No. 792,143. PATENTED JUNE 13, 1905.

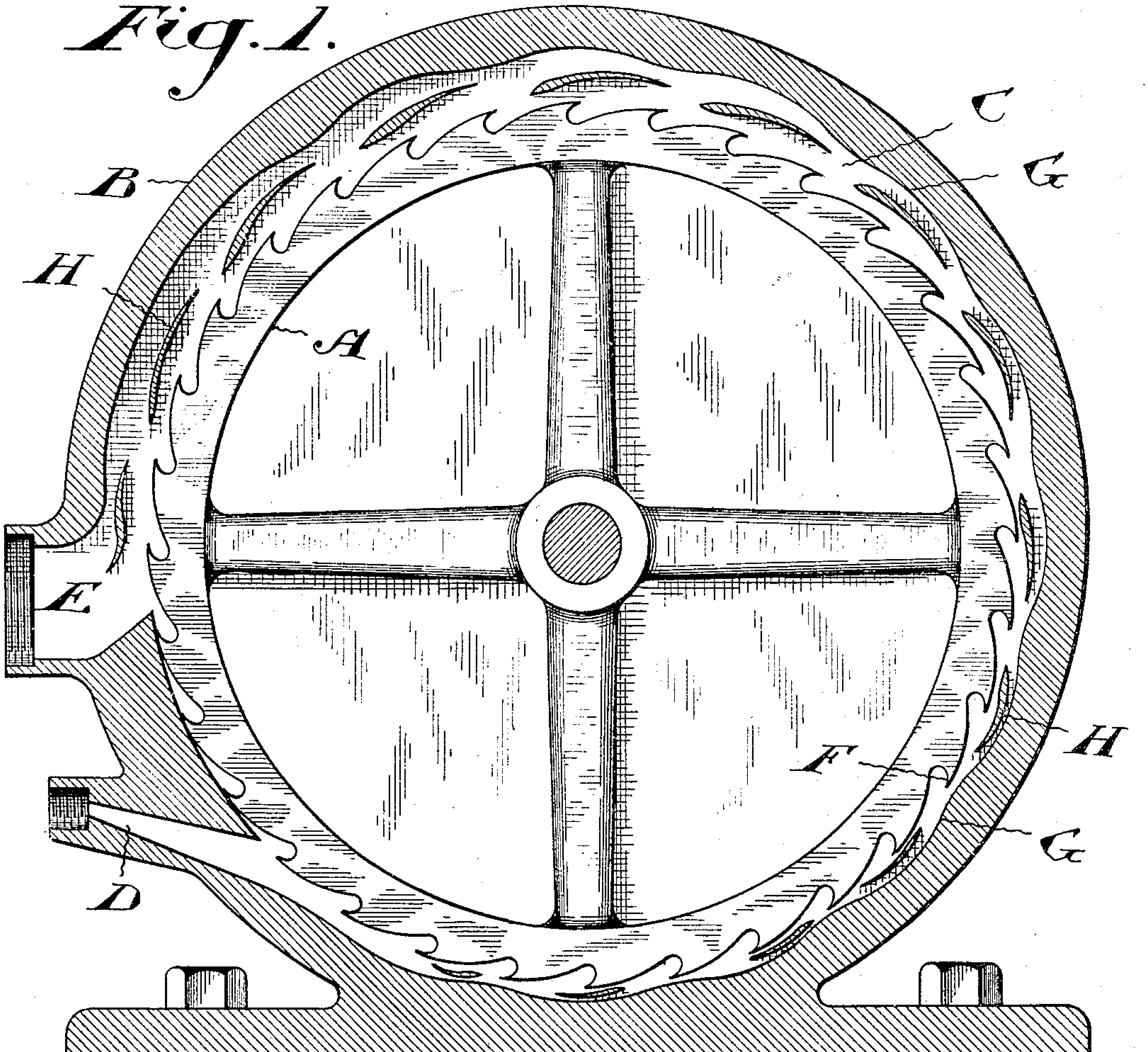
M. MATTHEWS.

