

R. H. RICE.
TURBINE.

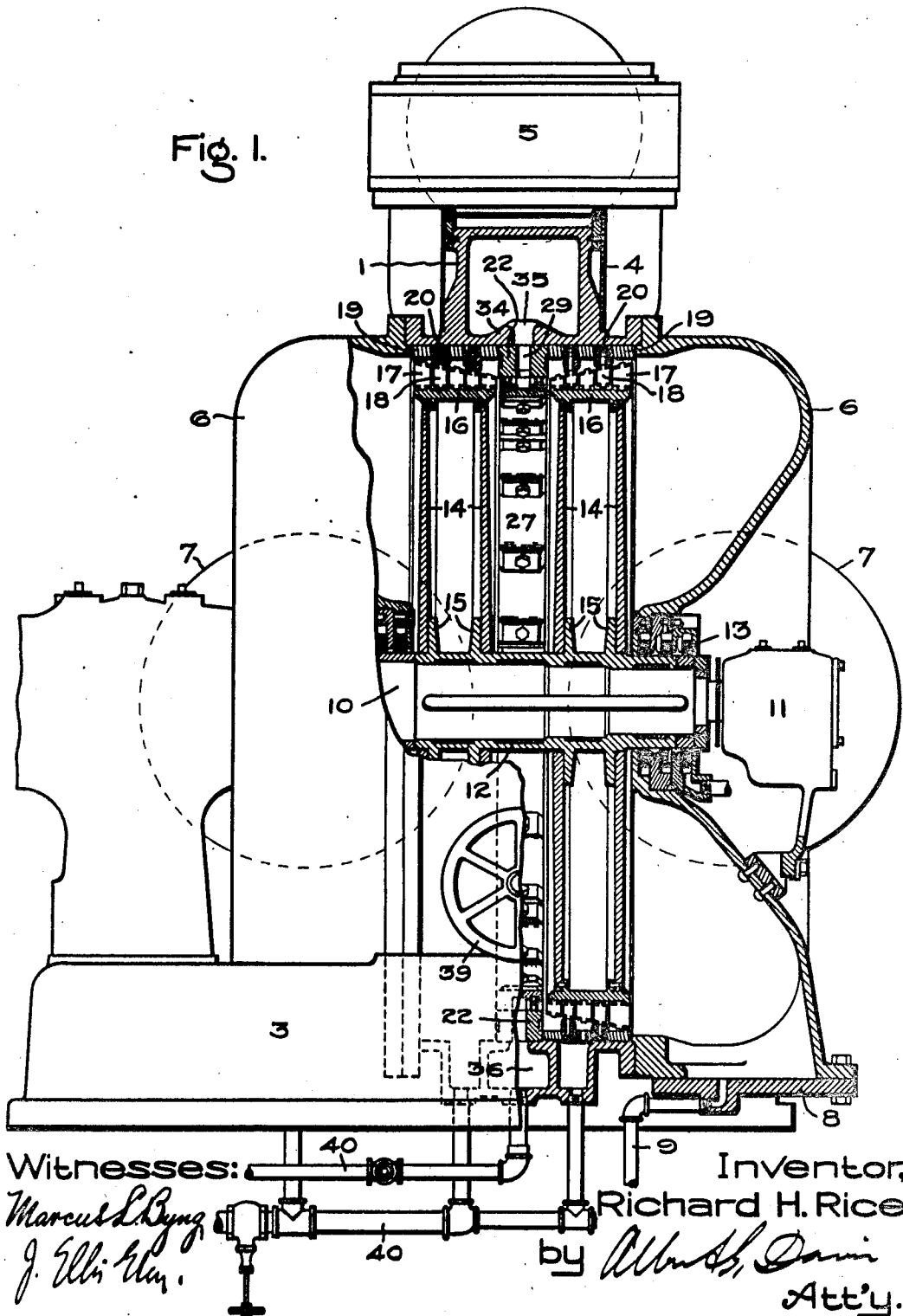
APPLICATION FILED SEPT. 22, 1909.

1,061,688.

Patented May 13, 1913.

