

No. 830,393.

PATENTED SEPT. 4, 1906.

J. WILKINSON.

ADJUSTABLE SUPPORTING MEANS FOR TURBINES.

APPLICATION FILED MAY 29, 1905.

2 SHEETS—SHEET 1.

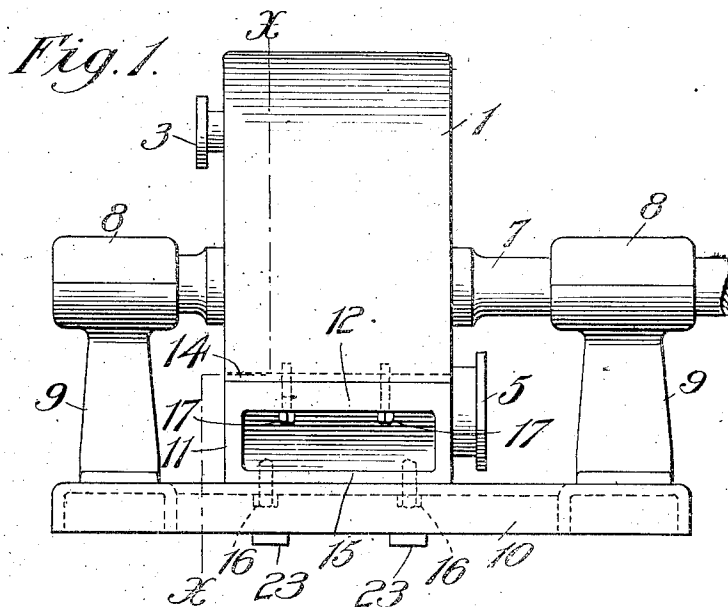


*Fig. 2.*

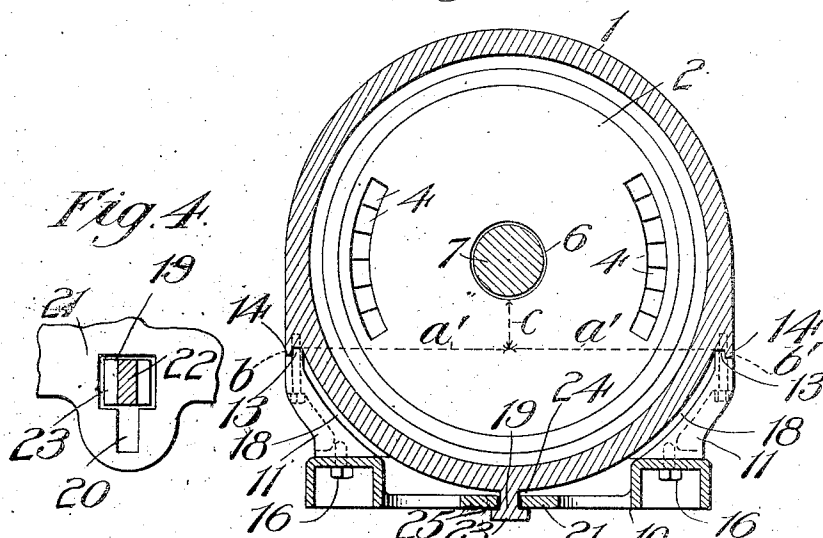
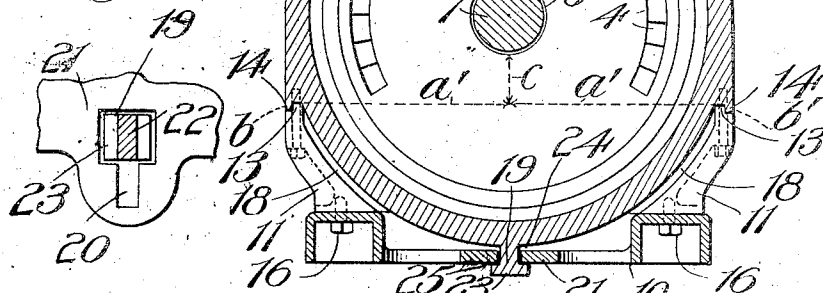


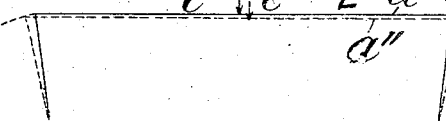
*Fig. 4.*



WITNESSES:

Edwin L. Bradford  
P. H. Burch

*Fig. 3.*



INVENTOR

James Wilkinson

BY

Attorney

No. 830,393.

