

No. 794,857.

PATENTED JULY 18, 1905.

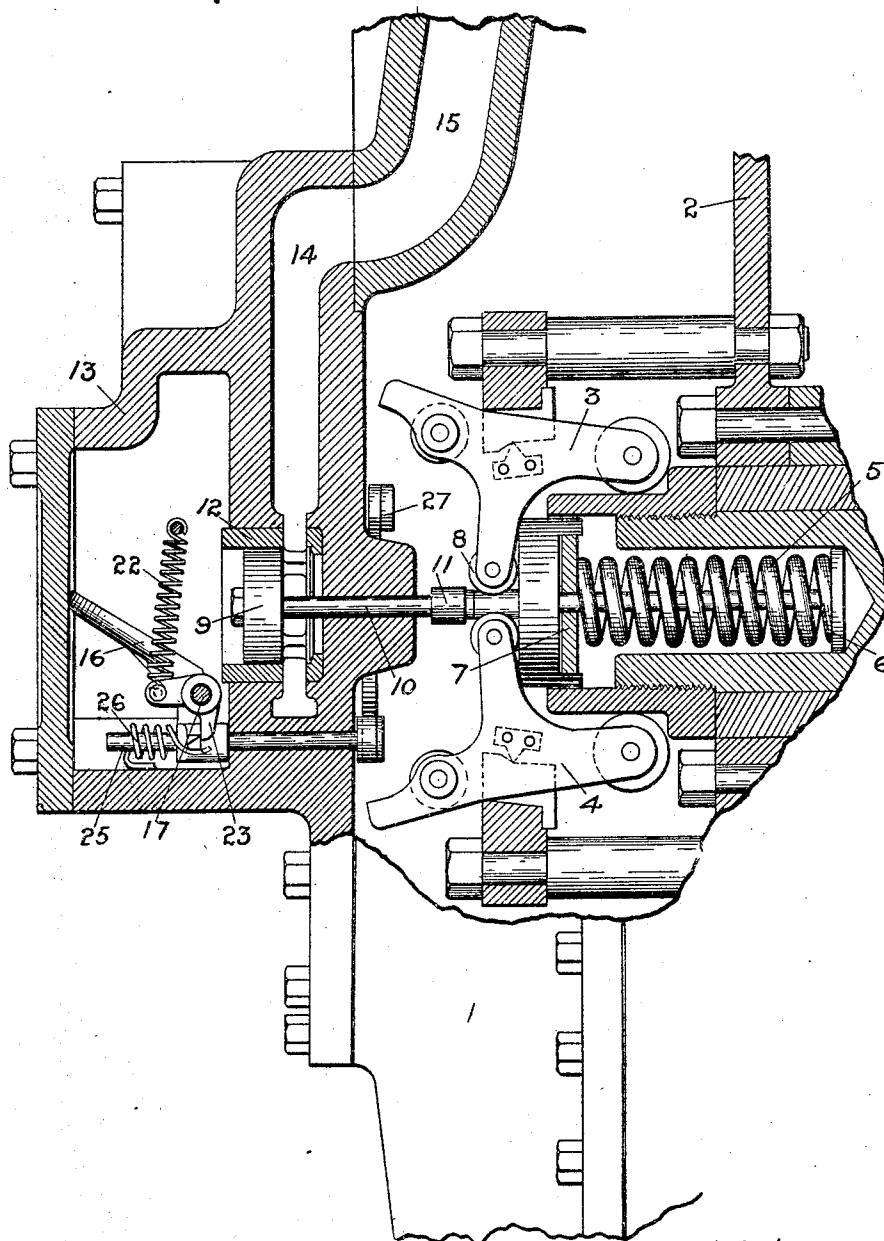
D. C. GARROWAY & A. T. GRAY.

EMERGENCY GOVERNOR FOR ELASTIC FLUID TURBINES.

APPLICATION FILED DEC. 31, 1903.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Robert C. Chapman
Benjamin B. Sull

INVENTORS:

David C. Garroway,
Alexander T. Gray,
by *Albert S. Davis*
Atty.

