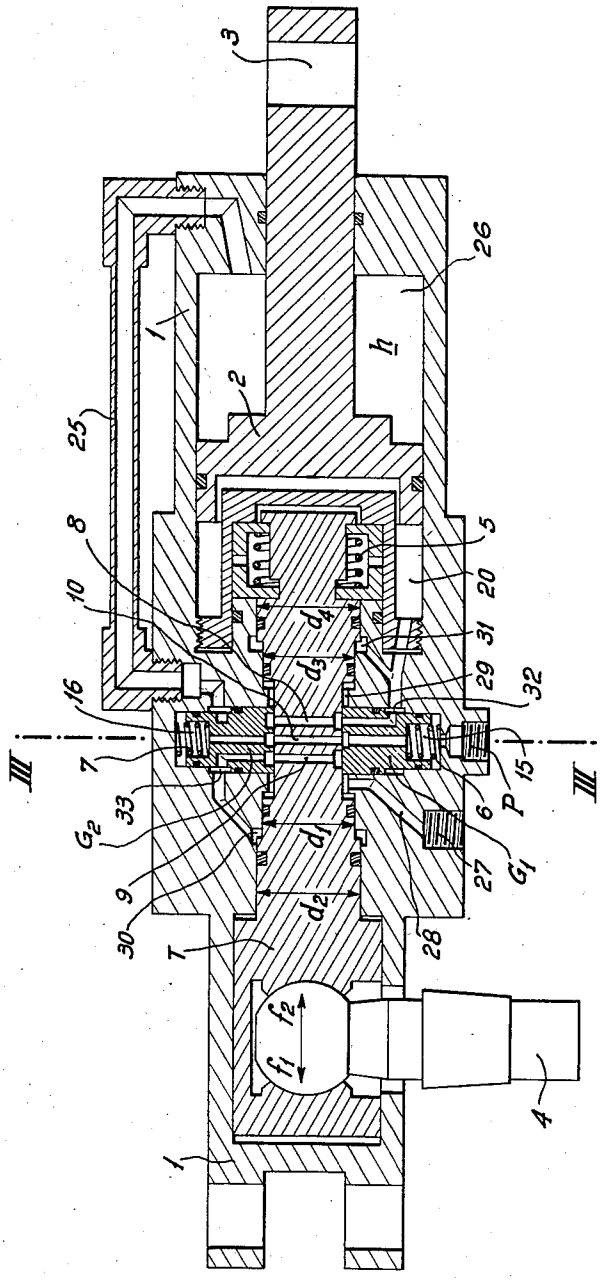
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HYDRAULIC JACK OF FOLLOW-UP TYPE

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FIG. 1



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FIG. 2

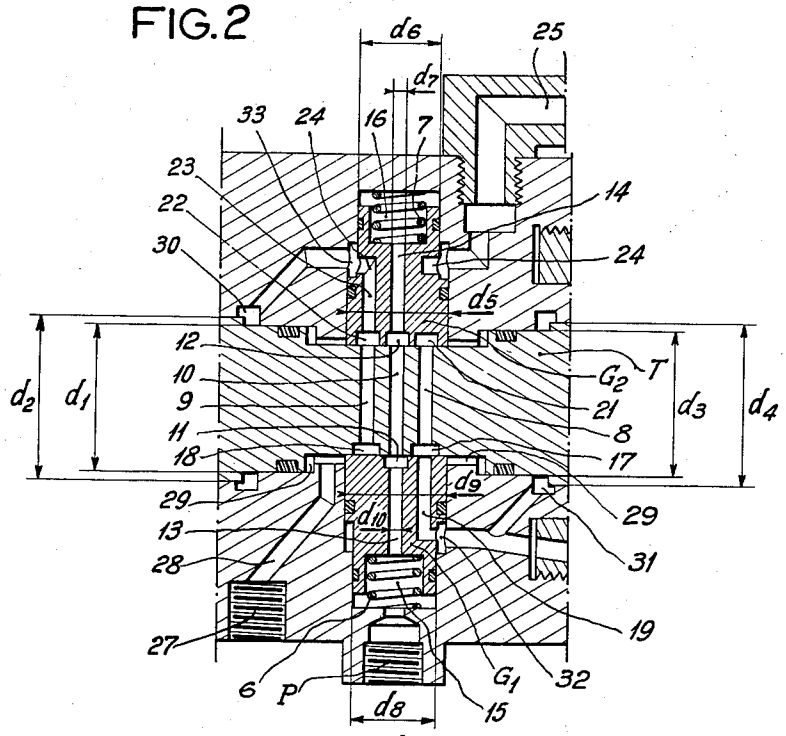
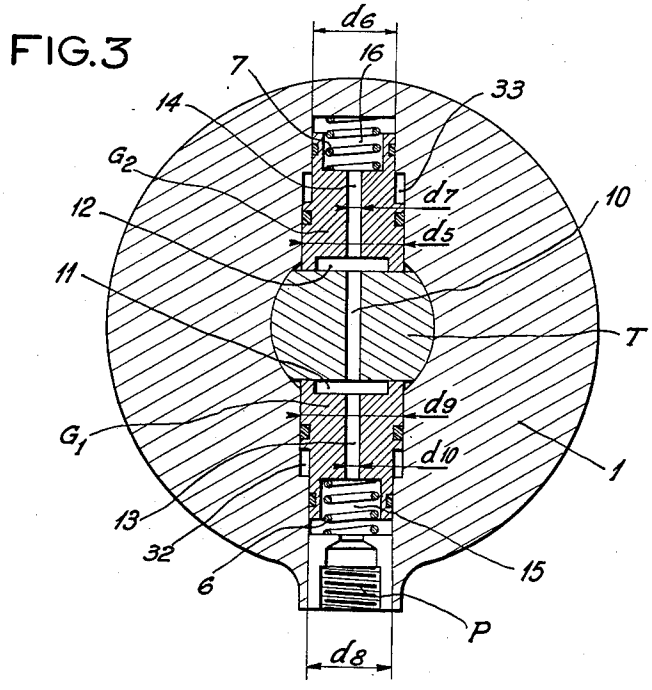


