

No. 877,873.

PATENTED JAN. 28, 1908.

E. C. TERRY.
STEAM TURBINE.

APPLICATION FILED NOV. 18, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

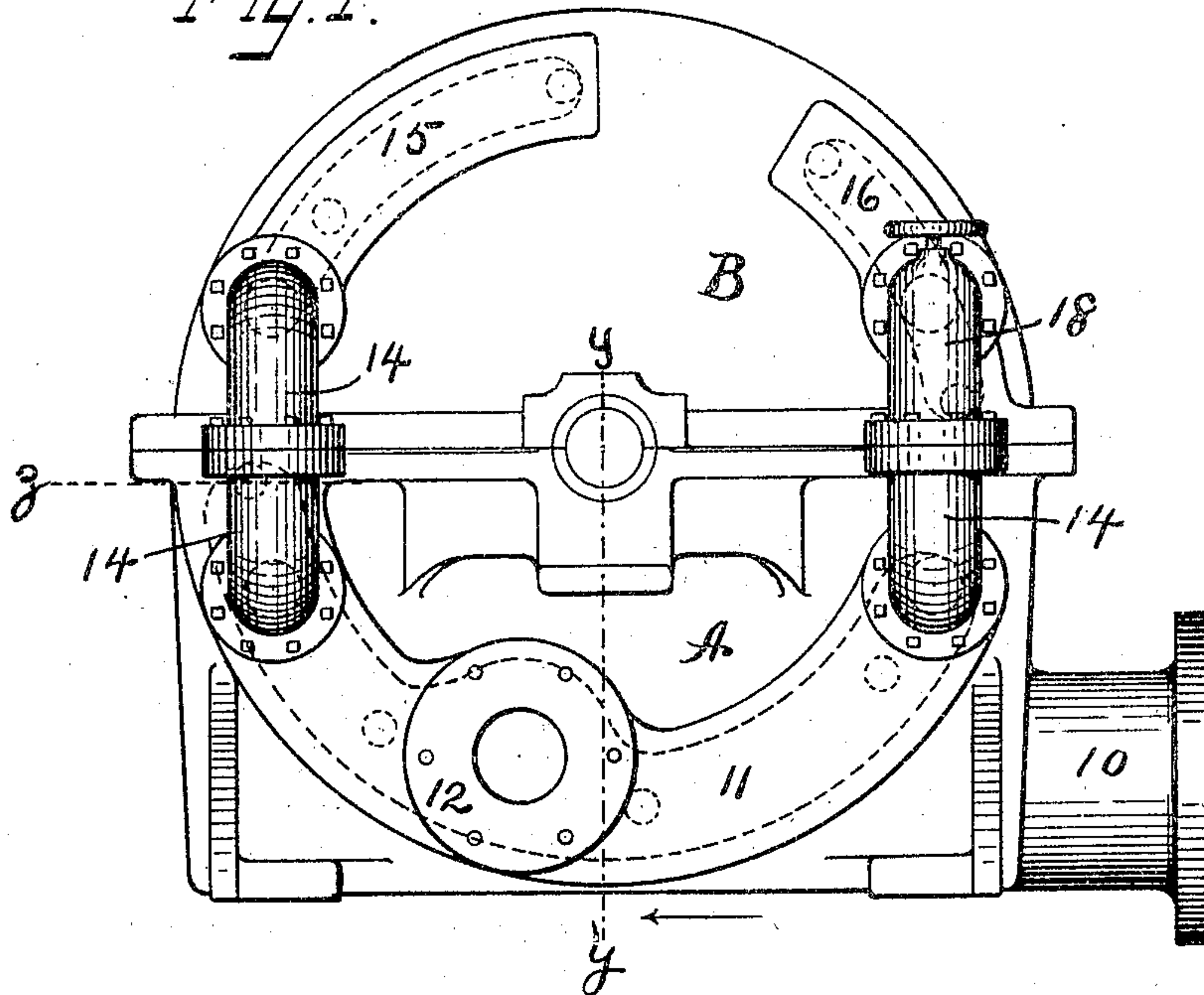
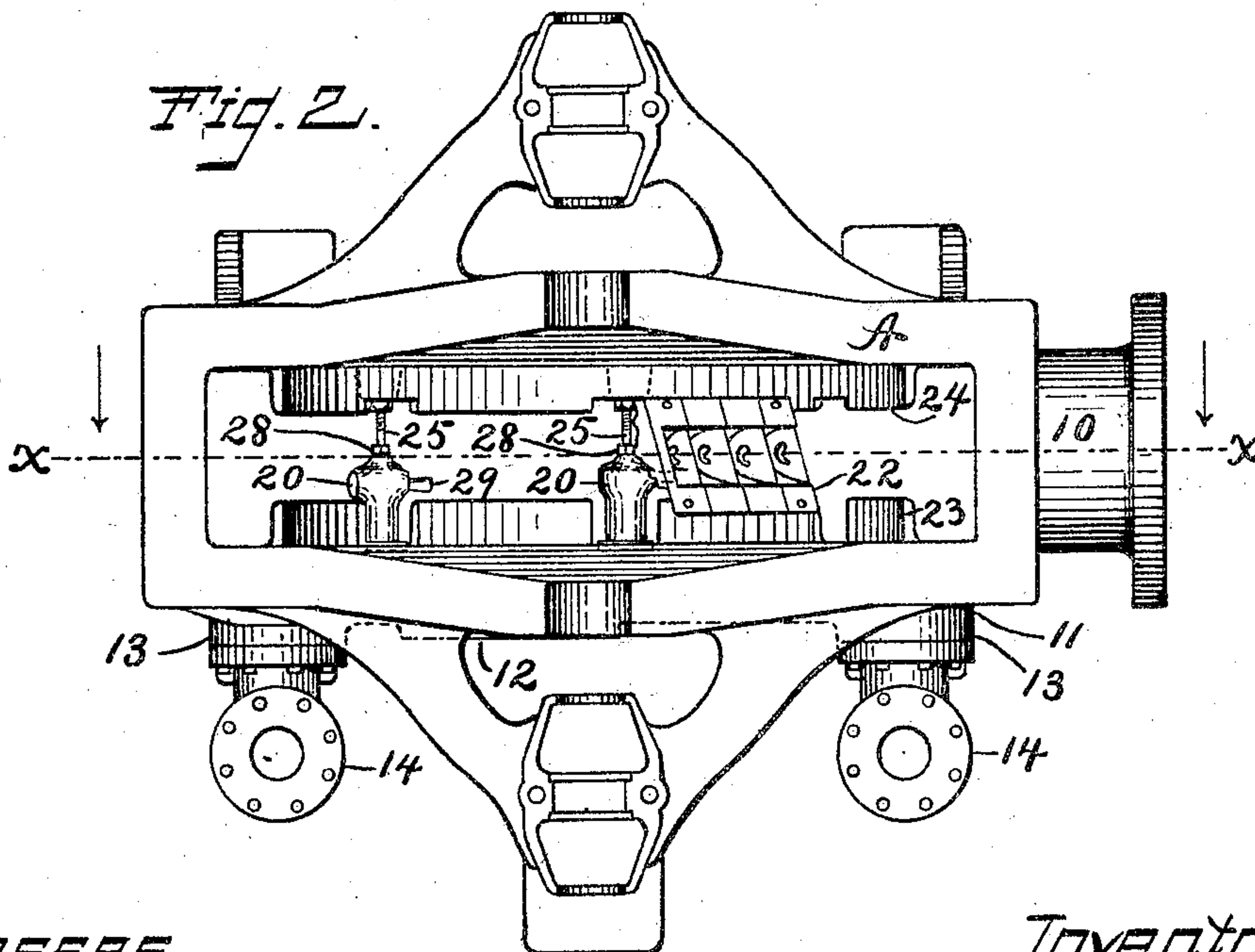