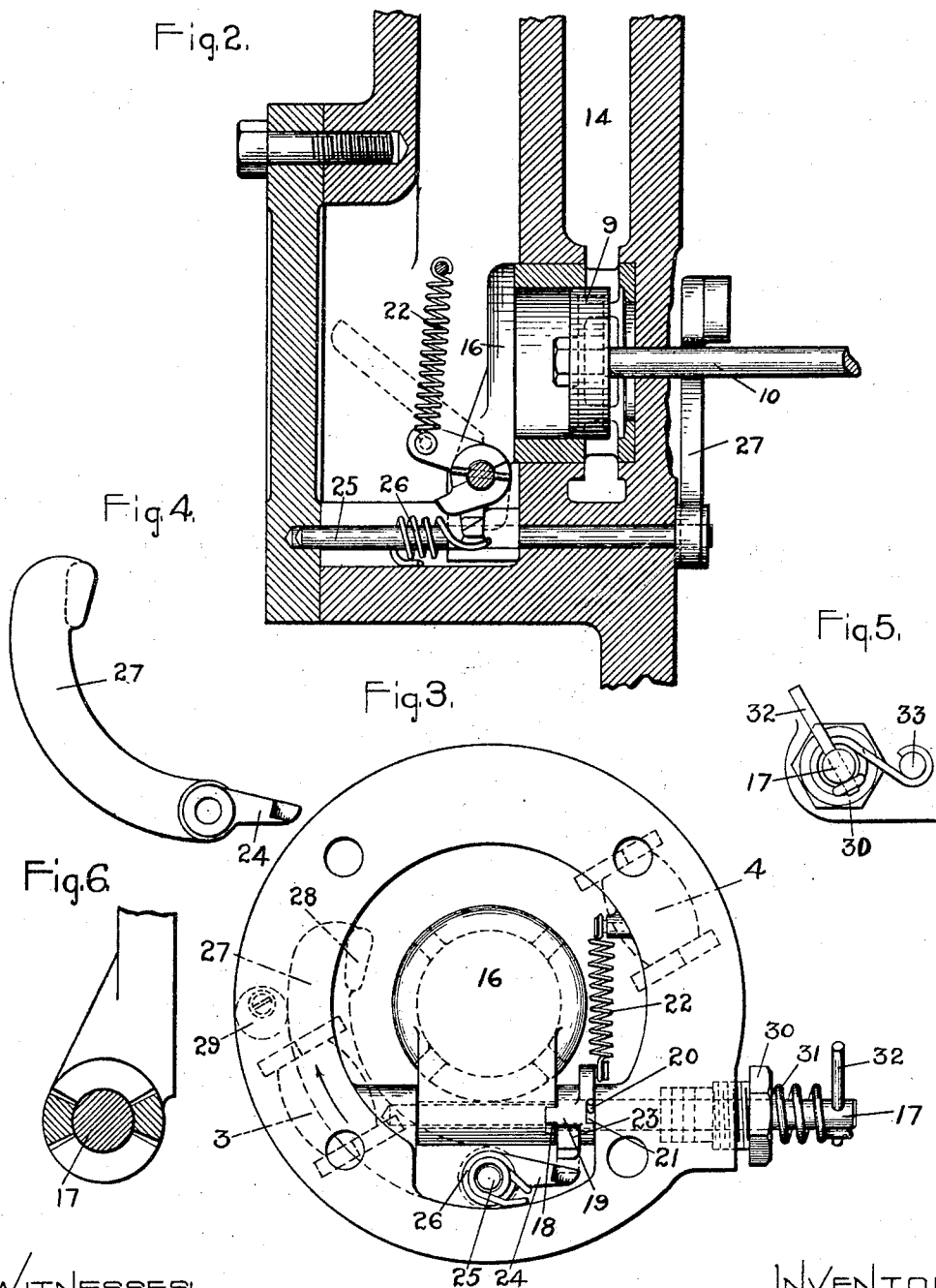
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WITNESSES:

Robert C. Chapman
Benjamin B. Hill

INVENTORS:

David C. Garroway,
Alexander T. Gray,
by *Albert D. Davis* Att'y.

