

No. 840,457.

PATENTED JAN. 1, 1907.

H. P. HILL.
STEAM TURBINE.
APPLICATION FILED JULY 20, 1906.

2 SHEETS—SHEET 1.

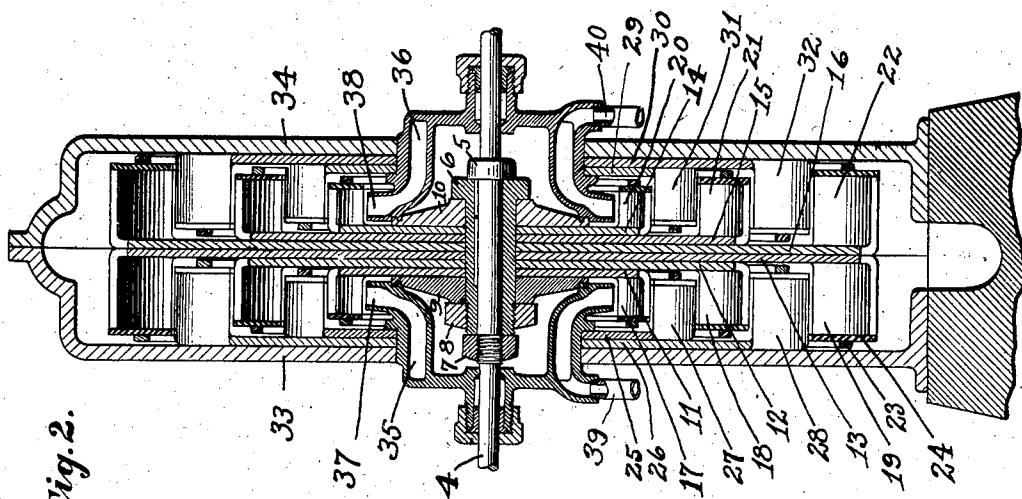


Fig. 2.

