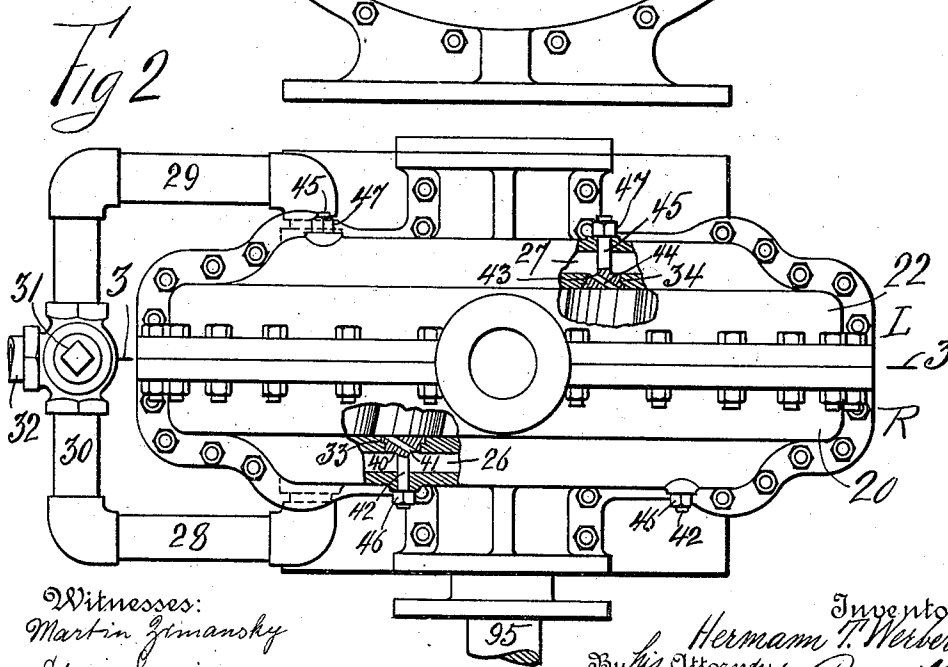
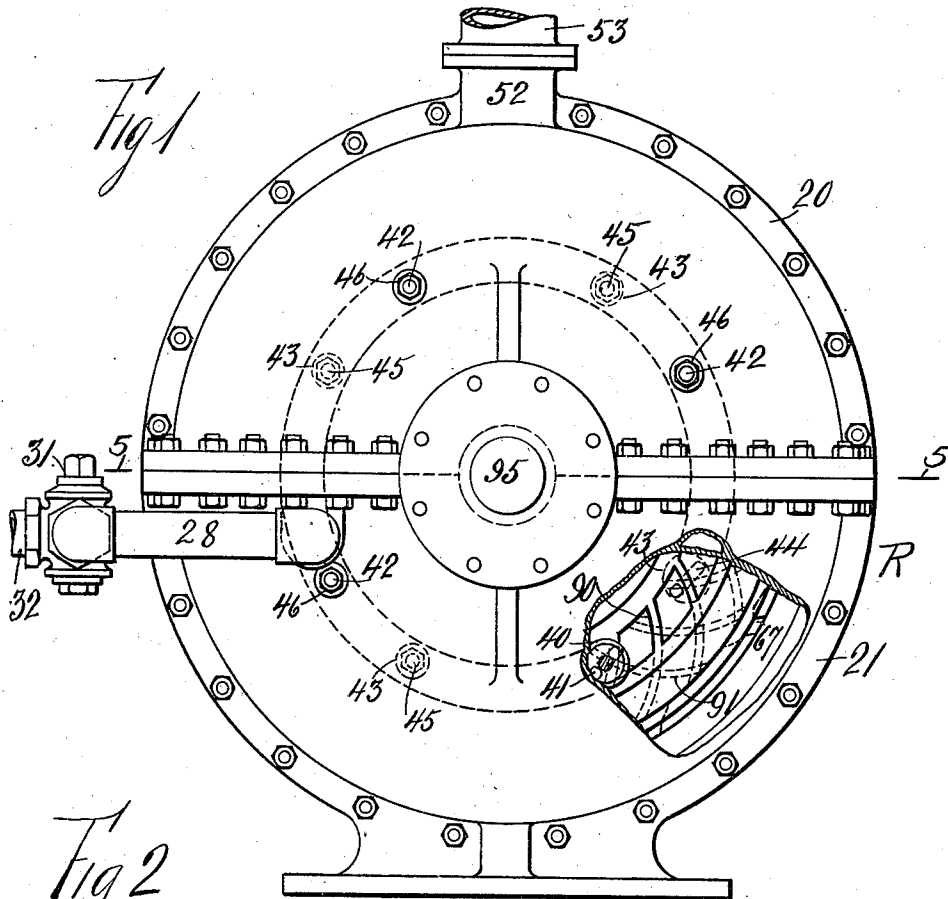


