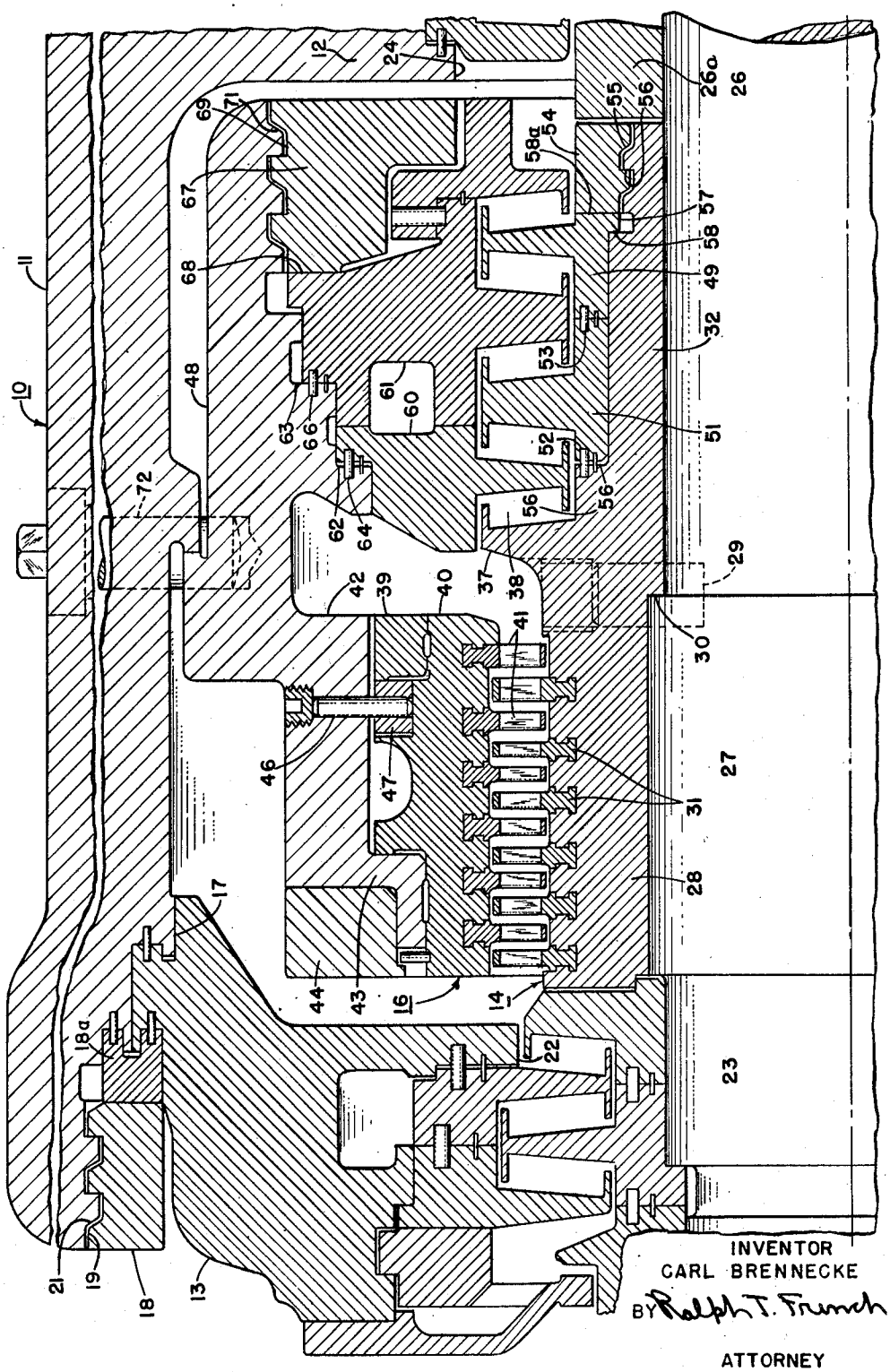
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TURBINE CONSTRUCTION

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TURBINE CONSTRUCTION

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This invention relates to turbines utilizing high temperature motive fluid and more particularly to axial flow steam turbines wherein the outer casings and the inner casings are undivided along their longitudinal axes.