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

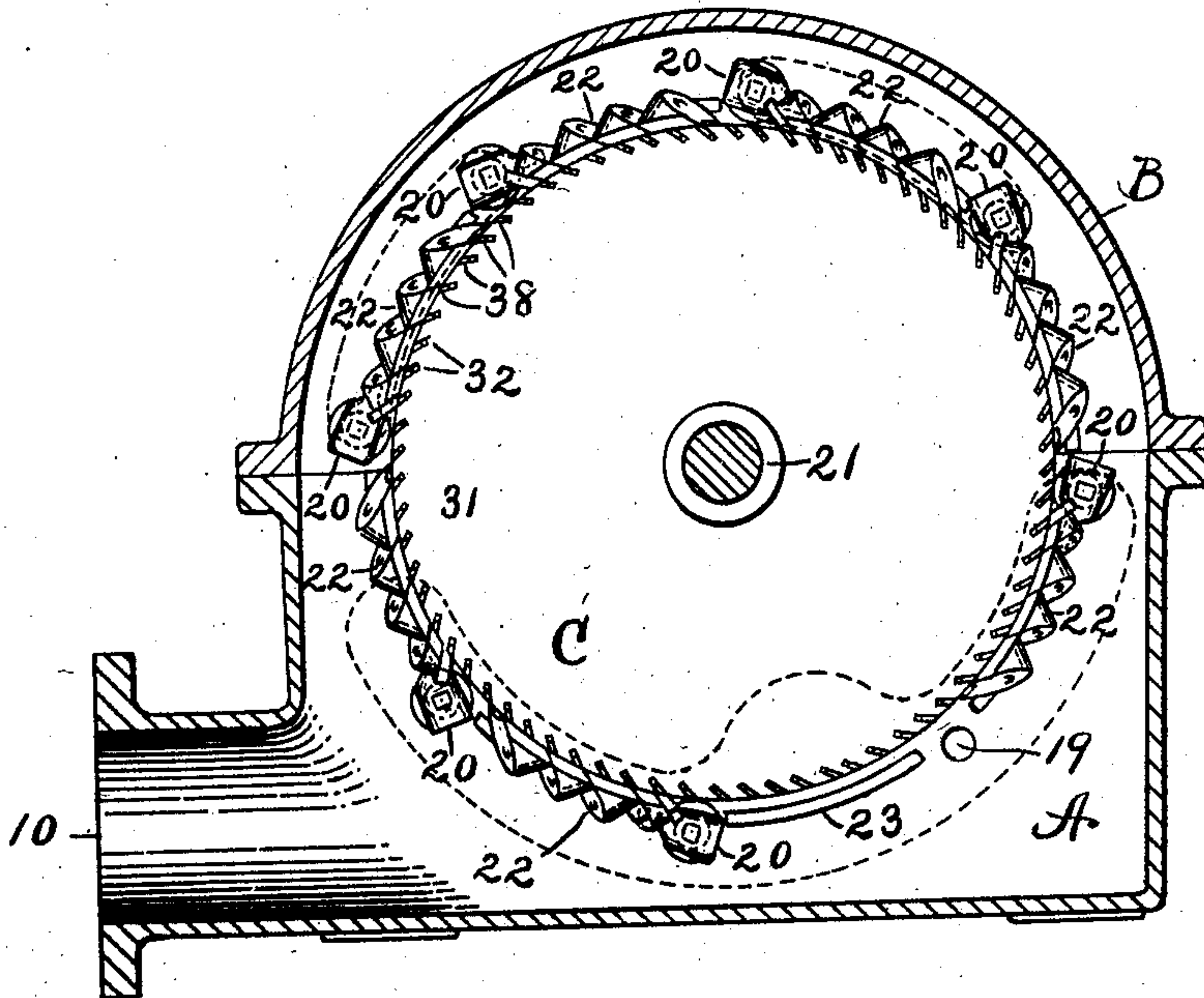
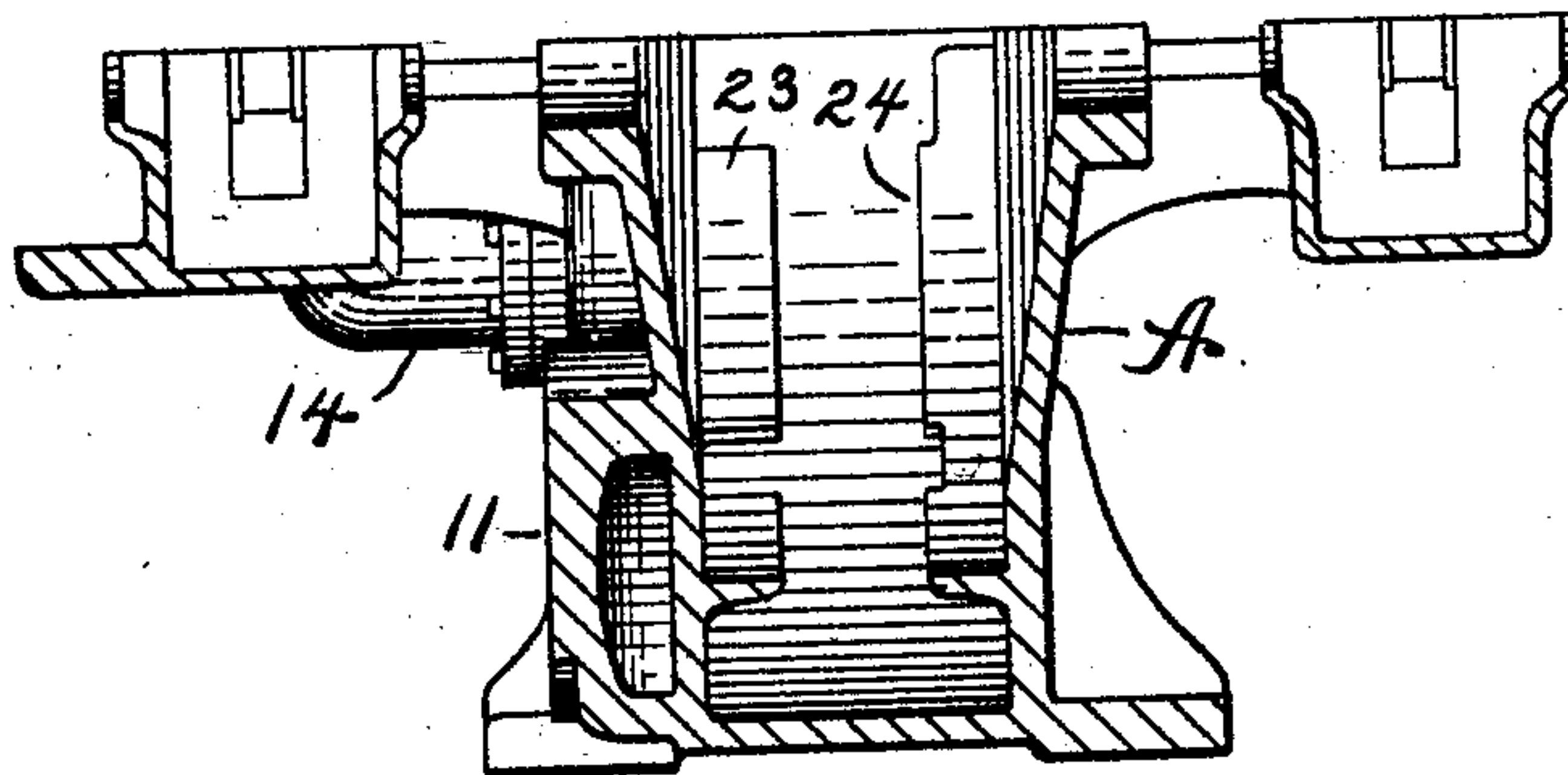


