No. 762,450. PATENTED JUNE 14, 1904.

J. C. STURGEON.

ELASTIC FLUID TURBINE.

APPLICATION FILED JULY 22, 1903.

NO MODEL.

Fig. 1.

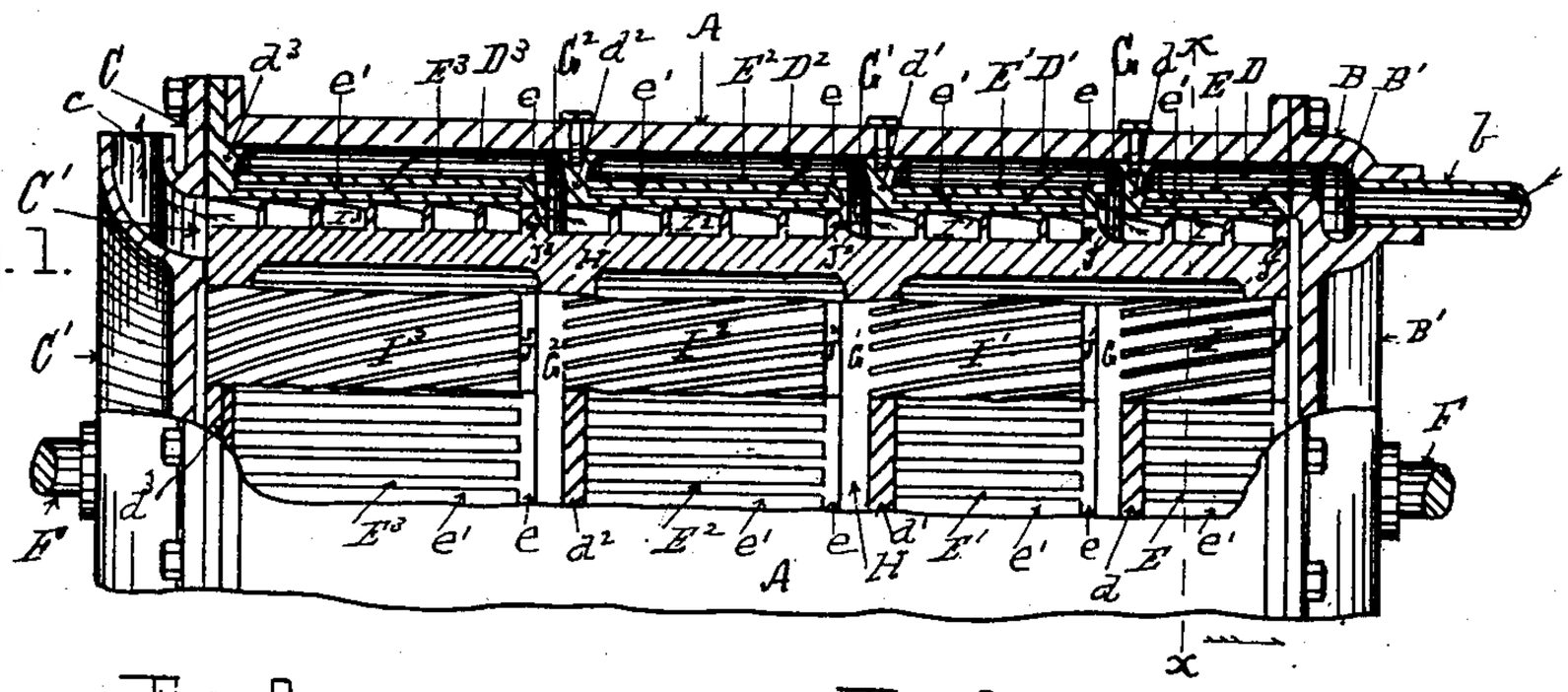


Fig. 2.

