

Nov. 1, 1932.

C. A. JACKSON

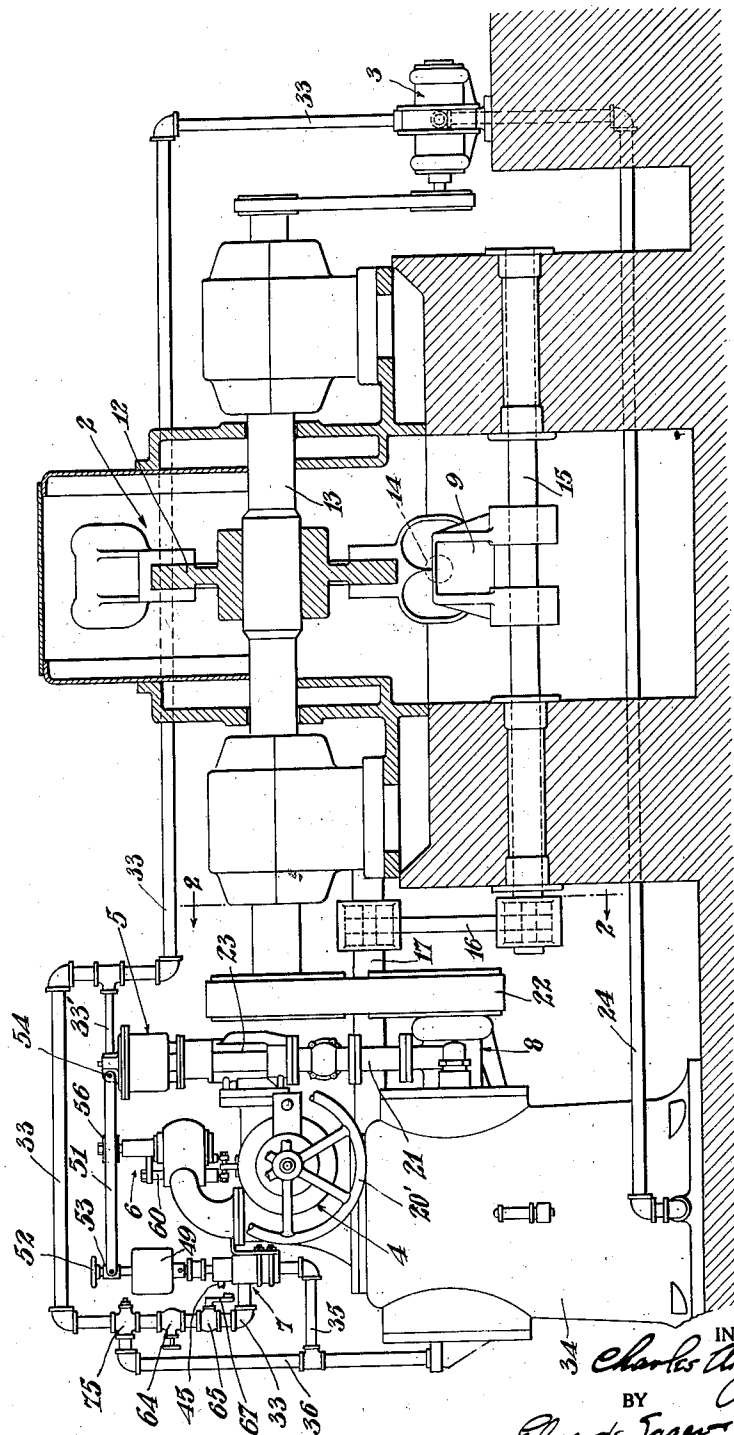
1,885,265

HYDRAULIC TURBINE GOVERNOR

Filed Dec. 31, 1925

3 Sheets-Sheet 1

Fig. 1.



INVENTOR
Charles A. Jackson
BY
Edwards, Sager & Brown
ATTORNEYS

Nov. 1, 1932.

