

Aug. 14, 1945.

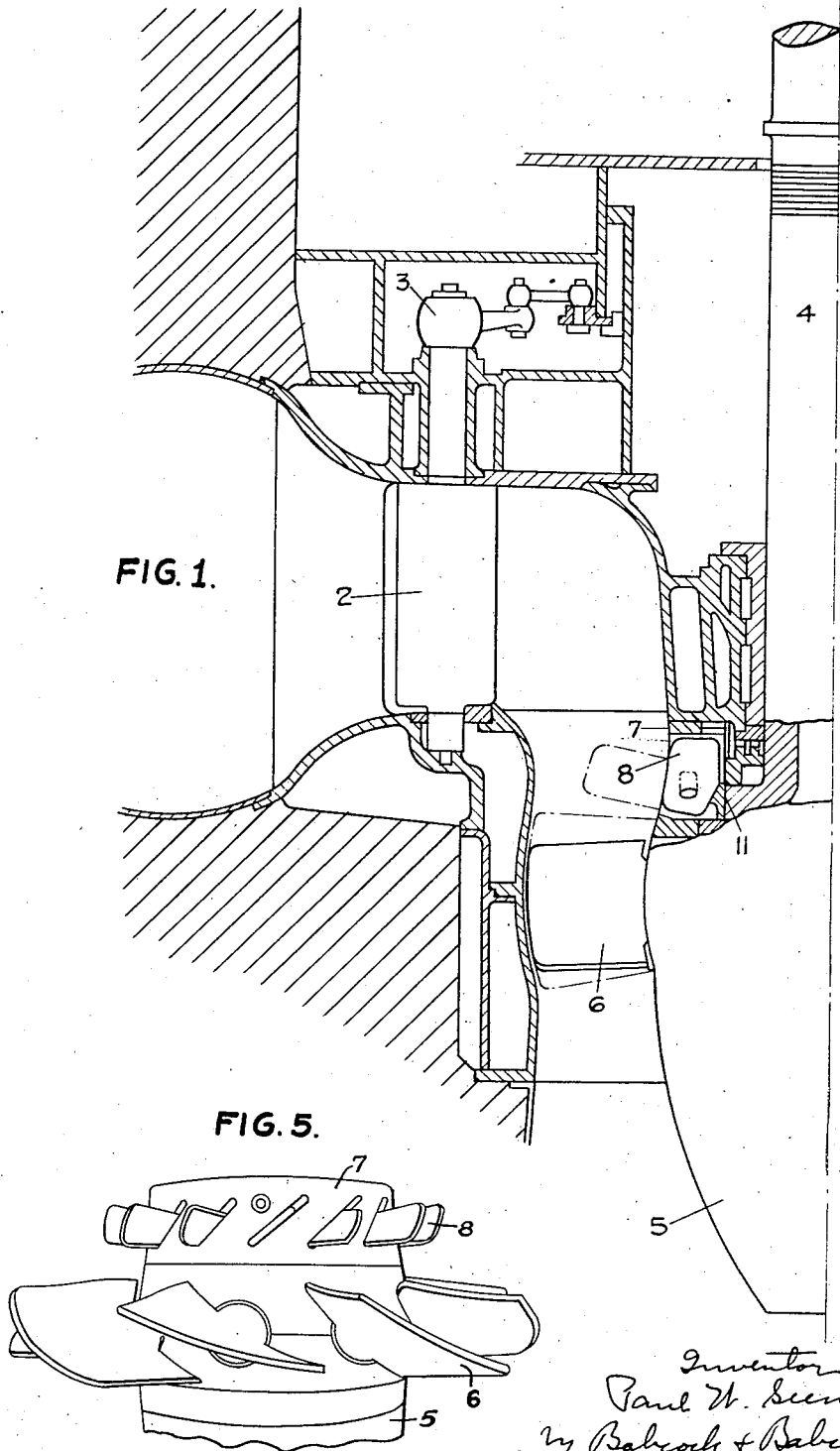
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2,382,108

