J. H. DORAN.

ELASTIC FLUID TURBINE.

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1,326,651.

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Fig. 1.

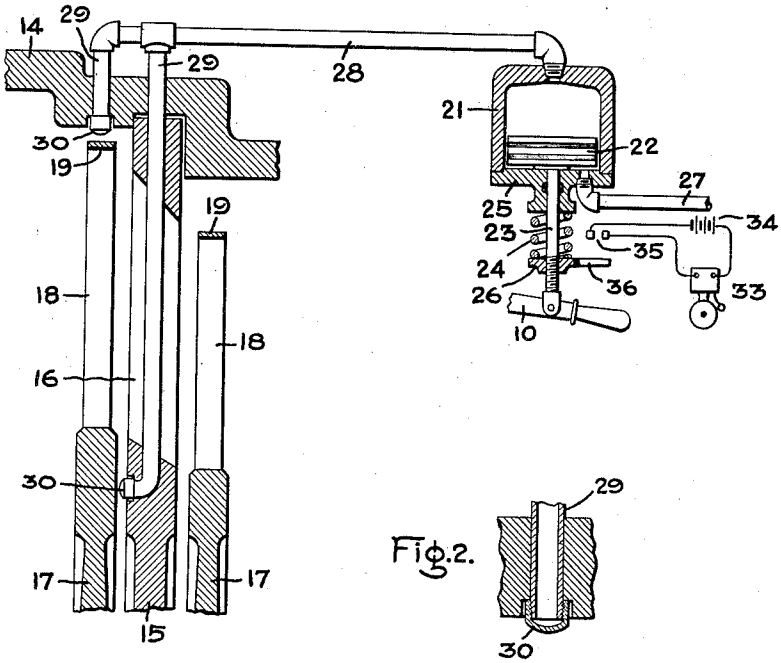
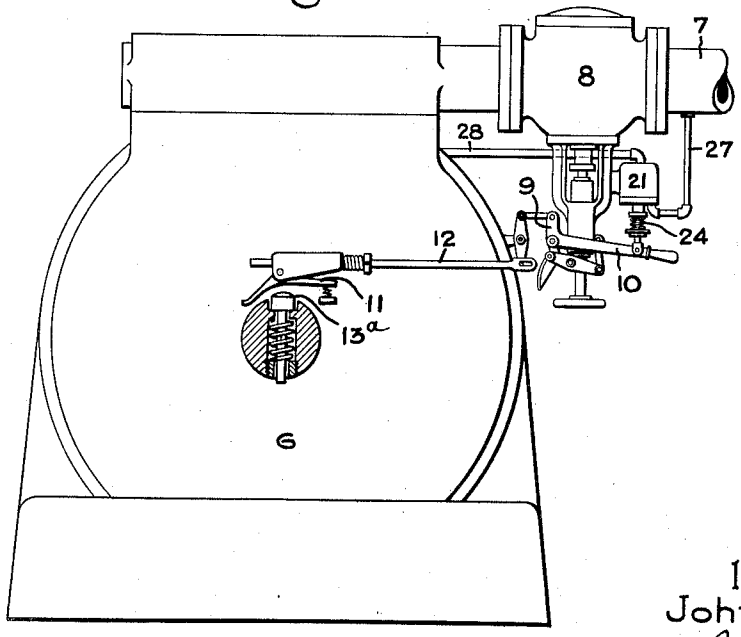


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

1,326,651. Specification of Letters Patent. Patented Dec. 30, 1919.

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To all whom it may concern:

Be it known that I, JOHN H. DORAN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to elastic fluid turbines and has for its object to provide an improved arrangement in a turbine whereby whenever relatively moving parts approach so closely to each other as to be likely to rub and cause damage, an alarm will be given or the machine will be automatically shut down, or both.

