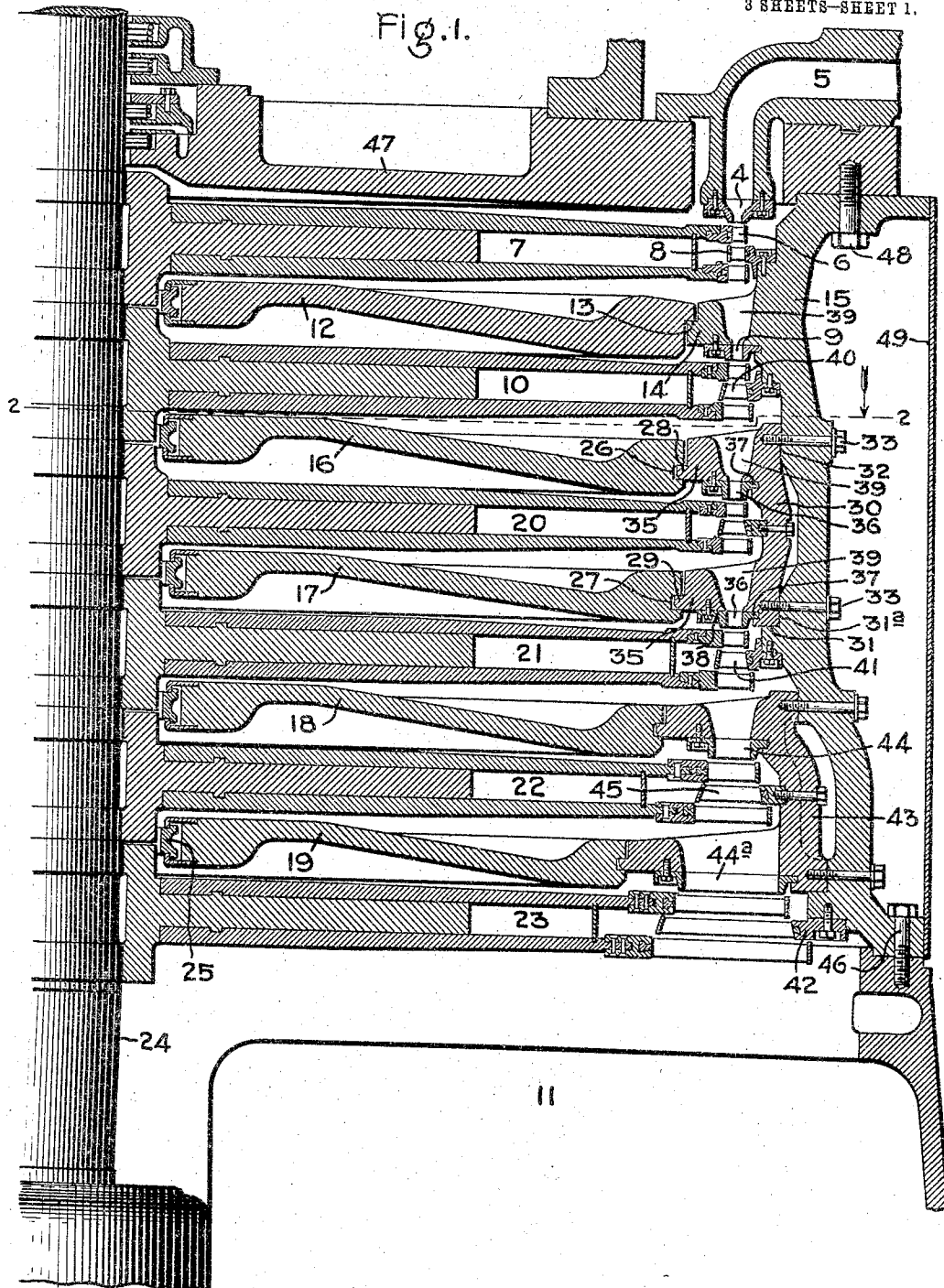


O. JUNGREN.
ELASTIC FLUID TURBINE.
APPLICATION FILED JAN. 27, 1912.

1,063,692.

Patented June 3, 1913.

