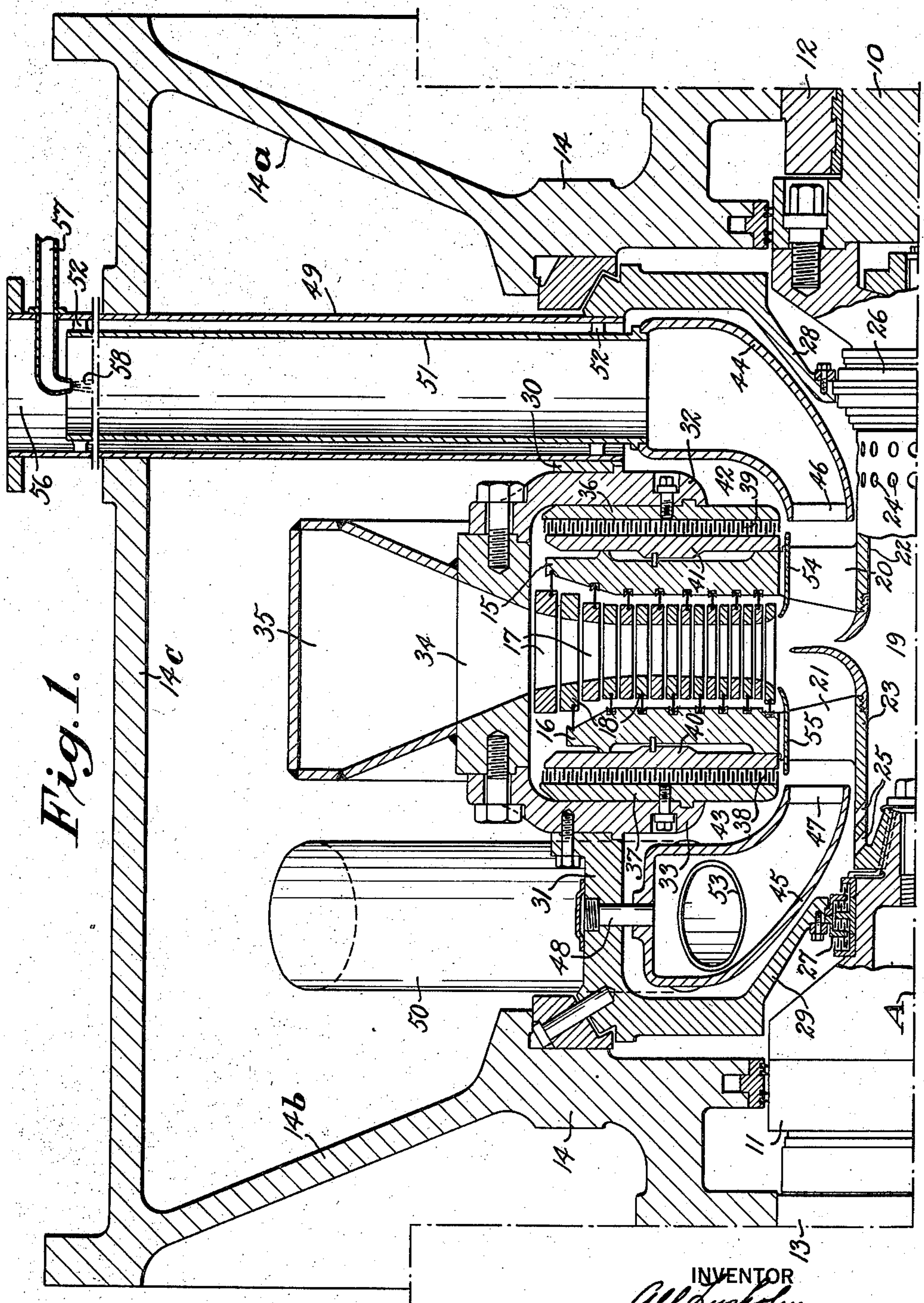
Jan. 5, 1937. A. LYSHOLM 2,066,788

TURBINE

Filed June 24, 1932 2 Sheets-Sheet 1



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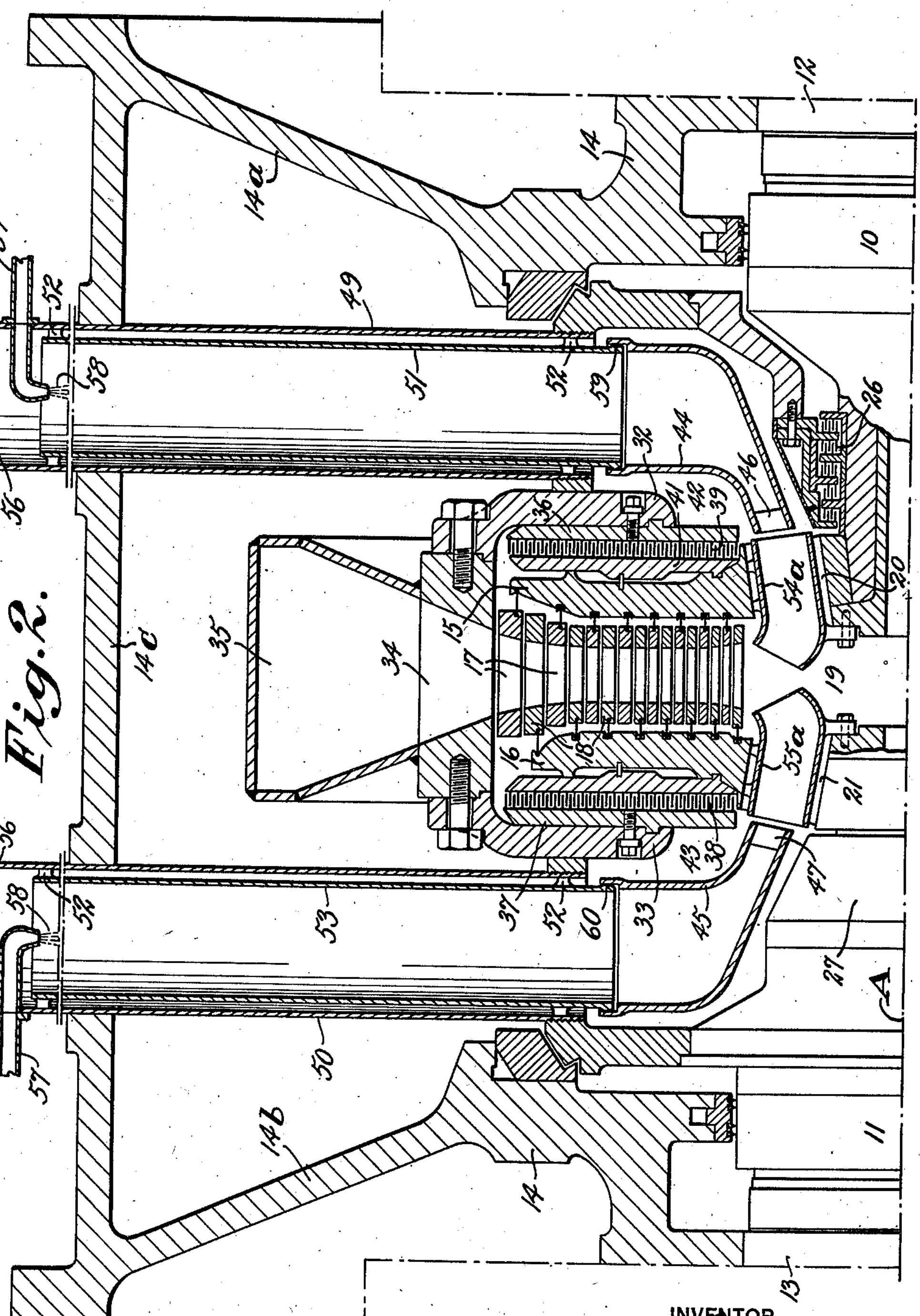

Fig. 2.

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TURBINE

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24 Claims. (Cl. 60—41)

The present invention relates to turbines adapted to be operated by high temperature motive fluids such as very highly superheated steam and/or combustion gases. More particularly the invention relates to turbines having central admission of motive fluid to the blading of the turbine and still more particularly, the invention relates to turbines of the radial flow type.

As is well known, increases in the power and efficiency of turbines may be obtained by increasing the temperature range through which the motive fluid is expanded and in order to increase this temperature range it has been proposed to utilize motive fluids having extremely high initial temperatures. The maximum initial temperature is, however, limited by the ability of the turbine parts to withstand the initial temperature of the motive fluid and in order to protect parts contacted by the motive fluid at initial temperature, it has been proposed in the past to provide cooling jackets for such parts. Such arrangements have not been satisfactory because of the difficulty of properly cooling all parts requiring cooling and because of the loss of heat from the motive fluid to the cooling medium before the motive fluid is usefully expanded in the turbine.

The primary object of the present invention is to improve upon prior forms of turbines and to provide a turbine in which high temperature motive fluid is admitted to the inlet of the turbine blading without subjecting the turbine parts adjacent to the inlet conduit to excessive temperatures and without resorting to the use of a separate cooling agent.

In accordance with the invention, the motive fluid supplied to the turbine is supplied thereto in separate streams, one of which is at high temperature and the other of which is at a relatively lower temperature, the latter stream being employed to afford the desired protection to certain of the turbine parts against the temperatures of the high temperature stream of motive fluid. The two streams of motive fluid are maintained in substantially separated state to a point adjacent to the inlet of the turbine blading and are then mixed and delivered to the blade system of the turbine for expansion therein.