Turbines using casings which are axially undivided cannot be assembled in a conventional manner. It is first necessary to assemble the rotor, stationary blade holder and axially undivided inner casing outside of the axially undivided outer casing and then to insert the assembled unit into the outer casing. It is therefore an object of this invention to simplify the assembly of such a turbine by providing a preliminarily-assembled unit which can be easily inserted into the undivided outer casing.

It is another object of this invention to provide an undivided inner casing adapted to reduce the number of separate parts which must be inserted into the undivided outer casing.

A more specific object is to provide a support to which the stationary labyrinth rings may be secured prior to their insertion into the outer casing.

These and other objects are effected by the invention as will be apparent from the following description taken in connection with the accompanying drawing, forming a part of this application:

In the drawing, the single figure is a longitudinal sectional view of a turbine whose outer casing is undivided axially and which embodies the present invention.

Referring to the drawing, the reference character **10** indicates, in its entirety, a typical axial flow turbine having an axially undivided outer casing **11** with an end wall **12** at the high pressure end or right-hand end as viewed in the drawing. The outer casing **11** with the end wall **12** and an end cover **13** secured to the low pressure or left-hand end of the outer casing substantially enclose a rotor component, generally indicated **14** and a stationary blade component, generally indicated **16**.

Only the top half of the turbine **10** has been illustrated but it is to be understood that the bottom half is of identical construction and that in the preferred embodiment the turbine is circular in a plane transverse to that illustrated.

The axially undivided outer casing **11** has on the left-hand end an access opening **17** to permit entry of the inner casing component **16** and the rotor component **14**.

The end cover **13** is connected to the outer casing **11** by any desirable means but, for purposes of illustration, a ring **18** having a plurality of threads **19** on its outer periphery, engaging a plurality of threads **21** on the inner periphery of the outer casing, is used. The cover **13** has an opening **22** permitting a portion **23** of the rotor to extend through the cover after the latter is secured to the casing.

At the right-hand side of the outer casing **11**, the end wall **12** projects radially inwardly toward the rotor but an opening **24** is provided to permit a portion **26** of the rotor to extend through the outer casing. These extended

rotor portions **23** and **26** are rotatably supported in bearings, not shown, disposed outside of the casing **11**, in any well known manner.

The rotor component **14** comprises a rotor **27** to which a blade holder **28** is secured by a plurality of radial pins **29** which serve to axially locate the blade holder and to transmit torque therefrom to the rotor. The blade holder **28** supports a plurality of rows of rotating blades **31**. Integral with the blade holder **28** is a sealing ring portion **32** disposed to the right of the blade holder **28**, as viewed in the drawing.

The stationary blade component **16** comprises an axially divided stationary blade holder **40** which supports a plurality of rows of stationary blades **41** designed to cooperate with the rotating blades **31**. The top and bottom half of the axially divided stationary blade holder **40** are securely connected together by a shrink ring **39**, located at the right-hand end thereof, as viewed in the drawing. The stationary blade holder **40** is also secured, by means to be subsequently described, to an axially undivided inner casing **42**. The inner casing **42** is provided at its left-hand end, as viewed in the drawing, with a radial inwardly-extending annular projection **43**, against whose inner radial surface the stationary blade holder **40** abuts. A shrink ring **44** may also be mounted, at the left-hand end, on the annular projection **43**, thereby providing additional strength. Relative expansion between inner casing **42** and the stationary blade holder **40** is provided for by a plurality of radial pins **46** and a plurality of cooperating sliding blocks **47**.

The inner casing **42** has, at the right-hand end, an annular projection **48** extending axially to the right. The inner periphery of this annular projection **48** defines the outer periphery of the sealing area **38**. Therefore, the annular sealing area **38** is bounded by the outer periphery of the sealing ring portion **32**, the inner periphery of the extended annular projection **48** and on the right by the end wall **12** of the outer casing while on the left substantially by a radially outwardly extending projection **37** which functions as a rotating labyrinth seal ring and is an integral part of the blade holder **28**.