ELASTIC FLUID TURBINE.

APPLICATION FILED FEB. 1, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



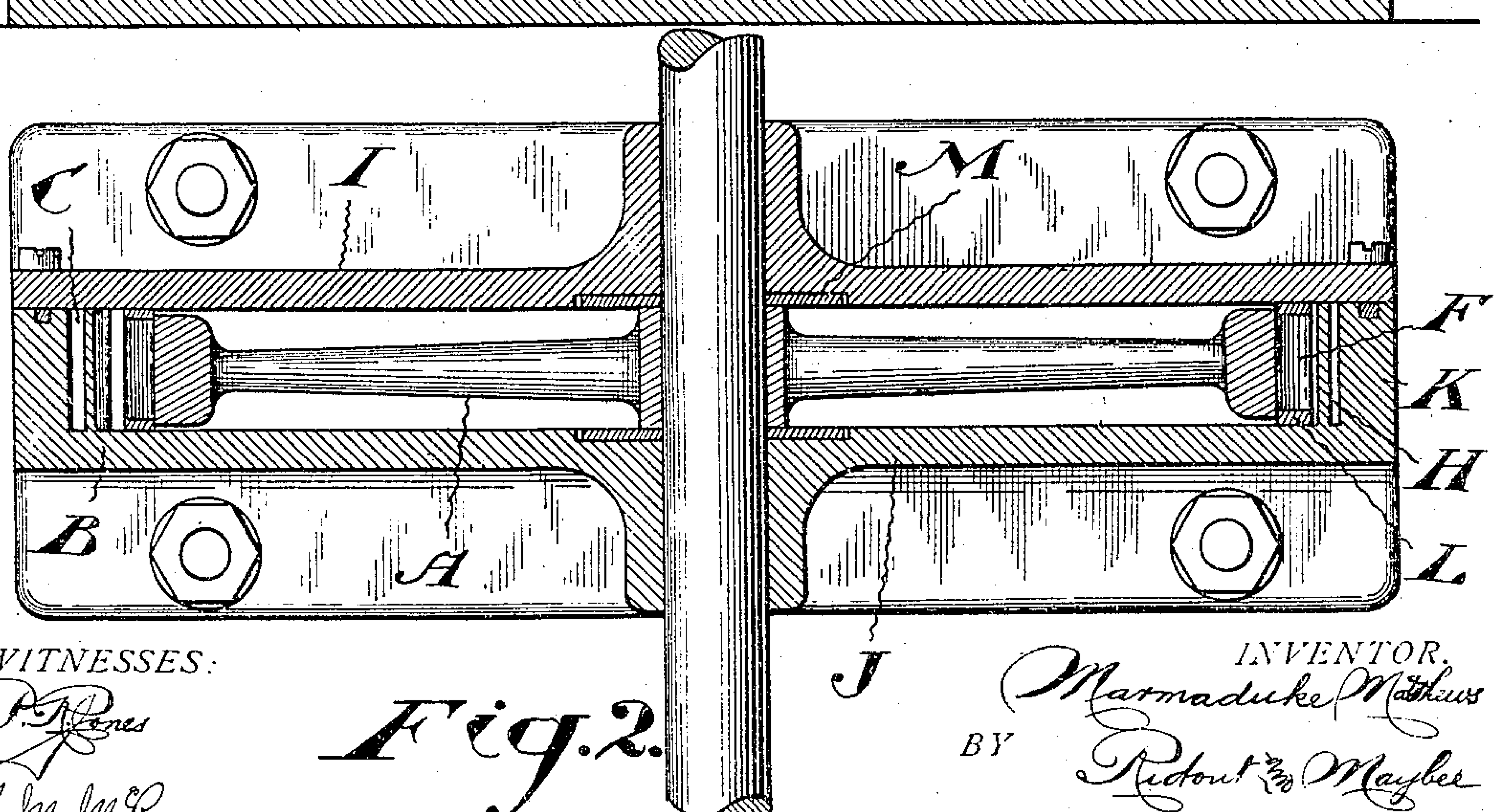


Fig. 2.