PATENTED SEPT. 4, 1906.

J. WILKINSON.

ADJUSTABLE SUPPORTING MEANS FOR TURBINES.

APPLICATION FILED MAY 29, 1905.

2 SHEETS—SHEET 2.

*Fig. 5.*

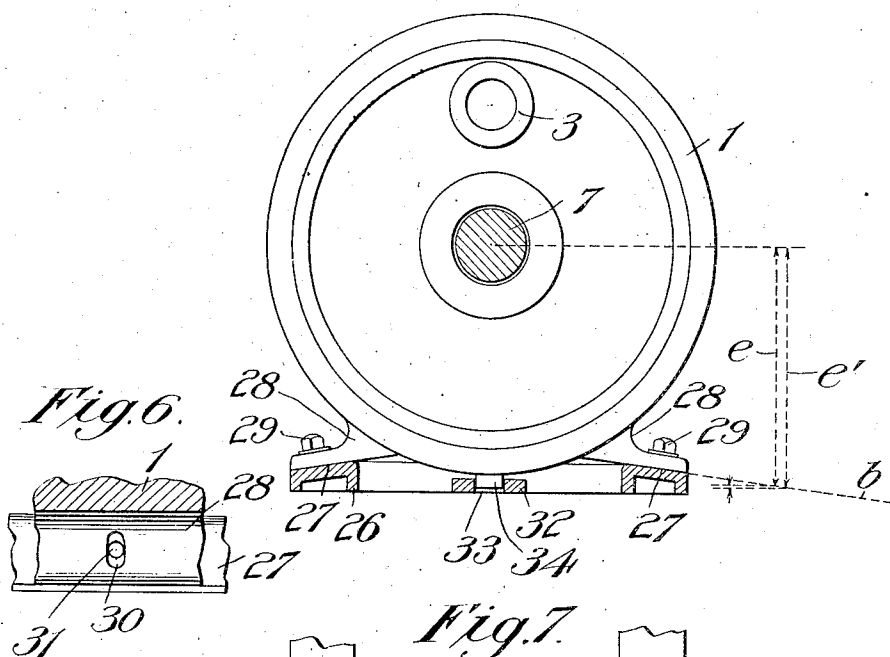
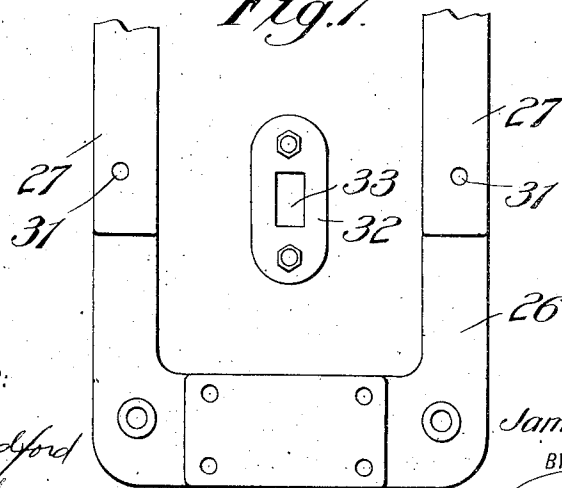


*Fig. 7.*



WITNESSES:

Edwin L. Bradford  
P. H. Burch

INVENTOR

James Wilkinson

BY

Wm. J. Johnson Jr.  
ATTORNEY

# UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO  
WILKINSON TURBINE COMPANY, A CORPORATION OF ALABAMA.

## ADJUSTABLE SUPPORTING MEANS FOR TURBINES.

No. 830,393.

Specification of Letters Patent.

Patented Sept. 4, 1906.

Application filed May 29, 1905. Serial No. 262,899.

*To all whom it may concern:*

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Adjustable Supporting Means for Turbines; of which the following is a specification.

My invention relates to supporting devices for turbine-casings designed to automatically maintain the alinement or adjustment of the stationary element surrounding the rotating part during changes in its dimensions caused by expansion or contraction.

