H. A. SINGRÜN.

REGULATING DEVICE FOR REACTION TURBINES.

APPLICATION FILED APR. 23, 1912.

1,038,977.

Patented Sept. 17, 1912.

2 SHEETS—SHEET 1.

Fig. 2

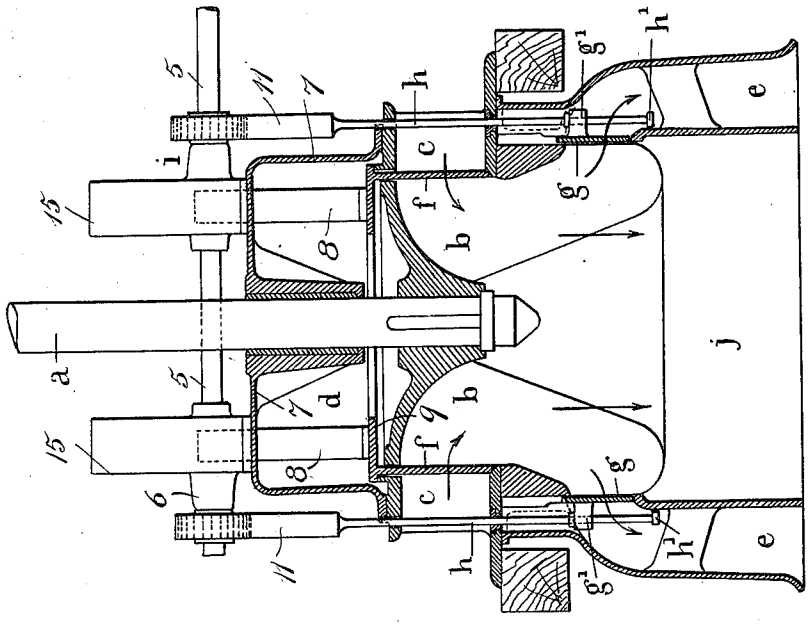
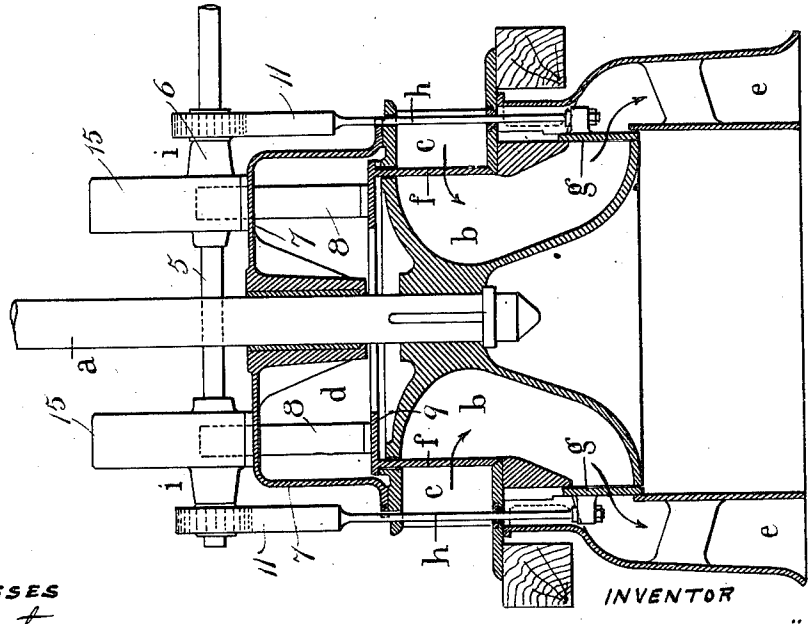


Fig. 1



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2 SHEETS—SHEET 2.

Fig.1[a].

