R. C. FROHLICH.

TURBINE.

APPLICATION FILED AUG. 2, 1909.

957,944. **Patented May 17, 1910.**

FIG. 1.

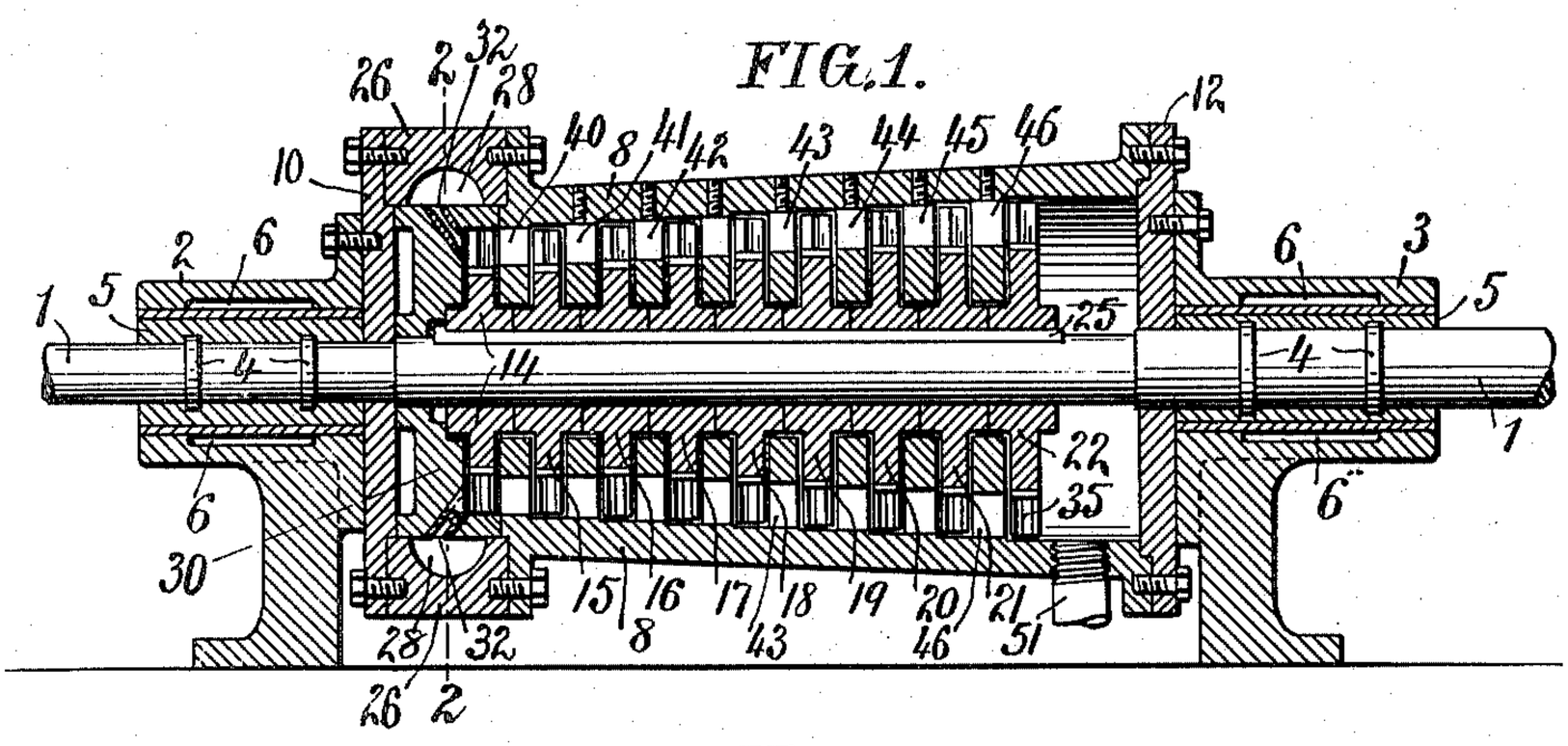


FIG. 2.