3 SHEETS-SHEET 1.



Witnesses:
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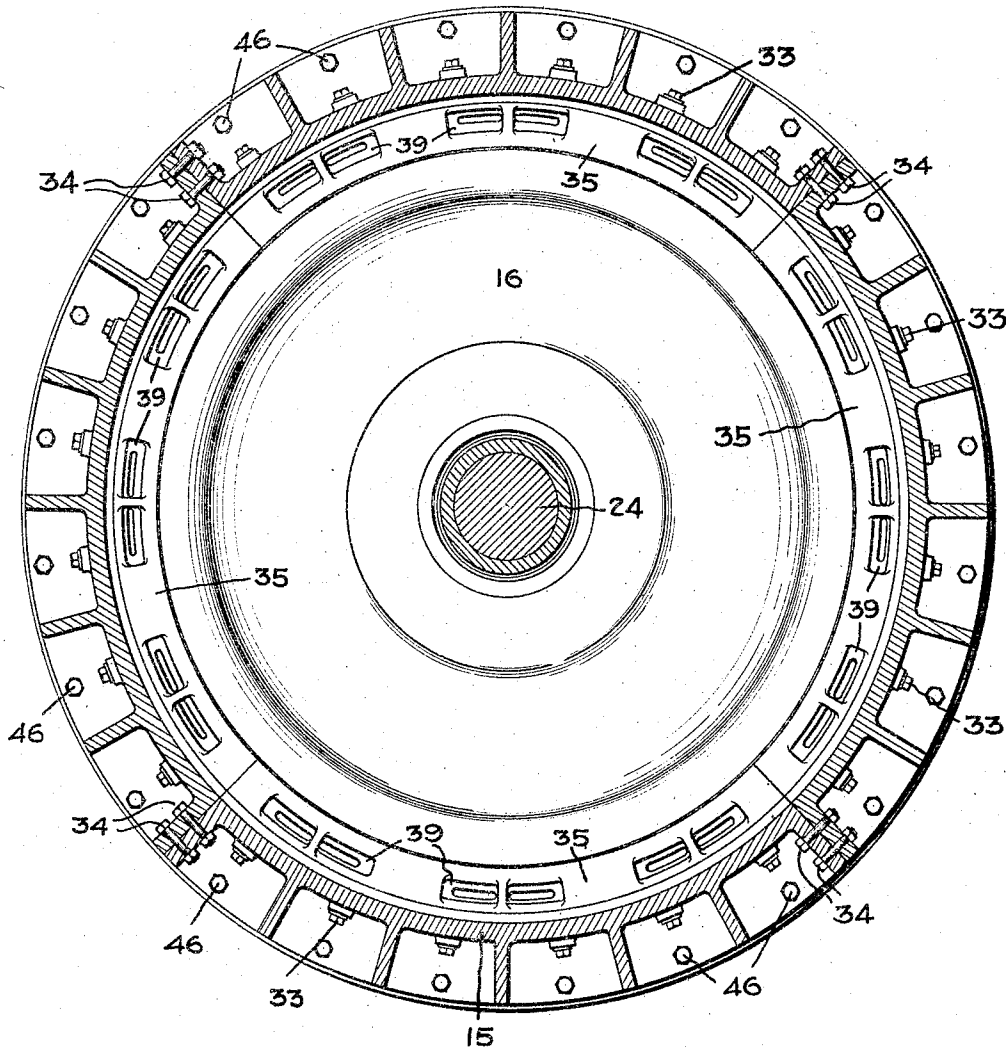
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3 SHEETS—SHEET 2.

Fig. 2.



