No. 762,453. PATENTED JUNE 14, 1904.

J. C. STURGEON.

ELASTIC FLUID TURBINE.

APPLICATION FILED FEB. 25, 1904.

NO MODEL.

Fig. 1.

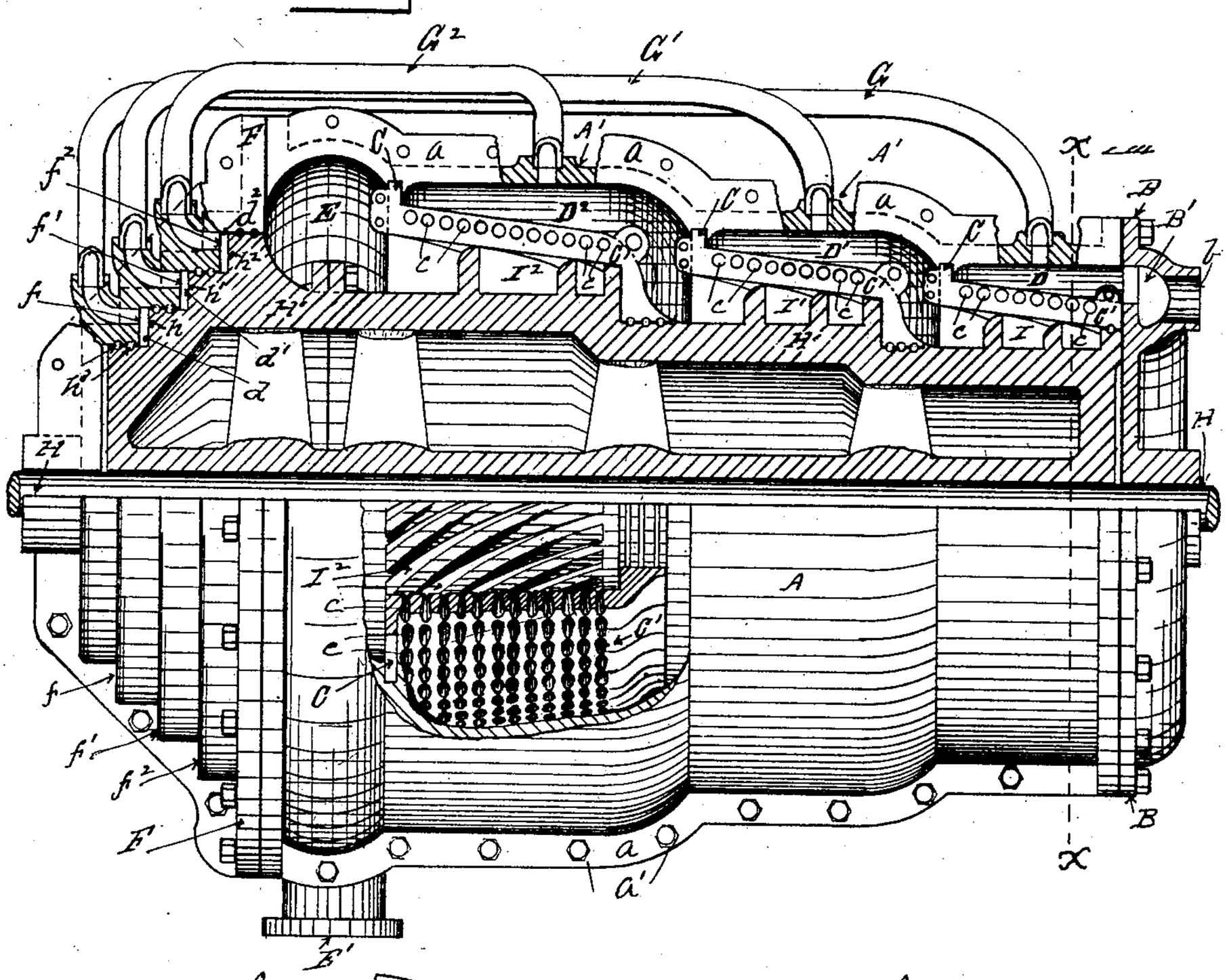


Fig. 2.

