accordance with the cubic law unless a modification is made in the transmission. The object of the present invention is to provide a fluid pressure operated device in which the response over the required limited working range corresponds to a different law, for instance, a logarithmic or quadratic law.

According to the present invention there is provided a fluid pressure operated device comprising a resilient diaphragm acted upon by fluid pressure and resilient means for applying an initial stress to the diaphragm to deflect it from its unstrained position without swamping its resilient characteristics. In order to avoid swamping the resilient characteristics of the diaphragm the resilient stressing means preferably has a stiffness or rate which is of the order of, or less than, the stiffness or rate of the diaphragm.

By applying an initial stress, as aforesaid, the working range of the diaphragm may be moved to some part of the cubic curve which approximates to the desired characteristics. Thus, a part of the curve may be chosen which approximates to a logarithmic curve or a quadratic curve, as desired. The resilient means for applying the initial stress is preferably adjustable to enable the required part of the cubic curve to be chosen for the working range.

In one form of the fluid pressure operated device according to the invention the resilient means for applying the initial stress to the diaphragm comprises another resilient diaphragm arranged side by side with the first and connected thereto. Preferably, the diaphragms are mounted by their peripheries and are interconnected by a movable coupling at the centres of the diaphragm. The use of the second diaphragm in this manner serves to ensure that the stress applied to the first diaphragm is in a straight line normal to that diaphragm. The coupling is conveniently adjustable in length in order to vary the applied stress.

A further feature of the invention consists in

that the coupling for the diaphragms comprises a screw-threaded part on one diaphragm and an adjusting screw, engaging in the screw-threaded part, passing through and having an abutment on the outer side of the other diaphragm and a resilient packing, e. g., of rubber, arranged around the screw between the two diaphragms. The applied stress may therefore be readily varied by turning the screw from the outer side of the diaphragm through which it passes so that the space between the diaphragms may be formed as a pressure chamber which is maintained fluid-tight while permitting the adjustment.

One specific construction of fluid pressure operated device according to the invention is shown in sectional elevation in the accompanying drawing.

Referring to the drawing, a resilient diaphragm 10 is clamped at its periphery on to a flange 11 of a plate 12 to form a chamber 13 to which the fluid pressure is applied through a pipe connection 14 so as to act on the diaphragm. The periphery of the diaphragm 10 is clamped between the flange 11 and a flange 15 at one end of a tubular distance piece 16. This distance piece has a flange 17 at its other end and another resilient diaphragm 18 is clamped between this flange 17 and a ring 19.

The two diaphragms are connected at their centres by a coupling. This coupling comprises a part 20 having a spigot 21 formed with a screw-threaded bore 22 and a screw 23 carrying an abutment for the diaphragm 18 and engaged in this screw-threaded bore. The screw 23 is rotatable in a socket member 24 which is secured in a hole in the diaphragm 18 by means of a flange 25 on the socket member and bearing on the inner side of the diaphragm and a nut 26 screw-threaded on the socket member and clamping the diaphragm against the flange 25. The socket member 24 has a tubular extension 27 receiving and guiding the spigot 21. An annular rubber packing 28 is provided around the spigot 21 and the tubular extension 27, and this packing is compressed endwise between the flange 25 and another flange 29 on the part 20. The screw 23 has a head 30 bearing on the socket member 24 at the outer side of the diaphragm 18.

The resilient diaphragm 18 imparts an initial stress to the diaphragm 10 which is acted upon by the fluid pressure and this initial stress may be adjusted by turning the screw 23 by means of its head 30, thereby serving to shorten or lengthen the coupling between the diaphragms.