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

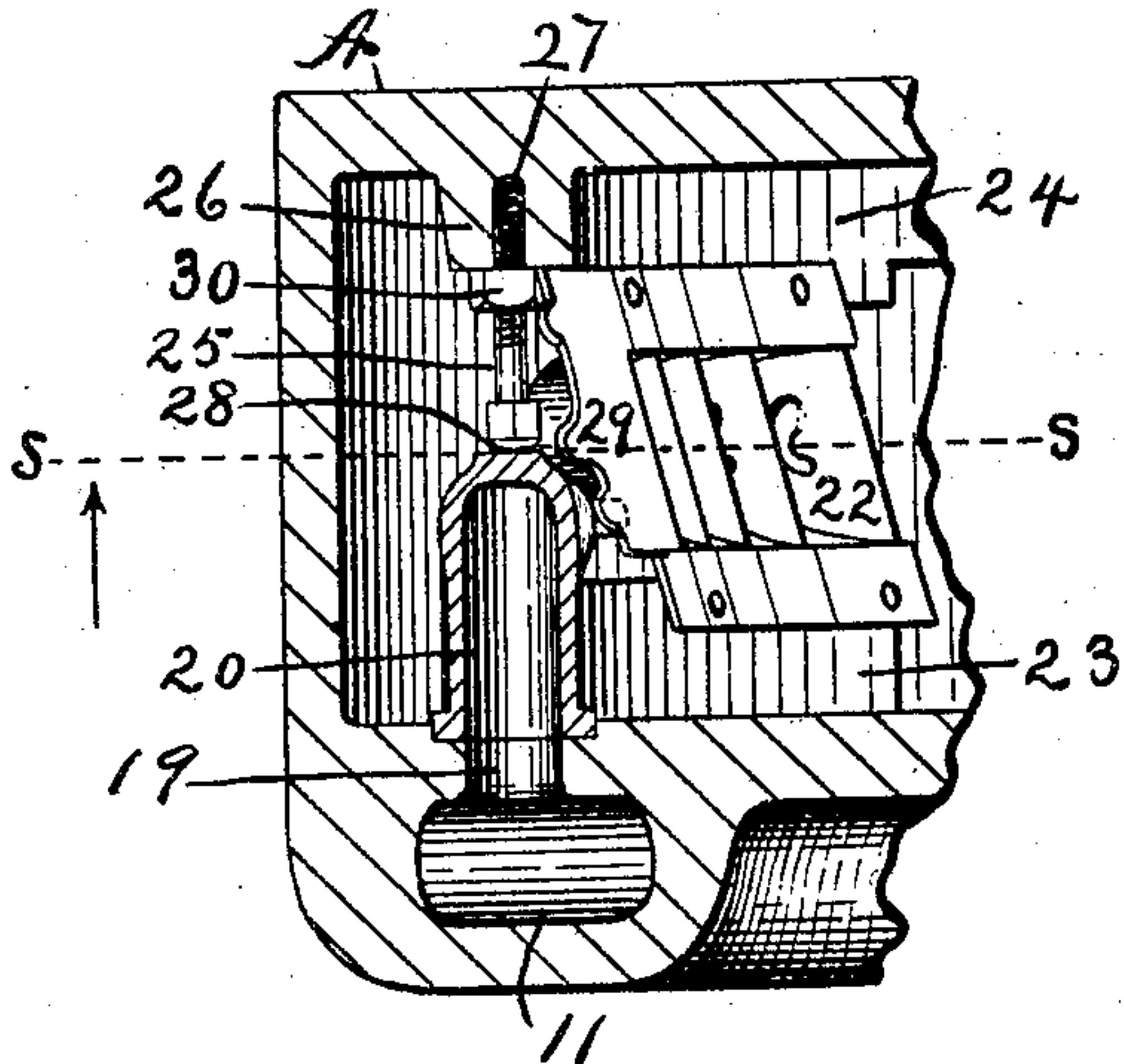


Fig. 6.

