F. HODGKINSON.

AUTOMATIC STOP FOR ELASTIC FLUID TURBINES.

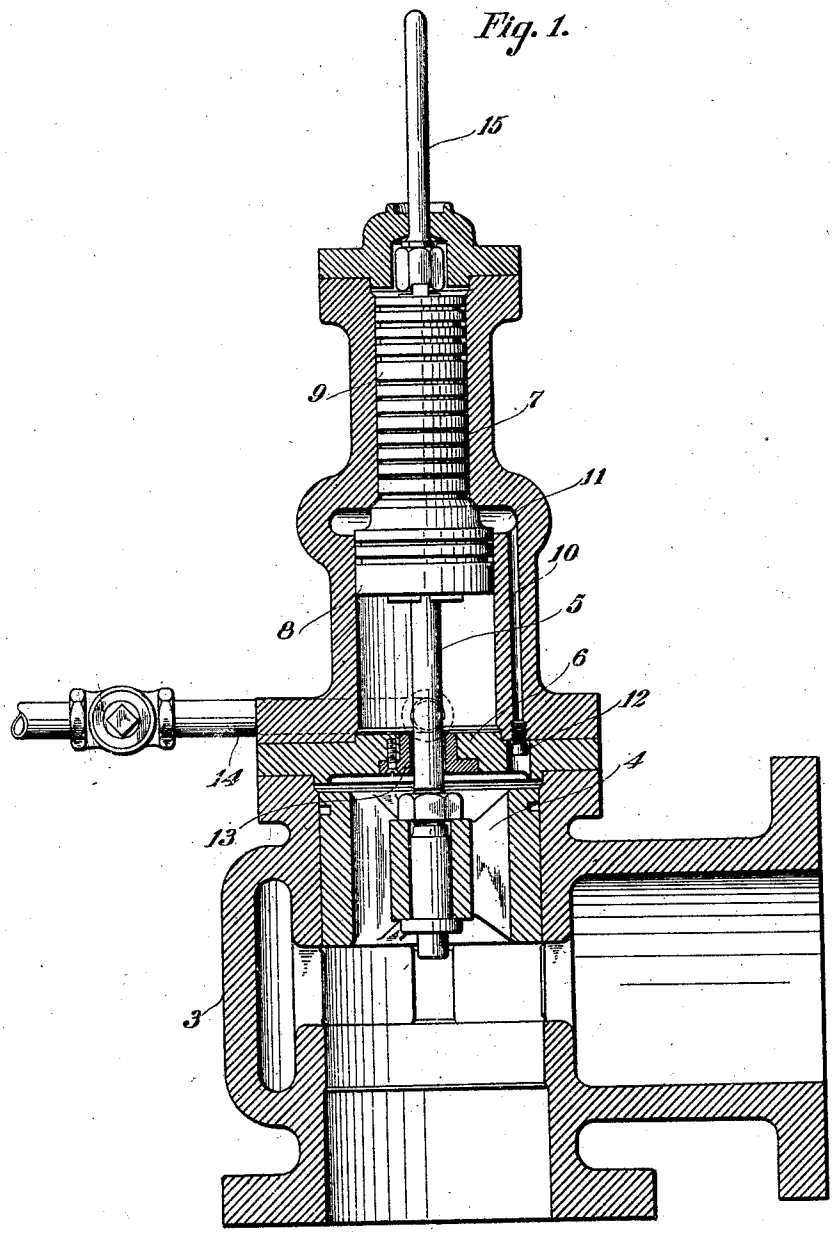
APPLICATION FILED NOV. 17, 1904.

940,689.