WITNESSES:

P. F. Jones

A. M. McRae

INVENTOR.

Marmaduke Matthews

BY

Ridout & Maybee

ATTORNEYS

No. 792,143. PATENTED JUNE 13, 1905.

M. MATTHEWS.

ELASTIC FLUID TURBINE.

APPLICATION FILED FEB. 1, 1905.

3 SHEETS—SHEET 2.

Fig. 3.

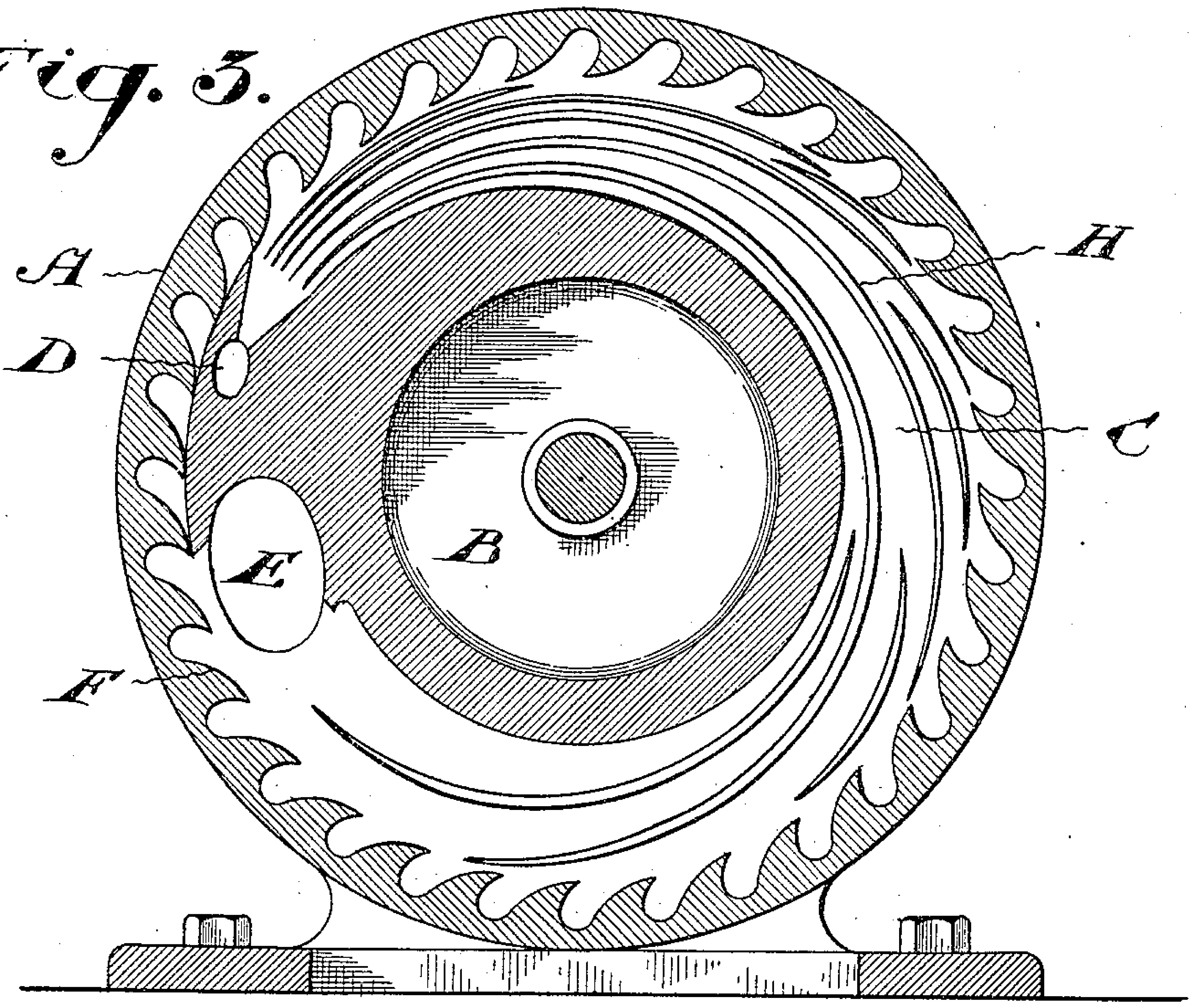
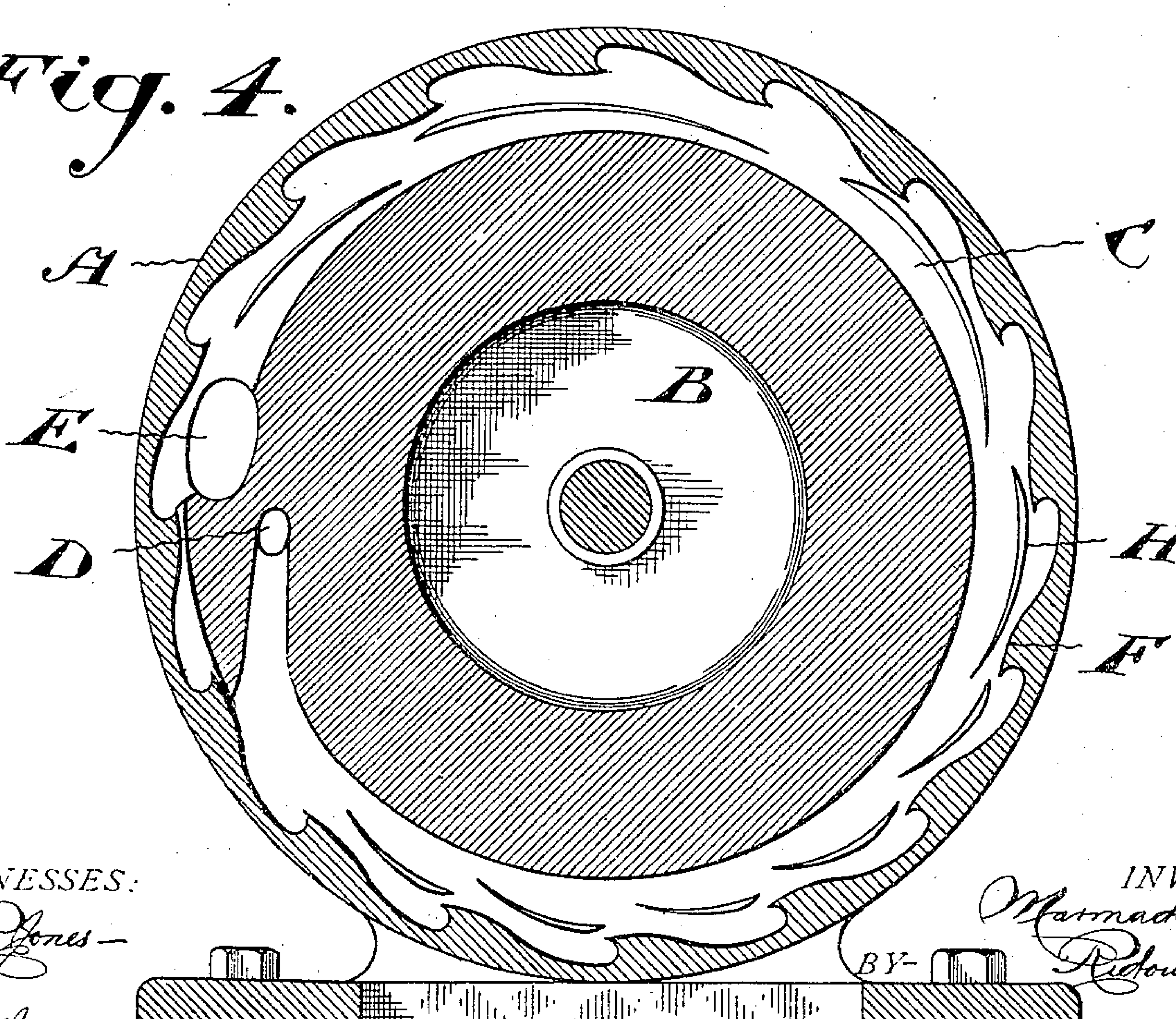


