W. E. SNOW.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAR. 7, 1906.

1,042,616. Patented Oct. 29, 1912.

2 SHEETS—SHEET 1.

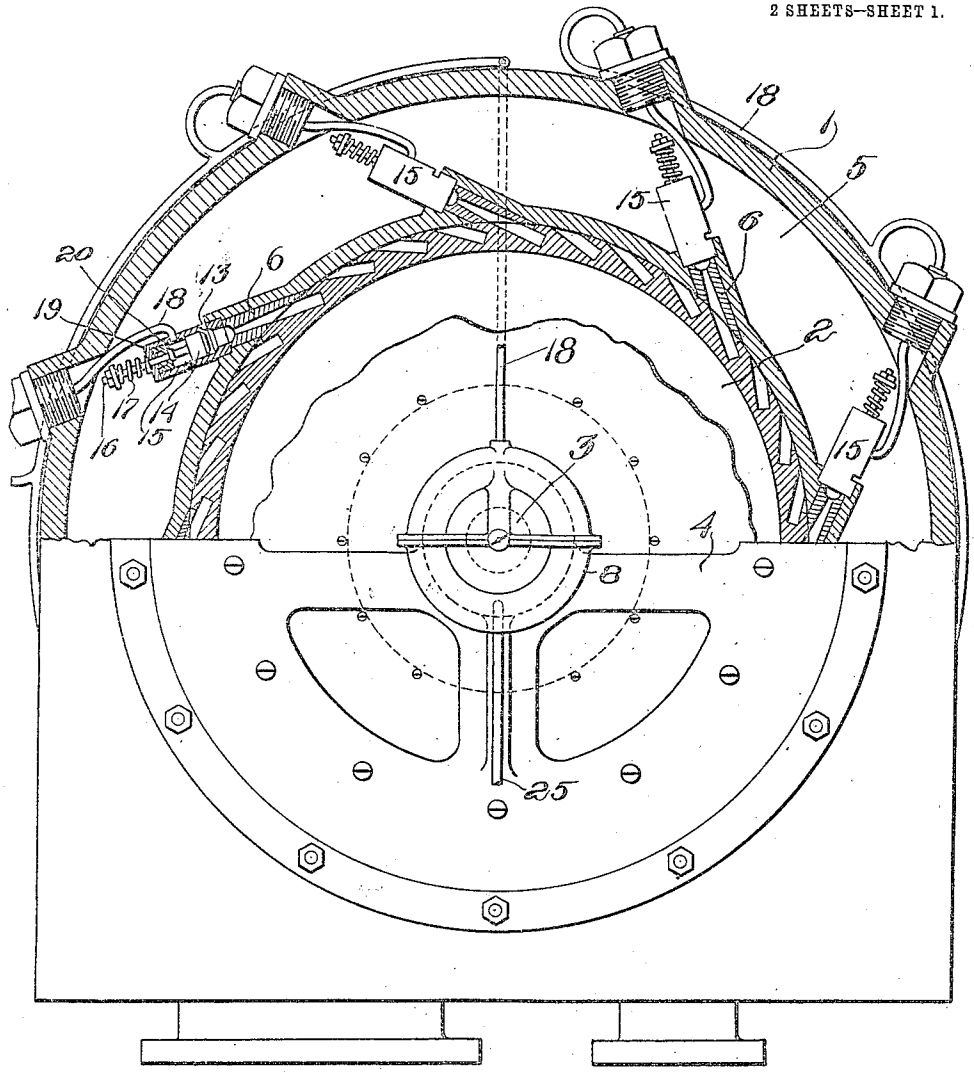

Fig. 1.

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1,042,316.

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2 SHEETS—SHEET 2.