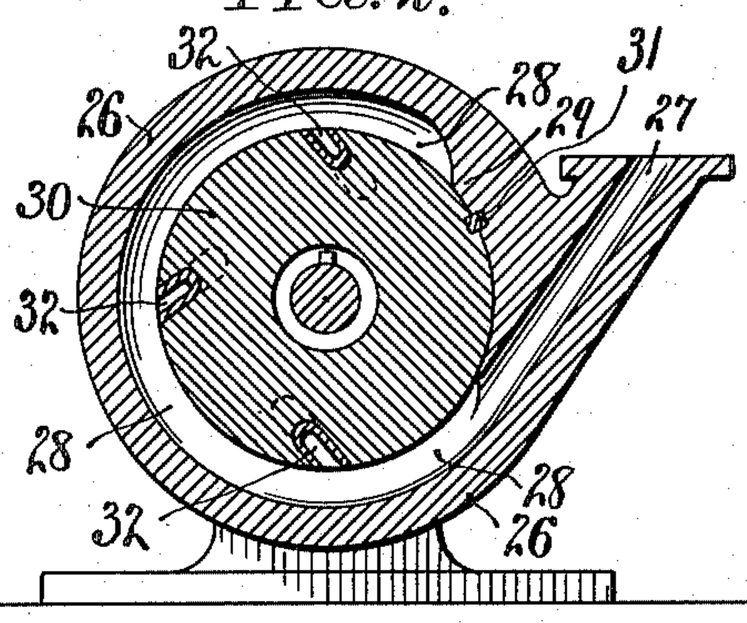


FIG. 3.

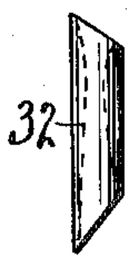


FIG. 4.

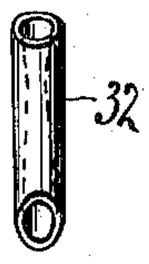


FIG. 8.

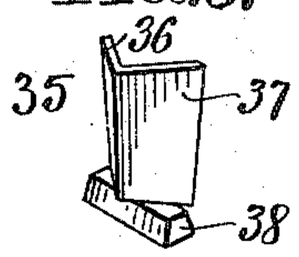


FIG. 5.

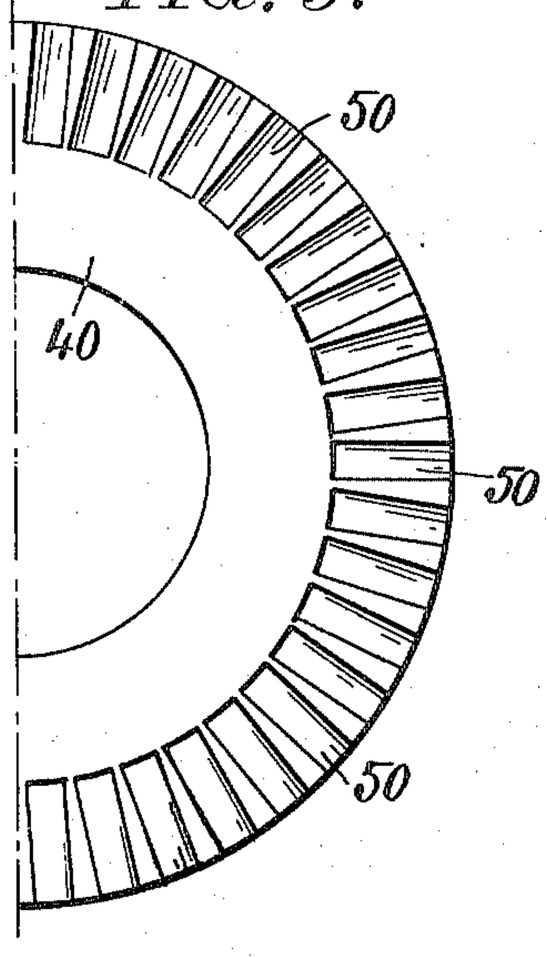


FIG. 6.