H. T. WEBBER.
REVERSING TURBINE.
APPLICATION FILED MAR. 3, 1910.

996,177.

Patented June 27, 1911.

4 SHEETS—SHEET 1.



Witnesses:
Martin Zimansky
Edmund Lewis

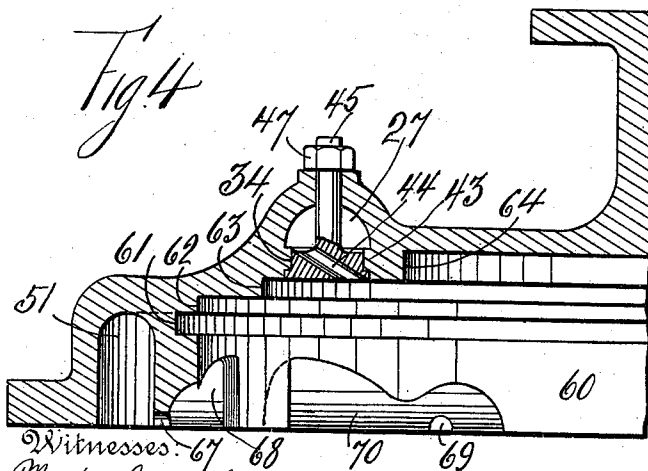
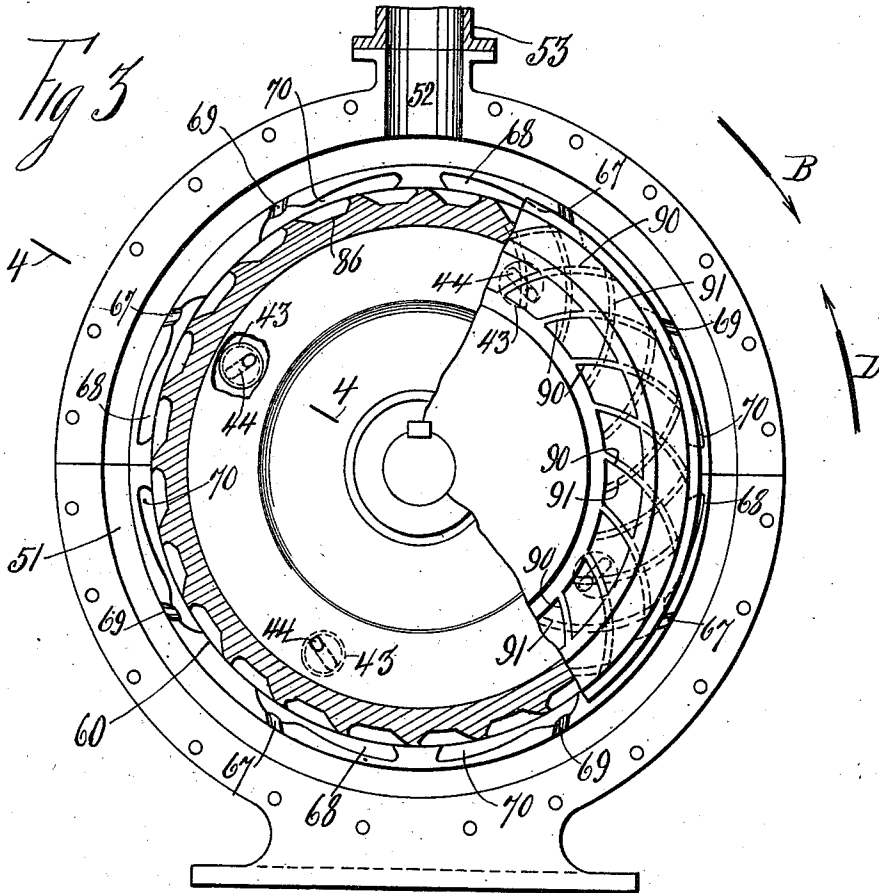
Inventor
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4 SHEETS-SHEET 2.