Thus, the working range of the diaphragm 10 may be selected from the normal cubic characteristic of the diaphragm to approximate with a logarithmic, quadratic or other law, which it is desired shall connect the applied fluid pressure with the movement of means actuated by the diaphragm 10. For example, there is shown in the drawing a pivoted pointer 31 carrying a jewel bearing 32 in which engages one end of a rod 33, the other end of which engages in another jewel bearing 34 mounted on the head 30 of the screw 23, the rod 33 being retained in its bearings by means of a spring 35. Instead of a pointer, however, the diaphragm may be arranged to operate any other device. In the construction shown in the drawing, the space between the diaphragms is open to the exterior through holes 36 in the distance piece 16. Alternatively, the space between the diaphragms may be closed to form a pressure chamber and although the adjusting screw 23 passes to the exterior of the diaphragm 18 such a chamber is maintained fluid-tight by means of the rubber packing 28.

I claim:

1. A fluid pressure operated device comprising a resilient diaphragm acted upon by fluid pressure, and resilient means for applying an initial stress to the diaphragm to deflect the diaphragm from its unstrained position without swamping its resilient characteristics, said resilient means having a spring rate not in excess of that of said diaphragm, the resilient means and the diaphragm being connected by adjustable means for selecting the working range of the diaphragm.

2. A fluid pressure operated device comprising a resilient diaphragm acted upon by fluid pressure, and resilient means for applying an initial stress to the diaphragm to deflect the diaphragm from its unstrained position without swamping its resilient characteristics, said resilient means having a spring rate not in excess of that of said diaphragm, said resilient means comprising another diaphragm arranged parallel to the first said diaphragm, the diaphragms being mounted by their peripheries and interconnected by a movable coupling at the centers of the diaphragms.

3. A fluid pressure operated device comprising a resilient diaphragm acted upon by fluid pressure, and resilient means for applying an initial stress to the diaphragm to deflect the diaphragm from its unstrained position without swamping its resilient characteristics, said resilient means having a spring rate not in excess of that of said diaphragm, the resilient means for applying the initial stress to the diaphragm comprising another resilient diaphragm arranged parallel to the first and connected thereto by a coupling which is adjustable in length in order to vary the initial stress applied to the diaphragm acted upon by fluid pressure.

4. A fluid pressure operated device comprising a resilient diaphragm acted upon by fluid pres-

sure, and resilient means for applying an initial stress to the diaphragm to deflect the diaphragm from its unstrained position without swamping its resilient characteristics, said resilient means having a spring rate not in excess of that of said diaphragm, the resilient means for applying the initial stress to the diaphragm comprising another resilient diaphragm arranged parallel to the first and connected thereto by a coupling which is adjustable in length in order to vary the initial stress applied to the diaphragm acted upon by fluid pressure, said coupling comprising a screw-threaded part on one diaphragm and an adjusting screw, engaging in the screw-threaded part, passing through and carrying an abutment on the outer side of the other diaphragm, and a resilient packing arranged around the screw between the diaphragms.

5. A fluid pressure operated device comprising a resilient diaphragm acted on by fluid pressure, a second diaphragm, means affording a positive connection between said diaphragms for applying a preliminary stress to the first named diaphragm to deflect said first named diaphragm from its unstrained position without swamping its resilient characteristics, said second diaphragm having a spring rate not in excess of that of said first named diaphragm.

6. A fluid pressure device for operating an indicator element or the like comprising a diaphragm secured at its peripheral edge and adapted to be acted upon by fluid pressure, said diaphragm having a smooth elasticity curve without points of inflection throughout its range of distortion, means for operatively connecting said element with said diaphragm for movement in accordance with the distortions of the latter throughout its range, means for converting the normal cubic movement of the diaphragm to effect an appropriate linear movement of the indicator element, said means comprising a resilient element connected to a central portion of said diaphragm for applying an initial and continuing stress to the diaphragm to deflect it from its unstrained position without swamping its resilient characteristics, said resilient means having a spring rate not in excess of that of the diaphragm.

7. A fluid pressure device for operating an indicator element or the like comprising a resilient diaphragm acted upon by fluid pressure, and resilient means for applying an initial stress to the diaphragm to deflect the diaphragm from its unstrained position without swamping its resilient characteristics, said resilient means having a spring rate not in excess of that of said diaphragm, and said diaphragm and resilient means being so constructed and arranged that the combined stiffness or spring rate of said elements is positive throughout the working range of the operated element.

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