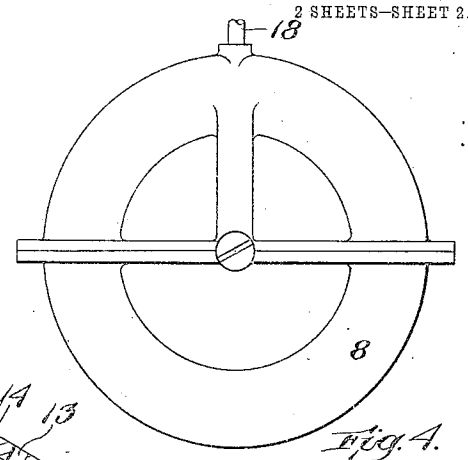
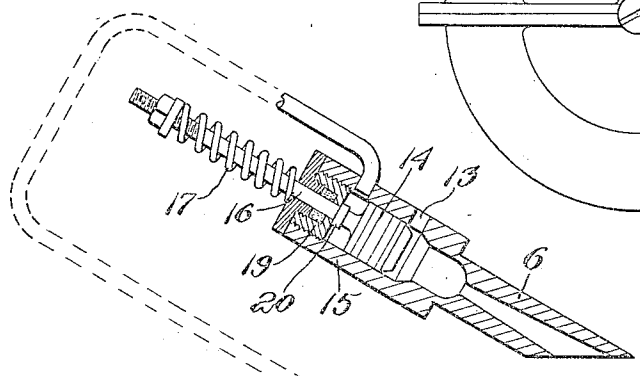


Fig. 4.



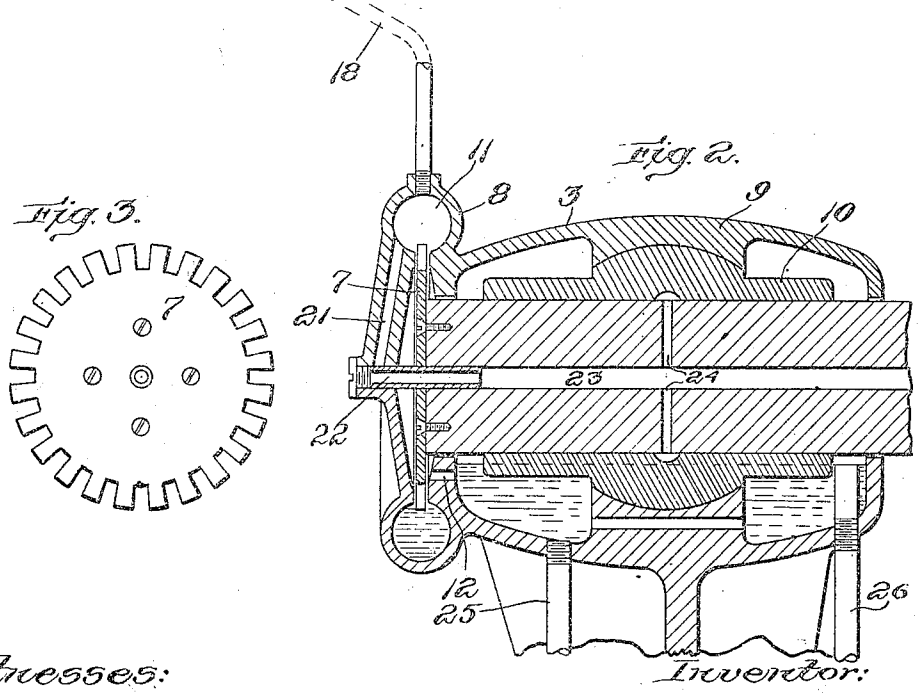


Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

1,042,616. Specification of Letters Patent. Patented Oct. 29, 1912.

Application filed March 7, 1906. Serial No. 304,625.

To all whom it may concern:

Be it known that I, WILLIAM E. SNOW, a citizen of the United States, residing at Hyde Park, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Elastic-Fluid Turbines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to improvements in elastic fluid turbines.

One object of the invention is to provide a simple and sensitive governing device for a turbine, in which mechanical connections and moving parts are avoided as far as possible, and in this respect the invention is intended particularly for use in turbines provided with multiple nozzles, where it is desirable to govern the turbine by throwing the nozzles successively into or out of operation.

