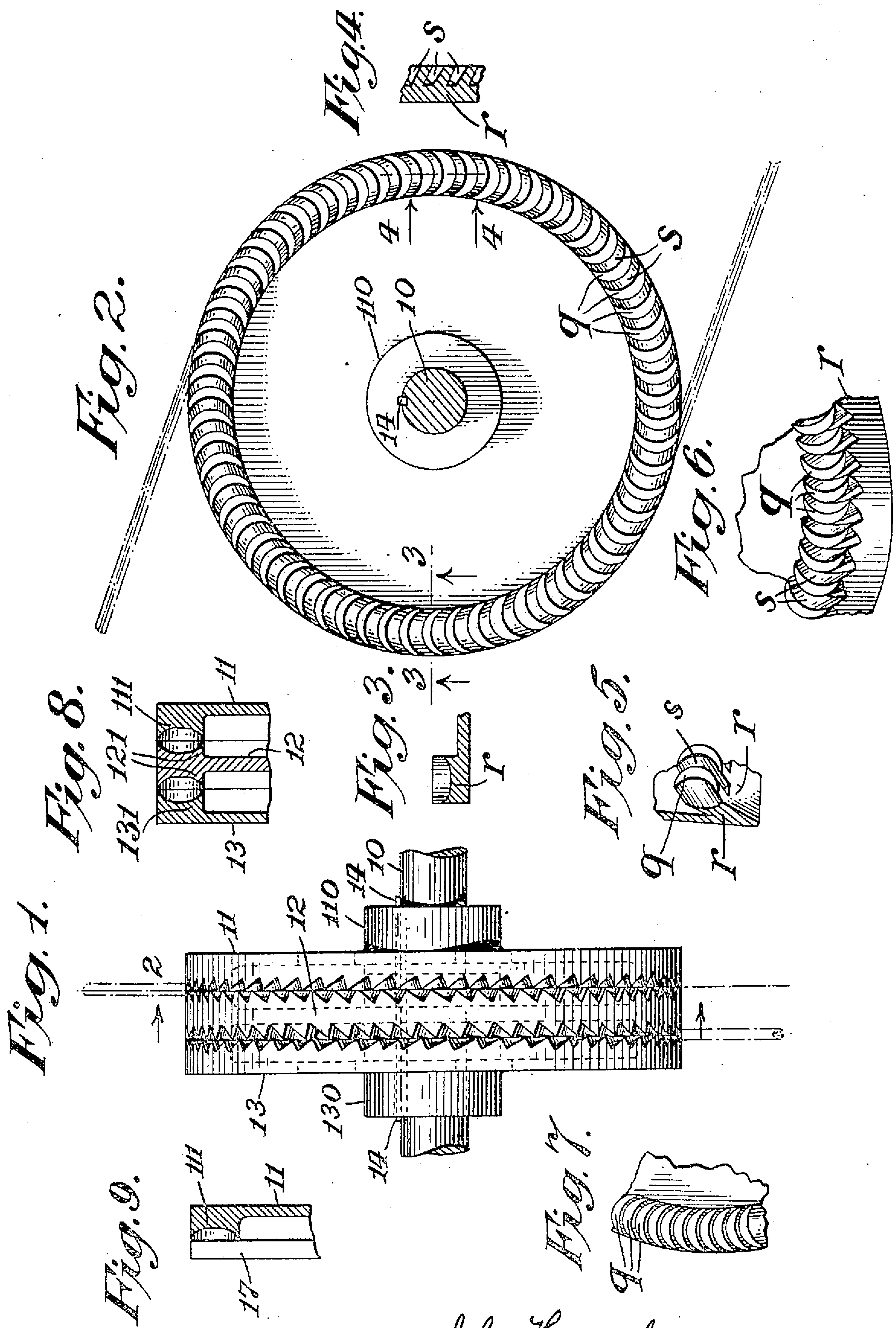
J. HORMBY.

TURBINE.

APPLICATION FILED JUNE 19, 1908.

927,534. Patented July 13, 1909.



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UNITED STATES PATENT OFFICE.

JOHN HORMBY, OF SPRINGFIELD, MASSACHUSETTS.

TURBINE.

No. 927,534. Specification of Letters Patent. Patented July 13, 1909.

Application filed June 19, 1908. Serial No. 439,285.

To all whom it may concern:

Be it known that I, JOHN HORMBY, a citizen of the United States, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Turbine-Motors, of which the following is a specification.

