

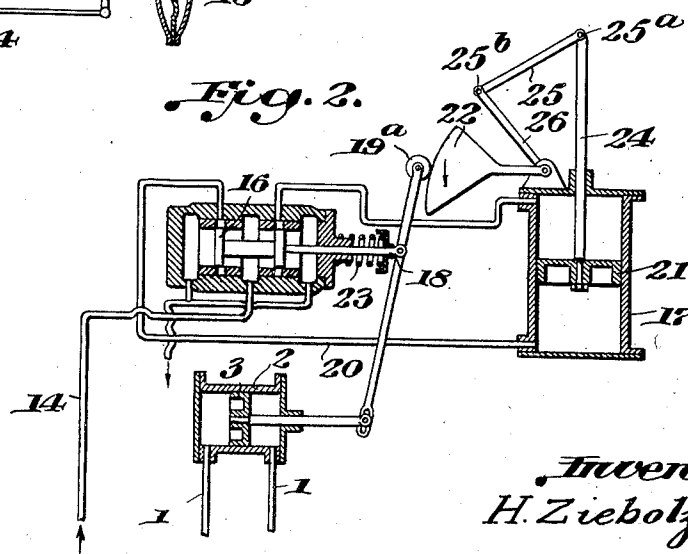
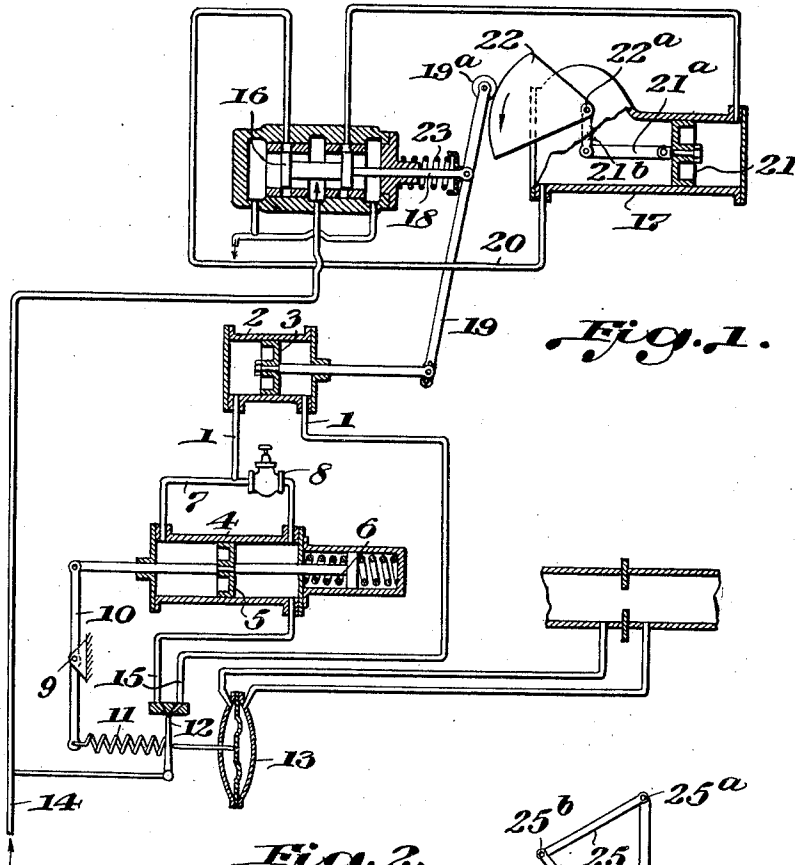
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PRESSURE FLUID OPERATED CONTROLLING DEVICE

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PRESSURE FLUID OPERATED CONTROLLING
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Regulator Company, Chicago, Ill., a corporation
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This invention relates to improvements in or relating to pressure fluid operated controlling devices of the type, comprising a servo-motor, a relay controlling a pressure fluid flow to the servo-motor and a so-called isodromic member to exert a restoring effect on the relay.

As is well known, such a restoring effect results in an advantage, to avoid a "hunting" or "over-shooting" of the controlling operation.

In such controlling devices it has proved to be advantageous to arrange the isodromic member in the pressure fluid circulation, i. e., in one of the pressure fluid conduits leading from the relay to the servo-motor. Such an arrangement is described in detail for instance in the Patent 1,959,889.

This arrangement, however, necessitates a predetermined dependence of the volume of the isodromic member with regard to the volume of the servo-motor. The isodromic member should have a volume twice as large as the volume of the servo-motor, as the movement of the isodromic piston out of its middle position into an end position should correspond as much as possible with the entire stroke of the servo-motor piston.

