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APPLICATION FILED DEC. 8, 1908.

925,218.

Patented June 15, 1909.

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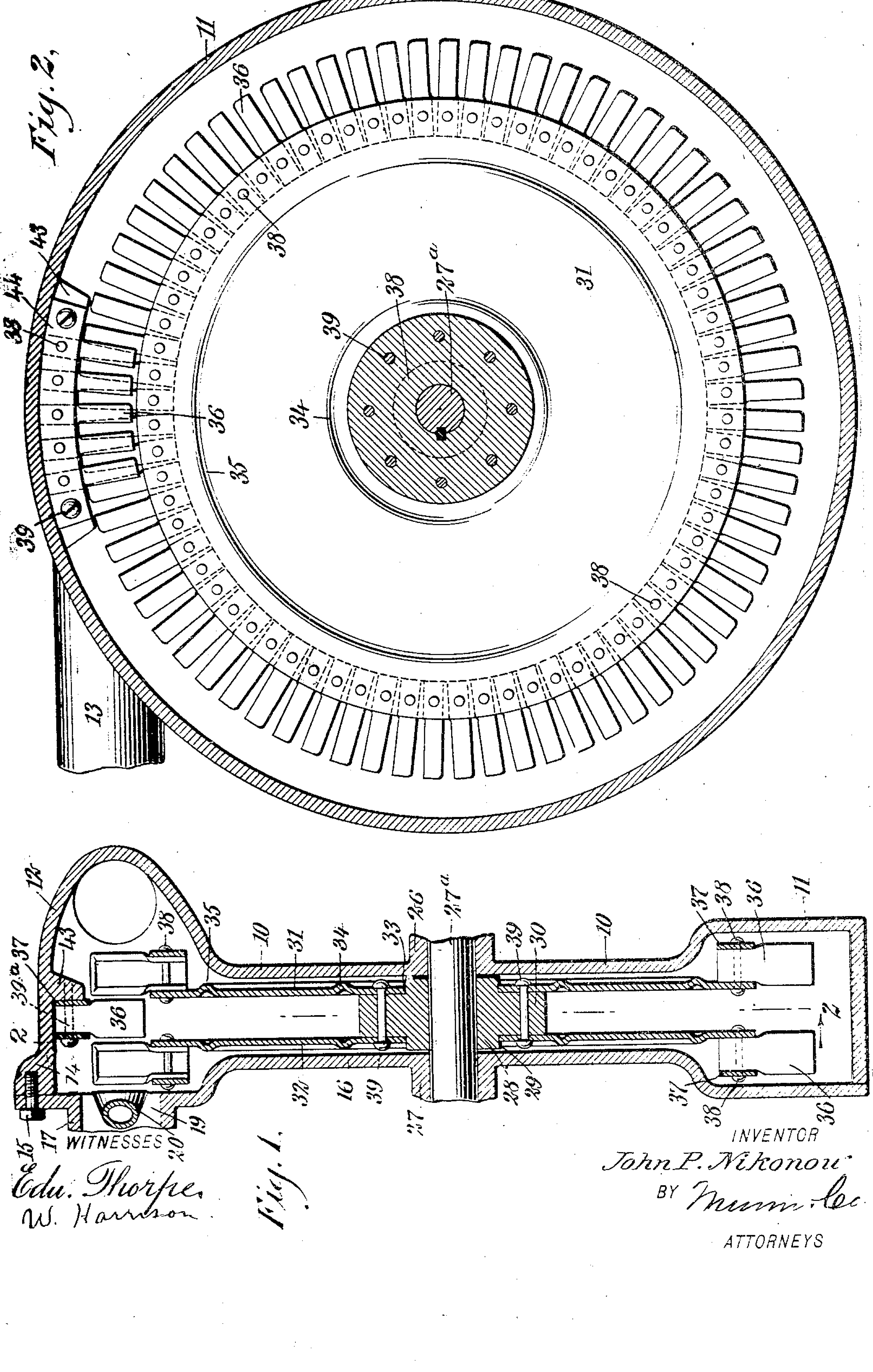

