March 13, 1934. G. A. BIGGS 1,950,773

HYDRAULIC TURBINE

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Fig. 1.

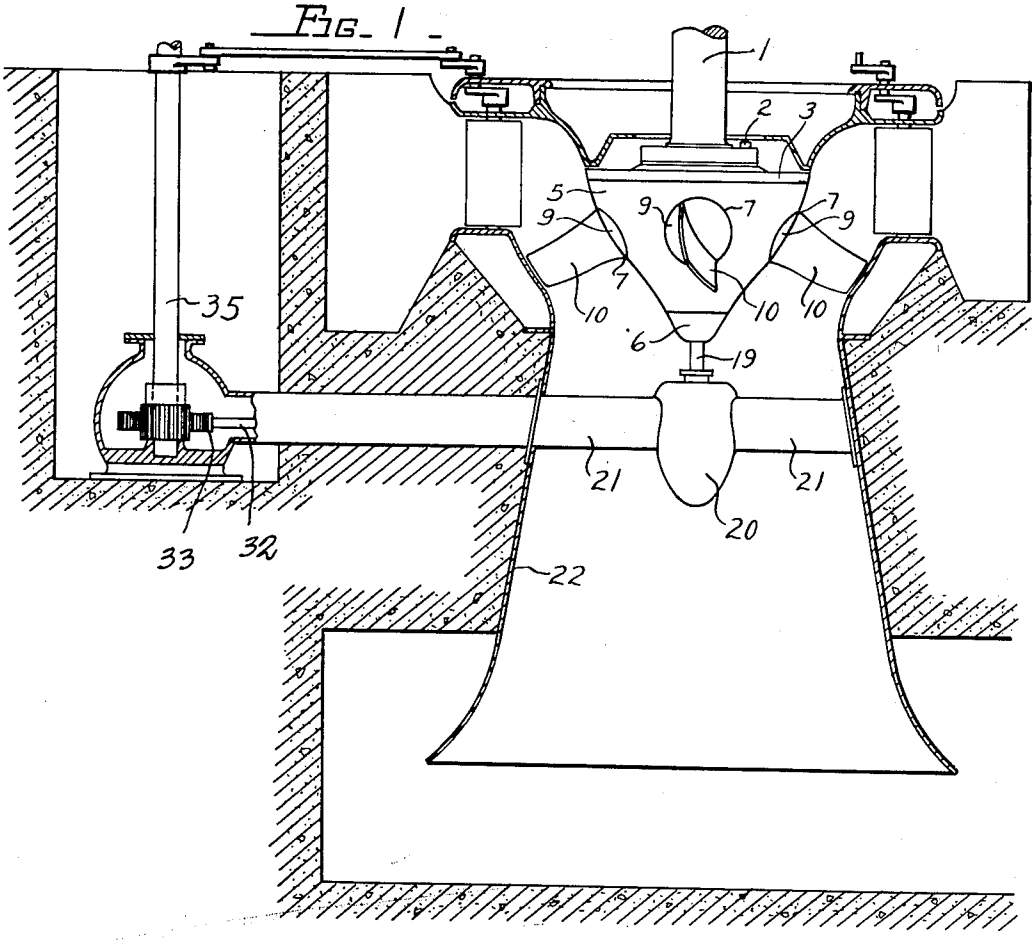
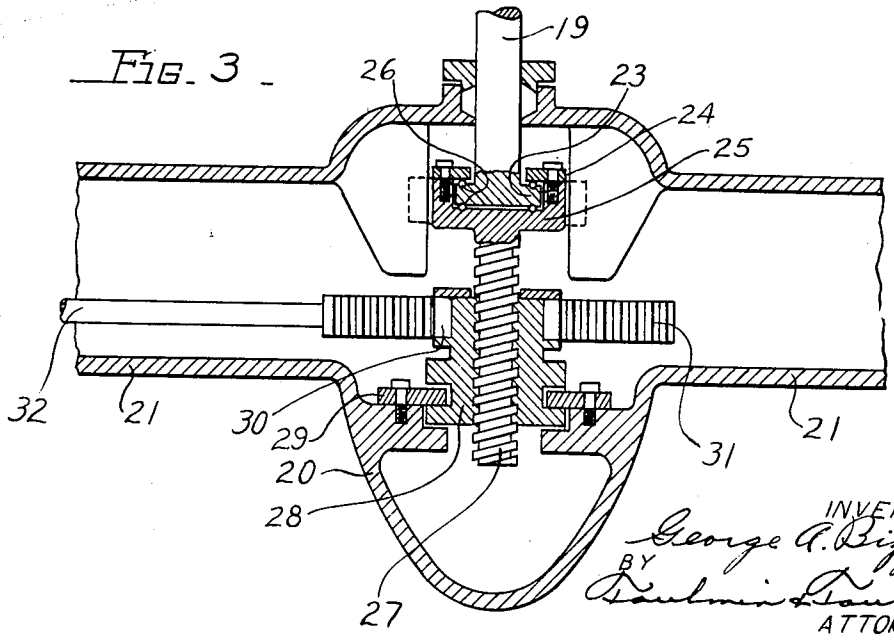


Fig. 3.



