

V. GELPKE.

TURBINE.

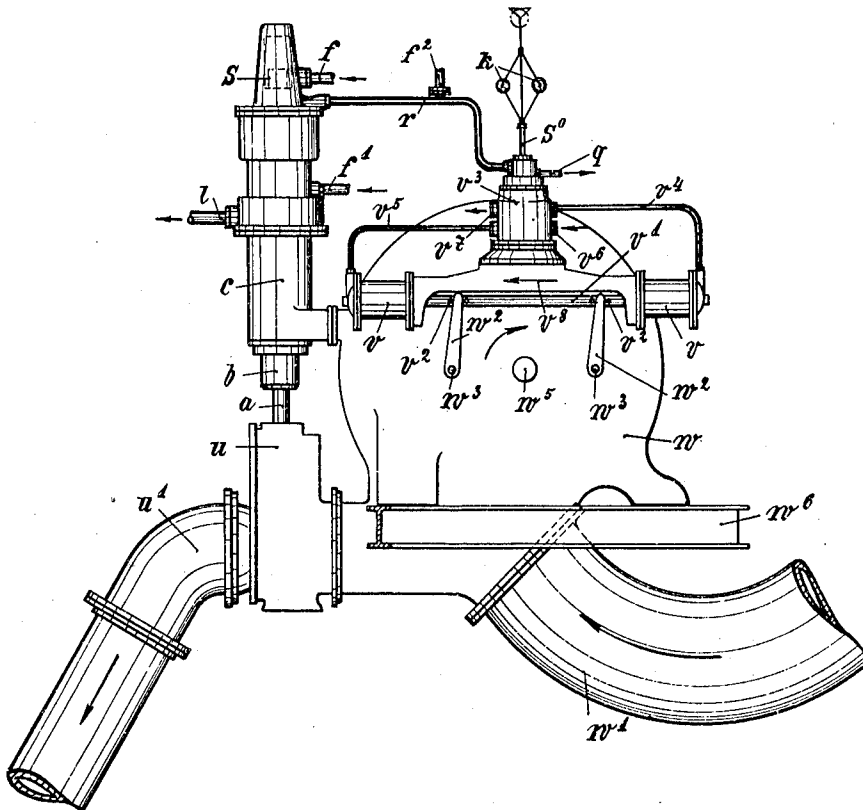
APPLICATION FILED AUG. 28, 1911.

1,035,116.

Patented Aug. 6, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



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Att'y

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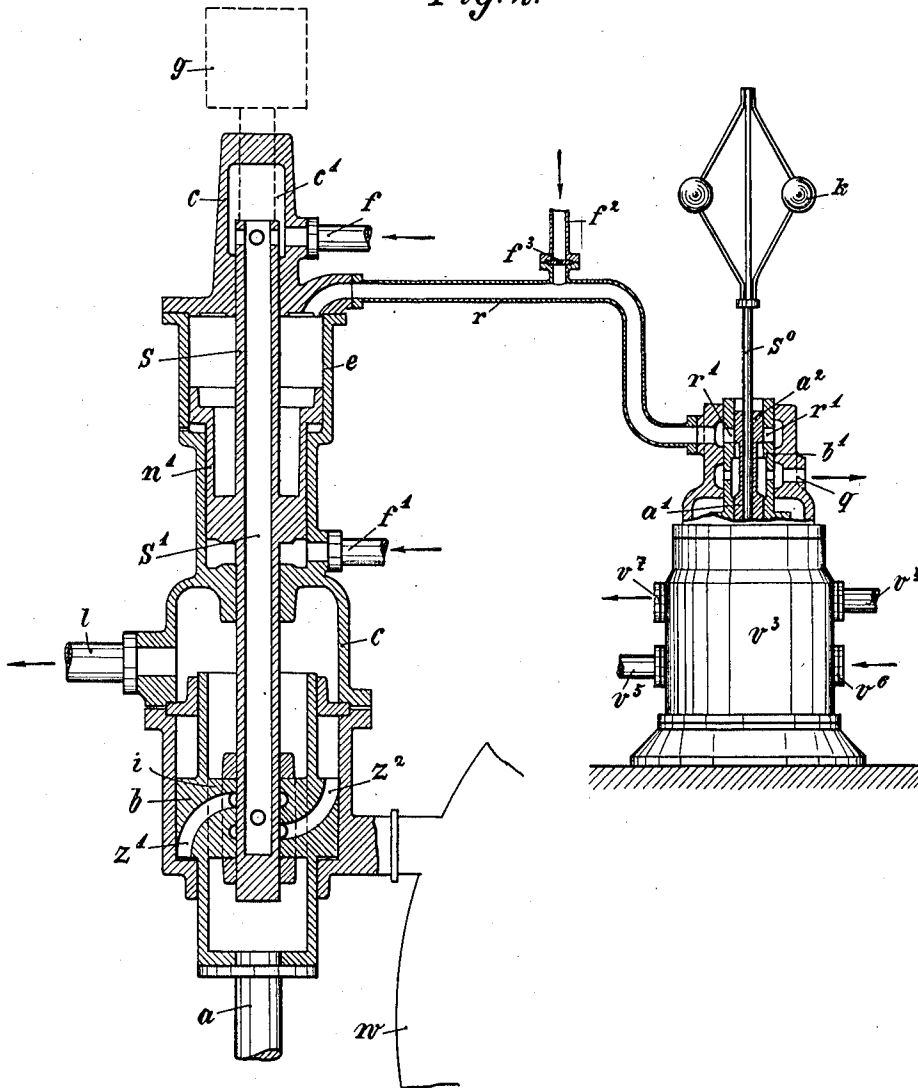
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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TURBINE.