3 SHEETS-SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

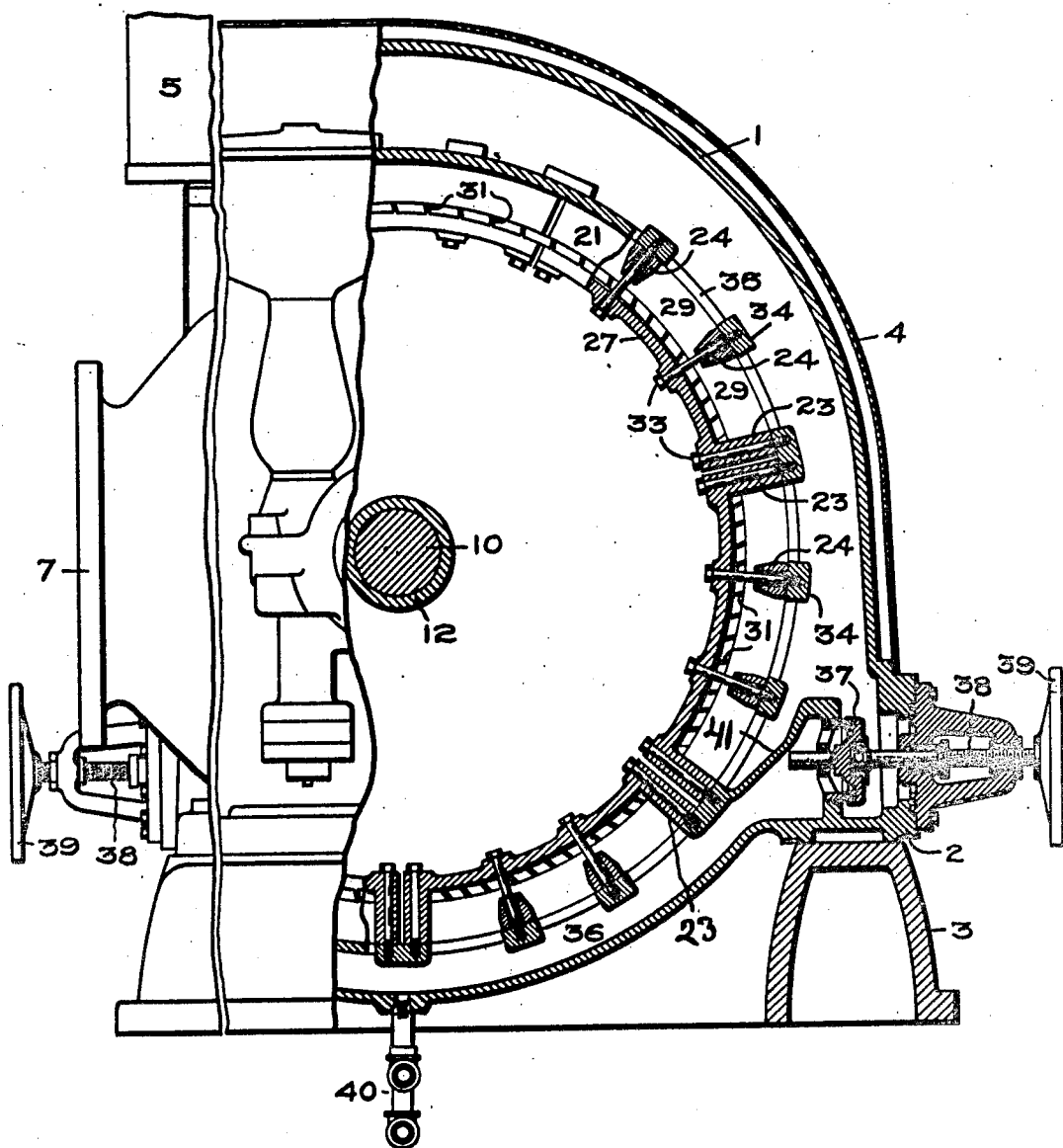


Fig. 2.