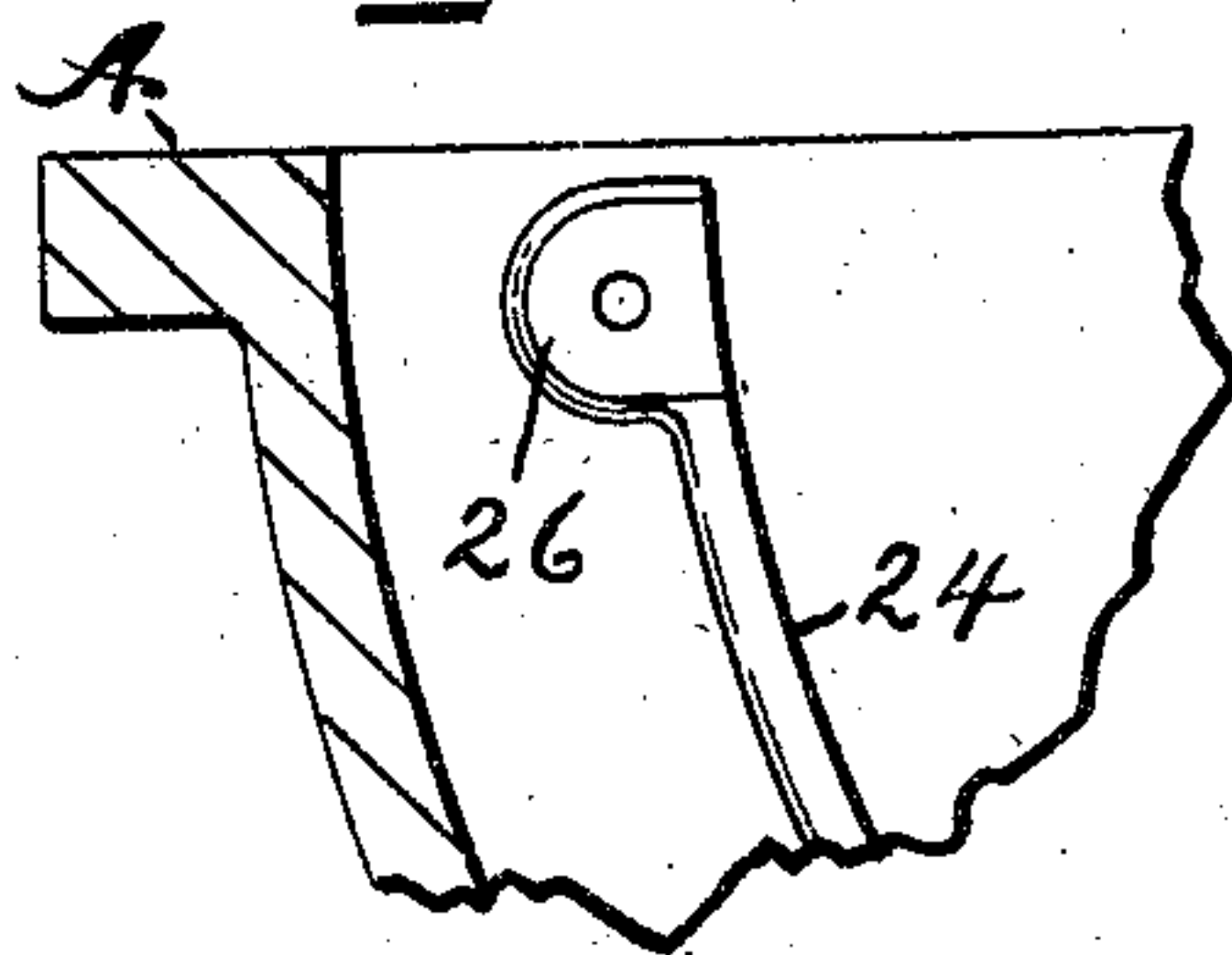


Fig. 7.

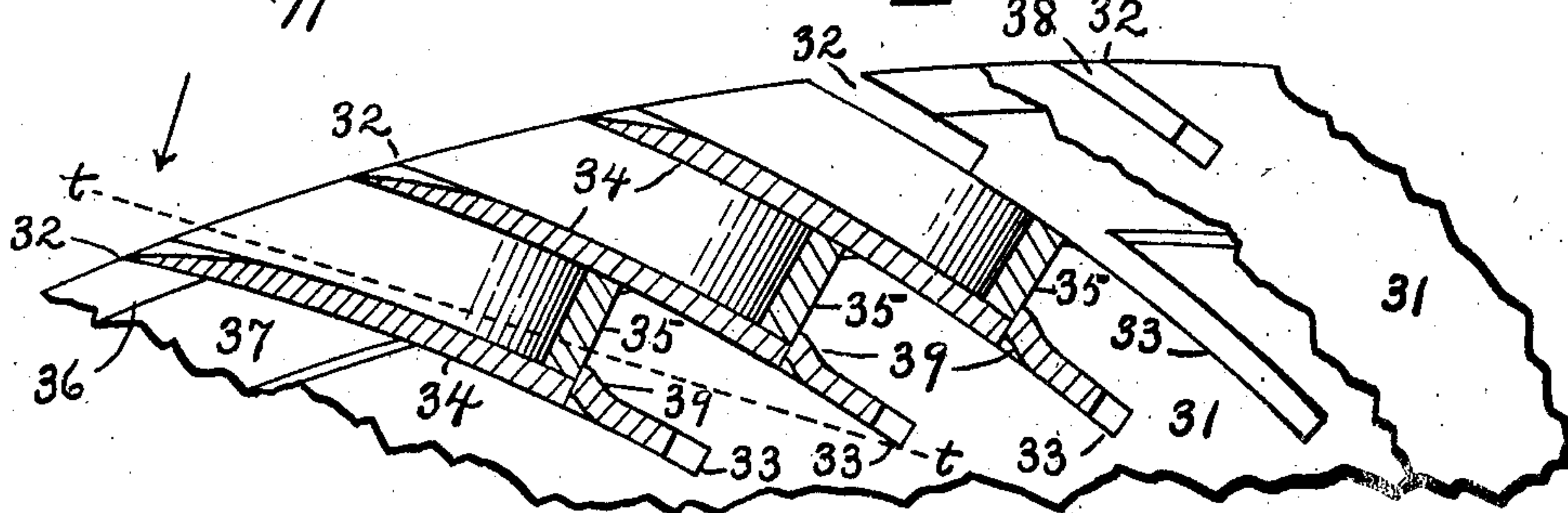


Fig. 8.