UNITED STATES PATENT OFFICE.

DAVID C. GARROWAY AND ALEXANDER T. GRAY, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

EMERGENCY-GOVERNOR FOR ELASTIC-FLUID TURBINES.

SPECIFICATION forming part of Letters Patent No. 794,857, dated July 18, 1905.

Application filed December 31, 1903. Serial No. 187,286.

To all whom it may concern:

Be it known that we, DAVID C. GARROWAY and ALEXANDER T. GRAY, subjects of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Emergency Governing Mechanism for Elastic-Fluid Turbines, of which the following is a specification.

In order to prevent elastic-fluid turbines from running away or attaining an abnormally high speed due to any cause, it is desirable to provide emergency-valves which are controlled by a governor and at the proper time come into service and either reduce the supply of motive fluid or cut it off altogether.

The present invention relates to emergency governing mechanism, more especially adapted to turbines, and has for its object to provide an apparatus which is simple in construction and is efficient and reliable in operation.

It is also the object of the invention to provide an emergency-valve which can only be tripped from a point or points within the turbine-casing and, further, that when once tripped can only be reset by shutting off the supply of motive fluid.

In carrying out the invention a speed-responsive device is driven by the shaft and may be mounted directly thereon or be driven therefrom by a belt or equivalent device. For convenience and simplicity the admission-valve may be situated in line with the wheel-axis in order to dispense with the use of levers, &c., and the speed-responsive device is connected thereto or is arranged to act thereon. Between the admission-valve and the source of supply is located the emergency-valve, which is so arranged that under normal conditions it offers no opposition to the steam-flow. The valve is entirely inclosed and has the capacity for self adjustment within certain limits to compensate for inaccuracies in alinement and workmanship. A latch normally holds the valve against a means, such as a spring or weight, which continually urges the valve in a direction to cut off the supply of fluid to the wheel or wheels. Attached to

or moving with the latch or arranged to trip the latch is a tripping-lever which is located in the path of the weights or other part of the speed-responsive device and is moved thereby under abnormal conditions as to speed. A spring may be arranged to move the latch and tripping-lever back to the normal position as soon as the valve is released. In order to reduce the number of parts and also decrease the space required by the parts, the same speed-responsive device may be employed to trip the emergency-valve and also to move the governor-valve. The invention is not, however, to be construed as being limited in this respect.

A resetting device is employed that extends to the outside of the casing and has an operating-handle affixed thereto. Between the resetting device and the valve is sufficient lost motion to enable the latter to close independently of the former, and between said device and an anchor is a spring which tends at all times to return it to an off position and out of the way of the valve. By reason of this arrangement whatever friction exists between the resetting device and the stationary parts has no effect on the valve. Since the actuator extends to the outside of the casing, it may also serve as a means to indicate the position of the valve.

In the accompanying drawings, which illustrate one embodiment of our invention, Figure 1 is a partial vertical section of an elastic-fluid turbine of the jet type. Fig. 2 is a partial sectional view showing the emergency-valve in the closed position. Fig. 3 is a front elevation of the valve and the parts closely associated therewith. Fig. 4 is a view in elevation of the emergency-valve tripping-lever. Fig. 5 is a detail view showing the spring used for returning the resetting device to its normal position; and Fig. 6 is a detail view in section, showing the lost motion between the emergency-valve and its closing device.