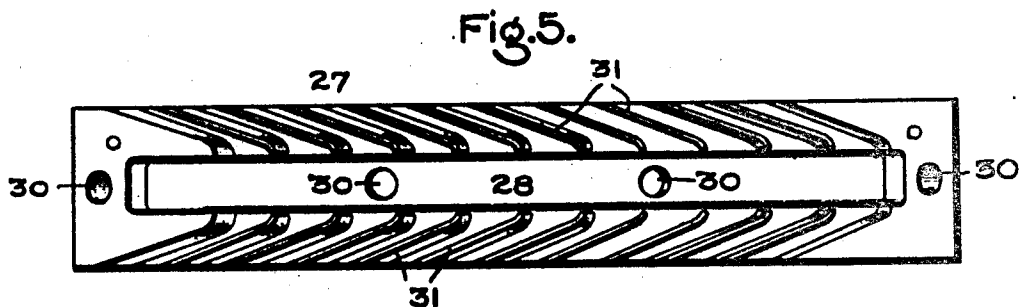
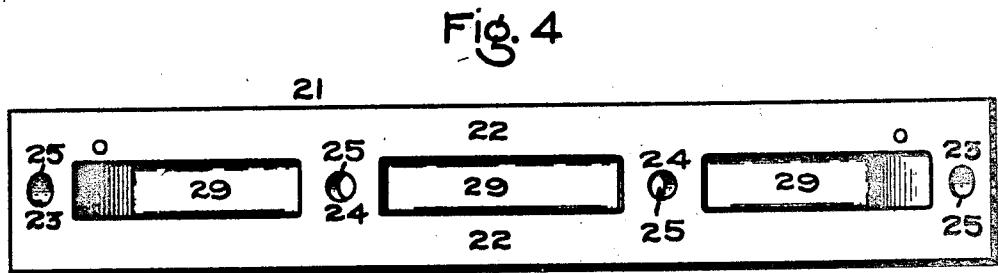
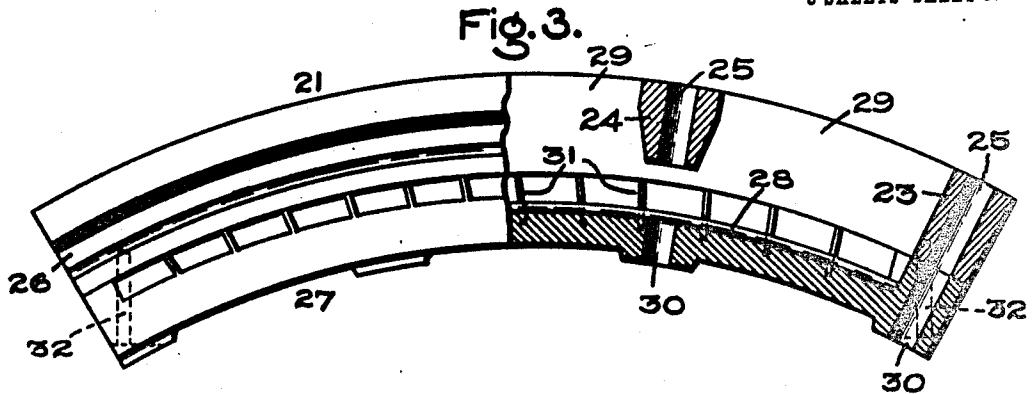
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Patented May 13, 1913.

3 SHEETS—SHEET 3.

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Witnesses:

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 Att'y.

UNITED STATES PATENT OFFICE.

RICHARD H. RICE, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TURBINE.

1,061,688.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed September 22, 1909. Serial No. 518,925.

To all whom it may concern:

Be it known that I, RICHARD H. RICE, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

This invention relates more particularly to that class of elastic fluid turbines which are driven by the exhaust fluid from a high pressure prime mover but is not limited to said class.

The invention will be set forth in the following description and illustrated in the accompanying drawings, as applied to a horizontal turbine, but it is capable of application to vertical turbines as well.

The object sought to be attained is simplicity and facility of manufacture, compactness, even distribution of steam, economy of operation, and a balancing of end thrusts. To this end, there are two bucket wheels with an annular nozzle between them having discharge passages facing in opposite directions. The steam chest is concentric with the nozzle. In making the nozzle, partitions of sheet metal are preferably cast into segments of a ring, so that one edge only is embedded in said segment. The outer surface of this segment or section is then turned true to fit snugly inside of an outer ring segment or section which abuts upon the free edges of the partitions and forms an outer wall for the passages between said partitions. Longitudinal slots through the outer section admit steam to the nozzle passages. The lower segments of the complete nozzle ring can be shut off from the steam chest by two valves located one on either side of the machine.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of a turbine embodying my improvements. Fig. 2 is a section transverse to the shaft and partly broken away. Fig. 3 is a side elevation, partly in section, of a nozzle segment. Fig. 4 is a plan view of the same, and Fig. 5 is a plan view of the inner section of said segment.

