No. 860,967. PATENTED JULY 23, 1907.

A. R. DODGE.

ELASTIC FLUID TURBINE.

APPLICATION FILED FEB. 27, 1906.

Fig. 1.

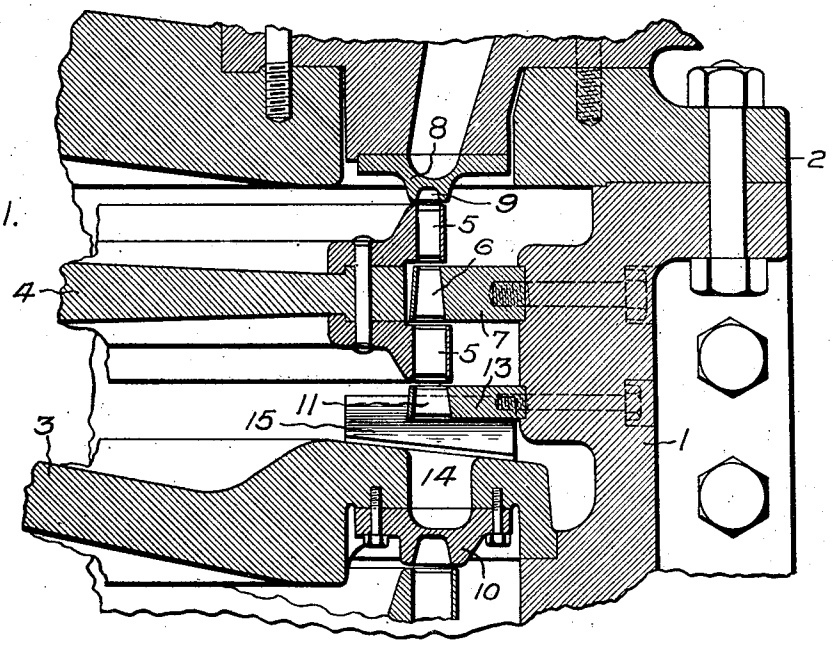
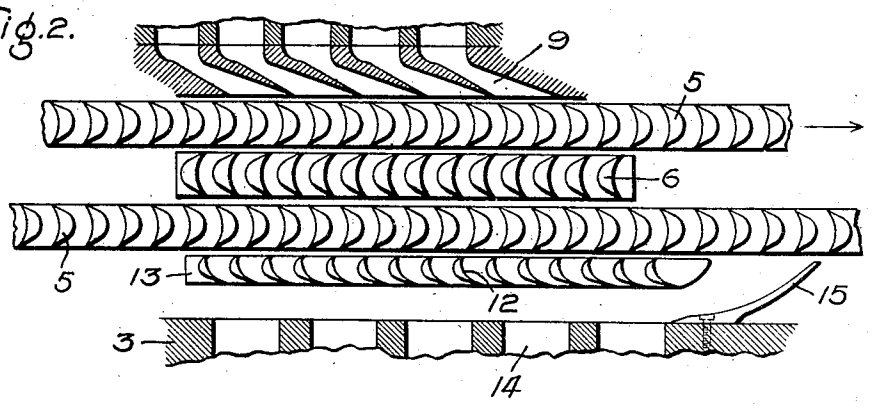


Fig. 2.



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UNITED STATES PATENT OFFICE.

AUSTIN R. DODGE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELASTIC-FLUID TURBINE.

No. 860,967. Specification of Letters Patent. Patented July 23, 1907.

Application filed February 27, 1905. Serial No. 247,430.

To all whom it may concern:

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

In building elastic-fluid turbines it is customary to place the walls or partitions forming or dividing the casing into compartments as close to the sides of the wheels as possible in order to reduce the size of the machine and also to decrease the amount of material used and the cost of manufacture. This is particularly true of machines of the jet or impact type, and it is also true to a greater or less extent of machines of the reaction type. The steam or other motive fluid, owing to the curvature of the buckets, leaves the wheel in a direction opposite to that in which it is rotating. By a series of careful tests I have ascertained that steam or other elastic fluid, upon exhausting from the wheel buckets of any given stage, will strike the adjacent wall, partition or diaphragm, as the case may be, and rebound against the wheel and retard its rotation. In addition to opposing the rotation of the wheel or wheels by rebounding at or near the point of discharge, I have found that a large body of steam is kept in motion in each stage in a direction counter to the movement of the wheel, which also tends to oppose the rotation of the wheel. Besides opposing the rotation of the wheels, eddies are formed which interfere with the free passage of motive fluid from stage to stage.

The object of the present invention is to prevent the steam or other fluid exhausting from the wheel buckets of a simple or multi-stage turbine from interfering with the efficient operation of the machine.

I have discovered that the objectionable rebounding, eddying, etc. can be prevented or largely decreased by interposing a means for directing or guiding the exhaust after it leaves the wheel buckets and before it enters the adjacent nozzles or fluid-discharging and directing devices, or exhausts to the atmosphere or to a condenser. Preferably it or they should be arranged to direct the exhaust in the same direction in which the wheel or wheels are rotating. The directing or guiding means may be constructed and arranged in a variety of different ways, one of the simplest of which is to provide a set of stationary guides or partitions resembling buckets adjacent to the last row of active buckets exhausting fluid in each stage, or in those stages where such devices are deemed necessary. The arc covered by these guiding means will be about the same as that of the nozzles or fluid-discharging device, and will increase from the high to the low-pressure stages. Some or all of the stages of a multi-stage turbine may be provided with these directing or guiding means.

