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DIAPHRAGM FOR TURBINES.
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1,017,566.

Patented Feb. 13, 1912.

Fig. 1.

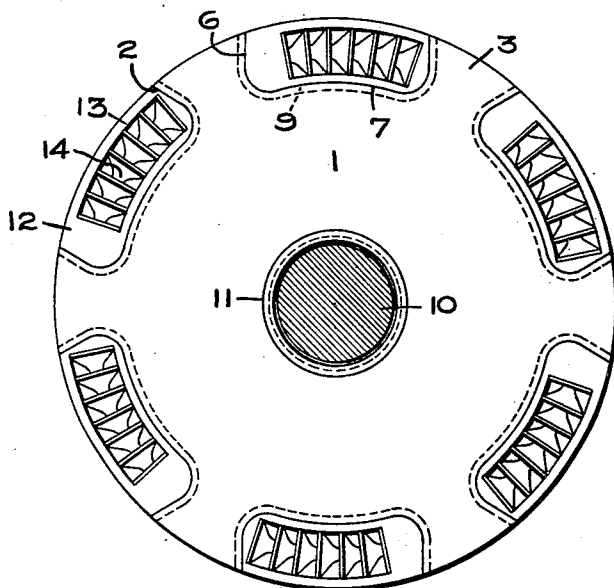


Fig. 2.

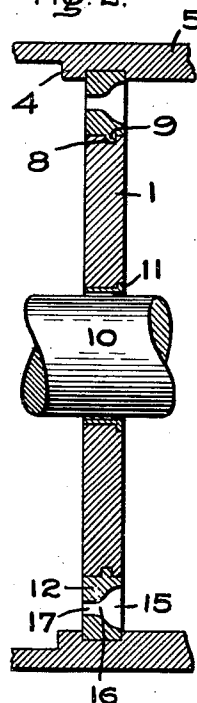
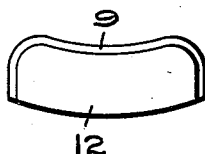


Fig. 3.



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DIAPHRAGM FOR TURBINES.

1,017,566.

Specification of Letters Patent.

Patented Feb. 13, 1912.

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To all whom it may concern:

Be it known that I, OSCAR LASCHE, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Diaphragms for Turbines, of which the following is a specification.

The present invention relates to diaphragms for turbines and has for its object to improve their construction.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and claims appended thereto.

In the annexed drawing is shown one of the embodiments of my invention wherein—

Figure 1 is a front elevation of a diaphragm; Fig. 2 is a section thereof; and Fig. 3 is a detail view of a filling piece.

1 indicates the main body of the diaphragm which can be made of cast-steel or other equivalent metal that is relatively light and strong for its weight. Its periphery is cut away at 2 to provide a number of recesses to receive nozzles or fluid directing devices. Between the recesses are projections 3 which engage a shoulder or other support 4 on the inside of the casing 5. These projections are made of sufficient strength to transmit strains due to the pressure difference on opposite faces of the diaphragm to the shoulder or other support without bending or breaking. A certain portion of the strains, however, are transmitted by the nozzle members or the filling pieces or blank members to the support or shoulder as will appear later. Each recess is provided with straight sides 6 and a curved bottom 7, the latter being concentric with the shaft axis. The side and bottom walls are provided with a continuous groove 8 that receives a tongue 9 on the nozzle member. The tongue and walls of the groove not only serve to interlock the member with the diaphragm but form a steam tight joint between said parts to prevent the escape of steam. Some of the strains due to unbalanced pressures on the diaphragm are transmitted by the tongue and walls of the groove to the nozzle members and by them are transmitted to the shoulder or other support 4, thereby making an exceedingly strong and effective arrangement. I have shown only one diaphragm but it is to be understood that two or more may be provided, the num-

ber depending upon the number of stages in the machine.

The diaphragm is bored centrally to receive the shaft 10 which carries the bucket wheels or the drum or drums as the case may be. Surrounding the shaft and carried by the diaphragm is a packing sleeve 11 which reduces the leakage of steam or other motive fluid around the shaft. The clearance between the shaft and sleeve should be made as small as possible consistent with free operation.

In each of the recesses is a member 12, some of which may be provided with nozzles 13 while others may be without and merely form blank walls or filling pieces. As shown the nozzle member is provided with a plurality of thin sheet metal partitions which are cast-jointed to said member. These partitions are radially disposed so as to discharge the motive fluid at the proper angle against the radially disposed wheel or drum buckets carried by the shaft. Each of these partitions has the same angle of exit and preferably also of entrance.

