No. 887,981. PATENTED MAY 19, 1908.

O. O. STORLE.

ELASTIC FLUID TURBINE.

APPLICATION FILED OCT. 5, 1906.

Fig. 1.

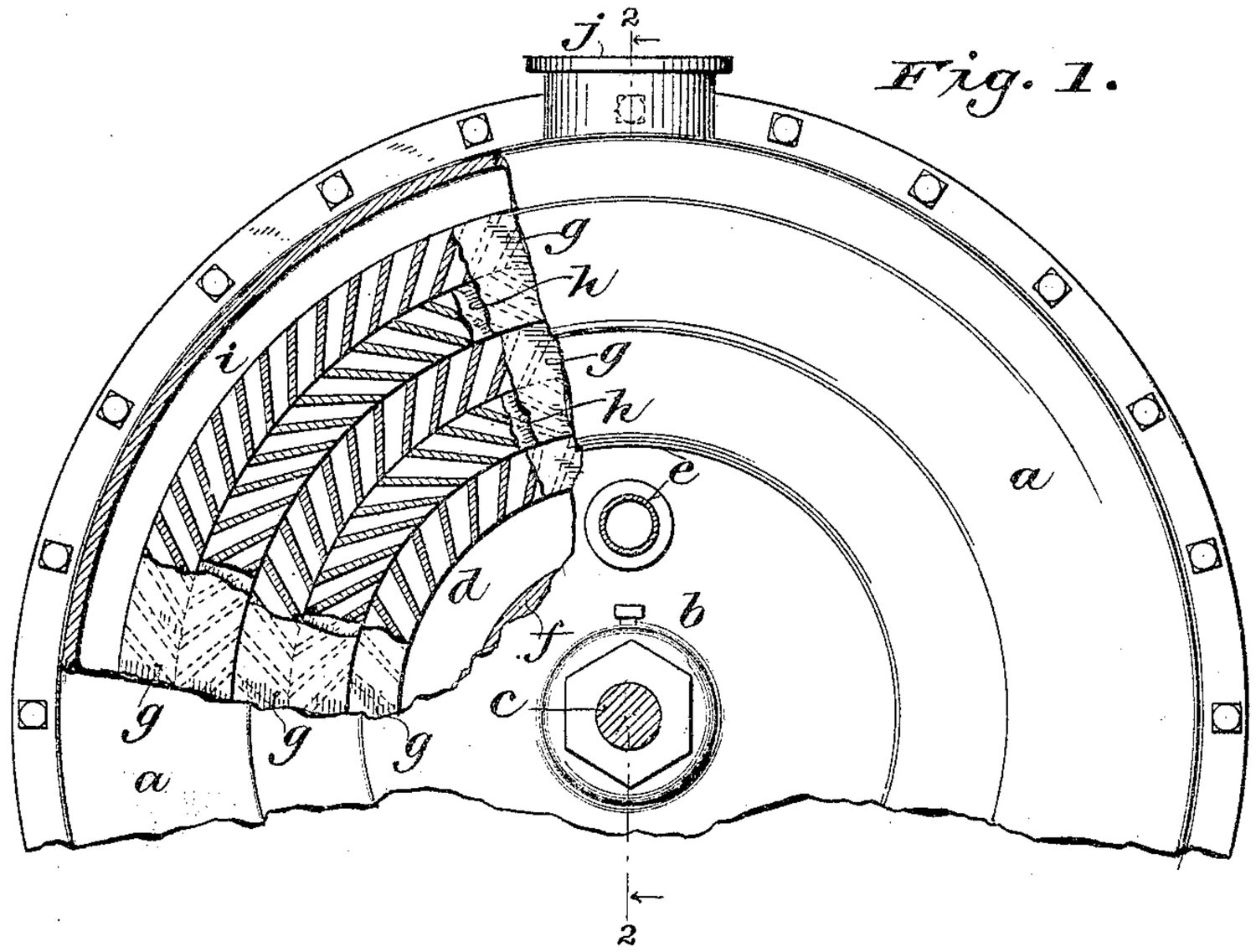


Fig. 2.