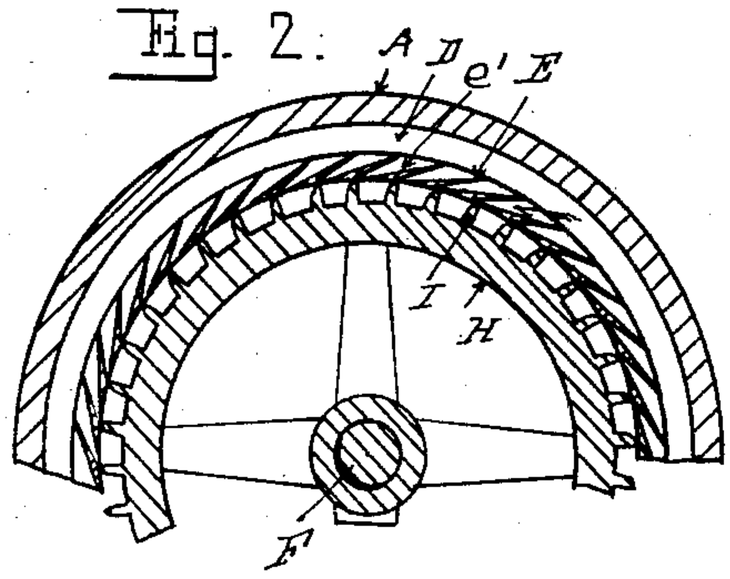


Fig. 3.

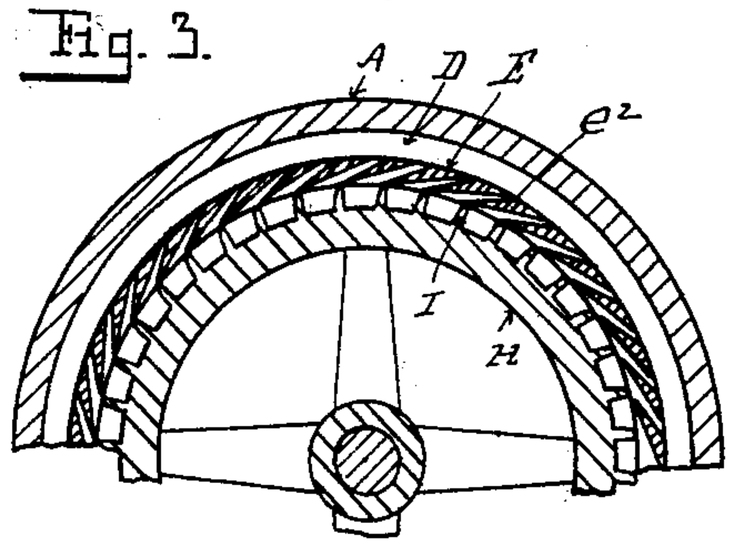
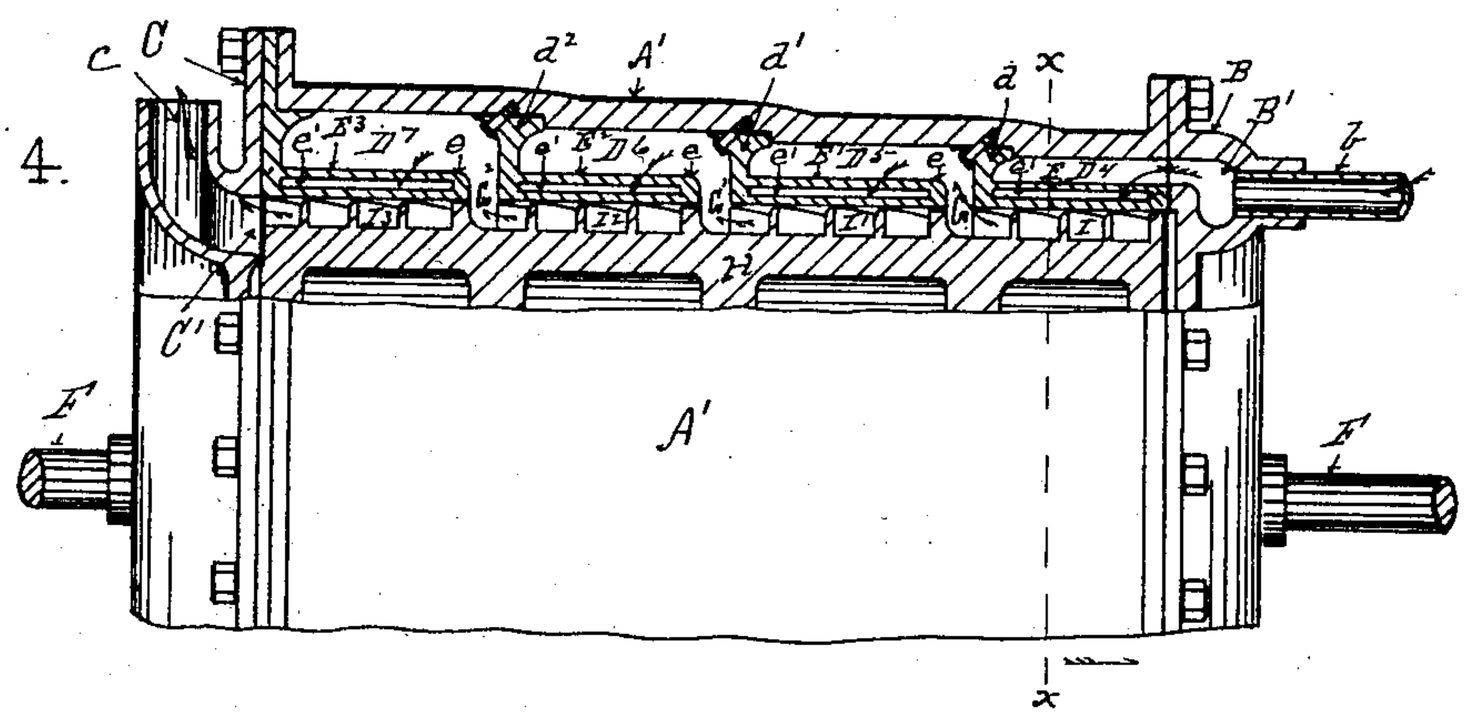


