No. 811,678. PATENTED FEB. 6, 1906.

W. L. WATERS.

BALANCING DEVICE.

APPLICATION FILED DEC. 5, 1904.

Fig. 1.

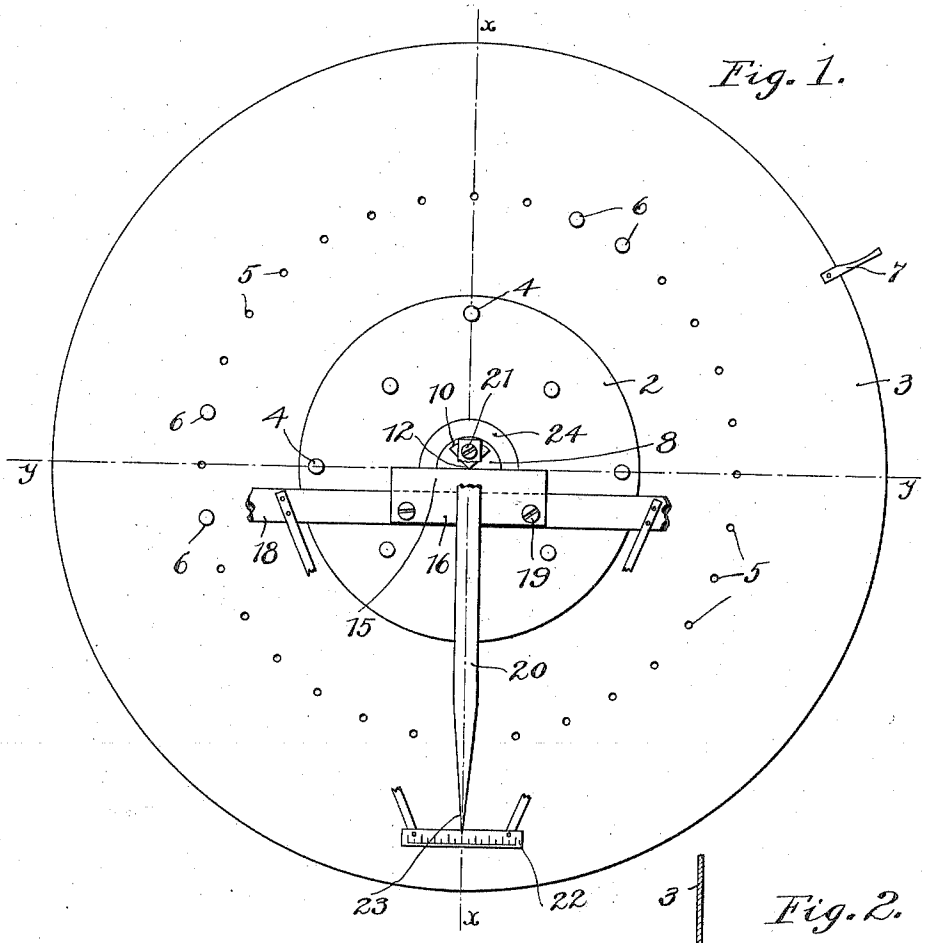


Fig. 2.

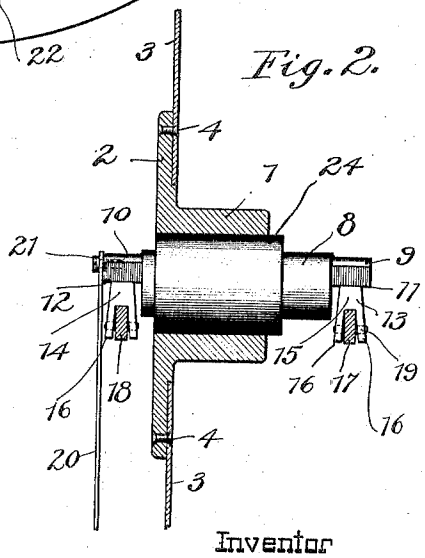


Fig. 3.

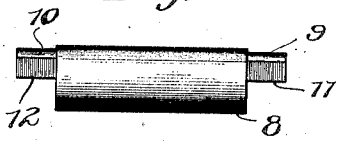
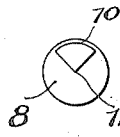


Fig. 4.



Witnesses

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WILLIAM L. WATERS, OF MILWAUKEE, WISCONSIN.

BALANCING DEVICE.

No. 811,678. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed December 5, 1904. Serial No. 235,457.

To all whom it may concern:

Be it known that I, WILLIAM L. WATERS, a subject of the King of England, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Balancing Devices, (Case No. 11,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to balancing apparatus; and its object is to provide an improved method and apparatus for balancing disks for turbines, pumps, or the like.

To procure efficient operation of turbines or pumps, it is necessary that the disks be absolutely balanced. Disks even when formed of supposedly-uniform material may be slightly unbalanced, and the unbalance is increased as buckets or mains are secured to the disk. I employ a novel method for compensating for deficiencies in weight which produce unbalancing, and each disk therefore is provided with a series of holes extending in a circle concentric with the disk or otherwise, which holes are adapted for the reception of rivets. I also provide an improved balancing apparatus for determining where these rivets must be placed to produce balance. This apparatus consists of a spindle upon which the disk to be balanced is mounted, this spindle having knife-edges coincident with the axis of the spindle for engaging balancing-ways, an indicating-needle being secured to the spindle and a scale for the needle being provided. Across the disk to be balanced are drawn two perpendicular diametrical axes. The disk is first mounted on the spindle with one of the axes parallel to the center line of the needle, which extends through the line of the knife-edge. Rivets are now inserted in the proper openings to balance the disk with respect to this axis, whereupon the disk is mounted upon the spindle with its other axis in line with the needle and more rivets, if necessary, are added to produce balance with respect to this other axis, and after such operations the disk will be in perfect balance.