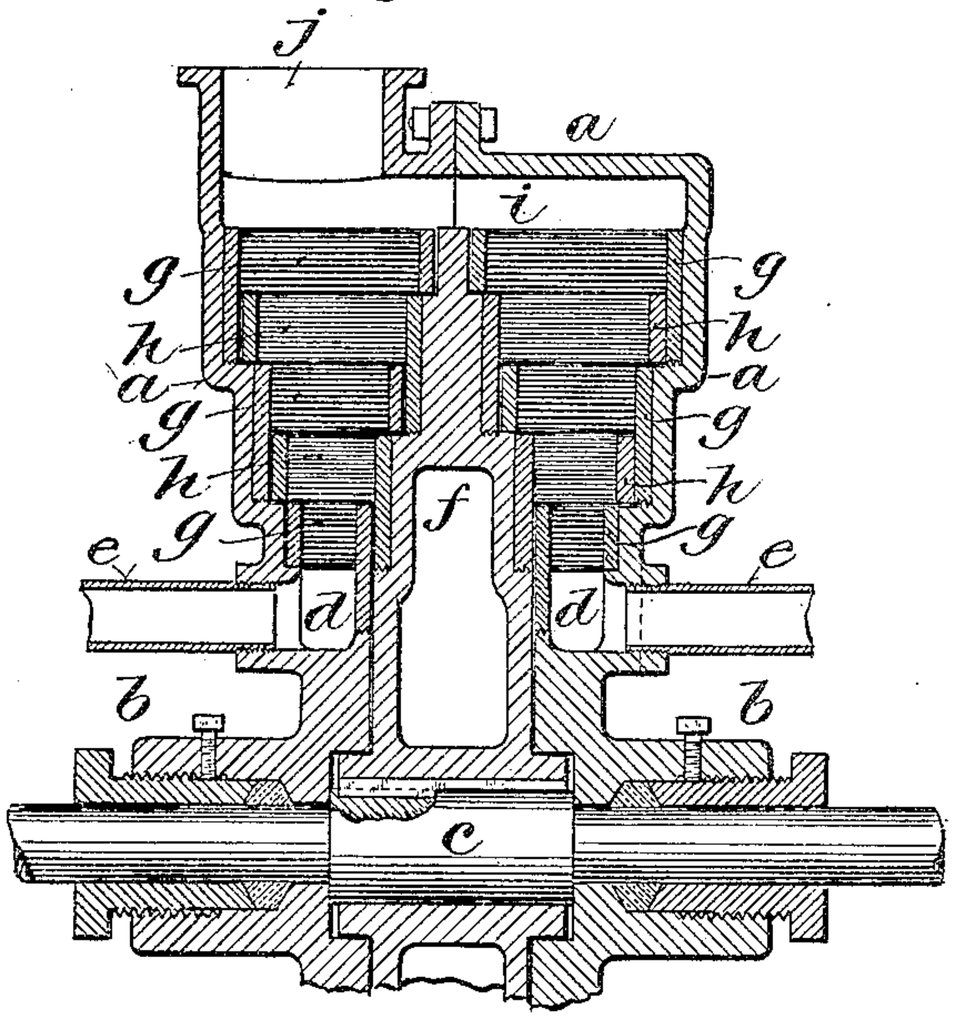
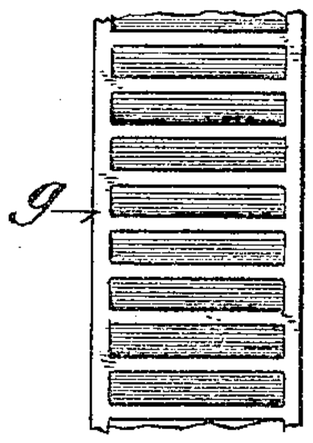


Fig. 3.



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UNITED STATES PATENT OFFICE.

OLE O. STORLE, OF TACOMA, WASHINGTON.

ELASTIC-FLUID TURBINE.

No. 887,981. Specification of Letters Patent. Patented May 19, 1908.

Application filed October 5, 1906. Serial No. 337,518.

To all whom it may concern:

Be it known that I, OLE O. STORLE, a citizen of the United States, residing at Tacoma, in the county of Pierce and State of Washington, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates more particularly to radial flow reaction turbines, and its main object is to simplify and improve the construction and operation of this type of turbines.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts as hereinafter particularly described and pointed out in the claims.

In the accompanying drawing like characters designate the same parts in the several figures.

Figure 1 is a partial side elevation of a steam turbine embodying the present invention, portions of the near sides of the case and of the nozzle and vane rings being broken away; Fig. 2 is an axial section on the line 2, 2, Fig. 1, and Fig. 3 is a developed plan view of a part of the outer nozzle ring.

The case *a* is preferably made in two similar sections which are flanged and bolted together in a central plane transverse to the axis of the turbine. Each section is formed or provided with a central stuffing box and bearing *b* for the runner shaft *c*, and with an annular steam or motive fluid supply passage *d* concentric with the associated shaft bearing. A steam or motive fluid supply pipe *e* connects with the passage *d* on each side of the turbine, or one of said passages may be supplied with steam or motive fluid from the other through openings in the intervening runner. A wheel or runner *f* is fitted to rotate in the casing and is keyed or feathered on the shaft *c* so as to turn the same therewith and at the same time be free to move endwise thereon and adjust itself to prevent binding between its sides and the opposing sides of the case. Each section or side of the case is preferably formed with a series of circular steps concentric with the supply passage *d*, and the runner *f* is also preferably formed with a series of corresponding steps as shown in Fig. 2. The outer walls of the nozzle rings *g* are preferably extended inwardly to overlap the outer side walls of the vane rings *h* and are internally threaded and screwed on the offsets or shoulders formed by the steps in the casing. In like manner the inner side walls of the vane rings *h* are preferably extended inwardly to overlap the inner side walls of the nozzle rings *g* and are internally threaded and screwed on the offsets or shoulders formed by the steps on the runner. Each of these rings with the vanes between the passages through them may be formed in one piece with the part to which they are attached, or may be made in sections or parts and otherwise attached thereto. The opposing side walls of the case and of the runner diverge or recede from each other from the center outwardly, as seen in Fig. 2.

