

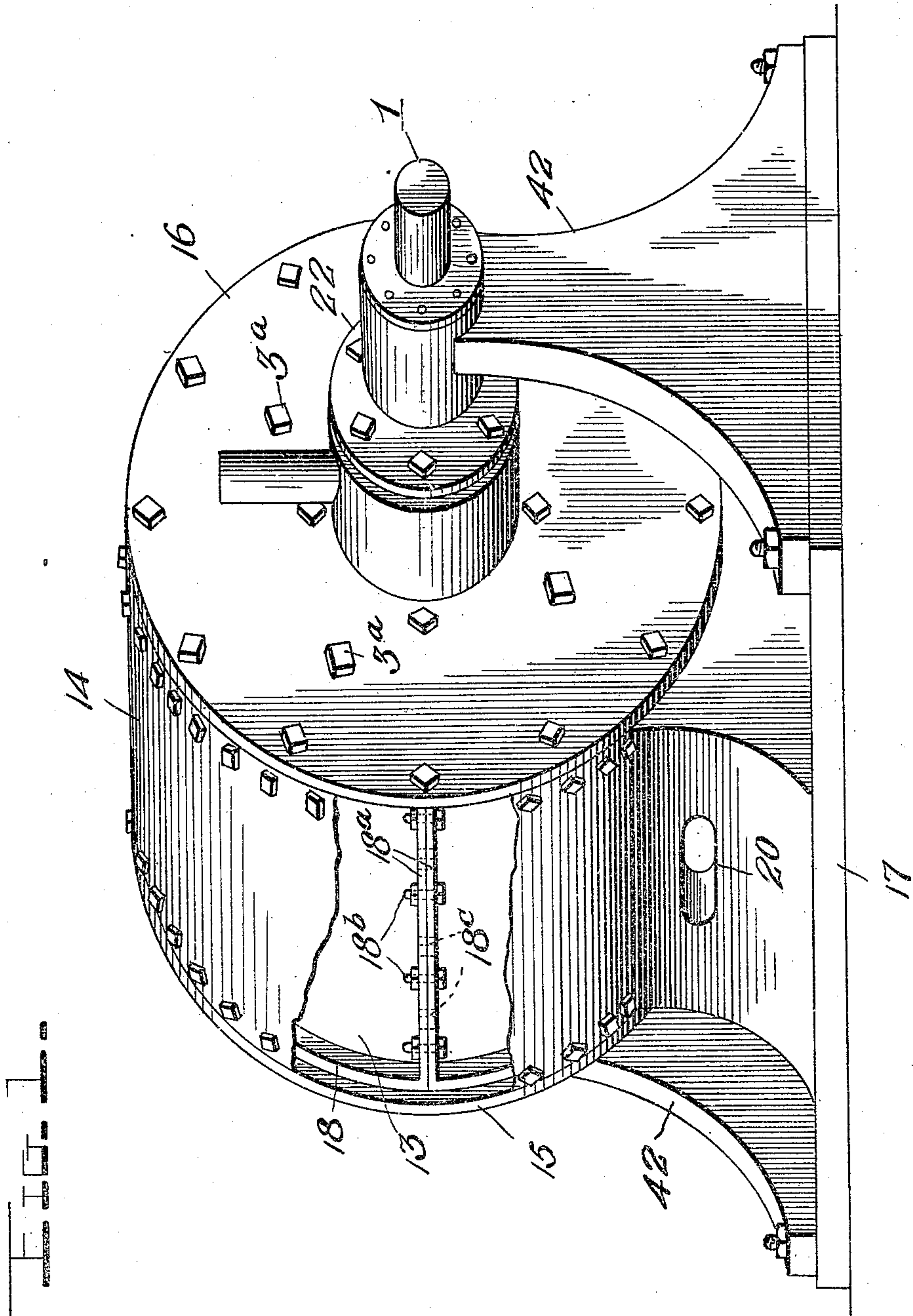
956,124.

J. MELVILLE.
STEAM TURBINE.

APPLICATION FILED JULY 29, 1909.

Patented Apr. 26, 1910.

5 SHEETS—SHEET 1.



Witnesses

Chas. L. Griestauer.
E. M. Ricketts

John Melville ^{Inventor}

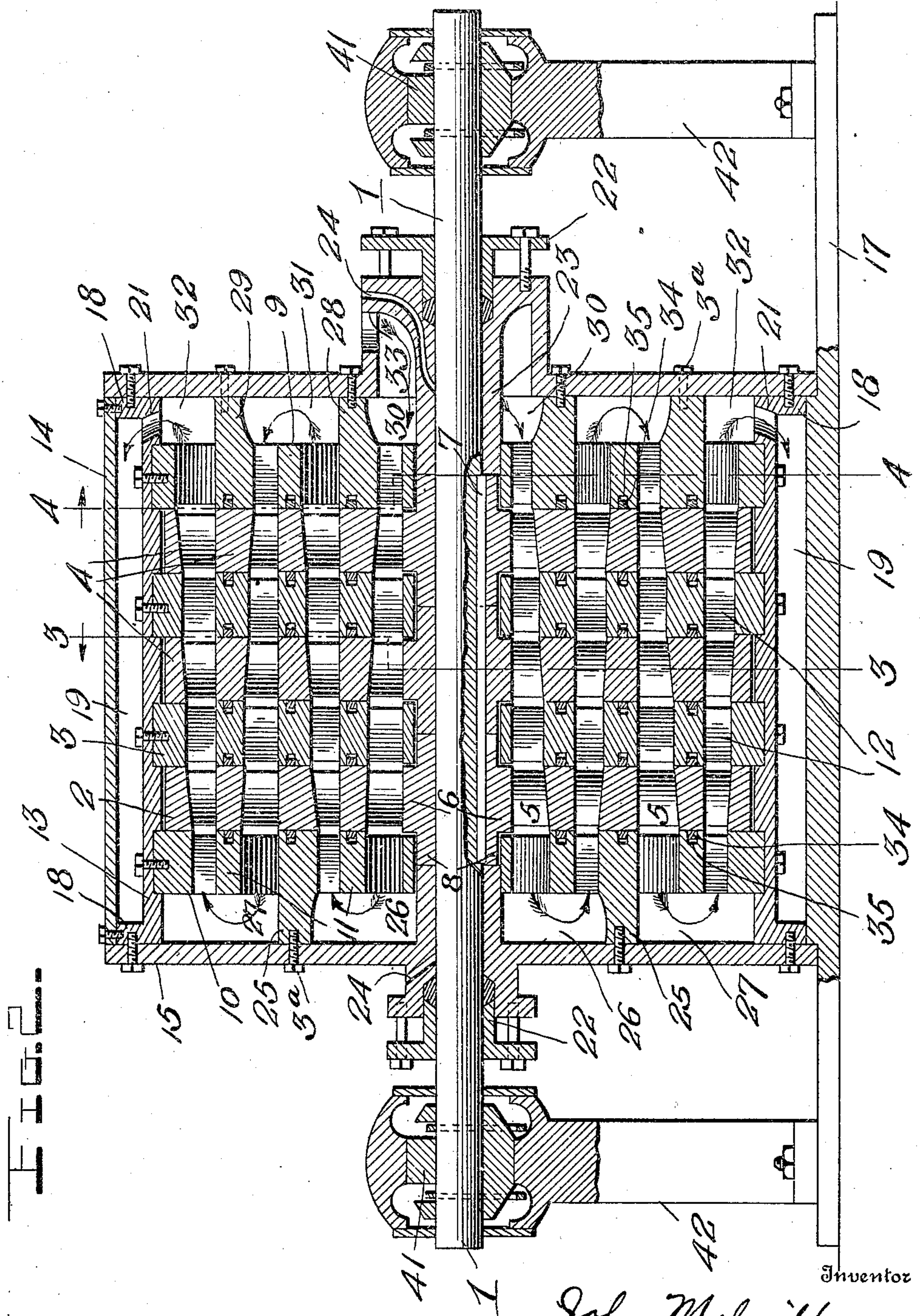
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Witnesses