Between the partitions are nozzle passages or sections 14 through which the fluid flows. Each passage is provided with a bowl 15, a throat 16 and a discharge portion 17. The passage between the throat and discharge end may enlarge or not depending upon the velocity to be imparted to the motive fluid. By making the nozzle members in the manner described I can utilize a metal with which the partitions can be readily cast jointed, which metal may be the same or different from that forming the body of the diaphragm. Further it will be seen that in cooling, owing to the relatively small amount of cast metal contained in the member, that the effects of distortion as the metal cools are reduced to a minimum. Again in case of a defective casting for one reason or another, the loss is small both in cost of labor and material. The additional machine work required to finish the recesses in the diaphragm is relatively small compared to the advantages set forth herein. The walls of the recess are so shaped that the members can readily be inserted and withdrawn from the diaphragm. This is advantageous in the event of injury in service. To remove or change one of the said members it is only necessary to open the turbine by removing the upper half of the cas-

ing and, if the member is not in the upper portion of the diaphragm, to rotate the diaphragm to bring it toward the top to make it accessible. This can be done without disturbing any of the other parts of the machine.

In some cases it is desirable to use a different number of nozzles than is shown in Fig. 1. To provide for this some or all of the members may have a different number of nozzle passages, which number may be greater or less. Instead of providing all of the members with nozzles, I may omit them entirely from one or more members, in which case the structure takes the form of a blank wall or filling piece as is shown in Fig. 3. Taking the structure shown in Fig. 1 for the purpose of illustration, six members are provided, each having six sections or nozzle passages; substituting a blank member for the one shown the number of active nozzles can be reduced one-sixth. Other variations will readily be understood from the example given.

One of the greatest advantages of my invention resides in the fact that standard diaphragms can be manufactured in large quantities, each having the same dimensions as every other. This means that special machinery may if desired be used advantageously not precluding of course the use of ordinary machinery. The nozzle members and blanks can be made in large quantities and kept in stock the same as the diaphragms. By substituting members having different numbers of nozzles, or different sizes, or different numbers and different sizes a great variety of combinations can be obtained. From this it follows that the diaphragms can be used between all stages in a given machine, the members only differing as to the number of nozzles or their size and shape. It will also be seen that I can use the same diaphragms in machines of widely differing outputs. This makes for uniformity and standardization of the output of the factory besides greatly reducing the cost of manufacture. It reduces the number of drawings, patterns, etc., which are necessary, also the chance of errors in workmanship. The members are easier to handle in the machine shop, and as before stated if one is injured the loss is far less than would be the case if the whole diaphragm and its nozzles had to be scrapped. In this connection it must be borne in mind that these diaphragms form a large item in the total expense of the machine.

By so constructing and arranging the members that the periphery of each interlocks with the casing or a shoulder or portion thereof, it is in a measure self supporting and, in addition, by reason of the interlocking with the diaphragm, all of the strains on the latter do not fall on the pro-

jections or parts 3 but are partially assumed by said members. This is a particular feature of advantage in the early stages of the machine where the pressure differences between stages are relatively great.

I have illustrated my invention in connection with a turbine of the Curtis type, but it is also useful in connection with machines of other types wherein the wheel casing is divided into stages or compartments.

I have shown the diaphragm as having six recesses to receive nozzle or blank members, but the number can be increased or decreased to suit the requirements. Instead of making all diaphragms with the same number of recesses, some may have more and others less. In this way the number of possible combinations for the same or different machines can be largely increased.

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 an elastic fluid turbine, the combination of a diaphragm having a peripheral recess, a detachable nozzle-containing member located in said recess and interlocking with the walls thereof, a casing, and means carried by the casing which engage the peripheral portion of the diaphragm and also the said member, the latter transmitting strains from the former to the casing.

2. In an elastic fluid turbine, the combination of a casing, a diaphragm within the casing having projections and peripheral recesses with members removably mounted in said recesses and interlocking with the walls thereof, the said members forming a part of the periphery of the diaphragm whose diameter is the same as that of the other parts and being held by the casing against outward movement.

3. In an elastic fluid turbine, the combination of a diaphragm having peripheral recesses and projections, nozzle members located in said recesses, each of said members being removable as a unit and comprising a cast metal body with sheet metal partitions which are cast-jointed thereto, the said partitions forming walls of the nozzle passages and means carried by the diaphragm and members which interlock.

4. In an elastic fluid turbine, the combination of a diaphragm having alternate projections and recesses in its periphery, a casing that supports the diaphragm at its periphery by means of the projections, detachable members which are mounted in and fill the recesses and engage the casing

to assist in supporting themselves and also the diaphragm, some or all of said members being provided with fluid conveying passages, and means interlocking the members and the diaphragm which also forms a fluid tight joint.

5. In an elastic fluid turbine, a casing, a diaphragm mounted in the casing so that it can be turned about its axis when the turbine is opened, said diaphragm having recesses in its periphery, and radially removable members mounted in the recesses and interlocking with the walls thereof, said members being normally held by the casing against outward movement and some or all of them being provided with fluid conveying passages.

6. In an elastic fluid turbine, the combi-

nation of a casing, a diaphragm fitting the interior of the casing and having a recess in its periphery, and a nozzle carrying member mounted in the recess, there being an interlocking joint between the edge of said member and the adjacent wall of the recess comprising a tongue on one of said parts cooperating with a groove in the other, and the outer edge of said member being of the same curvature as the periphery of the diaphragm and in engagement with the interior of the casing.

In witness whereof, I have hereunto set my hand this 18th day of September, 1909.

OSCAR LASCHE.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."