FIG. 3



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HYDRAULIC JACK OF FOLLOW-UP TYPE

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The invention relates to a hydraulic jack of the follow-up control type, working on a hydraulic pressure unit of the so-called "closed centre" type.

In this kind of hydraulic servo-control, it is necessary to reduce the internal leakages of liquid to the maximum possible extent and, as far as this can be achieved, to eliminate them from the interior of the distribution valve.

The servo-control according to the invention complies with these fundamental requirements.

It is characterized in that its moving member, actuated by the manual effort to be transmitted by servo-control, is constituted by a flat slide-valve which moves between the flat surfaces of two slide-faces in contact with said slide-valve, and comprises three transverse channels which pass right through it and which ensure the distribution of the liquid under pressure, in the following conditions:

(*a*) The central channel maintains a permanent communication between two chambers formed in the said slide-faces and of which one is coupled to the source of fluid under pressure.

(*b*) On the same edge of the flat slide-valve, on the incoming pressure side, the two lateral channels terminate in two cavities which, when the slide-valve is driven in one direction or in the opposite direction, alternately put one of the chambers of the jack in communication with the incoming pressure side and the other chamber is put to exhaust, by virtue of the presence of two opposite cavities belonging respectively to the said slide-faces.

(*c*) On the opposite edge of the flat slide-valve, these same lateral channels open into two further cavities formed in the slide-face which is located on the side opposite to the arrival of the pressure fluid.

Further characteristic features of this follow-up control will become apparent from the following detailed description with reference to the accompanying drawings.

In these drawings:

FIG. 1 is a longitudinal section of the device taken along the axis of the jack.

FIG. 2 is a partial view on a larger scale.

FIG. 3 is a transverse section taken along the line III—III of FIG. 1.

In the drawings, the body of the jack is shown at **1** and its piston at **2**. It will be assumed, for example, that the stationary point of the servo-control is at **3** on the piston rod, and that it is the whole of the body **1** which is compelled to move in the direction of the arrows f^1—f^2, depending on the action of the manual drive which is applied through the intermediary of the lever **4** on the flat slide-valve T.

In accordance with the invention, this slide-valve moves between two opposite cylindrical slide-faces G^1 and G^2, the flat bases of which are in contact with the slide-valve. A spring **5** ensures the centering of the slide-valve with respect to the slide-faces.

Two further springs **6** and **7** apply the slide-faces against the slide-valve, and ensure fluid-tightness within the interior of the servo-jack when starting-up under pressure.

The slide-valve is traversed by two channels **8** and **9**, located on either side of a central channel **10**.

In the position of rest, this central channel is located opposite cavities **11** and **12** formed in the slide-faces, and

into which open two channels **13** and **14** which deliver into two chambers **15** and **16** respectively, in which are housed the springs **6** and **7** referred to above. The arrival P of the liquid under pressure is coupled to one of these chambers, in this case **15**.

The lateral channels **8** and **9** terminate, on the side closest to chamber **15**, in the two cavities **17** and **18**.

When at rest, the chamber **17** covers the opening of a channel **19** formed in the slide-face G^1 and communicating permanently with the chamber **20** of the jack.

On the opposite edge of the flat side-valve, the channels **8** and **9** open respectively into cavities **21** and **22** of the slide-face G^2, and of which one, **22**, is extended by a channel **23** communicating via groove **24** and conduit **25** with the other chamber **26** of the jack.

The return to the tank is connected to the orifice **27** coupled by channel **28** to the annular space **29**. The operation of this hydraulic follow-up servo-control is effected as follows:

When the manually-operated swivel-jointed lever **4** urges the slide-valve T in the direction of the arrow f^1, the pressure coming from **15** is admitted to the chamber **20** of the jack along the path **13—11—17—19**.