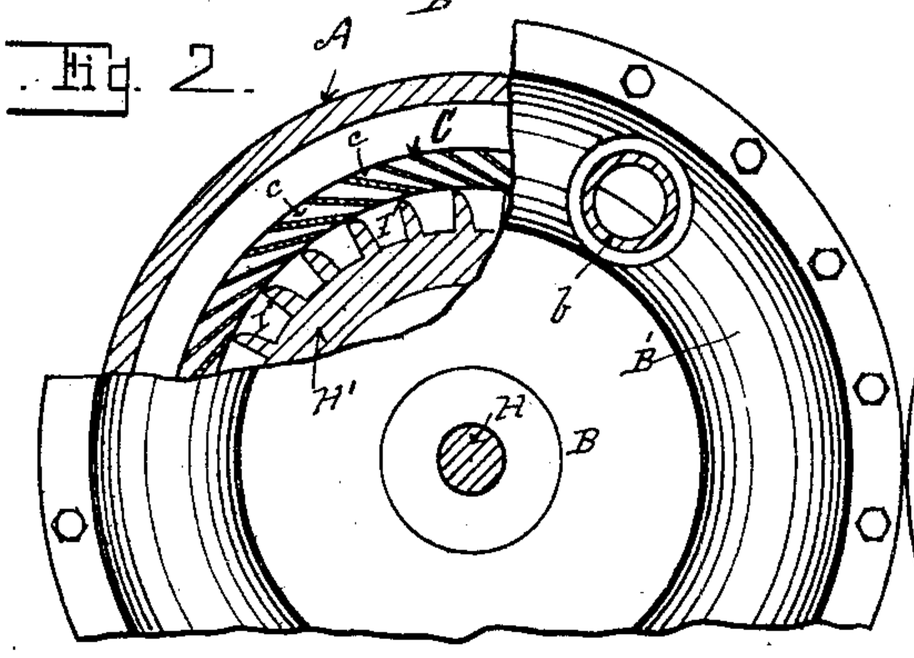
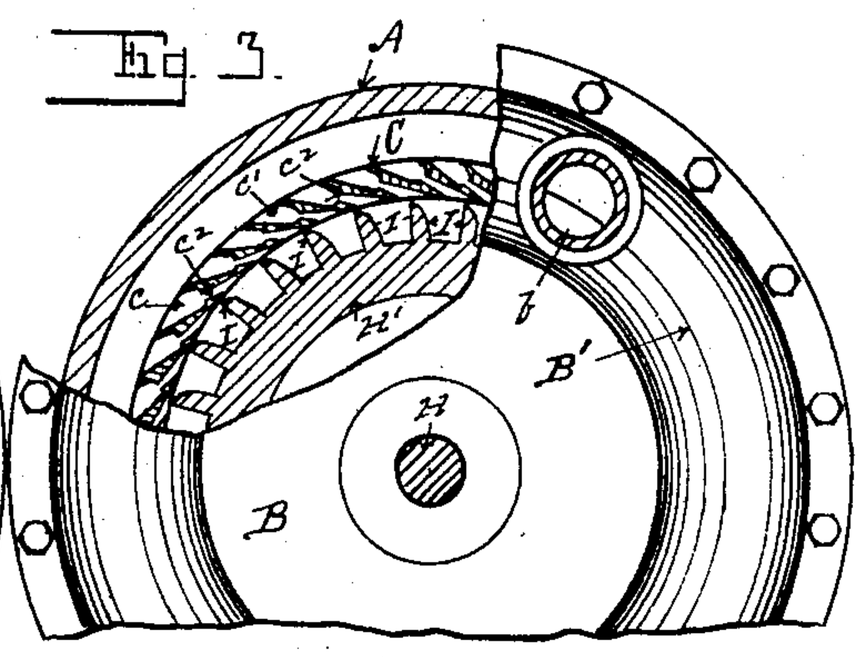


Fig. 3.



Witnesses.

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No. 762,453. Patented June 14, 1904.

UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

SPECIFICATION forming part of Letters Patent No. 762,453, dated June 14, 1904.

Application filed February 25, 1904. Serial No. 195,215. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. STURGEON, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Elastic-Fluid Turbine-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, forming part of this specification.

