O. A. BOYER.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAR. 13, 1909.

960,260.

Patented June 7, 1910.

2 SHEETS—SHEET 1.

Fig. 2

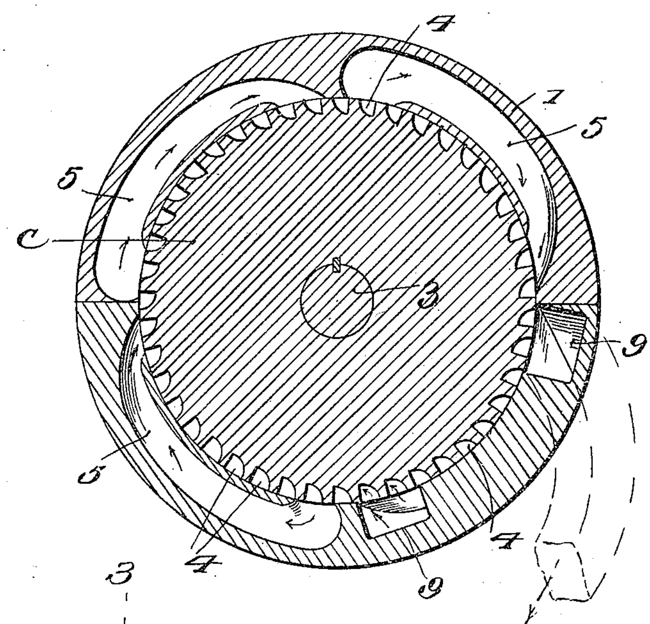
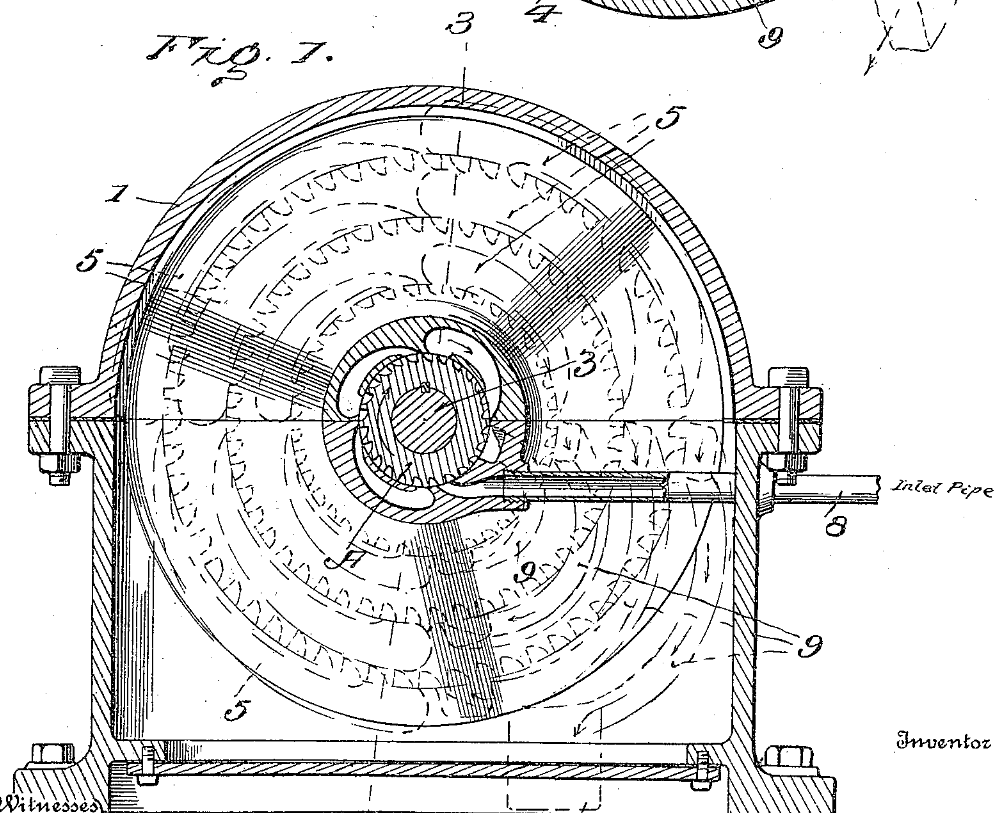


Fig. 1.