The casing 1 of the turbine is a substantially annular hollow casting supported by feet 2 upon a suitable foundation, such as the base 3. It is provided with the usual jacket 4. At some point, preferably the top, is a throttle valve inclosed in a casing 5 and controlling the flow of steam from the exhaust

of a high pressure engine or other source into the hollow casing 1 which thus serves as a steam chest for the turbine. On each side of the casing is placed an annular trough-shaped head 6 which is secured to the casing by a steam-tight joint. Each head has a large outlet 7 at one side, to discharge the exhaust steam which flows through the turbine buckets into said head. At the bottom of each head is an opening, closed by a plate 8, where the water of condensation can collect and be carried off by a drain pipe 9. By removing said plate this opening may be used as an exhaust outlet. A shaft 10 passes horizontally through the machine at the center of the casing and heads, and is journaled at one end in a bearing 11 mounted on one of the heads 6. A sleeve 12 is keyed on the shaft, and the joints between said sleeve and the heads 6 are made fluid tight by multiple packing 13 of any suitable description; such for instance as that shown in the patent to W. L. R. Emmet, No. 818,365. Two bucket wheels are mounted on the sleeve 12, each composed preferably of a pair of parallel disks 14 secured to flanges 15 on the sleeve and to rims 16. The buckets 17, preferably three for each wheel, are mounted on said rims in any approved manner, and cooperate with stationary intermediates 18 whose retaining bolts pass through rings 19 and have outside nuts 20, holding them in place. The rings 19 fit the inside surface of the annular steam chest 1 and are clamped there by the edges of the heads 6. The inner edges of the rings 19 abut against the annular nozzle, which is thus held between the two sets of buckets on the two bucket wheels. This annular nozzle is composed of a plurality of segments of suitable length, and each segment is composed of two concentric superposed sections, Fig. 3. The outer section 21 consists simply of two parallel side bars 22 connected at intervals by integral cross bars. The end cross bars 23 extend the full depth of the side bars, but the intermediate crossbars 24 are not so deep, terminating a little above the inner concave edge of the side bars. All the cross bars contain bolt-holes 25, which are radial to the segment. The outer faces of the side bars may be grooved at 26 for the sake of lightness, if desired. The inner section 27 has on its convex face a longitudinal groove 28 adapted to register with the slots 29

formed by the cross bars of the outer section. This groove terminates near the ends of the section, leaving sufficient stock for the bolt holes 30 registering with the holes 25 at the ends of the section 21.

Between its ends, the side walls of the groove 28 are cut away nearly to its bottom to receive the plurality of partitions 31, formed of sheet metal strips embedded in said section along their lower edges, being preferably cast in place when the section is cast. These partitions extend obliquely from the groove 28 to the side faces of the section, being arranged symmetrically on both sides of the groove, each pair of opposite partitions forming equal angles with said groove. The partitions are parallel, with their inner ends slightly curved to facilitate the entrance of the steam into the passages between them. These passages are inclosed on their upper sides by the concave surfaces of the side bars 22 of the outer section 21, which abut upon the free edges of the partitions when the two sections are fitted together, as shown in Fig. 3. The two sections of each segment are secured together by dowel pins 32 at their ends, and all the segments are secured to the inner surface of the steam chest 1 by radial bolts 33 passing through the holes 25, 30 into ribs 34 extending across the bottom of said chest. Between said ribs there are longitudinal slots 35 registering with the slots 29 in the sections 21, the steam in the chest can thus pass freely through said slots into the grooves 28 and thence laterally through the passages between the partitions 31 to the adjacent buckets, which are in line with said passages. Said buckets preferably increase in radial length from the nozzle to the outside of each wheel, and discharge the steam into the trough-shaped heads 6, whence it flows to the condenser through the discharge outlets 7.

In order to be able to vary to some extent the running speed of the turbine, a portion of the nozzle is divided off, and supplied with steam from an auxiliary steam chest 36, Fig. 2, that is somewhat shorter than the main chest 1. The main and auxiliary steam chests taken together form an annulus. These are separated or divided one from the other by walls 41 which are formed integral with the casing at their sides and outer ends, the inner ends making steam tight joints with the cross bars 23 of adjacent nozzle segments, and also assisting to support said nozzle. At each end of the auxiliary chest is a stop valve 37 mounted on a screwthreaded spindle 38 which passes out through a packed opening in the outer wall of the steam chest 1 and has a hand-wheel 39 by which it can be rotated to open and close said valve. By means of these valves, a portion of the annular nozzle can

be cut out of service when the running speed of the turbine is to be lowered.