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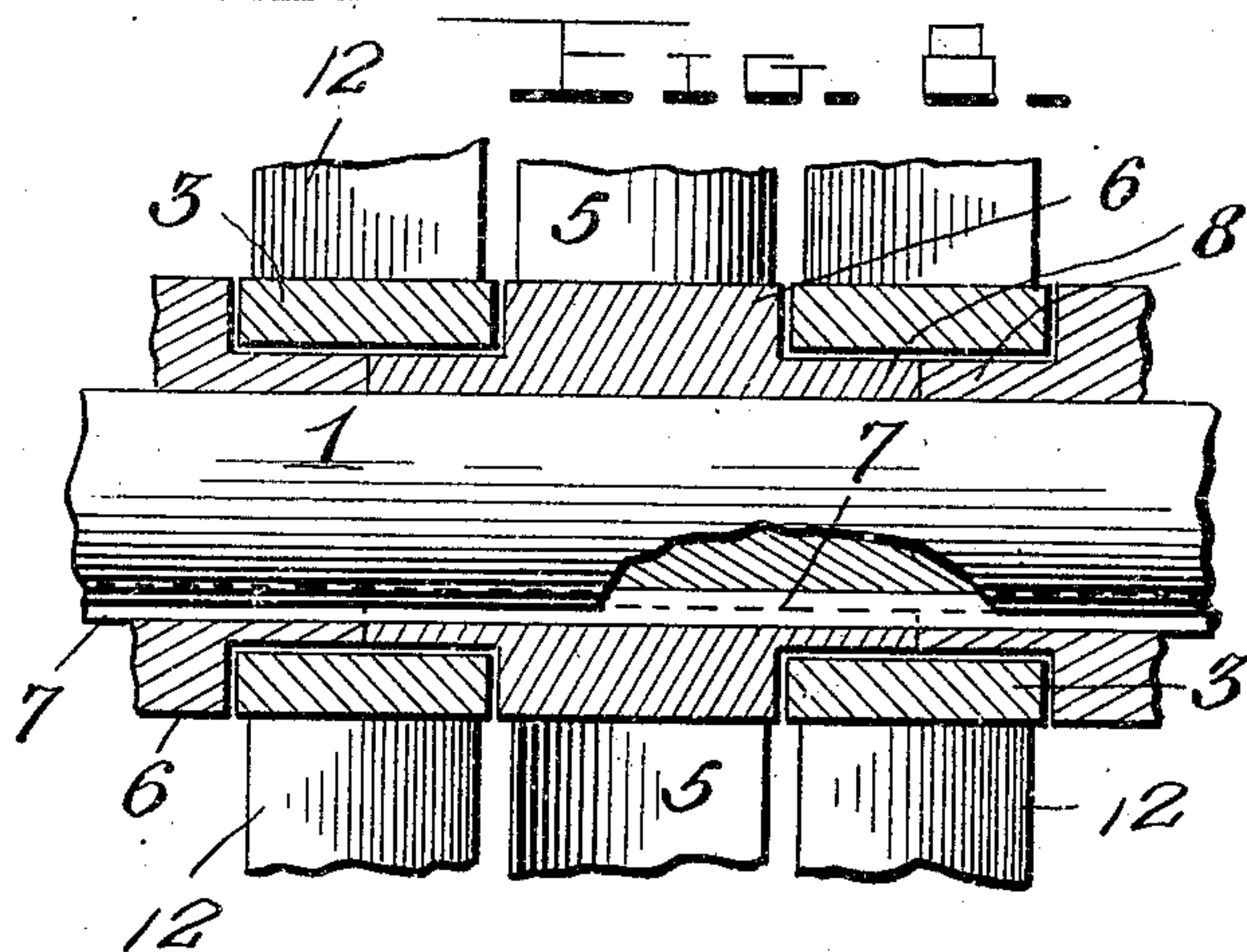
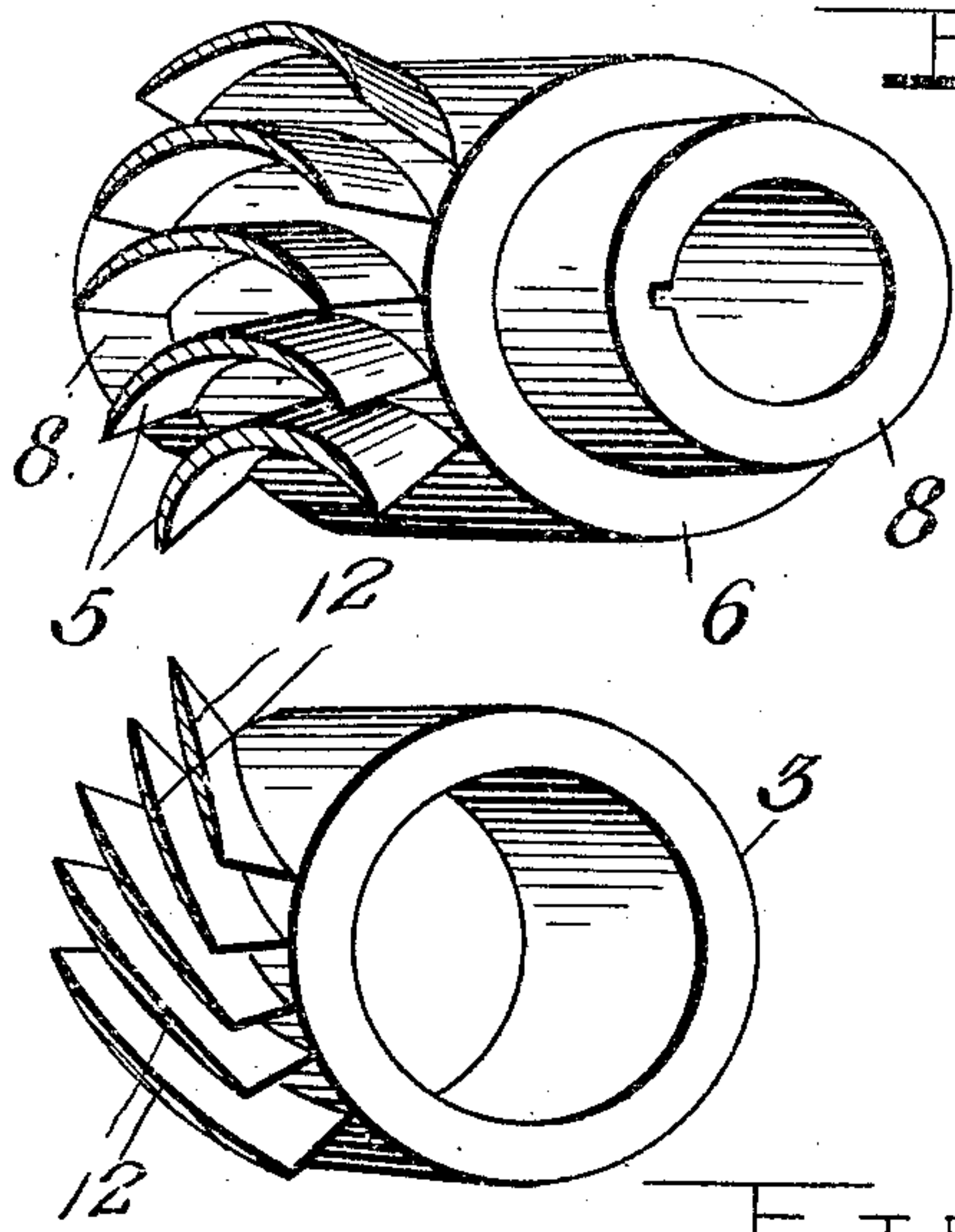
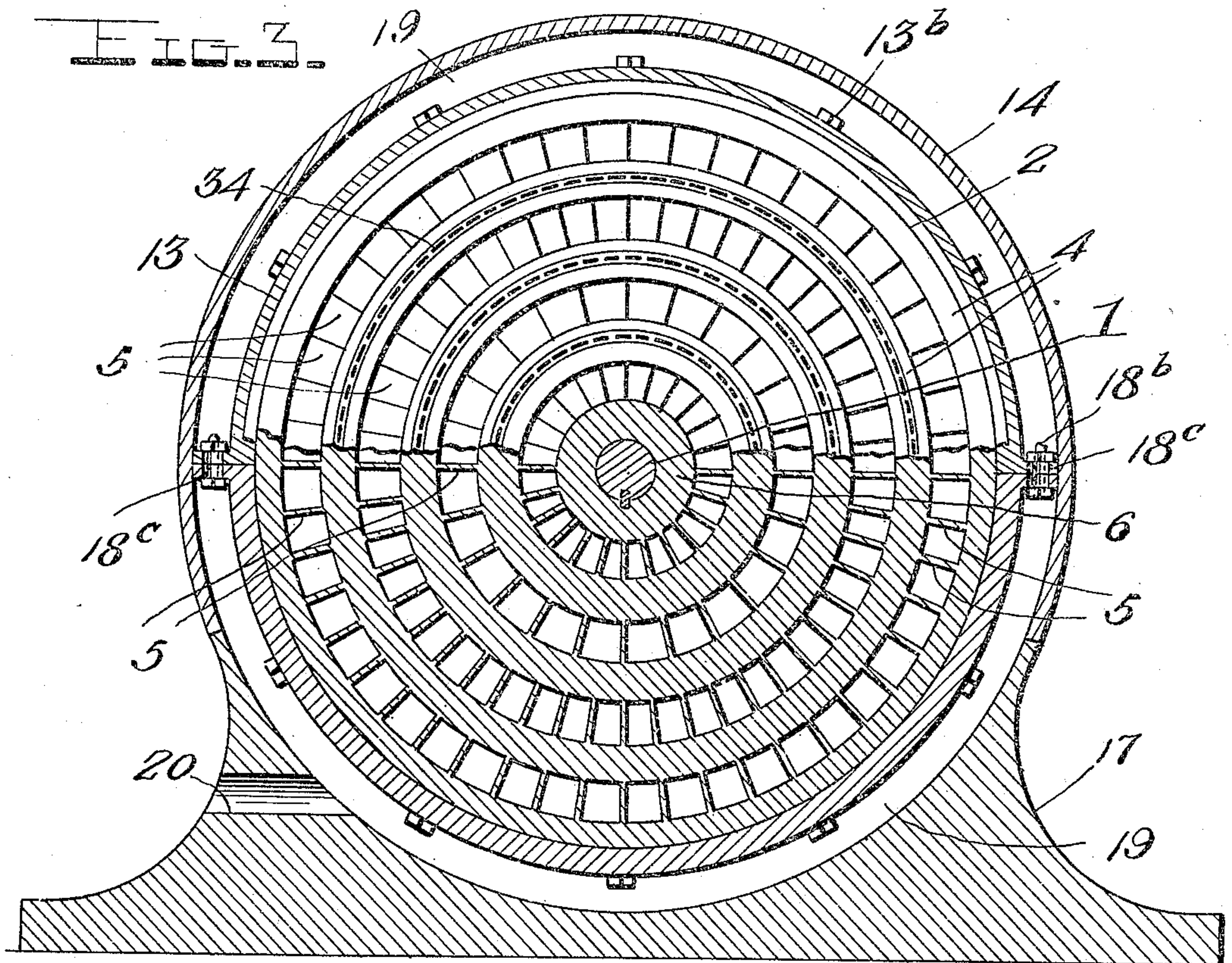
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5 SHEETS—SHEET 3.