Witnesses

W. H. Woodson

J. M. Fallin

Inventor

O. A. Boyer

By

[illegible], Attorneys.

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2 SHEETS—SHEET 2.

Fig. 3

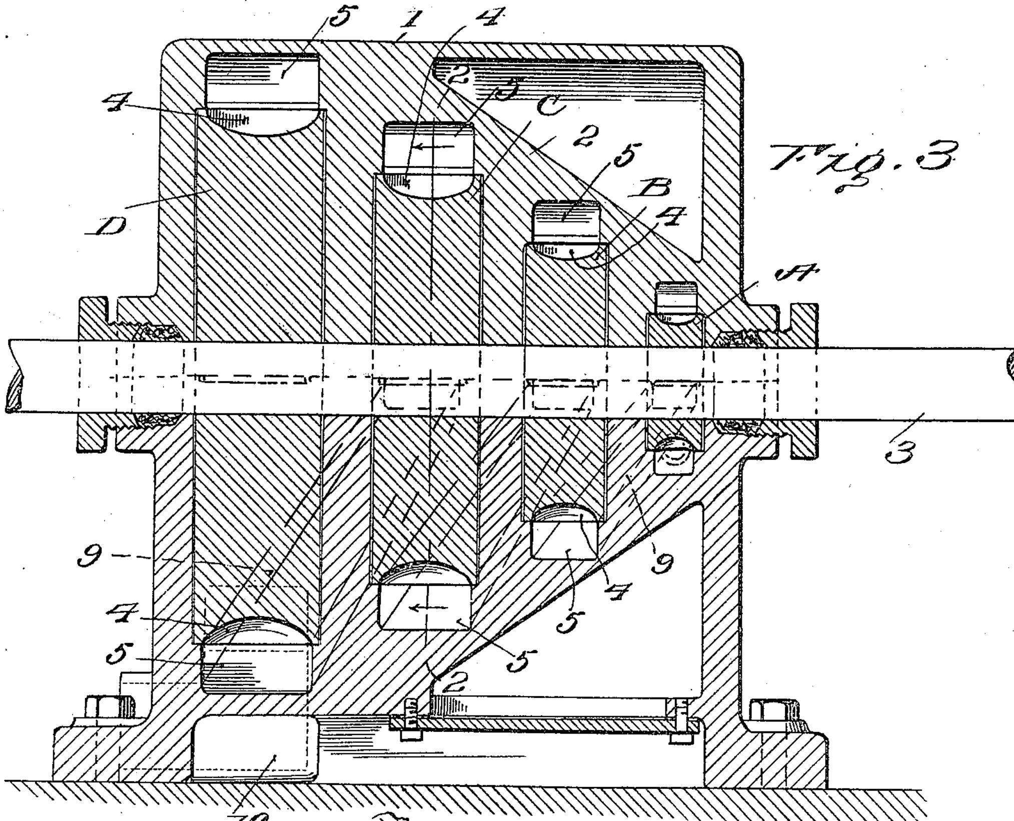


Fig. 4

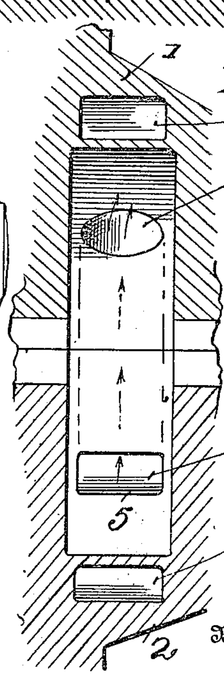


Fig. 5.