1 represents the casing for the turbine, which incloses the wheel or wheels 2 and also the speed-responsive device. The latter may be of any suitable construction. In the present instance it comprises weight-arms 3 and 4

and an opposing spring 5, which is seated at one end on a disk 6, located within the wheel-shaft, and on the other end on a movable abutment 7, that engages the rollers 8 of the weight-arms. Situated in line with the axis of the wheel-shaft is a governing-valve 9, that is moved back and forth by the stem 10, which is connected to the movable abutment of the speed-responsive device by the slip-joint 11. The valve is mounted in a detachable sleeve 12, which sleeve also forms a seat for the emergency-valve, to be hereinafter described. The governing-valve and sleeve are carried by a valve-casing 13, which is bolted to the turbine-casing 1. In the valve-casing is a passage 14, that communicates with a corresponding passage 15 in the turbine-casing and which leads to the nozzle or other device for discharging fluid against the bucket wheel or wheels 2.

Mounted within the valve-chamber is an emergency-valve 16, which is loosely pivoted at its lower end to a spindle 17, extending at right angles to the axis of the shaft. The object in loosely mounting the valve on the spindle is to insure the seating of the former on the sleeve 12. Without such an arrangement there would be difficulty in insuring a good seat, owing to slight inaccuracies in alinement and workmanship. As shown in the drawings, the valve is pivotally supported at its lower end. This arrangement is advantageous, in that the entrance of steam to the governing-valve is unobstructed. The invention, however, is not limited to this arrangement, since the valve can be supported at other points.

Referring to Fig. 3, it will be seen that the projection on the valve, which encircles the spindle, is provided with a slot 18, which receives a corresponding projection on the collar 19, which forms a part of the actuating and resetting device. This arrangement of the parts permits the valve to have a slight movement independent of its spindle.

The actuating and resetting device comprises a spindle 17, carrying a fixed pin 20, that is located in a slot 21 in the collar 19. The pin and slot are so arranged that the valve can be set in the position shown in Fig. 1 and the resetting device afterward moved to the position shown in Fig. 3 without interfering with the valve. By reason of this construction the friction between the resetting device and the stationary parts can be disregarded. Attached to the collar 19 in such a manner that it tends at all times to close the emergency-valve is an extension-spring 22, the outer end of which is attached to a fixed abutment. Depending from the collar is a dog 23, that engages with a latch 24, which is carried by a spindle 25, extending parallel with the axis of the wheel-shaft. In Fig. 3 the latch is shown depressed for the purpose of illustration. Surrounding one end of the shaft is

a coil-spring 26, which tends at all times to hold the latch 24 in the raised position. Inside of the wheel-casing and rigidly mounted on the spindle 25 is a tripping-lever 27, which is so positioned that when the speed of the wheel becomes abnormally great either or both of the weight-arms 3 or 4 while rotating with the shaft will engage therewith and cause it to rock the spindle 25 in a direction to release the dog 23, which permits the emergency-valve to close under the action of the spring 22. Once the valve is closed it is held against its seat by the full pressure of the steam, and the only way it can be opened is to cut off the supply of steam to the valve-chamber.

Referring to Fig. 3, 28 (shown in dotted lines) represents the face of the tripping-lever to be engaged by the governor weight-arms 3 and 4. In this figure the governor is supposed to be traveling in the direction of the arrow. In order to limit the outward movement of the tripping-lever, due to the action of the coil-spring 26, an adjustable stop 29 is provided. Changing the position of this stop will change the predetermined speed at which the emergency-valve will close.

In Fig. 4 is shown in elevation the tripping-lever 27 and the latch 24. These two parts are rigidly connected together. It is to be noted that the end 28 of the latch is beveled or cut away to permit the dog 19 to depress it when rotated by the resetting device.

In Fig. 5 is shown a means for changing the tension of the spring, which moves the resetting device to its off position. 17 represents the spindle, 30 the nut on the packing-gland, which gland prevents the escape of steam or other elastic fluid around the spindle, and 31 a coiled spring that surrounds the spindle. One end of the spring is attached to the operating-handle 32 or its spindle and the other end to a fixed abutment 33. This spring has a tendency at all times to move the resetting device to its initial position and out of engagement with the emergency-valve. If desired, this spring may be omitted, in which case the position of the handle 32 would serve as an indicator to show the position of the valve. When the spring is employed, the handle normally occupies its initial position; but by swinging it to the left it is always possible to ascertain whether or not the emergency-valve is open or closed, and in this sense it forms an indicator even when the spring is employed.

