No. 820,913. PATENTED MAY 15, 1906.

J. G. CALLAN.

GOVERNING MECHANISM FOR FLUID ACTUATED MOTORS.

APPLICATION FILED FEB. 23, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

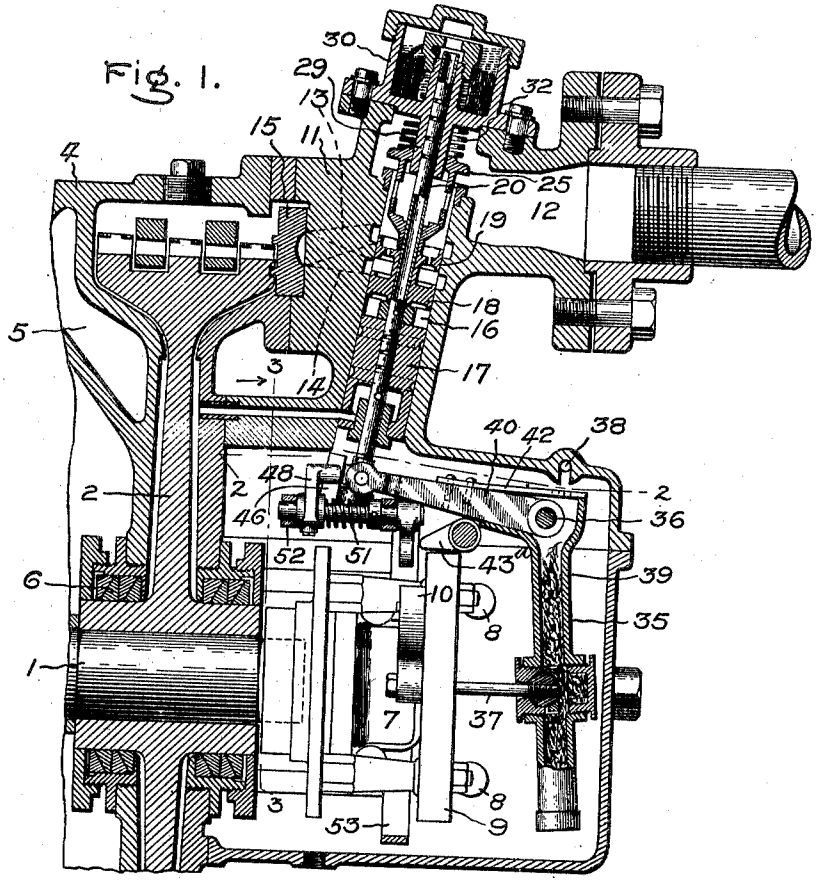
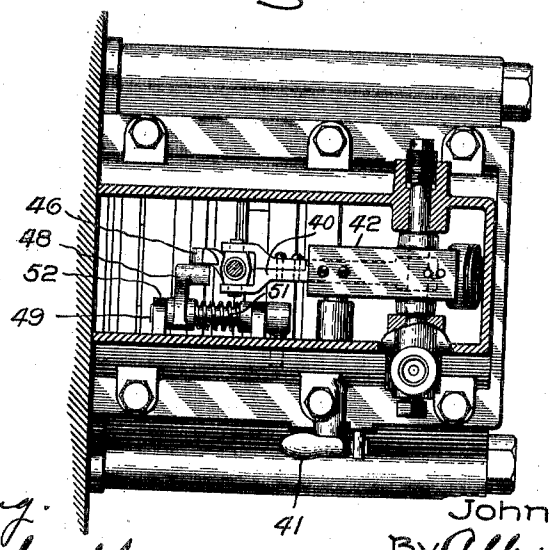


Fig. 2.



Witnesses:
Marcus L. Byng.
Alex. F. Macdonald.

Inventor,
John G. Callan,
By Albert G. Davis
Att'y.

No. 820,913. PATENTED MAY 15, 1906.

J. G. CALLAN.

GOVERNING MECHANISM FOR FLUID ACTUATED MOTORS.

APPLICATION FILED FEB. 23, 1905.

