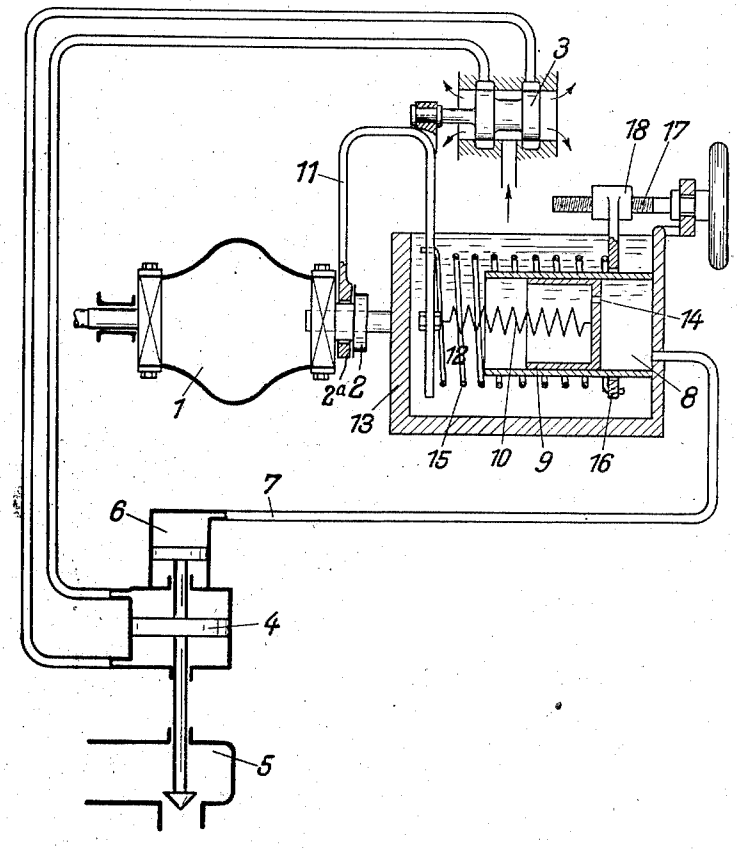
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SERVO-MOTOR GOVERNOR

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SERVOMOTOR GOVERNOR

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This invention relates to the automatic speed governors for power engines of the kind comprising a servomotor. Such governors always include a device for measuring the speed of the power engine. For this purpose a centrifugal device is generally employed in which the centrifugal force of rotating weights is balanced by the forces of similarly rotating springs. The rotating governor sleeve is positively connected to the rotating weights and springs, and slides axially when the equilibrium is altered. The non-rotating adjusting gear of the governor, which operates the control means for the servomotor, is acted on by the governor sleeve. In order to make the operation of the governor stable, it is well known that there must be in addition a return of the movements of the servomotor to the servomotor control means, in such a way that a certain speed is allotted to every position of the servomotor and vice versa.

Various forms of mechanical couplings have been employed between the governor sleeve and servomotor to effect the return movement and, usually, some part of the mechanical coupling could be adjusted manually to determine the critical operating speed of the governor system. The governors and the mechanical couplings have usually included a relatively large number of parts, and the designs have been such as to give rise to substantial frictional resistances and to lost motion or play between connected parts.

An object of the present invention is to provide a servomotor governor which is characterized by freedom from pivoted mechanical linkages in the governor and in the motion-transfer elements that couple the governor and servomotor. An object is to provide a servomotor governor of the type stated which includes a fluid coupling for effecting the return or follow-up adjustment of the governor. A further object is to provide a servomotor governor in which the mechanism for effecting the return movement and also the manually adjustable devices for setting the operating speed exert forces substantially axially of the governor sleeve.

The present invention consists in utilising as the revolution measuring means such a linkless flat spring governor and in effecting the return as well as the adjustment of the speed by forces acting axially on the sleeve thereof. In contradistinction to hitherto known designs the advantage is obtained that not a single link or the like is required in the whole device, so that all friction and even the slightest play is avoided. The precision of the governing is therefore better than in the known designs, all of which have links, knife-edges or the like in the pendulum itself, in the adjusting gear, in the return means or in the speed adjusting device.

In order that the invention may be more clearly understood, reference is made to the accompanying drawing which illustrates diagrammatically and by way of example one embodiment thereof.

In said drawing, 1 denotes a flat spring governor which, for the sake of simplicity, is advantageously disposed with its axes horizontal, and 2 is the rotating sleeve that is engaged by the non-rotating yoke or collar 2a at the end of a stirrup-shaped member 11 which is connected to the control slide valve 3 of the hydraulic servomotor 4. The pressure oil in the control slide valve 3 flows in and out, in the direction of the arrows indicated.

To one end of the piston rod of the servomotor 4 is rigidly joined the cone of a regulating valve 5, which cone regulates the flow of the driving medium to the power engine (which is not shown). At the other end the piston rod carries an auxiliary piston which moves in the cylinder chamber 6 and effects the return in the following manner: The cylinders 6 and 8, and also the connecting pipe 7 are entirely filled with oil as the cylinder 8 is within the oil chamber 12 and substantially below the level of the top of the chamber walls 13, so that every displacement of the piston 4 results in a corresponding displacement of the return piston 9. Between the piston 9 and the stirrup-shaped member 11 is disposed a return spring 10 under tension. Depending on the position of the piston 9, said spring exerts a certain force on the stirrup-shaped member 11 and thus on the sleeve 2, whereby the speed of equilibrium of the governor is influenced in accordance with the position of the servomotor 4. The piston 9 has a small leak port 14 in its base, the effect of which is that the tension of the spring 10 gradually vanishes during and after every regulating operation, so that the governor always exactly returns again to the original speed. The piston 9 also functions as an oil brake or damper to preclude excessive displacements of the control slide valve 3 upon changes in the speed of the governor. The oil level in chamber 12 thus eliminates the danger that during the downward movement of the piston 4 atmospheric air will be drawn through the opening 14 into the chamber 8 and into the tube 7, whereby the hydraulic rod system might become unrigid.