Witnesses: 67 68 70 69
 Martin Gimansky.
 Edwin Lemis

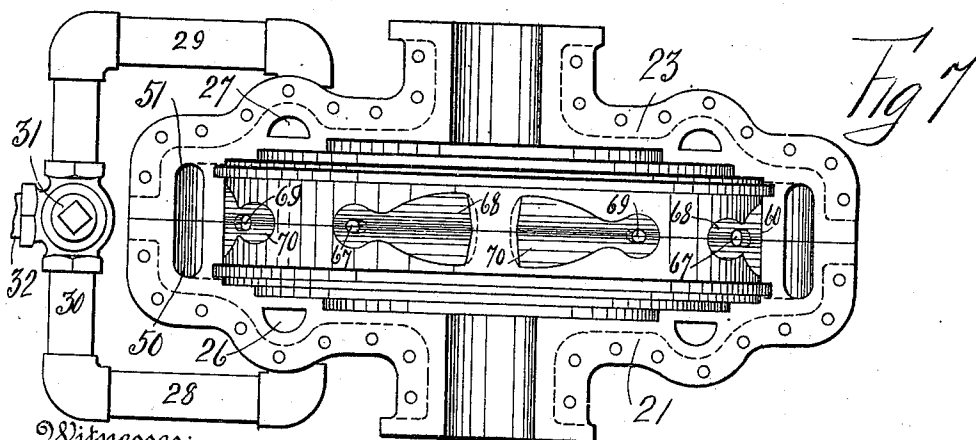
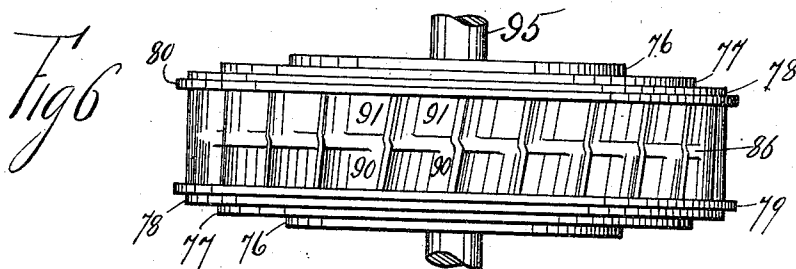
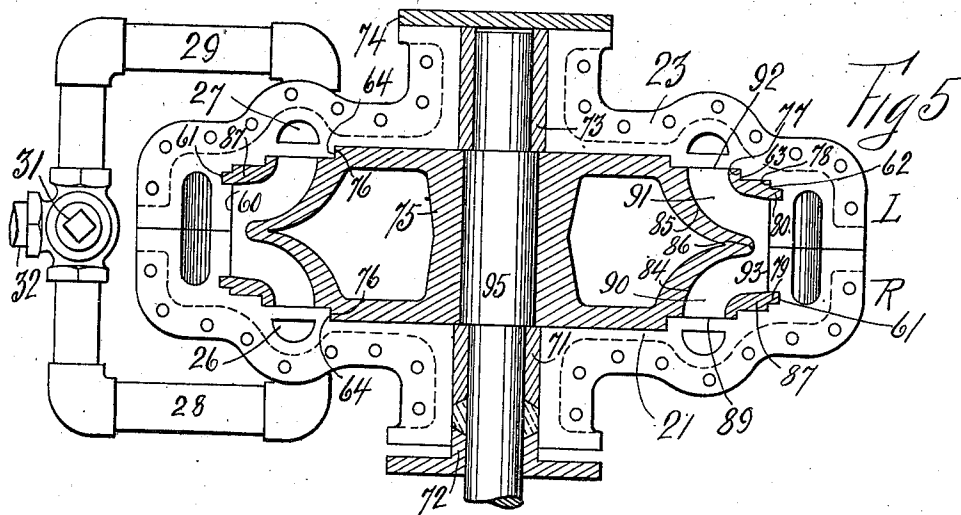
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4 SHEETS—SHEET 3.



