

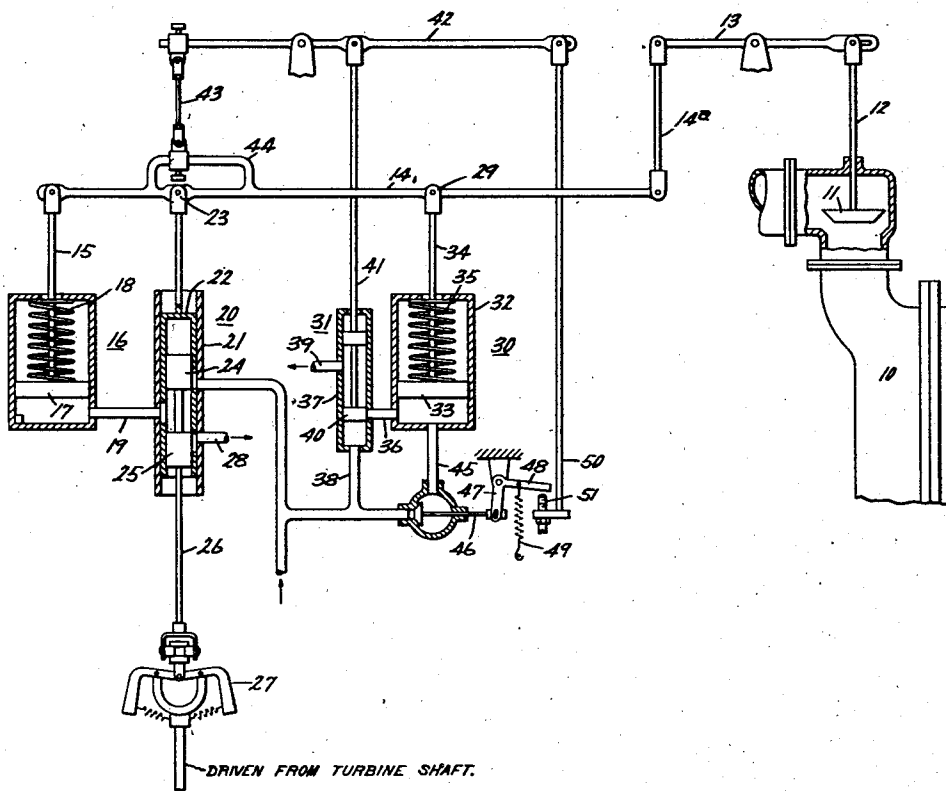
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GOVERNING MECHANISM FOR ELASTIC FLUID ENGINES

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GOVERNING MECHANISM FOR ELASTIC
FLUID ENGINESEdgar D. Dickinson, Beverly, Mass., assignor to
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The present invention relates to governing mechanisms for regulating a control valve or valves for elastic fluid engines in response to speed changes. More specifically the invention relates to governing mechanisms which include speed correcting means of the type disclosed in the patents to Standerwick, No. 1,629,318, filed November 28, 1925, and No. 1,810,627, filed October 19, 1929, and assigned to the General Electric Company.

The regulation of these governing mechanisms as a whole is instantaneously broad and can be narrowed by the speed corrector means to zero regulation if desired. In order to obtain stability, this correction takes place slowly so that if a large load, say full load, is suddenly taken off the machine the speed will increase in accordance with this instantaneous broad regulation. This sudden increase of speed may operate the emergency governor and trip the machine off the line.

The object of my invention is to provide an improved construction and arrangement of the type of governing mechanism referred to above whereby the control valve or valves are moved rapidly towards closing position in response to sudden changes of load, thereby preventing the turbine unit being tripped off by the emergency trip valve.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing which forms a part of my specification.

The single figure of the drawing shows a governing mechanism embodying my invention in connection with an elastic fluid turbine. The mechanism may be considered as comprising three essential elements: First, a motor and a control member for the motor actuated by a speed governor forming the parts of any ordinary speed governing mechanism; second, means for correcting the regulation of such ordinary speed governing mechanism in order to obtain zero regulation, that is, constant speed at any load, or, if desired, positive or negative regulation; and third, means provided in accordance with my invention to suddenly change the regulation during pre-emergency conditions.