2 SHEETS—SHEET 2.

Fig. 3

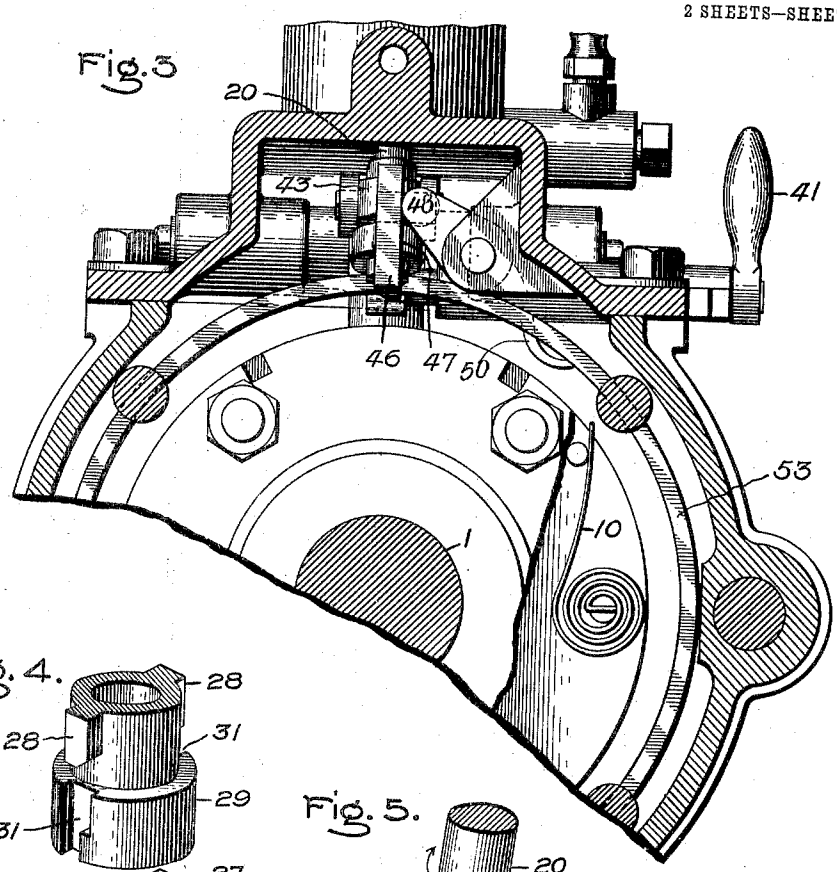


Fig. 4.

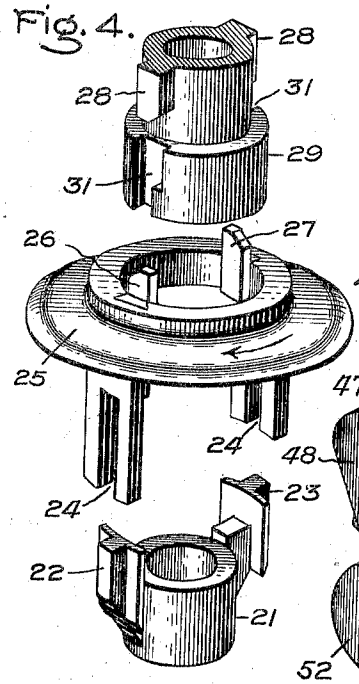


Fig. 5.

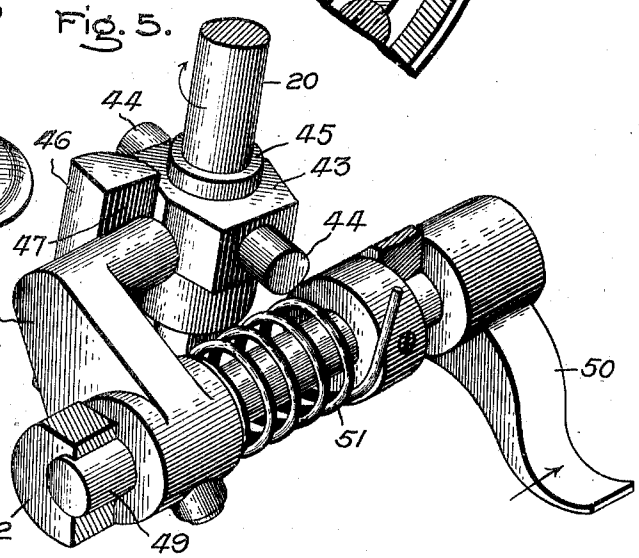
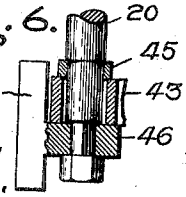


Fig. 6.



Witnesses:

Marcus L. Byng.

