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NOZZLE BOX ASSEMBLY

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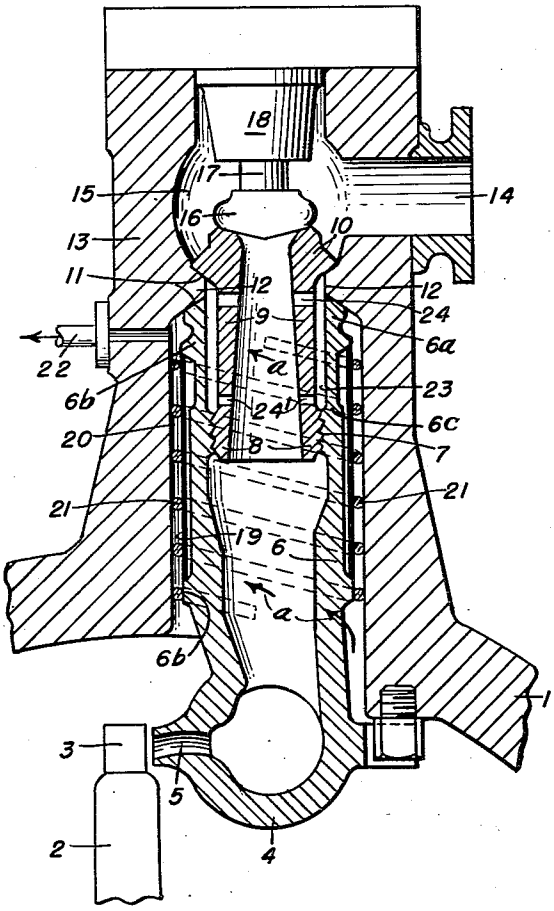

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NOZZLE BOX ASSEMBLY

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This invention relates to a nozzle box assembly for high temperature steam and gas turbines, and more particularly to a nozzle box assembly which includes a regulator valve having a single seat on a diffuser nozzle supplying motive fluid to a nozzle box.

In steam and gas turbines having several nozzle group regulating valves it is customary to provide at the high pressure housing (wheel box) an inflow box from which the operating medium flows to a number of nozzle boxes according to the number of regulating valves. The regulating valves have been mounted in the inflow box side by side with parallel axes and the nozzle boxes were fitted into the high pressure housing of the turbine and secured to the latter by bolts or by welding. The use of inflow boxes from which all nozzle boxes are supplied with operating medium involves complicated, and especially nonsymmetrical structural forms for the high pressure housing of the turbine, which constructions are unfavorable, especially with respect to thermal stresses and distortions. For this reason it has been proposed to provide separate valve housings adjacent the turbine, the operating medium flowing from them through conduits to the nozzle boxes in the high pressure portion of the turbine. This arrangement, however, is unfavorable because of the unregulated amount of steam present in the conduits, and because of the additional space required for the turbine installations.

Objects of the invention are to provide a nozzle box assembly including a regulator valve having a single seat on a diffuser body and which may be readily installed in a nozzle box housing integral with or attached to the high pressure housing of a steam or gas turbine. An object is to provide nozzle box assemblies comprising regulator valves, diffuser-nozzles and inlet connections which may be symmetrically disposed about the axis of the turbine housing. An object is to provide nozzle box assemblies of the type stated in which adjacent portions of the diffuser body and the inlet connection are maintained at substantially the same temperature by the operating medium.

These and other objects and the advantages of the invention will be apparent from the following specification when taken with the accompanying drawing in which the single view is a fragmentary axial section through a turbine provided with a valved nozzle box assembly embodying the invention.

In the drawing, the reference numeral **1** identifies the wall of the high pressure housing or so-called "wheel box" in which is arranged an impulse wheel **2** provided with a surrounding ring of buckets or blades **3** upon which high temperature motive fluid from a nozzle box **4** is directed by nozzle **5**. A substantially tubular inlet member **6** extends radially outward from and is integral with the nozzle box **4**; the inlet member having an internal shoulder **7** intermediate its length threaded upon the inner end **8** of a diffuser body **9** to clamp the outer end flange **6a** of the inlet body **6** and an external flange **10** of the diffuser body **9** upon seats **11** at the opposite faces of an internal shoulder **12** of a generally cylindrical nozzle box housing **13** extending radially from the wheel box **1** and having an opening **14** for admission of the motive fluid to an inlet chamber **15**. A disk regulating valve **16** seats upon the outer end of the diffuser body **9** and its stem **17** extends into a chamber **18** by which it is supported for axial movement for control by a servomotor, not shown, or by a customary variable transmission actuated by a speed regulator.