The action of our invention is as follows: Assuming that the speed of the wheel increases abnormally until one or both of the weight-arms or part carried thereby strike the tripping-lever 27, this causes a movement of the lever inward toward the center and a corresponding rotation of the spindle 25, which depresses the latch 24 and releases the dog 23 on the collar 19. The spring 22

then causes the valve to be seated on the sleeve 12, and the steam-pressure in the valve-chamber will hold it against its seat, and owing to the fact that the valve is loosely mounted on its spindle 17 a good seat for the valve is insured.

In Fig. 2 the emergency-valve is shown in closed position and the governor-valve 9 in a more or less open position. When the parts are operating under their proper conditions, the governing-valve 9 would be seated by the speed-responsive device at or about the time that the emergency-valve closes. Assuming now that the emergency-valve is closed and it is desired to reseal it, the supply of steam to the valve-chamber is cut off to relieve the pressure thereon. The handle 32 is then rotated to the left, which causes the pin 20 to engage with one of the walls of the slot 21 in the collar 19. As the collar is rotated the curved end of the dog 23 depresses and passes over the latch 24. As soon as the valve assumes the position shown in Fig. 1 the latch returns to the position shown and holds the valve in place. On relieving the pressure on the handle 32 the spring 31 returns it to the position shown in Fig. 3, which means that the actuating-pin 20 has been moved to the opposite end of the slot 21, so that it cannot interfere with the closing of the valve. This arrangement of parts is important because it reduces to a minimum the liability of the valve sticking at the time that it should close, and, furthermore, it relieves the spring 22 of all load except that due to the valve itself.

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

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

1. An elastic-fluid motor comprising a casing, a movable element mounted therein, a speed-responsive device, a valve for regulating the action of the fluid on the movable element, an emergency-valve which is tripped by the speed-responsive device, a casing therefor, and a resetting device for the emergency-valve which extends through the valve-casing.

2. An elastic-fluid motor comprising a casing, a movable element mounted therein, a valve for regulating the action of the fluid on the moving element, an emergency-valve for shutting down the motor, a speed-responsive device, which moves the regulating-valve and trips the emergency-valve, a casing common to the controlling and emergency valves, and a resetting device for the emergency-valve which extends through the valve-casing.

3. An elastic-fluid motor comprising a casing and a moving element located therein, a valve controlling the action of the fluid on the element, a loosely-mounted emergency-valve located within its casing, a resetting device for the emergency-valve which extends through the valve-casing, and a lost-motion connection between the valve and said device.

4. In an elastic-fluid turbine, the combination of a pivoted valve loosely mounted on a spindle to compensate for inaccuracies, and a resetting device which is connected thereto through a lost-motion connection.

5. In an elastic-fluid turbine, the combination of a valve-chamber, an emergency-valve located therein, a wheel-casing, a speed-responsive device for tripping the valve, and a means external to the chamber for resetting the valve.

6. In an elastic-fluid turbine, the combination of a valve-chamber, a casing, a valve in said casing, an actuator which extends from the valve-chamber to the casing, and a speed-responsive device which is wholly inclosed by the casing for moving the actuator.

7. In an elastic-fluid turbine, the combination of an emergency-valve, a tripping-lever for the valve, a speed-responsive device acting on the lever, a handle for resetting the valve, and a locking device in the valve-chamber for holding the valve open.

8. In an elastic-fluid turbine, the combination of a valve-chamber, a wheel-chamber which is connected thereto by a conduit, a valve which closes said conduit, a latch in the valve-chamber for holding the valve open, and a resetting device also located in the valve-chamber and controlled from the outside thereof.

9. In an elastic-fluid turbine, the combination of a valve-chamber, a wheel-chamber which is connected thereto by a conduit, a valve loosely mounted on a spindle in the chamber, a latch for holding the valve open, a resetting device which has a certain freedom of motion independent of the valve.

