

J. D. FRAIVILLIG.
STEAM TURBINE.
APPLICATION FILED APR. 10, 1908.

919,340.

Patented Apr. 27, 1909.
3 SHEETS—SHEET 1.

Fig. 2.

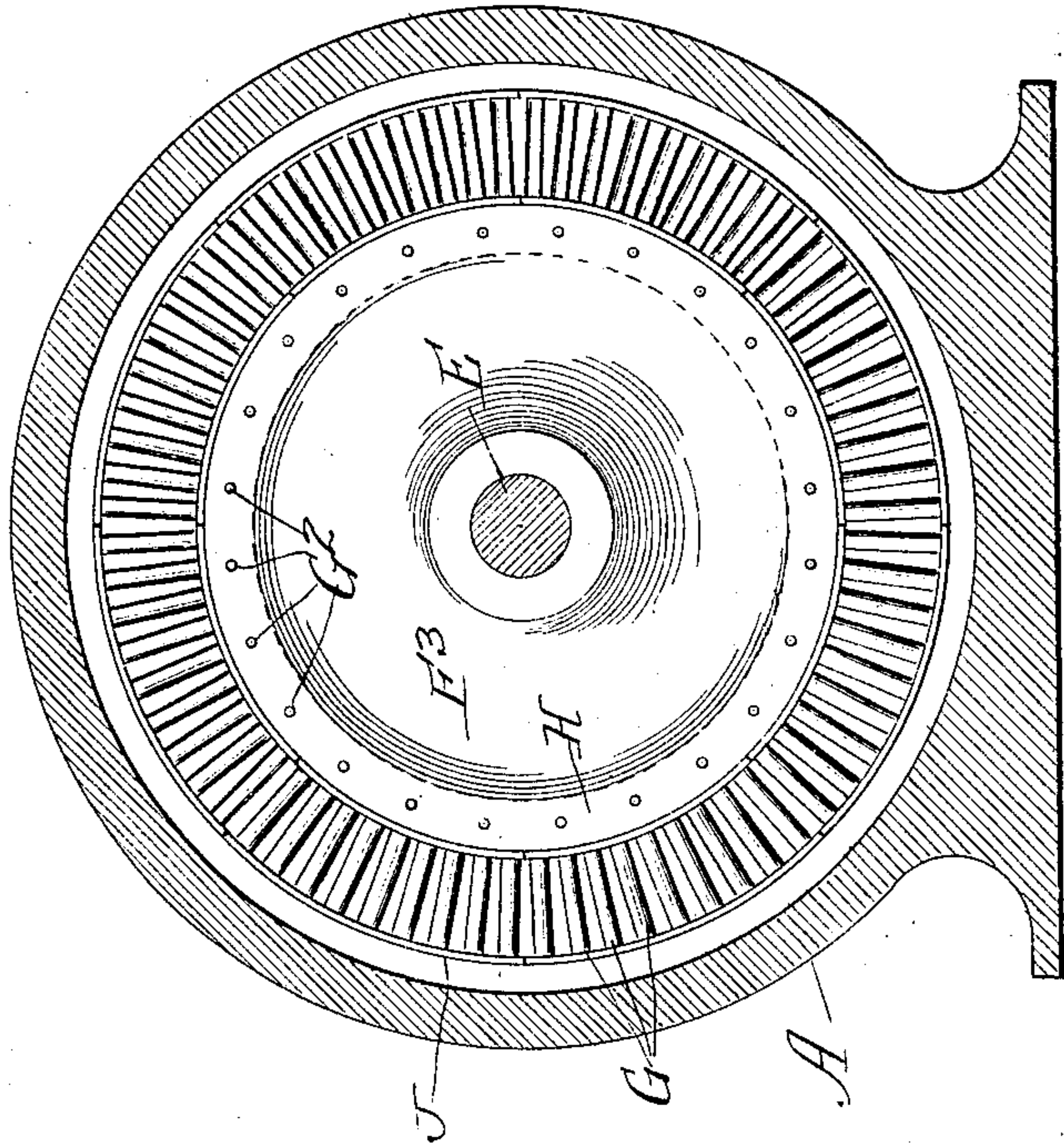
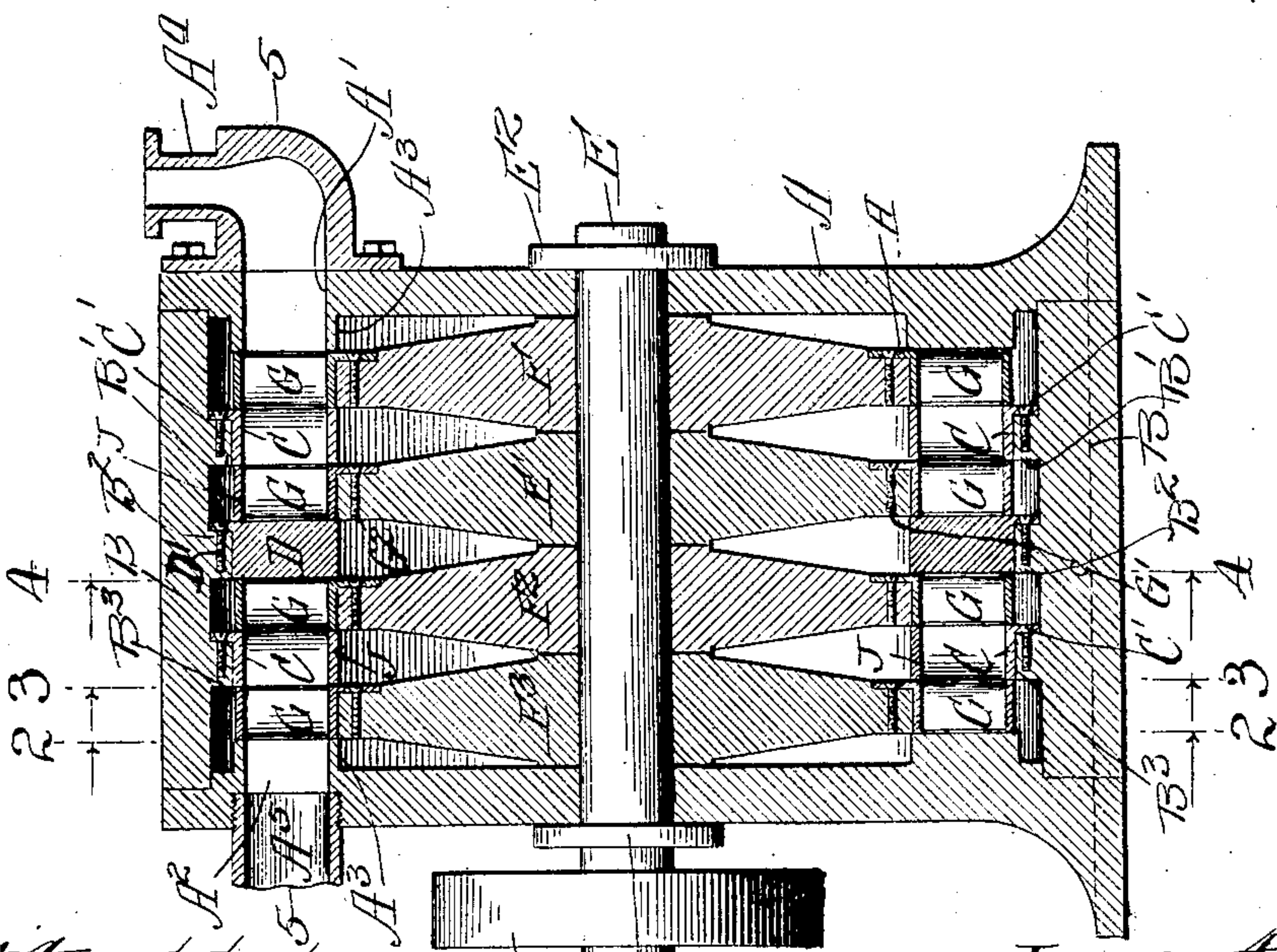