Witnesses:
Martin Grimansky.
Edmund Lewis

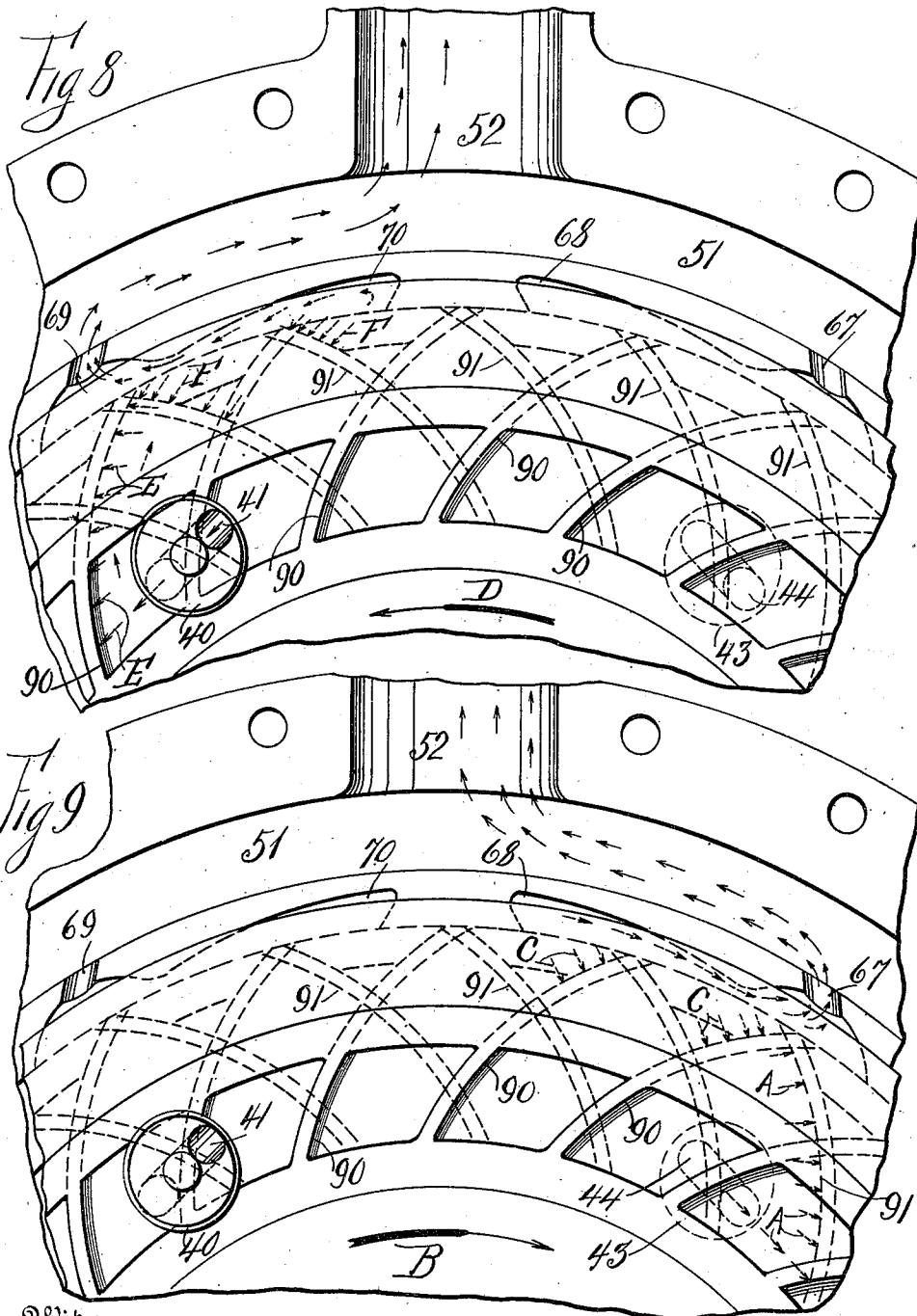
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H. T. WERBER.
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996,177.

Patented June 27, 1911.

4 SHEETS—SHEET 4.



Witnesses:
Martin Gimansky
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UNITED STATES PATENT OFFICE.