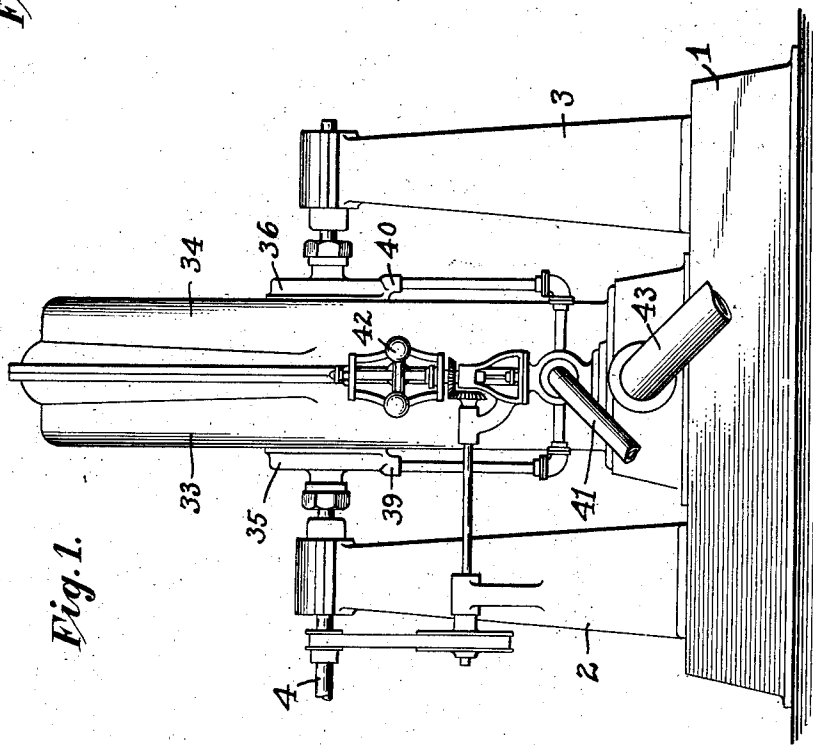


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

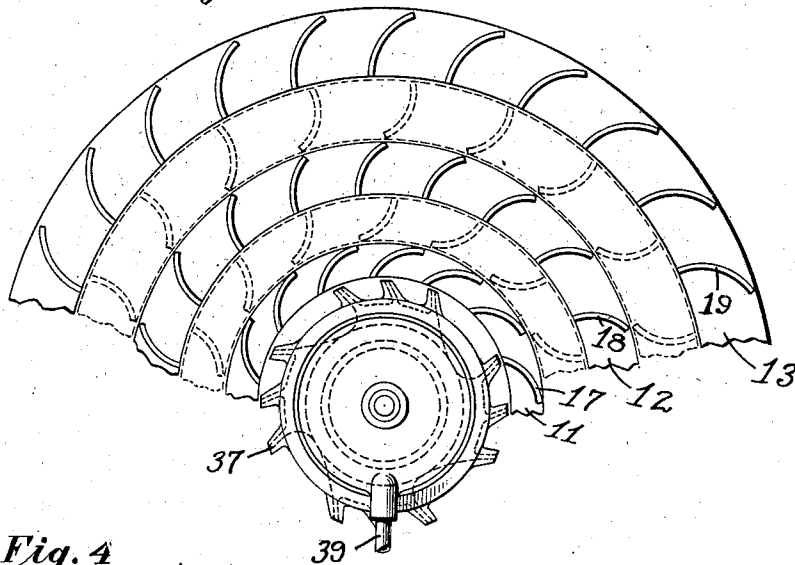


Fig. 4.

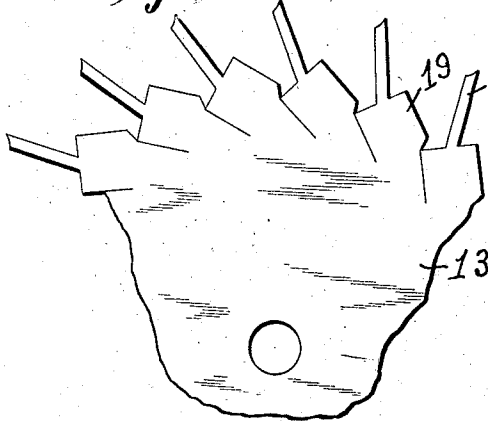


Fig. 5.

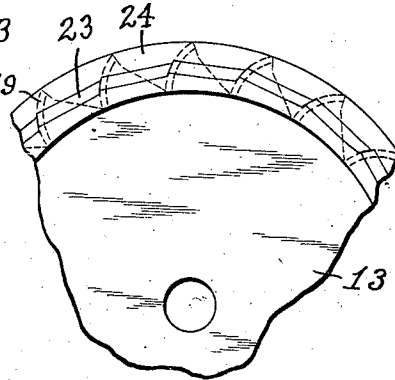


Fig. 7.

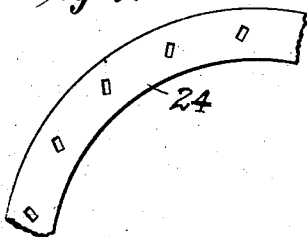
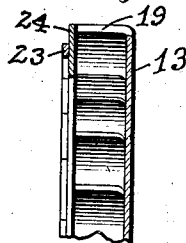


Fig. 6.



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UNITED STATES PATENT OFFICE.

HALBERT PAUL HILL, OF NEW YORK, N. Y.

STEAM-TURBINE.

No. 840,457.

Specification of Letters Patent.

Patented Jan. 1, 1907.

Application filed July 20, 1906. Serial No. 327,080.

To all whom it may concern:

Be it known that I, HALBERT PAUL HILL, a citizen of the United States, and a resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

This invention relates to steam-turbines, and has for its object the production of a device of this nature which shall embrace all of the advantages of the present existing types of turbines, such as the Parsons, Curtis, Allis-Chalmers, and De Laval.

One of the principal objects of my invention is to provide a turbine which shall be very compact and which shall occupy much less space for a given power than any of the present existing types. This also results in a great reduction in the weight of the engines.

Other objects will be in part obvious and will in part appear in connection with the description of the turbine shown in the accompanying drawings, which illustrate one embodiment of my invention.

Figure 1 is a side elevation of one form of a steam-turbine embodying my invention. Fig. 2 is an enlarged vertical cross-section showing the interior construction and arrangement of the buckets and supports. Fig. 3 is a side view of a portion of the bucket-supports, showing the relative arrangement of the rotatable and fixed buckets. Fig. 4 is a view of a portion of the disk from which the buckets are formed, showing the same before being bent into position. Fig. 5 is a view of a portion of the disk, similar to Fig. 4, showing the buckets bent into position. Fig. 6 is a cross-sectional view of a portion of Fig. 5. Fig. 7 is a detailed view of a portion of the supporting-ring.