Alex. F. Macdonald.

Inventor,
John G. Callan,
By Albert G. Davis
Att'y.

UNITED STATES PATENT OFFICE.

JOHN G. CALLAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR FLUID-ACTUATED MOTORS.

No. 820,913. Specification of Letters Patent. Patented May 15, 1906.

Application filed February 23, 1905. Serial No. 246,860.

To all whom it may concern:

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Governing Mechanism for Fluid-Actuated Motors, of which the following is a specification.

The present invention relates to valve mechanism for elastic-fluid motors, and has for its object to provide an improved valve mechanism for controlling the admission of motive fluid thereto in accordance with the demand for vapor energy and for shutting down the motor in case of emergency—such, for example, as would be the case when the shaft exceeds a certain number of revolutions per minute.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is an axial section of an elastic-fluid turbine. Fig. 2 is a sectional view taken on line 2 2 of Fig. 1 and looking downward in the direction of the arrow. Fig. 3 is a cross-section taken on line 3 3 of Fig. 1 and looking in the direction of the arrow. Fig. 4 is a perspective view of the emergency-valve and part of its actuating mechanism. Fig. 5 is a perspective view, on an enlarged scale, of the trigger and coöperating parts arranged to cause the emergency-valve to shut on a predetermined increase in speed; and Fig. 6 is a detail view of a part of the apparatus which is shown in Fig. 5.

1 represents the main shaft of the turbine, on which is mounted a bucket-wheel 2, having one or more rows of buckets for abstracting energy from the motive fluid. These buckets may be mounted on the sides or on the periphery of the wheel, as desired. In the present instance three rows of peripheral buckets are shown; but a greater or less number can be employed, if desired. Between the rows of wheel-buckets are other buckets, which may be stationary or rotary in character. In the present instance the buckets are stationary and are carried by the wheel-casing 4. The casing may be of any suitable construction and is provided with an exhaust-opening 5.

In order to prevent the escape of motive fluid from the casing at points adjacent to the wheel, suitable packings 6 are employed, which may engage with the hub of the wheel, as shown, or with the shaft or other part driven thereby. On the end of the wheel-shaft is mounted a governor or speed-responsive device 7, comprising pairs of weights 8 and a suitable opposing spring. The weights are supported in a suitable framework 9, which also carries one or more flat springs 10, that actuate the emergency-valve when the speed of the shaft exceeds a predetermined amount. These springs may be and preferably are of the clock-spring type, as shown in Fig. 3. As the speed increases abnormally the springs wind up and the free ends engage the trigger that causes the valve to close. Bolted to the side of the casing is a valve-chest 11, which is provided with an inlet-passage 12, communicating with a source of fluid-pressure and the passages 13 and 14, (shown in dotted lines,) the latter communicating with the fluid-discharge device 15. The said device is provided with one or more passages or sections which discharge steam or other motive fluid against the wheel-buckets.

The passages 13 and 14 in the present arrangement supply motive fluid to four nozzle-sections, each passage supplying two sections. Different arrangements may, however, be provided without departing from the invention. Formed in the valve-casing is a cylinder 16, which is closed at the lower end by a plug 17 and contains the piston-valves 18 and 19. The former controls the admission of steam to the passage 14 and the latter to the passage 13. The valves and passages are so arranged that the passage 13 may be entirely cut off while the passage 14 is in service. I may use one, two, or more valves for regulating the admission of motive fluid to the rotating element or bucket-wheel. Extending through the plug 17 and the valves 18 and 19 is a tubular stem 20. Mounted upon this stem above the upper controlling-valve is a sleeve 21. (Best shown in Fig. 4.) This sleeve is secured to the tubular stem 20 by a pin or other suitable means and is provided with two projections 22 and 23, which are adapted to register with slots 24, formed in extensions on the under side of the emergency or shut-off valve 25. The projections 22 and 23, moving in the slots 24, in effect constitute a telescoping joint or lost-motion connection, so

that the emergency or shut-off valve can move up and down with respect to the sleeve, and, conversely, the shut-off valve may be locked in its open position while the controlling-valve moves toward and away from it in opening and closing its ports. The projections also serve to rotate the shut-off valve in either direction about its axis as the tubular stem 20 is moved. In this connection it should be noted that the tubular stem 20 has a reciprocating motion and also an oscillatory motion, as will hereinafter appear.