Witnesses

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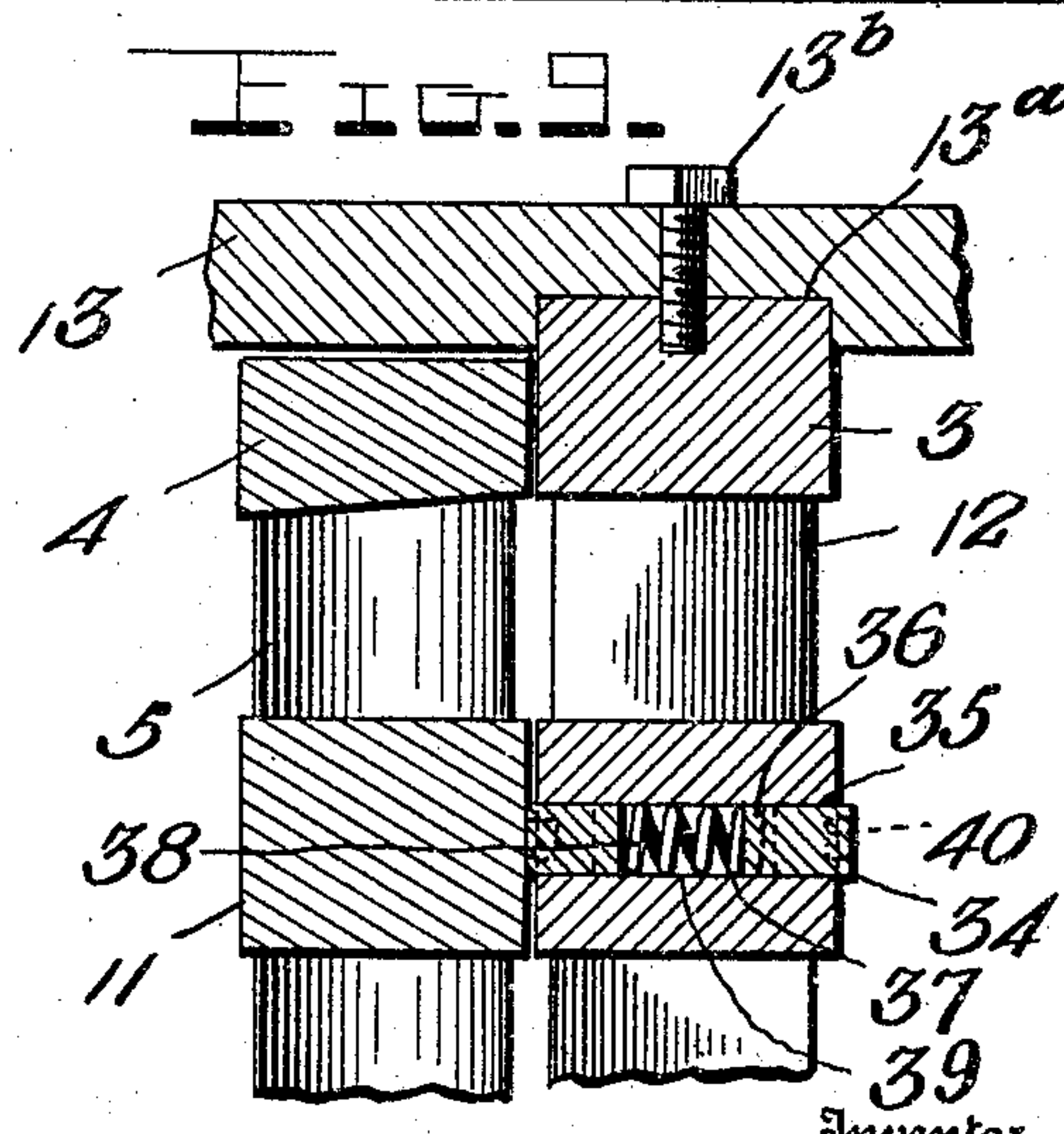
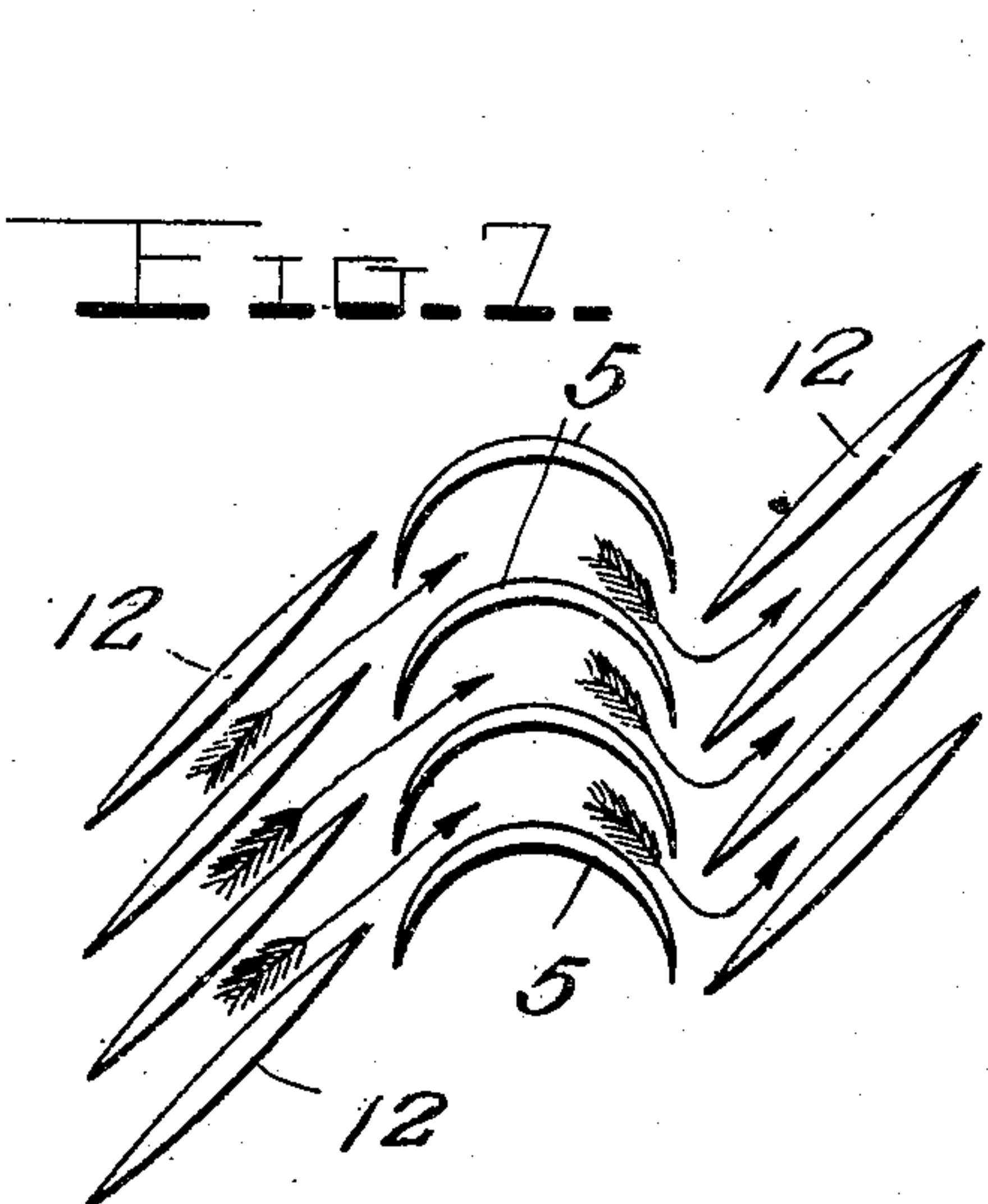