Elastic fluid turbines are built to run with close clearance and rubbing may result, for example, from unequal expansion due to temperature changes, from buckling or deflection of certain parts, from a wheel loosening on the shaft, or from a bucket cover coming loose. By my invention I aim to guard against damage to the machine whenever from any cause clearances are impaired to such an extent as to be likely to cause damage.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying specification and claims appended thereto.

In the drawing, Figure 1 is a diagrammatic view illustrating my invention; Fig. 2 is a sectional view of the end of a pressure pipe; and Fig. 3 is an outline of an elastic fluid turbine illustrating an arrangement for tripping a valve mechanism for shutting down the machine.

Referring to the drawing, which illustrates an embodiment of my invention, 6 indicates an elastic fluid turbine to which motive fluid is admitted by conduit 7 in which is located a suitable emergency valve mechanism 8. Emergency valve mechanism 8 is shown as being of a known type adapted to be tripped by a movement of the lever arm 9 toward the left which may be done manually by hand lever 10, or automatically whenever trip finger 11 releases the spring pressed rod 12. Trip finger 11 is released whenever the speed of the turbine becomes such as to cause a spring pressed emergency governor plunger 13^a to fly out and strike trip finger 11, this being a well known arrangement. It will be understood of course that the arrangement of valve 8 and the parts associated therewith illustrated is shown by way of example and that any suitable arrangement may be used.

In the present instance a turbine of the type comprising a casing divided into stages by diaphragms with bucket wheels in the stages is shown, and in Fig. 1, 14 indicates a portion of a turbine casing, 15 indicates a diaphragm having nozzle partitions 16, and 17 indicates bucket wheels. The bucket wheels carry rings of buckets 18 on the outer ends of which are fastened the bucket covers 19. Fig. 1 shows only a fragment of a turbine and it will be understood that a complete machine, as shown in Fig. 3, may comprise any number of stages each containing one or more bucket wheels.

Now in accordance with my invention, I provide in connection with the valve mechanism 8 a pressure responsive device which when actuated trips valve mechanism 8 to effect the closing down of the turbine, and such pressure responsive device is placed under the control of devices which project into clearance spaces of the turbine in such manner that if a clearance space is impaired beyond a predetermined amount the device will be operated upon to cause the pressure responsive device to trip the emergency valve mechanism.

In the present instance the pressure responsive device is shown in the form of a cylinder 21 in which is loosely mounted a piston 22. The piston 22 is connected by rod 23 to hand lever 10 of valve mechanism 8. A spring 24 surrounds rod 22 between the head 25 of the piston and a collar 26 connected to the rod. This spring tends to hold the piston in the position shown in Fig. 1, in which position the valve mechanism is caught open. Connected to the lower end of cylinder 21 is a pressure pipe 27 which may lead from any suitable source of pressure. In the present instance it is shown as connected with the elastic fluid supply conduit 7. Connected to the upper end of the cylinder 21 is a pipe 28 which is provided with branches 29, which terminate inside the turbine casing. The ends of branch pipes 29 are closed by caps 30, and such ends with the caps thereon project into clearance spaces between relatively moving parts of the turbine. Caps 30 may be made of any suitable material which will wear away

readily and they may be fastened into place by screw threads, as shown, or by other suitable means. It will be understood that as many of these branch pipes 29 may be used as is found desirable, and that their ends may terminate in such clearance as is deemed necessary. In Fig. 1, one pipe 29 is shown as associated with diaphragm 15 with its end terminating in the clearance space between such diaphragm and wheel 17. Another pipe 29 is shown as terminating in the clearance space between the bucket cover 19 of a wheel 17 and the inner surface of the turbine casing.

