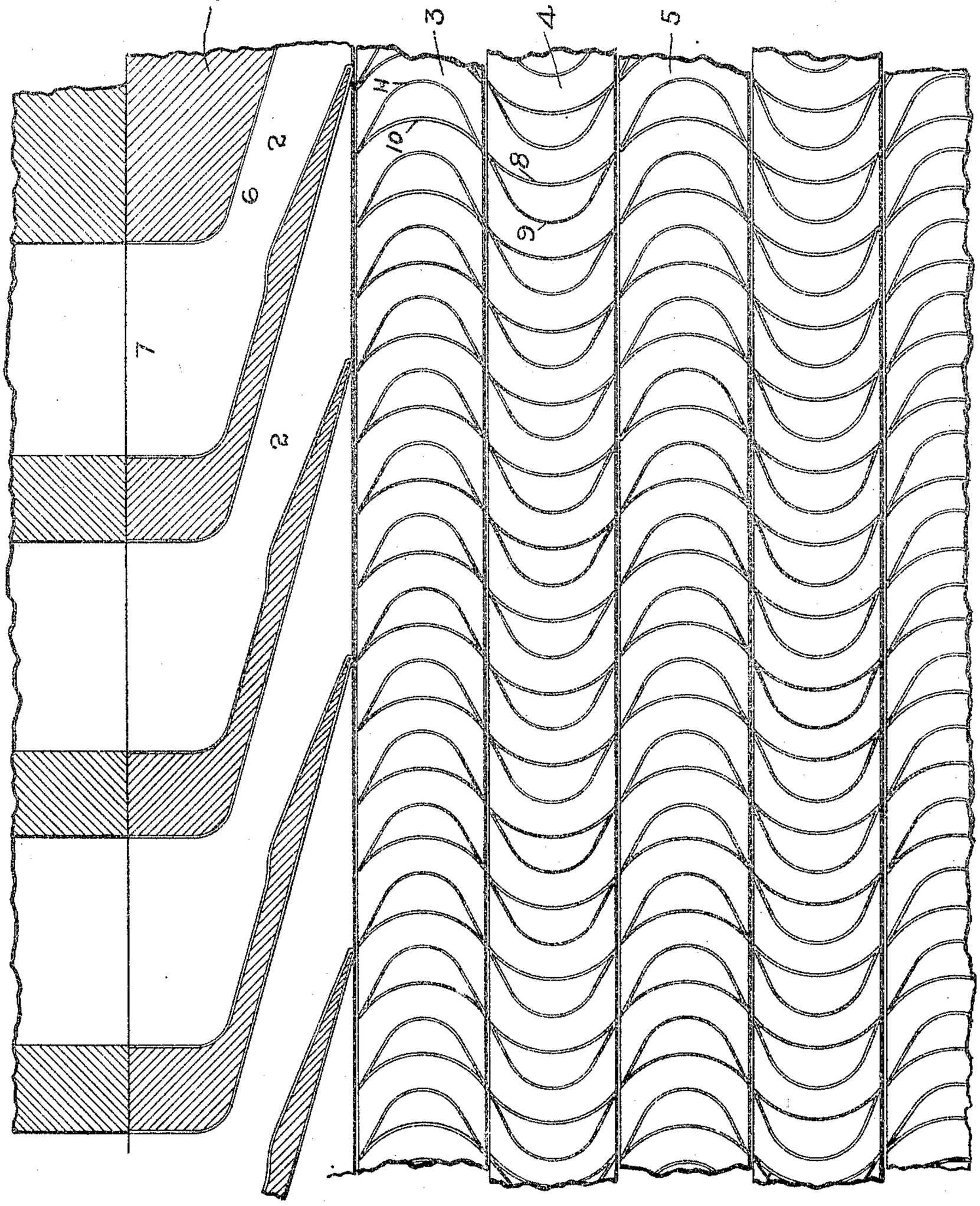
No. 776,518. PATENTED DEC. 6, 1904.

O. JUNGGREN.

TURBINE.

APPLICATION FILED JUNE 27, 1903.

NO MODEL.



WITNESSES:

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No. 776,518. Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

OSCAR JUNGGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 776,518, dated December 6, 1904.

Application filed June 27, 1903. Serial No. 163,338. (No model.)

To all whom it may concern:

Be it known that I, OSCAR JUNGGREN, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

In the construction of elastic-fluid turbines great care has to be exercised in finishing the buckets and nozzles, so that they will present smooth even surfaces to the fluid stream, because the efficiency of the machine is largely dependent thereon. The buckets or vanes are first cut on a bucket-cutting machine and afterward filed until they are smooth. The buckets may also be cast or otherwise formed. Owing to the curvature, most of the filing has to be confined to their receiving and discharge ends, although special means may be employed for filing the curved portion. The nozzles are usually first cast in the rough and afterward machined and filed. Obviously this finishing entails a good deal of extra work, which increases the cost of the turbine as a whole. I have also observed that where the metal employed in making these parts is not of uniform density the motive fluid in passing over their surfaces has a tendency to wear one portion more than another, thus roughening the surface and impairing the efficiency of the turbine.