Patented Nov. 23, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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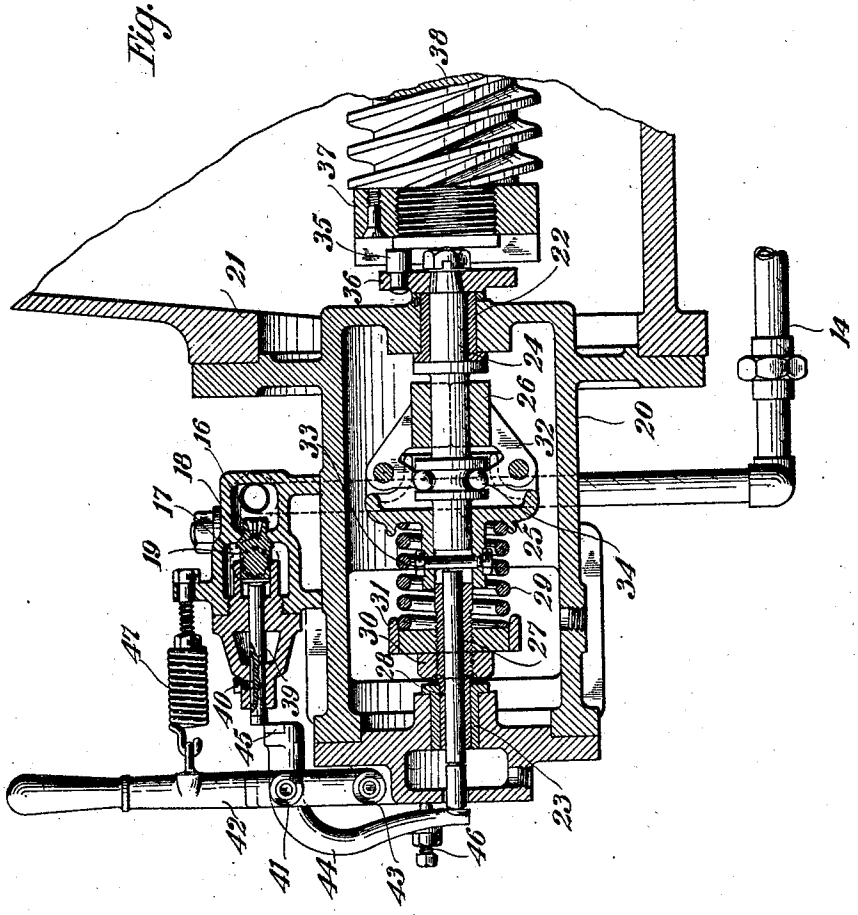
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANCIS HODGKINSON, OF EDGEWOOD PARK, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

AUTOMATIC STOP FOR ELASTIC-FLUID TURBINES.

940,689. Specification of Letters Patent. Patented Nov. 23, 1909.

Application filed November 17, 1904. Serial No. 233,081.

To all whom it may concern:

Be it known that I, FRANCIS HODGKINSON, a subject of the King of Great Britain and Ireland, residing at Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Automatic Stops for Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to elastic fluid turbines and more particularly to means whereby the working fluid supply thereto is automatically cut off when for any reason the turbine speed exceeds a certain predetermined limit. It is to be understood, however, that when certain combinations of the elements entering into the make-up of the apparatus as illustrated and described and hereinafter particularly claimed without reference to turbines, those combinations so claimed are to be deemed dominating whereever for other uses they may be found applicable.

Among the many objects of this invention which will readily appear to those skilled in the arts to which it appertains, one has been, to produce comparatively simple and efficient means for accomplishing the automatic cut-off of the working fluid supply to elastic fluid turbines when a predetermined speed is exceeded.

As this class of turbine is largely used for driving electrical apparatus, and, as excessive speed of a turbine, when driving such apparatus, is liable to be due to a cause, the effect of which would be similar to the blowing of a fuse or the opening of a switch or circuit breaker, a further object of this invention has been to produce an automatic device as above outlined which will assure that the fluid supply after being automatically cut off, remains so until manually cut in, when the cause of the excessive speed, may, before damage is done be determined and if possible remedied or removed.

To such ends, a practical embodiment of this invention is described in the specification and illustrated in the presented drawings throughout both views of which similar elements are denoted by like characters.

In the drawings Figure 1 is a sectional elevation of the fluid cut-off valve utilized with this invention and its operating motor, and Fig. 2 is a sectional elevation of the device controlling the operation of the fluid cut-off valve.

Situated at any suitable position along the fluid supply line to the turbine, is a valve casing 3 within which a piston valve 4 of any suitable type reciprocates. The stem 5 of the valve, projects through and beyond the end 6 of the valve casing and into a valve-motor cylinder 7 secured to the end of the valve casing. The valve-motor cylinder is bored to two diameters as shown in the drawings and the valve stem 5 carries two pistons 8 and 9 located in the different sized bores. Each of these pistons is preferably water-grooved to preserve a tight fit within its cylinder and a valved by-pass 10 through the top 6 of the valve casing and the wall of cylinder 7 leads from the interior of the valve casing 3 to a point 11 at all times above piston 8. A bushing 13 within end 6 of the valve casing surrounds valve stem 5 with a loose fit, whereby fluid is allowed to gradually leak through the bushing around the valve stem. The valve-motor cylinder, below piston 8, connects with the atmosphere through a pipe 14 controlled by means hereinafter described, and piston 9 is provided with an extension 15 which forms a tell-tale or visible indicator, and which extends out through an opening therefor in the end of the valve-motor casing. Assuming that pipe 14 is closed to the atmosphere and that the interior of valve casing 3 is subject to fluid under pressure, it will be seen that the pressure accumulated below piston 8 will hold the valve 4 open as shown in Fig. 1 against the pressure above piston 8 on account of the difference in effective areas on the opposite sides of piston 8; piston 9 occupying a larger or greater area than valve stem 5. It will be seen however that when pipe 14 is open to the atmosphere high pressure fluid will pass through by-pass 10 and the pressure on top of piston 8 will move said piston downward and close valve 4, as the area of by-pass 10 is greater than the leakage area around piston-rod 5 within bushing 13. It will be seen that the position of valve 4 is at all times visibly indicated by tell-tale 15.

