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PROCESS FOR THE REGULATION OF THE POWER OF OLEODYNAMICAL PLANTS, AND A DEVICE FOR CARRYING OUT THIS PROCESS

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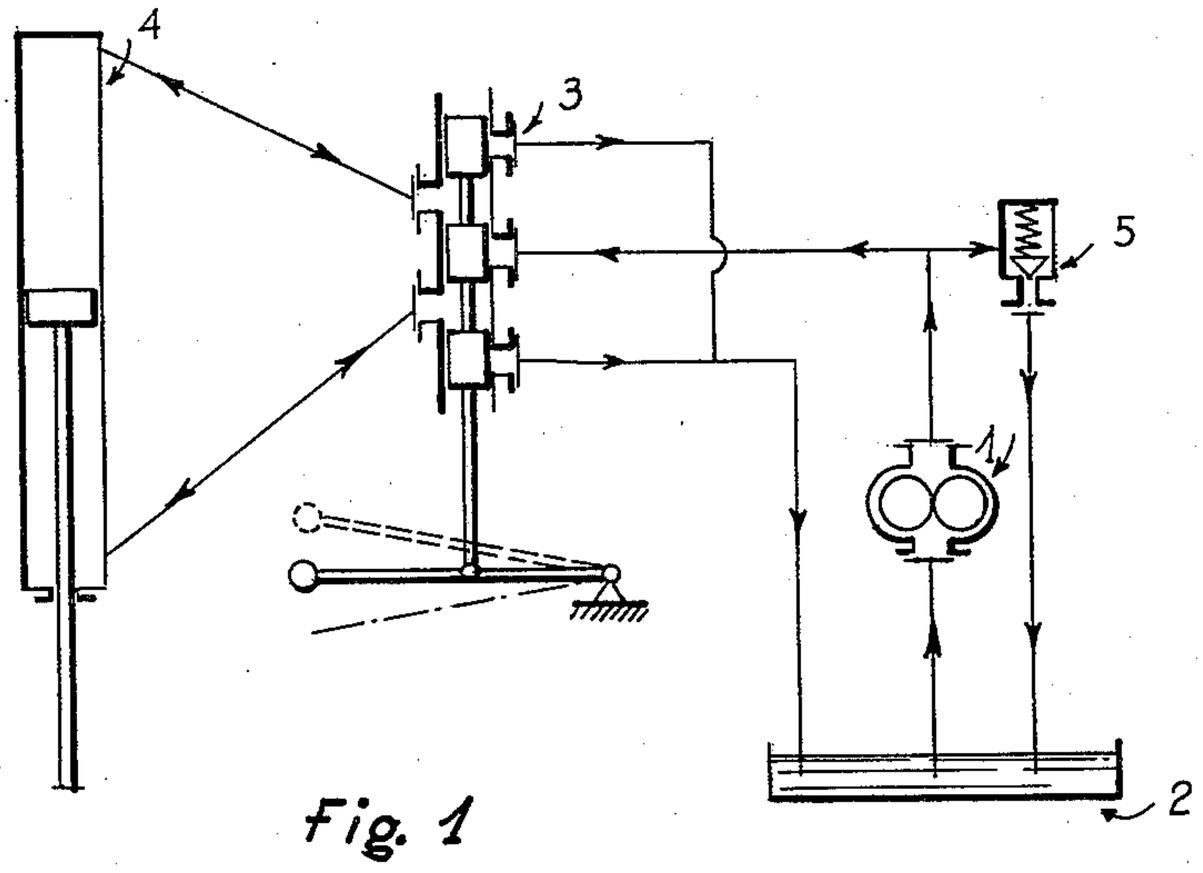