Other objects of the invention will be hereinafter pointed out in connection with the specific description of the illustrated embodiment of the invention.

The invention consists in the turbine hereinafter described, as defined in the claims.

In the drawings Figure 1 is a side elevation, partly in section, of an elastic fluid turbine embodying the present invention; Fig. 2 is a vertical section of the centrifugal pump, one of the shaft journals and one of the nozzles, showing diagrammatically the connection between the pump and the governing valve mechanism; Fig. 3 is a detail view of the paddle wheel of the centrifugal pump; and Fig. 4 is a detail elevation of the pump casing.

The illustrated embodiment of the invention is an elastic fluid turbine comprising a casing 1 and a wheel 2 which may be of any usual or suitable type. The wheel is mounted on a shaft 3 journaled on end frames 4 fixed to the casing. The casing is provided with an annular passage 5 which supplies live steam or other motive fluid to the nozzles 6, of which there are several, spaced evenly about the wheel.

The speed-governing devices which form a part of the present invention comprise a pump driven by the wheel 2, governing valves for the nozzles 6, and fluid-pressure-operated mechanism connected with the pump and acting to open or close the governing valves and throw the nozzle into or out of operation to govern the speed of the wheel. The pump, shown particularly in Figs. 2 and 3, is of the centrifugal type, and comprises a paddle wheel 7 in the form of a plate with marginal serrations, which is secured to the end of the wheel shaft 3 so as to be rotated rapidly thereby. The pump casing 8 is in two halves, formed integral with the upper and lower halves of the casing 9 in which the bearing blocks 10 for the shaft 3 are mounted. The pump casing 8 has an annular passage 11. The lower part of the journal casing 9 forms a reservoir for oil which is admitted through a passage 12 to the pump casing. When the turbine is in operation the rotation of the paddle wheel 7 forces the oil into the annular passage 11 with a pressure varying with the speed of rotation of the turbine.

As shown in Fig. 2, each nozzle 6 is supplied with steam through an inlet port 13 controlled by a governing plunger valve 14. The valve 14 slides in a cylinder 15 and has a stem 16 projecting through the back of the cylinder and acted upon by a compression spring 17 which normally holds the valve in open position. The cylinder 15 is connected by a pipe 18 with the pump. As the speed of the turbine rises and the pressure on the oil in the cylinder 15 and the pipe 18 increases a point is reached at which the oil pressure, acting upon the back of the valve 14, overcomes the initial compression of the spring 17, whereupon the governing valve is immediately closed and the action of the nozzle 6 is interrupted. It is considered preferable to make the spring 17 of such length and to otherwise so arrange and adjust the parts that the closing action of the governing valve when a certain speed is reached, shall be sudden and complete, so that the nozzle is either in full operation or out of operation, since the operation of the machine is more economical when the nozzle is operating under full head than when operating with only a partial supply of steam, and a gradual closing of the governing valve is therefore undesirable. This mode of operation is secured in the illustrated em-

bodiment of the invention, in which a certain amount of pressure is required, in addition to that necessary to overcome the spring 17, to overcome the friction against the stem 16 of the stuffing box 19 through which the stem passes at the end of the cylinder 15, so that the valve, once started in motion, will come to rest only when fully seated and will there remain until a substantial fall in speed and oil pressure permits it to be quickly opened again by the spring 17. The opening movement of the valve is limited by a shoulder 20 on the stem 16.

In order that the quick and complete opening and closing of the governing valves may be preserved in a multiple nozzle turbine without causing the governing devices to have a sudden and uneven operation, the springs by which the several governing valves are controlled may be adjusted to different degrees of force, so that as the oil pressure rises the governing valves are closed in succession, and as the pressure falls they are opened in inverse succession, so that while such nozzles as are operating at any time are operating under a full head of steam, the increase or diminution of steam supplied to the wheel as a whole is gradual, varying only by the operation of one nozzle at a time.