The high speed of rotation of turbine-shafts and bucket-wheels and the close clearances between moving and stationary parts of this type of motor make it necessary that the accurate concentric adjustment of such parts should be maintained at all times when the turbine is in action. In practice it has been found that as the parts of the turbine become heated by the motor fluid changes will result in the relative positions of the stationary and moving parts, due to the fact that the latter are supported by bearings or pedestals which are unaffected by the temperature of the motor-fluid, whereas the stationary parts exposed to the high-temperature fluid expand from the point of contact with their supports and will have a tendency to move toward and come in contact with the rotating parts. In certain types of turbines this relative movement of parts necessitates the jacking up of the shaft or lowering of the casing as the turbine is being heated up, while in other types the large clearances between stationary and rotating parts capable of taking up this relative movement of parts are provided at the sacrifice of efficiency. It therefore being desirable to keep the stationary parts concentric to the rotating element at all times, I have conceived that this can be effected automatically by providing supports for the stationary parts disposed so that when the turbine-casing changes its dimensions through expansion or contraction the effect of this change of dimension is utilized to maintain the relative adjustment of the stationary and rotating parts, so that these parts at all times maintain their relative positions at different temperatures.

I desire to protect and claim, broadly, any form of supporting means for the stationary

parts of the turbine designed to act automatically responsive to changes in dimensions of or variations in the temperature in the turbine to maintain said parts concentric.

More specifically, I have illustrated two applications of my invention as applied to a turbine of the horizontal type and have shown the turbine shell or casing supported in the one case by inclined legs, which are set at an angle and connected to the casing at such a point as will cause them to swing to and from each other in an arc as the turbine-casing expands or contracts, this angular movement of the legs being caused by the change in dimension of the casing and acting automatically to maintain the alinement and relative adjustment of the stationary and revolving parts. In the other case the turbine rests upon the inclined supports, to which it is slidably connected, the action of the casing's expansion being to raise or lower it by an automatic adjustment on its inclined supports.

My invention further consists in the details of construction and arrangement of parts hereinafter described, and more particularly set out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 is an outside view of a turbine, showing one of the swinging supports for the casing in side elevation. Fig. 2 is a vertical sectional view taken along the line  $x-x$  of Fig. 1 and showing the casing-supports in end elevation. Fig. 3 is a graphic view of the effect of the expansion and contraction of the casing in automatically adjusting stationary parts relatively to the rotating parts by means of swinging supports. Fig. 4 is a detail plan view of a portion of the bed-plate and illustrating the manner of connecting the turbine thereto by means of a T-head and slot. Fig. 5 is an end elevation of a turbine mounted upon inclined stationary supports. Fig. 6 is a detail view illustrating the elongated bolt-openings in the casing-foot to permit of its adjustment. Fig. 7 is a plan view, broken away, of the bed-plate supporting the turbine.

Similar reference-numerals refer to the same parts throughout the drawings.

The type of turbine shown being merely illustrative and forming no part of my present invention may be briefly described as comprising an outer shell or casing 1 and a plurality of diaphragm-partitions 2, which

are held in place by said casing and serve to divide the turbine into stages or wheel-compartments. Motor-fluid pressure is supplied to the initial stage through a port 3 and flows through the succeeding stages, which have communicating nozzles 4, to an exhaust-port 5. The several diaphragms are provided with circular openings 6 at their centers, through which the turbine-shaft 7 passes, this shaft projecting beyond the supply and exhaust heads of the turbine and being suitably supported in bearings 8. These bearings are mounted upon pedestals 9, which in turn rest upon the bed-plate 10. A bucket-wheel is disposed in each stage-compartment of the turbine and connected to the shaft 7 between the diaphragm-partitions. Buckets carried by these wheels cooperate with the nozzles 4 and act to drive the turbine in the usual manner.