Fig. 1

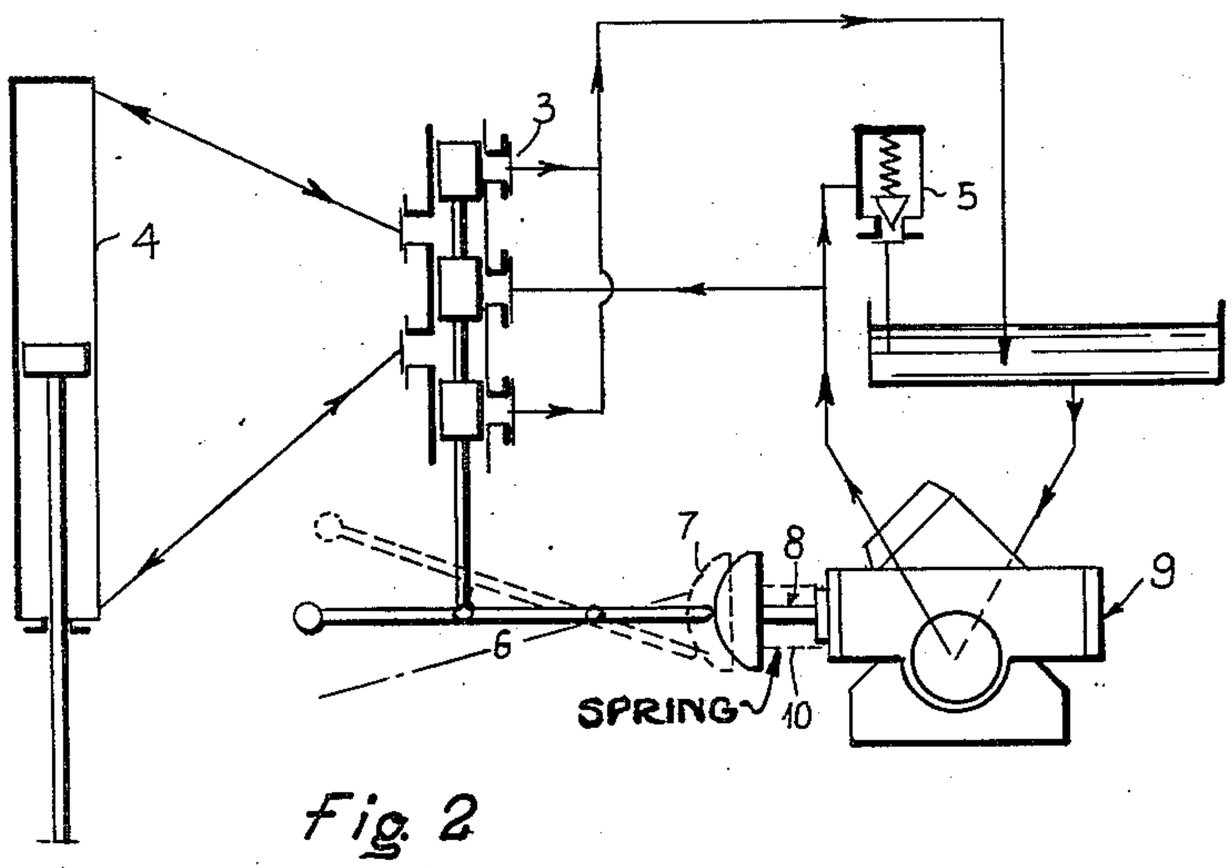

Fig. 2

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PROCESS FOR THE REGULATION OF THE POWER OF OLEODYNAMICAL PLANTS, AND A DEVICE FOR CARRYING OUT THIS PROCESS

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2 Claims. (Cl. 60—52)

This invention relates to a process and apparatus for regulating the power of oleodynamic plants of all kinds, and means for implementing the said process.

More particularly this invention may be adapted to trucks, road compressors, excavating machines, bulldozers and the like.

An object of this invention is to provide an oleo-dynamic apparatus comprising a variable delivery pump, means to control the passage of the fluid issuing from the pump and to direct said fluid to a hydraulic engine in which the passage of said fluid is regulated in such a way that the delivery or output of the pump will be totally and immediately received by said hydraulic engine at all times.

Another object of this invention is to prevent losses of energy and overheating of oil in the operation of a device of the kind referred to.

It is known that the classical realization of an oleodynamic circuit of power is based on the use of a hydraulic pump driven by a motor or an engine (for instance, an electric motor or an internal combustion engine) which provides the desired power for the distribution of oil to the different parts of the circuit (distributing valves, distributing devices, or deviators) and to linear hydraulic motors (jacks or hydraulic cylinders) or rotative motors having the function of transforming the hydraulic energy into mechanical energy which is necessary to effect the operation to which the circuit concerned is directed.

The pumps used in such circuits normally are volumetric pumps, owing to the high pressures which they have to produce, and in most cases said pumps are of constant delivery.

It follows that in opening the distributor and letting in oil, for instance, in one of the chambers of the hydraulic cylinder, the speed of displacement of the cylinder is a constant and well determined quantity.

The sole means for reducing such a speed is to open the distributor slightly so that oil entering into the hydraulic cylinder encounters enough resistance to open the relief valve and let out a part of the oil delivery. Other known methods are similar to the above, as in all cases one has to divert a part of the oil going to the cylinder in order to reduce the speed of displacement of the piston, and this oil so diverted goes out of the circuit.

In particular when the distributor is in its position of rest, all the flow of oil goes to the tank through the relief valve.

In all these cases there is a dissipative process causing a number of inconveniences, and particularly the following ones:

(*a*) Oil is appreciably heated, which reduces efficiency,

(*b*) Oil deteriorates rapidly making its replacement necessary,

(*c*) The quantity of oil used is greater than should be necessary,

(*d*) If the hydraulic mechanism has free pistons it is impossible to obtain braking by means of the same oil,

(*e*) The delivery of oil is not well regulated at the different loads and in certain cases a mechanical reductor is necessary,

(*f*) The distributor frequently receives hammering shocks and wears out readily.

According to the present invention means are provided to obviate the foregoing drawbacks by utilizing a pump with variable delivery. In this case, after having connected the delivery or output end of the pump to one of the chambers of the hydraulic cylinder through the distributing valve, by adjusting the delivery of the pump any speed of the piston can be obtained from a value of nil to the maximum value corresponding to the maximum delivery of the pump.