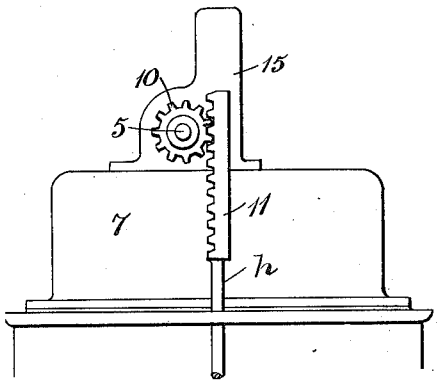
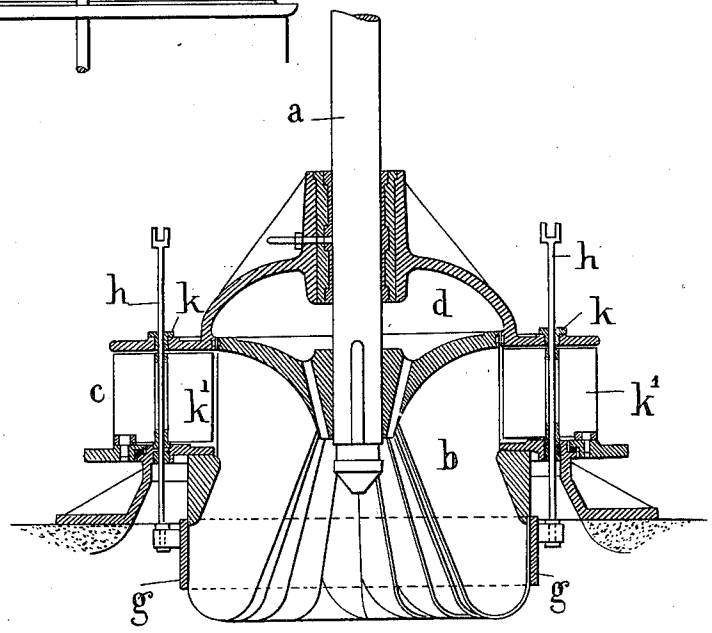


Fig.3.



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REGULATING DEVICE FOR REACTION-TURBINES.

1,038,977. Specification of Letters Patent. Patented Sept. 17, 1912.

Application filed April 23, 1912. Serial No. 692,653.

To all whom it may concern:

Be it known that I, HENRI ALBERT SINGRÜN, a citizen of the Republic of France, and a resident of Épinal, Department of Vosges, France, have invented a certain new and useful Improvement in Regulating Devices for Reaction-Turbines, of which the following is a specification.

Hydraulic reaction turbines allow of obtaining with high efficiency a high running speed and all the advantages accruing therefrom. This result is obtained by carrying the degree of reaction of these turbines to the extreme limits; but then the efficiency falls considerably when the power required or the volume of water at disposal is variable, because there exists only a single point of opening of the regulator which will correspond to the most favorable degree of reaction, that for which the turbine is constructed. Indeed the relation between the sectional area of the water inlet and that of its exit from the blade chamber alters with every position of opening of the regulator, because the sectional area of its exit remains constant while that of the inlet varies. Numerous proposals have been made in order to obviate this reduction of efficiency and in particular moving parts revolving integrally with the driving wheel have been employed to vary the sectional area of the exit from the blade-chamber; but the effect of centrifugal force added to the wear and the difficulties of upkeep caused by sand and grit carried along by the water were found to be so harmful that the application of these complicated devices has not been developed.

The present invention has for object to remedy these disadvantages; it allows of maintaining a constant hydraulic efficiency even with very variable outputs, producing at all degrees of admission an absolute constancy of the relation between the sectional area of the water inlet through the distributer and the sectional area of the outlet from the blade-chamber. This result is obtained by means of a regulating device independent of the power wheel and not participating in its rotational movement.

The accompanying drawings represent by way of example three methods of carrying out the invention.

Figure 1 shows in vertical section the application of the device to a turbine having centripetal inlet and centrifugal outlet. Fig. 1ª is a partial side elevation. Fig. 2 shows in vertical section the device applied to a mixed turbine of the "Hercules-Progress" or similar type, in which the inlet is centripetal and the discharge both centrifugal and parallel to the axis of the turbine. Fig. 3 shows in vertical section the device applied to a turbine with movable guides of the Francis type in which the inlet is centripetal and the discharge both centrifugal and parallel to the axis of the turbine.