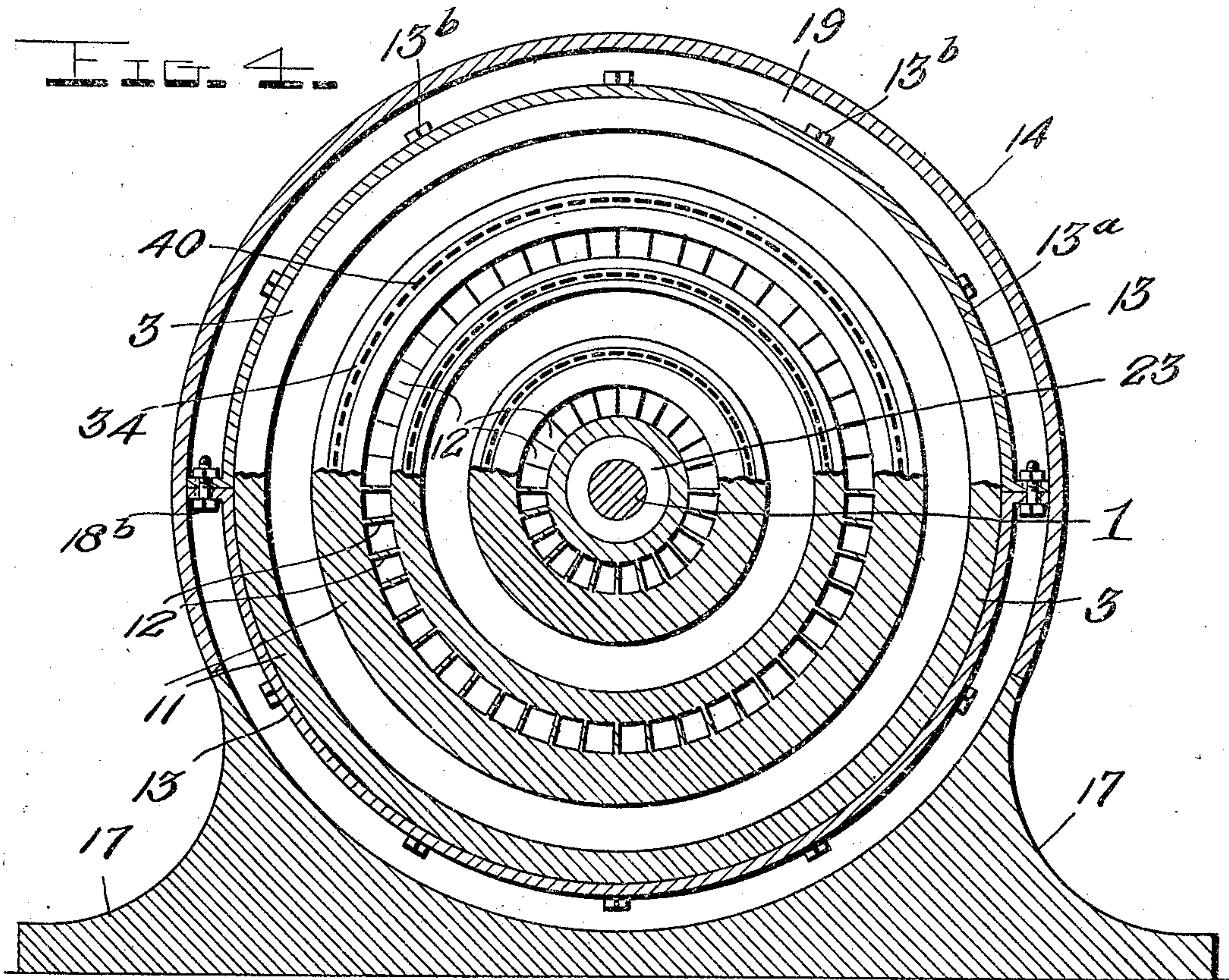
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5 SHEETS—SHEET 4.