The invention is based on the idea that this disadvantage may be removed without having to forego the advantages resulting from the arrangement of the isodromic member in the pressure fluid circulation and without having to resort to any artificial means, having defects in any other respect.

Further aims, objects and advantages of this invention will appear from a consideration of the specification which follows with the accompanying drawing, showing for purely illustrative purposes two embodiments of this invention:

Referring to the drawing:

Fig. 1 is a diagrammatic illustration of a first embodiment, showing a pressure fluid operated controlling device, comprising a main servo-motor, an auxiliary servo-motor, an isodromic cylinder, and a primary, as well as a secondary relay.

Fig. 2 shows a second embodiment, according to which the main servo-motor has a modified construction.

Referring now to Fig. 1, 1 are pressure fluid conduits leading from the primary relay to the servo-motor cylinder 2. 4 is the isodromic member, i. e., in the embodiment shown an isodromic cylinder, the piston of which being elastically held in its middle position by means of springs 6, as is well known in the art. The two ends of this cylinder are connected by means of a by-

pass 7 with one another, this by-pass having in a well known manner an adjustable throttle 8. The isodromic piston 5 acts upon a lever 10, rockably mounted as at 9 to exert a restoring action on the relay member 12, which is shown in the embodiment according to Fig. 1 as the Askania jet pipe. Between the jet pipe 12 and the lever 10 a spring 11 is arranged. The jet pipe 12 will be controlled by any convenient controlling impulse produced, for instance by means of a diaphragm capsule schematically shown as at 13. A pressure fluid conduit 14 coming from any suitable pressure source leads to the jet pipe 12 so that the pressure fluid leaving the mouth of the jet pipe enters the receiving nozzles 15 communicating with the conduits 1. Therefore, the jet pipe playing in front of the receiving nozzles 15 produces a pressure difference between the two conduits 1 in accordance with the reflection of the jet pipe from its middle position resulting from the impulse.

If, for instance the diaphragm capsule 13 deflects the jet pipe 12 towards the right, the pressure fluid flow enters the right end of the cylinder 2 and, therefore, displaces the piston 3 towards the left, whilst the pressure fluid passing out of the left end of the cylinder 2 returns through the isodromic cylinder 4 back to the other receiving nozzle 15, the isodromic piston 5 being moved towards the right, resulting in the well known yielding restoring effect with regard to the jet pipe 12.

The controlling device as described up to now is well known in the art. In such arrangements the piston 3 of the cylinder 2 directly acts upon the member to be adjusted (not shown), for instance a butterfly valve mounted in a gas or liquid conduit to keep constant the flow in this conduit.

Contrary to this well known arrangement, according to the invention, the servo-motor 2 acts only as an auxiliary servo-motor by means of which a second relay 16 will be controlled, whilst a second servo-motor, i. e., the actual working motor 17 is connected to the relay 16 by means of conduits 20, corresponding to the conduits 1 between the primary relay 12 and the auxiliary cylinder 2. In the illustrated embodiment the second relay 16 is constructed as a slide valve, whose controlling rod 18 is hinged to a lever 19. This lever is likewise acted upon by the auxiliary piston 3.

In the previously suggested case, in which the piston 3 will be displaced towards the left (due to the deflection of the jet pipe 12 towards the

right) the slide valve 16 is also moved towards the left so that the pressure fluid flow coming from the conduit 14 enters the lower conduit 20 leading to the left end of the main motor 17. The piston 21 of this motor is adapted to actuate this member to be adjusted, i. e., in this instance the valve 16, so that the movement of the piston 21 to the right correspondingly displaces the valve 16. For this purpose, the piston 21 is provided with a connecting rod 21a connected thereto, this rod 21a being pivotally connected to an arm or link 21b which, in turn, is rigidly secured to the pivotal axis 22a of a restoring cam 22. This pivotal axis extends through the casing of the servo-motor 17, so that if the piston 21 moves to the left from the position illustrated in Fig. 1, the arm 21b is moved to produce a movement of the cam 22 in a clockwise direction and vice versa. The upper end of the above mentioned lever 19 is held in engaging relation with the cam 22 by means of a spring 23 and roller 19a. Now if the cam 22 is turned around its axis 22a so as to follow up the movement of the main piston 21 when the latter moves to the right, the lever 19 is rocked in a clockwise manner under the influence of the compression spring 23, thereby restoring the said valve 16.

In other words, if the piston 3 moves to the left, pilot valve 18 will also move to the left, and thereby uncover line 20, which means that the piston 21 will move to the right. In order to reestablish equilibrium, this movement of piston 21 will operate the cam 22 in a counterclockwise direction, and the spring 23 which keeps contact with the cam surface and the lever 19 will move the pilot valve to the right until it is returned to its median position. Thus, a definite relation between the position of cylinder 3 and piston 21 is established.