In this case two distinct operations have to be carried out, viz. action on the distributor and action on the member regulating the delivery of the pump.

If these two operations are effected separately and successively certain drawbacks are produced.

In fact, if the member regulating the delivery of the pump is acted upon first, bringing the said delivery to a certain rate, there will be a period in which the distributor is still shut or only partially opened, giving rise to an excess of delivery which has to be discharged through an overpressure valve with a degenerative process like that which is described above. If, on the contrary, the distributor is opened before increasing the pump delivery, even for a short time, the delivery circuit of the pump (which is under pressure and in communication with the hydraulic cylinder which in turn communicates with the piston under load) may happen to discharge, in consequence of such pressure, more oil through the overpressure valve than it receives from the pump; in this case the piston under the action of the load moves in a direction contrary to what is desired.

According to this invention a process is provided for the distribution of oil and for the regulation of the delivery of same in oleo-dynamical circuits having a pump with variable delivery, and a device is also provided to implement such process, so as to eliminate the aforesaid drawbacks.

The process according to the present invention is based on the simultaneous operation of the valve (or valves) which distribute the oil to the different users of the circuit as well as of the device existing on the pump for regulating its delivery.

By this simultaneous operation the drawbacks previously mentioned, as well as others, are avoided, in that firstly the delivery of the pump and the openings of passage of the distributor are varied simultaneously, so that these openings are never such as to present an undesirable throttling of the oil flow, and secondly with the opening of the distributor being bound to an immediae increase of the delivery, the movable member of the hydraulic cylinder cannot move backwards.

For a better understanding, reference is made to the accompanying drawing in which

FIG. 1 is a diagram of a hydraulic circuit of a known type and

FIG. 2 shows a preferred embodiment of a device according to the present invention.

In FIG. 1 a pump 1 with a constant delivery driven by an engine (not shown), sucks oil from a tank 2 and sends it to a distributor 3, which allows it to deliver said oil to one of the two chambers of a double acting cylinder 4, so as to cause movement of the piston in either direction.

When the movable member of the distributor 3 is in an intermediate position, the oil delivered by the pump will necessarily find another way and, according to FIG. 1, it takes the way of an overpressure valve 5, which discharges oil from the circuit into the tank every time that the pressure on the delivery side of the pump is over a prefixed value (for instance in consequence of the fact that the hydraulic cylinder refuses to let in more oil).

The above mentioned drawbacks are encountered in this case.

Referring now to FIG. 2 of the drawings, it is to be

seen that lever **6** driving the distributor **3** is connected by means of a cam **7** to the member **8** regulating the variable delivery of a pump **9**.

More particularly, the pump **9** is provided with suitable means, such as a spring **10**, having the tendency to increase the delivery, this tendency being in contrast with the action of lever **6**, more or less, according to the position of said lever.

Under these circumstances it is evident that a simultaneous operation is obtained for the distributor **3** and for the member **8** regulating the variable delivery of the pump; besides, it is possible, by giving a suitable shape to the contour of the cam, to fully control the opening of the distributor as a function of the pump delivery.

For instance the section of passage of the distributor can increase proportionally with the delivery, so that the lead losses through the distributor are almost constant.

In a general way the shape of the cam may be fixed by the following principles: For each application the user chooses the pump **9**, the hydraulic utilizer **4** and the distributor **3**.

The maker of the pump has fixed the law according to which the displacement of rod **8** determines the capacity of pump **9** and the pressure head of the same. The maker of the distributor **3** has fixed the law according to which the displacement of its controlling rod determines (under said pressure head) the rate of flow of the liquid through the distributor **3** to the utilizer **4**. According to the present invention the operating outline of cam **7** (that is the locus of the points of contact with the extremity of the right end of lever **6**) is such that for every position the delivery capacity of pump **9** equals the quantity which can pass through distributor **3**.

The example shown in FIG. 2 provides for a single user in the circuit of delivery of the pump, and this user is shown as being a linear engine, for instance a jack; in the same figure the oil follows an open circuit. These characteristics are however no limitations inherent in the

present invention which applies also to a number of utilizers, possibly of different kind and to closed circuits, or to circuits not shaped according to FIG. 2, as well as to other embodiments, always within the scope of the appended cliams.

So, for instance, the connection between lever **6** driving the distributor **3** and member **8** regulating the pump delivery may be effected by a mechanism other than cam **7**.

I claim:

1. In combination: a variable delivery pump, a member controlling by its displacement the capacity of said pump, said member consisting of a rod terminating in a cam-shaped end acted upon by a spring urging said rod in a given direction, a lever which can be angularly moved around a pivot and which determines the displacement of a member opening or closing a passage of the liquid issuing from said pump, one end of said lever acting upon said cam-shaped end of said rod, against the action of said spring.

2. In a combination according to claim 1 an operating outline of said cam-shaped end of the rod being so shaped that in a given position of said lever the member opening or closing the passage of the liquid issuing from the pump admits exactly the quantity of liquid corresponding to the operation of the pump determined by said position of said lever.

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