No. 708,227. Patented Sept. 2, 1902.

R. B. HEWSON.

STEAM TURBINE.

(Application filed Mar. 7, 1902.)

(No Model.)

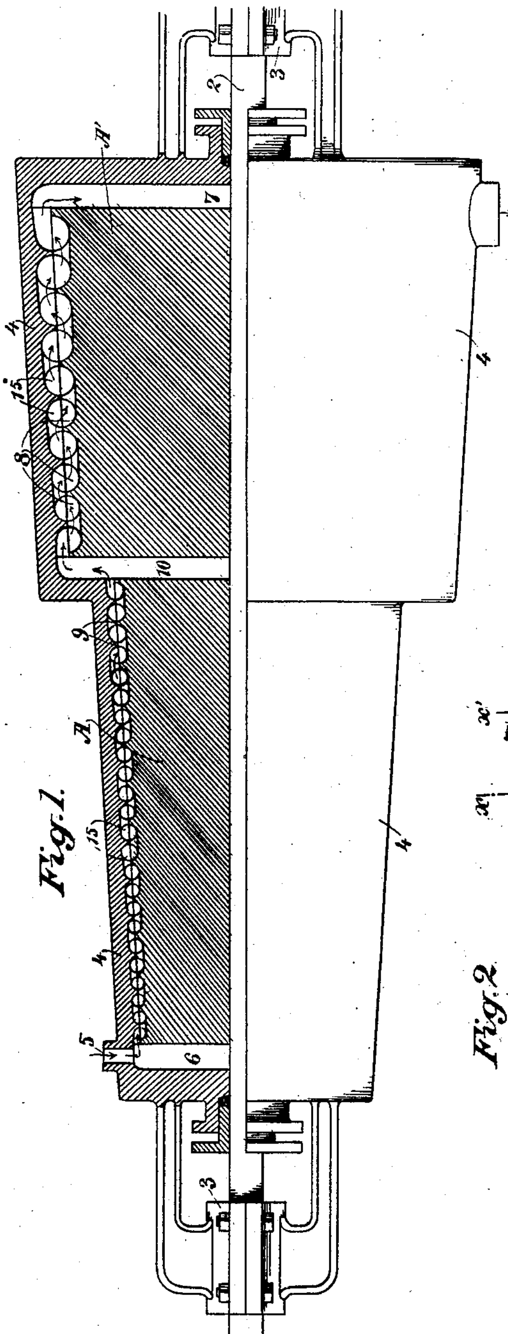

Fig. 1.

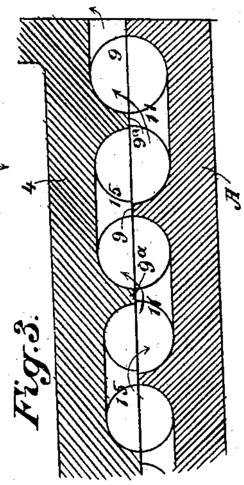

Fig. 3.

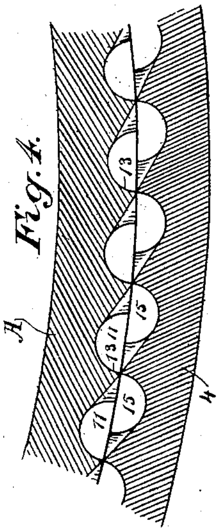

Fig. 4.

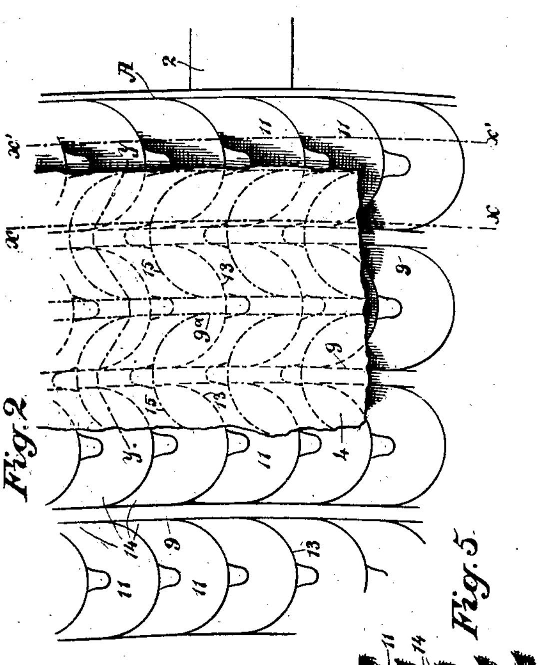

Fig. 2

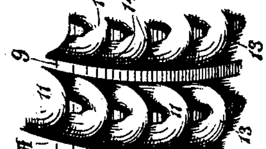

Fig. 5.

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UNITED STATES PATENT OFFICE.

ROBERT B. HEWSON, OF SAN FRANCISCO, CALIFORNIA.

STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 708,227, dated September 2, 1902.

Application filed March 7, 1902. Serial No. 97,038. (No model.)

To all whom it may concern:

Be it known that I, ROBERT B. HEWSON, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Steam-Turbines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an apparatus of that class known as "steam-turbines," in which steam or other elastic medium under pressure is employed expansively to propel a revoluble part mounted upon a shaft through which power is eventually transmitted.

My invention consists of one or more tapering or approximately cylindrical surfaces mounted and revoluble upon a central journal-shaft, and a correspondingly-shaped casing within which the revoluble parts fit closely, said revoluble parts and casings being provided with oppositely-placed buckets through which the steam or other elastic medium admitted at one end of the apparatus will be caused to pass, following the semicircular curve of the fixed buckets and the reverse curvature of the moving buckets, so as to produce an impulsive and a reactionary effect of the impelling medium. It consists also in constructing said buckets of gradually-increasing size from one end toward the other, whereby the impelling medium is used expansively. The impelling medium under pressure is admitted at one end and may pass through intermediate chambers to parts of the revolving member having successively larger diameter than the preceding and buckets of increasing size, and thence to an exhaust-chamber, from which it is finally discharged.

My invention also comprises the formation of the buckets of peculiar design and details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of the turbine, the upper half being shown in section. Fig. 2 is a development of a portion of the surface of the cylinder partly covered with the casing. Fig. 3 is a section on line $y\ y$, Fig. 2. Fig. 4 is a section on lines $x\ x$ and $x'\ x'$, Fig. 2. Fig. 5 is a view of the surface of cylinder.

The object of my invention is to so improve and arrange the buckets of this type of turbine that the maximum effect of expansion impulse and reaction may be secured.

Various forms of apparatus have been designed in which the kinetic energy of steam or other elastic medium under high pressure is utilized to propel a revoluble moving part. These parts have been made in the form of disks revoluble in suitable casings and having a series of buckets formed in the sides of the disks and in the casings, through which the steam is caused to pass with a reactionary effect upon the moving part.

In my present invention I have shown a revoluble part A A', mounted upon a shaft 2, turning in suitable journal-boxes, as at 3, and an exterior casing 4, within which the part A fits closely, the parts being turned and bored for that purpose.

5 is an inlet-passage, and 6 an annular chamber into which the receiving end of the part A opens, and 7 is an exhaust-chamber at the opposite end of the apparatus.

I have shown the part A as in the forms of frustums of cones gradually increasing in diameter from the receiving to the discharge end and having the surface formed with a series of surrounding buckets, as at 8, with intermediate barriers, as 9, between each annular set of buckets from one end to the other of the cone. It will be understood that this part may be made approximately cylindrical; but I have here shown it as in the form of a frustum of a cone enlarging from the receiving toward the discharge end, with the buckets upon the surface and with each succeeding series of buckets from the primary ones being made of larger capacity than the preceding ones. I have here shown the part A A' as in the form of two such frustums of cones, the second one having its receiving end of considerably larger diameter than the discharge end of the first one, so as to form an offset between the two, and at this point I have formed a chamber 10 within the casing, into which the exhaust from the buckets of the smaller cone is received and from which it is expanded and delivered into the buckets of the larger cone. These buckets in the larger cone are still increased in size, as will be necessary in order to have the same number of buckets surrounding this part as sur-

round the first portion, so that they will work in unison, and the steam or medium under pressure is still worked expansively through this second series of buckets. These two cones represent any number gradually increasing in size which it may be found desirable to use to thoroughly utilize the expansive force of the medium before it is exhausted.

The buckets in the surface of the revoluble part A are made as shown at 11, each series of a certain capacity surrounding the part A and being separated from the next adjacent series by an annular rim or barrier 9, having a sufficient width to prevent the actual communication between the parallel annular rows of buckets. One end of the bucket is curved to form a circular arc, as at 13, and the opposite end diminishes into points or lobes, as at 14, so that the semicircular curve of the adjacent bucket practically coincides with the curvature formed by the extension of these lobes of the antecedent bucket.

The exterior casing 4 has buckets or depressions formed in its inner concavity, as shown at 15. These buckets are of the same shape as the buckets of the part A, but are reversed in position. The deeper and circular portion of these buckets lies in the opposite direction from the same parts of the buckets of the revoluble portion A and the lobes or extensions of the casing-buckets extending around and coincident with the fronts of the succeeding buckets in the same manner as described for those of the revoluble part. The buckets and the casings lie with relation to those of the cone so that the center of the casing-bucket is coincident with the ring or barrier 9 of the cone, and the corresponding ring or barrier 9^a of the casing coincides with the central portion of the cone-bucket. As the diameter of the cone gradually increases it will be seen that in order to maintain the same number of buckets around every portion of the cone and in planes intersecting the axis longitudinally each series of buckets will be larger than the preceding series. Thus the elastic medium passing from one series to the other is allowed to act expansively until it has reached the end of the cone. If a plurality of these cones are employed, the exhaust from the last series of buckets of the first one will be received into the intermediate annular chamber 10, and from this chamber it will be delivered into the first buckets of the second and larger cone, acting through this series in the same manner as through the first and with a greater expansion, because of the increased size of the buckets. The arrangement of these buckets in both cases is such that the elastic medium passing through the curvature of the buckets of the casing is discharged thence into the reverse curvature of the buckets of the cone. Thus following the two semicircular or approximately S-shaped curves it produces the full impulsive and reactionary effect of the medium in its passage through each series of the buckets. By reason of the intermediate annular rings or barriers no escape of the medium can take place directly from one series of buckets to the next without first passing through the connecting-buckets of the casing.