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Witnesses

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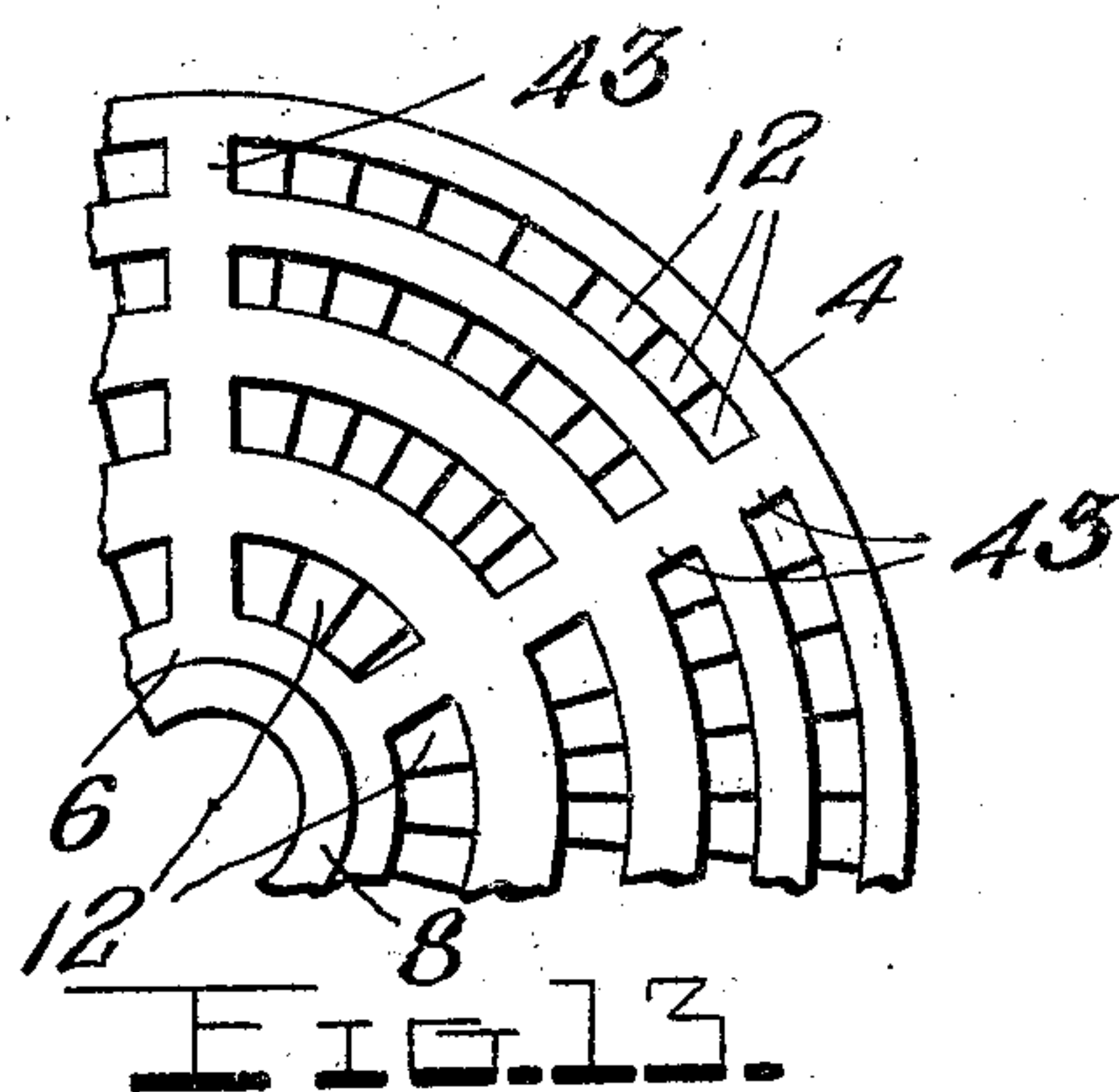
