(No Model.)

N. G. K. HUSBERG.

STEAM TURBINE.

No. 525,105. Patented Aug. 28, 1894.

Fig. 1.

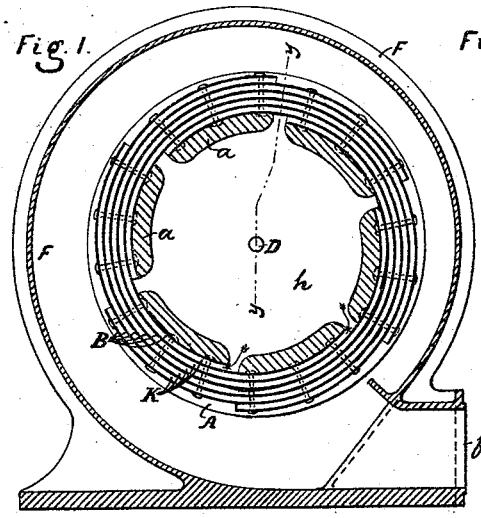

Fig. 2.

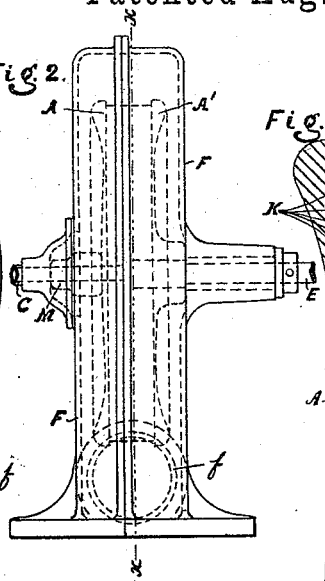

Fig. 4.

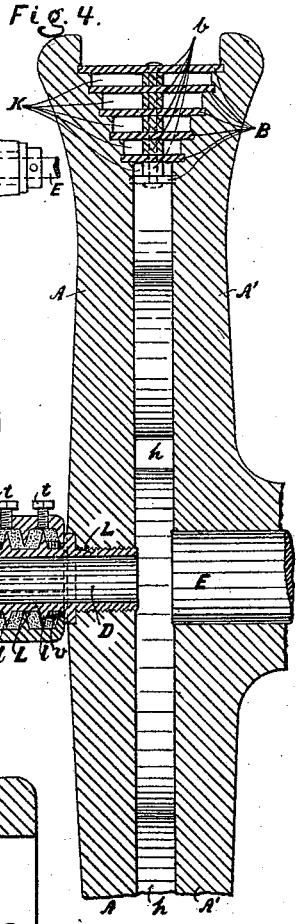

Fig. 3.

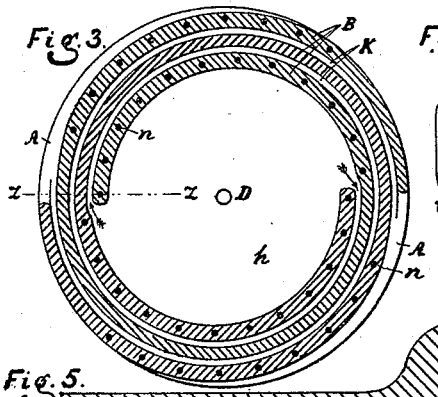

Fig. 6.

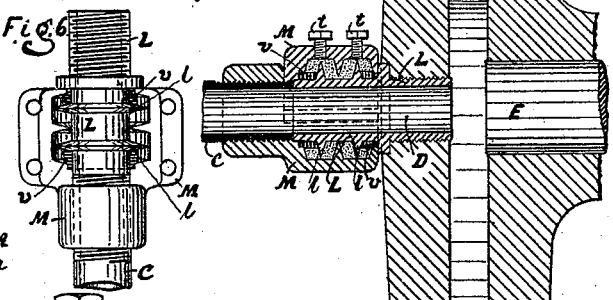

Fig. 5.