Fig. 4.



WITNESSES:

F. R. Jones

A. M. McRae

INVENTOR.

Marmaduke Matthews

BY Ridout & Maybee

ATTORNEYS

No. 792,143. PATENTED JUNE 13, 1905.

M. MATTHEWS.

ELASTIC FLUID TURBINE.

APPLICATION FILED FEB. 1, 1905.

3 SHEETS—SHEET 3.

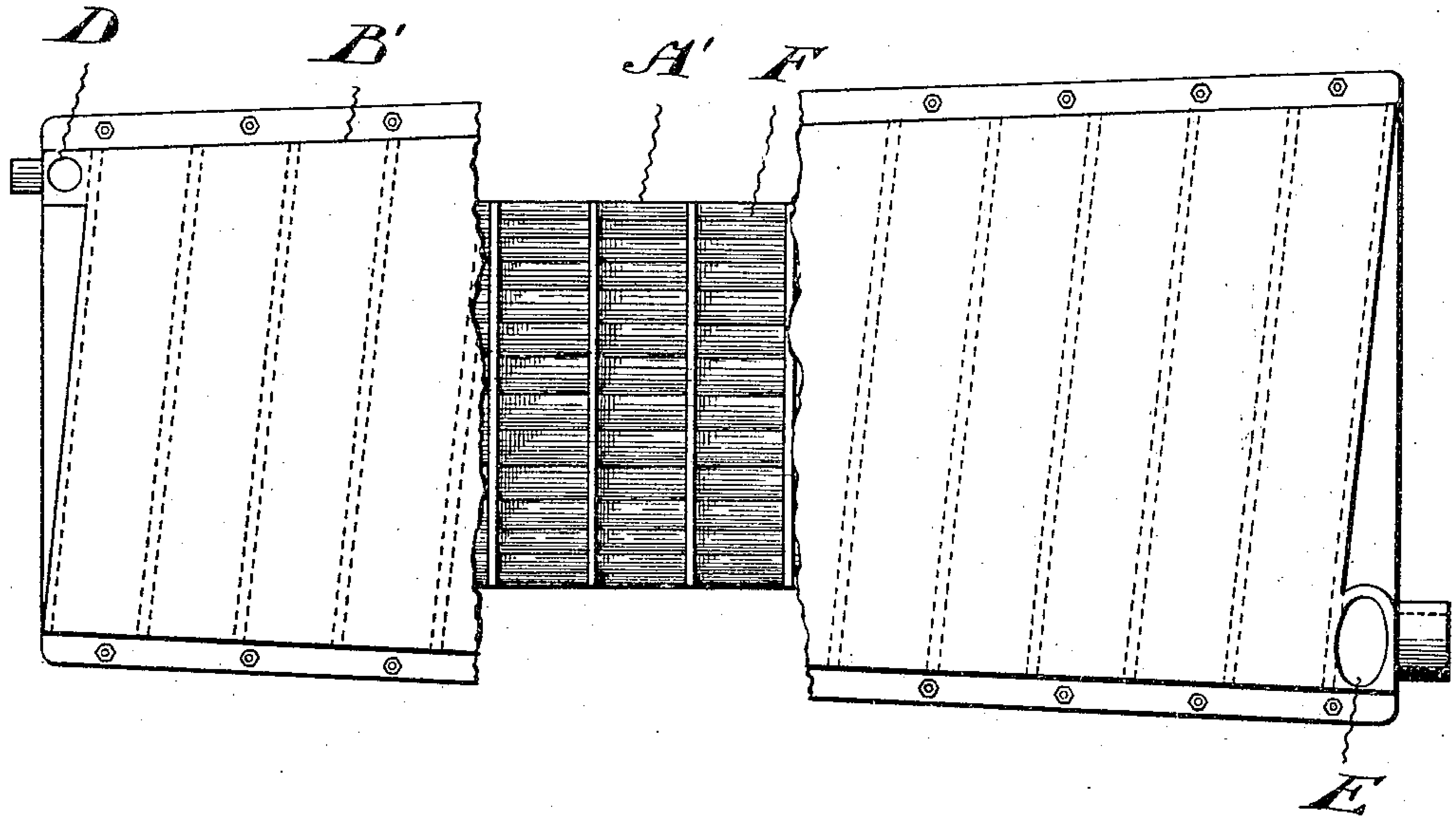


Fig. 5.

WITNESSES:
P. R. Jones.
A. M. McRae

INVENTOR.
Marmaduke Matthews.
BY Ridout and Maybee
ATTORNEYS

No. 792,143. Patented June 13, 1905.

UNITED STATES PATENT OFFICE.

MARMADUKE MATTHEWS, OF WYCHWOOD PARK, BRACONDALE, CANADA.

ELASTIC-FLUID TURBINE.

SPECIFICATION forming part of Letters Patent No. 792,143, dated June 13, 1905.

Application filed February 1, 1905. Serial No. 243,724.

To all whom it may concern:

Be it known that I, MARMADUKE MATTHEWS, of Wychwood Park, Bracondale, in the county of York, Province of Ontario, Canada, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to elastic-fluid turbines of the disk or cylinder type; and the object is to devise means for using the steam expansively and directing it repeatedly against the buckets of the rotor part without breaking the continuity of the flow.

With this object in view the invention consists, essentially, in providing the stator part with an annular elastic-fluid race communicating with the buckets of the rotor part, the said race increasing in capacity from the inlet to the exhaust and being provided with means for repeatedly directing the expanding fluid against the buckets of the rotor part, substantially as hereinafter more specifically described and then definitely claimed.

Figure 1 is a side sectional elevation of the improved turbine. Fig. 2 is a cross-section of the same. Fig. 3 is a side sectional elevation of a modification, and Fig. 4 is a similar view of another modification. Fig. 5 is a diagrammatic view of another modification.

In the drawings like letters of reference indicate corresponding parts in the different figures.