10. In an elastic-fluid turbine, the combination of a governing-valve located in line with the axis of the wheel, a valve located in line with the governing-valve, a means tending to close the valve, a latch opposing this tendency, and a resetting device for the valve.

11. In an elastic-fluid turbine, the combination of a governing-valve, an emergency-valve, a sleeve containing seats for both of the valves, and a speed-responsive device which successively operates the valves.

12. In an elastic-fluid turbine, the combination of a governing-valve, an emergency-valve, a speed-responsive device which acts directly on the governing-valve and indirectly on the emergency-valve, a latch which holds the emergency-valve open, a releasing device for the emergency-valve including a lever which

is acted upon by the speed-responsive device, and a resetting device that is connected to the valve through a lost-motion connection.

13. In an elastic-fluid turbine, the combination of a wheel, a governing-valve in line with the wheel-axis, a speed-responsive device situated between the wheel and valve for moving the latter, an emergency-valve arranged to cut off the supply of fluid to the governing-valve, and a means under the control of the speed-responsive device for causing the valve to close.

14. In an elastic-fluid turbine, the combination of a wheel, a governing-valve, a speed-responsive device, an emergency-valve, a spindle which carries a latch and extends parallel with the wheel-shaft, a means acted upon by the speed-responsive device for actuating the latch, and a spindle for supporting the emergency-valve which extends at right angles to the axis of the wheel.

15. In an elastic-fluid turbine, the combination of an emergency-valve, a spindle on which the valve is loosely mounted, a latch for holding the valve in a given position, and a resetting device which is connected to the latch through a lost-motion connection.

16. In an elastic-fluid turbine, the combination of a bucket-wheel, a casing therefor, a chamber discharging fluid to the wheel, an admission-valve regulating the action of the bucket-wheel, a valve in the chamber for shutting off the supply of fluid to the wheel, a speed-responsive device located in the wheel-casing, and an actuator for the shut-off valve that extends through the wall of the valve-casing into the wheel-casing and is adapted to be engaged by the speed-responsive device.

17. In an elastic-fluid turbine, the combination of a valve-chamber, a wheel-casing, governing and emergency valves for controlling the passage of fluid from the chamber to the casing, and means extending through the wall of the valve-chamber into the casing for actuating the valves.

18. In an elastic-fluid turbine, the combination of a valve-chamber, a valve located therein, a means for closing the valve, a latch with-

in the chamber for holding the valve in one of its positions, and a means extending through the wall of the chamber for resetting the valve and the latch.

19. In an elastic-fluid turbine, the combination of a valve-chamber, a valve located therein, a means for closing the valve, a latch within the chamber for holding the valve in one of its positions, and a means extending through the wall of the chamber for simultaneously resetting the valve and the latch.

20. In an elastic-fluid turbine, the combination of a valve-chamber, a valve located therein, a means for actuating and resetting the valve which is loosely connected thereto, and an actuator which is loosely connected to said means.

21. An elastic-fluid turbine comprising a bucket-wheel and casing, in combination with a valve-chamber, an emergency-valve located therein, an actuator for closing the valve, and a latch for holding it open, the latch and valve being located in the chamber.

22. In an elastic-fluid turbine, the combination of a bucket-wheel, an emergency-valve controlling the passage of fluid thereto, a spindle upon which the valve is loosely mounted, a handle for imparting rotary movement to the spindle, and a connecting means intermediate the valve and spindle, arranged to transmit motion from the spindle to the valve but not from the latter to the former.

23. In an elastic-fluid turbine, the combination of a bucket-wheel, a casing therefor, a shut-off valve mounted in the casing which is tripped from a point within the casing and is unbalanced when closed, so that the supply of fluid has to be cut off before it can be opened, and a means for resetting the valve when the pressure thereon is relieved.

In witness whereof we have hereunto set our hands this 29th day of December, 1903.

DAVID C. GARROWAY.
ALEXANDER T. GRAY.

Witnesses:

BENJAMIN B. HULL,
MARGARET E. WOOLLEY.