1,035,116.

Specification of Letters Patent.

Patented Aug. 6, 1912.

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To all whom it may concern:

Be it known that I, VICTOR GELPKE, engineer, a citizen of Switzerland, residing at 5 Schleinitzstrasse, Brunswick, Empire of Germany, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to improvements in turbines, and more particularly to turbines of that class in which for the purpose of avoiding blows of the water a by-passage is provided through which the water flows when the water supply to the turbine has been shut off, and which is automatically and gradually closed.

My invention relates more particularly to the apparatus for controlling the valve of the said by-passage, which controlling apparatus as heretofore constructed consists of a controlling member moved by the working cylinder of the speed regulator which causes a pressure fluid to act on a floating piston.

For the purpose of explaining the invention more in detail one example embodying the same has been shown in the accompanying drawings in which the same letters of reference having been used in all the views to indicate corresponding parts.

In said drawings—Figure 1 is a diagrammatical side view showing the turbine, its admission pipe, regulating device and the valve controlling the by-passage, Fig. 2, is a side view partly in section of the apparatus for controlling the valve of the by-passage of the arrangement shown in Fig. 1.

Before describing the part of the machine to which my invention more particularly relates, I shall describe in a general way the turbine and the parts directly connected therewith, in order that the operation of the controlling apparatus may more readily be understood.

The turbine w is mounted on a frame w^6 , and the water is supplied thereto through a tube w^1 . The turbine is provided with a by-passage u^1 which is normally closed by a valve disposed within a valve chamber u . For the purpose of avoiding the impact of the water the said valve is opened whenever the gates or guiding buckets of the turbine are suddenly closed by the automatic controlling mechanism. The said gates are set in the ordinary way by means of a motor which, in the example, shown in Fig. 1, consists of two pressure cylinders v each of

which is provided with a piston adapted to be acted upon by a pressure fluid from one side only. The said pistons are mounted on the same piston rod v^1 , and the latter is provided with lugs v^2 which, upon the axial displacement of the piston rod are adapted to carry along cranks w^2 mounted on shafts w^3 . The latter pass through the casing of the turbine and into the inner part thereof where they are connected with the gates in such a way that the latter are closed or opened by the displacement of the piston rod v^1 , as is known in the art. The movement of the motor v , v toward the right or left is effected in the usual way by means of a controlling valve v^3 (see German Patent No. 216,486) which is connected by pipes v^4 and v^5 respectively with the cylinders v , and which is controlled by a speed governor k driven by the turbine shaft w^5 , which governor causes a pressure liquid within the valve chamber v^3 to act either on the right hand cylinder or on the left hand cylinder v . The said pressure fluid is taken from a suitable storing receptacle and is admitted to the valve v^3 through an inlet v^6 and escapes therefrom through an outlet v^7 . The closing direction, or the direction in which the piston rod v^1 is moved for stopping the turbine, has been indicated by an arrow v^8 . When the turbine is thus stopped, the slide valve controlling the by-passage u^1 is automatically opened in order to avoid the impact of the water and the gradual closing operations of the slide valve controlling the by-passage is effected by means of a controlling apparatus which is located within a casing c . As appears from Fig. 1, the said controlling apparatus carries the stem a of the slide valve for controlling the by-passage u^1 , which stem is connected, for example, with a piston b sliding within the casing c .