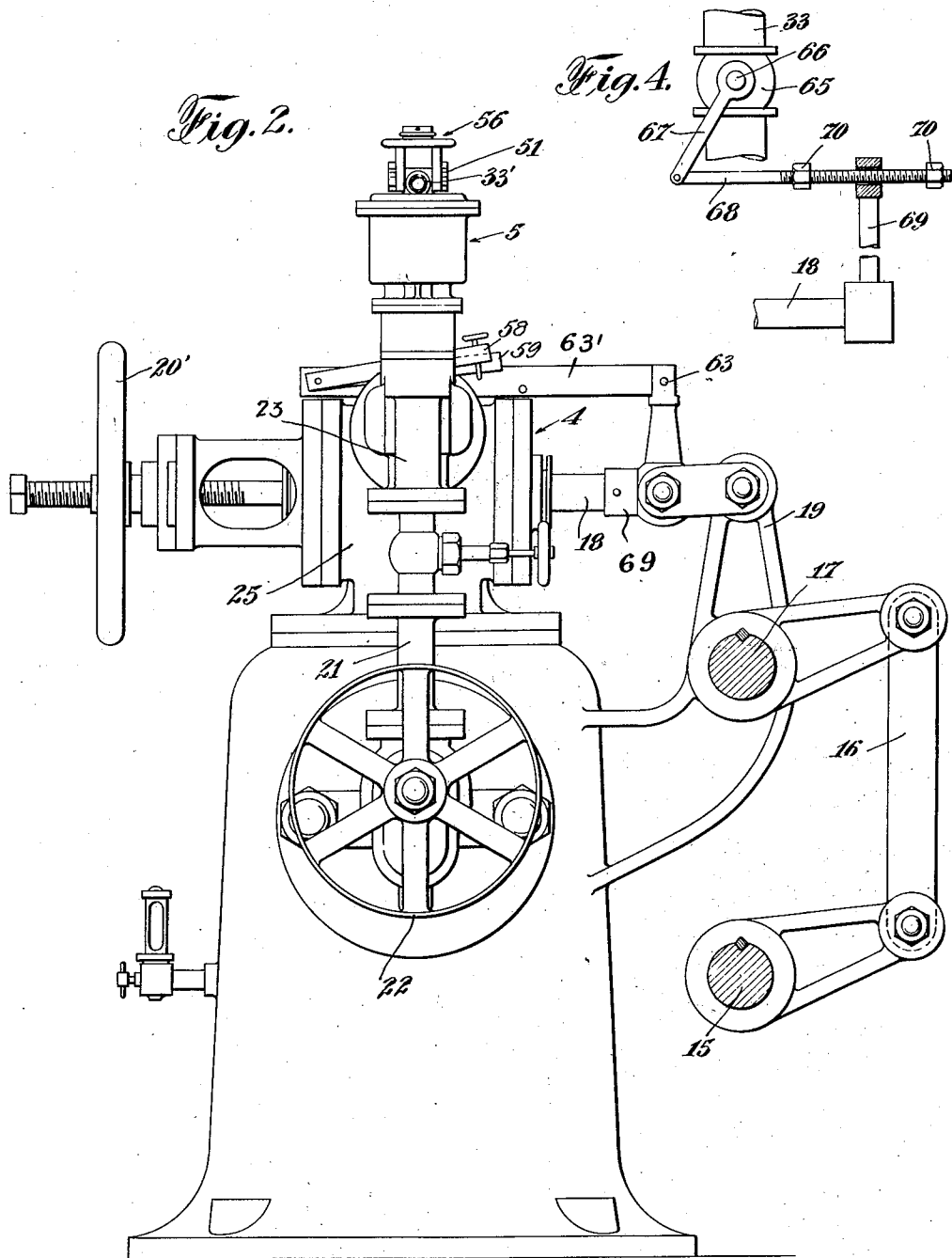
C. A. JACKSON

1,385,265

HYDRAULIC TURBINE GOVERNOR

Filed Dec. 31, 1925

3 Sheets-Sheet 2



INVENTOR
Charles A. Jackson
BY
Edwards, Sager & Bowler
ATTORNEYS

Nov. 1, 1932.