This invention relates to motors of the turbine type, and its novelty consists in the construction and adaptation of the parts as will be more fully hereinafter pointed out.

The motor consists primarily of a series of disks or plates mounted upon and firmly secured to a shaft which is supported in suitable bearings and which rotates when the disks are caused to be rotated under the influence of the propelling fluid. Like similar devices, it is provided with peripheral vanes or buckets, but in this device they are arranged in a novel and efficient manner.

The jet of propelling fluid, preferably steam, is directed tangentially against the periphery of each disk, and it is obvious that the efficiency of the motor increases in proportion as the number of vanes subjected to the influence of the propelling fluid is increased over a given arc, but under usual conditions the number of vanes is limited because of the difficulty of making them and securing them properly to their respective disks, and also because of the lack of rigidity and strength when they are so made and secured. I overcome these difficulties by making the vanes integral with the periphery of each disk, in effect forming them out of its substance, and arranging them in a peculiar manner, and I have secured in so doing certain other desirable results which will be hereafter pointed out.

In the drawings, Figure 1 is a front elevation of one form of motor embodying my invention; Fig. 2 is a side elevation of the right hand disk shown in Fig. 1, looking from left to right in that figure; Fig. 3 is a section on the plane of the line 3—3 in Fig. 2; Fig. 4 is a section on the plane of the line 4—4 in Fig. 2; Fig. 5 is a perspective of two of the vanes and a portion of the disk to which it is attached; Fig. 6 is a perspective of a number of the vanes and a portion of the disk to which it is attached, and Fig. 7 is a side elevation of a portion of the disk and its vanes when they are arranged closer together than in the form of device illustrated in Fig. 2; Fig. 8 is a radial section through the rims of the disks shown in Fig. 1, and Fig. 9 is a radial section of a rimmed disk in combination with a plane disk.

It should be said that owing to the curvature and obliquity of the vane surfaces illustrated certain optical delusions arise in looking at the drawings and these must be sought for and eliminated by the observer in order to understand the real construction and arrangement of the parts, but it seems impossible to avoid such delusions in a line of drawing.

In the drawings, 10 is a shaft supported in suitable bearings (not shown) which is adapted to be rotated by the power developed in the motor, and from which shaft the power is taken by means of pulleys, gearing, cranks, or other transmitting mechanism, as may be desired, worm gearing being preferred.

Disks 11, 12 and 13 are firmly secured to the shaft 10 in any suitable manner. In the form of device illustrated the disks 11 and 13 are shown supplied with hubs 110 and 130, respectively, and secured to the shaft by keys indicated at 14. They are ground steam tight and screwed together. The disk 11 is provided with a laterally projecting peripheral rim 111 wider than the general width of the disk and which rim is provided with vanes 112 against which the current of steam or other propelling fluid is caused to impinge. Similarly the disk 13 is provided with a laterally projecting peripheral rim 131 and with vanes 132 and the disk 12 is provided with a rim 121 extending on both sides of the disk and each of the faces of which is provided with vanes 122.

All of the vanes 112, 122 and 132 are made substantially alike, and a description of the vanes 112 of the disk 11 will apply equally well to those of the other disks.

Supposing the disk 11 to be placed in the position shown in Fig. 2, the vanes 112 are each cut out of its rim by means of a cylindrical tool or cutter, the axis of which is kept oblique to the general surface of the rim 111 during the cutting operation forming a series of substantially radial slits 3, each one of which is oblique to the general surface *r* of the rim and each one of which is in the shape of a crescent *q*. Between these slits *s* are left the vanes 112, each crescent shaped, and with the horns of the crescent arranged practically in the line of the same radius. Each vane has the outer horn *m* of its crescent lying in the periphery of the rim 111 and its inner horn *n* lying in the inner edge of such rim and each is provided with surfaces *l* which are oblique to the general flat surface of the disk and rim.

It is possible with a fine cutting tool to cut a relatively large number of vanes along the rim of each disk. The horn end of each crescent is only one-half of its depth at its center. This enables one to make double or more than the usual number of vanes, and each of these vanes is relatively short and thick and is of adequate strength to receive the impact of the propelling fluid and transmit the energy so developed.

Each vane or bucket is in reality only one-half of the usual width and I therefore identify this peculiar form by calling them "demi-vanes" or half vanes.