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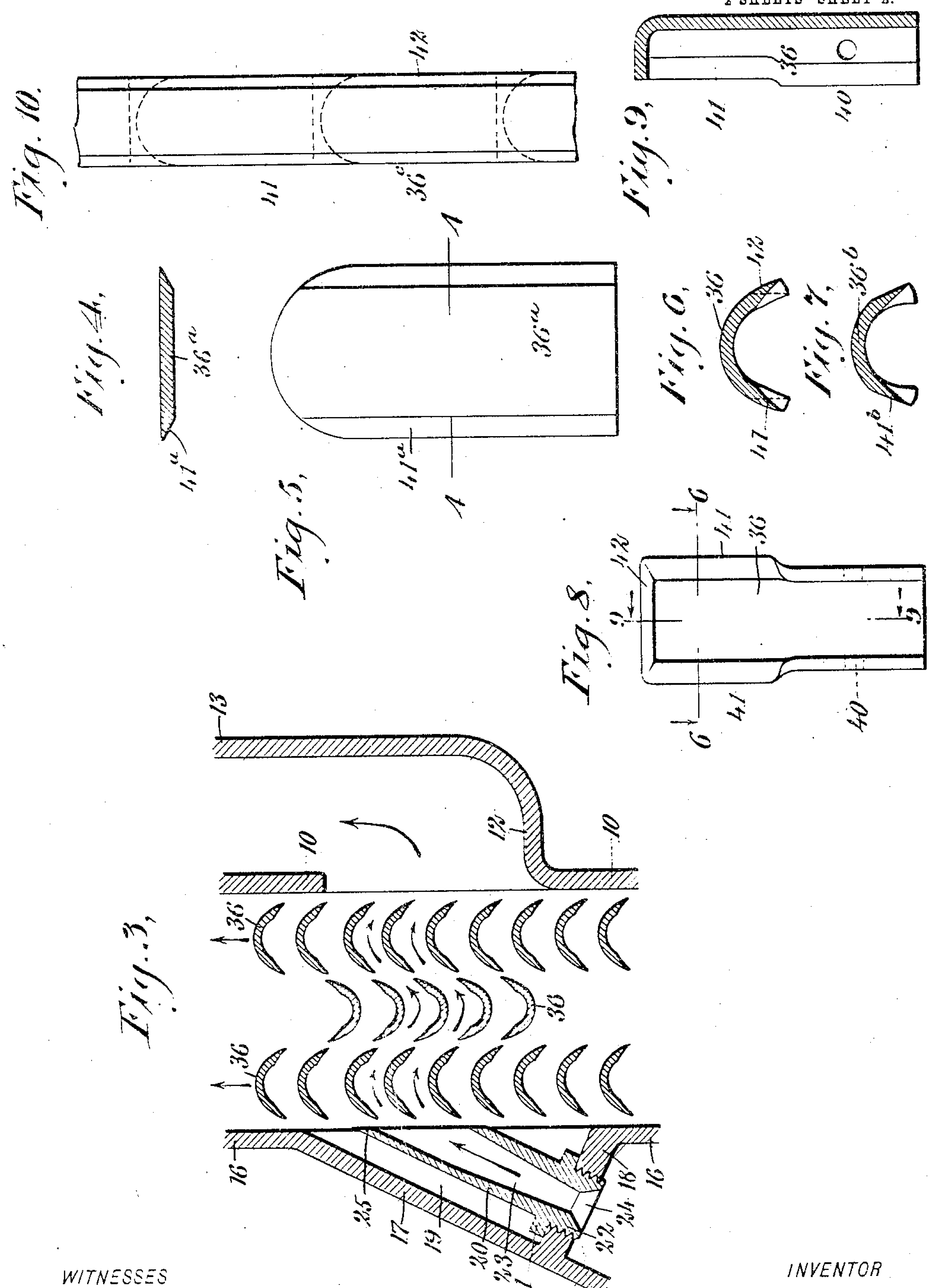

WITNESSES

Edward Thorpe

Walton Harrison

INVENTOR

John P. Nikonow

BY *Munn & Co.*

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHN P. NIKONOW, OF EVANSVILLE, INDIANA, ASSIGNOR TO SCHROEDER HEADLIGHT COMPANY, OF EVANSVILLE, INDIANA, A CORPORATION.