Fig. 1.



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Fig. 4.

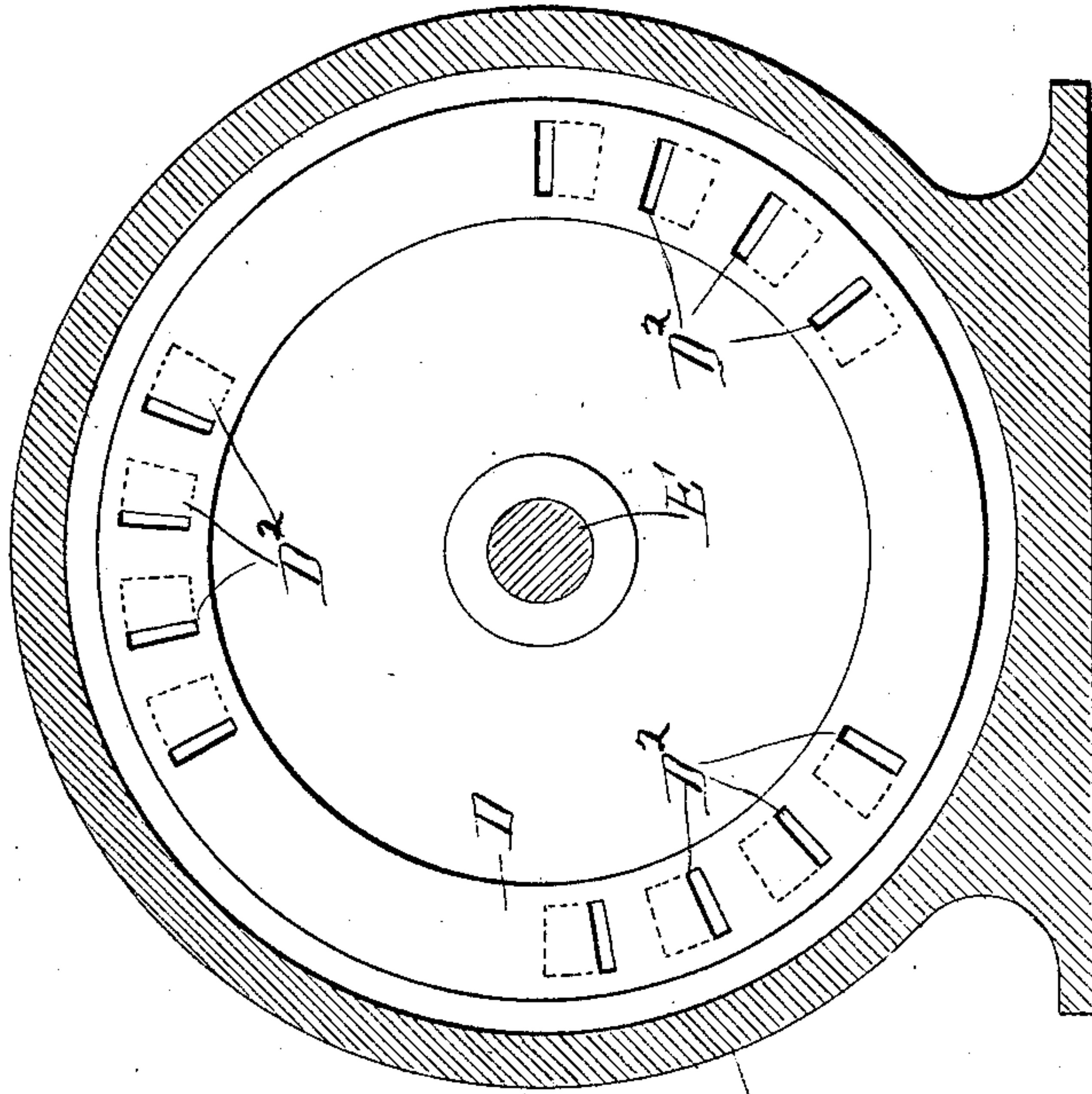
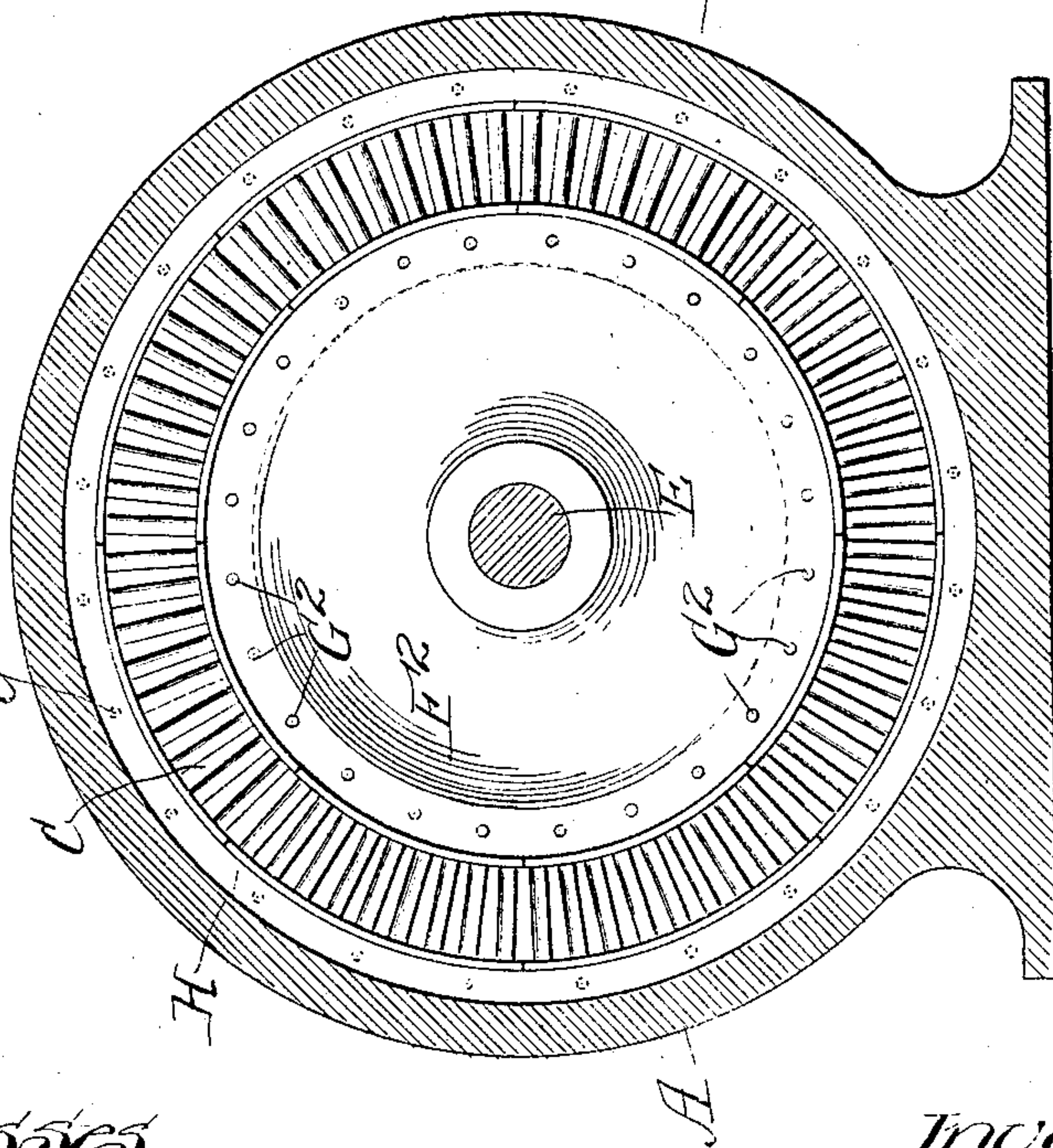


Fig. 3.