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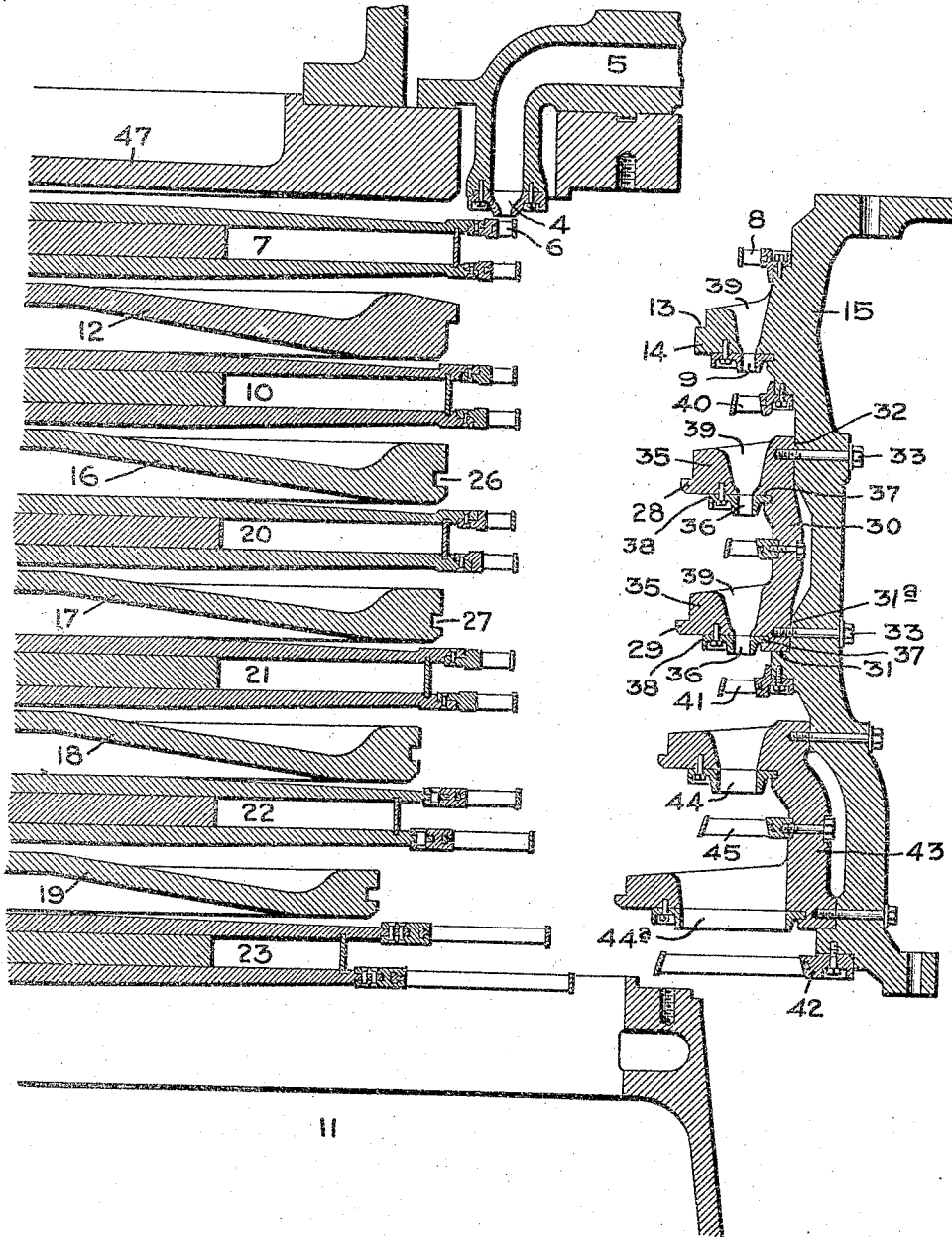
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Fig. 3.



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UNITED STATES PATENT OFFICE.

OSCAR JUNGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELASTIC-FLUID TURBINE.

1,063,692.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed January 27, 1912. Serial No. 673,667.

To all whom it may concern:

Be it known that I, OSCAR JUNGREN, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to multi-stage elastic fluid turbines and the object of the invention is the provision of a turbine of improved construction having a casing divided into segments with the diaphragms, nozzles and intermediate buckets so supported from the casing that one or more of the segments can be removed and the wheel buckets, intermediates and nozzles fully exposed for inspection and repair without dismantling the apparatus as a whole.

In the accompanying drawings illustrating one of the embodiments of my invention, Figure 1 is an axial half section of a portion of a turbine; Fig. 2 is a transverse section on the line 2-2 of Fig. 1; and Fig. 3 is a partial axial section illustrating the manner in which a section of the casing and its attached nozzles and intermediate buckets can be removed to inspect and repair the wheel buckets, nozzles, etc.