My invention relates more particularly to the controlling apparatus c for the slide valve of the by-passage u^1 , and an example embodying the same has been shown in Fig. 2.

In my U. S. Patent No. 1,002,669 dated September 5, 1911, the valve of the by-passage u^1 is operated by the pressure of a liquid, and the controlling apparatus for the said valve is actuated by the pistons of the cylinders v . In the modification shown in the present divisional application the

controlling apparatus for the said valve is not controlled by the said pistons but directly by the governor *k*. This construction acts more rapidly, because the movement of the valve is not dependent upon the movement of the pistons of the cylinders *v*, but is caused directly by the governor *k*.

In the accompanying drawings an example is shown in which the controlling apparatus *v*³ for the cylinders *v* which is controlled in the known way by the governor *k* is combined with the controlling apparatus for the valve for the by-passage *w*¹ into a single controlling device. This construction is preferable by reason of its simplicity, compactness, and the small number of moving parts.

The stem *a* which is connected with the valve of the by-passage is secured to a piston *b*. To the latter a pressure fluid, such as oil, is supplied from an inlet tube *f*, through passages *z*¹, *z*², the bore *s*¹ of the controlling rod *s*, and the chamber *c*¹ at the upper end of the casing *c*. By the pressure fluid the piston *b* is forced upward or downward according to the position of the rod *s*. The controlling rod *s* is forced upward by means of a differential piston *n*¹ provided thereon and acted upon by a pressure fluid, such as oil, admitted thereto from below through the tube *f*¹, as soon as the chamber *e* above the piston *n*¹ which normally is in communication with a pressure conduit *f*² is opened to the atmosphere. The piston *b* has a suitable number of bores *i* through which the chambers at the upper and lower sides of the piston are in communication. The hollow controlling rod *s* may be provided near its lower end with annular grooves to provide for exhausting from above and below the piston *b*, as shown in my U. S. Patent No. 1,002,669. The apparatus *c* is connected with an apparatus *v*³ through a pipe *r*. The apparatus *v*³ is a regulating valve of a construction shown and described for example in the German Patent No. 216,486, and its object is to transmit the effect of the governor *k* to the cylinders *v* (Fig. 1) by admitting the pressure fluid to the said cylinders, as is known in the art and described hereinafter. The rod *s*⁰, which is moved by the regulator *k*, is provided with two pistons in the casing *v*³, as disclosed by the above-mentioned German Patent No. 216,486, and the cylinder *a*¹ surrounding the rod *s*⁰ has within the casing *v*³ a lower extension which incloses the rod extension, so that there is space for play, but the two pistons are tightly inclosed. This latter structure or organization corresponds to the parts *a*, *s*, and *s*¹ and *s*² in the aforesaid German patent. The valve cylinder *b*¹, inclosing the cylinder *a*¹, has likewise a lower extension projecting through the entire casing *v*³ which corre-

sponds to the cylinder *b* of the German patent above noted, and is actuated in the same manner as the said cylinder *b* by the pistons of the motor embodying the cylinder *v*. If the controlling rod *s*⁰ is elevated by the governor, the piston *a*¹ is likewise forced upward by the pressure fluid acting thereon, as is known in the art. The piston *a*¹ is formed near its upper end with an enlarged portion *a*² which normally covers ports *r*¹ which are formed within the valve cylinder *b*¹, and which upon being opened connect the tube *r* with the outlet *q* for the pressure fluid. The valve cylinder *b*¹ incloses the piston *a*¹, and it is controlled in a known way from the cylinders *v*.

If the governor *k* rises and actuates the pistons of the cylinders *v* by lifting the controller rod *s*⁰ by means of a pressure fluid supplied to said cylinders through the intermediary of the piston *a*¹ and the ports of the valve cylinder coöperating therewith, the ports *r*¹ are simultaneously opened, and the pressure within the chamber *e* above the differential piston *n*¹ is removed, because the inlet tube *f*² is provided with a throttling disk *f*³, so that pressure can not be set up within the conduit *r* by the liquid from the tube *f*². Therefore the pressure liquid which is admitted through the tube *f*¹ forces the piston *n*¹ upward and the latter carries along the rod *s*, so that pressure fluid can pass through the pipe *f*, the bore *s*¹ of the rod *s* and the passage *z*¹ and below the piston *b*, so as to force the latter and the stem *a* upward. When the ports *r*¹ of the apparatus *v*³ are again closed in the known way by the upward movement of the valve cylinder *b*¹ which is controlled in the known way by the cylinders *v*, the normal pressure is reëstablished within the tube *r*, and as the area of the upper surface of the piston *n*¹ is larger than the area of its lower face, the said piston and the rod *s* are forced downward into their normal positions. The weight of the rod *s* and the piston *n*¹, and if necessary a weight (*g*, Fig. 2) provided on the latter assists the said downward movement.