C. A. JACKSON

1,885,265

HYDRAULIC TURBINE GOVERNOR

Filed Dec. 31, 1925

3 Sheets-Sheet 3

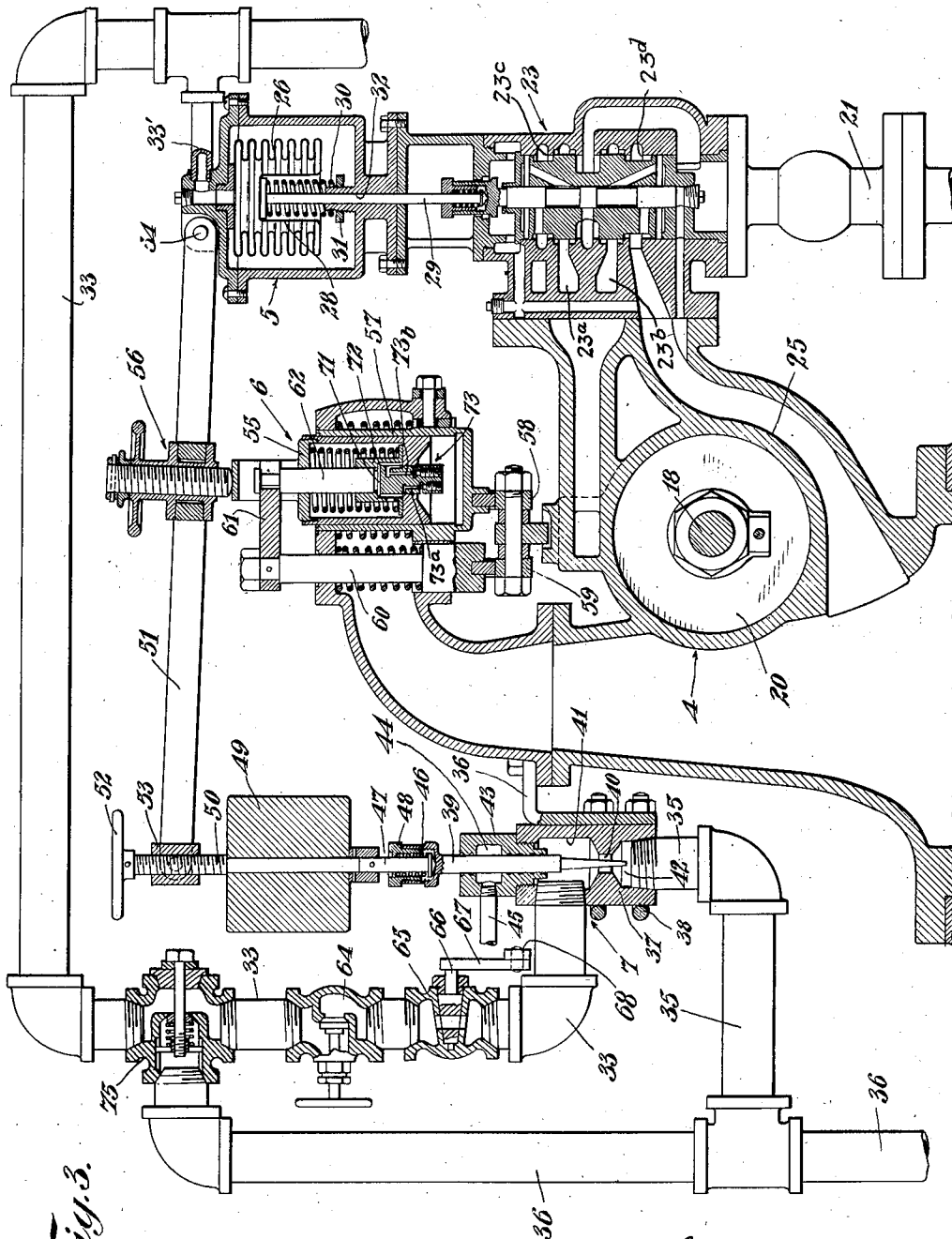


Fig. 3.

INVENTOR
Charles A. Jackson
BY
Edwards, Sager & Brown
ATTORNEY

UNITED STATES PATENT OFFICE

CHARLES A. JACKSON, OF RIDGEWOOD, NEW JERSEY

HYDRAULIC TURBINE GOVERNOR

Application filed December 31, 1925. Serial No. 78,509.

This invention relates to governing mechanisms and more particularly to a fluid operated governing mechanism especially adapted for the control of a hydraulic power generating mechanism.

In hydraulic installations such as herein specifically shown, there is provided generally a suitable type of hydraulic turbine, gate mechanism therefor, a servo-motor for controlling the gate mechanism, a speed responsive device actuated by the turbine, and means for controlling the operation of the servo-motor by the speed responsive device, the controlling means in turn including means for controlling actuating energy to the servo-motor and restoring mechanism associated with the motor, which prevents hunting action.

It is an object of my invention to provide a hydraulic pressure operated governor for controlling the gate mechanism and which has improved means for automatically controlling the pressure aside from the pressure generating means and its actuating means. Another object is to provide means for controlling the pressure in accordance with the degree of gate opening. A more specific object is to control this pressure by the restoring mechanism associated with the servo-motor. A still further object is to provide means for controlling the gate opening irrespective of whether the speed responsive device would indicate that a different control of the gate was desirable, this means constituting broadly, in one phase of the invention, a load limiting mechanism. In this respect a more specific object of the invention is to provide a valve in the fluid pressure system which will be actuated by and upon predetermined movement of the servo-motor. A further object is to provide means for normally shutting down the turbine by controlling the fluid pressure system, and more specifically to provide either a hand-operated valve or a solenoid actuated valve which might be actuated by a remote control or automatically in accordance with the operation of other mechanisms.

In addition to the foregoing objects other objects of my invention are to provide certain improved details of construction and

general arrangement of parts, which will be more apparent from the following description of the accompanying drawings in which:

Fig. 1 is a partially sectional vertical elevation of the general assembly.

Fig. 2 is a vertical transverse section taken on lines 2—2 of Fig. 1, certain elements being omitted for sake of clearness, such as the pulleys and driving belt.