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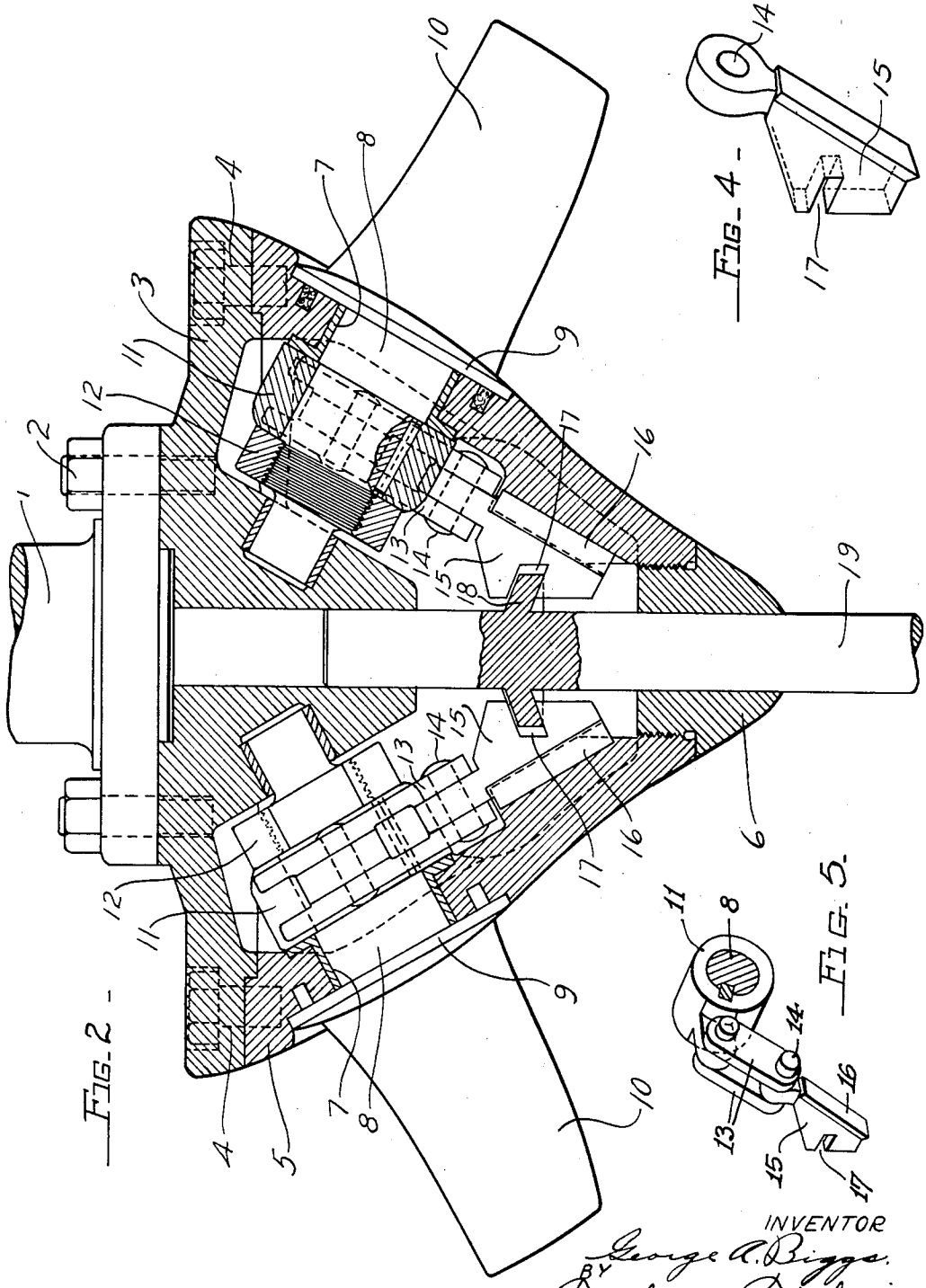


FIG. 2.

FIG. 4.

FIG. 5.

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UNITED STATES PATENT OFFICE

1,950,773

HYDRAULIC TURBINE

George A. Biggs, Springfield, Ohio, assignor to The James Leffel & Company, Springfield, Ohio, a corporation of Ohio

Application June 21, 1932, Serial No. 618,490

9 Claims. (Cl. 253—148)

My invention relates to hydraulic turbines and, in particular, to the operation of adjustable vanes in a hydraulic turbine.

It is my object to provide means of adjusting the vanes of a hydraulic turbine from the bottom of the turbine to thereby eliminate the necessity of operating the turbine through the turbine blades weakening the shaft or increasing its weight, although part of my invention is adaptable to operation through the shaft, if it is desired.

Referring to the drawings:

Figure 1 is a section through the runner adjusting mechanism showing the runner in elevation;

Figure 2 is a section through the runner;

Figure 3 is an enlarged section through the adjusting mechanism;

Figure 4 is a perspective of one of the actuating blocks.

Figure 5 is a perspective of the link structure for rotating the vanes.