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3 SHEETS—SHEET 3.

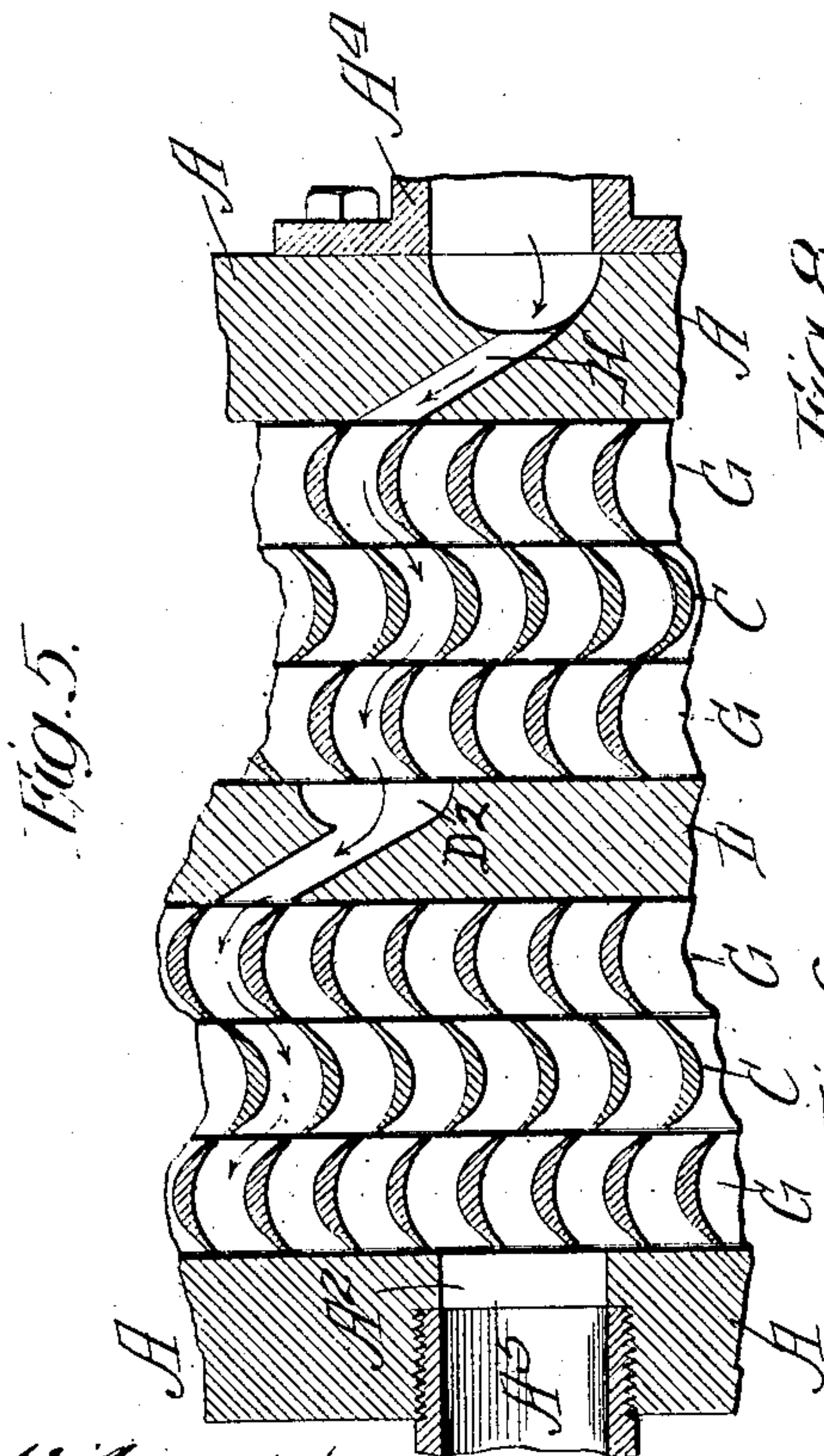