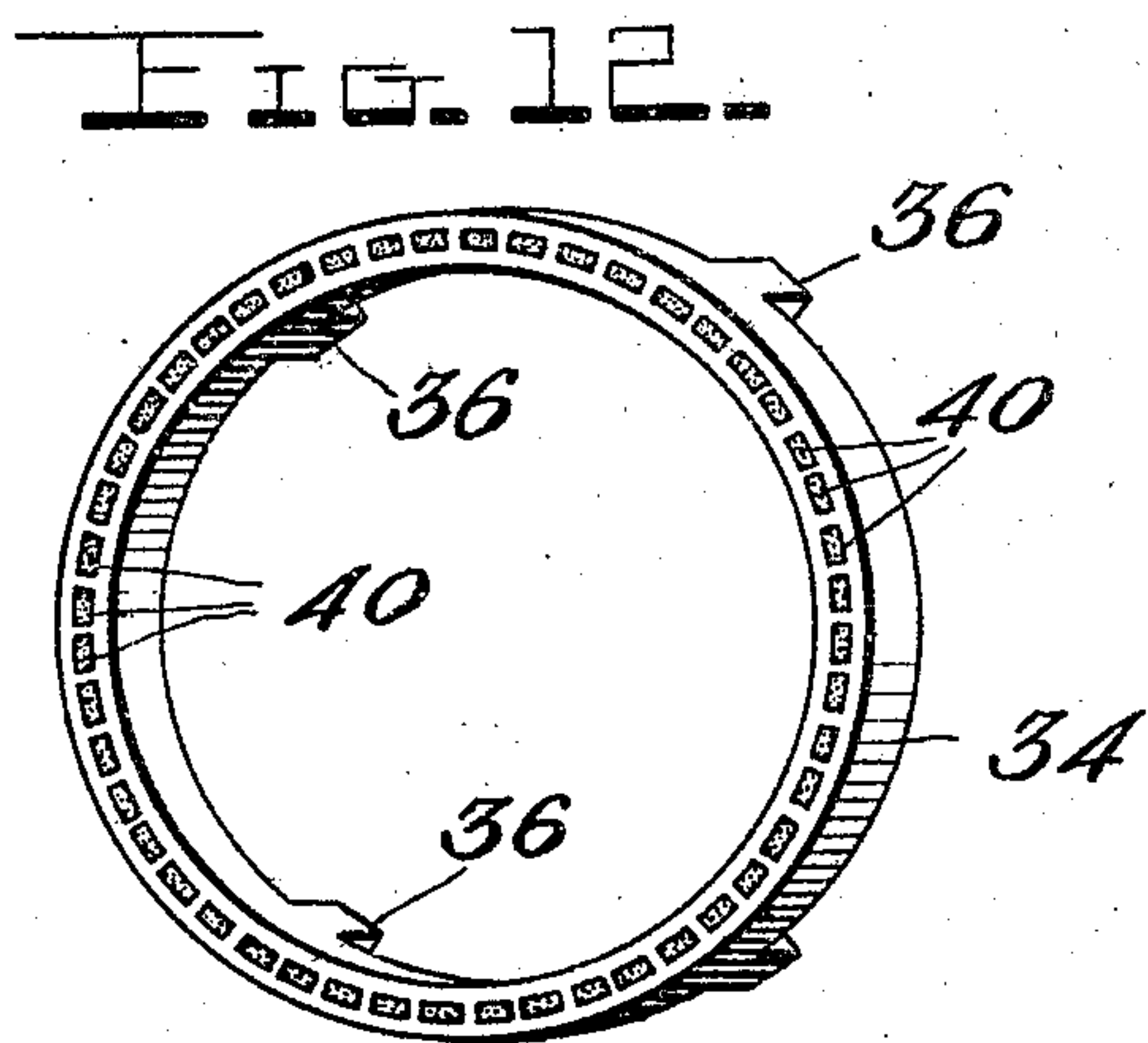
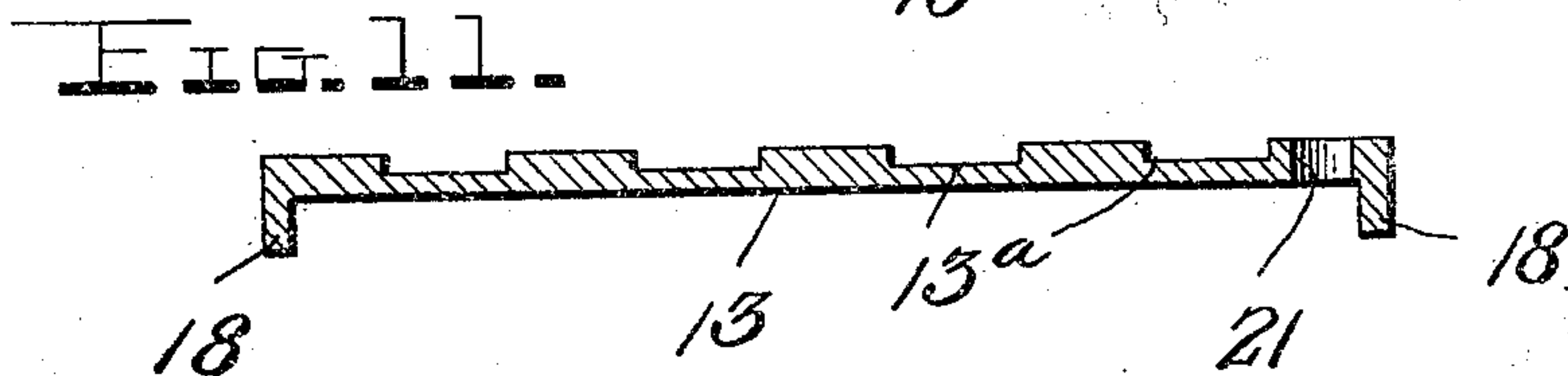
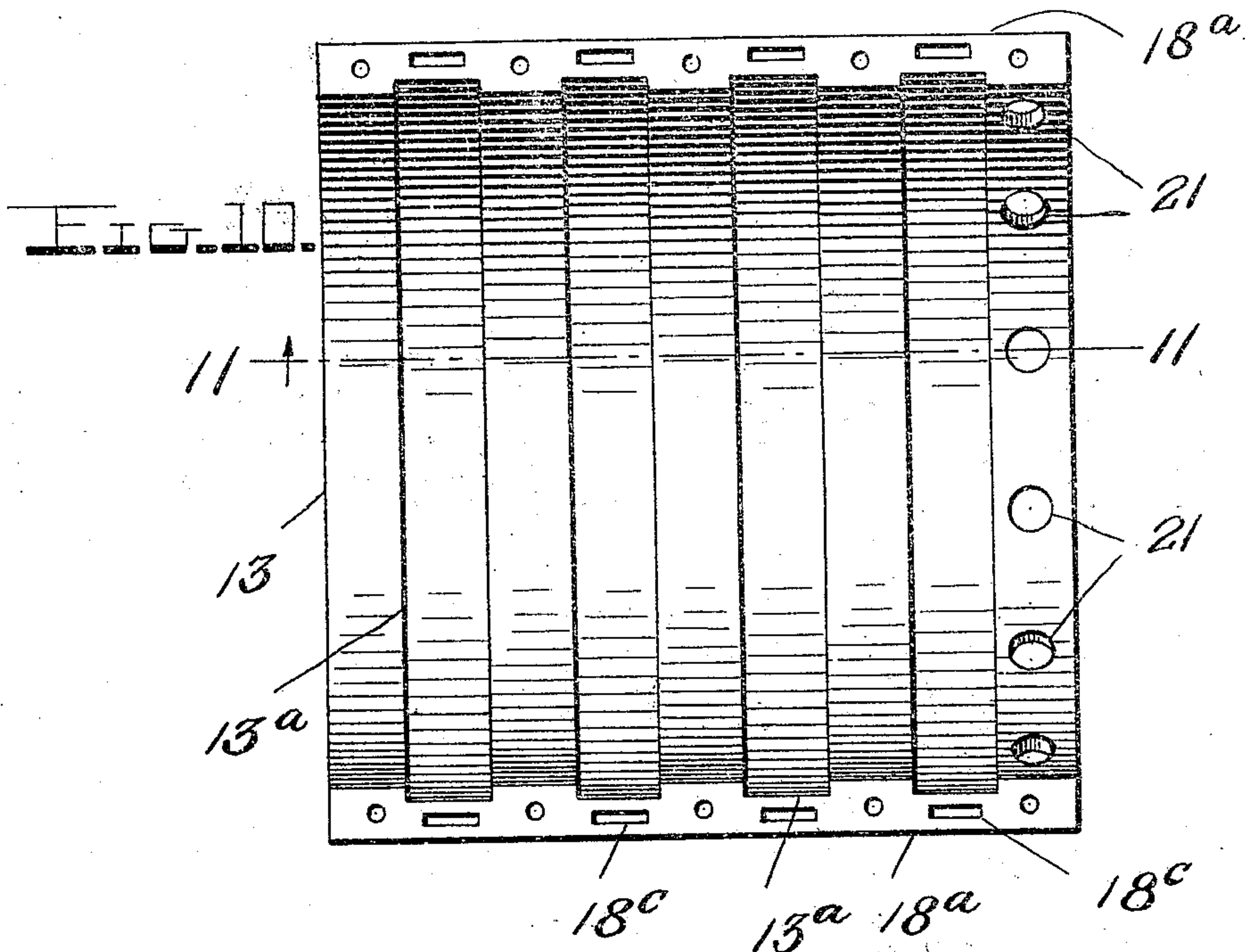
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6 SHEETS—SHEET 5.

