

O. JUNGREN.

DIAPHRAGM AND NOZZLE CONSTRUCTION FOR TURBINES.

APPLICATION FILED DEC. 18, 1911.

1,061,675.

Patented May 13, 1913.

Fig. 1.

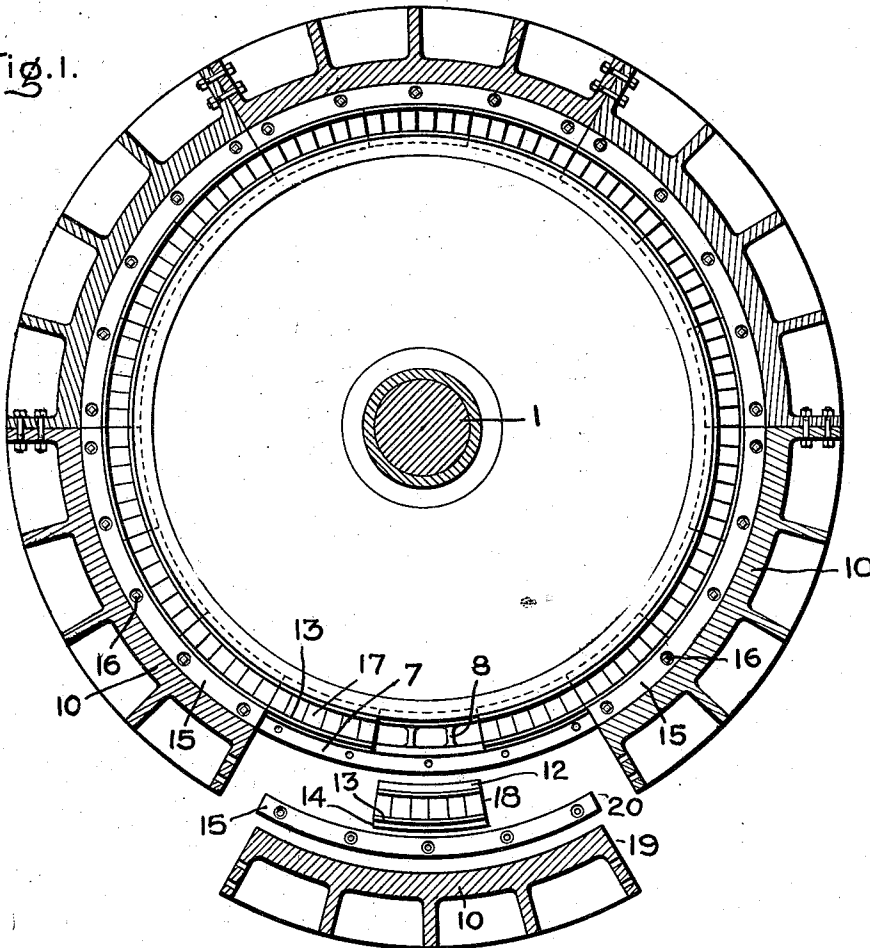
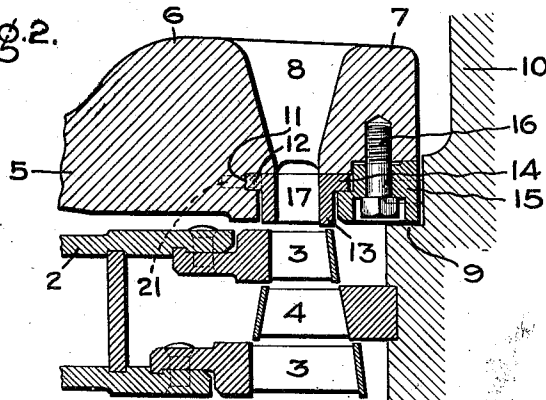


Fig. 2.



Witnesses:

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UNITED STATES PATENT OFFICE

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DIAPHRAGM AND NOZZLE CONSTRUCTION FOR TURBINES.

1,061,675.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed December 18, 1911. Serial No. 666,549.

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 Diaphragm and Nozzle Constructions for Elastic-Fluid Turbines, of which the following is a specification.

At the present time diaphragms for turbines of the multi-stage impulse type are commonly made of a single or an axially divided casting having nozzle passages formed near the periphery. These passages are formed between sheet-steel partitions that are cast-jointed to the body of the diaphragm. This construction, while satisfactory to direct or handle the steam, is open to certain structural disadvantages or objections. In the first place, a construction of this kind is necessarily expensive and if by reason of poor work in the foundry the diaphragm when completed has one or more loose nozzle plates or partitions, it becomes necessary to scrap the whole diaphragm. Further, if at any time it becomes necessary or desirable to change the nozzles in any given intermediate stage or stages, it is necessary to take down the whole machine in order to install a new diaphragm with its nozzles.