Supported on the sealing ring portion **32** of the rotating blade holder are a plurality of one piece rotating annular labyrinth sealing rings **49** and **51** which extend radially outward and into the sealing area **38**. The rotating labyrinth rings **49** and **51** are prevented from rotation relative to each other and to the sealing ring portion **32** by a plurality of pins **52** and **53** and are secured to the sealing ring portion **32** by a locking ring **54**. The ring **54** has a plurality of threads **55** on its inner periphery which engage a plurality of threads **56** on the outer periphery of the sealing ring portion **32**. The dowel pins **52** are inserted between the radially outwardly extending shoulder **56** adjacent the one piece labyrinth sealing ring farthest to the left and dowel pins **53** between adjacent one piece sealing rings. The labyrinth ring **49** farthest to the right has a radial inwardly extending flange **57** which is forced to abut against a shoulder **58** on the sealing ring portion **32**. The ring **54** bears against the labyrinth ring farthest to the right, as at **58***a*, and this force is thus transmitted from one labyrinth ring to another and ultimately, upon expansion of the rings, to the shoulder **56**.

The annular projection **48** of the inner casing **42**, extending axially to the right, supports a plurality of one piece annular stationary labyrinth sealing rings **60** and **61**. These rings are secured to the annular projection **48** in much the same manner as the rotating labyrinth rings **49** and **51** are secured to the sealing ring portion **32**, previously described. Integral with the annular projection **48** are a plurality of radially inwardly extending

shoulders 62 and 63 to which are attached the labyrinth rings 60 and 61 by a plurality of dowel pins 64 and 66 and a second locking ring 67. The ring 67 has a plurality of threads 69 on its outer periphery which engage a plurality of mating threads 71 on the inner periphery of the annular projection 48. The ring 67 bears against the labyrinth ring farthest to the right, as at 68.

The above described components are assembled in the following manner: The unit composed of the rotor component 14 and the stationary blade component 16 is assembled prior to insertion in the outer casing 11, the rotating blade holder 28 with its rotating blades 31 being placed on the rotor 27 so as to abut at the shoulder 30. The rotating blade holder 28 is positioned along the rotor 27 by first being disposed along the right hand portion 26 and thereafter moved axially to the left until it abuts the shoulder 30. Since the rotating blade holder 28 is loosely fitted to the rotor 27, any necessary assembly adjustments may be made. Thereafter holes are drilled and reamed for receiving a plurality of radial pins 29 which lock the rotating blade holder 28 to the rotor 27.

The two halves of the stationary blade holder 40 are placed in cooperating relation with the rotor component 14 and retained in that relation by the shrink ring 39. Thereafter, the assembled rotor and stationary blade component are positioned in the inner casing 42 and the shrink ring 44 applied.

The labyrinth sealing rings are assembled axially as follows: The one piece stationary annular labyrinth ring 60 with its dowel pins 64 is inserted axially into the inner casing 42 through the open right-hand end thereof, the free ends of the pins 64 being received in mating recesses provided in the extended annular shoulders 62, thereby locking the ring 60 against rotation relative to the inner casing 42. The one piece rotating annular labyrinth ring 51 with its dowel pins 52 is next inserted axially and secured to the shoulder 56 by reception of its pins 52 in mating recesses provided in shoulder 56. By alternately assembling a stationary and then a rotating ring any desired number of such rings can be assembled. After the last sealing ring has been placed in position, the threaded locking rings 54 and 67 are assembled. Thereafter a ring 26*a*, which may be a portion of an additional sealing ring (not illustrated), may be secured to the rotor portion 26 in any suitable manner, such as by shrinking, threading or pinned thereon.

After the rotor component and the stationary component have been assembled in the manner described above, this assembly is placed within the outer casing 11 through the access opening 17 with part of the rotor 26 extending through the outer casing end wall. The inner casing 42 is then secured to the outer casing 11 by radial pins 72. Thereafter the end cover 13 is assembled to the outer casing 11 and secured by rings 18 and 18*a*.

From the foregoing it will be seen that this invention provides in turbines having axially undivided outer casings a rotor component and an inner casing component, together with their respective labyrinth seals, which may be assembled prior to insertion into the undivided outer casing.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

What is claimed is:

1. An elastic fluid turbine comprising, a rotor, a stationary blade holder which is axially divided, cooperating blading carried by said rotor and said stationary blade holder, an inner casing which is axially undivided enclosing said stationary blade holder, means securing said stationary blade holder to said inner casing, an outer casing which is axially undivided having at one end an access opening to permit entry of said inner casing and at the other end a radially inwardly projecting end wall substantially enclosing said inner casing, means securing said inner casing to said outer casing, a sealing ring portion on said rotor, said inner casing having an annular projection encompassing the said sealing ring portion of said rotor and defining therewith an annular sealing area, and stationary sealing rings distributed along and supported by the annular projection of said inner casing whereby they are disposed within the sealing area.