The controlling device for exhaust pipe 14 will now be described. Pipe 14 in Fig. 2 which is a continuation of pipe 14 in Fig. 1 communicates with a chamber 16 which in turn communicates with a chamber 17

through a passage way 18 controlled by a valve 19. Chamber 17 is in direct communication at all times with the atmosphere and the position of valve 19 determines or controls the operation of the supply cut-off valve 4. In order that valve 19 opens passage 18 and places exhaust pipe 14 in communication with the atmosphere to close valve 4 when the speed of the turbine to which the device is attached exceeds a certain predetermined limit, the device is preferably connected to the turbine shaft. The valve controlling device, which is self-contained, so to speak, is carried within a housing 20, which is bolted or otherwise secured to one end of the turbine casing 21; or 21 may represent one end of a bearing housing for the turbine shaft.

Rotatably journaled within bushings 22 and 23 formed in opposite ends of housing 20 is a centrifugal spring resisted device or agent, comprising a revoluble shaft 24, a member 25 revoluble with said shaft 24 but movable longitudinally thereof by means of fly-balls or weights 26; a pin 27 adapted to be moved by member 25; a revoluble bushing 28 surrounding pin 27 and a spring 29 resisting the centrifugal action of weights 26 and which is adjustable as to its resistance by means of a nut 30 lying against a containing collar 31. Arms 32 which carry the weights 26 are pivotally mounted on member 25, which member is formed in halves and bolted together as at 33. Each arm 32 is formed in the nature of a bell crank lever and the short arm of the lever is ball ended as at 34 and lies within an annular groove or space between shoulders formed for that purpose on shaft 24. From this it will be seen that when the force due to the outward movement under centrifugal action of weights 26 is sufficient to overcome the resistance of spring 29, the member 25 will be forced longitudinally of shaft 24, and bolt 33 which lies within the path of pin 27, will move against said pin 27 and force it outwardly or longitudinally within its surrounding bushing. This centrifugal device which is contained within housing 20 is, as before stated, preferably driven from the turbine shaft and this is done by means of a flexible connection now described. A pin 35 carried on a disk 36 keyed or otherwise secured to shaft 24 lies within a slot formed within a collar 37, which is screwed or otherwise fastened onto the end of the turbine shaft 38. This pin 35 lies loosely within the slot formed in the end of collar 37 and it will be seen that by means of this, a driving connection is easily established between the turbine shaft and the centrifugal device without the necessity of fine alinement of the turbine shaft and shaft 24. It will be seen that one size of the centrifugal device may be utilized for many different sizes of turbines, and that this construction forms an efficient yet extremely cheap type of coupling. Valve 19 is provided with a stem 39 which is prevented from turning by means of a screw 40 which lies within a channel formed in the stem.

Pivotally mounted at 41 within a bifurcated supporting arm or lever 42, which in turn is pivoted at 43 to the end of housing 20 is a tripping lever 44, one end of which always lies in the path of pin 27, while the other end, when the device is in operative position, lies in the path of valve stem 39. The end 45 which lies in the path of valve stem 39 is provided with a hardened sharp edged block, and an adjustment screw 46 is provided whereby a nice adjustment between the end of valve stem 39 and this hardened block at the end 45 of the tripping lever, is accomplished.

A spring 47 is attached to the bifurcated lever 42 and operates to hold one end of the tripping lever 44 in contact with the pin 27 and the other end in contact with the lower end of the valve stem 39 and thereby holds the valve 19 to its seat and closes communication between the pipe 14 and the atmosphere. As the speed of the turbine increases, the weights 26, which are fulcrumed on the shaft 24, move outwardly and force the member 25 longitudinally of the shaft in opposition to the pressure of the spring 29. When the turbine reaches a predetermined and excessive speed, the weights 26 force the member 25 to such a position that the lost motion between the bolt 33 and the pin 27 is taken up and the pin 27 is moved longitudinally to actuate the tripping lever 44. The pin 27 by turning the tripping lever 44 about its fulcrum 41 moves the end 45 off the valve stem 39 and permits the valve 19 to open under the influence of the fluid pressure within the pipe 14 and to thereby place the pipe 14 into direct communication with the atmosphere. The spring 47, which is attached to the lever 42 on which the tripping lever 44 is fulcrumed, permits the lever 42 to yield under the force transmitted by the pin 27 and consequently permits the lever 44 to be tripped; that is, moved from under the stem 39 with less effort. As soon as the pipe 14 is in communication with the atmosphere the valve 4 is immediately closed and the fluid supply to the turbine is cut off.