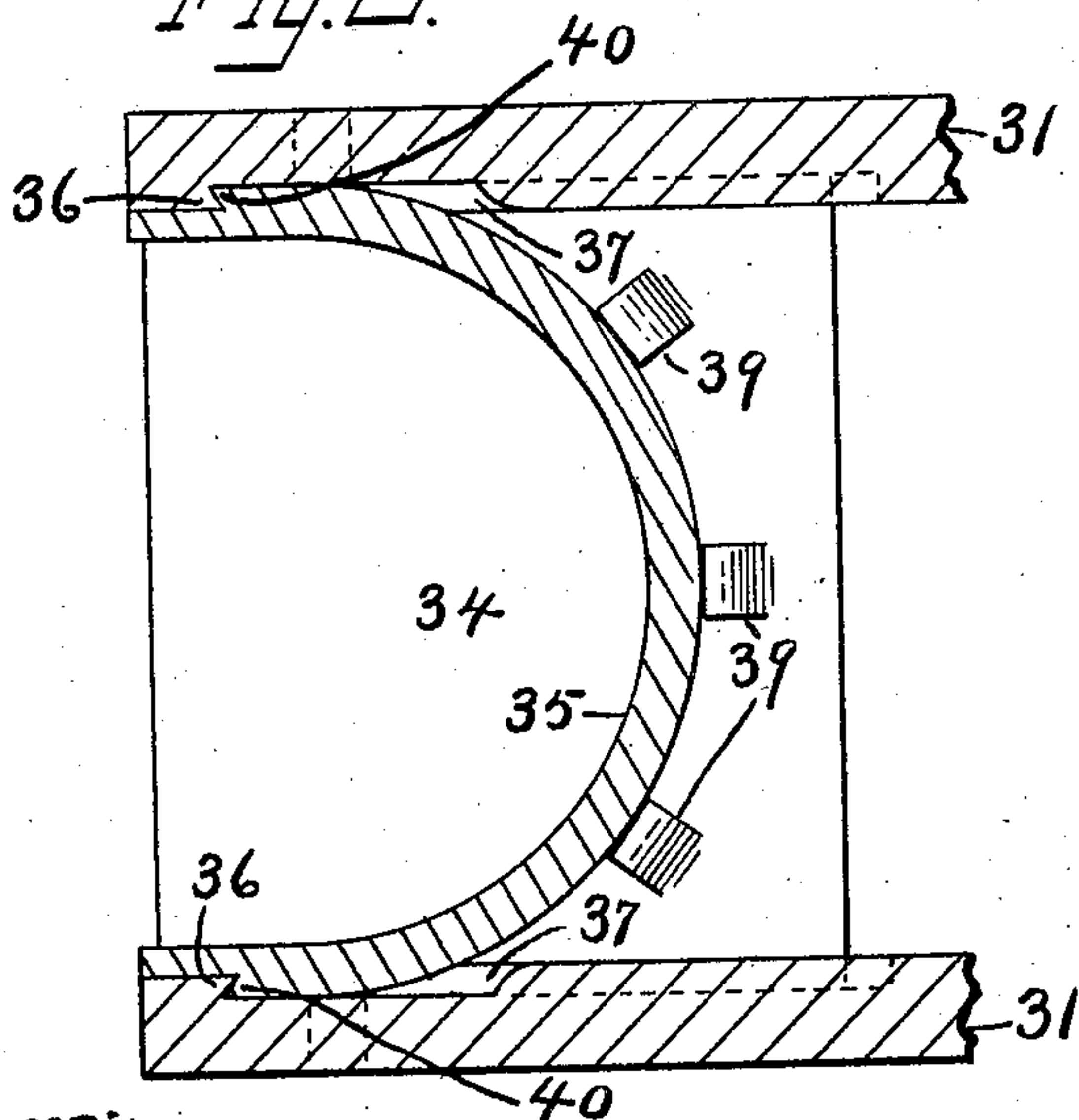
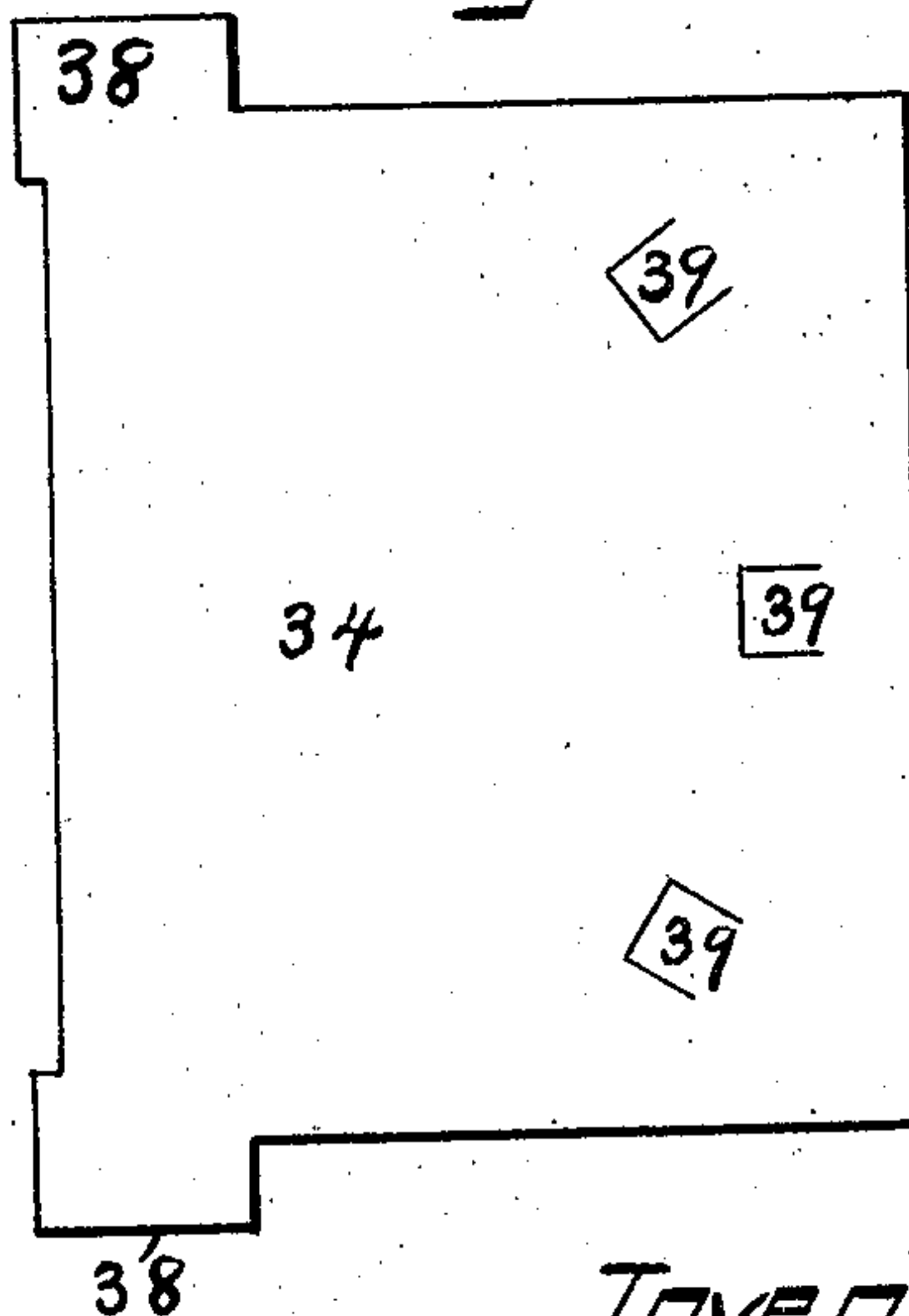