The object of the present invention is to reduce the cost and simplify the construction of turbines by providing the part or parts which are subjected to a greater or less extent to the action of the motive fluid with a protective coating which will present a smooth and at the same time a hard unbroken surface to the stream of motive fluid. The coating or covering is preferably applied to said part or parts while in a plastic or semiplastic state. For such a covering I may use a vitreous material or an enamel or enamel-like material which will stand high temperatures without disintegrating. A covering of this kind will reduce the "skin friction" between the fluid stream and the walls to a minimum, and it also has the advantage of prolonging the life of the parts and at the same time adds to the economy of operation by conserving the heat of the motive fluid. The covering will fill in any inequalities in the metal, and thus reduce the machine-work.

In carrying out my invention the nozzles or other discharging devices and the vanes or buckets or parts to be covered are given the necessary form by casting or cutting with suitable tools. The surfaces of the parts need not be given an especially-smooth finish; but it can be done, if desired. The surfaces of the parts which are to be subjected directly to the action of the fluid stream, and in some instances those which are not to be directly subjected to the fluid, are then given a coat or coats of a tough vitreous material, such as enamel, which will adhere closely to the metal. The coating should have the same coefficient of expansion as the part covered, or as nearly so as possible, and should be fairly thick and adhere permanently to the part to which it is applied. The coating can be applied to the parts in the ordinary manner employed in coating metal with enamel. The composition of which the covering is composed can be varied to suit the particular requirements of the turbine. Under ordinary conditions only the walls of the nozzle and those of the stationary intermediate buckets would be covered with vitreous or enamel-like coating; but under certain conditions the wheel-buckets can also be covered.

In the accompanying drawing, which illustrates one embodiment of my invention, I have shown a part of an elastic-fluid turbine in section.

1 represents a nozzle or other device for discharging fluid to the buckets. This device may be of any suitable character, either expanding or non-expanding, as desired. In the present instance the nozzle comprises a plurality of closely-associated expanding nozzle-sections 2, which sections are arranged to deliver fluid in a solid stream to the row of buckets 3 on the wheel. The buckets may be of any suitable form. In the present instance they are shown as being provided with a thickened central portion and sharpened front and rear edges. Situated adjacent to the discharge

end of the first row of wheel-buckets is a row of intermediate stationary buckets 4 of suitable form, which receive the fluid from the first row of wheel-buckets and after reversing its direction discharge it against the adjacent row of wheel-buckets 5. From these buckets the fluid enters the adjacent intermediate buckets, which again changes its direction and delivers it to an adjacent row of wheel-buckets.

In the present embodiment of my invention I have shown a three-wheel-per-stage turbine; but the invention is applicable to machines having a different number of wheel-buckets.

The walls of the nozzle which direct the passage of the fluid particles to the buckets are provided with a protective coating 6, made of a vitreous or enamel-like material. This covering fills in all of the tool-marks on the surfaces and presents a smooth unbroken surface to the fluid stream. The covering is extended into the bowl 7 of each nozzle and may be extended beyond that point, if desired. The covering should be tough and should adhere closely to the metal structure. In addition to this it should have as nearly as possible the same ratio of expansion as the part to which it is applied.

Each of the intermediate buckets 4 is provided on its working face with a protective coating of vitreous or enamel-like material, which strongly adheres to it. This coating is applied to the working or concave surface 8 and may also be applied to the convex surface 9. The coating in addition to covering up the inequalities in the metal and presenting a smooth surface to the fluid stream, which reduces its skin friction, also tends to conserve the heat of said fluid and in this manner tends to increase the efficiency of the machine.

Under certain conditions I may coat the wheel-buckets with a vitreous or enamel-like material in addition to the intermediate buckets. When this is done, the coating is applied to the concave working surfaces 10 and may be applied to the convex surfaces 11.

My invention further has the advantage that the covering or lining for the buckets and nozzles can be renewed at a small expense when worn, thus preserving at all times the proper shape for the expensive and carefully-made parts.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now believe to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an elastic-fluid turbine, the combination of vanes or buckets which are subjected to the effects of the motive fluid, with coverings which protect the surfaces of the vanes or buckets and reduce the friction and wear.

2. In an elastic-fluid turbine, the combination of a means for discharging motive fluid, vanes or buckets which are subjected to the effects of the motive fluid, and coverings for the vanes or buckets, which reduce friction and conserve the heat of the fluid stream.

3. An elastic-fluid turbine comprising a nozzle and vanes or buckets subjected to the action of the fluid discharged by the nozzle, in combination with a lining for the walls of the nozzle and a covering for the working faces of the vanes or buckets.

4. An elastic-fluid turbine comprising a casing and buckets acted upon by the motive fluid, in combination with a vitreous or enamel-like covering for the surfaces of the buckets which are subjected to the effects of the motive fluid for reducing friction and preserving the buckets.

5. An elastic-fluid turbine comprising a nozzle and buckets arranged to receive motive fluid from the nozzle, in combination with a vitreous or enamel-like covering for the working surface of the nozzle and that of the buckets for reducing friction and conserving the heat in the fluid stream.

6. A nozzle for an elastic-fluid turbine, having a lining of vitreous or enamel-like material.

7. A bucket for an elastic-fluid turbine, which has on its working face a covering of vitreous or enamel-like material.

In witness whereof I have hereunto set my hand this 26th day of June, 1903.

OSCAR JUNGGREN.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.