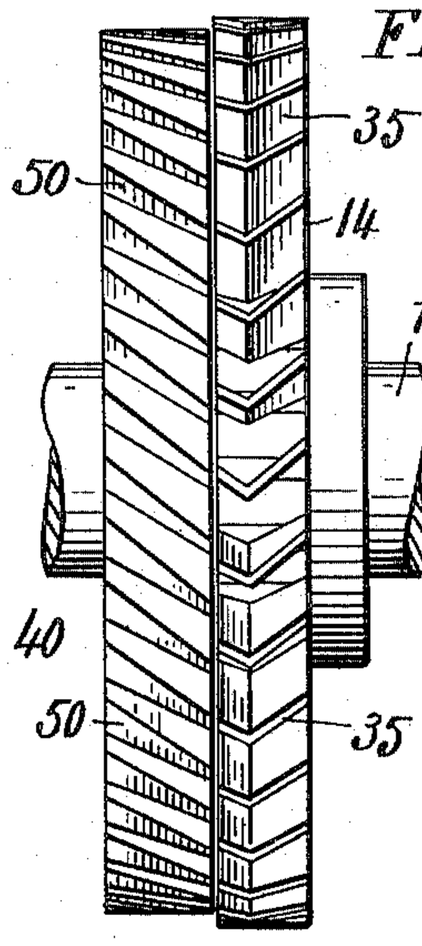
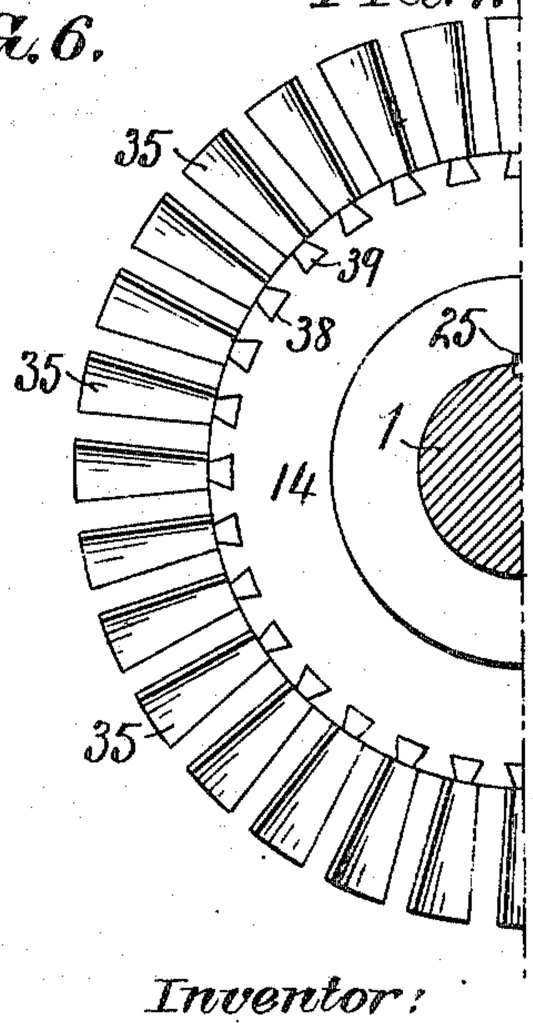


FIG. 7.



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UNITED STATES PATENT OFFICE.

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TURBINE.

957,944. Specification of Letters Patent. Patented May 17, 1910.

Application filed August 2, 1909. Serial No. 510,837.

To all whom it may concern:

Be it known that I, RICHARD C. FROHLICH, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Rotary Engine or Turbine, of which the following is a specification.

My invention relates to improvements in a rotary engine or turbine and particularly relates to that type known as a horizontal axial flow turbine.