It will be noted that the opening 6 in the diaphragm leaves but a very small clearance between the shaft and diaphragm, this being a preferred construction to reduce to a minimum the leakage of pressure around the shaft between stages. If motor-fluid pressure, such as boiler-steam, be admitted to the turbine whose parts when cold assume the relative position shown in Fig. 2, the increase in temperature in the casing and diaphragm will cause them to expand and will increase their dimensions radially. If the casing be supported rigidly at its lower end, it will be evident that this expansion of the diaphragms will tend to raise the lower periphery of the opening 6 into contact with the shaft 7, since the latter will not change its position, due to the fact that its supporting-pedestals are unaffected by the heat and have no compensating movement corresponding with the vertical expansion of the diaphragms. In other words, this would raise the opening in the diaphragm until the latter by contact with the shaft might cause serious injury to the machine. To avoid these objections and to maintain the relative adjustment of parts, I mount the casing in accordance with the construction illustrated on Sheet 1 upon inclined supports 11, which are connected to each side of the casing at a point slightly below the shaft-opening in the diaphragm. These supports are preferably formed in the shape of a square frame, having an upper cross-piece 12, which extends the axial length of the casing and is provided with a shoulder 13, which interlocks with a flanged shoulder 14 along the side of the shell. The leg-supports 11 for each pedestal are inclined inwardly at an angle to the bed-frame, to which the bottom cross-piece 15 of the pedestal is suitably connected by bolts 16. Bolts 17 connect the cross-pieces 12 to the casing. The only point of contact between the supporting-pedestals and the casing is at the shoulder 13, the other portions of the pedes-

tals being separated by a space 18 from the sides of the casing, that may be packed with a heat-insulating material, so that the pedestals will not be affected by the heat of the casing. The pedestals on each side of the turbine are similar in construction and connected at opposite points on the casing.

In operation as the turbine becomes heated the expansion of the shell and diaphragm along the line  $a'$ , Fig. 2, will spring the pedestals outwardly around the arcs indicated by the curved dotted lines  $b$  and  $b'$ . This movement of the pedestals will cause a lowering of the casing sufficient to compensate the tendency of the expansion of the stationary casing and diaphragm to move the shaft-opening 6 upwardly and the diaphragm into engagement with the shaft. In other words, referring to Fig. 3, the expansion of the line  $a'$  will cause this line to be lowered to the position shown in the dotted line  $a''$ , and the extent of this lowering of the line will correspond with the increase in the dimensions of the diaphragm between the line  $a'$  and the shaft-opening due to expansion, as indicated by the lines  $c$  and  $c'$ . Thus, as will be seen from Fig. 3, as the stationary parts of the turbine expand the pedestals spring outwardly and the diaphragm is lowered automatically and in correspondence with the tendency of its expansion to move it into engagement with the shaft, and in a properly-constructed machine the opening in the diaphragm will remain concentric with the shaft.

I provide the casing with means to limit the range of its movements; due to the swing of its supports, and also to prevent any lateral movement of the turbine which might arise if one support should spring or bend more easily than the other. A pair of T-shaped lugs 19, formed integral with or detachably connected to the casing, are inserted into openings 20 in a portion 21 of the base-frame. By shifting the casing endwise the shanks 22 of the lugs enter the reduced portions of the openings 20, so that the heads of the lugs engage the base. The bed-frame is cut away from around the portion 21 to prevent the heat conducted to it through the lugs from expanding the bed-frame.

The clearances between the base-frame and the casing on one side and the heads 23 of the lugs on the other side may be so adjusted that the former, which is indicated at 24, will be open, when the turbine is cold, to an extent equal to the distance the casing and diaphragms will expand in a radial line. After this expansion has taken place the clearance 24 will be closed and the clearance indicated at 25 correspondingly opened. The lugs thus act to prevent an excess of casing movement, and, if desired, this excess movement may be taken advantage of to give the supports a slight initial tension either way.

The automatic adjusting-supports for the turbine (illustrated on the second sheet of drawings) comprise a base-plate 26, provided on each side with oppositely-sloping surfaces 27, upon which rest the angularly-disposed feet 28, connected to the turbine-casing. Bolts 29 secure the feet to the base, passing through elongated openings 30 in the feet and through openings 31 in the surfaces 27. The openings 30 are elongated, so that the feet 28 can slide on the bearing-surfaces 27 as the casing expands or contracts along the dotted lines, Fig 5. It will be evident that as the casing expands the feet will slide down the inclined surfaces 27, thus lowering the casing, and as they are drawn back up the inclines by the contraction of the casing the latter will be raised. The extent of the radial expansion of the casing and the requisite amount of travel of the feet 28 on the inclined surfaces is indicated in the dotted lines to the right of Fig. 5, where the difference in the lines *e* and *e'* represents the radial expansion of the diaphragm to be provided for and the distance between the intersections of these lines, and a line *b*, representing a projection of a sloping surface 27, gives the requisite extent of movement of the feet 28 upon the surfaces 27. To guide the turbine and preserve its vertical alinement, I provide a guide-plate 32, having an opening 33, into which projects a guide-lug 34, connected to or formed integral with the casing. This lug fits closely in the opening 33, and thus limits the movement of the casing to a true vertical line, the plate 32 being securely bolted to the foundation.