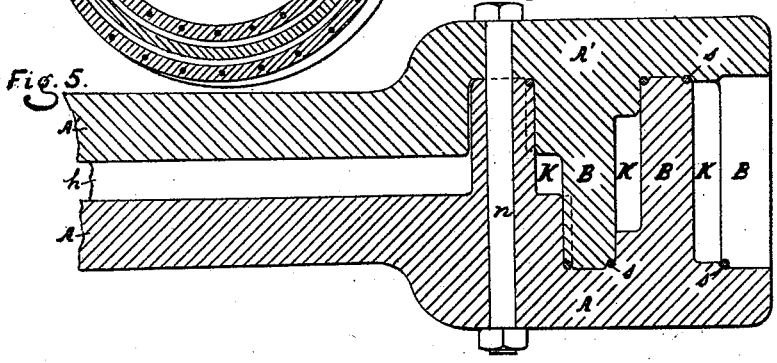

Fig. 7.

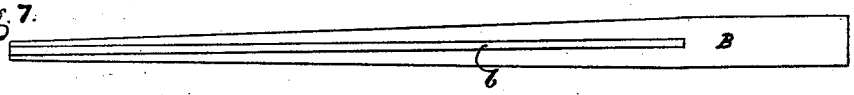

Fig. 8.

Witnesses:

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NILS G. K. HUSBERG, OF STOCKHOLM, SWEDEN.

STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 525,105, dated August 28, 1894.

Application filed September 8, 1893. Serial No. 485,127. (No model.)

To all whom it may concern:

Be it known that I, NILS G. K. HUSBERG, a subject of the King of Sweden and Norway, residing at Stockholm, in the Kingdom of Sweden, have invented a new and useful Steam-Turbine, of which the following is a specification.

My invention, which relates to improvements in steam-turbines, has for its objects to increase the efficiency and economy of such motors; to avoid leakage between the steam supply-pipe and the turbine wheel; and to simplify its construction.

In the accompanying drawings Figure 1 is a sectional elevation taken on the line *x*—*x* of Fig. 2, which latter is an end view of a steam-motor constructed according to my invention, and Fig. 3 a cross section of a turbine wheel of a modified construction. Figs. 4 and 5 are, in enlarged scales, sections on the lines *y*—*y* of Fig. 1 and *z*—*z* of Fig. 3 respectively, and Figs. 6, 7 and 8 detail views.

The steam-chambers K of the turbine wheel are formed of the traverse plates B with parts of the circular side plates A, A′ of the wheel, and into this latter passes the steam from the supply-pipe C through the central orifice D of the plate A. The plate A′ is secured to the shaft E and the wheel inclosed in the case F, which at *f* will be connected to the waste-pipe, that has to conduct the exhausted steam into the atmosphere, to a condenser or elsewhere. The greater portion of the shaft E has been broken away and merely one of its journals is therefore to be seen on the drawings. A pulley may be secured to the axle between its bearings for the transmission of motion to other machines. If the shaft E passes through both the plates A and A′, it will have to be made hollow, so as to convey the live steam into the wheel. This is by preference constructed with an inner reservoir or compartment *h*, into which the steam from the pipe C issues before passing into the expanding chambers or channels K. The reaction of the steam during its passage through these chambers, wherein it expands without hinderance, causes the wheel to rotate. It depends principally upon the construction of the steam-chamber K, if the fluid acts to the best advantage in the wheel or not. Said chamber, which is open merely at its inner end, where the steam enters into it, and at its outer, at the wheel's periphery at the other end, whence the steam freely makes its exit, must be made very narrow, comparatively long, curved more or less, and to its outer part be given a more tangential than radial direction in the wheel. Besides the sectional area of this chamber or channel increases by degrees, continuously from its inner aperture out to its outer extremity, the increase being wholly or principally in the direction of the axis of the wheel, that the acting pressure of the steam in the chamber may come the farthest possible out from the axis, and the velocity of the steam be about the same in all parts of one and the same cross section of the channel. The wheel will be constructed with two or more expansion-chambers K with free exhaust-passages for the steam at the wheel's periphery, and the chambers are to be so arranged and of such a length, that a plane passing in an axial and radial direction from the axis of the wheel through any point of the most contracted area of one of the said expanding chambers cuts by its prolonged part, if prolonged sufficiently in a radial direction beyond the outer side or traverse plate of this chamber, all the faces or sides of the expanding part of an adjacent other such chamber in the same wheel.