ELASTIC-FLUID TURBINE.

No. 925,218. Specification of Letters Patent. Patented June 15, 1909.

Application filed December 8, 1908. Serial No. 466,487.

To all whom it may concern:

Be it known that I, JOHN P. NIKONOW, a subject of the Czar of Russia, and a resident of Evansville, in the county of Vanderburg and State of Indiana, have invented a new and Improved Elastic-Fluid Turbine, of which the following is a full, clear, and exact description.

My invention relates to turbines of the general kind used in connection with elastic fluids, such as steam, compressed air or gases of combustion, my more particular purpose being to produce a device of this type having its parts so shaped and arranged as to be cheaply made and easily assembled, and in its complete form offering particular advantages as to efficiency, durability, and replacement and interchangeability of parts.

My invention further comprehends a turbine vane made of sheet metal by cutting and stamping the same into proper shape to form the finished vanes.

My invention still further relates to the construction of the revoluble member of the turbine and to the manner in which the movable vanes are secured thereupon.

My invention also relates to the means which I use for securing in position the stationary vanes which are located adjacent to the path of travel of the movable vanes.

In addition to the objects above stated my invention relates further to the shape of the inlet nozzle and to the construction of various other parts of the turbine for the purpose of attaining various other objects hereinafter mentioned.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a central vertical section through the turbine, showing the stationary casing and its accompanying parts, and further showing a movable member of the turbine provided with vanes arranged in two groups disposed upon opposite sides of the stationary vanes, this view further showing how all of the vanes are mounted in position; Fig. 2 is a section upon the line 2—2 of Fig. 1, looking in the direction of the arrow; Fig. 3 is a diagrammatic section showing the relations of the stationary vanes and movable vanes, and also indicating the path of travel of the elastic fluid; Fig. 4 is an end elevation of one of the blanks struck from sheet metal and provided with bevels; Fig. 5 is an inverted plan view of the blank shown in Fig. 4; Fig. 6 is a cross section upon the line 6—6 of Fig. 8, looking in the direction of the arrow, this view being taken through the finished vane, the latter being stamped into shape from the blank shown in Figs. 4 and 5, the bevels being, in this instance, upon the inside of the vane; Fig. 7 is a cross section through another form of vane made also from the blank shown in Figs. 4 and 5, the bevel, however, being upon the outside of the vane; Fig. 8 is a plan view of the finished vane ready to be mounted in position; Fig. 9 is a section upon the line 9—9 of Fig. 8, looking in the direction of the arrows and showing more completely the form of the finished vane, and Fig. 10 is a plan view of the specially drawn strip from which the blanks are cut in making the vanes.

A stationary casing 10 is provided with an enlarged portion 11 of substantially annular form, this enlarged portion having a protuberance 12, and connected with the latter is an exhaust pipe 13. The casing 10 is provided with an annular bead 14 into which are inserted a number of bolts 15. A head 16 is secured upon the casing 10 by aid of the bolts 15 and is provided with a protuberance 17 containing a partition 18 and an inlet port 19.

A nozzle 20 is provided with a shoulder 21 and with a threaded portion 22 which extends through the partition 18, the latter being threaded to mate it so that when the nozzle is mounted in position, as indicated in Fig. 3, the shoulder 21 engages the partition 18 and presses upon it with sufficient force to hold the nozzle stationary. The nozzle 20 is provided with a conical bore 23 having an enlargement 24. The general direction of the nozzle 20 is oblique relatively to the general plane of the turbine and terminates in a bevel 25, this bevel coinciding in direction with the adjacent inner surface of the head 16. Annular bearings 26, 27 support a revoluble shaft 27^a and mounted rigidly upon the latter is a circular block 28 provided with shoulders 29 and with a reduced portion 30, this reduced portion having a general annular form.