956,124.



Witnesses

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UNITED STATES PATENT OFFICE.

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STEAM-TURBINE.

956,124.

Specification of Letters Patent.

Patented Apr. 26, 1910.

Application filed July 29, 1909. Serial No. 510,226.

To all whom it may concern:

Be it known that I, JOHN MELVILLE, a citizen of the United States, residing at Angels Camp, in the county of Calaveras and State of California, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification, reference being had to the accompanying drawings.

10 This invention relates to improvements in steam turbines and its objects are first to increase the efficiency of motors of this character; second, to simplify the design of the same; third, to produce an equal steam
15 pressure on all opposing points; and fourth to economize floor space and weight.

With the above and other objects in view, the invention consists of the novel features of construction and the combination and arrangement of parts hereinafter fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of the improved steam turbine, portions of its parts being broken away and in section; Fig. 2 is a vertical longitudinal section; Figs. 3 and 4 are vertical transverse sections taken, respectively, on the planes indicated by the lines 3—3 and 4—4 in Fig. 2; Fig. 5 is an incomplete sectional perspective of the hub of one of the rotors; Fig. 6 is a similar view of one of the stators; Fig. 7 is a diagrammatic view illustrating the action of the steam in its passage through the stator vanes and rotor buckets; Fig. 8 is an enlarged longitudinal section through a portion of the shaft showing the manner in which the stationary and movable parts are arranged thereon; Fig. 9 is an enlarged detail section showing the arrangement of the packing rings; Fig. 10 is a view of one section of the cylinder; Fig. 11 is a sectional view taken on the plane indicated by the line 11—11 in Fig. 10; Fig. 12 is a detail perspective view of one of the packing rings; and Fig. 13 is a view of a portion of a modified form of one of the rotary sections or rotors of the turbine.

Referring more particularly to the drawings, 1 denotes a rotary shaft carrying a plurality of rotary sections or rotors 2 arranged between stationary sections or stators 3. The rotors 2 are circular in form and each consists of a plurality of solid, concentric
55 annular rings 4 and a plurality of annular

rows or circles of buckets 5 which are arranged between and unite adjacent rings 4. The buckets 5 project radially but are curved transversely so that they are U-shaped or concavo-convex in cross section, as shown in Fig. 3. The innermost ring of each rotor 2 forms a hub 6 which receives the shaft 1 and is fixed thereto preferably by means of a longitudinal key 7. The hubs 6 of the several rotors project beyond the side faces of the remaining rings 4 and are reduced, as shown at 8, to enter the hubs of the stators 3.

The endmost stators 9, 10 are slightly different in construction from the intermediate stators 3, each of which latter consists of a plurality of solid, concentric rings 11 united by annular concentric rows of stationary vanes 12 arranged preferably at an angle to the shaft 1 or as indicated in Fig. 3. The number of solid rings in the stators corresponds to the number in the rotors and said rings are so disposed as to oppose each other and thereby dispose the annular rows or circles of vanes 12 in the stators opposite the rows or circles of buckets 5 in the rotors, whereby the steam will travel from the vanes 12 in one stator or section to the buckets 5 in the next adjacent rotary section or rotor and from the latter to the succeeding stator, as will be understood upon reference to Fig. 7.

The stators and rotors are arranged within a stationary cylinder or casing consisting preferably of an inner cylinder 13 made in two half-sections, as shown in Figs. 10 and 11 of the drawings, and a spaced outer cylinder or shell 14, the two being spaced apart and united by removable heads 15, 16, as more clearly shown in Fig. 2 of the drawings. A suitable base 17 for the turbine may be formed integral with or separate from and secured to the lower end of the cylinder 13, which latter has at its open ends radially projecting annular flanges 18 to which the heads 15 and the outer jacket 14 are preferably bolted, as shown. The outer jacket 14 forms between it and the exterior of the cylinder 13 an annular space 19 for the exhaust steam, which latter finds its outlet from the turbine through an opening in one side of the base 17. The annular space 19 is closed at one end by the head 15 and flange 18 but its other end is in communication with the interior of the cylinder through an annular series of openings 21

formed in said cylinder, as clearly shown in Figs. 2, 10 and 11 of the drawings. The half-sections of the cylinder 13 are formed at their opposing longitudinal edges with outwardly projecting flanges 18^a which are adapted to be bolted together, as shown at 18^b, and which are formed with registering slots or openings 18^c, the latter affording communication between the separated portions of the annular space 19. The inner face or bore of the cylinder 13 is formed with annular grooves 13^a within which the outermost rings of the several stators 3 fit and are secured by screws 13^b, as clearly shown in the drawings. The heads 15, 16 are provided with the usual stuffing boxes 22 and their hub portions are extended inwardly, as shown at 23, to enter the hubs of the endmost stators 9, 10 and abut against the hubs of the endmost rotors 2, as clearly shown in Fig. 2. Said hub portions of the heads 15, 16 may be provided with suitable oil passages 24 by means of which the portions of the shaft which rotate in said heads may be lubricated.

One or more of the solid rings of each of the endmost stators 9, 10 are extended to form annular ribs which engage the inner faces of the heads 15, 16 and form within the cylinder at its ends, annular spaces which afford communication between adjacent rows of vanes in said stators. As illustrated, but one rib 25 is provided upon the stator 10 and forms at said end of the cylinder two annular spaces or chambers 26, 27; while the other endmost stator 9 is provided with two of such ribs 28, 29, which latter form at said end of the cylinder three annular spaces or chambers 30, 31, 32. Screws 3^a pass through the cylinder heads 15, 16 and into the ribs 25, 28, 29 to effect a steam tight connection between said parts and prevent the passage of steam directly from one chamber to the next adjacent one. Steam is admitted into the cylinder preferably through an inlet opening 33 formed in a hollow portion of an enlarged hub on the head 16, which hollow portion is in communication with the chamber 30. The course of the steam from this point to the exhaust chamber 19 is indicated by arrows in Fig. 2, upon reference to which figure, it will be seen that steam passes from the chamber 30 through the innermost annular rows of vanes and buckets in the stators and rotors to the chamber 26 where it expands further and passes through the next series of annular rows of buckets to the chamber 27 where it further expands and turns through the outermost annular rows of vanes and buckets to the chamber 32. The latter is in communication with the space 19 through the openings 21 above described and the steam after passing through the space 19 exhausts from the opening 20

or a suitable exhaust pipe connected thereto. By causing the steam to pass through the space 19, a greater amount of the heat of the same is utilized. It will be seen that the steam will travel alternately in opposite directions from end to end of the turbine in a longitudinal direction and after passing through each of its longitudinal passages it enters a space where it is allowed to expand slightly and from which it returns through rows of vanes and buckets, the diameter of which rows is larger than that of the rows it has previously passed through, whereby the expansive action of the steam is effectively utilized and unequal pressure on opposite points of different sides or parts of the turbine is obviated.