The emergency or shut-off valve is provided with two cam projections 26 and 27, the upper ends of which are beveled to engage with projections 28, formed on the hub-like extension 29 of the head 30, the latter containing a chamber for lubricant. The hub projection is also provided with slots 31, somewhat after the fashion of a bayonet-joint. The walls of one or both of the slots form stops for limiting the angular or twisting motion of the valve in both directions. When the valve 25 is moved upward with respect to the projection 29, the beveled ends of the projections 26 and 27, engaging with suitable beveled surfaces on the stationary projections 28, give it a slight twisting movement to the right. When the valve is permitted to drop slightly, the lower ends of the projections 26 and 27 engage with shoulders formed in the part 29. This tendency of the valve to rotate to a given position is assisted by the coiled compression-spring 32, of which spring the primary function is that of closing the valve 25 whenever it is released, as will be described hereinafter. It will be seen that the projections 26 27 on the valve and the shoulders on the stationary projection 29 of the head form a lock for holding the valve open and that the locking and unlocking is accomplished through the valve-stem 20.

The upper end of the tubular valve-stem 20 extends into a head 30, which, for convenience, also forms an oil or grease carrying chamber; but this latter feature can be omitted, if desired. The head is secured in place by a number of bolts, and between the body of each bolt and the surrounding metal is a certain amount of space, so that the head can be rotated for the purpose of adjusting the position of the trigger that releases the emergency or stop valve, as will appear hereinafter. The chamber of the head is partially filled with asbestos or waste which is saturated with a lubricant. Any leakage of steam into the chamber tends to float the oil into the open end of the valve-stem 20 and convey it downward to a point where it will lubricate the portion of the stem passing through the plug 17. The plug is chambered at the lower end and the chamber is connected to the interior of the wheel-casing to carry off the water and lubricant.

In order to reciprocate the controlling-valves 18 and 19, a connection in the form of a bell-crank lever 35 is provided, having a fulcrum 36. The lever is connected to the speed-responsive device 7 by a rod 37, having a ball on its outer end that is seated in a suitable adjustable bearing in the lever. The lever is made hollow and is filled with some fibrous material which acts as a wick to supply lubricant to the spherical bearing. Situated directly above the opening in the lever is an oil-hole 38, by means of which the fibrous material in the lever can be saturated with oil. The oil in the upper portion of the wick will lubricate the spherical bearing by gravity, while the lower portion of the fibrous material will act as a wick to raise the oil sufficiently in case the supply is low to lubricate the bearing. In this way the supply of lubricant will last for a considerable time. The only channel of egress for lubricant fed from time to time into lever 35 is through the space surrounding the rod 37. As the oil gradually finds its way out of this opening it will be picked up by the currents of air due to the fan-like action of certain of the parts of the governor and will be thrown outward in fine spray, thus lubricating the parts of the governor.

The casing surrounding the governor and bell-crank lever is provided with a drainage-opening on the under side, which may be valved or not, as desired. The rod 37 may be rotated with the shaft-governor or not, as desired. I may employ one or more suitable bearings or slip-joints between the rod, governor, and bell-crank lever 35. The bell-crank lever is composed of two principal parts 39 and 40, the former extending substantially vertical and the latter substantially horizontal. The fulcrum 46 is common to the two parts. To the part 40 of the lever is secured a flat spring 42, which engages a suitable surface on the portion 39 of the bell-crank lever and normally holds the two parts together, as shown. The object of this arrangement is to permit the emergency or stop valve to be reset by means of the resetting device 43 (the latter being provided with a handle 41, located outside the casing) irrespective of the position of the portion 39 of the bell-crank lever and of the rod 37 and parts of the speed-governor. Without such an arrangement the rod 37 might be buckled in setting the emergency-valve, and thus destroy its usefulness. In other cases the tension of the spring would be too great to be overcome by the resetting device. As the speed of the turbine varies the lower end of the bell-crank lever is moved back and forth according to the conditions, and the motion is transmitted through the bell-crank lever

to the valve-stem 20, the latter moving the valves 18 and 19 back and forth over the supply-passages to the nozzles, and thus varying the supply of motive fluid to the buckets.