The general outer surface of each rim 111, 121 and 131, except as its continuity is interrupted by the slits *s*, is a plane parallel with the flat surface of each disk and perpendicular to the axis of the shaft 10. A flat disk can, therefore, be secured against such rim as shown in Fig. 9 (where the disk is indicated by the reference numeral 17) and such flat disk may either be mounted on the same shaft as the vaned disk or serve purely as a guiding surface for the latter. The manner in which I prefer to arrange the disks, however, is shown in Fig. 1. In this figure it will be noted that the disks 11 and 13 have the demi-vanes on the inner faces of their rims while the central disk 12 has the demi-vanes on the outer faces of its rims. The slits *s* between the demi-vanes on the disks 11 and the adjacent slits between the demi-vanes on the disk 12 are inclined toward the observer standing in front of Fig. 1, while the slits between the demi-vanes on the disks 13 and the adjacent slits between the demi-vanes on the disk 12 are inclined from the observer. Therefore, if the stream of propelling fluid is directed against the first two series of demi-vanes, or between the disks 11 and 12, the disks and shaft will rotate in the direction of the hands of a watch (as shown in Fig. 2) while, if the stream of propelling fluid is directed against the second series of demi-vanes between the disks 12 and 13, the disks and the shaft will rotate in the reverse direction.

It will be noted that in each adjacent series, the demi-vanes incline away from each other. It, therefore, follows that any side thrust of the steam commonly developed in motors of this class is taken up and neutralized and the shaft rotates easily in its bearings without any injurious vibration or reciprocation, leaving only such a slight vibration as will be sufficient to move the shaft to lubricate its bearings.

The injurious side thrust is more completely eliminated if the demi-vanes of the adjacent series are staggered as shown in Fig. 1. When this last mentioned arrangement is employed any tendency to injurious vibration is at once eliminated and the rotation of the shaft in its bearings is free and remarkably uniform in its character.

What I claim as new is:—

1. In combination, a circular supporting disk, and a series of turbine demi-vanes crescent-shaped in cross section formed upon said disk at an inclined angle thereto uniform through the series, and with their concave surfaces away from their propelling jet, for the purpose specified.

2. In combination, a circular supporting disk, and a series of turbine demi-vanes crescent-shaped in cross section formed upon said disk, and extending laterally therefrom, at an inclined angle thereto, uniform throughout the series, and with their concave surfaces away from their propelling jet, for the purpose specified.

3. A shaft, a turbine disk mounted thereon, crescent-shaped vanes projecting laterally from and at an angle to said disk, and terminating in a common plane, and an adjacent disk in contact therewith, along said plane.

4. A shaft, two turbine disks mounted thereon having rims projecting toward each other and each provided with demi-vanes, the outer surfaces of the vanes on both disks being parallel to the same plane.

5. A shaft, two turbine disks mounted thereon having rims projecting toward each other and each provided with demi-vanes oblique to the planes of their respective disks.

6. A shaft, two turbine disks mounted thereon having rims projecting toward each other and each provided with demi-vanes oblique to the planes of their respective disks, the vanes of the two disks being at an angle to each other.

7. A shaft, two turbine disks mounted side by side thereon, each disk having demi-vanes projecting toward each other and contacting in a common plane, the vanes of the two disks being at an angle to each other.

8. A shaft, two turbine disks mounted side by side thereon, each disk having demi-vanes projecting toward each other and contacting in a common plane, the vanes of the two disks being at an angle to each other, the openings between them being staggered.

9. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disks having two series of outwardly projecting demi-vanes.

10. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, the inwardly projecting demi-vanes of one series meeting

the outwardly projecting demi-vanes of the adjacent series in a common plane.

11. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, the vanes of two of the adjacent series being staggered.

12. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, all of the vanes being oblique to their respective disks.

13. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, all of the vanes being oblique to their respective disks, and those of one series being arranged at an angle to those of the adjacent series.

14. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, all of the vanes being oblique to their respective disks, the oblique surfaces being substantially cylindrical.

15. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, all of the vanes being oblique to their respective disks, and those of one series being arranged at an angle to those of the adjacent series, the oblique surface being substantially cylindrical.

16. A shaft, three turbine disks mounted thereon in series, the two outer disks having a series of inwardly projecting demi-vanes and the inner disk having two series of outwardly projecting demi-vanes, all of the vanes being oblique to their respective disks, and those of one series being arranged at an angle to those of the adjacent series, and those of the second series being arranged at a different angle to those of its adjacent series.

Witness my hand this 17th day of June, 1908, at the city of New York, in the county and State of New York.

JOHN HORMBY.

Witnesses:
HERMAN MEYER,
WILLIAM R. BAIRD.