One of the features of my invention which enables me to accomplish the desired results is in the arrangement of the buckets or blades upon which the steam is caused to operate. In the preferred construction these buckets are formed in series by stamping the same from a single sheet or disk of metal in a circle, and by bending these portions at right angles to the disk, at the same time giving to it the proper curvature, I provide a series of buckets which are not only simple and cheap to manufacture; but one in which all the buckets will be exact duplicates of one another on account of the fact that each one is produced by the same operation of stamp-

ing. Any number of these series of buckets may be provided, each series being constructed, as above described, from a single sheet of metal, but on a larger circle than the preceding series.

Both the rotating and the fixed series of buckets may be made in exactly the same manner, each having its circle of buckets of such a size that when the same are placed in position in the engine in the manner described hereinafter in connection with the drawings a radially-extending path for the steam will be provided.

The steam is admitted at the center to a steam-chest and discharged by means of suitable ports against the first series of buckets and in expanding passes in successive stages in a radially-extending path from the first series of rotating buckets to the first series of fixed buckets in a similar manner through the several stages or series to the circumference of the casing to the exhaust.

The buckets or blades are given the proper curvature to attain the most efficient results. The amount of curvature, as well as the number and arrangement of blades, is the result of a great number of experiments and calculations with engines of this type in order to attain the best results.

The steam is admitted at the center at its highest pressure and expands as it passes to the circumference. The number of buckets, as well as the space in each successive stage, also increases on account of the increasing diameters upon which the same are constructed.

The rotating member may be constructed by placing the disks from which the several series or stages of buckets or blades are stamped back to back, so that the buckets extend in opposite directions. A corresponding number of fixed buckets similarly constructed are so positioned that they extend intermediary of the successive stages or series of rotating buckets from both sides. The object of providing such an arrangement is to avoid the end thrust which would be present if buckets were provided at one side only of the rotating member, resulting in a perfectly-balanced engine with no end thrust.

One of the features of the construction of the buckets or blades is in providing a projection at the outer end of each blade as the same are stamped from the sheet or disk of metal above described.

A ring provided with openings adapted to

receive these projections may then be placed in position over the ends of the buckets after the same have been bent up at right angles to the disk from which they are stamped.

5 The projections extending through the openings in this ring may then be bent down at a right angle, so as to engage the adjacent buckets, thus forming a brace for the same and providing a very solid and rigid construction. These projections may be used with-
10 out the ring in the smaller sizes, if desired.

It is thus seen that I have provided a steam-turbine which on account of the construction and arrangement of the several
15 stages of buckets or blades is very light in weight for a given horse-power on account of the buckets being formed from a sheet or disk of metal, which thus forms at the same time a support for the same. In the larger
20 sizes of engines the buckets may be formed from separate pieces and set into the disk-supports, if desired.

On account of the radial path provided for the steam a very compact construction taking
25 up very little space is provided and also enables the doing away with the end thrust by locating the several series of buckets on opposite sides of the rotating member, resulting in a balancing of the pressure of the
30 steam.

I have thus set out the general features of a construction embodying my invention, and I will now describe in detail the construction illustrated in the accompanying drawings.

35 Upon a suitable standard or base 1 is mounted the supports 2 and 3, in which is journaled the shaft 4. This shaft may be provided with a shoulder or collar 5, against which the supporting member 6 may be held
40 in position by means of a nut 7. This member is also keyed to the shaft 4 and is provided with a nut 8, which holds the retaining members 9 and 10 in position to clamp the bucket-supporting disks 11, 12, and 13 on
45 one side and 14, 15, and 16 on the opposite side in position, as shown in Fig. 2. The buckets 17, 18, and 19 are formed from the disks 11, 12, and 13, and the buckets 20, 21, and 22 are formed from the disks 14, 15, and
50 16 by first punching the same from a flat disk of metal in the form shown in Fig. 4 and then bending the same into the form shown in Figs. 3 and 5. The projection 23, which is formed on each of these buckets, passes
55 through openings provided in the ring 24 and are then bent over the outside of this ring and are of such a length that they then engage the adjacent bucket.

The buckets and supports just described
60 are attached to the shaft and form the rotatable members. The fixed buckets may be formed in a similar manner from the disks 25 and 26, as shown at 27 and 28, on one side of the rotating member, and a similar set of
65 fixed buckets may be formed from the disks

29 and 30, as shown at 31 and 32 on the opposite side of the rotating member.