Referring now more specifically to the arrangement indicated in the drawing, a turbine 10 has a control valve 11 for controlling the admission of elastic fluid thereto. This valve has a stem 12 connected to a fulcrumed lever 13 which in turn is connected by a link 14^a to the right-hand end of a follow-up lever 14. The left-hand

end of the latter is connected to the stem 15 of a hydraulic motor 16 having a piston 17 fastened to the stem and biased in downward direction by a spring 18. The lower part of the motor cylinder is connected by a pipe 19 to a control member or pilot valve 20 comprising an outer casing 21, a sleeve 22 connected by a stem and a pivot 23 to an intermediate point of the follow-up lever 14. The pilot valve also includes a pair of valve heads 24 and 25 secured to a stem 26 which in turn is connected to a speed governor 27 driven from the turbine shaft.

The arrangement so far described forms an ordinary speed governing mechanism which operates as follows: During decrease in load, causing an increase in speed, the flyweights of the governor move outward and effect downward movement of the pilot valve heads 24 and 25. The pilot valve head 25 thereby uncovers a lower port in the sleeve 22, and permits oil or like actuating fluid being drained from underneath the piston 17 of the hydraulic motor 16 through the pipe 19, the pilot valve, and a discharge conduit 28 of the latter. The draining of actuating fluid from underneath piston 17 causes downward movement of the piston under the action of the spring 18 whereby the lever 14 is turned in counter-clockwise direction about an intermediate point or pivot 29, resulting in closing movement of the turbine control valve 11. During counter-clockwise movement of the lever 14 the sleeve 22 of the pilot valve is moved downward, shutting off the connection between the pipe 19 and the drain pipe 28, or, from another viewpoint, resuming its "original relative" position with respect to the pilot valve heads.

The mechanism so far described effects positioning of the control valve 11 in response to load changes but at the same time it also effects a change in speed with changing load of the turbine. This change in speed will best be appreciated by considering the fact that during the above described operation the pilot valve heads 24 and 25 have been moved into a lower position. This lower position corresponds to a different position of the flyweights of the speed governor. The inherent width of the regulation of the ordinary speed governing mechanism is corrected or overcome by correcting means comprising a motor, in the present instance shown as a hydraulic motor 30, and a control member for the motor shown as an ordinary pilot valve 31. The motor includes a cylinder 32, a piston 33 therein having a stem 34 pivoted to

the above mentioned intermediate point or pivot 29 of the follow-up lever 14. The piston 33 is biased downward by a spring 35 and oil or like actuating fluid is admitted to and drained from the lower chamber of the cylinder by a conduit 36 connecting the cylinder to the pilot valve 31. The latter includes a casing 37 connected to said pipe 36 and having a supply conduit 38 and a drain conduit 39. The connection of pipe 36 with the pilot valve casing 37 is normally covered by a valve head 40 fastened to a stem 41 which latter is pivoted to a fulcrumed lever 42. The lever 42 has a left-hand end connected by an adjustable link 43 to a lever 44 forming a part of the lever 14.

