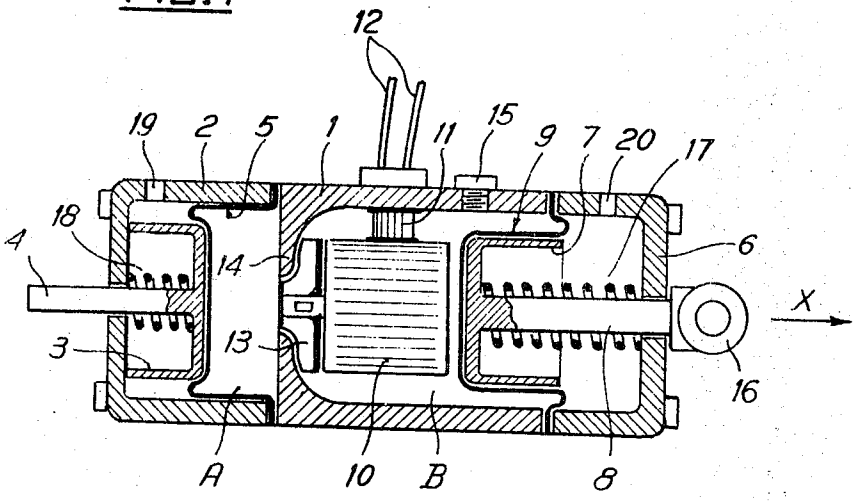
Oct. 20, 1970 T. LEVRINI 3,534,551

HYDRAULIC ACTUATING DEVICE

Filed Sept. 26, 1968

FIG. 1



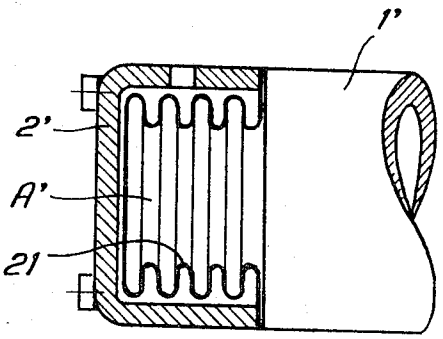


FIG. 2

FIG. 3

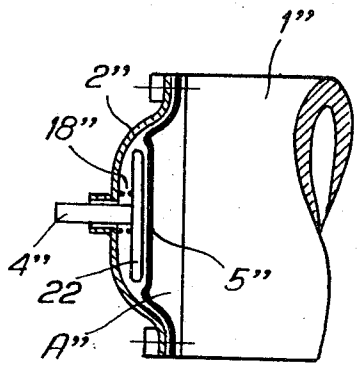
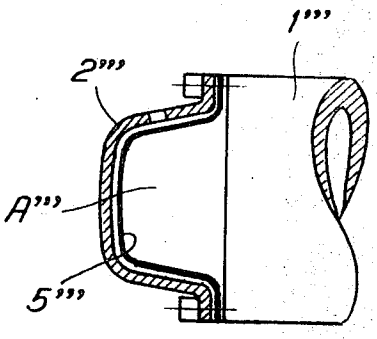


FIG. 4



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HYDRAULIC ACTUATING DEVICE

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Int. Cl. F15b *15/18*
U.S. Cl. 60—52 4 Claims

ABSTRACT OF THE DISCLOSURE

The device serves to actuate members in general with a reciprocating movement and it includes two elements fluodynamically connected to each other between which is interposed the delivery and the suction of a pressure generator in such a way that, when the latter is actuated, the two elements are moved apart.

This invention concerns a hydraulic actuating device.

In many cases, in particular for reciprocating movements (operating apparatus—controls of valves, window and door frames and the like), simple and compact devices are needed, which are easy to install and require a minimum maintenance.

The device of the present invention meets said requirements, said device being substantially characterized in that it includes at least one hydraulic thrust member of the variable volume type and a container having also a variable volume, the variation of which is opposite that of the thrust member but of the same value, whereas the liquid which fills the whole inner volume of the device is displaced by means of a pumping unit, from the container to the thrust means and/or vice versa.

The invention will now be described with reference to the attached schematic drawing which shows a merely indicative and non-limiting example of the present invention.

In the drawing:

FIG. 1 is an axial cross-section of a first embodiment of the device according to the invention;

FIGS. 2, 3 and 4 are partial diagrammatic cross-section views of some structural modifications.