The exact method of balancing and the construction of the apparatus therefor will be best understood with reference to the accompanying drawings, in which—

Figure 1 is a more or less diagrammatic view illustrating a disk mounted on the balancing-spindle with its axes parallel to the side of the needle. Fig. 2 shows the construction and arrangement of the balancing-apparatus parts. Fig. 3 is a side elevation of the disk-supporting spindle and the pivot edges, and Fig. 4 is and end view of Fig. 3.

The disk I have illustrated consists of a hub portion 1, having a flange 2, to which is secured the sheet-metal disk 3 by means of rivets 4. A series of holes or openings 5 is drilled or punched through the disk 3 and may be arranged in any manner—for instance, in a circle, as shown in Fig. 1. These openings or holes are intended for the reception of rivets 6. As buckets, such as 7, are secured to the periphery of the disk, more or less unbalance of the entire bucket-wheel about its axis is produced, and this unbalance must be compensated for and corrected to procure efficiency.

The spindle 8 of the balancing apparatus has extensions 9 and 10 from the ends thereof, these extensions being beveled down to form knife-edges 11 and 12, which coincide with the axis of the spindle 8. These edges rest on hardened-steel supports 13 and 14, which are shown as consisting of a body part 15 and legs 16. These supports saddle over parallal balancing-ways 17 and 18, and by means of set-screws 19, passing through the legs 16, these supports may be secured to the balancing-ways at any point thereof. An indicating-needle 20 is secured to the end of the extension 10 by means of a screw 21, the center line of the needle extending perpendicularly through and from the knife-edge. A scale 22, which may be suspended from the balancing-ways, is disposed so that the point 23 of the needle will rest at the zero-point of the scale when the needle is in vertical position.

As the extensions 9 and 10 are disposed above the axis of the spindle 8, the spindle will be unbalanced; but the weight of the needle 20 is such as to neutralize the effect of the extensions and to perfectly balance the spindle, so that it will remain in any position to which it is rotated about the knife-edges. To secure the disk to be balanced to the spindle, a bushing 24 is provided, which snugly fits the spindle and the bore in the hub 1 of the bucket-wheel. Bushings of various sizes may be used to fit the varying sizes of bore of the bucket-wheels.

Before the bucket-wheel is mounted on the balancing apparatus axes X and Y are drawn across the face thereof, as shown in Fig. 1.

For the first operation of balancing the bucket-wheel is mounted so that the X axis coincides with the central line of the needle. If the point of the needle moves to either side of the zero-point, the bucket-wheel is out of balance, and one or more rivets 6 are inserted in the appropriate holes 5 to restore the wheel to perfect balance with respect to the axis X. The bucket-wheel is then turned until the Y axis coincides with the needle center line and the same operation performed to restore the wheel to balance with respect to this axis, and after these two operations the wheel will be in perfect balance.

The ways 17 and 18 may be of any length to allow for any number of balancing apparatus.

Other changes in construction and arrangement of the parts may also be made without departing from the spirit of invention, and I do not, therefore, wish to be limited to the exact arrangement and construction shown.

I claim as new, however, and desire to secure by Letters Patent—

1. In balancing apparatus for disks or wheels, the combination of a spindle upon which the disk or wheel to be balanced is mounted, there being V-shaped extensions from said spindle provided with knife-edges, supports for said spindle engaged by said knife-edges, a needle extending from one of said extensions, and an indicating-scale for said needle.

2. In balancing apparatus for balancing wheels or disks, the combination of a spindle upon which the wheel or disk to be balanced is mounted, said spindle being provided at its end with pivoting knife-edges, supports for said spindle engaged by said pivot edges, an indicating-needle extending from said spindle, and an indicating-scale for said needle.

3. In balancing apparatus for balancing wheels or disks, the combination of a spindle upon which the wheel or disk to be balanced is mounted, there being extensions from said spindle provided with knife-edges coincident with the axis of the spindle, supports for said spindle engaged by said knife-edges, an indicating-needle extending from one of said extensions, and a scale for said indicating-needle.

4. In a balancing device for balancing wheels or disks, the combination of a spindle upon which the disk or wheel to be pivoted is mounted, there being extensions from the ends of said spindle having knife-edges coincident with the axis of the spindle, bearings engaged by said knife-edges, balancing-ways upon which said bearings are mounted, an indicating-needle extending from one of said extensions, and an indicating-scale for said needle.

5. In a balancing device for balancing wheels or disks, the combination of a spindle upon which the wheel or disk to be balanced is mounted, there being extensions from the ends of said spindle disposed above the axis thereof, having knife-edges disposed coincident with the axis of the spindle, bearings engaged by said knife-edges, parallel balancing-ways separably engaged by said bearings, an indicating-needle secured to one of said extensions and extending downwardly therefrom with its center line extending perpendicularly through the axis of the spindle, and an indicating-scale for said needle.

6. In a balancing device for balancing wheels or disks, the combination of a spindle upon which the wheel or disk to be balanced is mounted, there being extensions from the ends of said spindle disposed above the axis thereof, said extensions having knife-edges at the lower end thereof disposed coincident with the axis of the spindle, steel bearing plates engaged by said knife-edges, parallel supporting-ways upon which said bearings are movably mounted, an indicating-needle secured to one of the extensions and extending downwardly therefrom with its center line passing through the axis of the spindle, and an indicating-scale for said needle, the weight of the needle below the axis of the spindle being such as to balance the weight of the extensions above the axis of the spindle.

In witness whereof I hereunto subscribe my name this 1st day of December, A. D. 1904.

WILLIAM L. WATERS.

Witnesses:
JOHN E. HUBEL,
W. S. MAY.