H. H. DOLE.

GOVERNING MECHANISM.

APPLICATION FILED JULY 28, 1908.

980,616.

Patented Jan. 3, 1911.

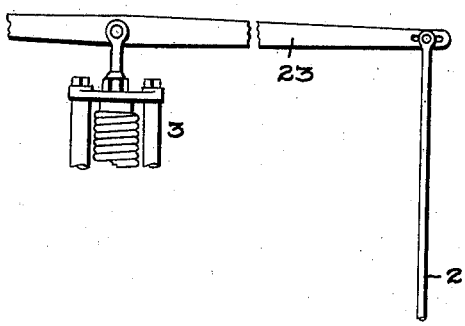


Fig. 1.

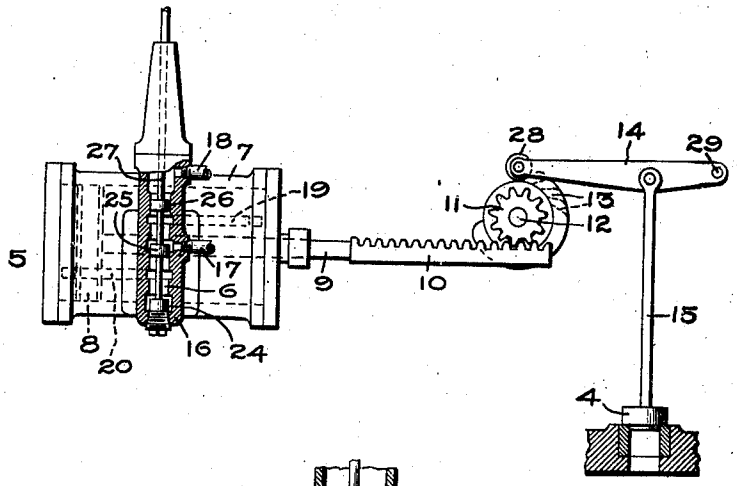
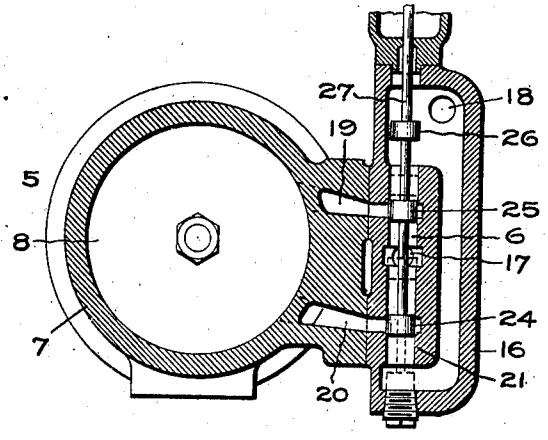


Fig. 2.



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UNITED STATES PATENT OFFICE.

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GOVERNING MECHANISM.

980,616. Specification of Letters Patent. Patented Jan. 3, 1911.

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To all whom it may concern:

Be it known that I, HENRY H. DOLE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Governing Mechanism, of which the following is a specification.

The invention relates to governing mechanism for prime movers which are actuated by a suitable motive fluid, the speed of the prime movers being controlled by said mechanism through its regulation of the quantity or pressure of the motive fluid supplied to them.

The delivery of the motive fluid to the movable member of the machine in which the energy of said fluid is to be transformed into energy of motion, such as energy of rotation or of reciprocation, is directly controlled by valves or other similar devices which either vary the period of admission of the fluid, or vary the cross-section of the stream of fluid or its pressure, or both. It is possible in some instances to effect the regulation of the action of these valves or devices by actuating them directly from a load-responsive device or governor but such control is undesirable because of the heavy load placed upon the governor. To avoid this objectionable load, governing mechanisms have been devised in which the manipulation of the controlling valves or other devices is performed by a suitable motor which is energized from the prime mover or from some other source of energy than the governor, the action of said motor being controlled by a suitable device connected to the speed-responsive device or governor. This device is moved to its various operative positions by the speed governor with but little effort because it is of small size and if a valve, may be balanced with respect to the pressure of the operating fluid controlled by it. The movement of the motor in one direction opens the admission valves of the prime mover to supply more energy thereto, and its opposite movement closes them to diminish the supply of energy.

The object of my invention is to provide means whereby when the connection between the governor and the motor controlling device is broken or disconnected, said device will be automatically moved to such a position as to actuate the motor to shut off the supply of energy to the prime mover, thus safe-guarding it against possible injury due to an excessive increase in speed when released from the control of the governor by the interruption of said connection.

In the accompanying drawing illustrating in a somewhat diagrammatic manner one of the embodiments of the invention, Figure 1 is a side view, with portions in section, of a fluid-actuated motor for opening and closing the motive fluid supply valves of a prime mover and of a portion of the governor or speed responsive device which controls said motor, the parts being in the position which they occupy when the connection between the governor and the pilot or controlling valve of the motor is interrupted; and Fig. 2 is a transverse section through the motor cylinder and its valve chest showing the position of its valve under normal conditions.