To the stirrup-shaped member is also secured

a speed spring 15, the right-hand end of which is rigidly joined to a spring plate 16. The tension of the spring 15 can be adjusted in accordance with the desired speed by means of a spindle 17 and nut 18. The spring 15 is secured against rotation both on the spring plate 16 and on the stirrup 11, and thus prevents any rotation of the stirrup 11 with the sleeve 2 around the axis of the governor. Since the governor 1 rotates and the collar 2a does not, a frictional torque is set up on the collar 2a the magnitude of which is dependent on the forces exerted at the time in question by the spring 15 and, during control intervals, the spring 10. This torque endeavours to turn the collar 2a together with the stirrup 11 about the axis of the governor, and in order to prevent such a rotation the spring 15 is so secured at its two ends against rotation that it must transmit the frictional torque from the stirrup 11 to the spring plate 16. This frictional torque, which arises from the fact that both the return and the adjustment of the speed are effected by forces which act in an axial direction on the sleeve 2, is thus transmitted on the one side to the driving shaft through the rigidity of the band springs of the governor 1, and on the other side to the spring plate 16 through the spring 15 which is secured against rotation. In both cases the moment is taken up in such a way that no friction can occur which might hinder the movement of the sleeve in the axial direction. The loading of the sleeve can therefore be made as high as desired without detracting from the sensitivity of the apparatus.

If for example, the spring plate 16 be displaced to the left by turning the spindle 17, there is induced on the governor sleeve 2 a force also directed towards the left, which reduces the speed of equilibrium of the governor. The arrangement may also be such, or the spring 15 can be made so powerful that the band springs of the governor 1, which are straight in the unstressed state, can also be brought into the position of equilibrium shown in the drawing when the machine is stationary, in which position the edges of the control slide valve 3 cover one another. With this arrangement it is thus possible to adjust the speed from its maximum value down to a state of rest, and to drive the power engine with automatic regulation at any desired speed between the state of rest and the maximum value.

I claim:

1. In a servomotor governor, the combination with speed measuring means comprising a shaft, a rotating governor sleeve and means supporting the same for axial movement, a plurality of normally flat jointless leaf springs each secured to and rotatable with said shaft and said governor sleeve, and a non-rotatable collar in engagement with said sleeve for axial displacement thereby, of a control member, means actuated by axial movement of said governor sleeve and collar for adjusting said control member, means actuated by movement of said control member for returning the governor sleeve to normal position after axial movement thereof, said returning means including spring means coaxial with said governor sleeve, and torsion spring means secured respectively to said non-rotating collar and to a non-rotating member to balance the frictional torque developed by the rotation of said governor sleeve in engagement with said collar.

2. In a servomotor governor, the invention as claimed in claim 1, in combination with means manually adjustable to displace said non-rotating member towards and away from said sleeve, thereby to adjust the critical speed of said speed measuring means.

3. The invention as claimed in claim 1, wherein said shaft and governor sleeve are horizontal; and said returning means includes an oil chamber, a cylinder coaxial with said governor sleeve and within and substantially below the upper edge of said oil chamber, and a piston slidable in said cylinder, said spring means of the returning means being connected between said piston and said governor sleeve.

4. A servomotor governor comprising a speed measuring device including a governor sleeve and a plurality of normally flat leaf spring members for displacing said sleeve axially in response to rotation of said spring members, the axis of said governor sleeve being substantially horizontal, a cylinder coaxial with said governor sleeve, a chamber for maintaining said cylinder filled with oil, a piston in said chamber, an inverted stirrup carried by said governor sleeve and having one leg depending into said chamber, a spring between said piston and said leg, a control member, fluid pressure means including a valve actuated by said stirrup for displacing said control member, and a hydraulic transmission between said control member and piston for displacing said piston upon a displacement of said control member.

5. A servomotor governor as claimed in claim 4, in combination with manually adjustable means for exerting a force upon and axially of said governor sleeve, said adjustable means comprising a plate surrounding said cylinder, means manually operable to adjust said plate axially of said cylinder, and a coiled spring coaxial with said plate and cylinder, the ends of said coiled spring being secured to said stirrup and to said plate.

6. In a control system, the combination with a centrifugal governor consisting of leaf-springs, a rotatable and axially slidable governor sleeve on a rotating shaft, and a non-rotatable member slidably arranged on said shaft and adapted to be co-axially displaced by said governor sleeve, of a servomotor including a control slide-valve connected with said non-rotatable member, an oil brake axially spaced from said governor and comprising a cylinder and piston coaxial with said governor sleeve, spring means connected at one end to said non-rotatable member and at the other end to said piston, hydraulic means for transmitting the movement of the servomotor to said oil-brake to displace said piston upon a displacement of said servomotor, whereby said piston and spring means are adapted to return said governor sleeve to normal position after axial movement thereof, and resilient means to balance the frictional torque developed by the rotation of said governor sleeve in engagement with said member.

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