Fig. 9.



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UNITED STATES PATENT OFFICE.

EDWARD C. TERRY, OF HARTFORD, CONNECTICUT, ASSIGNOR TO TERRY STEAM TURBINE COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION.

STEAM-TURBINE.

No. 877,873.

Specification of Letters Patent.

Patented Jan. 28, 1908.

Application filed November 18, 1907. Serial No. 402,575.

To all whom it may concern:

Be it known that I, EDWARD C. TERRY, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

My invention relates to improvements in steam turbines; particularly to steam turbines made in substantial accordance with Letters Patent No. 741,385, granted to me Oct. 13, 1903, and the objects of my improvements are simplicity and economy in construction, together with convenience in assembling the parts and a substantial and reliable machine when assembled.

In the accompanying drawings:—Figure 1 is a side elevation of my steam turbine. Fig. 2 is a plan view of the lower part of the case with certain parts attached. Fig. 3 is a vertical section of the case, with a side elevation of the wheel and most of the reversing chambers, the plane of section being indicated by the line $x x$ of Fig. 2, looking in the direction indicated by the dart. Fig. 4 is a vertical section of the lower part of the case on the line $y y$ of Fig. 1. Fig. 5 is an enlarged sectional plan view of certain parts, on line z of Fig. 1. Fig. 6 is a vertical section of a portion of the lower part of the case on the line $s s$ of Fig. 5. Fig. 7 is an enlarged sectional view of a portion of the wheel, together with a side view of a portion of the wheel, the portion shown in side elevation being at the right hand end of the said view. Fig. 8 is a sectional view of a portion of the wheel on the line $t t$ of Fig. 7. Fig. 9 is a detached plan view of one of the bucket plates.

The case is made in two parts the same being divided horizontally in the plane of the axis of the wheel. The lower part A is provided at one end with an exhaust 10, while on one side is a steam chamber 11, having a seat or connection 12 for the attachment of a steam supply pipe, not shown. The steam chamber 11 extends over nearly the half circle of the said lower part of the case as indicated by broken lines in Fig. 1. At or near the upper ends of this steam chamber is a pipe seat or connection 13, by which to connect a bracket pipe or elbow 14, the upper ends of which bracket pipes are

preferably in the horizontal plane of the dividing line between the lower part A and upper part B of the case as shown in Fig. 1. The said upper part B has two separate steam chambers 15, 16, or more properly two sub-sections of the complete steam chamber, and each of these sub-sections are provided with seats or connections, like the seats 13, by which to attach a bracket pipe or elbow 14, as shown at the left in Fig. 1, or if desired, a right angle cut off valve 18, as shown at the right in Fig. 1. These bracket pipes or pipe and valve, connect the steam chamber 11 in the lower part A of the case with the two steam chambers or sub-sections in the upper part B of the case, so that the whole together constitute one steam chamber that extends substantially in an annular form for nearly the whole circumference of the case.

The ends of all the steam chambers, or sections are closed so that there is no communication of one with the other except through the pipe brackets. That wall of these chambers which lies nearest to the wheel chamber of the case is provided with jet ports 19, Figs. 3 and 5, and as indicated in broken lines in Fig. 1, for letting the steam into the jet bodies 20 within the case. As shown, there are four of these jet-ports in the steam chamber 11 and two each in the steam chambers 15 and 16. The number and special location of the jet ports may vary according to circumstances. By the employment of a cut off valve in one or both of the pipe connections between the chamber in the upper and lower parts of the case, the steam may be cut off from a part of these ports, as may be desired. Suitable packing or gaskets may be employed to make tight joints for the bracket pipes, but inasmuch as the steam chamber does not open into the wheel case, (except through the jet ports,) it is not necessary to place any gasket between the two parts of the case.