Fig. 3 is an enlarged fragmentary partially sectional and elevational view of the mechanism associated with the servo-motor which is shown wholly in elevation at the upper left-hand corner of Fig. 1.

Fig. 4 is a diagrammatic view showing the load limit mechanism.

The general arrangement of the various parts comprises a turbine 2, a speed responsive device or auxiliary speed control pump 3 which serves as a speed governor, a servo-motor 4, a servo-motor valve actuating mechanism 5, a restoring mechanism 6, compensating valve mechanism 7, a pump 8 for generating servo-motor fluid pressure, and a turbine flow controlling mechanism 9, which is actuated by movement of the servo-motor 4.

A brief general operation of the device is: when a turbine load is partly relieved the turbine speed will momentarily increase, causing the pump 3 to generate a pressure above normal due to the compensating valve 7 restricting flow from the pump 3, and this pressure causes actuation of the servo-motor valve as by the mechanism 5 to permit generated pressure from the pump 8 to move the servo-motor, thereby moving the deflector 9 into the path of the water stream and accordingly the turbine speed will drop. Before the turbine can drop to a speed which is proportional to the load thereon the restoring mechanism 6 will actuate the compensating valve 7 (which is broadly a part of the restoring mechanism) to relieve the excess pressure from pump 3, thereby stopping servo-motor movement due to the fact that the actuating mechanism 5 will be restored to normal position. Reverse operations are effected when an increased load comes on the turbine.

More specifically the turbine 2 comprises a runner 12 mounted upon a shaft 13, which is connected by suitable pulley and belt arrangement to the auxiliary speed control pump 3. This connection might also be by gears or direct connected. Flow to the runner from a needle nozzle disposed in front of the deflector 9 and diagrammatically indicated by dotted lines at 14 in Fig. 1 is controllable by the deflector 9 in a well-known manner, and this mechanism constitutes broadly a gate control. A shaft 15 supports the deflector 9 and is oscillated by suitable linkage connections 16 and an oscillating shaft 17, which is connected to a servo-motor piston rod 18 as by suitable linkage connections 19. The servo-motor and linkage connections therefrom to the deflector is of a well-known construction and a detailed description thereof is not thought necessary except to say that the piston rod 18 is connected to a piston 20, which is controlled by fluid pressure flowing through a suitable hand valve controlled pipe 21 from the pump 8, this pump being actuated by a suitable belt and pulley connection 22 driven from the turbine shaft 13. The hand valve is for shutting off pressure when the governor is being operated manually through handwheel 20'. Fluid flow from the pipe 21 is controlled in a usual manner by a well-known valve mechanism 23 wherein supply ports 23a and 23b and exhaust ports 23c and 23d communicate respectively with the left and right ends of the servo-motor. It will suffice to say that this valve has a neutral position wherein the piston 20 will be held stationary; an upper position wherein fluid will be admitted from the pipe 21 to the left end of the servo-motor cylinder 25 as viewed in Fig. 2, and discharges exhaust fluid from the right cylinder end and a lower position wherein fluid is admitted to the right cylinder end and exhausts it from the left end.

In order to control the servo-motor by the regulating valve 23 in accordance with turbine speed the valve actuating means 5 is provided with a pressure diaphragm 26 of the bellows type having a cup-shaped supporting portion 28 extending inwardly of the diaphragm. A stem 29 is at one end operatively connected to the valve mechanism 23, while the other end is yieldably pressed as by a spring 30 against the transverse portion of the cup 28. A suitable nut 31 has threaded engagement with a boss 32 for adjusting the tension of the spring 30. Pipes 33 and 33' allows communication between the pump 3 and the diaphragm interior.

To allow pump 3 to increase the pressure in order to actuate the diaphragm 26 the compensating valve mechanism 7 is disposed in pipe 33 between pump 3 and a reservoir 34 to which pipe 33 is connected as by a pipe 35 leading into a drain pipe 36. A pipe 24 con-

ducts fluid from the reservoir 34 to the pump 3. The compensating valve 7 has a casing 37 supported upon the servo-motor frame by a bracket and U-bolts 38. A tapered valve stem 39 controls fluid flow between the pipes 33 and 35 as by cooperating with a restricted passage 40, which connects enlarged bores 41 and 42. A suitable plug and gland member 43 providing a combined chamber closure and valve guide has a recess 44 to which is connected a drain pipe 45. This arrangement provides in effect a packing gland of a type which will permit leaking fluid to be properly taken care of. An enlarged hollow portion 46 is pivotally and yieldably connected to a stem 47 as by a spring and threaded plug connection 48. A weight 49 is freely mounted upon a threaded shaft 50, which has pivotal and threaded engagement with the free end of a lever 51. A suitable hand grip 52 is provided for rotating the shaft 50 within the pivotal lever connection 53 to thereby adjust the valve 39 relative to the opening 40. The other end of the lever 51 has a pivotal connection 54 with a stationary housing of the valve actuating mechanism 5.