The fixed buckets and disks may be attached to the casing, which may be formed in two parts, as shown at 33 and 34, which
70 may be secured together in any suitable manner.

A centrally-located steam-chest 35 is provided on one side and a similar steam-chest 36 on the opposite side of the rotating member. These steam-chests are provided with
75 suitable discharge-nozzles 37 and 38, which may be positioned with relation to the buckets as shown in Fig. 3.

A joint is preferably provided between the
80 steam-chests 35 and 36 and the retaining members 9 and 10, as shown in Fig. 2. The purpose of this joint is to reduce the space in which the steam can expand and also to prevent leakage. Stuffing-boxes may also be
85 provided around the shaft 4, as shown.

The steam is admitted to the steam-chests 35 and 36 by means of suitable pipes 39 and 40 from a supply-pipe 41. A governor 42
90 may also be provided to control the steam inlet. The steam after passing the several stages of buckets is discharged into an exhaust-chamber provided around the periphery of the casing and is finally discharged
95 through an exhaust-pipe 43.

What I claim is—

1. In a steam-turbine, a series of buckets formed by bending the same up at an angle from a single piece of material, and means for admitting steam for operating said buck-
100 ets.

2. In a steam-turbine, a series of buckets formed by bending the same up at an angle from the periphery of a disk, and means for admitting steam for operating said buckets.
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3. In a steam-turbine, a plurality of-series of buckets, each series being formed by bending the same up at an angle from the periphery of a disk and the buckets in the several series being formed in concentric circles, and
110 means for admitting steam for operating said buckets.

4. In a steam-turbine, a series of buckets formed by bending the same up at an angle from a single piece of material, each bucket
115 being formed with a projecting portion adapted to engage the adjacent bucket of the series, and means for admitting steam for operating said buckets.

5. In a steam-turbine, a series of buckets
120 formed by bending the same up at an angle from a single piece of material, each bucket being formed with a projecting portion, a flat ring positioned over the outer ends of said series of buckets and having openings therein
125 through which said projections may be passed to hold the same and the buckets in position, and means for admitting steam for operating said buckets.

6. In a steam-turbine, in combination, a
130

plurality of series of rotatable buckets, each series being formed from a single flat disk of metal and bent up at an angle therefrom, said disks being mounted upon the shaft of the turbine, a plurality of series of fixed buckets, said buckets being so positioned in relation to each other as to provide a path by means of which the steam may pass in successive stages from the said rotatable buckets to the said fixed buckets causing the former to be rotated, and means for admitting steam for operating said buckets.

7. In a steam-turbine, in combination, a series of rotatable buckets formed by bending the same up at an angle from the periphery of a single flat disk mounted upon the shaft of the turbine, a series of fixed buckets, said buckets being so positioned in relation to each other as to provide a path by means of which the steam may pass in successive stages from the said rotatable buckets to the said fixed buckets causing the former to be rotated, and means for admitting steam for operating said buckets.

8. In a steam-turbine, in combination, a plurality of series of rotatable buckets, each series being bent at an angle from a single disk of material, and a plurality of series of fixed buckets, said buckets being so positioned in relation to each other as to provide a radially-extending path for the steam and by means of which the steam in expanding passes in successive stages from the said rotatable buckets to the said fixed buckets causing the former to be rotated.

9. In a steam-turbine, in combination, a plurality of series of rotatable buckets, each bucket being provided with a projection bent at an angle from the body portion thereof and adapted to engage the adjacent bucket, and a plurality of series of fixed buckets, said buckets being so positioned in relation to each other as to provide a radially-extending path for the steam and by means of which the steam in expanding passes in successive stages from the said rotatable buckets to the said fixed buckets causing the former to be rotated.

10. In a steam-turbine, in combination, a plurality of series of rotatable buckets, each bucket being provided with a projection therefrom, a ring having a series of openings through which said projections extend and over which they may be bent so as to engage the adjacent buckets, and a plurality of series of fixed buckets, said buckets being so positioned in relation to each other as to provide a radially-extending path for the steam and by means of which the steam in expanding passes in successive stages from the said rotatable buckets to the said fixed buckets causing the former to be rotated.

Signed at the city of New York, in the county of New York and State of New York, this 11th day of July, A. D. 1906.

HALBERT PAUL HILL.

Witnesses:

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LEWIS J. DOOLITTLE.