The object of my invention is to construct a turbine in which the motive fluid is admitted at one end of the cylinder of the turbine and distributed to a plurality of driving wheels in such a manner that the motive fluid is utilized to its fullest extent in the rotation of the said driving wheels.

A further object of my invention is to provide a suitable receiving-chest into which the motive fluid is first admitted.

A further object of my invention is to provide suitable means for directing the motive fluid from the receiving-chest to the driving wheels.

A further object of my invention is in the improved construction of the distributers and in the construction of the blades upon the driving wheels.

These together with various other novel features of construction and organization of the several parts constitute my invention.

In the accompanying drawings: Figure 1 is a central vertical section through my improved turbine; Fig. 2 is a transverse section taken on line 2—2 Fig. 1, showing the receiving-chest and receiving-chest-distributer; Figs. 3 and 4 are detail views in elevation of the nozzle used in the receiving-chest-distributer; Fig. 5 is a side elevation of one of the driving wheel distributers, drawn on a larger scale; Fig. 6 is a face view of the distributer as shown in Fig. 5, and showing a face view of one of the driving wheels; Fig. 7 is a face view of the driving wheel as shown in Fig. 6; and, Fig. 8 is a perspective view of one of the blades of the driving wheel detached.

Referring to the drawings, in which like references indicate like parts, 1 represents the shaft of a turbine rotatably mounted in suitable bearings 2 and 3. Said shaft 1 is provided with annular collars 4 which fit into recesses formed in sleeves 5, secured in the said bearings 2 and 3, which hold the shaft against any longitudinal thrust and said bearings are provided with annular spaces 6 for cooling the bearings by the circulation of water. Between the said bearings 2 and 3 is located the cylinder 8 having heads 10 and 12 which are rigidly secured to flanges formed upon said bearings 2 and 3. The said shaft 1 extends through the center of said cylinder 8 and is provided with a plurality of driving wheels 14 to 22 which are secured to said shaft by a key 25.

A receiving-chest 26 is located at one end of the cylinder 8. The said receiving-chest may be formed in the cylinder but the construction shown in the drawing is preferable, in which the said receiving-chest is secured between the end of the cylinder 8 and the head 10. The receiving-chest 26 is provided with an inlet port 27, shown in Fig. 2, which communicates with the chamber or recess 28, formed around the greater portion of the inner surface of the receiving-chest. Said recess 28 terminates before it reaches the inlet port 27. The portion 29 of the receiving-chest forms a stop which closes the end of the recess 28.

A circular receiving-chest-distributer 30 is tightly fitted into the receiving-chest 26 and is rigidly held therein by a key 31. The receiving-chest-distributer 30 completes the chamber formed by the recess 28 in said receiving-chest 26, into which chamber the motive fluid is admitted through the said inlet port 27.

The receiving-chest-distributer 30 is provided with apertures into which are fitted nozzles 32, shown detached in Figs. 3 and 4, which said nozzles are so positioned in said receiving-chest-distributer that the motive fluid will be directed into the cylinder and impinge against the buckets 35 of the driving wheel 14, secured to the shaft. The said nozzles are constructed, as shown in dotted lines, Figs. 3 and 4, with the conical bore thereof tapering from the ends toward the central part of said nozzle, which construction has been found to be the most efficient means for conveying the motive fluid to the driving wheels. The outer surface of the nozzle is made slightly conical as is also the apertures in the receiving-chest-distributer,

which permits the nozzle to be driven tightly into its proper position and also prevents the possibility of the nozzle being forced through the said aperture and striking the buckets of the driving wheel. The ends of said nozzles are beveled so that they will be flush with the surfaces of the receiving-chest-distributers.

The driving wheels are provided with buckets 35, clearly shown in Fig. 8. Said buckets are constructed of a plate which is struck up to form blades 36 and 37, the former one of which is smaller than the other and said blades are set at approximately right-angles to each other. The plate forming the blades 36 and 37 is secured to a base 38 having the sides thereof beveled and said base fits into a dovetail groove 39 formed across the face of the driving wheel. The said base may be riveted or secured to the driving wheel in any suitable manner.