Operatively connected to the lever 51 intermediate its ends is the restoring mechanism 6. This mechanism is of a well-known type and it will suffice to say that the same comprises a dash-pot piston 55 operatively connected to the lever 51 as by a suitable adjustable connection generally indicated at 56. A yieldably held dash-pot cylinder 57 is controlled by a longitudinally inclined cam 58, while cam 59 inclined in the same general direction as cam 58 controls movement of a centralizing device including a yieldably held shaft 60, cross member 61 and a stem 62, which has an annular collar 71 engageable with the shoulder of a bore formed within a normally yieldably downwardly pressed sleeve 72. The cam 59 is generally made adjustable by a screw 59'. A vent valve mechanism 73 formed as an integral part of rod 62 controls flow of fluid past the piston 55 and into and from the lower end of the cylinder 57, thereby controlling the rate of restoration of the compensating valve mechanism 7. The cams 58 and 59 are mounted upon a supporting bar 63' which is moved parallel to the servo-motor axis by a suitable connection 63 to the rod 18.

The mode of operation of this restoring mechanism is well known, but briefly is as follows: When the turbine speed decreases, due to an increased load, the piston 20, as shown in Fig. 3, moves in the direction pointing towards the end of the piston, or in a right-hand direction, as seen in Fig. 2. Movement of the servo motor piston moves the cams 58 and 59, and, due to the downward inclination of the cam 58, permits downward movement of cylinder 57 by the spring surrounding the same. The piston 55 tends to

follow quickly the downward movement of cylinder 57, due to the decreased pressure in the cylinder 57, and accordingly permits downward movement of the left end of lever 51. During this period, the position of pilot valve 73 is controlled by the position of cam 59 relative to stem 60, and during this period the pilot valve permits fluid flow into cylinder 57 from the interior chamber of the piston 55 as through the small passage 73a and ports leading therefrom in the valve 73. When the turbine speed increases, due to decreased load, the cam 58 is moved in a direction to cause its inclined surface to thrust cylinder 57 upwardly, which instantly causes a corresponding upward movement of the piston 55, and likewise upward movement of the lever 51. The passage 73b and ports leading therefrom in valve 73 gradually allow flow of fluid from the cylinder 57 to the hollow portion of the piston 55, until the piston 55 comes to a point of equilibrium controlled by the centralizing mechanism, including pilot valve 73 and element 60.

A usual type of hand controlled stop valve 64 disposed in pipe 33 may be closed to allow building up of pressure therein and accordingly actuate the valve mechanism 23 to that degree which will shut down the turbine. A suitable solenoid controlled valve could, of course, either be substituted in place of the valve 64 or inserted in pipe 33 in addition thereto. The solenoid could be actuated by any suitable remote control mechanism or automatically in accordance with the operation of other mechanisms such as might be selected.

In order to limit the turbine load a load limit mechanism is controlled by the operative connections between the deflector and servo-motor, whereby the motor will be prevented from moving the deflector completely out of the jet or beyond a predetermined point. The power generated by the turbine will accordingly be limited. This mechanism comprises a usual type of plug valve 65 disposed in the pipe 33 and has a shaft 66 which is oscillated by an arm 67 pivotally connected to a shaft 68. The piston rod 18 of the servo-motor carries a laterally extending fixed arm 69 which is slidable over the shaft 68 to abut one or the other of nuts 70 or 70' which are adjustably threadedly connected to the shaft 68. When the servo-motor moves to a predetermined point to cause engagement between the nut 70 and arm 69 the valve 65 will be moved towards closing position, thereby permitting the building up of normal pressure in the pipe 33 and accordingly movement of the valve mechanism 23 to its neutral position, thus causing the servo-motor to come to a standstill. Further closure of valve 65 is accordingly prevented and only normal pressure thereby maintained.

In operation, assume that the turbine is

rotating at normal speed and driving the auxiliary speed control pump 3 so that oil flows through pipe 33 and past needle compensating valve 7 to the drainage chamber in the base 34. Also, the valve mechanism 23 will be in its neutral or mid-position, and accordingly the servo-motor piston will be stationary, thereby holding the deflector 9 in a single position. During this period the tension of the spring 30 will be just sufficient to balance the oil pressure on the diaphragm 26, this pressure being controlled by the needle valve 39, which will have such a position during normal operation to effect such a balance.