Fig. 4.



Witnesses.
F. J. Barrett
H. M. Sturgeon

Inventor.
John C. Sturgeon

No. 762,450. Patented June 14, 1904.

UNITED STATES PATENT OFFICE.

JOHN C. STURGEON, OF ERIE, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO ALBERT F. DOBLER, OF GIRARD, PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

SPECIFICATION forming part of Letters Patent No. 762,450, dated June 14, 1904.

Application filed July 22, 1903. Serial No. 166,590. (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 object the construction of an engine of this type of an annular shell having a series of annular chambers therein provided with slots or steam-jet openings through the inner walls thereof at angles to radial lines through the axes of said chambers, hereinafter designated as "diagonal" slots or steam-jet openings, with a rotatable cylinder within said shell provided with annular rows of vanes on the periphery thereof coinciding with and adjacent the inner walls of the chambers in the shell, so that the steam in its passage through the engine on entering the first chamber of the series is discharged therefrom through the diagonal slots or jet-openings in the inner wall thereof against the first row of vanes on the cylinder, from whence it passes to the second chamber and is again in like manner discharged through the diagonal slots in the inner wall thereof against the second row of vanes on the cylinder, which operation of the steam is consecutively repeated until it has traveled through all of the chambers of the series and operated upon all of the rows of vanes on the cylinder and finally passes out at the exhaust of the engine. To accomplish this result, I construct the engine with an annular shell, to the steam-inlet end of which there is preferably secured a head provided with suitable steam-inlet mechanism, and to the exhaust end of the shell is also preferably secured a head provided with a suitable exhaust-chamber with an opening therefrom. On the inner surface of this shell I provide a series of annular chambers, consecutively increasing in capacity from the inlet to the outlet of the engine. The inner walls of these chambers are secured to and supported by radial rings or flanges preferably removably secured in the shell and forming the rear end walls of said chambers. The inner walls of the chambers are provided with diagonal slots or steam-jet openings, through which the steam discharges from the chambers. In this shell there is a rotatable cylinder provided with vanes on its periphery coinciding with and adjacent to the inner faces of the inner walls of the chambers in the shell. The vanes are preferably placed spirally on the periphery of the cylinder, and the ends thereof toward the steam-inlet end of the shell are closed and the opposite ends thereof are open, while the ends of the annular chambers in the shell toward the steam-inlet end of the shell are open and the opposite ends closed, and between the closed ends of the chambers in the shell and the closed ends of the vanes on the cylinder there are annular passages through which the steam passes from the open ends of the vanes to the next succeeding chamber, so that the steam passing from the first chamber through the diagonal slots in the inner wall thereof impinges against the first row of vanes on the cylinder and thence travels longitudinally between the vanes until it enters the passage to and passes therethrough to and into the second chamber, from whence it is again discharged against the second row of vanes, which operation is consecutively repeated by the steam in its traverse through the engine until it reaches the exhaust-chamber thereof. It will be observed that the chamber in the shell consecutively increase in capacity from the steam-inlet to the steam-outlet of the engine, which provides room for the gradually-increasing volume of the steam caused by its gradual expansion during its passage through the engine, while the short passages traveled by the steam between the end of each row of vanes and the next succeeding chamber leaves a minimum amount of