With reference to FIG. 1, the body **1** of the device has on the left-hand side a cover **2**, in which piston **3**, provided with a guiding stem **4**, can be reciprocated in an axial direction. A flexible diaphragm **5** of the rolling type, provides the seal of the variable volume chamber A. On the right-hand side, body **1** is provided with a second cover in which piston **7**, provided with guiding stem **8**, can be axially reciprocated. A flexible diaphragm **9** of the rolling type, provides the seal of the variable volume chamber B, with the co-operation of the body **1**. The latter houses an electric motor **10**, rigidly fixed to body **1** at **11**, said motor being fed from the outside by conductors **12** in sealing relationship through connection with the body **1**. At least one centrifugal or axial impeller **13** is keyed to motor shaft **10**, to realize, in co-operation with front wall **14** of body **1** (provided with a central suction hole), the pumping action to displace the liquid from chamber A into chamber B.

FIG. 1 shows the device in its resting position, that is, with chamber A (between diaphragm **5** and impeller **13**) at its maximum volume and chamber B (between diaphragm **9** and impeller **13**, at its minimum volume). The

whole cavity, between the two diaphragms **5** and **9**, is entirely filled with the liquid, the removable tap **15** serving to fill the cavity with a suitable liquid. When motor **10** is started, impeller **13** sucks the liquid out of chamber A, to transfer it, under pressure, into chamber B. Consequently, pistons **3** and **7** move in the direction shown by arrow X indicated in FIG. 1 and the chambers A and B change their volume in the opposite direction and by an equal amount. The end **16** of stem **8** performs an operation on a driven member (not shown). When motor **10** is stopped, an external load or a spring **17** moves the two pistons in a direction opposite to that shown by arrow X until said pistons reach the illustrated resting position, whereas the liquid flows, through impeller **13**, from chamber B, back into chamber A.

In order to realize certain loading effects, to prevent the formation of cavitations or air bubbles in the liquid and to permit any desired orientation of the device without being affected by gravity or others forces piston **3** also can be loaded (for instance by spring **18**) in the direction of the positive movement of the liquid. Covers **2** and **6** are provided with at least one window (**19** and **20**), to connect the chambers, switch or located between said covers and the diaphragms, to the atmosphere.

The device is completely sealed and without sliding gaskets (dynamic gaskets) and then requires no particular maintenance. The travelling speed in the direction of arrow X or in the opposite direction, can be obtained by suitable means (not shown), to regulate the effective area of the parts through which the liquid flows from one chamber into the other. Said speed adjustment can be limited to one or more fractions of the run; or be variable along the run itself, if said port adjusting means are linked to the same movable parts.

Besides, the pump can be of a different type, i.e. of the volumetric or positive displacement type and it is necessary in this case to provide a maximum-pressure valve as well as means for returning the liquid such as a valve from B into A; or otherwise, by reversing the pump motion (in this case the device can be a double-acting device). It is understood that it is possible to realize the variable volume chamber arrangement also in another way. For instance, chamber A′, as shown in FIG. 2, is formed by a metal housing of the corrugated type **21**, arranged in the cover **2′** integral with body **1′**. As shown in FIG. 3, chamber A″ is formed by a flat diaphragm **5″** and with a stiff plate **22**, acting on said diaphragm. The remaining parts, that correspond to FIG. 1, are marked with the same reference numerals (but with the addition of two apexes).

In the example shown in FIG. 4, wherein the parts corresponding to the above-described parts, are marked with the same reference numerals (but with the addition of three apexes), chamber A‴, as realized, consists of one simple cup **5‴** of flexible or resilient material.

I claim:

1. A hydraulic actuator comprising:

(a) a casing having therein first and second variable volume chambers separated by a transverse wall element having a passageway to establish fluid communication between said chambers,

(b) the total volume of said first and second chambers being substantially constant,

(c) at least one wall of each of said chambers being deformable,

(d) a centrifugal pump positioned within one of said chambers and having its input contiguous to said passageway and its output in the same chamber in which it is positioned.

2. The hydraulic actuator of claim 1 further including:

(a) means to bias the deformable wall of the chamber in which the pump is positioned towards the other deformable wall,

(b) a piston element extending outwardly of said casing and having a part engaged with that deformable wall which is biased,

(c) the said fluid passageway located centrally of said transverse wall.

3. The hydraulic actuator of claim 2 wherein both of said deformable walls are biased toward each other.

4. The hydraulic actuator of claim 2 including spaces within said casing into which said deformable walls move, said spaces being vented to the atmosphere.

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