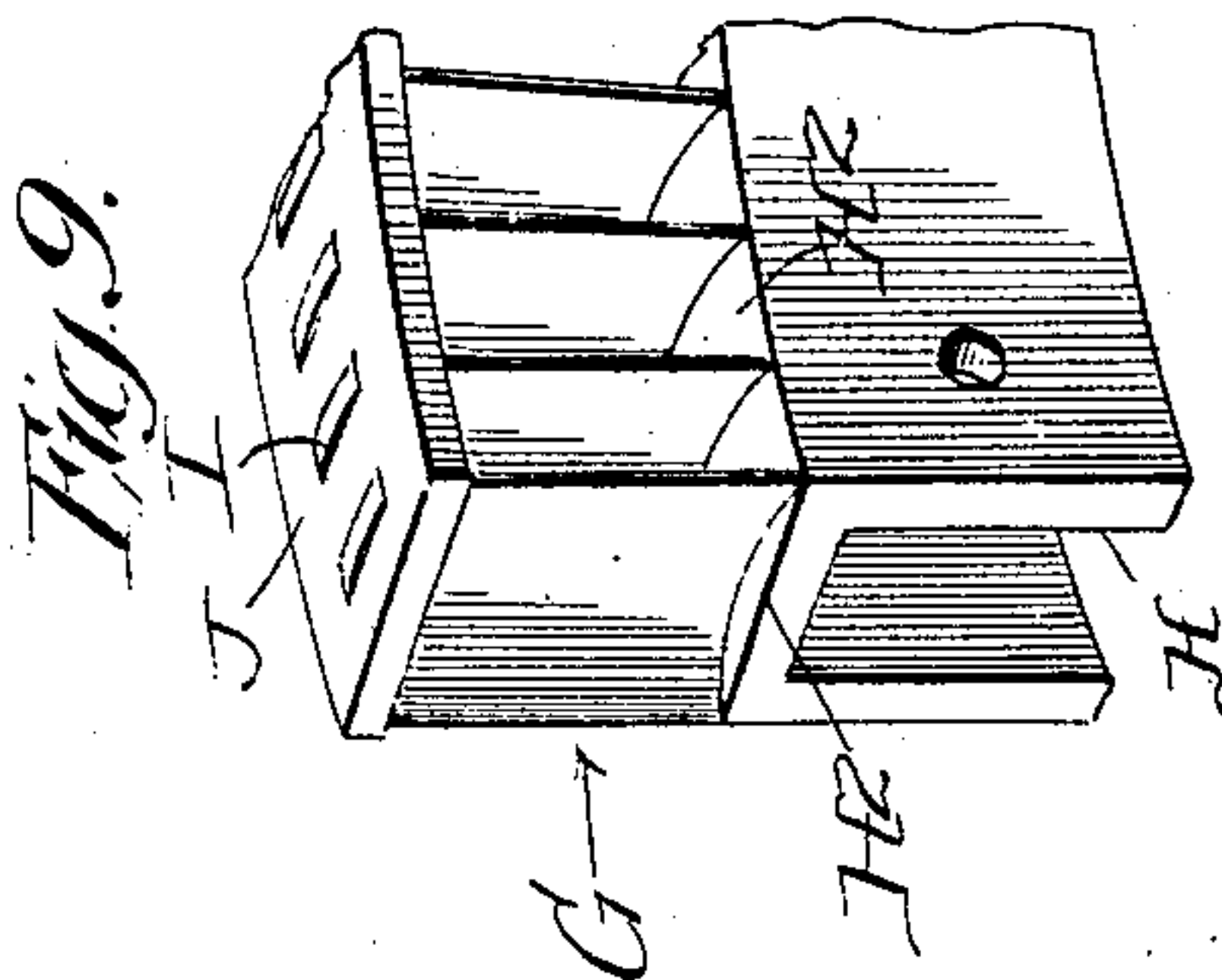
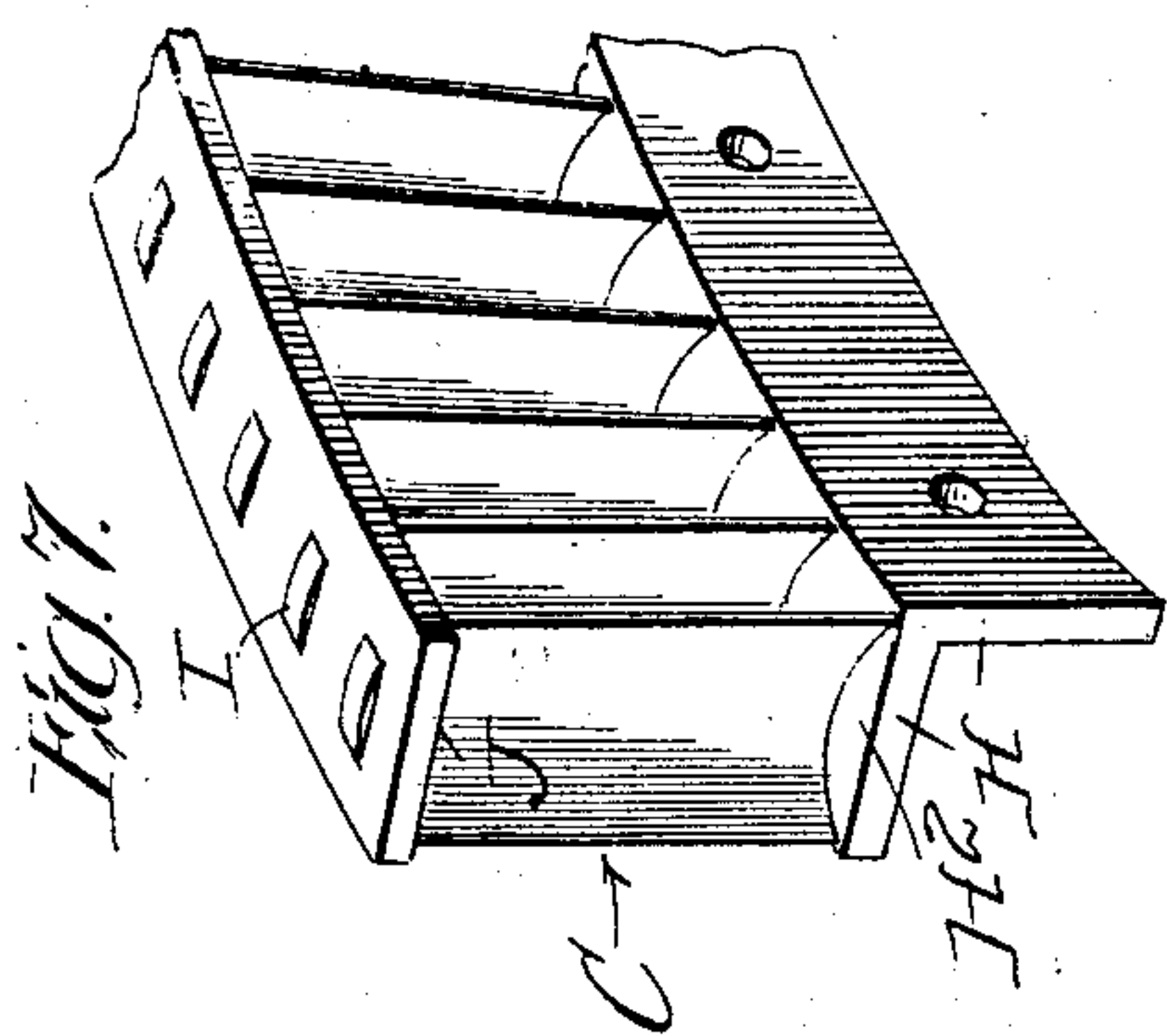