room for unnecessary and wasteful expansion of the steam.

The features of my invention are hereinafter fully set forth and described, and diagrammatically illustrated in the accompanying drawings, in which—

Figure 1 is a view of a section of my improved elastic-fluid turbine-engine partially in elevation and partially in section. Fig. 2 is a transverse section of the same on the line *x x* in Figs. 1 and 4. Fig. 3 is a like transverse section showing a modified form of the jet-openings in the inner walls of the chambers in the shell of the engine. Fig. 4 is a view in section of a modified construction of the chambers in the shell of my improved elastic-fluid turbine-engine.

In Fig. 1 of the drawings, A is the annular shell of the engine; B, a head on the steam-inlet end thereof; B′, an annular steam-chest therein, and *b* a steam-inlet pipe; C, the head on the exhaust end of the shell; C′, an exhaust-chamber therein, and *c* the exhaust-outlet therefrom. On the inner surface of the annular shell A, I make a series of annular chambers D D′ D^2 D^3, consecutively increasing in capacity. The rear end walls of these chambers consist of radial rings or flanges *d d′* d^2 d^3, preferably removably secured to the shell A, to which rings or flanges I secure the rear ends of the inner annular walls E E′ E^2 E^3 of said chambers, and through these inner annular chamber-walls I make diagonal slots or steam-jet openings *e′*. (Clearly shown in Fig. 2.) Between the chamber end walls *d d′* d^2 d^3 and the ends *e* of the inner annular walls E′ E^2 E^3 of the chambers D′ D^2 D^3 there are radial passages G G′ G^2, which lead from the open rear ends of the vanes on the cylinder, hereinafter described, into the open ends of the chambers D′ D^2 D^3, as illustrated in Figs. 1 and 4. Within the shell A, on a shaft F, I mount a cylinder H so that it will rotate freely. Upon the periphery of the cylinder H, I secure annular rows of vanes I I′ I^2 I^3, which vanes are connected together at the ends thereof toward the steam-inlet of the engine by radial walls J J′ J^2 J^3 on the periphery of the cylinder, while the opposite ends thereof are open. The vanes in said rows are preferably arranged spirally on the cylinder, as illustrated in Fig. 1, and the rows of vanes I I′ I^2 I^3 are so located on the cylinder H that they respectively coincide with the inner faces of the inner walls E E′ E^2 E^3 of the chambers D D′ D^2 D^3 and so that the open ends of the rows of vanes I I′ I^2 are directly under the radial end walls *d d′* d^2 of said chambers and the peripheries of the vanes in close proximity to the inner faces of the inner walls E E′ E^2 E^3 of said chambers and the inner faces of their end walls *d d′* d^2 d^3, and as the steam enters the first chamber D of the series it passes through the diagonal slots or steam-jet-openings *e′* in the inner wall E thereof and impinges against the first row of vanes I and passes out between the open ends of said vanes under the wall *d* of said chamber and thence through the passage G into the second and somewhat larger chamber D′, from whence it discharges through the diagonal slots *e′* in its inner wall against the second row of vanes I′, as before, and in this manner the steam travels consecutively through the remaining and successively-enlarging chambers of the series and in its passage from each chamber impinges against the row of vanes adjacent thereto until it passes out into the exhaust-chamber C′, whereby the steam in its traverse through the engine acts consecutively upon the several rows of vanes on the cylinder and causes it to rotate.

In Fig. 3 I show a modified construction of slots or jet-openings e^2 in the inner walls E, &c., of the chambers D, &c., this form of jet-opening gradually enlarging from the chamber outward in contradistinction to the slots or jet-openings *e′*, (shown in Fig. 2,) which gradually diminish from the chamber outward, and I can utilize either form of said jet-openings desired in my engine with equal facility.