In operation, pressure is supplied to the cylinder 21, pipe 28, and branch pipes 29 by pipe 27. Owing to the loose fit of piston 22 in cylinder 21 the pressure readily leaks by it so that the pressures on opposite sides of the piston are the same. The spring 24 therefore holds piston 22 in the position shown in Fig. 1. The pressure in pipe 28 and branch pipes 29 will be the same as that in cylinder 21 and pipe 27. If now, due to any cause, a clearance space is impaired beyond the permissible amount, the result will be that a rotating part of the turbine will engage a cap 30 and wear the same away. This will quickly relieve the pressure on the upper side of the piston 22 with the result that the pressure on the lower side will move the piston against the action of spring 24 thereby tripping the valve mechanism 8, which will immediately close and shut down the turbine. In this connection it will be understood that the clearance between piston 22 and cylinder 21 is such that leakage past the cylinder is comparatively slow so that when one of the caps 30 is worn away the pressure above the piston 22 will be relieved more quickly than it can be built up by leakage past piston 22.

As will be readily understood the arrangement may be such that a signal will be actuated either in addition to or instead of shutting down the machine, and in Fig. 1 I have shown diagrammatically an electrically operated signal 33 connected in circuit with a battery 34, stationary contacts 35, and a contact 36 which is carried by but insulated from collar 26. When piston 22 moves upward it brings contact 36 into engagement with contacts 35 to cause the actuation of signal 33.

In the specific arrangement illustrated, pipes 27, 28 and 29 are connected with the high pressure steam supply and the pipes will become filled with water due to condensation of steam and will be under high pressure. When rubbing occurs on a cap 30 this pressure will tend to blow the cap off so the device will act quickly. Also it will be noted that the arrangement is normally under pressure so that should a pipe 29 accidentally burst the mechanism will operate and give warning that something is wrong with the system.

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. The combination with an elastic fluid turbine, of a pressure pipe which projects into a clearance space in the turbine and has a closed end, and a pressure responsive device which is actuated in case such clearance space is impaired to such an extent that the closed end of said pipe is disrupted.

2. The combination with an elastic fluid turbine, of a pressure pipe which projects into a clearance space in the turbine and has a closed end, a pressure responsive device connected to said pressure pipe, and means operated by said pressure responsive device to shut down the turbine in case such clearance space is impaired to such an extent that the end of the pressure pipe is worn off.

3. The combination with an elastic fluid turbine, of a pressure pipe which projects into a clearance space in the turbine and has a closed end, a pressure supply connected to said pipe, and means which is operated to shut down the turbine in case the pressure in said pipe is relieved.

4. The combination with an elastic fluid turbine, of a pressure pipe which projects into a clearance space in the turbine and has a closed end, a pressure supply connected to said pipe, and means which is operated to give a signal in case the pressure in said pipe is relieved.

5. In an elastic fluid turbine, a pressure pipe carried by a diaphragm and provided with a closed end which projects into the clearance space between the diaphragm and a wheel, and a pressure responsive mechanism connected with said pipe which is operated in case the wheel comes into contact with the end of said pipe and wears it off.

6. In an elastic fluid turbine, a pressure pipe carried by the casing and projecting into a clearance space between the casing and the rim of a wheel, and a pressure responsive mechanism connected with said pipe which is operated in case the wheel comes into contact with the end of said pipe and disrupts it.

7. In an elastic fluid turbine, a pressure responsive mechanism, and a plurality of pipes connected thereto in multiple and having closed ends which terminate in clearance spaces in the turbine, whereby in case a clearance space is impaired to such an extent that the end of one of said pipes is dis-

rupted said pressure responsive mechanism will be actuated.

8. In combination, an elastic fluid turbine having an emergency valve mechanism, a cylinder, a piston in the cylinder connected to the valve mechanism to trip the same, a pressure pipe leading from a source of pressure to the cylinder on one side of the piston, and a pressure pipe leading from the cylinder on the other side of the piston and having a closed end which terminates in a clearance space in the turbine, there being sufficient leakage past said piston so that the last named pipe is under pressure and the pressure on the two sides of the piston is the same, whereby in case the clearance is impaired to such an extent that a moving part of the turbine disrupts the end of said last-named pipe, the pressure on the one end of said piston will be relieved and the valve mechanism tripped.

In witness whereof I have hereunto set my hand this 5th day of December, 1918.

JOHN H. DORAN.