HERMANN T. WERBER, OF BROOKLYN, NEW YORK.

REVERSING-TURBINE.

996,177.

Specification of Letters Patent. Patented June 27, 1911.

Application filed March 3, 1910. Serial No. 546,978.

To all whom it may concern:

Be it known that I, HERMANN T. WERBER, a citizen of the United States, and a resident of the borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Reversing-Turbines, of which the following is a specification.

This invention relates to reversing turbines. Among its objects is the production of such an apparatus in which the blade wheel is constructed to interlock with the housing thereof, to reduce the leakage of the propelling fluid between said elements to a minimum. Adjustable inlet valves are provided to direct the propelling fluid to strike the blades of the blade wheel at the requisite angles to efficiently rotate the same.

The invention is further characterized by means for impinging the propelling fluid against one of the surfaces of each of the blades of the blade wheel, and after turning the wheel a portion of a revolution, conducting the steam on the reverse side of reverse blades of the wheel, to thereby use the expansive effect of the steam to turn the wheel in the same direction before being discharged by means of the exhaust appurtenances of the invention.

Figure 1 represents a side view of the invention, Fig. 2 shows a top plan view partly broken away of Fig. 1, Fig. 3 is a partial section of Fig. 2 on the line 3, 3 and a partial side view of the blade wheel of the invention, Fig. 4 shows a partial enlarged section of Fig. 3 on the line 4, 4, Fig. 5 represents a section of Fig. 1 on the line 5, 5, Fig. 6 is a top plan view of the blade wheel of the invention, Fig. 7 represents a top plan view of the lower half of the housing of the invention with its piping and Figs. 8 and 9 show enlarged fragmentary portions of the invention.

The housing of the turbine is represented to comprise four portions designated by the numerals 20, 21, 22 and 23 which are bolted together as shown. The portions 20 and 21 I will collectively indicate by the letter R and consider them the right hand side of the housing, while the portions 22 and 23 I will collectively indicate by the letter L and consider the left hand side of said housing.

An annular inlet port 26 is formed in the right hand side R of the housing and an annular inlet port 27 is formed in the left hand side L of the housing. Inlet branch

piping 28 leads to the port 26, and inlet branch piping 29 leads to the port 27. Piping 30 with the three-way cock 31 connects the branch piping 28 and 29, while the feed pipe 32 leads to said three-way cock.

Openings with the shoulders 33 extend from the port 26 to within the housing, and openings with the shoulders 34 extend from the port 27 to within the casing. Adjustable valve plugs 40 with the inclined ports 41 and spindles 42 are located in the openings having the shoulders 33, and similar adjustable valve plugs 43 with the inclined ports 44 and spindles 45 are located in the openings having the shoulders 34. The spindles 42 pass through the port 26 and are clamped in place by means of the nuts 46 that bear on the outer face of the right hand side R of the housing, while the spindles 45 pass through the port 27 and are clamped in place by means of the nuts 47 that bear on the outer face of the opposite side of the housing. One half 50 of an annular exhaust port is formed with right hand side of the housing and the other half 51 thereof is formed with the left hand side of the housing.

An exhaust conduit 52 is formed with both the halves 50 and 51 of the exhaust port and has connected thereto the exhaust pipe 53.

A cylindrical surface 60 is formed within the housing and has extending from each side thereof the recess 61. From each recess 61 extends an annular shoulder 62, and from the latter extends the annular shoulder 63, while an annular shoulder 64 extends from each end of the shoulders 63. There are thus formed stepped sides and ends for the inner surfaces of the housing. Exhaust ports 67 extend between the annular ports 50 and 51 and the exhaust cavities 68 of the housing, and exhaust ports 69 extend between the annular ports 50 and 51, and the exhaust cavities 70 of the housing. The ports 67 and 69 take opposite directions and the exhaust cavity of one is on one side of its port and the exhaust cavity of the other is on the other side of its port. The ports 67 have between them the ports 69 so that neither are adjacent to each other.

The right hand side R of the housing has formed therewith a bearing with the sleeve 71 and gland 72 to form a stuffing box, while the left hand side of the housing has formed therewith a bearing with the sleeve 73 and cap 74.