Mounted upon opposite sides of the reduced portion 30 are two disks 31, 32 substantially alike. Each of these disks is provided with a central opening 33 in order to facilitate the mounting of the disks upon the circular block 28. Each disk is further provided with two annular beads 34, 35 concentric with each other and also with the center of the disk. The disks being made of sheet metal the beads 34, 35 are readily formed by crimping, stamping, pressing or even by drop-forging, as desired.

I find that the disks are materially strengthened by providing them with the beads 34, 35, and further that by using a plurality of such beads disposed concentrically, the disk is strengthened to a greater extent than would ordinarily be expected from computing the aggregate strength afforded by the beads separately. The reason of this is that one of the beads, by serving to brace and stiffen the disk, enables the other bead to exert its individual strength to better advantage.

Mounted upon the outer edges of the disks 31, 32 are movable vanes 36 which are secured in position by aid of rings 37 of sheet metal and rivets 38, the rivets extending directly through the rings 37, the vanes 36 and outer edges of the disks. Rivets 39 extend through the reduced portion 30 of the circular block 28 and also through the two disks 31, 32, thereby securing these disks firmly upon the circular block and holding them in favorable position to promote their stiffness.

As the inner surface of the disks abut directly against the shoulders 29 of the circular block 28, it is almost impossible for the disks to move, crimp or buckle. The rivets 39 holding the inner edges of the disks firmly against the reduced portion 30, and also holding the inner edges of the disks directly against the shoulders 29, effectively prevent the disks 31, 32 from yielding at any point near the circular block 28, and thus enable the central portions of the two disks, because of the great strength and rigidity thus conferred upon them, to assist the outer portions of the disks in resisting undue strain.

Each vane 36 is provided with a hole 40 and with beveled surfaces 41, 42. In making these vanes I prepare specially drawn metal strips 36^c provided with beveled surfaces 41, 42, which I cut into pieces of proper shape, and from these I stamp the buckets. In some instances, as indicated in Fig. 7, I prefer to so form the blank that the bevels are upon the outside, as indicated at 41^b, so that the completed vane has in cross section the general form indicated at 36^b, Fig. 7.

The vanes being completed and mounted upon the disks 31, 32, by aid of the rings 37 and rivets 38, the movable member of the turbine, comprising practically all of the revoluble parts, is now completed. Integral with the casing 10 and disposed internally at the top thereof is a lug 43 of arcuate form. Two sections 44 of sheet metal are disposed adjacent to these lugs, and riveted intermediate these sectors are a number of vanes, the vanes and sectors together forming the single composite member which, as a whole, is secured upon the lug 43 by aid of the bolts 39^a which extend through both plates. By loosening these bolts the member in question may be bodily detached at will.

The bevels 41, 42 or 41^b, as the case may be, have such inclination that the inner and outer surfaces adjacent to the edges of the vanes have an angle variation of twenty to thirty degrees. In other words, the sharpness of the edges of a vane, whether of the form in Fig. 6 or that shown in Fig. 7, is represented by an angle which should not vary in degrees to any greater extent than that just indicated. The purpose in forming the angle as just stated is to enable the steam to enter the spaces between the vanes without meeting any obstruction and without shock, and consequently without undue loss of efficiency. For instance, referring to Fig. 3, it will be noted that the steam or other elastic medium, in coming in contact with any vane, is so cleft as to be guided gently into the spaces in front of and back of the vane, so that all back pressure is reduced to a minimum and the vane is as little in the way as possible, except as regards the effective pressure applied to it.

The operation of my device is as follows: An elastic medium, such as steam, being admitted through the nozzle 20, expands in passing through the bore 23 and is projected at a high velocity against the adjacent group of movable vanes and is thence deflected against the small stationary group of vanes 36, shown at the top of Figs. 1 and 2, and being again deflected, they strike the remaining group of movable vanes, thence passing out through the exhaust pipe 13. From this course of travel, it will be observed (see Fig. 3) that the steam has two velocity stages.