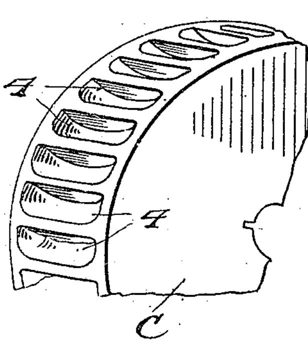
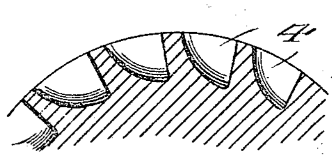


Fig. 6.



Inventor

O. A. Boyer

Witnesses

W. N. Woodson

J. M. Fallin

By, Victor J. Evans, Attorneys.

UNITED STATES PATENT OFFICE.

ORAM A. BOYER, OF HARRISBURG, PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

960,260. Specification of Letters Patent. Patented June 7, 1910.

Application filed March 13, 1909. Serial No. 483,254.

To all whom it may concern:

Be it known that I, ORAM A. BOYER, a citizen of the United States, residing at Harrisburg, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to rotary engines of the impact type and has for its object a preferably compound turbine which is so constructed and arranged that it will operate with a maximum kinetic efficiency, and with practically no waste of velocity and expansive effect of steam, or other elastic fluid medium, the same being finally exhausted at atmospheric pressure after its force has been entirely expended.

With this and other objects in view, the invention consists in certain constructions and arrangements and combinations of the parts that I shall hereinafter fully describe and claim.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawings in which:

Figure 1 is a transverse sectional view through one embodiment of my invention; Fig. 2 is a similar view, the section being taken approximately on the line 2—2 of Fig. 3; Fig. 3 is a longitudinal sectional view taken substantially on the line 3—3 of Fig. 1; Fig. 4 is a fragmentary sectional view through a portion of the turbine; Fig. 5 is a fragmentary perspective view of one of the motors; and, Fig. 6 is a longitudinal section thereof.

Corresponding and like parts are referred to in the following description and indicated in all the views of the accompanying drawings by the same reference characters.

Referring to the drawings, the numeral 1 designates the body portion of my improved turbine which may be of any desired construction, type or design, except as hereinafter noted, and which preferably tapers or is of truncated cone shape at one end as indicated at 2.

3 designates the spindle or shaft which may also be of any desired construction or design and which is journaled in any desired way in the body portion 1, said spindle carrying any desired number of rotors.

My improved turbine as shown, is preferably a compound one. In that embodiment of the invention illustrated in the accompanying drawings I have illustrated four rotors as embodied in the turbine case, the same being designated A, B, C and D to distinguish them one from the other. It is to be observed that these rotors increase, as they progress, in diameter, and preferably also in thickness. The body portion 1 is formed with chambers for the accommodation of the respective rotors, the latter substantially filling the chambers, it being of course understood that clearance spaces are provided. Each rotor is formed with a series of peripheral buckets 4 which are preferably of the shape shown in Figs. 5 and 6, one wall being curved and the opposite wall straight. It is preferred also that the bottom wall of each bucket be concave in a transverse direction, the lowest point being substantially in the middle. Coacting with the buckets 4 are nozzles 5 which are formed in the body portion 1 and which are arranged in coincidence with the peripheries of the respective rotors, being disposed for the major portion of their length substantially tangential thereto, as best illustrated in Fig. 2. One end of each nozzle may be square or of any other desired shape as indicated at 6 in Fig. 4, but the other end which is the tip or discharge end of the nozzle is preferably elliptical as indicated at 7 in Fig. 4 so as to conform to a certain extent with the buckets 4. It is to be particularly observed (see Fig. 2) that the receiving end of each nozzle is disposed in a substantially radial relation to the rotor and gradually curves or merges into the main tangential portion of the nozzle, the eddies of steam being thereby maintained so as to secure a maximum efficiency thereof. It is also to be noted that the nozzles increase in area as they progress from the initial entrance point of the steam or other elastic fluid, to the point of final discharge; this being true not only of the several rotors and their corresponding nozzles relative to each other, but also true of the plurality of nozzles for each rotor.