My invention relates to elastic-fluid turbine-engines, and has for its objects the combination in an engine comprising substantially a shell having a series of annular chambers therein closed at their rear ends and having the inner walls thereof provided with slots or steam-jet openings at angles to lines radiating from the axes of said chambers and hereinafter designated as "diagonal" slots or steam-jet openings, and a rotatable cylinder mounted therein concentric with the inner walls of said chambers and provided on its periphery with rows of vanes coinciding with and adjacent to the inner walls of said chambers, of a series of pressure or thrust chambers, preferably in the rear end of the shell and operating against the longitudinal thrust of the cylinder in that direction, each of which pressure or thrust chambers is connected with one of the annular chambers in the shell, so that the steam-pressure in each pressure or thrust chamber corresponds to the pressure in the annular chamber in the shell connected therewith, whereby the longitudinal pressure of the steam on the cylinder is equalized in both directions. I accomplish this result in the construction of engine herein shown by forming on the rear end of the cylinder a series of steps and in the rear head of the shell corresponding steps, the combination of each step on the cylinder and the corresponding step in the shell-head forming a pressure or thrust chamber, from which a pipe leads to a corresponding chamber in the shell, and in the construction shown there is one pressure or thrust chamber for each annular chamber in the shell, connected therewith by a pipe, so that the steam-pressure in each annular chamber is communicated to the corresponding pressure or thrust chamber connected therewith.

Another feature in the construction of this engine is the making of the diagonal steam-jet openings in the inner walls of the chambers in the shell in the form of round holes bored diagonally through the inner chamber-walls instead of diagonal slots therein, by which means I greatly simplify the construction of the inner chamber-walls.

These and other features of my invention are hereinafter fully set forth and explained, and illustrated in the accompanying drawings, in which—

Figure 1 is a view, partially in elevation and partially in section, of an elastic-fluid turbine-engine embodying my invention. Fig. 2 is an end view of the same, partially in elevation and partially in section, on the line $x\,x$ in Fig. 1. Fig. 3 is a like view of a modified construction of the same.

In the drawings illustrating my invention the shell of the engine is preferably made in two half-sections A A′, secured together by means of flanges a and bolts a', passing therethrough. On the inlet end of the shell I secure a suitable head B, provided with an annular steam-chamber B′ and a steam-inlet b. In the shell A A′, I secure walls C C′, which form the rear end and inner walls of a series of annular chambers D D′ D² in the shell A A′, these end and inner chamber-walls C C′ being preferably made in half-sections secured together and removably secured in the shell A A′.

In the inner walls C′ of the annular chambers D D′ D², I make diagonal steam-jet openings c, preferably in the shape of conical holes c, gradually decreasing in area from the inlet to the outlet thereof, as illustrated in Figs. 1 and 2. I can, however, make diagonal steam-jet openings c' in the inner chamber-walls C, as illustrated in Fig. 3, in which the steam-jet openings c' are enlarged from the inlet substantially half of the length thereof and then contracted to a comparatively small open-

ing c^2, from whence to the outlet ends of said openings they are again enlarged, which feature is clearly illustrated in Fig. 3. I can, however, utilize either form of steam-jet opening thus shown and described with good results.

At the outlet end of the shell I make an exhaust-chamber E, provided with an exhaust-outlet E′, and I provide the rear end of the shell A A′ with a head F, the outer end of which is stepped down in regular stages, so as to form a series of radial and annular outer compression or thrust chamber walls f f' f^2 for compression or thrust chambers d d' d^2, from which pipes G G′ G² lead to and connect with the annular chambers D D′ D² in the shell, so that the steam-pressure in said annular chambers D D′ D² is thereby respectively communicated to the pressure or thrust chambers d d' d^2 corresponding thereto.

On the shaft H, I mount a rotatable cylinder H′ concentrically with the inner walls C′ of the annular chambers D D′ D², and on the periphery of the cylinder H there are rows of spiral vanes I I′ I² coinciding with and adjacent to the inner walls C′ of said chambers. The end of each row of vanes under the inlet ends of said chambers are closed, and the opposite end of each row of vanes are open, so that the steam passes out from the open end of each row of vanes into the annular chamber succeeding thereto and from the open end of the last row of vanes into the exhaust-chamber E. The rear end of the cylinder H′ is preferably extended out into the rear head of the shell and is provided with step-down shoulders h^2 h' h on the end thereof corresponding to the steps f^2 f' f on the head F and operate to form the inner radial and annular walls of the pressure or thrust chambers d^2 d' d, so that the steam-pressure in said chambers is communicated to the cylinder in opposition to the pressure of the steam in the chambers D D′ D² acting thereon.

The peripheral walls of each of the shoulders h h' h^2 operate in close proximity to the inner wall of each step f f' f^2 on the head, and annular grooves h^3 are therein provided, preferably in both adjacent surfaces, which operate to form an automatic steam-packing therefor.