I have found this turbine to be exceedingly efficient in economizing the use of expansive fluid employed. Its parts are easily replaced when worn out, or interchanged for other parts of the same kind. As is well known in this and many other arts, parts made from metal stampings are much more cheaply constructed than if cast or machined, yet in a device such as a turbine it is difficult to make stampings answer the purpose required, owing to the exact conditions presented in the problem of construction. Such being the case, it will be realized that many advantages accrue from using the parts above described and in the relation stated. For instance, the vanes shown in Figs. 6, 7 are required to possess great strength and stiffness, and also to have preferably some little elasticity. These advantages are all attained by performing the stamping as described.

Referring more particularly to Fig. 9, it will be seen that the vane, because of its shape, is self-bracing. Further, being made from sheet metal, it is much lighter than it would be if it were machined down from a thick block of metal or were cast in a block-like form. Sheet metal is exceedingly hard upon its surface, owing to the process of rolling whereby it is made into a sheet. The "skin hardness", as it is called, of the sheet metal is not destroyed by the conversion, in the manner above described, in the stamping of the blank of sheet metal into the form of the finished vane.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a turbine, the combination of a revoluble disk of metal provided with an annular bead whereby said disk is strengthened, vanes mounted upon said disk and revoluble therewith, and means for directing an elastic fluid against said vanes.

2. In a turbine, the combination of a revoluble block, a disk of sheet metal engaging said revoluble block, fastening members for securing said disk firmly upon said revoluble block, said disk being provided with concentric beads integral with it for the purpose of strengthening it, vanes mounted upon said disk, and means for directing against said vanes a fluid medium.

3. In a turbine, the combination of a casing provided with a lug integral therewith and extending internally thereof, a number of vanes to be supported upon said lug, metallic sectors connected rigidly with said vanes and disposed upon opposite sides thereof, and means for connecting said metallic sectors directly to said lug.

4. In a turbine, the combination of a casing provided with a lug disposed internally thereof, a number of vanes to be supported by said lug, a pair of metallic members disposed upon opposite sides of said vanes, rivets connecting said vanes and said metallic sectors together so as to form a single member of composite form, and means for securing said member thus formed rigidly in relation to said lug.

5. In a turbine, the combination of a casing having an enlarged portion of annular form, a plurality of stationary vanes mounted centrally of said casing, a plurality of revoluble disks disposed upon opposite sides of said stationary vanes, a plurality of separate vanes mounted upon each of said revoluble disks and secured thereto, said vanes upon said revoluble disks extending therefrom in opposite directions and into said enlarged portion of annular form, and means for directing against all of said vanes a fluid medium.

6. In a turbine, the combination of a casing provided with a lug of arcuate form disposed within said casing and projecting internally thereof, a plurality of vanes, a pair of sectors secured upon opposite sides of said vanes for holding the same in a fixed relation to each other, thus forming a single composite member, and means for securing said single composite member upon said lug.

7. In a turbine, the combination of a casing provided with a lug of arcuate form projecting internally thereof, a plurality of vanes, a pair of sectors secured upon opposite sides of said vanes for holding the same fixed relatively to each other, thus forming a single composite member, and mechanism controllable at will for detachably securing said composite member upon said lug.

8. In a turbine, the combination of a casing provided with an inlet port and with a partition adjacent to said inlet port, said partition having a threaded opening, a nozzle connected rigidly with said partition and extending therefrom toward said inlet port, said nozzle having an annular shoulder engaging said partition, said shoulder being disposed upon the side of said partition toward said inlet port for the purpose of steadying said nozzle.

9. In a turbine, the combination of a casing provided with an inlet port, and further provided with a partition adjacent to said inlet port, a nozzle connected rigidly with said partition and provided with a bevel extending entirely across said nozzle, and further provided with an annular shoulder engaging said partition and bracing said nozzle, said shoulder being disposed upon the side of said partition toward said inlet port.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN P. NIKONOW.

Witnesses:

Laura M. Gabert,

Daniel M. Fairchild.