The blade wheel is shown to comprise the hub 75 with the shoulder 76, that register with the shoulders 64 of the housing, and the shoulders 77 and 78 that register respectively with the shoulders 63 and 62 of the housing. Projecting annular flanges 79 and 80 extend beyond the circumferential body of the blade wheel and register with the recesses 61. The said shoulders, flanges and recesses form stepped sides and ends for the blade wheel and provide means that reduce leakage between the wheel and the housing. The hub of the blade wheel has formed therewith the curved circumferential, tapering surfaces 84 and 85 which meet at the apex 86 between which and the outer circumferential portions 87 of the blade wheel are located the curved blades 90 and 91. The blades 90 extend from the apex 86 toward the right hand side of the housing, while the blades 91 extend from said apex to the left hand side of said housing. The blades 90 and 91 have opposite convexed surfaces with respect to each other and are inclined to a plane that is perpendicular to the axial center of the wheel. Inlet openings 89 are formed in one side of the blade wheel for the blades 90 and inlet openings 92 are formed in the other sides of the wheel for the blades 91. Outlet openings 93 and 94 are formed in the circumferential surface of the wheel for said blades 90 and 91.

The hub 75 of the blade wheel is secured to a shaft 95 supported on the bearing 73 of the left hand side of the housing, and in the bearing 71 of the right hand side R of said housing.

To use the reversing turbine, steam or other fluid enters by either the branch piping 28 or 29, depending upon the location of the valve plug in the three way-cock 31, and which determines the direction of the wheel. If the fluid or steam enters the piping 29 it is first led to the annular port 27 and from thence passes through the ports 44 of the valve plugs 43, and impinges at angles of 45 degrees indicated by the arrows A (see Fig. 9) against the concave curved surface of each of the blades 91 that are in the paths of the propelling fluid as it leaves said ports to rotate the blade wheel in the direction of the arrow B. After the fluid impinges on the blades 91 of the blade wheel, a partial turn thereof takes place and the high pressure steam then enters the exhaust cavities 68 that are adjacent and accompany the ports 44. From the latter the steam is led against the convex faces of the blades 90 when they are opposite each of the said cavities 68 as indicated by the arrows C, making effective the expansion of the steam on the convex surfaces of the said blades 90. Now when the wheel continues to rotate in the direction of the arrow B the steam is forced through the ports 67, and finally

enters the annular exhaust port with the halves 50 and 51. It will be noted that to rotate the blade wheel in the direction of the arrow D (Fig. 8) that the plug valves 40 which are in the right hand side R of the housing are located to direct the jets of live steam so as to impinge against the concave surfaces of the blades 90 at angle of about 45 degrees in vertical intersecting planes of the blades as shown at E. After the jets of steam impinge against the concave surfaces of the blades 90, the steam enters similarly as for the other side of the wheel, the exhaust cavities 70 from which it is led against the concave sides of the blades 91 as indicated by the arrows F. The blade wheel will now rotate in the direction of the arrow D, the steam next entering the exhaust cavities 70 and from thence flows through the ports 69 from which latter as before the steam finds its way to the exhaust ports 50 and 51. It will be also noted that the horizontal elements of the surfaces of the blades of the blade wheel are inclined to the sides of the wheel, as indicated in Fig. 6, and that by the directions given to the live jets of steam by means of the ports 41 and 44, the said jets strike the inclined blades so as to obtain efficient impulses against the surfaces of said blades for the rotation of the wheel. It will be noted that the valve plugs can be adjusted in vertical planes to vary the angles of the directions of the flow of the jets of live steam in their vertical planes of action. There is produced with the invention for each direction of rotation of the wheel impacts of jets of live steam against the concave surfaces of the blades of the wheel and also the effect of said jets of steam during the expansion thereof against the convex surfaces of the accompanying reversed blades of the wheel. The combined effect of a live steam jet and its expanded volume tends to drive the blade wheel in the same direction. The combination produces high pressure acting surfaces on one side of each blade and low pressure acting surfaces on the other side of said blade. In this case the concave surfaces being the high pressure sides and the convex surfaces being the low pressure sides.

Having described my invention what I desire to secure by Letters Patent and claim is:

1. In a turbine the combination of a blade wheel, two sets of blades formed with the wheel, one set reversed to the other, means to impinge a fluid against the surfaces of one set of blades and means to direct the said fluid to impinge against the reversed sides of the other set of blades.