Referring particularly to Fig. 1, A is the rotor part of the turbine, and B the stator, the spindle of the rotor part being, of course, suitably journaled in the sides of the stator. Between the stator and rotor parts is formed an annular race C for the passage of the elastic fluid employed. This race, it will be seen, communicates with the buckets of the rotor part. In a cross-section this annular race may vary considerably in its ordinary form, being rectangular, as shown in Fig. 2. With this annular race communicates the nozzle D for the elastic fluid. Adjacent to the nozzle D the annular race communicates with the exhaust E. It will be seen that the race C increases progressively in capacity from the inlet to the exhaust, so that the fluid may be used expansively. The exhaust is therefore, of course, of considerably greater capacity than the nozzle D. The periphery of the rotor part is provided with a series of buckets F. These are shown saw-toothed in shape; but I do not confine myself to the exact form shown or any other form, my invention lying more particularly in the method of directing the fluid against the buckets rather than in the buckets themselves. The peripheral wall of the steam-race is preferably waved or undulated, as shown, the sides G of the undulations being so inclined as to direct the fluid coming in contact with them against the buckets of the rotor. Owing to the great velocity of the fluid, these undulations or corrugations are of a comparatively slight and gradual nature, so that the fluid is disturbed as little as possible in its flow and friction kept at a minimum. In the fluid-race are located a series of directing-blades H, inclined forwardly in the direction of the motion of the rotor. A clear space is left between each of these blades, the periphery of the annular race, and the buckets of the rotor. I further find it preferable to increase progressively the space between the blades and the buckets from the inlet toward the exhaust to accommodate the volume of the fluid. When undulations in the inner periphery of the annular race are employed, the blades are so located as to take up the work of the sides G of the undulations and direct the fluid reflected from them against the buckets of the rotor. The undulations and the blades are so proportioned that the increase in the capacity of the race due to the hollow of an undulation is balanced by the decrease due to the mass of the blade located in the race opposite the hollow of the undulation. Thus despite the introduction of the blades in the race choking of the fluid is avoided and the expansion is continuous and unbroken. In wheels of small diameter these directing-blades may be found sufficient for the purpose without the employment of the undulations, or, if desired, the undulations may be employed at one part of the fluid-space and omitted at another. It will be noted that the blades are located in the annular fluid and do not simply form nozzles connecting a fluid-space with the buckets of the rotor.

In Figs. 3 and 4 I show the inner part as stator and the outer as rotor, the reverse of the arrangement shown in Figs. 1 and 2. This construction remains substantially the same, with the exception that the inlet or nozzle D and the exhaust E have to be led through the side of the stator part instead of into the periphery or rim, as in Fig. 1. This distinction applies also to the form shown in Fig. 4. A further difference is shown in Fig. 3, and that is that a number of the directing-blades H extend from the vicinity of the nozzle to the point at which they are intended to deliver the elastic fluid against the buckets of the rotor.

It will be seen that in all the forms shown the elastic fluid after the first impact is allowed progressively to expand and is brought again and again into contact with the buckets of the rotor, thus reinforcing the feed at such frequent intervals as may be desired and distributing the pressure for impact upon the greatest amount of surface possible on the periphery of the rotor. A certain proportion of the elastic fluid is directed by each blade against the rotor, and the remainder escapes farther along between the blade and the periphery of the annular race. This fluid expands and is partly caught by the next blade to be directed against the buckets in the vicinity of the said blade, together with a portion of the fluid which has passed between the buckets and the first-mentioned blade. As the action under each blade is the same, by the time the fluid has arrived at the exhaust practically every part of it has been brought into contact with the buckets of the rotor and, indeed, most of it has contacted with the said buckets more than once, this being accomplished without in any way breaking the continuity of the flow of the elastic fluid or impairing its elasticity. By this means I transform the largest possible portion of the kinetic energy of the fluid into rotary motion of the rotor.

While the turbine may be constructed in various ways, I show in Fig. 2 what I consider a preferable method. The outer part is formed of the side plates I and J. On one of these is formed the rim K, the other side being bolted to the rim with a suitable gasket or packing between the parts. The blades H are cast or formed with one of the sides. The buckets F are cast on the periphery of the rotor A, and their sides are formed of separate rings L. This construction is simple, cheap, and the various parts are easily accessible for machine-finishing. To prevent leakage where the shaft projects through the side plates I and J, I employ washers M, loose on the shaft, but closely fitting the same. The steam-pressure holds these tightly against the sides to close any space between the shaft and the sides. These washers must either fit against the faces of the sides or if set in recesses, as shown, the recesses will be large enough to bring no pressure on the periphery of the washers.

In Fig. 5 I indicate how an outer stator part B′ may be wound helically round a cylindrical rotor A, in effect made up of a series of disks set side by side on the same shaft and each provided with its buckets. By this means a great length of race is provided with a small diameter of rotor, thus providing for full expansion of the fluid. The race will of course progressively increase in cross-section and be provided with directing-blades, as in the other forms illustrated.