My invention, therefore, has for its object to overcome the short-comings or deficiencies in existing structures and to provide a nozzle containing diaphragm of improved construction in which the nozzles are made up in units or groups and detachably secured to the diaphragm by suitable means. By suitably dividing the turbine casing in axial planes and properly positioning the diaphragm within the casing so that the groups of nozzles register with the casing segments, said groups of nozzles can be removed and others substituted by removing one casing segment at a time and this without disturbing the machine as a whole. In addition, the buckets on the wheel adjacent the nozzles are rendered accessible which was not possible with the old construction.

My invention is especially adapted for very large vertical shaft machines where the parts of necessity must be very massive as it has its greatest utility in this con-

nection but it is not necessarily limited to this application.

In the accompanying drawing which illustrates one of the embodiments of my invention, Figure 1 is a cross-sectional view of a vertical shaft turbine looking upward, and Fig. 2 is a partial axial section showing the means employed to secure the nozzles in place.

1 indicates the main shaft of the turbine and mounted thereon is a wheel 2. In the present instance this wheel comprises two parallel disks each of which carries a row of vanes or buckets 3, against which the steam from the nozzles impinges. Between each two rows of wheel buckets is located a row of intermediate guide vanes or buckets 4, which receive steam from one set of wheel buckets, and after changing its direction, discharge the same against the adjacent row of buckets. These guide buckets are carried by the wheel casing.

The diaphragm 5 is provided with a thickened peripheral portion 6 and a supporting outer portion 7, the two being united by heavy radially extending ribs of sufficient strength to withstand the strains on the diaphragm. The outer ring 7 is supported by the shoulder 9 on the inside of the casing 10, and hence the weight of the diaphragm and the pressure to which it is subjected must be sustained by the ribs 8. The under side of the diaphragm is provided with an annular groove 11 to receive an internal annular shoulder 12 formed on the nozzle 13. The nozzle is also provided with an annular peripheral shoulder 14 that engages and is supported by the shouldered securing ring 15. The ring 15 is secured to the outer portion 7 of the diaphragm by vertically extending bolts 16. The ring rests on the casing shoulder 9 and the arrangement is such that the bolts 16 cannot work loose and drop into the interior of the casing because their heads will strike the shoulder 9.

The nozzle proper comprises inner and outer annular members between which are located the partitions 17, the latter being cast-jointed to said members. This arrangement has the advantage that it is possible to make a nozzle out of any desired material best suited for the purpose, while the diaphragm can be made out of steel or

other metal. The upper surface of the nozzle is finished as is also the cooperating under surface of the diaphragm. The inner and outer members only engage the diaphragm and the ring 15 at the shoulders 11 and 14 so as to reduce the necessary amount of machine work.

My invention has thus far been described as though the nozzle was made in a single piece. I will now describe how the parts are arranged so that the nozzles can be removed and replaced without taking down the whole machine. To this end the casing 10 is divided into segmental sections, the planes of division being axial. In the present instance the casing is divided into six segments which are bolted to each other and to the base and top of the machine. The nozzles or nozzle passages are arranged in groups and the joints between the ends of the inner and outer annular supporting members are located in axial planes, so that one or more of the groups such as 18, can be removed by moving it outwardly from the machine after the casing segment 19 has been removed. The securing ring 15 is also made in segments, such as 20 for example, and the length of each of these segments covers the same arc as is covered by a casing segment and the joints between the parts of the ring and between the parts of the casing register. In the present embodiment of the invention, three groups of nozzles 18 are provided for each casing segment and hence for each ring segment 20. In order to insure the assembling of the groups of nozzles in the proper angular position, pins 21 are provided as shown in dotted lines of Fig. 2. I may provide one of these pins for each group of nozzles or a less number as desired.

Assuming that the machine is assembled and that it is desired to get at or remove one or more of the nozzle groups, a casing segment, such as 19, is unbolted and moved in a radial direction away from the turbine. The bolts 16 are then unscrewed and a ring segment such as 20 removed. This permits the removal of one or more of the groups such as 18 as is desired. By removing the group of nozzles access is had to the upper row of wheel buckets, and this without disturbing the remainder of the machine or the alinement. By turning the bucket wheel by hand, the buckets will be successively brought within the field of observation, and at the same time sufficient space is provided to permit the insertion of a tool for working on the buckets if it be found necessary or desirable.