Water of condensation collecting at the bottom of the two steam chests can be drained off through the pipes 40.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A turbine having an annular hollow casing, walls that extend from the outer portion of the casing toward the shaft and divide the interior thereof into main and auxiliary steam chests which taken together form an annulus, a valve means in at least one of said walls for controlling the flow of steam between the chests, an annular nozzle that is surrounded by said chests and is fitted steam tight to the inner ends of said dividing walls, inlet and outlet conduits, and a rotor that is acted upon by the steam from the nozzle.

2. A turbine having a hollow casing forming an annular steam chest, means supplying steam to said chest, a detachable nozzle mounted on the chest and forming a wall thereof, said nozzle discharging steam laterally in two directions, walls on the opposite sides of the casing that divide the chest into two parts, said walls making steam tight connections with the casing and nozzle. a rotor having two sets of buckets disposed one on each side of the nozzle and receiving steam therefrom, and a valve means controlling the passage of steam from the main to the auxiliary chest.

3. A turbine having an annular hollow casing forming a steam chest, the interior of said chest having a substantially rectangular cross-section with parallel side walls and being provided with openings in its bottom, an annular nozzle concentric with said steam chest, provided with slots registering with said openings and having passages running laterally in opposite directions, and a wheel on each side of said nozzle having buckets in line with said passages.

4. A turbine having a shaft, a hollow annular casing concentric with said shaft and having a steam chest formed therein, an annular nozzle fitted to the inner surface or bore of the casing and discharging steam received from said chest laterally in both directions, rings fitted to the bore of the casing at each side of the nozzle, a bucket wheel mounted on the shaft at each side of said nozzle, intermediate buckets carried by the rings, and heads inclosing said wheels

which are secured to the casing and hold said rings and nozzle against lateral movement.

5 A turbine having an annular hollow casing forming a main steam chest, means supplying steam to the upper portion of said chest, an annular nozzle mounted on the inner wall of the chest, a portion of said nozzle receiving steam from said chest, an
10 auxiliary steam chest arranged at the opposite or bottom portion of the main chest for supplying steam to the remainder of the nozzle, and valves in the walls of the auxiliary chest for controlling the flow of
15 steam between the two chests.

6. A turbine having a casing forming main and auxiliary steam chests, the two forming an annulus, walls which separate the chests one from the other, valves in the walls controlling the flow of steam from one chest to the other, means operating said valves from the outside of the casing, an annular nozzle having passages discharging laterally, one part of said nozzle receiving steam from the
20 auxiliary chest only, a rotor that has buckets acted upon by the steam from both parts of the nozzle, and exhaust conduit means.

7. A turbine having an annular hollow casing forming a steam chest, an annular
30 nozzle concentric with said chest, an auxiliary steam chest supplying steam to a portion of said nozzle, and a valve at each end of said auxiliary steam chest.

8. A turbine having an annular hollow casing forming a steam chest, and an annular nozzle concentric with said chest and composed of a plurality of segments each comprising two superposed sections.

9. In a turbine, a nozzle segment comprising two superposed sections, the outer one having openings through it, and the inner one having laterally extending passages communicating with said openings and running obliquely to the sides of said segment. 40

10. In a turbine, a nozzle segment comprising two superposed sections, the outer one having openings through it, and the inner one having a groove and cutaway sides, with oblique parallel partitions running from said groove to the side faces of said
45 section. 50

11. In a turbine, a nozzle segment comprising two superposed sections, the outer one having openings through it, and the inner one having a groove and cutaway sides, with oblique parallel partitions running from said groove to the side faces of said section, said partitions being formed of sheet metal strips with their lower edges cast into said section. 55 60

12. In a turbine, a nozzle segment comprising two superposed sections, the outer one having openings through it, and the inner one having a groove and cutaway sides, with oblique parallel partitions running from said groove to the side faces of said section, and making equal angles therewith on both sides, the upper edges of said partitions fitting against the inner face of the outer section. 65 70

In witness whereof, I have hereunto set my hand this 20th day of Sept., 1909.

RICHARD H. RICE

Witnesses:

JOHN A. McMANUS, Jr.,

CHARLES A. BARNARD.