In Fig. 4 I show a modified construction of the shell and of the annular chambers therein, in that the chambers D^4, D^5, D^6, and D^7 therein shown are successively enlarged from the steam-inlet to the steam-outlet of the engine by successively increasing the radial depths thereof in contradistinction to successively increasing their lengths, as in Fig. 1, either mode of construction operating equally well for the purpose—viz., the successive enlargement of the capacity of the chambers to provide for the gradual expansion of the steam as it passes through the engine.

I have hereinbefore described the construction and operation of my improved engine so fully that it is believed that further description thereof is unnecessary.

It will be observed that in the drawings and hereinbefore I have shown and described four chambers and corresponding rows of vanes. I can, however, use any number of chambers and rows of vanes desired, and therefore reserve the right so to do.

In my application for a patent for an elastic-fluid turbine-engine, filed June 19, 1903, Serial No. 162,179, I showed and described a conical shell having a series of annular chambers and a conical cylinder therein, but did not therein describe and claim the features in elastic-fluid turbine-engines herein shown and described. Therefore I have herein shown and described this invention, so as to enable others skilled in the art to which it appertains to construct and use the same, and in so doing I do not desire to confine myself to the exact construction thereof herein shown and described, as it is obvious that the same may be modified in many respects without departing from the spirit of my invention.

Therefore 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, of an annular shell having a series of annular chambers therein into which the steam consecutively enters, and from which it is consecutively discharged, radial end walls closing the rear ends of said chambers, inner annular chamber-walls secured to said end walls and having diagonal slots or steam-jet openings therethrough gradually increasing in width toward their discharge ends, a cylinder rotatable in said shell, vanes on the periphery of said cylinder coinciding with and adjacent to the inner faces of the inner walls of said chambers, and radial rings or flanges on said cylinder closing the spaces between the ends of the vanes toward the inlet end of the engine, substantially as set forth.

2. The combination in an elastic-fluid turbine-engine, of an annular shell, having a series of annular chambers therein into which the steam consecutively enters, and from which it is consecutively discharged, radial rings or flanges removably secured in said shell so as to form the rear end walls of said chambers, annular walls secured to said removable rings or flanges so as to form the inner walls of said chambers and having diagonal slots or steam-jet openings therein, a cylinder rotatable in said shell, rows of vanes on the periphery thereof corresponding to and coinciding with the inner faces of the inner walls of said chambers, substantially as set forth.

3. The combination in an elastic-fluid turbine-engine, of an annular shell having a series of annular chambers therein consecutively increasing in capacity toward the outlet end of the engine, into which the steam consecutively enters and from which it is consecutively discharged, radial rings or flanges removably secured in said shell so as to form the rear end walls of said chambers, annular walls secured to said removable rings or flanges so as to form the inner walls of said chambers and having diagonal slots or steam-jet openings therethrough, a cylinder rotatable in said shell, a row of vanes on the periphery thereof coinciding with and adjacent to the inner face of the inner wall of each of said annular chambers, and radial rings or flanges on said cylinder closing the openings between the vanes toward the inlet end of the engine, substantially as set forth.

4. The combination in an elastic-fluid turbine-engine, of an annular shell having a series of annular chambers therein consecutively increasing in capacity, radial walls closing one end of each chamber and inner annular chamber-walls secured to said radial walls and having diagonal slots or jet-openings therein, a cylinder rotatable in said shell, and spiral vanes on the periphery of the cylinder coinciding with and adjacent to the inner faces of the inner walls of said annular chambers, substantially as set forth.

5. The combination in an elastic-fluid turbine-engine, of an annular shell having a series of annular chambers therein consecutively increasing in capacity, and passages leading to the inlet ends of said chambers, radial walls closing one end of each of said chambers and forming one side of each of said passages, annular inner chamber-walls joined to each chamber end wall and having diagonal slots or jet-openings therein, a cylinder rotatable in said shell, and annular rows of spiral vanes on the periphery of the cylinder coinciding with and adjacent to the inner faces of the inner walls of said annular chambers, substantially as set forth.

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

JOHN C. STURGEON.

Witnesses:
H. M. STURGEON,
F. J. BASSETT.