The drawing illustrates in a general way the application of my invention to a prime mover such as a steam turbine or engine having a speed-responsive device or governor 3 driven by or from its main shaft, and a puppet valve or set of valves 4 which under the control of the governor regulate the supply of steam or other motive fluid from a suitable source to the turbine rotor or other moving member of a prime mover that converts the energy of the steam into energy of motion, but obviously the invention may be applied in ways other than the particular one illustrated.

The governor 3 is not connected directly to the valves 4 to raise and lower them, because such an arrangement would impose so great a load on the governor as to interfere with close regulation of the speed. The energy for operating the valves is furnished by a hydraulic or other fluid motor 5, the application of said energy being controlled by the governor through its connection with the pilot valve 6. The motor 5 includes a cylinder 7, a piston 8 movable within the cylinder, and a piston rod 9 which projects outward through one of the cylinder heads. Any other suitable motor can be used instead of the fluid motor illustrated, if desired. The piston rod 9 is connected at its outer end to a

rack 10 which meshes with a gear 11 on a shaft 12. On this shaft 12 is a series of cams 13 which are set about the axis of the shaft so as to come into operation in successive order and to operate the valves 4 in a similar order by means of levers 14 connected to the valve stems 15. The valves 4 are located within the steam-chest of the turbine or engine and their stems 15 preferably project therefrom through suitable stuffing boxes located in the walls of the chest.

On some convenient portion of the cylinder 7 a valve-chest 16 is located. The pipes 17 and 18 convey a suitable pressure fluid to and from the cylinder through the chest. The flow of fluid from the supply or inlet pipe 17 through the ports or passages 19 and 20 to either end of the cylinder to move the piston back and forth to open and close the valves 4, is controlled or regulated by a pilot valve 6, as is also the flow of said fluid from the cylinder through said ports to the exhaust pipe 18. A valve seat 21 is arranged within the chest and the valve 6 is moved over the seat by its connection 22 to the governor lever 23. The pilot valve 6 has three cylindrical members or valves 24, 25 and 26, spaced apart on its stem 27. Under normal operating conditions only the valves 24 and 25 are active. Oil, water or other fluid under pressure is delivered by the pipe 17 to a point between the valves 24 and 25 so that its pressure on them is balanced, thus lessening the load upon the governor by making the valve easy to move. If the valve 6 is moved upward, Fig. 2, the port 20 is opened to the exhaust through the interior of the chest and fluid is admitted through the port 19 to move the piston to the left, Fig. 1. This movement of the piston if continued will so rotate the shaft 12 as to move all of the cams to their inoperative positions, thus closing the valves. When the valve 6 is moved downward, Fig. 2, the port 19 is opened to the exhaust through the interior of the chest and fluid from the pipe 17 is admitted through the port 20 to the interior of the cylinder to move the piston toward the right, Fig. 1, to rotate the shaft and cams in the opposite direction to open some or all of the valves 4, said cams engaging the rollers 28 on the levers 14 and swinging them about their pivots 29 to raise the valves 4. Any well-known follow-up device may be used if desired to prevent over-travel of the piston and valves and hunting of the governor.

Should the connection between the governor and pilot valve 6 be accidentally disconnected or broken, the valve will drop by gravity to the position shown in full lines, Fig. 1, or dotted lines in Fig. 2, with its lower end resting on the wall of the valve-chest, and if only the cylindrical members or valves 24 and 25 were provided the operating fluid would pass freely out through the exhaust pipe 18 leaving the piston in the position it occupied when the break in the connection occurred, with some if not all of the valves 4 open, a condition which might under some circumstances cause the turbine or engine to run away and do considerable damage to itself and near-by apparatus. To prevent such a catastrophe the cylindrical member or valve 26 is provided. When the valve 6 drops, this member enters the bore of the valve seat and fluid from the pipe 17 enters between it and the valve 25 and is directed through port 19 to the right side of the piston 8 to move it and the rack 10 to closed position, Fig. 1, while fluid from the other side of the piston is permitted to exhaust through the port 20. That is, the rack 10 will rotate the cams 13 until all of their active portions are out of contact with the rollers 28, leaving the levers and valves in the position shown in Fig. 1 with the steam supply shut off from the turbine or engine which will gradually slow down and stop. While the invention is illustrated as applied to a machine in which the valve 6 occupies a vertical position, obviously it could be applied to a machine in which the valve is located in a horizontal or some position other than a vertical one. If the valve were horizontal or nearly so, some means, such as a spring, would be used to perform the function effected by its own weight in the illustrated embodiment of the invention, namely, to bring the valve into the position, Fig. 1, which it occupies after its connection to the governor is interrupted. The action of gravitation might in the case of a vertical valve be supplemented by that of a suitable weight or spring, if desired, but the arrangement shown is simple and performs its function in an effective manner.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus is only illustrative, and that the invention can be carried out by other means.