The operation of the emergency mechanism will now be described. As has already been said, the steam-valve has a reciprocating motion for controlling purposes and in addition to that an oscillatory motion for operating the emergency or shut-off valve. In Fig. 5 is shown a perspective of the mechanism employed for oscillating the valve-stem. 20 represents the lower end of the valve-stem, which passes loosely through a block 43, the latter being provided with trunnions 44, that enter openings in and are supported by the forked end of the horizontal portion 40 of the bell-crank lever. This block is held between a shoulder or collar 45 and a T-shaped piece 46, the latter having a square opening through which the end of the stem passes, and the whole is secured in place by a screw-thread and nut. It will thus be seen that the block 43 and T-shaped piece 46 move up and down with the valve-stem in response to speed changes occurring in normal governing. The front face 47 of the vertical portion of the T-shaped piece 46 is made flat, and engaging therewith is a projection or pin carried by the arm 48, the latter being mounted upon the spindle 49. On the opposite end of the spindle is a trigger 50, that is adapted to be actuated by the clock spring or springs 10, Fig. 3, mounted on the frame of the shaft-governor. The trigger 50 is normally held by the spring 51 in the path followed by the emergency or clock-spring governor when it is extended by centrifugal force at excessive speed. The spindle 49 is carried by suitable bearings 52, as is clearly shown in Fig. 2. The trigger 50 extends through an opening formed in the stationary ring or damping device 53, the latter surrounding the shaft-governor and being located in the path of the extended clock-springs 10, Fig. 3. The object of this ring is to prevent the springs from vibrating, striking the retracted trigger, and possibly breaking after the emergency or stop valve has been tripped by the trigger. Assuming that the trigger 50 is moved in the direction of the arrow, Fig. 5, the pin on the arm 48 will engage the face 47 of the T-shaped piece 46 and oscillate the valve-stem 20 in the direction of the arrow, and since the sleeve 21, Fig. 4, is rigidly secured to the stem it will rotate the emergency or stop valve 25 also in the direction of the arrow, and this in turn will cause the projections 26 and 27 to slip off the shoulders formed in the slots 31 in the stationary piece 29, and the compression-spring 32 will force the valve downward and close it, this closure being assisted by the steam-pressure in the conduit 12. Owing to the fact that the face 47 of the T-shaped piece 46 is flat and extends parallel to the valve-stem 20, it makes no difference what position the valve-stem occupies when the trigger is struck by the clock-spring the shut-off valve will close. This I consider to be an important feature of the invention. When it is desired to reset the emergency-valve, the arm 43a, Fig. 1, is rotated in a clockwise direction, which raises the outer end of the part 40 of the bell-crank lever against the tension of the spring 42 until the projections 26 and 27 on the valve are thrown into position to engage with the shoulders on the part 29, after which the set device is moved to the position shown. In resetting the shut-off valve the steam to the supply-passage 12 should be cut off. It has been stated that the position of the trigger can be adjusted from the outside of the valve-casing by adjusting the head 30. This is done in the following manner: The retaining-bolts are first loosened and then the head is rotated slightly in one direction or the other, as the case may be This motion is transmitted to the valve-stem through the parts 29, 25, and 21 of Fig. 4 and rotating the valve-stem in one direction or the other will move the flat face 47 of the T-shaped piece 46 at the end of the valve-stem toward or away from the axis of the trigger-carrying spindle 48. Obviously as the face 47 is moved toward or away from the spindle the angular position of the arm 48, and therefore of the trigger 50, will be changed. In other words, the end of the trigger is nearer or farther away from the axis of the main shaft and the critical speed of which the emergency-governor operates is changed. The adjustment shown is a limited one, because only a very slight adjustment is necessary; but it can be increased, if desired, as will be readily understood. The primary object, however, of moving the trigger as described is to so place it that it will almost retreat within the limiting and protecting orbit 53 when the emergency-valve is tripped. The action of the emergency-governor is, as a rule, very nearly isochronous. It will be seen that the governor is mounted in a chamber which is cut off from the steam-space and that the casing inclosing it can be removed or replaced when the turbine is in operation. By inclosing the governor and other parts as described they are protected from injury, as well as from dust and dirt, and are yet readily accessible for examination or adjustment. I may use my invention in connection with various forms of elastic-fluid motors, since it is not limited to the particular type shown. In event of its being used with a turbine it applies to reaction as well as jet or impact machines or to machines embodying the features of both.

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 shown 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 controlling-valve, a shut-off valve, a single actuator for actuating the controlling-valve and tripping the shut-off valve, and a means for moving the actuator.