Referring to the drawings in detail, 1 is a runner shaft connected by bolts 2 to a cap plate 3 which, in turn, is connected by bolts 4 to the hollow hub 5 which carries the detachable nose 6.

Arranged in the hollow hub 5 in the apertures 7 are the shafts 8 and hubs 9 of the adjustable vanes 10. On the shafts 8 are mounted the collars 11 retained thereon by the nuts 12, which collars engage with the links 13 that are pivoted at 14 to the sliding blocks 15 that are guided in the guide ways 16 in the hub 5. These blocks are slotted at 17 and engage with a shoulder 18 on the adjusting shaft 19.

This adjusting shaft may be operated through the runner shaft 1 but I prefer to operate it as indicated from beneath the hub of the runner. For this purpose, I extend the shaft 19 into the stream line housing 20 which is supported by the transverse supports 21 that are mounted upon the draft tube 22.

The bottom of the shaft 19 has a flange 23 engaged by the ring 24, which is carried on the cup 25.

Ball bearings 26 are interposed between this connection to permit free rotation between the shaft 19 and the cup 25. The cup 25 is provided with a screw 27 mounted in a screw block 28 retained by the ring 29 in the housing 20. Mounted on this screw block is a gear 30 engaged by the reciprocating rack 31 that is actuated by the shaft 32 extending out of the draft tube 22 through the casing 21 where the rack 33 engages the gear 34 on the gate shaft 35.

Thus, there may be a simultaneous adjustment of the gates and of the runner vanes in accordance with the water flow.

It will be understood that I desire to comprehend within my invention such modifications as may be necessary to adapt it to varying conditions and uses.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a hydraulic turbine, adjustable gates, a runner having adjustable vanes, a draft tube, a support between the runner and the draft tube, means extending from the bottom of the runner through the support and supported by the support for adjusting said vanes, and means for connecting said adjusting means to the gates above the runner.

2. In a hydraulic turbine, a draft tube, a runner having adjustable vanes, means in said hub and extending therefrom adapted to adjust said vanes, a casing below said hub into which said adjusting means extends and by which it is supported, a support between the casing and the draft tube, and means in said casing extending through the support from said adjusting means to a point outside of the draft tube of the runner for adjusting said vanes.

3. In a hydraulic turbine, adjustable gates, a runner having adjustable vanes, a draft tube, means in said hub and extending therefrom adapted to adjust said vanes, a casing below said hub into which said adjusting means extends and by which it is supported, a support between the casing and the draft tube, means in said casing extending through the support from said adjusting means to a point outside of the draft tube of the runner for adjusting said vanes, and means for connecting the gates above said runner to said adjusting means for simultaneous operation.

4. In a hydraulic turbine, adjustable gates, a runner having adjustable vanes, a draft tube, means in said hub and extending therefrom adapted to adjust said vanes, a casing below said hub into which said adjusting means extends, a support for the casing extending from the casing to the opposite sides of the draft tube and serving as the only means to support and center the casing, means in said casing extending through the support from said adjusting means to a point outside of the draft tube of the runner for adjusting said vanes, and

means of connecting the gates above said runner to said adjusting means for simultaneous operation, said casing and supporting means therefor below the runner hub in the draft tube being streamline so as not to impede the flow of water thereover.

5. In a hydraulic turbine, a runner having a hub and a plurality of adjustable vanes and comprising a vane body and an actuating shaft, a gear on said shaft, a rack slidably mounted in said hub engaging with said gear, an actuating block connected to said rack and slidably engaging said hub and a reciprocating actuating shaft engaging with said block extending out of the hub.

6. In combination, a runner comprising a hub, a runner shaft and adjustable vanes, a reciprocating shaft extending out of said hub, means for connecting said reciprocating shaft to the runner vanes for rotating them, a worm on said reciprocating shaft, a worm nut and gear, a rack adapted to actuate said gear. and means for actuating said rack extending from the rack to a point outside of a draft tube enclosing said runner.

7. In combination, a runner comprising a hub, a runner shaft and adjustable vanes, a reciprocating shaft extending out of said hub, means of connecting said reciprocating shaft to the runner vanes for rotating them, a worm on said reciprocating shaft, a worm nut and gear, a rack adapted to actuate said gear, means for actuating said rack extending from the rack to a point outside of a draft tube enclosing said runner, gates for adjusting the flow of liquid over the runner through the draft tube and means connected to said rack for the simultaneous adjustment of said gates.

8. In a hydraulic turbine, the combination of a runner, adjustable buckets thereon, means exterior of said runner and extending from a point below it upwardly into the runner for adjusting said buckets, streamlined supporting means inclosing and supporting said adjusting means below the runner, and constituting water guiding means for guiding the water flowing from the runner.

9. In a hydraulic turbine, the combination of a runner, adjustable buckets thereon, means exterior of said runner and extending from a point below it upwardly into the runner for adjusting said buckets, streamlined supporting means inclosing and supporting said adjusting means below the runner and constituting water guiding means for guiding the water flowing from the runner, bucket means controlling the introduction of water into the runner, and means interconnecting said bucket adjusting means and said means controlling the introduction of water into the runner for simultaneous operation and adjustment.

GEORGE A. BIGGS.