2. An elastic fluid turbine comprising, a rotor, a rotating blade holder, means securing said rotating blade holder to said rotor, a stationary blade holder which is axially divided, cooperating blading carried by said rotating blade holder and said stationary blade holder, an inner casing which is axially undivided enclosing said stationary blade holder, means securing said stationary blade holder to said inner casing, an outer casing which is axially undivided having at one end an access opening to permit entry of said inner casing and at the other end a radially inwardly projecting end wall substantially enclosing said inner casing, means securing said inner casing to said outer casing, a sealing ring portion on said rotating blade holder adjacent the end wall of said outer casing, said inner casing having an annular projection encompassing the said sealing ring portion of said rotating blade holder and defining therewith an annular sealing area, stationary sealing rings disposed radially inward distributed along and engaging said annular projection, and means for securing said stationary sealing rings to said annular projection.

3. An elastic fluid turbine comprising, a rotor, a rotating blade holder, means securing said rotating blade holder to said rotor, an annular stationary blade holder divided along its longitudinal axis, cooperating blading carried by said rotating blade holder and said stationary blade holder, an annular inner casing undivided along its longitudinal axis enclosing said stationary blade holder, means securing said stationary blade holder to said inner casing, an outer casing which is axially undivided having at one end an access opening to permit entry of said inner casing and at the other end a radially inwardly projecting end wall substantially enclosing said inner casing, means to secure said inner casing to said outer casing, a sealing ring portion on said rotating blade holder between the blading and the end wall of said outer casing, said inner casing having an annular projection encompassing the said sealing ring portion and defining therewith an annular sealing area, said annular projection having at the end farthest removed from the blades a plurality of threads on its inner periphery, stationary labyrinth sealing rings engaging said annular projection between the bladed end and the threaded end of said inner casing, a first ring having a plurality of threads on its outer periphery engaging said threads on the inner periphery of said annular projection whereby said stationary labyrinth sealing rings are secured to said inner casing, rotating labyrinth sealing rings distributed along and supported by said sealing ring portion, said sealing ring portion having threads on its outer periphery at the end farthest removed from the blades, and a second ring having threads on its inner periphery engaging the threads on the outer periphery of said sealing ring portion whereby said rotating labyrinth rings are secured to said rotor.

4. An elastic fluid turbine comprising, a rotor, a rotating blade holder, means securing said rotating blade holder to said rotor, said rotating blade holder carrying a plurality of axially spaced circumferential rows of rotating blades on its outer periphery, an annular stationary blade holder divided along its longitudinal axis, said stationary blade holder carrying a plurality of axially spaced circumferential rows of stationary blades on its inner periphery cooperating with the rotating blades, a sealing ring portion on said rotating blade holder between the blading and the end wall of said outer casing, a first

shrink ring fitted to the end of said stationary divided blade holder adjacent said sealing ring portion for maintaining said divided blade holder assembled, an axially undivided annular inner casing enclosing said stationary blade holder, an axially undivided outer casing having at one end an access opening to permit entry of said inner casing and at the other end a radially inwardly projecting end wall substantially enclosing said inner casing, means securing said inner casing to said outer casing, said inner casing being spaced from said stationary blade holder throughout a major portion of its length and being provided at the end farthest removed from said sealing ring portion with a radially inward annular projection engaging said stationary blade holder, a second shrink ring fitted to said annular projection, additional connecting means between said stationary blade holder and said inner casing providing for relative expansion, said inner casing having a labyrinth sealing ring support structure projecting axially therefrom and encompassing the said sealing ring portion and defining therewith an annular

sealing area, said stationary sealing ring support having a plurality of threads on the inner periphery at the end farthest removed from the blades, stationary labyrinth sealing rings supported between the bladed end and the threaded end of said stationary sealing ring support, a locking ring having a plurality of threads on its outer periphery engaging the threads on the inner periphery of said labyrinth sealing ring support, thereby securing said stationary labyrinth sealing rings to said stationary sealing ring support, rotating labyrinth sealing rings distributed along and supported by said sealing ring portion, said sealing ring portion having a plurality of threads on its outer periphery at the end farthest removed from the blades, and a second ring having a plurality of threads on its inner periphery engaging the threads on the outer periphery of said sealing ring portion, thereby securing said rotating labyrinth rings to said sealing ring portion.

No references cited.