The steam first enters through any desired inlet pipe 8 into the nozzle 5 for the rotor A and after acting successively on the nozzles of such rotor is passed by a preferably curved passage 9 (see dotted lines in Fig. 1) to the nozzles of the next rotor and from thence to the rotors C and D in succession, through the instrumentality of corresponding passages until it is finally discharged through the exhaust port 10 at substantially atmospheric pressure. In the practical operation of the turbine as the steam enters through the pipe 8 and is admitted to the buckets of the rotor A, an impulse will be imparted to said rotor to turn the same and the spindle or shaft 3, and the steam at high velocity will be almost instantly passed to the first nozzle of the series and expanded therein so as to secure the expansive effect as well as the velocity to again act upon the rotor as soon as it is passed to the next nozzle in the series and so on until it is finally discharged through the exhaust port. It will thus be seen that by my invention advantage is taken not only of the high velocity of the steam but of the expansive force thereof to expend on the turbine every dynamic unit of which the steam is possessed, the nozzles increasing in area and acting successively upon the rotors which increase in size until, as above stated, at the final discharge of the steam, the pressure is reduced to practically *nil*.

In the preferred arrangement of parts, the steam first acts upon the rotors in succession at points almost directly underneath the shaft of the spindle 3. By this arrangement, a counterbalance effect is secured which reduces the vibration to a minimum and also reduces the wear upon the parts. As the steam is admitted not in a lateral direction, to the rotors, but in a direct circumferential direction thereto, it is clear that end thrust or vibration is entirely obviated.

It is to be understood that my invention is not limited to any size, shape, proportion, construction or arrangement of the various parts except as is defined by the appended claims, and that it is not limited to any compounding as these are measures which must be left to the designer and manufacturer according to the particular requirements of the case at hand. Neither is the invention limited to any particular number of buckets or nozzles for each rotor.

Having thus described the invention, what is claimed as new is:

1. An expansion turbine including a cylindrical casing and a rotor therein provided with peripheral pockets to receive the impact of the fluid, said casing being provided on its interior face with a plurality of separated expansion chambers, each chamber being substantially concentric to the rotor and having an inlet and an outlet opening at opposite ends of the chamber and registering with said pockets, said chamber gradually contracting from its inlet end toward its outlet end, and the outlet opening being smaller than the inlet, the end wall of the outlet end of the chamber being gradually inclined inward and toward the direction of movement of the rotor.

2. An expansion turbine including a cylindrical casing, a plurality of rotors mounted therein, said rotors being of gradually increasing size, the casing for the rotors being formed with a plurality of expansion chambers arranged around the inner face of the casing in registry with each of the rotors, each of said chambers having an inlet and an outlet opening at opposite ends, said chamber gradually contracting in area toward its outlet end, said chambers gradually increasing in area throughout the series of chambers for each rotor, and the chambers of each rotor being of greater area than the corresponding chambers of the rotor preceding.

3. An expansion turbine including a casing having formed therein a series of rotor chambers, each rotor chamber being separated from the adjacent rotor chamber by a solid wall, a shaft passing through the casing, a series of rotors attached to said shaft and gradually increasing in size from one end of the casing to the other, the inner face of each of the rotor chambers in the casing being formed with a primary inlet and an outlet chamber, and a series of expansion chambers, each expansion chamber extending approximately concentrically to the rotor, having an inlet opening at one end and an outlet opening at the other, said expansion chambers gradually increasing in size from the inlet end to the outlet end, and the outlet end having an end wall inclined inward and in the direction of the rotor travel, said casing being further provided with an initial inlet passage leading into the inlet chamber of the smallest rotor chamber, a final exhaust passage leading from the outlet chamber to the largest rotor, and a series of conducting passages leading from the outlet chamber of the rotor chambers to the inlet chamber of the next succeeding rotor chamber, said conducting passages each having a curve only slightly diverging from the path of movement of the rotor.

In testimony whereof I affix my signature in presence of two witnesses.

ORAM A. BOYER. [L. S.]

Witnesses:

W. N. Woodson,

Frederick S. Stitt.