When the turbine load is reduced the turbine speeds up, thereby causing the pump 3 to increase its discharge pressure due to the fact that the needle valve 39 effects only a constant discharge area in the port 40. This increased pressure acting within the diaphragm 26 forces the valve mechanism 23 toward its lower position, whereupon fluid flowing from the pump 8 and through the pipe 21 will act upon the right side of the servo-motor piston 20 as viewed from Fig. 2 and exhaust fluid from the left cylinder end, thereby moving as by linkages 16 and 19 the deflector 9 upwardly into the path of the nozzle stream. Before normal turbine speed is attained the needle or compensating valve 39 is moved towards full open position, thereby reducing to normal the discharge pressure of the pump 3, and accordingly permitting the spring 30 to move the valve mechanism 23 to its mid position, thereby holding the servo-motor piston stationary. The compensating valve is moved to its open position by the restoring mechanism 6 in that when the servo-motor is initially moved the longitudinal cam 58, moved longitudinally by the connection 63 and servo-motor, causes upward movement of the dash-pot cylinder 57 and the fluid which is trapped in the lower end thereof will cause upward movement of the piston 55 and the lever 51, which in turn moves the compensating valve upwardly. The compensating valve will be held open only a sufficient length of time to reduce the pressure to normal, this time limit being controlled by the leakage valve mechanism 73, which permits the trapped fluid in the lower end of the dash-pot cylinder 57 to flow into the hollow piston 55, during which time the piston will be forced downwardly by the weight 49. The operation of the leakage valve mechanism 73 and sleeve 72 is well understood as is also the centralizing mechanism including cam 59 and shafts 60 and 62, the operation of this particular mechanism not being specifically a part of my present invention. The turbine speed still being above normal due to the fact that the compensating valve 7 was opened and pressure restored to normal before the turbine could

attain its normal speed, the pump 3 with the valve 7 again in its normal position will generate a discharge pressure above normal and accordingly again cause downward movement of the valve stem 29, resulting in further left-hand movement of the servo-motor piston, and accordingly further movement of the deflector 9 into the nozzle stream. The restoring mechanism 6 is again actuated by the longitudinally movable cam 58 to again open the compensating valve 7 to restore discharge pressure to normal, whereupon the servo-motor piston is brought to rest. This cycle of operation is continuous until the turbine finally reaches its normal speed.

If the turbine load should be increased instead of decreased, thereby causing a decreased speed the restoring mechanism 6 and the needle valve will reversely function. For instance, assuming the speed to drop, discharge pressure of the pump 3 will fall, and accordingly the spring 30 will move the valve mechanism 23 upwardly to cause right hand servo-motor movement, which results in moving the deflector 9 in an outward direction from the nozzle stream. The servo-motor movement will permit the dash-pot cylinder 57 to be moved downwardly by its co-operating spring and to the receding surface of the inclined cam 58. The weight 49 will accordingly move the piston 55 downwardly and move the compensating valve 7 towards closing position and allow the building up of normal pressure, whereupon the diaphragm 26 will finally move the valve mechanism 23 to mid position. Due, however, to the outward movement of the deflector 9 from the nozzle stream more energy will be supplied to the turbine and accordingly tend to speed up the same. The rate at which the compensating valve moves towards closing position is, of course, controlled by the rate of fluid flow between the hollow piston 55 and the lower end of the dash-pot cylinder 57. As the turbine speed gradually reaches normal the servo-motor controlled by the dash-pot and compensating valve mechanisms is controlled in the manner as previously described so as to bring all elements involved back to their normal setting.

To shut down the turbine by use of the servo-motor it is only necessary to close the valve 64, whereupon the discharge pressure from the pump 3 will be maintained above normal, thereby causing the servo-motor to move the deflector 9 to its full closing position. If it is desired to limit servo-motor movement automatically nuts 70 as shown in Fig. 4 may be adjusted to the desired points, whereupon the arm 69 carried on the servo-motor piston rod 18 will engage the right hand nut, thereby moving the valve 67 to a restricted port position. This causes a pressure increase above normal sufficient to move the valve mechanism 23 downwardly and ac-

cordingly reverse servo-motor movement. The degree of port restriction may be such as to maintain pressure of the pump 3 above normal. The load limit valve 65 would, of course, be opened when the servo-motor moves in the opposite direction. Thus, it will be seen that I have provided a hydraulic governor mechanism which includes preferably a servo-motor, a fluid pressure speed responsive device, such as the pump 3, and means for controlling said pressure by supplemental means, such as the compensating valve, stop valve, or load limit valve, in accordance with such conditions as variations in the pressure from normal and the servo-motor movements aside from various other conditions in the machine. Under any conditions the pressure if reaching abnormal value will be released by the relief valve 75 which may be of any usual type. Both pumps are preferably of the meshing gear type although other types could be used such as centrifugal, or reciprocating.