Steam or other motive fluid is supplied to the nozzles 4 of the initial stage of the turbine by passages 5 leading from a steam chest (not shown). The quantity of steam so supplied is usually controlled by some well known form of governing mechanism. The nozzles 4 discharge steam at relatively high velocity against the first row of buckets 6 on the wheel 7. Intermediate buckets 8 are arranged between the two rows of wheel buckets. The number of rows of buckets can, however, be varied from the number illustrated. After leaving the first wheel, the steam enters the nozzles 9 which discharge it against the buckets of the second wheel 10. It then flows in a similar manner through the succeeding stages of the turbine to the exhaust 11. The first stage is separated from the second stage by a diaphragm 12 which is supported on a shoulder 13 formed on a ring 14 which projects inwardly from the casing 15. Diaphragms 16, 17, 18 and 19 separate the other stages, the number of stages varying in accordance with the different operating con-

ditions for which the turbines are designed. The wheels 7, 10, 20, 21, 22 and 23 of the different stages are mounted on a shaft 24 which can have its axis disposed horizontally or vertically. For convenience, the turbine will be described as having its shaft vertical. Suitable packings 25 are carried by the inner edges of the diaphragms and serve to prevent leakage from one stage to another.

The outer edges of the diaphragms 16 and 17 are provided with grooves 26 and 27 which receive tongues or rings 28, 29 projecting inwardly from an annular supporting member 30 that rests on a shoulder 31 on the casing 15 and has the upper and lower portions of its periphery fitted to the casing at 31^a and 32. The member 30, which is U-shaped in cross-section, is held in place on the casing by the bolts 33. The casing is made in two or more segments and secured together at the joints by the bolts 34. The casing of the turbine shown in the drawings, by way of illustration, has four segments and the supporting member 30 is divided into the same number of parts with its joints registering with those of the casing. At the top and bottom of said member are inwardly extending annular projections or rings 35 that carry the tongues 28, 29 that support the diaphragms. The number of the rings or projections 35 can be more or less than the number shown if desired. The nozzles 36 are carried by the lower faces of the projections 35 and are made in segments, each segment comprising a group of nozzle passages and the number of nozzle segments being usually greater than the number of segments of the casing 15 and the supporting member 30 with said segments so arranged that some of the joints between them register with the joints of the supporting member and the casing so that each segment of the casing and its attached parts can be removed as a unit. The outer side of the nozzles is provided with flanges 37 that enter grooves in the member 30 and the inner side with flanges 38 that are bolted to the projections 35. Passages 39 formed in said projections lead the steam from the preceding stage to the nozzles. The number of these passages and the arc of the wheel buckets covered or supplied by them increases from the admission toward

the exhaust end of the turbine, although in several of the later stages they may extend over substantially the whole circle. Similarly, the intermediate buckets 40 bolted to the middle portion of the supporting members extend around the full circle of said member in the later stages while in the earlier stages the arc covered by them is smaller. The intermediate buckets 8, 40, 41 and 42 are bolted to shoulders formed on the casing.

A segmental supporting member 43 similar to the member 30 is mounted in the lower part of the casing and supports the diaphragms 18 and 19 together with the nozzles 44 and 44^a and the intermediate buckets 45. The casing is fastened to the base of the turbine by the bolts 46 and the cover or head 47 is attached to the top of the casing by the bolts 48. A sheet-metal lagging 49 is fastened to the upper and lower flanges and the ribs of the casing to give the exterior of the machine a more finished appearance. The space between the lagging and the casing can be filled with non-conducting material if desired to prevent the radiation of heat from the turbine.

Fig. 3 illustrates, in a somewhat diagrammatic manner, how a segment of the casing with its attached parts can be taken out as a unit after the bolts 34, 46 and 48 have been unscrewed. The steam chest and its attached nozzles 4 can also be removed if desired by taking out the bolts which secure the chest to the head 47. One or more casing segments can be removed at the same time so long as a sufficient number is left in position to support the diaphragms and the head. From said figure, it is apparent that the buckets and nozzles are fully exposed and made readily accessible for inspection, changes and repairs. If it is only desired to examine or replace the wheel buckets, one segment of the casing will be removed and the wheels turned to bring all the buckets successively into the opening. If the intermediate buckets and nozzles are to be looked after, then one or two segments of the casing can be removed and replaced after inspection before taking out others so that the diaphragms and the head will always be properly supported. Thus the turbine can be readily inspected and repaired without dismantling the wheels, shaft and the generator that is usually carried by the upper end of the shaft. This facility of inspection and repair is a great advantage particularly in the case of large machines with massive parts and results in a saving of time with improved service.