The centrifugal pump is utilized also to supply the shaft journals with a constant flow of lubricant. The passage 11 is connected by a passage 21, formed in the pump casing 8, with a nipple 22 fixed axially in the pump casing and projecting into a central longitudinal bore 23 in the wheel shaft 3. By means of radial passages 24 communicating with the bore 23 the oil entering under pressure through the passage 21 is conducted to the bearing surfaces of the shaft journal. The oil escaping from the ends of the journal is caught again in the journal casing 9. The supply of oil in the reservoir is maintained by introducing oil when necessary through a pipe 25 and an overflow 26 is provided to prevent flooding of the casing. The passage 23 passes completely through the shaft 3 so that both of its journals are supplied with oil.

Although, for convenience in combining the functions of lubricating and governing, the centrifugal pump is supplied with oil as an operating fluid, other fluids may be used in the governing devices. Except in so far as a centrifugal pump is specified in the claims it will be understood that pumps of other types may be used, although the centrifugal pump is considered preferable as its operation is very uniform, there being no fluctuations of pressure such as occur in piston pumps. The invention in general is not limited to the details of construction and operation set forth in the description of the illustrated embodiment, but may be embodied in other forms broadly defined by the claims.

I claim—

1. An elastic fluid turbine, having, in combination, a wheel, a pump actuated thereby, a nozzle, a fluid pressure controlled plunger valve therefor, a cylinder within which the valve fits, and connections between the pump and the cylinder through which the fluid acted on by the pump is directed against the back of the valve to operate it in accordance with the speed of the wheel, substantially as described.

2. An elastic fluid turbine, having, in combination, a wheel, a pump actuated thereby, a nozzle, a fluid pressure controlled plunger valve therefor, a cylinder within which the valve fits, and connections between the pump and the cylinder through which the fluid acted upon by the pump is directed against the back of the valve to operate it, substantially as described.

3. An elastic fluid turbine having, in combination, a wheel, a pump actuated thereby, a plurality of nozzles, governing valves for the nozzles, fluid-pressure-actuated means connected with the pump for closing the valves, and springs connected with the valves and adjusted to different degrees of strength so as to permit the valves to close successively as the speed of the wheel increases, substantially as described.

4. An elastic fluid turbine, having, in combination, a wheel, a centrifugal pump actuated thereby, a nozzle, a fluid pressure controlled plunger valve therefor, a cylinder within which the valve fits, and connections between the pump and governing valve cylinder for directing the fluid acted upon by the pump against the back of the valve to operate it in accordance with the speed of the wheel, substantially as described.

5. An elastic fluid turbine, having, in combination, a wheel, a centrifugal pump actuated thereby, a nozzle, a cylinder communicating with the nozzle, a plunger valve fitting within the cylinder for governing the flow of steam through the nozzle, a conduit leading from the pump to the cylinder back of the valve, and a spring for normally holding the valve open, substantially as described.

6. An elastic fluid turbine, having, in combination, a wheel, a pump actuated thereby, a nozzle, a fluid pressure controlled plunger valve normally open, a cylinder within which the valve fits, and connections between the pump and the cylinder for transmitting the pressure generated by the pump directly to the back of the valve whereby the fluid pressure on the valve varies in accordance with the speed of the wheel, substantially as described.

7. An elastic fluid turbine, having, in com-

bination, a wheel, a pump actuated thereby, a nozzle, a fluid pressure controlled plunger valve, a cylinder within which the valve fits, means normally opening the valve, and means between the pump and cylinder for transmitting the pressure generated by the pump directly to the back of the valve whereby the pressure on the valve to close it varies in accordance with the speed of the wheel, substantially as described.

8. An elastic fluid turbine, having, in combination, a wheel, a pump actuated thereby, a nozzle, a fluid pressure controlled plunger valve, a cylinder within which the valve fits, a conduit forming a free communication between the cylinder and pump for transmitting the pressure generated by the pump directly to the back of the valve in accordance with the speed of the wheel, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

WILLIAM E. SNOW.

Witnesses:

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