I claim:

1. A governing mechanism comprising a servo-motor, a fluid pressure generating pump normally operative as a speed governor whose pressure varies in accordance with its speed, actuating means therefor, and means separate from said actuating means for controlling said pressure oppositely to the direction of variation and in accordance with movement of the servo-motor.

2. A governing mechanism comprising a servo-motor, a fluid pressure pump normally operative as a speed governor, means controlled by fluid pressure therefrom to control said motor, and means for variably controlling said pressure, including a reciprocable needle valve having a given position for normal pump speed, a lever connected thereto, and mechanism connected to said lever for actuating said needle valve to restore the same to its given position automatically when the pump varies from its normal speed.

3. In combination with a hydraulic turbine having means for controlling flow thereto, of a fluid pressure pump driven thereby and normally operative as a speed governor wherein the pressure varies with the speed, a servo-motor for controlling said flow control means, and means for controlling said servo-motor by fluid pressure from said pump, including a servo-motor fluid distributing valve actuated by fluid pressure from said pump, said distributing valve having a neutral position for normal turbine speed, and means for restoring said distributing valve to its neutral position upon movements therefrom including valve means for relieving discharge pressure from said pump automatically when the turbine speed is above normal.

4. In combination with a hydraulic turbine having means for controlling flow thereto, of a fluid pressure pump driven thereby

and normally operative as a speed governor, a servo-motor for controlling said turbine flow control means, means for controlling said servo-motor by fluid pressure from said pump including a servo-motor fluid distributing valve actuated by fluid pressure from said pump, means for relieving discharge pressure from said pump automatically when the turbine speed is above normal, and means for controlling said relief means, prior to the time when the turbine speed drops to normal, so as to increase discharge pressure from said pump to above normal pressure.

5. In combination with a turbine having flow controlling means, of a servo-motor for controlling said means, means for controlling said servo-motor including a fluid pump driven by said turbine and adapted to have its discharge pressure increase with increased turbine speed above normal, a servo-motor fluid distributing valve, actuating means therefor operated by pressure from said pump and movable from a given position to permit actuation of said servo-motor automatically when the turbine speed is above normal, and means for restoring said latter movable means to substantially said given position before the turbine attains a normal speed, said restoring means having provision for effecting its restoring action by varying the pressure of the fluid discharged from said speed responsive device.

6. In combination with a turbine having flow controlling means, of a servo-motor means for controlling said servo-motor including a fluid pump, means for driving said pump by said turbine whereby the pump discharge pressure increases with increased turbine speed above normal, a servo-motor valve means operatively connected to said valve for actuating the same by pressure from said pump, said valve being movable from a given position to permit actuation of said servo-motor when the turbine speed is above normal, means for moving the valve back to its given position when the pump pressure is reduced, means for varying the pump pressure to restore said valve to substantially said given position before the turbine attains a normal speed, and means automatically operative after said restoring action to effect further control of the fluid pressure from said pump and thereby effect further operation of the servo-motor.

7. A governing mechanism comprising speed responsive means for generating fluid pressure in accordance with its speed and being operative at a normal speed to produce a normal discharge pressure, valve means for variably controlling said pressure, actuating means therefor automatically operative upon a drop below normal speed to restrict fluid flow through said valve means whereby normal pressure is restored.

8. A governing mechanism comprising a

fluid pressure generating speed governor operative at a normal speed to produce a normal pressure, valve means for variably controlling said pressure, and actuating means therefor automatically operative upon an increase in speed above normal to increase the flow area through said valve means whereby normal pressure is restored.

9. A governing mechanism comprising a servo-motor, fluid pressure generating means, means actuated by the fluid pressure therefrom for controlling said servo-motor, and means for limiting motor movement by controlling said pressure automatically only when said motor reaches a predetermined position.

10. A governing mechanism comprising a servo-motor, fluid actuated means for controlling said motor, and means for limiting the movement of said motor automatically only when said motor reaches a predetermined position, including means for controlling the pressure for said fluid actuated means.

11. A governing mechanism comprising a servo-motor, a fluid pressure actuated element for controlling the same, a fluid passage having communication with said fluid actuated means, a valve in said passage, and means for actuating said valve, including a member movable with said motor and operative to limit positively movement of the motor in one direction only when the motor reaches a predetermined position.

12. A governing system comprising a servo-motor, fluid actuated means for controlling energy flow to said motor and disposed to one side thereof, a compensating valve mechanism disposed on the other side of said motor adapted to vary the actuating fluid pressure of said means, restoring mechanism disposed adjacent said motor and intermediate said fluid actuated means and said compensating mechanism, and means for operatively connecting said compensating and restoring mechanism whereby movement of the restoring mechanism moves said compensating valve.