The inlet connection **6** is of less diameter than the bore of housing **13** in which it is mounted, and has external shoulders **6b** axially spaced along the same for supporting a cylindrical radiation guard **19** which is radially spaced from housing **13** by an annular gap **20** through which expanded motive fluid is withdrawn from the interior of housing **1** to serve as a cooling agent. A helically coiled wire **21** is preferably arranged in the annular space **20** to guide the cooling agent along an elongated path, as indicated by the arrows *a*, to a suction pipe outlet **22** which may be connected to the turbine housing, for example after the second reaction stage.

The portion **6c** of the inlet connection between the threaded shoulder **7** and its outer end **6a** constitutes an expansion neck which is spaced radially from the diffuser body **9** by an annular chamber **23** through which a flow of the heated motive fluid is established from inlet openings **24** through the outer end of diffuser body **9** and outlet openings **24'** at its inner end. A portion of the motive fluid thus flows through the annular chamber **23** because of the pressure drop along the flaring bore of the diffuser body **9**.

The described screw connection of the nozzle box inlet to the diffuser body results in several advantages. It provides a simple, space-saving solution for the problem of mounting the nozzle boxes in a housing integral with or attached to the turbine wheel box, and one which permits the nozzle box housings to be arranged radially of the turbine axis, whereby the nozzle box housings may be independent of each other and symmetrically arranged around the entire turbine wheel box. Non-uniform thermal stressing of the wheel box is further reduced by exhausting expanded working fluid through the nozzle box housings and the provision of the guide coil **21** in the cooling passage reduces the quantity of fluid required for a given cooling effect. When, as shown, the threaded shoulder **7** of the inlet connection **6** is at some distance from its outer end **6a**, the relatively long heated section **6c** reduces the stresses imposed on the screw connection by temperature differences.

The invention imposes no limitations upon the general construction of the turbine since the nozzle box housings may be integral with the wheel box, as shown, or may be separately formed and secured to the wheel box by bolts or by welding, as has been customary in the past.

I claim:

1. In a high temperature fluid turbine having a wheel box enclosing a turbine wheel, a generally cylindrical nozzle box housing extending radially from the turbine wheel box, said housing being provided with a motive fluid inlet and having an internal shoulder positioned radially inward of said inlet, said shoulder having an inner and an outer annular face, a diffuser body having a flaring bore therethrough and an outer external flange seated on the outer face of said housing shoulder, a nozzle box having a generally tubular inlet member telescoped over and threaded upon said diffuser body and having an outer end flange seated against the inner face of said housing shoulder, a nozzle on said nozzle box for directing motive fluid upon the turbine wheel, and valve means in said housing and adjacent said motive

fluid inlet for controlling the flow of motive fluid through said nozzle.

2. In a high temperature fluid turbine, the invention as recited in claim 1, wherein said valve means comprises a disk valve having a seat on the outer end of said diffuser body, and means including a valve stem supporting said disk valve for axial movement with respect to its seat on said diffuser body.

3. In a high temperature fluid turbine, the invention as recited in claim 1, wherein the outer end of said tubular inlet member is telescoped over and separated from said diffuser body by an annular space, and means comprising radial openings through and spaced axially of the wall of said diffuser body for establishing a flow of motive fluid through said annular space to heat said inlet connection.

4. In a high temperature fluid turbine, the invention as recited in claim 1 wherein said inlet member has a diameter less than that of the bore of the nozzle box housing to provide an annular cooling space opening at its inner end into said turbine wheel box, and means comprising a suction outlet communicating with the outer

end of said cooling space for establishing a flow of expanded motive fluid therethrough.

5. In a high temperature fluid turbine, the invention as recited in claim 4, wherein said tubular inlet member has external shoulders axially spaced along the same, in combination with a cylindrical radiation shield supported on said inlet member shoulders constituting the inner wall of the annular cooling space, the wall of the bore of the nozzle box housing constituting the outer wall of the annular cooling space.

6. In a high temperature fluid turbine, the invention as recited in claim 5, in combination with means within said annular cooling space forming a helical passage therein extending from said wheel box to said suction outlet.

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