The swinging or sliding supports may be of any desired construction and may be attached at different points of the turbine-casing and in a different manner without departing from the spirit of my invention.

Without limiting myself to the details of construction shown, what I desire to claim and protect by Letters Patent is:—

1. The combination with a rotary motor comprising stationary and rotatable parts, of supporting means for said parts, the supporting means for one of said parts being adapted to act automatically responsive to temperature changes in the motor to maintain said stationary and rotatable parts concentric.

2. In an elastic-fluid turbine of the horizontal type, a shaft, a casing, separate supporting means for said shaft and casing, said supports for the casing being adapted to automatically coact with its changes in dimension and maintain its geometric center unchanged under varying temperature conditions.

3. The combination with a rotary motor comprising stationary and rotating parts, of separate supporting means for said parts disposed so as to be substantially unaffected by the changes in temperature of said parts one

of said supporting means being adapted to coact with the changes in dimension of the parts supported thereby, due to their expansion or contraction, to automatically maintain them in relative adjustment with the other parts under different temperature conditions.

4. The combination with a rotary motor comprising stationary and rotating parts, of a base-plate, and supporting devices for said stationary parts connected to said plate and capable of movement relative thereto, said movement being effected by the expansion or contraction of said stationary parts for adjusting them automatically with relation to said rotating parts.

5. The combination with a rotary motor having stationary and rotating parts, of a supporting means for the stationary parts comprising inclined members which are disposed on opposite sides of the motor and acted upon by the expansion of the stationary parts to raise or lower the latter.

6. The combination with a rotary motor having stationary and rotating parts, of a supporting means for the stationary parts comprising inclined members which are disposed on opposite sides of the motor and acted upon by the expansion of the stationary parts to raise or lower the latter, and guide means to prevent the stationary parts shifting laterally.

7. The combination with a rotary motor having stationary and rotating parts, of a supporting means for the stationary parts comprising inclined members which are disposed on opposite sides of the motor and acted upon by the expansion of the stationary parts to raise or lower the latter, and means to limit the vertical movement of said stationary parts.

8. In an elastic-fluid turbine comprising a casing, diaphragms having shaft-openings, and a shaft, of supports connected to each side of said casing and adapted to be spread or contracted by changes in the dimensions of said casing to raise or lower it and maintain said shaft-openings in the diaphragms substantially concentric with said shaft.

9. In combination, an elastic-fluid turbine comprising stationary and rotatable parts, said stationary parts comprising a casing, and inclined yieldable supporting members connected to said casing only on opposite sides thereof and acted upon by the changes in the dimensions of the casing to shift its position, for the purposes described.

10. A supporting means for an elastic-fluid turbine comprising inclined legs between which the turbine is suspended, said legs having a single point of connection to the turbine on opposite sides thereof and at other points being disposed out of contact with the turbine.

11. In combination with a turbine, sup-

porting means therefor between which the turbine is disposed, said means being connected to the turbine on opposite sides and spread apart by its expansion, and a guide to limit the resultant movements of the turbine to a straight line between its supporting means.

12. A supporting means for a turbine comprising a bed-plate, supporting members thereon, a casing for the turbine to opposite sides of which said members are connected and by the expansion and contraction of which said members are moved to change the position of said casing, and means to limit the movements of said casing to the same vertical line relative to said bed-plate.

13. The combination with a horizontal turbine having a casing, and shoulders on opposite sides of said casing, of pedestals on each side of the turbine for supporting it, which pedestals are connected to said shoulders and disposed out of contact with the cas-

ing at other points, and guide means to prevent the stationary parts of the turbine shifting laterally.

14. The combination with a horizontal turbine having a casing, and parallel shoulders axially disposed on each side of said casing, of supporting-frames on each side of the turbine, said frames being provided with an upper shouldered member which interlocks with a shoulder on each side of said casing and having inwardly-inclined legs which are adapted to be bent by the changes in the dimensions of said casing, said legs being disposed out of contact with said casing, and a main supporting member for said legs.

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

JAMES WILKINSON.

Witnesses:

SETH G. JAMESON,  
J. J. DEVENISH.