2. In a governing mechanism, the combination of a controlling-valve, a shut-off valve, a governor, and a lever actuated by the governor which moves the controlling-valve under normal conditions, and the shut-off valve under abnormal conditions.

3. A fluid-actuated motor in combination with a regulating-valve, a shut-off valve, an actuator common to the valves, a speed-responsive device acting through the actuator to move the regulating-valve to govern the motor, and a second speed-responsive device acting independently of the first for actuating the shut-off valve through the actuator.

4. A fluid-actuated motor, in combination with a regulating-valve, a shut-off valve, an actuator common to the valves, a speed-responsive device for reciprocating the actuator and the regulating-valve to govern the admission of fluid to the motor, and a second speed-responsive device acting under emergency conditions to rock the actuator and close the shut-off valve.

5. In a governing mechanism, the combination of a valve for controlling the admission of motive fluid to the bucket-wheel, a shut-off valve, an actuator common to the valves, a load-responsive device, and a means actuated by the load-responsive device for reciprocating the actuator to control the supply of motive fluid, and for imparting rotary movement to the actuator for closing the shutting-off valve.

6. In a governing mechanism, the combination of a reciprocating valve for controlling the admission of motive fluid to the bucket-wheel, a shut-off valve, a valve-stem through which the piston and shut-off valves are actuated, and a speed-responsive device which reciprocates the stem for governing the supply of motive fluid and rotates it for actuating the cut-off valve.

7. In a governing mechanism, the combination of a controlling-valve, a shut-off valve, a speed-responsive device for actuating the controlling-valve, an actuator which is common to the valves, and an emergency-governor actuated by the shaft for turning the shut-off valve about its axis by means of the actuator when it is desired to operate it.

8. A fluid-actuated motor in combination with a regulating-valve, a shut-off valve, an actuator common to both valves, a lock for holding the shut-off valve open, a telescope-joint between the shut-off valve and the actuator, and means for moving the actuator.

9. In a governing mechanism, the combination of a shut-off valve, a means for holding the valve open, a controlling-valve, a stem which moves both the controlling and the shut-off valves, means including a lost-motion for fastening the shut-off valve to the stem, and a speed-responsive device for moving a controlling-valve without disturbing the shut-off valve, and a second speed-responsive device for moving the shut-off valve without changing the position of the controlling-valve.

10. In combination, a fluid-actuated motor, a speed-responsive device, a valve controlling the admission of fluid to the motor, a support for the valve, a projection or lock between the valve and support arranged to hold the valve in a predetermined position, and a connection between the speed-responsive device and the valve for disengaging the valve and projection or lock.

11. In combination, a fluid-actuated motor, a speed-responsive device driven thereby, a valve controlling the admission of fluid to the motor, a support for the valve, a lock for holding the valve in a given position, a cam for setting the valve, and a stop for limiting the movement of the valve.

12. In a governing mechanism, the combination of a shut-off valve, a lock for holding the valve in an open position, and a means responsive to abnormal increases in speed for rotating the valve in a direction to unlock it and permit the same to close.

13. In a governing mechanism, the combination of a controlling-valve, a shut-off valve, a single stem for reciprocating the controlling-valve and releasing the shut-off valve, a lock for the shut-off valve which is controlled by the stem, and a spring for seating the shut-off valve.

14. In a governing mechanism, the combination of a controlling-valve, a shut-off valve, a lock which normally holds the shut-off valve open, a means for closing the valve, and a lever actuated by the governor for moving the controlling-valve and releasing the shut-off valve.

15. In combination, a fluid-actuated motor, a speed-responsive device driven thereby, a valve controlling the admission of fluid to the motor, a hollow lever transmitting motion from the speed-responsive device to the valve, a casing inclosing the speed-responsive device and lever, and a means for supplying lubricant to the interior of the lever for lubricating the parts.

16. In a governing mechanism, the combination of a valve, a speed-responsive device, a connection between the valve and said device, and a means for lubricating the joint between the connection and the device

which also supplies the lubricant for the parts of the device.

17. In a governing mechanism, the combination of a valve and its casing, a tubular stem therefor having suitable guides, a lubricant-containing chamber which communicates with the interior of the stem and discharges lubricant into it, as the water due to condensation rises in the chamber, and a speed-responsive device for moving the stem and the valve.

