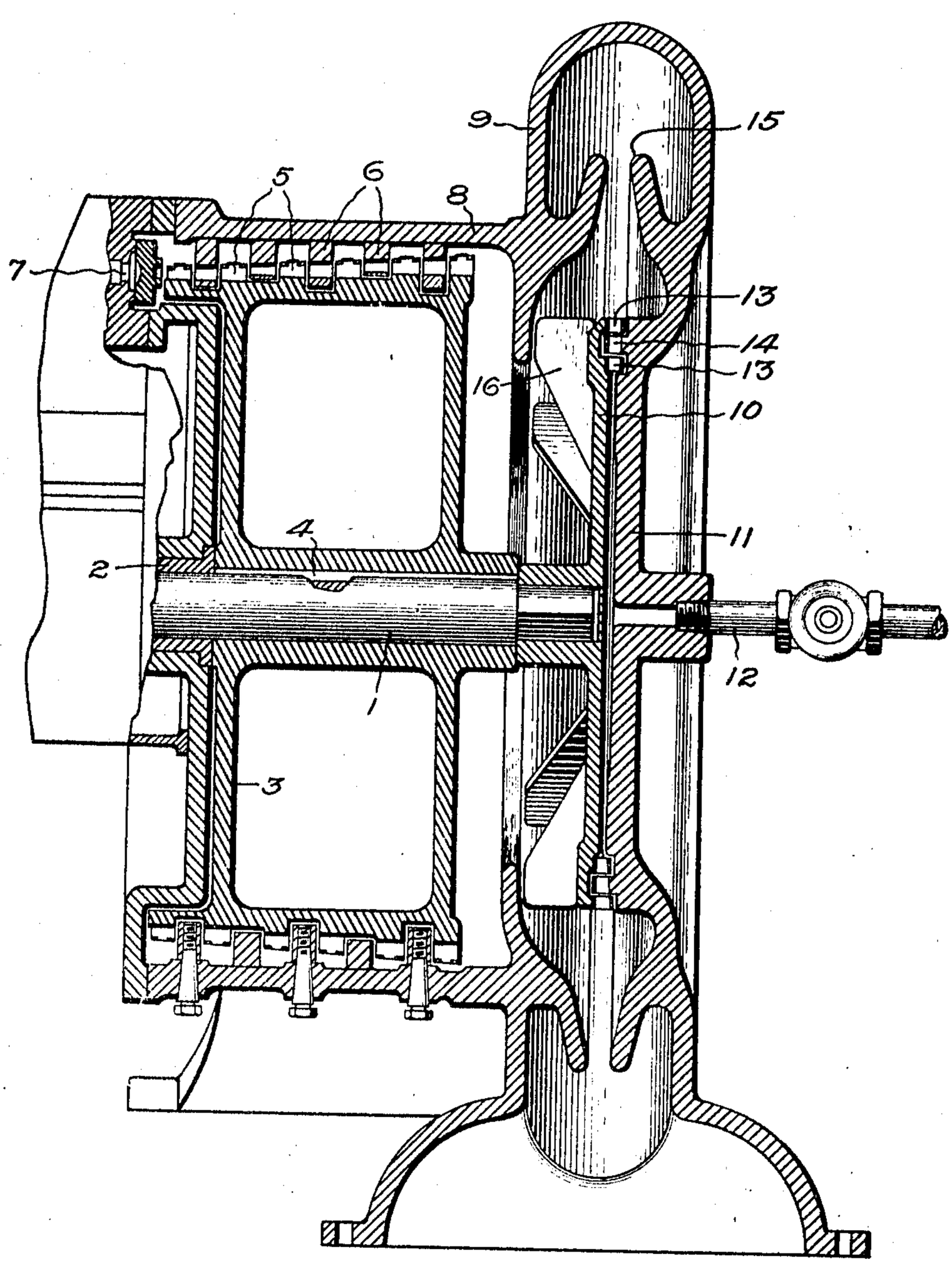
E. THOMSON.

BALANCING MEANS FOR TURBINES.

APPLICATION FILED MAR. 19, 1907.

969,734.

Patented Sept. 6, 1910.



Witnesses:

Marcus L. Byng.

J. Ellis Glen.

Inventor,

Elihu Thomson,

By Albert G. Davis

Att'y.

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

BALANCING MEANS FOR TURBINES.

969,734. Specification of Letters Patent. **Patented Sept. 6, 1910.**

Application filed March 19, 1907. Serial No. 363,219.

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Balancing Means for Turbines. of which the following is a specification.

This invention relates to elastic fluid turbines, and its object is to provide means for balancing the end thrust on the shaft caused by the steam or other elastic fluid flowing through the sets of buckets.

The invention has special reference to turbines of the axial flow, horizontal type, but is not necessarily confined thereto.

It consists, in brief, in a disk secured to the end of the shaft or at some other convenient point thereon, and inclosed in the casing of the turbine with one face adjacent to a stationary portion of said casing. Elastic fluid is admitted to the space between said disk and said stationary portion of the casing, the latter forming an abutment, so that the tension of the fluid exerts a pressure against the disk, tending to force it away from the abutment. The line of pressure is parallel with the axis of the shaft, and is arranged to be in opposition to the end thrust produced by the fluid acting on the buckets. If desired, the fluid escaping from between the disk and the abutment may be utilized to produce a torsion on the shaft by causing it to pass through suitable buckets and intermediates. The body of escaping steam or other fluid is directed through a contracted annular mouth into an enlarged exhaust chamber, and the effect of this contracted mouth is in the nature of an ejector, so that more or less of a vacuum is produced in the turbine casing. This effect may be heightened by placing fan blades on the disk.