In Fig. 1, *a* is the shaft of the turbine, *b* the power-wheel with centripetal inlet and centrifugal discharge, *c* the water inlet distributer, *d* the dome or casing inclosing the turbine, *e* the discharge or tail-pipe. A cylindrical regulator *f* allows of obstructing the inlet-orifices in the distributer while a second cylindrical regulator *g* allows of obstructing the outlet passages from the blade-chamber. The regulator *g* is connected by rods *h* to the operating mechanism *i* of the regulator *f* so that the two move together. The amplitude of the movements is determined in such a way that the sectional area of the outlet remains always proportional to the sectional area of the admission, which provision allows of preserving in all positions of opening the degree of reaction which is the most favorable in theory and practice. The operating mechanism *i* may comprise a horizontal shaft 5 turning in bearings 6 on the cap 7 and carrying pinions (within the hoods 15) gearing into vertical racks 8, 8, on the ring 9, which carries the gates of the regulator *f*, *f*. On this same shaft are pinions 10 with which gear into vertical racks 11 (Fig. 1ª) on the upper ends of the rods *h*, so that by turning the shaft 5 by hand or otherwise, the gates *f* and *g* may be raised or lowered.

In Fig. 2, the same letters indicate the same parts as in Fig. 1; the power-wheel *b* has centripetal inlet and mixed discharge that is to say centrifugal discharge through the tube *e* and discharge parallel to the axis through the central tube *j*. The rods *h* are extended and terminate in heads *h'*. They slide freely through sockets *g'* carried by the regulator *g*. Consequently the movement of the two regulators *f* and *g* becomes simultaneous only after a certain point in the stroke, when the heads h' abut against the socket *g'*. Only at this point does the

outlet regulator begin to affect the degree of reaction of the turbine.

After having passed through the blade chamber, the water flows in the case of Fig. 1 through the free annular sectional area of the tail tube *e*, and in the case of Fig. 2 through the central tube *j* if the regulator *g* is closed and through both the central tube *j* and the free annular area of the tube *e*, if the regulator *g* is open. When the tube acts under vacuum, the tubes *e* (Fig. 1) or *e* and *j* (Fig. 2) form suction-tubes. In this case, if the turbine is working with reduced admission of water, the normal sectional area of the discharge tube may be too large for the volume of water, which may lead to a failure of the priming of the water column. The arrangement of the two tail tubes *j* and *e* (Fig. 2) remedies this disadvantage. Indeed, in the case of reduced admission, the discharge tube *e* is obstructed by the regulator *g* in such a way that the sectional area of discharge is very considerably reduced.

Fig. 3 shows the application of the device to a turbine with movable guide-blades of the Francis type. The rods *h* controlling the regulator *g* pass through the pivotal axes *k* of the guide-blades *k'*.

It will be noted that the turbine in Fig. 3 has no discharge tube; the discharge tubes may likewise be suppressed in the arrangements of Figs. 1 and 2; they are necessary only in the case where the turbine works under suction, that is to say when it is placed at a certain height above the level of the tail-water. It is quite evident on the other hand that the invention is not limited to the three foregoing examples and that it may be applied to all other system of turbines vertical or horizontal.

Claims:

1. A regulating device for reaction turbines, comprising means for controlling the sectional area of the inlet to the turbine wheel and means for controlling the sectional area of the discharge outlet from the wheel, and means for operating the same to secure a proportional modification of the sectional area of said inlet and outlet passages, for the purpose described.

2. A regulating device for reaction turbines, comprising means for controlling the sectional area of the inlet to the turbine wheel and means for controlling the sectional area of the discharge outlet from the wheel, and means for operating the same to secure a proportional modification of the sectional area of said inlet and outlet passages and being independent of the turbine wheel and its motion, for the purpose described.

3. A regulating device for reaction turbines comprising means at the inlet and discharge ports of the turbine for controlling the flow therethrough, said controlling means being independent of the turbine wheel and its motion, and being regulable to secure a proportional modification of the sectional area of said ports, as described.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

HENRI ALBERT SINGRÜN.

Witnesses:
CHARLES DONY,
LÉON PEILLY.