Outside of the outer and larger nozzle rings *g* the case forms an annular exhaust passage *i* with which an exhaust pipe or connection *j* communicates on one side. The partitions or guide vanes of the nozzle rings are connected and the passages between them are closed on their inner sides next to the runner by continuous rings or walls, and the moving vanes *g* are connected and the passages between them are closed on their outer sides by continuous rings or walls next to the case, so that the steam or other motive fluid is compelled to flow through the passages between successive series of vanes in a generally radial direction from the supply passages *d* to the exhaust passage *i*. Any steam or other fluid which may leak through the clearance space between the inner side of a nozzle ring and the runner, or through the clearance space between the outer side of a vane ring and the case, must pass into or across the passages in the next outer ring transverse to the general direction of the flow of the main body of steam through the several rings.

The increasing width of the vanes and of the passages between them from the supply passages *d* to the exhaust passage *i*, provides for the increasing volume of steam or other motive fluid as it expands and its heat and pressure drop in passing through successive nozzle and vane rings.

By the construction and arrangement of parts as herein shown, the available energy of the steam or other motive fluid is utilized to the fullest extent, and at the same time the parts of the engine are simple and easy to make and assemble.

I claim:

1. In an elastic fluid turbine the combination of a case having annular motive-fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case the wall of which at one side of the runner is stepped and formed with threaded shoulders concentric with the axis of the runner, internally threaded nozzle rings screwed upon said shoulders, and concentric series of vanes attached to the runner and alternating with the nozzle rings, substantially as described.

2. In an elastic fluid turbine the combination of a case having annular motive-fluid supply and exhaust passages, a stepped runner inclosed by and fitted to turn in said case and formed with threaded shoulders concentric with its axis, internally threaded vane rings screwed on said shoulders, and concentric nozzle rings attached to the case and alternating with the vane rings, substantially as described.

3. In an elastic fluid turbine the combination of a case having annular motive-fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case, opposing walls of the case and runner between the supply and exhaust passages being stepped and formed with threaded shoulders concentric with the axis of the runner, internally threaded nozzle rings screwed on the shoulders of the case and internally threaded vane rings screwed on the shoulders of the runner and alternating with the nozzle rings, substantially as described.

4. In an elastic fluid turbine the combination of a case having annular motive fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case and formed on opposite sides with threaded shoulders or offsets concentric with its axis, the opposing walls of the case being stepped and formed with threaded shoulders also concentric with the axis of the runner, internally threaded nozzle rings screwed on the shoulders of the case, and internally threaded vane rings screwed on the shoulders of the runner and alternating with the nozzle rings, substantially as described.

5. In an elastic fluid turbine the combination of a case having annular motive-fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case, vane rings attached to the runner concentric with its axis and having continuous annular walls on the sides next to the case, which is formed with circular offsets concentric with the axis of the runner, and nozzle rings alternating with the vane rings and having continuous annular walls on both sides of the guide vanes, the walls next to the case being attached thereto and extended inwardly over the adjacent annular walls of the inner vane rings, substantially as described.

6. In an elastic fluid turbine the combination of a case having annular motive-fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case and formed with circular offsets concentric with its axis, nozzle rings attached to the case concentric with the axis of the runner and having continuous annular walls on the sides next to the runner, and vane rings alternating with the nozzle rings and having inwardly extended continuous annular walls attached to the runner and overlapping the adjacent annular walls of the inner nozzle rings, substantially as described.

7. In an elastic fluid turbine the combination of a case having annular motive-fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case, opposing walls of the case and runner having circular offsets concentric with the axis of the runner and receding from each other outwardly in a radial direction, nozzle rings attached to the offsets of the case concentric with the axis of the runner and having continuous annular walls on both sides of the guide vanes, and movable vane rings attached to the offsets of the runner concentric with its axis and having continuous annular walls on both sides of the vanes, the walls of the nozzle rings next to the case extending inwardly and overlapping the adjacent annular walls of the inner movable vane rings, and the walls of the movable vane rings next to the runner extending inwardly and overlapping the adjacent annular walls of the inner nozzle rings, substantially as described.

8. In an elastic fluid turbine the combination of a case having annular motive fluid supply and exhaust passages, a runner inclosed by and fitted to turn in said case and having circular offsets on opposite sides concentric with its axis and approaching each other towards its periphery, the opposing walls of the case having similar offsets which recede from the runner towards the exhaust passage, nozzle rings attached to the offsets of the case concentric with the axis of the runner and having continuous annular walls on both sides of the guide vanes, and movable vane rings attached to the offsets of the runner concentric with its axis and having continuous annular walls on both sides of the vanes, the walls of the nozzle rings next to the case extending inwardly and overlapping the adjacent annular walls of the inner movable vane rings, and the walls of the movable vane rings next to the runner extending inwardly and overlapping the adjacent annular walls of the inner nozzle rings, substantially as described.

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

OLE O. STORLE.

Witnesses:
CHAS. L. GOSS,
MAUDE L. EMERY.