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. In a turbine, the combination of wheels having buckets on their peripheries, diaphragms arranged between the wheels, the diameter of the diaphragms being less than the diameter of the adjacent bucket bases, a casing within which the wheels and diaphragms are located, said casing being divided into segments and having an inwardly extending shoulder, an inner cylindrical supporting member that rests on said shoulder and in turn engages the periphery of the diaphragms and supports them, and intermediate buckets cooperating with a wheel that are carried by said member.

2. In a turbine, the combination of bucket wheels, a diaphragm arranged between adjacent wheels, a casing within which the wheels and diaphragm are located, said casing being divided into segments and provided with an internal shoulder, a segmental cylindrical member that rests against the shoulder and engages the periphery of the diaphragm to hold it in position, nozzles carried by said member, and intermediate buckets carried by said member and arranged in segments having joints that register with those in the member, said intermediate buckets extending between rows of wheel buckets.

3. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels, a casing within which the wheels and diaphragms are located, said casing being divided into segments, and a segmental annular member that is mounted on the inner wall of the casing and is provided with a plurality of inwardly extending projections that engage the periphery of the diaphragms and support them.

4. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels and having grooves in their peripheries, a casing within which the wheels and diaphragms are located, said casing being divided into segments, and a segmental annular member that is mounted on the inner wall of the casing and is provided with a plurality of inwardly extending projections having tongues that engage the grooves in the diaphragms and support them.

5. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels, a casing within which the wheels and diaphragms are located, said casing being divided into segments and provided with an internal shoulder, a segmental annular member that rests against the shoulder and is provided with a plurality of inwardly extending projections that engage

the periphery of the diaphragms, and nozzles carried by said projections.

6. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels and having grooves in their peripheries, a casing within which the wheels and diaphragms are located, said casing being divided into segments and provided with an internal shoulder, and a segmental annular member that rests against the shoulder and is provided with a plurality of inwardly extending projections having tongues that engage the grooves in the diaphragms.

7. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels and having grooves in their peripheries, a casing within which the wheels and diaphragms are located, said casing being divided into segments and provided with an internal shoulder, a segmental, annular member that rests against the shoulder and is provided with a plurality of projections that extend inwardly over the wheel buckets and have tongues that engage the grooves in the diaphragms, and nozzles carried by the projections, there being passages in said projections that supply the nozzles.

8. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels, a casing within which the wheels and diaphragms are located, said casing being divided into segments and provided with an internal shoulder, a segmental annular member which rests against the shoulder and is provided with inwardly extending projections adjacent its upper and lower edges that engage the periphery of the two adjoining diaphragms and support them, nozzles carried by the projections, and intermediate buckets secured to the member between said projections.

9. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels, a casing within which the wheels and diaphragms are located, said casing being divided into segments and provided with an internal shoulder, a segmental annular member having one edge resting against the shoulder and also having joints that register with the joints of the casing, bolts that secure the member to the casing, projections that extend inwardly from the member over the wheel buckets and engage the diaphragms to support them, and nozzles carried by the projections, there being

passages in said projections leading to the nozzles.

10. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels, a casing within which the wheels and diaphragms are located, said casing being divided into segments, a segmental annular member arranged within the casing, bolts that secure said member to the casing, projections that extend inwardly from the member over the wheel buckets, there being grooves in the inner surface of the member, one of the walls of which coincides with a face of the projections, segmental nozzles that are attached to said faces and have joints that register with the joints of the casing, flanges on one side of the nozzles that enter the grooves, flanges on the opposite side of the nozzles, and bolts that secure the last named flanges to said faces, there being passages in the projections that lead to the nozzles.

11. In a turbine, the combination of bucket wheels, diaphragms arranged between the wheels, a casing within which the wheels and diaphragms are located, said casing being made in segments, a segmental annular supporting member of U-shaped cross-section mounted in the casing, the projections of which engage the peripheries of a pair of diaphragms and support them, and detachable nozzles carried by the member, there being passages in said member that lead to the nozzles.

12. In a turbine, the combination of a segmental casing having an internal shoulder, a cylindrical member which rests on the shoulder at one end and has a finished face at the other end which engages the inner surface of the casing, said member having inwardly extending shouldered projections, diaphragms engaged by the projections, fluid discharging devices carried by the projections, rows of rotating buckets that receive elastic fluid from said devices, and intermediate buckets which are carried by the member and are located between the projections and cooperate with the rotating buckets.

In witness whereof, I have hereunto set my hand this 25th day of January, 1912.

OSCAR JUNGREN.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.