From the foregoing it follows that the main piston 21 continuously follows the movements of the auxiliary piston 3. As this piston operates in response to the yieldingly controlled relay 12, the main piston 21 likewise operates in such a manner as if its relay 16 is combined with an isodromic restoring member. On the other hand it is obvious from this arrangement that the dimensions of the isodromic cylinder 4 and the main or working cylinder 17 are in no way related with one another. Therefore, the isodromic cylinder 4 and also the auxiliary cylinder 2 may be constructed sufficiently small, i. e., independently of the working motor 17, without having to forego the advantages of the isodromic restoring operation and the further advantages resulting from the isodromic member in the pressure fluid circulation between the primary and the auxiliary cylinder.

The embodiment according to Fig. 2 differs from that according to Fig. 1 in the manner in which the piston of the working servo-motor 17 is connected to the cam 22. In this embodiment the restoring cam 22 for exerting a positive restoring action on the secondary relay 16 is pivotally mounted at the cylinder 17 and rigidly connected with the rocking arm 26. The upper end of this arm is pivoted to a controlling rod 25 as at 25b, this rod being likewise linked to the piston rod 24 of the cylinder 17 as at 25a.

Otherwise the fundamental structure and the manner of operation is the same as described with reference to Fig. 1.

It is to be noted that the invention may be used for any isodromic controlling device. However, the inventive idea is especially valuable in

such cases, in which the controlling process operates with great delay, because in these cases (for instance the regulation of the water level in boilers or the like) any temporary inoperativeness of the restoring member is very undesirable due to "hunting" or "over-shooting" of the controlling process resulting from such an inoperativeness, which is unavoidable in the well known devices in which the isodromic member is so constructed that in its end position the pressure fluid can freely flow through the isodromic member. As soon as this is the case, the restoring operation will be interrupted. The object of this special construction of the isodromic member is to reduce the volume of the isodromic member as far as possible.

In other respects the present invention is also not restricted to the particular embodiments herein shown and described. Moreover, the arrangement and the construction of the individual parts may be modified without departing from the spirit of the invention as defined in the appended claims.

What is claimed:

1. In a pressure fluid operated controlling device, in combination, a main servo-motor for actuating a member to be controlled, an auxiliary servo-motor having a small pressure fluid volume relative to that of said main motor, a primary relay connected to control the pressure fluid flow to said auxiliary motor in response to a controlling impulse acting on said relay, a pressure fluid operated restoring motor arranged in the pressure fluid circulation between said relay and said auxiliary motor and connected to exert a yielding restoring action on said relay, a secondary relay mounted to be controlled by said auxiliary motor and to control the pressure fluid flow to said main motor in response to the movement of said auxiliary motor, and restoring means between said main motor and said secondary relay to exert a rigid restoring operation on said secondary relay.

2. In a pressure fluid operated controlling device, in combination, a main servo-motor for actuating a member to be controlled, an auxiliary servo-motor having a small pressure fluid volume relative to that of said main motor, a primary relay connected to control the pressure fluid flow to said auxiliary motor in response to a controlling impulse acting on said relay, a pressure fluid operated restoring motor arranged in the pressure fluid circulation between said relay and said auxiliary motor and connected to exert a yielding restoring action on said relay, a secondary relay mounted to be controlled by said auxiliary motor and to control the pressure fluid flow to said main motor in response to the movement of said auxiliary motor, a restoring cam connected to be rotated by said main motor for exerting a rigid restoring operation on said second relay, a restoring lever connected to said auxiliary motor and to said secondary relay and means to hold said lever in engaging relation with said curve.

3. In a pressure fluid operated controlling device, in combination, a main servo-motor for actuating a member to be controlled, an auxiliary servo-motor having a small pressure fluid volume relative to that of said main motor, a primary relay connected to control the pressure fluid flow to said auxiliary motor in response to a controlling impulse acting on said relay, a pressure fluid operated restoring motor arranged in the pressure fluid circulation between said relay and said aux-

5 iliary motor and connected to exert a yielding restoring action on said relay, said main motor having a cylinder and a piston therein, a secondary relay mounted to be controlled by said auxiliary motor and to control the pressure fluid flow to said main motor in response to the movement of said auxiliary motor, a restoring cam rotatably mounted and rigidly connected with

a rocking arm, a transmitting rod hinged to said rocking arm and to the piston rod of said main servo-motor for rotating said cam upon a controlling movement of said main motor, a restoring lever connected to said auxiliary motor and to said secondary relay and means to hold said lever in engaging relation with said cam.

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