To avoid leakage round the supply-pipe C, at the place where it communicates with, or enters into the central orifice of the wheel plate A, I construct the latter at said place with a cylindrical, hollow, detachable or non-detachable projecting piece L, which even may be the shaft of the wheel, and provide this with one or more elevated annular rings *l*, as shown in Figs. 4 and 6. These form some annular compartments with a recessed piece or sleeve M, which made in two sections bolted together is secured to the pipe C and surrounds the piece L. The said compartments will be filled with some pulverized stuff, by preference asbestos powder. This will prevent the escape of steam, especially if two compressible packing rings *v* be inserted between the parts L and M, one at the free end of each part. Through the holes that are closed by the bolts *t*, is the pulverized material to be entered into the upper halves of

the aforesaid compartments. This construction can be so modified, that the piece M be secured to the piece or tube L projecting from the wheel's side plate instead of to the pipe C, which in that case will be provided with annular rings and grooves, and that there be merely two chambers formed between the parts L and M for the tightening material, but it is better to have several such. As the sectional area of the steam-chamber continuously increases in the direction of the axis of the wheel from the channel's K inlet to its exhaust-issue, so must also the traverse plates B increase in breadth accordingly, and when stretched in plan thus get the shape of the plate shown in Fig. 7. Along the middle of this plate, beginning at its narrow extremity, is fixed a metallic rib or strip *b* of the same length as the steam-channel. Its thickness corresponds throughout its length to the width of the channel and the strips form thus with the underlying parts of the plates B, when they have all been bent and got same curvature as the channels, placed side by side close together and joined with rivets or other means, a compact annular ring in the center plan of the wheel, as shown in Figs. 1 and 4. Between each pair of traverse plates B have thus become formed two steam-chambers or channels K, which number may be increased by attaching two or more strips to each plate B. The side plates A, A′ are of cast iron, or other cast metal, and into same enter a little the longitudinal sides of the plates B, as shown in Fig. 4. The connecting traverse pieces *a*, which may have any desired shape, are all cast in one piece with the plates A, A′.

The turbine wheel will be constructed with an even number of steam-chambers, when its traverse plates also are of cast metal. Every second of the plates B will then be cast in one piece with the plate A and the corresponding others in one piece with the plate A′. The chambers K will thus become formed first when the one piece of joined side and traverse plates has been fitted on to the opposite other piece of joined such plates. The shape of the channel K requires, when the plate A is parallel to A′, that each of the traverse plates B, at its base, be made heavier, the additional goods being as thick on both sides of said plate as the channel is wide and increasing in height from the channel's outer to its inner aperture, as will be understood on referring to Fig. 5. Between those heavier parts of the plates B of the one piece enter the free longitudinal sides of the traverse plates B of the corresponding other piece of the wheel. The edges of the said free sides should be recessed or grooved, and in each of the recesses fixed a cord or strip *s* of rubber or other suitable tightening material. This will be compressed when the nuts of the bolts *n*, that hold the parts of the wheel together are drawn home, and prevents thus the steam to pass from one chamber to another. A wheel having traverse plates of cast iron will best be made with merely two and very seldom with as many as four steam-chambers.

What I claim is—

1. The combination in a steam-turbine of the supply-pipe C with the wheel A, A′ having a central orifice or steam-passage D and two or more expanding steam-chambers or channels K each one open merely at its inner end, where the steam enters into it, and at its outer, at the wheel's periphery being, other end, and all besides so constructed, arranged and of such a length, that a plane, passing in an axial and radial direction from the axis of the wheel through any point of that inner smallest aperture of the channel K whence its sectional area continuously increases to the exhaust-exit at the wheel's periphery cuts, by its prolonged part if prolonged sufficiently in a radial direction beyond the sides of that channel, all the faces or sides at the wheel's periphery of another such expanding chamber or channel of the same wheel, all substantially as set forth.

2. In a steam-turbine the combination with the supply-pipe C and recessed sleeve M of the central, hollow piece L, projecting from the wheel plate A and provided with one or more annular elevations *l*, forming with the recess or recesses of the sleeve M some annular compartments, which are to be filled with a pulverized tightening material, all substantially as shown and described.

3. The combination in a steam-turbine of the wheel A, A′, the projecting hollow piece L with the annular compressible rings *v*, the supply-pipe C with the recessed sleeve M, and a pulverized tightening material entered into compartments formed between the pieces L and M, all substantially as and for the purpose set forth.

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