The operation of the speed correcting mechanism is as follows: As pointed out above, the lever 14 is turned in counter-clockwise direction about the intermediate point or pivot 29, effecting closing of the control valve 11 during increasing turbine speed. This movement of the lever 14 also effects actuation of the correcting mechanism in that its connection with the fulcrumed lever 42 by the link 43 causes said lever 42 to be turned counter-clockwise about its fulcrum. This causes upward movement of the pilot valve stem 41 whereby the pilot valve head 40 uncovers its port, that is, the connection to pipe 36, and permits oil or like actuating fluid to be supplied from the inlet pipe 38 through the pilot valve and the pipe 36 to the cylinder 32 of the hydraulic motor 30. The piston 33 of the motor 30 then is moved upward against the biasing force of the spring 35, thereby turning the lever 14 about its connection with the stem 15 and moving the sleeve 22 of the main pilot valve upward. The upward movement of sleeve 22 permits actuating fluid to be drained from the hydraulic motor 16 through the main pilot valve 20, causing further downward movement of the piston 17, resulting in further closing movement of the turbine control valve 11, effecting a further decrease in speed until finally the speed governor 27, the pilot valve heads 24 and 25 and the sleeve 22 resume their original position. The turning movement of the lever 14 during this operation causes through the link 43 and the fulcrumed lever 42 the pilot valve head 40 of the correcting means to resume its original position. As pointed out above, the link 43 is adjustable. In the position shown, the correcting means acts to maintain constant speed of the turbine, that is, zero regulation. If the link 43 is moved to the left or to the right, positive or negative regulation may be obtained.

The correcting means for correcting the regulation of the ordinary mechanism has slow action which, as pointed out above, is undesirable whenever sudden load changes on the turbine occur, especially when load is suddenly thrown off the turbine. This drawback is overcome with my invention by the provision of means for accelerating the operation of the correcting means in response to sudden speed changes. This means comprises an auxiliary conduit including a valve for conducting actuating fluid to the correcting motor 30 in response to a sudden decrease in speed. In the present example I have shown a conduit 45 connected between the bottom of the cylinder 32 of the corrector motor and the supply conduit 38 for the auxiliary pilot valve 31 including a valve 46 having its stem connected to one arm of a fulcrumed bell crank lever 47, having another arm 48 biased downward by a tension spring 49

to normally maintain the lever valve 46 closed. In proximity with the arm 48 is an adjustable link 50 having its upper end pivoted to the aforementioned fulcrumed lever 42. The link 50 serves to actuate the valve 46 through the bell crank lever 47. In the present example the lower end of the link 50 is provided with an adjustable screw 51 somewhat spaced from the right-hand end of the arm 48 of the bell crank lever 47.

The operation of the mechanism is as follows: During normal operation, as pointed out above, the fulcrumed lever 42 is turned in counter-clockwise direction about its fulcrum during decreasing load on the turbine. If this decreasing load exceeds a certain magnitude the fulcrumed lever 42 is turned sufficiently in counter-clockwise direction to effect engagement between the lower end of the link 50, that is, the screw 51, and the bell crank lever 47 whereby said bell crank lever is turned about its fulcrum to effect opening of the valve 46. This permits actuating fluid to be directly supplied to the hydraulic motor 30 through the conduit 45, effecting rapid upward movement of the piston 33 and resulting in rapid closing movement of the turbine control valve 11. Thus, it will be readily seen that with the arrangement of the valve 46 and the means for actuating this valve, the action of the correcting means is considerably accelerated by taking away the control of the correcting motor 30 from the correcting pilot valve 31, thus eliminating the time element induced by the correcting pilot valve inclosing direction. This acceleration is important in that it prevents the speed from rising beyond a certain value at which the emergency governor would cause complete shutting of the turbine trip valve not shown.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination of an elastic fluid engine having a control valve for regulating the flow of elastic fluid to the engine, a speed governing mechanism for regulating the control valve in response to speed changes, means for automatically correcting the regulation of the speed governing mechanism, and means for accelerating the operation of the correcting means in response to sudden speed changes.

2. The combination of an elastic fluid engine having a control valve for regulating the admission of elastic fluid thereto, a speed governing mechanism for controlling the valve including a speed governor driven by the engine, a main hydraulic motor for moving the control valve and a main pilot valve connected to the speed governor for controlling the main hydraulic motor, means for correcting the regulation of the speed governing mechanism comprising an auxiliary hydraulic motor connected to the main pilot valve and an auxiliary pilot valve connected to the main motor for controlling the auxiliary motor, and means for accelerating the operation of the correcting means comprising a conduit including a valve for directly conducting actuating fluid to the correcting motor and a lever mechanism connected to the auxiliary pilot valve for opening the normally closed lever valve in response to sudden speed changes.