The wheel C is mounted in the case on the shaft 21, and is, with the exception of certain details herein after described, the same as in my aforesaid patent. The reversing chambers 22 are in the main the same as in the said patent, although they are differently put together and are mounted differently. They are grouped or assembled in segments of four chambers each and are mounted on annular

flanges or ribs 23 and 24, where they are held in any proper manner, as for example by means of screws 25, Figs. 2 and 5. The rib or flange 23 is on the steam chamber side of the case and is broken at points to make room for jet bodies 20. The flange 24 on the opposite side of the case has bosses 26 formed integral therewith and with the sides of the case, which bosses are drilled and threaded to receive abutting bolts 25. The jet ports are counter bored or swept off to form smooth seats for the flanged end of the jet bodies 20, as best shown in Fig. 5. The other end of the jet bodies are formed with an abutment or seat 28, for the other ends of the bolts to abut. The hollow jet bodies are provided with jet nozzles 29, which are set in position to send a jet of steam through the first one of the reversing chambers of each segment at one side edge of the said chamber, into the buckets of the wheel near one side substantially the same, in a general way, as in my aforesaid patent. In order to secure the jet bodies in place it is only necessary to turn in the bolts 27, place the body in the proper position and then unscrew the bolts to force the head firmly against the abutment of the jet body to hold it in place as best shown in Fig. 5. Turning up the set nut 30 will prevent any accidental loosening of the parts.

As in my aforesaid patent the wheel C is formed of two side plates and buckets set therein at the periphery of the wheel. These side plates or disks 31 are provided with notches 32 that extend inwardly from the edge in a direction obliquely to a radial line. The opposing inner faces of the side plates of the wheel are formed with annular grooves near their edge and inside of these grooves oblique grooves 33 are formed, the same extending inwardly in alinement with the notches 32. The buckets are formed of plates 34 set into the said notches and grooves, and curved edge plates 35 placed between the bucket plates to complete the substantially semi-circular or U shaped buckets. These edge plates are shouldered near their outer ends and these shoulders are let into the annular grooves, in the opposing faces of the two side plates of the wheel, in a general way the same as in my aforesaid patent.

In my present invention the outer wall or shoulder 36 of the annular grooves 37 is undercut or dove-tailed as shown in Fig. 8. The wings 38 of the bucket plates 34 are a little less in width, measuring from the outer edge inwardly, than the depth of the notches 32 in the edge of the wheel, and the grooves 33 are a little deeper than the width of the bucket plates, measured in the same way. Each bucket plate is provided with three projections 39 for the outer wall or face of the edge plates 35 to abut against. These pro-

jections are preferably formed of integral tongues or slugs cut on three sides from the body of the plate, and then the free ends of the tongues or slugs are bent so as to project slightly, as best shown in Fig. 7. The outer ends of the edge plates, as in my former patent, are reduced in thickness to form a shoulder for abutting against the outer wall of the annular groove 37, and in my present invention this shoulder 40 is of a beveled or dove-tail form to fit and engage the correspondingly shaped shoulder 36 of the annular groove 37.

In assembling the parts a bucket plate is pushed edgewise into the grooves 33 with the wings 38 in the notches 32. It is pushed in a little beyond its final position, the depth of the notches and grooves permitting this to be done. An edge plate is next crowded into position on that side of the bucket plate from which the projections 39 extend. The outer ends of these edge plates are pressed towards each other a little to permit the shoulders 40 to pass in between the two sides plates 31, until the said shoulders face the annular grooves 37. The resiliency of the metal will then force the ends of the edge plates apart to carry the shoulders into the said grooves. If desired one bucket plate and one edge plate may be pushed into place simultaneously instead of separately. In either case, after insertion, the bucket plate and edge plate are together forced outwardly until the dove-tail shoulders of the edge plate and annular groove snugly engage each other and the projections 39 are in contact with the outer curved face of the edge plate. Another bucket plate and edge plate is then added in like manner and so on until the wheel is completed. The friction of the parts when thus constructed will hold the buckets in position when once properly placed. The dove-tail shoulders will always hold the outer ends of the edge plates closely against the side plates of the wheel.

I claim as my invention—

1. In a steam turbine, a case divided into two parts in a plane extending longitudinally through the axis of the turbine, separate steam chambers in the said two parts, and a bracket pipe connecting the said steam chambers.

2. In a steam turbine, a case divided into lower and upper parts in a horizontal plane extending longitudinally of the axis of the turbine, a main steam chamber in the lower part of the said case, two separate chambers in the upper part of the said case, and outside connections between the said chamber in the lower and the chambers in the upper part of the case.

3. In a steam turbine, a case having a steam chamber in one side thereof with jet ports leading from the said chamber to the interior of the case, jet bodies seated on the

side of the case over the said jet ports, and abutting bolts on the opposite side of the case for holding the said jet bodies in place.

4. In a steam turbine, the case having substantially annular ribs on its opposite sides and segments of reversing chambers seated upon and secured to the said ribs.

5. In a steam turbine, the case having substantially annular ribs on its opposite sides, segments of reversing chambers seated upon and secured to the said ribs, a steam chamber in one side of the said case, jet ports leading from the said chamber to the interior of the said case, jet bodies seated over the said jet ports, and means for holding the said jet bodies in place at the end of each of the segments of reversing chambers.

6. In a steam turbine, a wheel having two side plates provided with annular grooves in their opposing inner faces, bucket plates held between the said two side plates, and edge plates of substantially U shape, the outer

ends of the said edge plates and the outer wall of the said annular groove having dovetail shoulders in engagement with each other, substantially as described.

7. In a steam turbine, a wheel having two side plates provided with annular grooves in their opposing inner faces, oblique notches in the outer edges of the said plates, oblique grooves in alignment with said notches, bucket plates fitted to the said notches and grooves, projections on one of the broad sides of the said bucket plates and edge plates bearing on the said bucket plates, the said edge plates and the said annular grooves being provided with engaging dovetail shoulders, and the outer curved wall of the said edge plates engaging the broad side projections of the said bucket plates.

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