It will be seen that valve 4 will remain closed and the fluid supply cut off from the turbine until tripping lever 44 is again manually placed in position by means of lever 42.

I claim—

1. In a device of the class described, the combination with a chamber having an inlet port and an outlet port, a cut-off valve, a pressure pipe in communication with the chamber through the inlet port and in communication with the casing of the cut-off

valve to normally hold the cut-off valve unseated, a valve normally seated to close the outlet port in the chamber, a latch bearing against said valve to hold it seated against pressure in the pipe, an adjusting means for said latch, a speed-responsive device and means actuated by the speed-responsive device for tripping said latch to permit the pressure in the pipe to unseat the valve for the chamber and thereby relieve the pressure in the pipe to permit the cut-off valve to close.

2. In a device of the class described, a fluid supply line for motors, an emergency valve in the line, a fluid actuated emergency valve motor operatively connected to said emergency valve and normally holding said valve open, a speed-responsive device driven by the motor, and means whereby the motor may be driven at a speed less than a determined maximum without effecting a movement of the emergency valve, said last named means being actuated by the speed-responsive device to effect a quick closing movement of the emergency valve when the speed-responsive device indicates a speed of the motor above a maximum.

3. In combination, a fluid supply line for a motor, an emergency valve in the line, a pressure device for normally holding the emergency valve open, a speed-responsive device driven by the motor, and means actuated by the speed-responsive device for relieving pressure on the emergency valve to effect a closing movement thereof when the motor exceeds a determined maximum speed.

4. In combination, a fluid motor, a fluid supply line therefor, an emergency valve in the line, a fluid actuated valve motor operatively connected to said valve, a speed-responsive device driven by the fluid motor, an auxiliary valve controlling the delivery of motive fluid from said valve motor, adjustable means for seating the auxiliary valve to maintain through the agency of said valve motor said emergency valve open, and means actuated by said speed-responsive device for tripping said adjustable means to relieve pressure in the valve motor and thereby cause said emergency valve to be closed.

5. In combination, a pressure chamber adapted to communicate with a valve casing of an emergency valve, a port in said chamber adapted to communicate with the atmosphere, a valve for said port, means for normally keeping said valve seated to close the port in the chamber, a speed-responsive device, and means actuated by the speed-responsive device for moving the valve-closing means out of contact with said valve and thereby permitting the pressure in the chamber to unseat the valve to allow the pressure in said chamber to escape to the atmosphere so as to relieve the pressure on the emergency valve and cause said emergency valve to close.

6. In a mechanism for controlling motive fluid to a motor, a valve casing through which the motive fluid must pass from the source of supply to the motor, a cut-off valve in said valve casing, a fluid actuated means for said valve and having opposing pressures on opposite sides, a valve casing having a normally closed chamber adapted to open to the atmosphere, a pressure pipe communicating with the closed chamber and with a chamber on one side of the fluid actuated means, a valve normally closing the chamber to maintain pressure in the pipe, seating means opposing the pressure in the pipe to normally keep the last named valve seated, and a speed-responsive device which at a predetermined speed will relieve the seating pressure on the last named valve whereby the pressure in the pipe will unseat the last named valve and exhaust the pressure in the pipe so as to cause the fluid actuated means to seat the cut-off valve.

7. In combination, a chamber having an inlet port and an outlet port, a pipe communicating with said chamber through its inlet port and having communication with a pressure supply, means in the pipe to communicate with a cut-off valve to hold the cut-off valve unseated while there is pressure in the pipe, a valve for the outlet port of said chamber, a yieldingly supported means for normally holding said last mentioned valve seated, a speed-responsive device, and means actuated by the speed-responsive device for causing the valve seating means to move out of operative engagement with the valve and thereby permit the pressure to escape from the pipe and the chamber and to allow the cut-off valve to become seated.

In testimony whereof I have hereunto subscribed my name this 15th day of November, 1904.

FRANCIS HODGKINSON.

Witnesses:
JNO. S. GREEN,
DAVID WILLIAMS.