At the same time, the chamber **26** of the jack is put to the return to the tank at **27** over the path **25—24—23—22—9—18—29—28**.

The body **1** of the jack is thus displaced, under servo-control, in the direction f^1.

Conversely, when the lever **4** acts on the slide-valve T in the direction of the arrow f^2, the pressure coming from **15** is admitted to the chamber **26** of the jack over the circuit **13—11—18—9—22—23—24—25**.

At the same time, the chamber **20** of the jack is connected to the return to the tank at **27** by **19—17**, the annular space **29** and the conduit **28**.

The body **1** of the jack is therefore moved under servo-control, in the direction f^2.

It can readily be seen that in both the directions f^1 and f^2, the control is effectively a follow-up, since any forward movement of the body **1** and with it of the slide-faces G^1 and G^2, tends to cut-off the communication—from the cavities to the channel—which had initiated the said forward movement.

It should be observed that the spring **5** determines the threshold effort necessary in order that the operator can "feel" the servo-mechanism.

Similarly, it is necessary during the control operation that the operator should feel a restoring force proportional to the outward force which is applied to the jack. It is for that purpose that two restoring chambers are formed at **30** and **31**. A force is applied by the pressure acting on the difference in cross-sections: d_2—d_1 for the chamber **30**, and d_4—d_3 for the chamber **31**. The chamber **30** creates a restoring force when the pressure is admitted to the annular chamber **26** of the jack. The chamber **31** creates this force when the pressure is admitted to the full section of the jack in the chamber **20**.

It should also be noted that the pressure of the liquid arriving at **15** acts continuously and simultaneously on the slide-faces, thus preventing them from moving away from the flat slide-valve. The pressure acts on the annular sections $(r)=(d_8—d_{10})$ for the slide-face G^1, and $(s)=(d_6—d_7)$ for the slide-face G^2. To this action of the pressure, there is of course added the force applied by the springs **6** and **7**.

Finally, in accordance with an advantageous feature of this servo-control, in order to prevent the slide-faces from becoming "detached" from the slide-valve during the successive phases of the distribution, a so-called "compensating section" is provided on each of the slide-

faces: namely, $32=(d_9—d_8)$ on the slide-face G^1, and $33=(d_5—d_6)$ for the slide-face G^2.

These sections are in fact subjected to the pressure of that of the chambers of the jack which is supplied during the distribution phase in force, which has the result of increasing the force which applies the slide-face concerned against the flat distribution slide-valve.

What I claim is:

1. A hydraulic jack comprising first and second bodies adapted to move relative to one another, a slide valve slidably supported in one of said bodies, slide faces in said one body past which said slide valve is adapted to move, said slide valve being provided with a central passageway and two lateral passageways extending therethrough, a pair of chambers, one being provided in each of said slide faces, one of said chambers being adapted for being placed into communication with a pressure fluid source, said chambers being permanently placed into communication with one another via said central passageway of the slide valve, said slide valve having surfaces respectively in contact with the slide faces, said slide valve in the surface thereof closer to said chamber which is in communication with the pressure fluid source being provided with a pair of cavities opening into said lateral passageways, the slide face in contact with the surface of the slide valve which is remote from the chamber which is in communication with the pressure fluid source being provided with cavities which open into said lateral passageways, said bodies defining respective first and second chambers which when selectively furnished with pressure fluid provide for opposite directions of relative movement of the bodies, means permanently establishing communication between one of the chambers defined by said bodies and one of the cavities in the slide face, means permanently establishing communication between the other of the chambers defined by said bodies and the cavity in the slide valve which communicates with the lateral passage which is in communication with the other of the cavities in the slide face, said slide valve and said one body defining an annular space surrounding that slide face in which is provided the chamber which is in communication with the pressure fluid source, said cavities in the slide valve being dimensioned to be isolated from the chamber provided in the associated slide face, with the slide valve in a neutral position, said cavities being respectively placed into communication with the latter mentioned chamber when the slide valve is moved in opposite directions, the direction of relative movement between the bodies being determined thereby.

2. A jack as claimed in claim 1, wherein said surfaces of the slide valve which are in contact with the slide faces are flat surfaces and the slide faces have mutually flat surfaces.

3. A jack as claimed in claim 1, wherein both said means which establish respectively communication between said chambers defined by the body and the cavities in the slide valve and the slide face are each provided with a restoring chamber, each of the restoring chambers being formed along different cross-sections of the slide valve to exert a force on the slide valve resisting displacement thereof when pressure fluid is furnished to the respective chamber defined by the bodies as a result of movement of the slide valve.

4. A jack as claimed in claim 1, wherein both said means which establish respectively communication between said chambers defined by the body and the cavities in the slide valve and the slide face are each provided with a compensating chamber which is bounded by a respective surface of a slide face such that with pressure fluid furnished to the compensating chambers forces are developed on said slide faces urging the latter against said slide valve.

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