In addition to preventing the rebound and eddying of the exhaust from opposing the rotation of the wheel, I have discovered that some of said exhaust may be made to assist in the rotation of the wheel by being properly directed against the buckets. That is to say, the exhaust is first properly guided away from the buckets, then its direction of flow is changed somewhat, and finally it is directed against the buckets on the exhaust side. This last-mentioned feature is accomplished by means of a guide which is attached to the casing or other support. It may act in conjunction with the guides previously referred to, or it may act alone or with other guides especially provided.

In the accompanying drawing which illustrates one embodiment of my invention, Figure 1 is a partial axial section of a turbine showing a part of the first two stages of a multi-stage machine; and Fig. 2 is a partial section through the nozzles of the same machine taken at right angles to that of Fig. 1.

1 represents the wheel casing which is provided with a head 2 and one or more diaphragms 3 for dividing the interior of the wheel casing into separate compartments. The present drawing illustrates a part of a four-stage turbine of the jet or impact type. Located in each compartment is a wheel 4 containing one or more rows of buckets 5. When there are two or more rows of wheel buckets, intermediate buckets 6 are provided between each two rows of wheel buckets. The intermediate buckets are mounted on a support 7 which in turn is bolted or otherwise secured to the wheel casing. Steam or other elastic fluid is admitted to the turbine by nozzles 8, usually of the sectionalized type, comprising a plurality of closely associated sections 9. These nozzles may be expanding or non-expanding in character. The passage of steam or other elastic fluid from one stage to the next is controlled and directed by stage nozzles 10 which are similar in construction to the admission or high-pressure nozzles, except that the passages therein are somewhat larger and cover a somewhat greater arc of the bucket wheel. Situated adjacent to the exhaust side of the wheel buckets in one, two or more of the stages, are directing and guiding means 11 for preventing the fluid from rebounding from the walls of the casing against the buckets comprising a plurality of partitions 12, usually curved and somewhat resembling the buckets in form. These partitions are mounted on a common support 13 which in turn is bolted or otherwise secured to the wheel casing. The construction of these directing and guiding means is similar in all of the stages except that they cover a somewhat greater wheel arc in the low- than in the high-pressure stages. Some or all of the fluid passing between the partitions 12 enters the passages 14 which communicate with the sections of the stage nozzle or nozzles 10. The high-pressure or admission nozzles

may be arranged in groups located at suitable points around the wheel, or a single nozzle comprising one or more sections may be employed. In general it may be stated that the stage nozzles should follow the same arrangement or grouping as the admission or high-pressure nozzles.

In order that any steam or other fluid which does not immediately flow through the passages 14 may be utilized to assist in the rotation of the wheel, one or more directing and guiding means 15 in the form of plates are provided which are bolted or otherwise secured to a diaphragm or wall of the casing. This directing means is so positioned that any steam or other fluid passing over it is directed against the lower bucket wheels or lower buckets 5 in a direction to assist in rotating the wheel. There should be at least as many of these directing and guiding means 15 as there are sets of directing and guiding vanes 12, although more can be provided if desired.

The operation of my invention is as follows: Steam or other elastic fluid passes through the admission nozzles 9 under the control of separately actuated valves and strikes the first row of wheel buckets in a manner to produce rotation in the direction of the arrow. After the steam passes through the wheel buckets it is received by the intermediate buckets 6 and its direction changed, after which it is discharged against the adjacent row of wheel buckets in a manner to produce rotation in the same direction. The steam leaving the last row of wheel buckets in a given stage is deflected by the directing partitions into the passage 14 leading to the stage nozzles. Any steam which is not so deflected is directed by the directing or guiding plate 15 against the wheel buckets in a manner to assist in the rotation.

In accordance with the provisions of the patent statutes, I have described the princlple of operation of my invention, together with the apparatus which I now consider 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. An elastic-fluid turbine comprising a casing, wheel buckets, and a device for discharging fluid against the buckets to produce rotation, in combination with a means for preventing the motive fluid after it is exhausted from the buckets from opposing their rotation and a separate means for directing the exhaust fluid against the wheel in a manner to assist its rotation.

2. An elastic-fluid turbine comprising a casing a diaphragm dividing the casing into compartments, wheel buckets located in said compartments, and a device for discharging fluid against the buckets to produce rotation, in combination with a guide composed of a number of blades or partitions which receive the exhaust from the wheel buckets and after changing its direction discharge it in the general direction of rotation of the wheel, and a means mounted on the diaphragm in a manner to direct a portion of the exhaust against the wheel.

3. An elastic-fluid turbine comprising a casing arranged in stages, wheel buckets for each stage, and a device for discharging fluid against the buckets to produce rotation, in combination with a passage leading to the adjacent stage, and a means which receives the exhaust from the buckets and after reversing its direction discharges a portion of it against the exhaust side of the buckets, the said discharging device and means coöperating to produce rotation.

4. An elastic-fluid turbine comprising a casing arranged in stages, a bucket wheel for each stage, the buckets of which run in close proximity to the walls of the casing, and a device for discharging fluid against the buckets, in combination with a means for guiding the exhaust fluid away from the buckets and at the same time imparting to a portion of it a direction of flow which will assist the rotation of the wheel.

5. An elastic-fluid turbine comprising a casing, wheel buckets running in proximity to the walls of the casing, and a nozzle or device for discharging fluid against the buckets to produce rotation, in combination with stationary buckets located adjacent to the wheel buckets to receive the motive fluid exhausting therefrom, the said stationary buckets discharging fluid substantially in the plane of and in the direction of rotation of the wheel.

In witness whereof, I have hereunto set my hand this 23rd day of February, 1905.

AUSTIN R. DODGE.

Witnesses:
BENJAMIN B. HULL,
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