I claim, in this application forming divisional application divided out of the application Serial No. 617,397, filed March 28, 1911, as my invention:

1. The combination with a motor, a fluid supply thereto, a by-passage adapted to be thrown into communication with said fluid supply, means for normally breaking communication between said fluid supply and by-passage, and means to control the fluid supply to the motor, of a cylinder, a piston movable therein and operatively connected with said means for breaking communication between said fluid supply and by-passage, a hollow rod adapted to be thrown into communication with the hollow of said cyl-

inder at one side of the piston, means to supply a pressure fluid to the hollow of said rod, means controlled by said controlling means for the fluid supply and operative when the fluid supply is being shut off to establish communication between the hollow of the rod and the hollow of the cylinder on the said side of the piston and to move the piston into position for throwing said fluid supply and by-passage into communication with each other, and means to return said piston into normal position.

2. The combination with a motor, a fluid supply thereto, a by-passage adapted to be thrown into communication with said fluid supply, means for normally breaking communication between said fluid supply and by-passage, and controlling means dependent upon the speed of the motor and acting on said fluid supply, of a cylinder, a piston movable therein and operatively connected with said means for breaking communication between said fluid supply and by-passage, a hollow rod adapted to be thrown into communication with said cylinder on one side of the piston, means to supply a pressure fluid to the hollow of said rod, means controlled by said controlling means for the fluid supply and operative when the fluid supply is shut off to establish communication between the hollow of said rod and the cylinder on the side of the piston and to move the piston into position for throwing the fluid supply and by-passage into communication with each other, and means to return said piston into normal position.

3. The combination with a motor, a fluid supply thereto, a by-passage adapted to be thrown into communication with said fluid supply, means for normally breaking communication between said fluid supply and by-passage, and controlling means for said fluid supply, of a cylinder, a piston movable therein and operatively connected with said means for breaking communication between said fluid supply and by-passage, a hollow rod movable within a bore of said piston and adapted when shifted to come into communication with said cylinder on one side of the piston, means to supply a pressure fluid to the hollow of said rod, a piston secured to said rod, means controlled by said controlling means for the fluid supply and operative when the fluid supply is shut off to supply a pressure fluid to said piston secured to the rod in a direction to shift the rod into position for communication with the cylinder, and means to return said piston within the cylinder into normal position.

4. The combination with a motor, a fluid supply thereto, a by-passage adapted to be thrown into communication with said fluid supply, means for normally breaking communication between said fluid supply and by-passage, a subsidiary motor for regulating the fluid supply, a fluid supply to said subsidiary motor, and regulating means for said fluid supply to the subsidiary motor, of a cylinder, a piston movable within said cylinder, a hollow rod movable within a bore of said piston and adapted when shifted to come into communication with the cylinder at one side of the piston, means to supply a pressure medium to said rod, means controlled by said regulating means for the subsidiary motor to shift said rod into position for communication with the cylinder, and means to return said piston into normal position.

5. The combination with a motor, a fluid supply thereto, a by-passage adapted to be thrown into communication with said fluid supply, means for normally breaking communication between said fluid supply and by-passage, a subsidiary motor for regulating the fluid supply, a fluid supply to said subsidiary motor, and regulating means for said fluid supply to the subsidiary motor, said regulating means comprising a governor, a stem connected therewith, and a movable piston surrounding said stem, of a cylinder, a piston movable therein and operatively connected with said means for breaking communication between said fluid supply and by-passage, a hollow rod movable within a bore of said piston and adapted when shifted to come into communication with said cylinder on one side of the piston, means to supply a pressure fluid to the hollow of said rod, a piston secured to said rod, a fluid supply thereto adapted to shift the same with the rod in communication with said cylinder and connected with said regulating means, a slide valve inclosing the piston of said regulating means for the fluid supply to the subsidiary motor and operated by said regulating means and adapted in combination with the piston of the regulating means to control the fluid supply to the piston secured to said rod, and means to return the piston within said cylinder into normal position.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

VICTOR GELPKE.

Witnesses:

WILHELM LEHRKE,
WILLI JAHN.