Fig. 8.

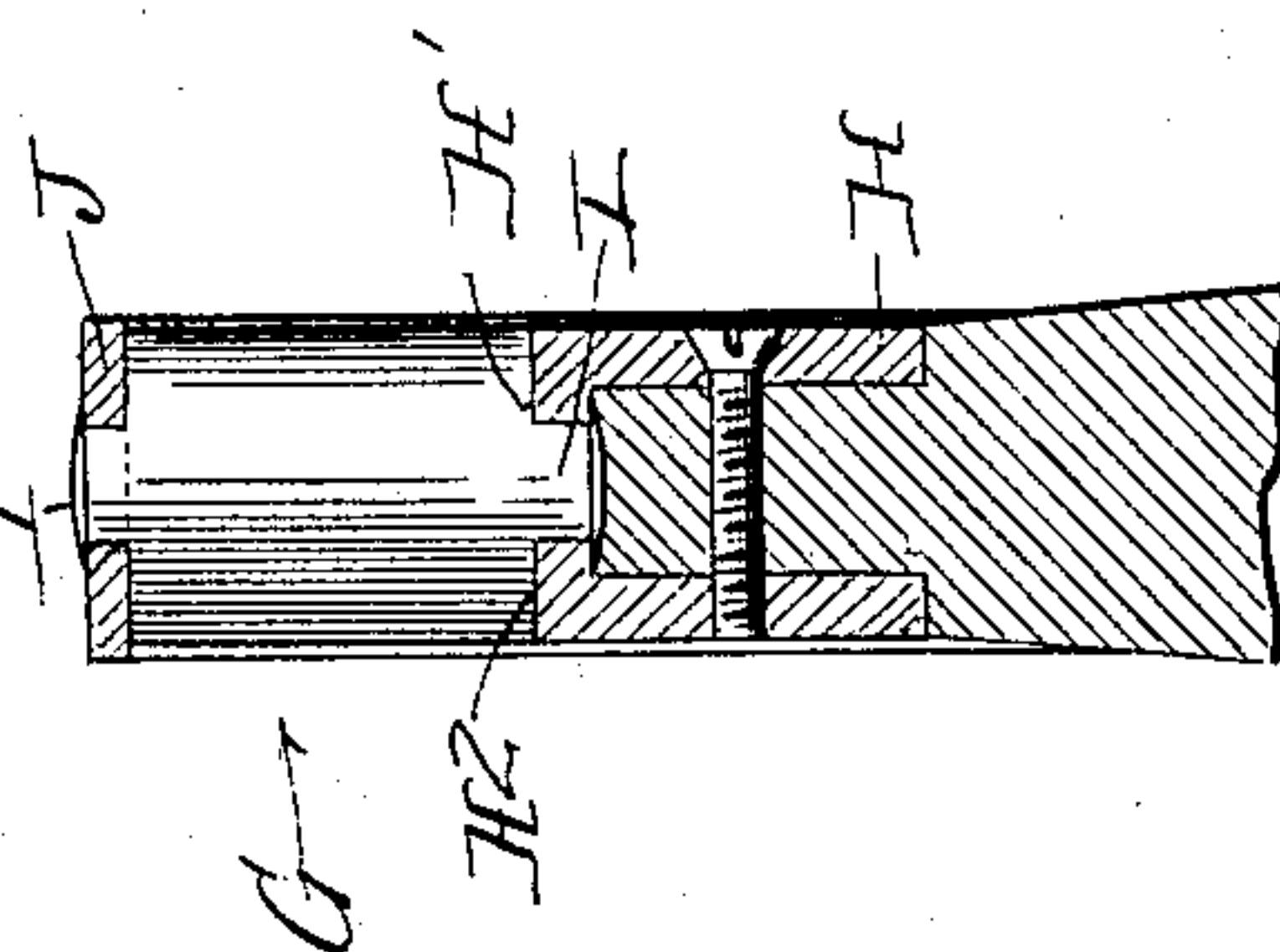
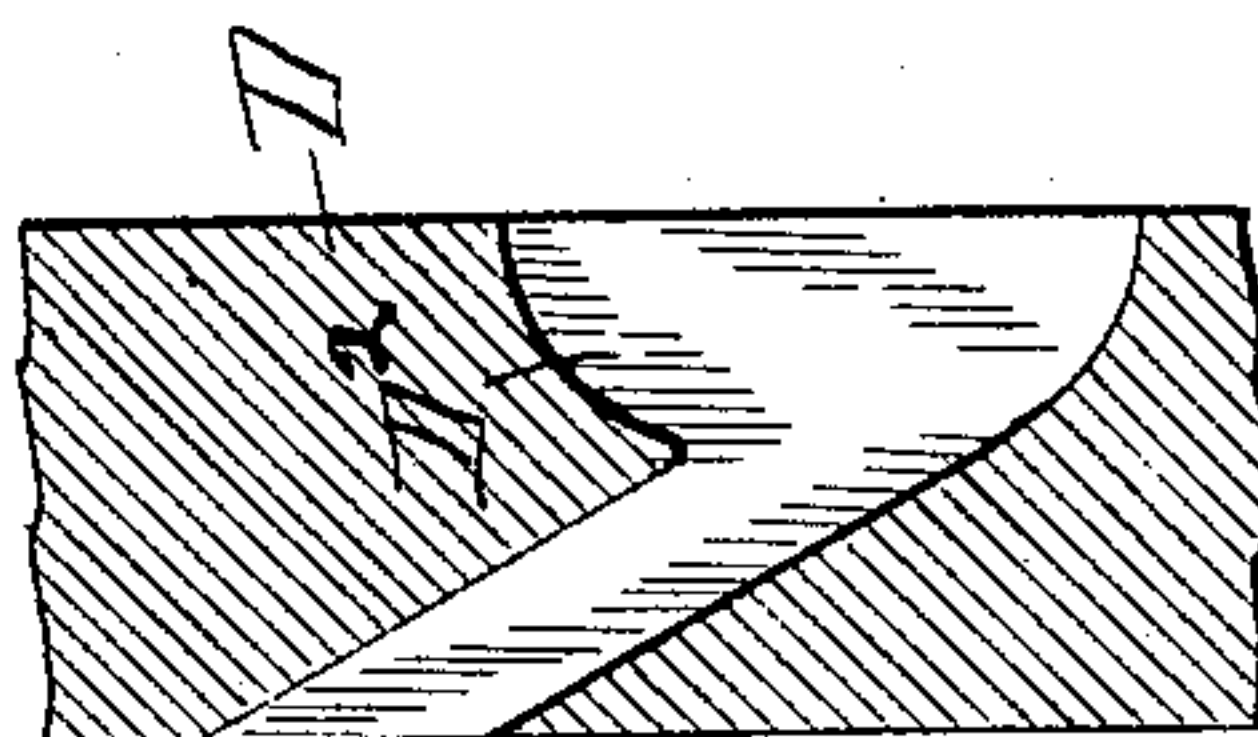