I am enabled by this construction to utilize the maximum effect of impulse and reaction upon the part to be driven.

The buckets may be cast, drop-forged, or otherwise produced, and no machine-work is necessary except the cylindrical finishing to provide a perfect fit between the casing and the cone-surfaces.

By this construction I avoid all projecting or intermeshing blades, such as are generally employed in this class of motors. The surfaces which run together may be given a perfect fit, as the buckets of both parts are located below the surfaces. The impelling medium enters and leaves each individual bucket in the direction parallel to the direction of revolution of the part carrying the bucket.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination in a steam-turbine of a revoluble conical part having open buckets in annular successive series around its periphery, an inclosing casing within which the movable part fits and is revoluble, corresponding open buckets formed in said casing and in planes intermediate to the planes of the buckets of the cone, means for admitting an elastic medium under pressure to the smaller end of the cone, and transmitting it alternately through the buckets of the cone and those of the casing to the larger end and exhaust.

2. The combination in a steam-turbine of an approximately cylindrical or conical part, a casing within which it is journaled and revoluble, said revoluble part having open buckets arranged in annular series around its periphery and from end to end with intermediate ring or barrier surfaces, correspondingly-shaped open buckets reversed in position within the interior of the casing, intermediate between the buckets of the movable part, and also having ring or barrier stops interposed between each series of buckets.

3. The combination in a steam-turbine of a plurality of approximately cylindrical or conical parts, with offsets at the junction of each smaller and larger section, a correspondingly-shaped casing within which the first portion is turnable, open buckets formed in series around the sections and of gradually-increasing size, each series being separated from the adjacent series by rings or barriers, corresponding open buckets formed in the interior of the casing and having a reversed position from those of the revoluble part, and lying intermediate between each series of said

part whereby the medium under pressure is caused to pass from end to end of the apparatus in alternate reverse curves through the stationary and movable buckets and is expanded at each successive passage.

4. The combination in a steam-turbine of a part consisting of a series of frustums of cones, each larger in diameter than the preceding ones, a casing having the same shape within which said cones are journaled and revoluble, concavo-convex buckets formed in series around the cones, and of successively-increasing size from the smaller to the larger end, correspondingly-shaped buckets reversed in position within the interior of the casing, each series forming a connection between the two adjacent series of the cone, and intermediate annular separating-surfaces between each series of buckets of the cone and of the casing.

5. The combination in a steam-turbine of a series of cones, each of larger diameter than the preceding and having a common axis, a casing of same shape within which the cones are journaled and turnable, buckets formed in succeeding series around the cone with intermediate separating barrier-surfaces, corresponding buckets reversely formed within the casing and connecting with each adjacent series of buckets of the cone, an annular chamber with which the smaller end of the first cone connects into which the medium under pressure is admitted, a second annular chamber intermediate between the first and second cone into which the medium from the first cone is exhausted and from which it is delivered to the buckets of the second cone and an exhaust-chamber into which the medium is delivered from the second cone.

6. A steam-turbine comprising a plurality of approximately cylindrical or conical parts and correspondingly-shaped casings within which they are revoluble, buckets formed in series around the revoluble part from one end to the other, said buckets being made semicircular at the deepest end and having curved diminishing lobes forming the rear ends, said lobes having a curvature corresponding with the semicircular end of the next succeeding bucket, annular barrier-surfaces interposed between each adjacent series of buckets, correspondingly-shaped buckets formed in the interior of the casing, and in reverse position to those of the revoluble part, said buckets alternating with those of the revoluble part and forming a connection between each two adjacent series thereof, the casing-buckets having corresponding barrier-surfaces between them whereby the medium under pressure is caused to act directly and with impulsive and reactionary effect as it passes through the buckets from one end to the other.

7. A steam-turbine consisting of an approximately cylindrical or conical part and a correspondingly-shaped casing within which the first portion is journaled to fit and revolve, both of said parts having reversely-disposed open buckets, (interior to) the fitted contiguous surfaces with intermediate barriers, and means admitting an elastic medium under pressure to pass alternately through said buckets.

In witness whereof I have hereunto set my hand.

ROBERT B. HEWSON.

Witnesses:
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