AUTOMATIC SPEED LIMITING DEVICE FOR HYDRAULIC TURBINE ROTORS

Filed Nov. 21, 1944

2 Sheets-Sheet 1



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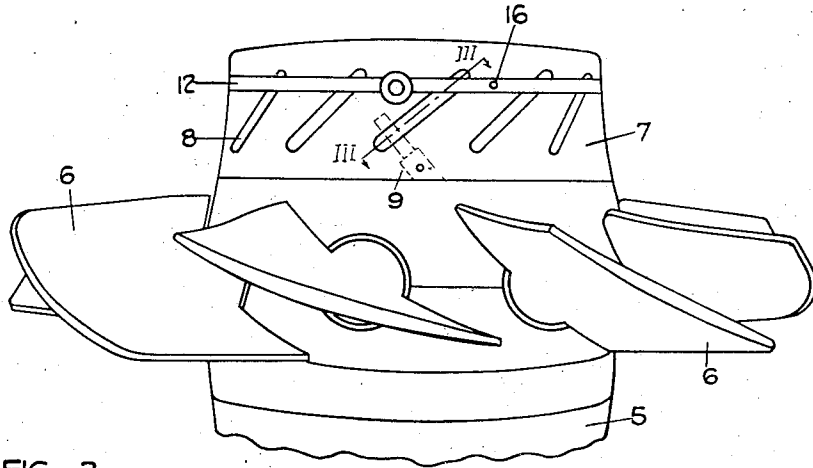


FIG. 2.

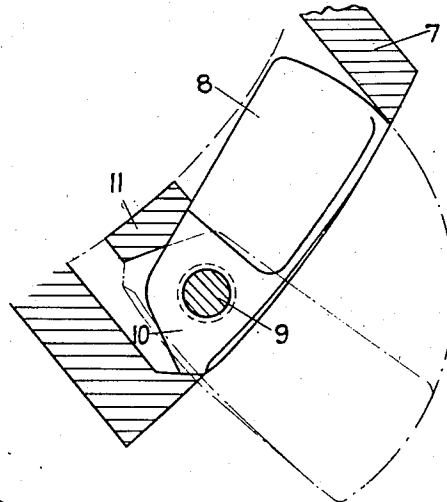


FIG. 3.

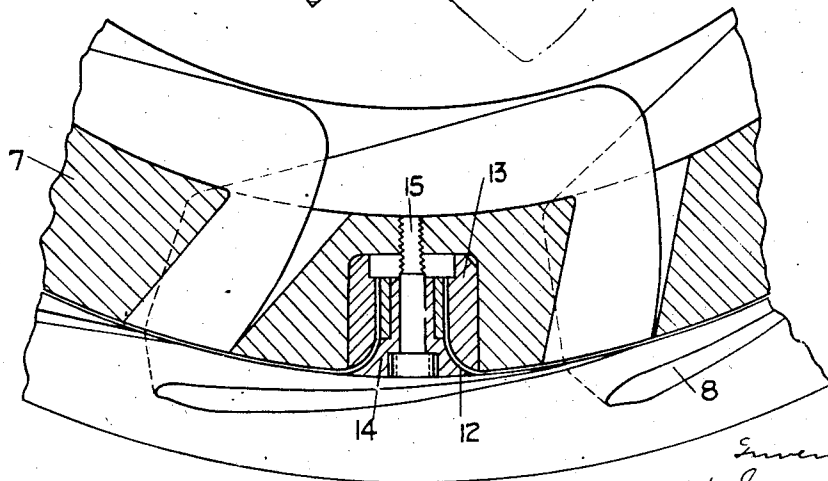


FIG. 4.

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UNITED STATES PATENT OFFICE

2,382,108

AUTOMATIC SPEED LIMITING DEVICE FOR
HYDRAULIC TURBINE ROTORS

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Application November 21, 1944, Serial No. 564,532
In Great Britain August 23, 1943

1 Claim. (Cl. 253—143)

The prior Patent Specification No. 470,396 is concerned with providing the hub of a hydraulic turbine rotor with an automatic speed limiting device in the form of a ring fastened to the hub of the rotor adjacent to and preferably above the turbine blades and a number of braking or deflecting vanes hinged or slidably mounted on or within this ring, which vanes are normally retained against the action of centrifugal force and so held out of the stream. When a certain speed is exceeded, centrifugal force causes these members to project into the stream. In one particular arrangement, the vanes are retained by links proportioned to snap when a certain force thereon is exceeded.