Fig. 6.



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UNITED STATES PATENT OFFICE.

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STEAM-TURBINE.

No. 919,340.

Specification of Letters Patent.

Patented April 27, 1909.

Application filed April 10, 1908. Serial No. 426,277.

To all whom it may concern:

Be it known that I, JOSEPH D. FRAIVILLIG, a citizen of the United States, residing at 15 Dawn street, in the city of Schenectady, in the county of Schenectady and State of New York, have invented a new and useful Improvement in Steam-Turbine Engines, of which the following is a specification.

The object of my invention is to provide an engine in which the buckets or vanes are so constructed as to be cheaply made, readily attached and removed from the fixed and moving parts of the engine and easily duplicated or repaired, and that are of such shape and arrangement as to give the best results.

The manner in which I accomplish my object is described in the following specification and illustrated in the accompanying drawings in which:—

Figure 1 is a vertical central section of the engine; Fig. 2 is a vertical cross section on the line 2—2, Fig. 1; Fig. 3 is a vertical cross section on the line 3—3, Fig. 1; Fig. 4 is a cross section on the line 4—4, Fig. 1; Fig. 5 is a horizontal section on the line 5—5, Fig. 1; Fig. 6 is a horizontal sectional detail through the diaphragm; Fig. 7 is a perspective view of a segmental part of the buckets detached from the engine; Fig. 8 is a vertical cross sectional view of one of the segmental parts, and Fig. 9 is another perspective view of one of the segmental parts showing a change in construction from that shown in Fig. 7.