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

1. In a governing mechanism, the combination of a regulating valve, a motor for opening and closing the valve, a controller for the motor that is normally suspended and has a tendency to drop under the action of gravity, a load-responsive device which is connected to and actuates the controller, and a normally inactive means causing the motor to close the regulating valve when the connection between said device and the controller is interrupted and said controller drops under the action of gravity.

2. In a governing mechanism, the combination of a regulating valve for motive fluid,

a motor for opening and closing the valve, a controlling valve for regulating the operation of the motor which is arranged for vertical movement, a load responsive device, a connection from the device to the controlling valve, and normally inactive means coöperating with said controlling valve to automatically cause the motor to close the regulating valve when said connection is interrupted and the controlling valve drops under the action of gravity.

3. In a governing mechanism, the combination of a load-responsive device, a valve for regulating the supply of motive fluid to the prime mover to be governed, a motor for operating the valve which is energized from a source of energy other than said load-responsive device, a controlling valve for regulating the operation of the motor to cause it to open and close the valve during normal operative conditions, a valve chest in which the controlling valve is mounted, a connection from the load-responsive device to the controlling valve, and a device within said valve-chest coöperating with said controlling valve, which device is automatically made operative, when said connection is interrupted, to cause the motor to close the valve.

4. In a governing mechanism, the combination of an admission valve for regulating the supply of motive fluid to the prime mover to be governed, a fluid operated motor for opening and closing the valve, a connection between the valve and the motor, a valve which regulates the operation of the motor by controlling the supply of operating fluid thereto, a stem for the valve, a load-responsive device, a connection between the device and the valve stem, and means mounted on the stem which coöperates with the controlling valve to cause the motor to close the admission valve when said last named connection is interrupted.

5. In a governing mechanism, the combination of an admission valve for regulating the supply of motive fluid to the prime mover to be governed, a fluid actuated motor for operating the valve, a connection between the valve and the motor, a valve which controls the supply of fluid to the motor, a speed-responsive device, and a connection between the speed-responsive device and the controlling valve, said valve having a portion which regulates the operation of the motor during normal operating conditions and another portion which is automatically brought into coöperation with the first portion to cause the motor to close the valve when said last named connection is interrupted.

6. In a governing mechanism, the combination of admission valves for regulating the supply of motive fluid to the prime mover to be governed, a fluid motor for operating the valves, a connection between the motor and the valves, a balanced valve which controls the supply of operating fluid to the motor, a stem for said valve, a speed-responsive device, a connection between the stem of the controlling valve and the speed-responsive device for operating the valve from said device, and means mounted on the valve stem adjacent the balanced valve which is automatically brought into coöperation with said valve to cause the motor to close the admission valves when said last named connection is interrupted.

7. In a governing mechanism, the combination of admission valves for regulating the supply of motive fluid to the prime mover to be governed, means for operating the valves including a fluid-actuated motor having a cylinder and a piston movable therein, a speed-responsive device, a valve for controlling the supply of operating fluid to the motor, a cylindrical seat for the valve, ports leading from the seat to opposite ends of the cylinder, and a connection between the speed-responsive device and the controlling valve, said valve comprising two cylindrical members that are spaced apart and receive the operating fluid between them so as to balance its pressure thereon, said members being moved over the ports by the speed-responsive device to regulate the admission and exhaust of said fluid to and from the cylinder, and a third cylindrical member adjacent the other two which is normally inoperative but is automatically brought into operation to coöperate with the other two members to cause operating fluid to be admitted to and exhausted from the cylinders in such a manner as to operate the motor to cause it to close the admission valves when said connection is interrupted.

8. In a governing mechanism for elastic fluid turbines and other prime movers, the combination of admission valves controlling the supply of motive fluid to the turbine or other prime mover, means for operating the valves including a fluid-actuated motor having a cylinder and a piston movable therein, a speed-responsive device, a valve for controlling the flow of operating fluid to and from the cylinder, a cylindrical seat for the valve, ports leading from the seat to the opposite ends of the cylinder, a connection between the speed-responsive device and the controlling valve, said valve comprising a vertical stem, two cylindrical members spaced apart on the stem adjacent its lower end and receiving operating fluid between them so as to balance its pressure thereon, said members being moved over the ports by the speed-responsive device to regulate the admission and exhaust of said fluid to and from the cylinder, and a third cylindrical member on the stem above the other two members which is normally inoperative

but is automatically brought into coöperation with said members to cause the operating fluid to be admitted to and exhausted from the cylinder in such a manner as to operate the motor to cause it to close the admission valves when said connection is interrupted and the valve drops due to gravity, and an abutment adjacent the seat against which the valve strikes when it drops, said abutment limiting its downward movement.

In witness whereof, I have hereunto set my hand this twenty-fifth day of July, 1908.

HENRY H. DOLE.

Witnesses:

W. E. KENNEDY,

W. B. STEEVES.