13. A governing system for a hydraulic turbine comprising a gate mechanism, a servo-motor therefor moved in opposite directions by fluid pressure, a valve mechanism for controlling and distributing actuating fluid to said servo-motor, means for actuating said valve by fluid pressure, and means for controlling fluid to said valve actuating means, including a pressure generating pump normally operative as a speed responsive device wherein the discharge pressure increases with increase of turbine speed and decreases with a drop of turbine speed, a compensating valve for variably controlling the discharge pressure during normal operation of the servo-motor, and a restoring mechanism controlled by the servo-motor for

effecting restoring operation of said compensating valve.

14. A governing system for a hydraulic turbine comprising a gate mechanism, a servo-motor therefor moved in opposite directions by fluid pressure, a valve mechanism for controlling actuating fluid for said servo-motor, means for actuating said valve by fluid pressure, and means for controlling fluid to said valve actuating means including a pressure generating pump normally operative as a speed responsive device wherein the discharge pressure increases with increase of turbine speed and decreases with a drop of turbine speed, a compensating valve for variably controlling the discharge pressure during normal operation of the servo-motor, a restoring mechanism controlled by the servo-motor for effecting operation of said compensating valve, and means automatically operative upon predetermined movement of said servo-motor for limiting the load on said turbine by controlling the discharge pressure from said pump.

15. A governing system for a hydraulic turbine comprising a gate mechanism, a servo-motor therefor moved in opposite directions by fluid pressure, a valve mechanism for controlling actuating fluid for said servo-motor, means for actuating said valve by fluid pressure, means for controlling fluid to said valve actuating means including a pressure generating pump normally operative as a speed responsive device wherein the discharge pressure increases with increase of turbine speed and decreases with a drop of turbine speed, a compensating valve for variably controlling the discharge pressure during normal operation of the servo-motor, a restoring mechanism controlled by the servo-motor for effecting operation of said compensating valve, and means automatically operative upon predetermined movement of said servo motor for limiting the load on said turbine by controlling the discharge pressure from said pump, said load limiting means including a valve disposed in the discharge pipe line of said pump within which is also disposed the compensating valve.

16. A governing mechanism for a turbine comprising a servo-motor, fluid actuated means for controlling movement thereof, a pump driven by the turbine for supplying actuating fluid to said means and normally operative as a speed governor, means adapted to be moved when rendered operative for limiting the load on said turbine irrespective of the load which normally would be permitted by the operation of said speed responsive device and means for effecting movement of said limiting means automatically when a predetermined position of the servo motor is reached.

17. A governing mechanism for a turbine comprising a servo-motor, fluid actuated

means for controlling the same, a fluid pressure generating pump normally operative as a speed responsive device for supplying fluid pressure to said latter means, and load limit mechanism for the turbine comprising a valve in the discharge side of said pump and having a lost motion connection with said servo-motor whereby upon predetermined servo-motor movement said lost motion connection is rendered operative to move the load limit valve towards closing position.

18. In combination, a prime mover, a governing mechanism therefor, comprising a servo-motor, means for controlling movement of said servo-motor in accordance with the speed of said prime mover, and means including a normally movable element for limiting movement of said motor, thereby to limit the load on said prime mover, said limiting means being independent of said speed controlling means thereby permitting limiting action to take place irrespective of any action of said speed controlling means which might otherwise permit a different load to be placed upon said prime mover.

19. In combination, a prime mover, and governing means therefor comprising a servo-motor having a fluid distributing valve mechanism, a fluid pressure pump driven by said prime mover whereby the pressure generated by said pump increases and decreases respectively as the speed of the prime mover increases and decreases, a fluid pressure chamber having a movable portion directly connected to said distributing valve, a pipe leading from said pump and having a constant degree of communication with said chamber throughout operation, a discharge orifice disposed in said pipe, a compensating valve cooperating with said orifice and connected to one end of an arm, the other end of which is pivotally fixed, and means for moving said arm so as to increase the opening through said orifice when the pump pressure increases and to permit movement of said arm so as to restrict fluid flow through said orifice when the pump pressure decreases.

20. The combination as set forth in claim 19 having a spring for moving in one direction said movable part which is connected to the distributing valve.

21. The combination as set forth in claim 19 wherein said compensating valve is moved towards its restricted position by a weight.

22. A governor system for a prime mover, comprising in combination, a servo-motor having an element for controlling the power actuating medium therefor, means for moving said element from a neutral position by fluid pressure in accordance with speed variations of said prime mover, means for supplying fluid pressure thereto, and mechanism adapted automatically upon movement of said servo-motor to restore said element to its neutral position upon movement there-

from, said restoring mechanism having provision whereby said restoring action is effected through fluid pressure, said restoring mechanism including a compensating valve mechanism, and a fluid connection between
5 said valve mechanism and the power element, said valve mechanism being moved toward its closing position when the speed of the prime mover decreases and vice versa.

CHARLES A. JACKSON.