18. In a governing mechanism, the combination of a valve and its casing, a tubular stem therefor having suitable guides, a lubricant-containing chamber which communicates with the interior of the stem and discharges lubricant into it and to the guides, as the water due to expansion and condensation rises in the chamber, a passage discharging lubricant and water from the valve-stem into the wheel-casing, and a speed-responsive device for moving said stem and valve.

19. In a governing mechanism, the combination of a controlling-valve, a shut-off valve, a stem that is common to both valves, a speed-responsive device, a connection between the speed-responsive device and the valve-stem composed of two principal parts which are movable with respect to each other, a means for actuating the shut-off valve, and a device for resetting the shut-off valve which acts through the said connection.

20. In a governing mechanism, the combination of a shut-off valve, a speed-responsive device, a stem for moving the valve, a two-part lever connected to the valve and the speed-responsive device, an emergency governor for causing the valve to close, and a device acting upon one portion of the lever for resetting the valve.

21. In a governing mechanism, the combination of a controlling-valve, a stem for actuating it, a governor, a two-part bell-crank lever for operating the valve, one part being connected to the valve and the other to the governor, and a chamber in one part of the lever which carries lubricant for the governor.

22. In a governing mechanism, the combination of a shut-off valve, a governor, a trigger actuated by the governor for closing the valve, a casing which incloses the trigger and governor, and a means located external to the casing for adjusting the position of the trigger with respect to the governor.

23. In a governing mechanism, the combination of a shut-off valve, a governor, a trigger moved by the governor for actuating the valve, a casing which incloses the trigger, a stem for transmitting motion from the trigger to the valve, and a means located external to the casing for imparting an oscillatory motion to the stem for adjusting the position of the trigger with respect to the governor.

24. In a governing mechanism, the combination of a valve, a speed-responsive device for moving the valve, a casing which incloses the valve, and means exterior of the casing for changing the critical speed at which the valve is actuated.

25. In combination, a fluid-actuated motor, a speed-responsive device driven by the motor, a valve controlling the admission of fluid to the motor, a stem for the valve, a lever attached to the speed-responsive device which is provided with a forked end, and a trunnion-block located in the fork, which is attached to the valve-stem.

26. In a governing mechanism, the combination of a shut-off valve, a governor, a stem for actuating the valve, a lever which connects the stem with the governor, a block pivotally mounted in the lever through which the valve-stem extends, a means attached to the valve-stem for oscillating it, a trigger acting on said means to oscillate the valve-stem, and a means sensitive to speed variations for moving the trigger when the speed exceeds a predetermined amount.

27. In combination, a fluid-actuated motor, a speed-responsive device driven thereby, a valve controlling the admission of fluid to the motor, a support for the valve, a lock for holding the valve in a given position, a cam for setting the valve, a stop for limiting the movement of the valve, and a spring for seating the valve when the lock is released.

28. In combination, a fluid-actuated motor, a valve-chest mounted thereon, a valve mounted therein, a speed-responsive device driven by the motor, means transmitting motion from the speed-responsive device to the valve, and a support for the means which is carried by the valve-chest.

29. In combination, a fluid-actuated motor, a speed-responsive device driven by the motor, a valve actuated by the speed-responsive device for controlling the motor, a perforated stem for the valve, a head through which the stem passes, and an opening communicating with the perforation in the stem and the motor-casing so that leakage around the stem is conveyed into the motor-casing.

30. In a governing mechanism, the combination of a movable element, a valve for regulating the action of the motive fluid upon the element, a second valve for shutting off the fluid to said element, an actuator which is reciprocated to move the regulating-valve and oscillated to move the shut-off valve, and a load-responsive device for moving the actuator.

31. A fluid-actuated motor, in combination with a regulating-valve, a shut-off valve, an actuator common to the valves, and means responsive to load changes acting through the actuator to move the regulating-valve and also the shut-off valve.

32. A fluid-actuated motor, in combination with a regulating-valve, a shut-off valve, a stem common to both valves, and a load-

responsive means for reciprocating the stem to move one valve and for oscillating it to move the other valve.

33. A fluid-actuated motor having independent admission-ports, in combination with valves arranged to move back and forth over the ports and cut them into and out of service successively, an emergency-valve, a stem common to the valves, and speed-responsive means acting through the stem on the valves.

In witness whereof I have hereunto set my hand this 17th day of February, 1905.

JOHN G. CALLAN.

Witnesses:

JOHN A. McMANUS, Jr.,

DUGALD McK. McKILLOP.