In the drawings A indicates the end plates which constitute the base and bearing parts of the engine. In the upper part of these plates are apertures A^1 and A^2 for the inlet and outlet of steam. On the inside of each plate and forming part thereof is a projecting ring A^3 . Secured between these plates is a cylindrical body B in the interior of which are a series of projecting rings B^1 , B^2 and B^3 . Attached to each of the rings B^1 and B^3 is a ring of buckets C constructed in segmental parts as shown in Fig. 7 and secured to said rings by screws C^1 as shown in Figs. 1 and 3. Attached in the same way to the ring B^2 is a diaphragm D shown in Figs. 1 and 4. Supported in the plates A is a shaft E. Secured on this shaft between the plates A are a series of disks F, F^1 , F^2 and F^3 . Attached to the periphery of each of these disks is a ring of buckets G secured thereon by the screws G^2 , in segmental parts as shown in Fig. 7. The rings of buckets C and G are constructed of a segmental angular flange H either in the

form shown in Fig. 7, or in the form shown in Figs. 8 and 9. In these flanges are a series of apertures H^1 . Extending through these apertures and riveted to the flange, is the end I of a bucket which extends in a curved line from edge to edge of the top H^2 of the flange H as shown in Fig. 9. Riveted in the same way to the top of these buckets is a segmental ring J. This ring is of the same width as the flange H. The disk D secured on the ring B^2 by the screws D^1 is provided with three series of apertures D^2 . These apertures are shown in Figs. 4, 5 and 6 and correspond in form and direction with the steam inlet A^1 , as shown in Figs. 5 and 6. Secured to the end plate over the steam inlet A^1 , is a steam fitting A^4 , adapted to support a valve to regulate the admission of steam. In the exhaust aperture A^2 in the opposite end plate is an exhaust pipe A^5 , and on the shaft E is a pulley E^1 and collars E^2 , adapted to be secured on the shaft. The steam inlet A^1 and exhaust outlet A^2 extend through the inside ring A^3 in the end plates as shown in Fig. 1 at any point in the circle, but in the drawing they are shown in line.

To assemble the parts described, the segmental parts of the bucket ring G are secured to the disks F, F^1 , F^2 and F^3 . The shaft is inserted in the left end plate and the disks placed and secured thereon, the concave face of the buckets in each ring facing in the same direction and thereby adapted to register with the diagonal opening of the steam inlet A^1 , as shown in Fig. 5. The right end plate is then placed on the shaft and the bearing collar E^2 secured thereon. When thus placed on the shaft E between the end plates A the hubs of the disks F and F^3 are in running contact with said plates, and the flange H and ring J of the bucket ring G on the disks F and F^3 should be in running contact with the rings A^3 on the plates A as shown in Fig. 1. The bucket rings C are secured to the rings B^1 and B^3 inside the cylinder B, the concave faces of the buckets facing in the opposite direction of those in the rings G as shown in Fig. 5. The diaphragm D is secured to the ring B^2 with the diagonal apertures D^1 in the direction to deliver the steam against the concave faces of the buckets G in the disk F^2 . When thus mounted on the cylinder as described, the cylinder being in two or more sections, it is placed between the end plates and secured thereto and the parts secured together in any suitable man-

ner. When secured, the rings C and diaphragm D fit between the rings G as shown in Figs. 1 and 5. When a supply of steam is admitted through the steam part A¹, it strikes the concave face of the bucket in the ring G on the disk F, and moves said ring disk and shaft around; the steam is then deflected from the buckets in the ring G against the concave face of the buckets in the stationary ring C. The buckets in the ring C deflects the steam into the first direction, and it strikes the concave faces of the buckets in the ring G on the disk F¹, from which it enters the enlarged ends of the three series of apertures D² in the fixed diaphragm D, through which it passes in the same direction as through the part A¹, and strikes the concave faces of the buckets in the ring G on the disk F², passes into the buckets of the fixed ring G, is thereby deflected to strike the concave faces of the buckets in the ring G on the disk F³ and from there passes out through the exhaust A² as shown in Fig. 5.

It is obvious that instead of a single diaphragm and two series of moving and stationary bucket rings, the number of series may be made to suit the purpose and power for which the engine is particularly constructed.

What I claim and desire to secure by Letters Patent is:

1. A turbine steam engine consisting of two end plates having corresponding internal projecting rings, and a steam and exhaust port through said opposite rings; a shaft revolubly supported in the center of said plates adapted to support a pulley; a series of disks secured on said shaft between said plates; a bucket ring secured on the periphery of each of said disks; a cylindrical part secured between said end plates, and inclosing said disk and bucket rings, said cylindrical part having a series of projecting internal rings; a bucket ring secured to each of said internal rings, each of said rings being

adapted to fit between each pair of rings on said disks and to register therewith; a diaphragm secured on one of said rings of said cylindrical part intermediate of the other rings therein, said diaphragm being adapted to fit between two of said bucket rings on said disks, and having a series of diagonal steam ports adapted to register with said bucket rings as described.

2. In a turbine engine, the combination with an inclosing case, having inlet and exhaust ports; a shaft rotatably supported therein; disks secured on said shaft within said case; a bucket ring secured on each of said disks spaced from each other, and a double series of fixed bucket rings secured radially in said case between said rings on said disks; of a diaphragm separating said series of fixed bucket rings, said diaphragm being secured to said case between two of said disk rings and having steam ports adapted to register with said rings on said disks and case.

3. In a turbine engine, a plurality of rotatable and fixed bucket rings, each of said rings consisting of a flanged part having peripheral holes, a series of buckets shouldered to fit said holes and secured therein, each of said buckets having a vertical concave face and a convex back, said face and back extending transversely across the periphery of said flanged part and radially from the periphery thereof to an outer ring to which they are secured, said ring being adapted in width to the width of said buckets and flange; means for supporting a series of said bucket rings in a rotatable position in said engine; and means for securing one or more series of said bucket rings in a fixed position in said engine intermediate of said rotatable bucket rings as described.

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