In the form shown in Fig. 3 the device approximates a little more closely to the multinozzle type, as several of the blades will be directing substantially live fluid against the buckets of the rotor, and this arrangement is equally applicable to the form shown in Fig. 1.

Of course in practice both the inlet and the exhaust may be controlled or throttled, if desired; but no novelty is claimed for this.

It will be seen that my turbine is very simple and easily constructed, that end thrust is completely avoided, and that the steam is used expansively without in any way breaking its flow.

What I claim as my invention is—

1. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two increasing in capacity from its inlet to its exhaust end and continuously communicating with the buckets from end to end; and means located in said race for repeatedly directing the fluid against the buckets, substantially as described.

2. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two increasing in capacity from its inlet to its exhaust end and continuously communicating with the buckets from end to end, the periphery of the annular race being undulated in contour to cause the fluid to be successively redirected against the buckets, substantially as described.

3. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two, increasing in capacity from its inlet to its exhaust end and communicating with the buckets; and a series of directing-blades set in the race, each adapted to direct a portion of the flow toward the buckets, substantially as described.

4. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two, increasing in capacity

from its inlet to its exhaust end and communicating with the buckets, the periphery of the annular race being undulated in contour to cause the fluid to be successively redirected against the buckets; and a series of directing blades or walls set in the race, each adapted to direct a portion of the flow toward the buckets, substantially as described.

5. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two, increasing in capacity from its inlet to its exhaust end and communicating with the buckets; and a series of directing blades or walls set in the race and each separated by a clear space from the buckets and the periphery of the race, substantially as described.

6. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two, increasing in capacity from its inlet to its exhaust end and communicating with the buckets; and a series of directing blades or walls set in the race and each separated by a clear space from the buckets and the periphery of the race, the space between the blades and the buckets increasing progressively from the inlet to the exhaust end of the race, substantially as described.

7. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two, increasing in capacity from its inlet to its exhaust end and communicating with the buckets, the periphery of the annular race being undulated in contour to cause the fluid to be successively redirected against the buckets; and a series of directing-blades set in the race, each adapted to direct a portion of the flow toward the buckets, the blades and undulations being proportioned and arranged to coöperate with one another, substantially as described.

8. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part comprising two sides and a rim formed integral with one of the sides, and forming with the rotor part an annular steam-race; and directing-blades in said race integral with one of the sides substantially as described.

9. In a fluid-turbine the combination of a rotor part provided with a plurality of series of circumferential buckets, arranged side by side on the same axis; a stator part inclosing the same; and an elastic-fluid race between the two parts communicating with the buckets and extending helically from end to end of the engine, and a series of directing blades or walls set in the race, and each separated by a clear space from the buckets and the periphery of the race.

10. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two communicating with the buckets; and a series of directing blades or walls set in the race and each separated by a clear space from the buckets and the periphery of the race, the space between the blades and the buckets increasing progressively from the inlet to the exhaust end of the race, substantially as described.

11. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two communicating with the buckets; and a series of directing blades or walls set in the race and each separated by a clear space from the buckets and the periphery of the race, the space between the blades and the buckets increasing progressively from the inlet to the exhaust end of the race, substantially as described.

12. In a fluid-turbine the combination of a rotor part provided with circumferential buckets; a stator part, an annular fluid-race being formed between the two, increasing in capacity from its inlet to its exhaust end and communicating with the buckets; and a series of directing blades or walls set in the race and each separated by a clear space from the buckets and the periphery of the race, the space between the blades and the hollows of the undulations being proportioned to balance one another in cubical contents, and so maintain the equable and continuous increase in the capacity of the fluid-race, substantially as described.

Toronto, January 30, 1905.

MARMADUKE MATTHEWS.

In presence of—

J. EDW. MAYBEE,

P. R. JONES.