2. In a turbine the combination of a blade wheel, two sets of blades formed with said wheel, one set reversed to the other, means to impinge a fluid on one side of

either set of blades and means to impinge the same fluid during its expansion on the reversed side of the other set of blades after having impinged upon the first set.

5 3. In a reversing turbine the combination of a housing, a blade wheel journaled therein, two sets of blades formed with the wheel, one of which is reversed to the other, an annular inlet port formed with the right
10 hand side of the housing and an annular inlet port formed with the left hand side of the housing, openings leading from said ports to within the housing, adjustable valve plugs with ports located in said openings to conduct a propelling fluid from said
15 annular ports to their accompanying set of blades and means to conduct the fluid after having impinged on said set of blades to the reversed sides of the other set of blades and
20 an exhaust port connected with the housing.

4. In a reversing turbine the combination of a blade wheel, stepped sides formed with said wheel, two sets of blades one reversed
25 to the other for the wheel, a housing for the wheel and shoulders formed in the housing to register with the stepped sides of the wheel, an annular inlet port formed in the housing, means to conduct a fluid from the
30 inlet ports to either set of the blades of the wheel, means to direct the fluid against the reversed sides of the second set of blades after having impinged on the first set, and an exhaust port in the housing.

35 5. In a reversing turbine the combination of a blade wheel, two sets of blades formed with the wheel, one reversed to the other, stepped sides formed with the said wheel, annular flanges extending from the circumferential surface of the wheel, a housing for the wheel having recesses that register with said flanges, and shoulders that register with the stepped sides of the wheel, a plurality of inlet ports formed in the housing
40 on each side of the wheel, means to conduct a fluid for either set of inlet ports to one set of blades, and means to impinge the fluid against the reversed sides of the second set of blades, after having impinged on the
50 first set, and exhaust appurtenances connected up with the turbine.

6. In a reversing turbine the combination of a blade wheel, a hub for said wheel, curved circumferential tapering surfaces
55 formed with said hub extending on the opposite sides of an apex of said surfaces, blades extending from said surfaces on opposite sides of the apex, the blades on one side of the apex concaved in opposite directions with respect to the blades on the other side of the apex, an annular inlet port in the housing on the opposite sides of the

blade wheel, adjustable valve plugs interposed between said inlet ports and the sides of the blade wheel, an annular exhaust port
65 adjacent to the circumferential surface of the wheel and an exhaust conduit extending from the said annular exhaust port.

7. In a reversing turbine the combination of a blade wheel, stepped sides for the
70 wheel, flanges extending from the circumferential surface of the wheel, blades extending from each side of the wheel to the central and circumferential portions thereof, inlet openings between the blades on
75 each side of the wheel and outlet openings between said blades at the circumferential portions of the wheel, a housing inclosing and registering with the blade wheel, means to lead a fluid against the blades on either
80 side of the wheel, and means to discharge said fluid after acting on said blades.

8. In a reversing turbine the combination of a housing, a blade wheel journaled therein, blades on the opposite sides of a plane
85 passing through the wheel and which is perpendicular to the axial center thereof, the blades on one side of said plane reversed in direction to the blades on the other side thereof, means to impinge steam against the
90 surfaces of the blades located on one side of said plane and means to next conduct said steam expansively against the blades on the other side of the said plane and on the reversed sides of the latter blades.

9. In a reversing turbine the combination of a housing, a blade wheel journaled therein, blades on one side of said wheel and reverse blades on the other side thereof, means to direct live steam against the
100 blades on either side of the wheel and means to expansively direct the steam against the reverse blades.

10. In a reversing turbine the combination of a housing, a blade wheel journaled in the housing, blades on one side of the wheel and reverse blades on the other side of the wheel, exhaust cavities in the circumferential surface of the housing adjacent to the outer edges of the blades, means to lead jets
110 of steam against one side of either set of blades, said steam entering said exhaust cavities after impinging on the blades, the exhaust cavities conducting the steam expansively on the reverse sides of a number
115 of the other set of blades.

Signed at the borough of Manhattan in the county of New York and State of New York this 23d day of February A. D. 1910.

HERMANN T. WERBER.

Witnesses:

A. A. DE BONNEVILLE,
ARTHUR MARION.