Distributers 40 to 46, shown drawn on a larger scale in Figs. 5 and 6, are placed between the driving wheels. Said distributers are rigidly secured in the cylinder 8 and each distributer is provided with a central opening which permits the distributers to encircle the hubs of the driving wheels, which allows the latter to turn freely while the distributers remain stationary.

The distributers are provided with grooves or passageways 50 formed in the periphery of the same. Said grooves extend to a depth equal to the height of the buckets upon the driving wheels, said grooves are larger at the inlet side and narrower at the outlet side of said distributer and said grooves are set at an angle to the axis of said distributer so that the motive fluid will be collected from one driving wheel and directed to the next adjoining driving wheel at such an angle that the greatest force of the motive fluid will be exerted upon the driving wheels and most effectively rotate the latter.

The cylinder is provided with an exhaust outlet pipe 51 and said cylinder is larger in diameter at the exhaust end and the distributers and driving wheels gradually increase in diameter so that the motive fluid will be permitted to expand.

The operation of my invention is as follows: Steam or any other suitable motive fluid is admitted under pressure, through the inlet port to the receiving-chest, from which it is directed by means of a plurality of nozzles conveniently spaced around the circumference of the receiving-chest-distributer. Said nozzles direct the motive fluid against the blades of a driving wheel 14 located adjacent to the said receiving-chest-distributer, the motive fluid after rotating the driving wheel 14 and the shaft to which the latter is keyed, passes through the grooves or passageways formed in the distributer 40 located between the driving wheels 14 and 15. Said distributer 40 directs the motive fluid to the second driving wheel 41 against the buckets of which the force of the motive fluid is exerted. The motive fluid thus acts upon the several driving wheels between each of which is placed a stationary distributer to collect the motive fluid and direct it against the blades of the next adjoining driving wheel. The motive fluid thus acts upon all of the driving wheels as it passes from the receiving-chest to the outlet end of the cylinder.

It will be understood that I do not limit my invention to the exact construction shown, as various changes may be made in the number of the distributers and the bucket wheels and in the arrangement of the several parts without departing from my invention.

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

1. In a turbine, the combination of a cylinder, a shaft, a wheel secured on said shaft, a receiving-chest formed in said cylinder with an annular groove formed upon the inner surface of the same and having a portion thereof forming a stop to close the end of said recess, a receiving-chest-distributer fitted within said receiving-chest and having a plurality of apertures formed therein communicating with said recess formed in said receiving-chest and directed toward said wheel.

2. In a turbine, the combination of a cylinder, a shaft, a wheel secured on said shaft, a receiving-chest formed at one end of said cylinder with a groove formed upon the inner surface thereof, said receiving-chest having a portion thereof closing said recess formed therein, a receiving-chest-distributer secured within said receiving-chest, said wheel located adjacent to said receiving-chest-distributer and having blades thereon, and said receiving-chest-distributer having a plurality of apertures formed therein directed toward the said blades upon said wheel.

3. In a turbine, the combination of a cylinder, cylinder heads, a shaft, a wheel, a receiving-chest between said cylinder and one of said heads, said receiving-chest having a groove formed around the inner surface of the same, an inlet port formed in said receiving-chest, a portion of said receiving-chest forming a stop to close the end of said recess, a receiving chest-distributer fitted within said receiving-chest and said receiving-chest-distributer having a plurality of apertures formed therein communicating with said recess and directed toward said wheel.

4. In a turbine having a cylinder, a shaft, a plurality of wheels upon said shaft, blades upon the periphery of said wheels, the com-

bination of distributers secured in said cylinder and placed between said wheels, said distributers having grooves formed in the periphery of the same to direct the fluid from one of said wheels to the next adjoining wheel and the said grooves formed in said distributers being wider at the inlet side and tapering toward the outlet side of said distributers.

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