The object of the present invention is to provide means for retaining the speed limiting members out of the water stream, which means are adapted to break when a certain force is exceeded and thereby release all the speed limiting members substantially simultaneously. The invention consists in a belt or chain enveloping all the speed limiting means and thus retaining them out of the stream, which belt includes means proportioned to break when a certain force—due to centrifugal action on the speed limiting means—is exceeded.

The speed limiting means may take any of the forms of sliding, hinged or springy vanes set forth in the said Specification No. 470,396, a particularly convenient arrangement being one in which each of a ring of vanes mounted immediately above the working blades of the turbine is pivotally mounted on a hinge pin having its axis in a plane which although transverse to the rotor axis is inclined thereto at an angle other than 90° whereby the vanes when they swing out are not parallel to but are inclined to the rotor axis oppositely to the direction of inclination of the working blades.

The invention is illustrated by the accompanying drawings Figs. 1-5 of which Fig. 1 is the left hand half of a vertical cross section through a complete hydraulic turbine of the swivelling propeller bladed type incorporating the invention; Fig. 2 is a perspective view showing the swivelling blades and the ring of braking vanes—in the closed position—of part of the rotor of the turbine shown in Fig. 1; Fig. 3 is an enlarged sectional view on the line III—III of Fig. 2 showing the pivoted braking vanes; Fig. 4 is an enlarged view showing the retaining band fixing and Fig. 5 is a perspective view showing the braking vanes projecting in the fully operated position.

With reference to the accompanying drawings, the turbine shown in Fig. 1 is of the conventional swivelling bladed propeller type and the stator includes the enveloping turbine casing 1 from which the incoming water flows between the pivoted shutters 2 on its way to the rotor blades. The shutters are operated in the usual manner by the lever and link mechanism indicated at 3 under the automatic control of the turbine speed governor. The rotor comprises the vertical shaft 4 terminating in the hollow hub 5 carrying the swivelling blades 6. Secured to the hub 5 immediately above the blades 6 is the ring 7 incorporating the automatic speed limiting device according to the invention. Within this ring 7 are mounted a number of braking vanes 8 each of which is hinged as shown in Figs. 2 and 3 about a hinge pin 9 with its axis in a plane transverse to the rotor axis, the movement of the braking vanes 8 being limited by the engagement of tail pieces 10 thereon with the stop ring 11. Under normal working conditions each of the braking vanes 8 lies within and flush with the outer surface of the ring 7 which forms a smooth continuation of the hub 5 and are retained in this position by a retaining band 12 fastened round the outer cylindrical surface of the ring 7. The two ends of the retaining band 12 terminate in a retaining block 13—located in the ring 7—and are clamped thereto by means of the tapered plug 14 which is bolted to the ring 7 by means of the bolt 15 and may be locked in position by means of a light spot weld.

A hole 16 is provided in the retaining band 12 and reduces the cross sectional area at one particular place so that when a certain predetermined force is reached the retaining band will snap. This predetermined force is the tension produced in the retaining band 12 by the sum of the forces due to centrifugal action on all the braking vanes 8 at some predetermined safe excess speed of the rotor. When this breaking force is reached, the retaining band 12 snaps, thereby releasing all the braking vanes 8 which fly out substantially simultaneously and remain out—at least until the rotor has been brought substantially to rest. A chain with a weak link could be used instead of the band. The braking vanes may be overbalanced so that when they fly out, gravity will tend to keep them in the outer position. Once the braking vanes start to protrude, the pressure of the water thereon will, of course, tend to force them out and hold them out.

To reset the device for normal operation of

the turbine, it is necessary for someone to get inside the turbine, replace all the vanes and fasten another retaining band or chain around them.

It will be understood that the attachment holding the band in place may be designed to break and release the ends of the band when a predetermined force is exceeded, in which case the local reduction of strength of the band is unnecessary, or a wire rope or other cord may be used in place of the band.

What I claim as my invention and desire to secure by Letters Patent is:

A hydraulic turbine, a rotor therein, driving blades on said rotor, a ring of speed-limiting vanes on said rotor mounted for centrifugal movement outwards into the water stream and a frangible retaining belt device enveloping said vanes.

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