The steam in passing between the straight angularly disposed stationary vanes 12 is directed by the same into the curved or U-shaped rotary buckets 5 so that the impact and expansion of the steam will cause said buckets to rotate.

If desired, the vanes and buckets of the corresponding rows of the successive stators and rotors may be made of gradually increasing size from one end to the other of the turbine, whereby the expansive action of the steam will be continuously used from its inlet to its exhaust, as will be understood upon reference to Fig. 2 of the drawings.

In order to prevent leakage of steam from one row of buckets or vanes to the next succeeding row, packing rings 34 are arranged between the innermost solid rings of the stators and rotors. Said packing is preferably in the form of metal rings set in annular grooves 35 formed in the outer faces of the solid rings 11 of the stators and held against rotation with the rotors, against which latter they bear, by forming the rings 34 with lugs 36 which enter recesses 37 in the bottoms of the grooves 35. The packing rings are projected against the solid rings 4 of the rotors by means of coil springs 38 arranged in seats or recesses 39 in the bottoms of the grooves 35. In the intermediate stators the spring seats 29 preferably extend from the groove 35 in one side to the groove in the other side so that the springs 38 in said seats serve to project both of the packing rings in such stator, as shown in Fig. 9 of the drawings. The outer faces of the metal packing rings 34 have cavities milled or drilled in them for the reception of graphite or other lubricant indicated at 40 in the drawings. The projecting ends of the shaft 1 are mounted for rotation in bearings 41 which may be of any suitable form and construction but which are preferably of the oil ring self lubricating type shown and arranged upon standards 42 rising from the base 17.

In Fig. 13 of the drawings I have shown a portion of a slightly modified form of one

of the rotary sections or rotors 2, in which the several solid rings 4 are united at intervals by solid connecting portions 43 which form radial arms. The same idea may be embodied in the stators 3.

The operation of the invention is as follows: Steam is admitted through a suitable steam supply pipe connected to the opening 33 in the enlarged or chambered hub of the cylinder head 16 and passes from the chamber 30 in the direction of the arrows in Fig. 2. Said steam passes back and forth through the several stator and rotor sections in a direction longitudinally of the shaft, as indicated by the arrows in said figure and finds its escape into the space 19 and from thence through the exhaust opening 20 or a suitable pipe connected thereto. It will be noted that by having the steam first enter and pass through the smallest circle of rotor buckets of the several rotors, then turn through the next larger circle, etc., the expansive action of the steam is utilized through its entire passage through the turbine; and in such passage of the steam it is baffled to a certain extent which causes the steam to travel more slowly and hence to give the turbine great efficiency without excessive speed. Furthermore, the pressure of steam being the same on all sides of the turbine, its balance is perfect and no balanced piston is required as in other turbines. It will be further noted that my improved turbine is exceedingly compact so that it will require but little floor space and it will be still further noted that the turbine is comparatively light in weight when its power capacity is considered.

While I have shown and described in detail the preferred embodiment of my invention, it will be understood that I do not wish to be limited to the precise form, proportion, arrangement and details of construction set forth, since various changes may be made within the spirit and scope of the invention.

Having thus described the invention what is claimed is:

1. In a turbine, the combination of a plurality of rotors, each having concentrically arranged solid rings and interposed annular rows or circles of buckets, stators arranged between the rotors and having concentric solid rings corresponding to the solid rings of the rotors and arranged in axial alignment therewith, said stators also having vanes for directing steam into the buckets of the rotors, a cylinder having said stators fixed within it, removable heads for said cylinder, a shaft extending through the cylinder heads and fixed to said rotors, bearings for said shaft, annular partition ribs between the endmost stators and the cylinder heads to divide the spaces at the ends of the cylinder into annular chambers, packing rings between the solid rings of the stators

and rotors, a jacket surrounding the cylinder and spaced therefrom to provide an exhaust steam chamber, the latter being in communication with the outermost annular chamber at one end of the cylinder, said exhaust steam spaces having an outlet, and means for admitting steam into the innermost annular chamber at one end of the cylinder.

2. In a turbine, the combination of an outer cylinder, an inner cylinder made in sections consisting of curved plates having outwardly projecting flanges secured to the outer cylinder, said inner cylinder being formed with internal annular grooves, heads closing said inner cylinder and united to the flanges on the sections of the same, the space between the two cylinders forming an exhaust steam chamber, a plurality of stators secured in the grooves in said inner cylinder, a shaft rotatable in suitable bearings and extending through said heads, rotors fixed to said shaft and disposed in alternation with said stators, said rotors and stators having co-acting steam passages, and means for directing steam through said passages.

3. In a turbine, the combination of a shaft, a plurality of rotors fixed in spaced relation thereon, and each having concentrically arranged annular rings and interposed annular rows or circles of buckets, an outer cylinder having ends or heads, through which latter said shaft extends, stators fixed to the cylinder and disposed in alternation with said rotors, each of said stators having concentric solid rings corresponding to the solid rings of the rotors and arranged in axial alignment therewith, said stators also having vanes for directing steam into the buckets of the rotors, and concentric annular partition rings formed integral with the solid rings of the endmost stators and secured to the ends or heads of the cylinder, and means for admitting steam into, and exhausting it from, said cylinder.

4. In a turbine, the combination of a shaft mounted in suitable bearings, a plurality of rotors arranged in spaced relation and fixed to said shaft, each of said rotors having concentrically arranged solid rings and interposed annular rows or circles of buckets, a cylinder, a plurality of stators fixed in said cylinder and arranged in alternation with said rotors, each of said stators having concentric solid rings corresponding to the solid rings of the rotors and arranged in axial alignment therewith, and also having annular series of vanes for directing steam into the buckets of the rotors, the solid rings of said stators being formed in their side faces with annular grooves, and the latter having in their bottoms recesses arranged at intervals, certain of said stators being also formed with transverse openings communicating with said grooves, one-piece packing rings arranged in said grooves of the stators

and adapted to engage the side faces of the solid rings of the rotors, said packing rings being formed on their bottom faces with integral lugs to project into the recesses in the bottoms of said grooves to prevent rotation of the packing rings, coil springs arranged in the transverse openings in said stators for actuating the packing rings, and

means for admitting steam into said cylinder and exhausting it therefrom.

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

JOHN MELVILLE.

Witnesses:

P. V. GOODLOE,
U. K. HURRLE.