The accompanying drawing is a longitudinal section of a horizontal turbine embodying my invention.

The shaft 1 journaled in a suitable bearing 2 carries the bucket wheel or drum 3, which is secured to said shaft by a key 4 or otherwise. The drum is provided with a plurality of rows of buckets 5, suitably spaced apart to admit the stationary intermediates 6 between them. Steam or other elastic fluid is supplied to the first ring of buckets through suitable nozzles or other fluid discharging devices 7, expanding or otherwise, and flows from one set of buckets to the next along the entire length of the drum, escaping finally into the casing 8, which incloses all the working parts, and is constructed with an annular exhaust passage 9.

A disk 10 is secured to the shaft, preferably in the plane of the exhaust passage, as shown. One face of this disk is located near the flat head 11 of the casing, leaving a thin circular space between them, with which a pipe 12 communicates. Steam or other elastic fluid is conducted through this pipe and exerts a pressure against the disk, the head of the casing forming an abutment for the expanding steam. The area of the disk is so proportioned to the normal steam pressure that the end thrust caused by the impact of the steam upon the buckets is counterbalanced by the pressure on the disk.

If desired the periphery of the disk may be provided with radial buckets 13 coöperating with stationary intermediates 14 on the head 11. In any event, the steam escaping from between the disk and the head 11 flows into the exhaust passage 9; preferably through a contracted mouth 15 annularly disposed concentric with the disk. The effect of this contracted mouth is to produce an ejector action upon the fluid contents of the casing, so that the exhaust therefrom is rendered more positive. To assist in this action, the disk may, if desired, be equipped with fan blades 16, which by their centrifugal action force the exhaust steam toward the exhaust passage.

By reason of the reaction of the buckets on the periphery of the disk, the pressure in the space between the disk and the head 11 is maintained practically uniform, and owing to the congested passageway by which the steam must escape from this space, the amount so passing is comparatively small. Inasmuch as this is utilized to assist in the rotation of the shaft, the device is not a wasteful one.

If desired, I may provide a thrust collar or other equivalent device to accurately locate the rows of wheel and intermediate buckets and take up any unbalanced thrust not cared for by the disk and its associated parts. Such a device would compensate for

any changes in pressure of the fluid supplied to the chamber between the disk and the stationary abutment.

I have shown a turbine of the partial-flow impact type, but it is to be understood that the invention is of wide application and includes turbines of other types, as for example, those of the reaction type.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The combination with an elastic fluid turbine and its shaft, of a disk secured to said shaft, a casing, a surface in proximity to one face of said disk, a pipe communicating with the space between said surface and the disk and conveying elastic fluid whereby a pressure will be exerted on the disk in opposition to the end thrust on the shaft, and an ejector that is acted upon by the fluid exhausting from the turbine to decrease the pressure in the casing.

2. The combination with an elastic fluid turbine and its shaft, of a disk secured to said shaft, a casing, a stationary surface in proximity to said disk, means for admitting elastic fluid to the space between said disk and surface, buckets carried by said disk, and an ejector that is acted upon by the fluid exhausting from the turbine and also by that from said buckets.

3. The combination with an elastic fluid turbine and its shaft, of a disk secured to said shaft, a stationary casing inclosing said turbine and having a head in proximity to said disk, leaving a space between them with a congested outlet at the periphery of the disk, means for admitting elastic fluid to said space, and an ejector for decreasing the fluid pressure in the casing that is acted upon by the fluid exhausting from the turbine and also by that from the congested outlet.

4. The combination with an elastic fluid turbine and its shaft, of a disk secured to said shaft, a casing inclosing said turbine and having a head in proximity to said disk, means admitting fluid to the space between the disk and head, an exhaust passage communicating with said casing, and a contracted mouth receiving elastic fluid from said turbine and disk and discharging into said exhaust passage.

5. The combination with the shaft of an elastic fluid turbine, of a disk secured to said shaft and provided with fan blades, a casing inclosing said turbine and disk and having an annular exhaust passage, a contracted mouth discharging into said passage in the plane of the disk, and means for maintaining a substantially constant pressure of elastic fluid upon one face of said disk.

6. The combination with an elastic fluid turbine and its shaft, of a disk secured to the shaft, a casing having a head in proximity to said disk, means for admitting elastic fluid to the space between the disk and the head to exert a pressure in opposition to the end thrust on the shaft, means for restricting the escape of elastic fluid from said space and an annular contracted mouth which receives exhaust from the turbine and said restricting means for decreasing the fluid pressure within the casing.

7. An elastic fluid turbine, comprising a rotating element, buckets and fluid discharging devices which extract the energy from the fluid, and an exhaust conduit receiving fluid from the buckets, in combination with a balancing disk located at the low pressure end of the turbine, buckets thereon, and means for subjecting the disk to high pressure elastic fluid to balance end thrust, and an ejector which receives the exhaust from the buckets on said rotating element and disk and discharges the fluid into the said exhaust conduit.

8. In an elastic fluid turbine, the combination of relatively rotatable buckets, means admitting fluid thereto, a casing, a conduit receiving the exhaust from the buckets, a fan which receives fluid from the buckets, and an ejector which receives uncondensed exhaust vapor from the fan and discharges it into the exhaust conduit.

In witness whereof, I have hereunto set my hand this fifteenth day of March, 1907.

ELIHU THOMSON.

Witnesses:

JOHN A. MCMANUS, JR.,

HENRY O. WESTENDORP.