In operation the steam enters the first chamber D and is discharged against the first row of cylinder-vanes I and passes out of the open ends of said row of vanes into the chamber D′, from whence it is discharged as before, this operation being consecutively repeated by the steam in its traverse through all of the chambers until it is discharged from the last row of vanes into the exhaust-chamber E. Meanwhile when the steam enters the first chamber D a portion thereof passes through the pipe G to the pressure or thrust chamber d, and as it enters the second chamber D′ a portion thereof from that chamber passes through the pipe G′ to the pressure or thrust chamber d' and in like manner from the chamber D² to the pressure or thrust chamber d^2, whereby the pressure of the steam acting upon the cylinder longitudinally in both directions is equalized at whatever pressure the steam may be in the chambers D D′ D².

In this construction I have shown and described three annular chambers D D′ D² in the shell and the like number of pressure or thrust chambers d d' d^2 in the shell-head. It is obvious, however, that I can use any desired number of the annular chambers in the shell and an equal or greater number of pressure or thrust chambers connected therewith with good results, the important feature being to so arrange them with relation to each other that the action of the steam therein upon the cylinder will be substantially equalized in both directions. It is also obvious that the system of pressure or thrust chambers herein shown and described can be utilized in the construction of any elastic-fluid turbine-engine in which the steam is consecutively discharged from a series of chambers against vanes on a cylinder rotating within such series of chambers.

Therefore, having shown and described my invention so as to enable others to construct and utilize the same, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination in an elastic-fluid turbine-engine, comprising substantially a shell having a series of annular chambers therein, a rotatable cylinder and vanes thereon coinciding with and adjacent to the inner walls of said chambers, of one or more pressure or thrust chambers acting longitudinally on said cylinder in opposition to the thrust thereon caused by the action of the steam in its passage through the engine, and conduits connecting one or more of said annular chambers with said pressure or thrust chamber or chambers, substantially as set forth.

2. The combination in an elastic-fluid turbine-engine, of a shell having a series of annular chambers therein, a rotatable cylinder concentric with the inner walls of said chambers, vanes on said cylinder coinciding with and adjacent to the inner walls of each chamber, two or more pressure or thrust chambers acting on the rear of said cylinder longitudinally in opposition to the action of the steam thereon in its passage through the engine, and pipes or steam-passages connecting some of said annular chambers with said pressure or thrust chambers, substantially as set forth.

3. The combination in an elastic-fluid turbine-engine, of a shell having a series of annular chambers therein the inner walls whereof are provided with diagonal steam-jet openings, a rotatable cylinder concentric with the inner walls of said chambers, a row of vanes on the cylinder coinciding with and adjacent

to the inner wall of each chamber, a series of pressure or thrust chambers acting longitudinally on the rear end of the cylinder, a pipe or duct connecting each annular chamber with a pressure or thrust chamber corresponding thereto, substantially as set forth.

4. The combination in an elastic-fluid turbine-engine, of a shell having a series of annular chambers consecutively increasing in capacity from the inlet to the exhaust of the engine, the inner walls of which are provided with diagonal steam-jet openings, a rotatable cylinder concentric with the inner walls of said chambers, a row of vanes on the cylinder coinciding with and adjacent to the inner wall of each chamber, a series of pressure or thrust chambers communicating longitudinal pressure against the rear end of the cylinder in opposition to the longitudinal thrust caused by the action of the steam passing through the annular chambers in the shell, and a pipe or conduit connecting each annular chamber with a corresponding pressure or thrust chamber, substantially as set forth.

5. The combination in an elastic-fluid turbine-engine, of a sectional shell, removable annular chamber end and inner walls forming a series of annular chambers therein consecutively increasing in capacity from the steam-inlet to the exhaust of the engine, and having diagonal steam-jet openings in the inner walls of said chambers, a rotatable cylinder concentric with the inner walls of said chambers, a row of spiral vanes on the cylinder coinciding with and adjacent to the inner wall of each chamber, a series of pressure or thrust chambers communicating longitudinal pressure to the cylinder in opposition to the longitudinal thrust thereon caused by the action of the steam passing through the annular chambers in the shell, and a pipe or duct connecting each annular chamber in the shell with a pressure or thrust chamber corresponding thereto, substantially as set forth.

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

JOHN C. STURGEON.

Witnesses:

H. M. STURGEON,

G. F. MEAD.