The feature of removing the nozzles without dismounting the machine and the feature of getting access to the first row of wheel buckets in each stage is of immense practical advantage, especially in stations

where the load conditions are such that every machine ought to be in operation every day, and even in those stations having an extra turbine, it is very undesirable to keep a machine out of operating condition for any considerable period of time owing to the fact that an accident might occur which would injure one or more of the other machines in service, thereby dangerously overloading the remainder.

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 diaphragm for a turbine comprising a body portion and a peripheral portion connected thereto, a detachable nozzle comprising inner and outer members with partitions between forming passages, and a clamping ring separate from the nozzle for securing it to the diaphragm.

2. A diaphragm for a turbine comprising a cast metal body portion and a peripheral portion between which the elastic fluid flows, means connecting said portions, a detachable nozzle located on one side of the diaphragm which is provided with a peripheral shoulder, means for securing the inner portion of the nozzle to the body of the diaphragm, means engaging the shoulder for securing the outer portion of the nozzle to the said peripheral portion of said diaphragm, and retaining devices that pass through the last named means into said peripheral portion.

3. A diaphragm for a turbine comprising a body portion and a peripheral portion separated by an annular space through which steam flows, ribs formed integral with both portions for uniting them, a nozzle which registers with said annular space and receives steam therefrom, an annular shoulder carried by the body of the diaphragm for supporting one side of the nozzle, and a detachable shouldered ring carried by said peripheral portion for supporting the other side of said nozzle.

4. A diaphragm for a turbine comprising body and peripheral portions between which the steam flows, a nozzle that has surface engagement with both of said portions, a shoulder between the nozzle and one of said diaphragm portions, a detachable ring that is secured to the other portion of said diaphragm, and a shoulder between the ring and the nozzle.

5. In a turbine, the combination of a bucket wheel, a shouldered casing therefor, 130

a diaphragm, a nozzle for discharging steam against the buckets, and a ring which is located between the diaphragm and the shoulder on the casing and transmits the thrust on the diaphragm to said shoulder and which also engages and holds said nozzle in place.

6. In a turbine, the combination of a bucket wheel, a casing therefor, a diaphragm comprising body and peripheral portions that are separated by a steam space, ribs connecting said portions, a nozzle located in line with and receiving steam from said space, and a ring that is located between the said peripheral portion and the shoulder on the casing and forms the sole means for transmitting the strains on the diaphragm as a whole to said shoulder, said ring also serving to engage and hold the peripheral portion of the nozzle.

7. In a turbine, the combination of a bucket wheel, a casing therefor that is divided axially into segments, a nozzle that is carried by the diaphragm, and is divided axially into segments, certain of the nozzle joints registering with the casing joints, and means for securing the nozzle to the diaphragm that is also divided axially into segments, the joints in said means registering with certain of those between the casing segments so that a portion of said means can be removed through the opening caused by the removal of a casing segment.

8. In a turbine, the combination of a bucket wheel, a casing therefor that is divided axially into segments, a nozzle that is carried by the diaphragm and is divided axially into segments, certain of the nozzle joints registering with the casing joints, a shoulder formed between the nozzle and the diaphragm to support the inner edge of the nozzle, a segmental ring for supporting the outer edge of the nozzle, the joints in said

ring registering with those between the casing segments, and a shoulder between said ring and the nozzle.

9. In a turbine, the combination of a bucket wheel, an internally shouldered casing therefor which is divided axially into segments, a nozzle that is also divided into segments a portion of whose joints register with those of the casing, and a segmental detachable ring for securing the nozzle which rests on the shoulder and transmits the thrusts from the diaphragm to the casing, certain of the ring joints registering with those of the casing.

10. In a turbine, the combination of a bucket wheel, an internally shouldered casing therefor which is divided axially into segments, a nozzle that is also divided into segments a portion of whose joints register with those of the casing, a segmental detachable ring for securing the nozzle which rests on the shoulder and transmits the thrusts from the diaphragm to the casing, certain of the ring joints registering with those of the casing, and axially extending bolts for securing the ring to the diaphragm which are exposed when a casing segment is removed.

11. In a turbine, the combination of a bucket wheel, a casing therefor having a means for receiving the thrust of the diaphragm, a nozzle which is removably secured to the diaphragm, and a means that forms the sole agent for transmitting thrust from the diaphragm to the receiving means of the casing and which also secures the nozzle to the diaphragm.

In witness whereof, I have hereunto set my hand this 16th day of December, 1911.

OSCAR JUNGREN.

Witnesses:

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