The invention has particular utility in connection with gas turbines, that is, turbines intended to be operated by high temperature motive fluid consisting wholly or in part of combustion gases. It is also particularly applicable to radial flow turbines of the type having a central admission chamber for motive fluid. The invention has therefore been illustrated as embodied in radial flow turbines of the double rotation type, although it is to be understood that in its broader aspects, the invention is not to be limited to the specific type of turbine herein illustrated but is to include all types of turbines falling within the scope of the appended claims when construed as broadly as is consistent with the state of the prior art.

For a better understanding of the invention and of the more detailed objects thereof, reference may be had to the accompanying drawings forming a part of this specification and the ensuing description thereof.

In the drawings:

Fig. 1 is a more or less diagrammatic longitudinal half section of a double rotation radial flow turbine embodying the invention and

Fig. 2 is a similar view of another form of the same type of turbine.

Referring now to Fig. 1, the reference character A represents the axis of rotation of the turbine with respect to which the turbine is substantially symmetrical. The turbine comprises two oppositely rotating shafts 10 and 11 journalled in bearings 12 and 13 supported in a stationary turbine part 14. Shafts 10 and 11 carry at their inner ends the turbine discs 15 and 16 respectively, these discs in turn carrying a plurality of interleaved blade rings 17 and 18 which form a radial flow blade system. Radially inwardly of the blade system at the inlet end thereof, there is provided a central admission chamber 19 for motive fluid. Discs 15 and 16 are perforated as at 20 and 21 to provide passages for flow of motive fluid to the central admission chamber 19 and the annular shaft parts 22 and 23 are perforated at 24 and 25 to permit motive fluid to flow into the portion of the chamber 19 situated axially between the adjacent ends of the shafts.

Leakage of motive fluid around the shafts is prevented by the shaft packings 26 and 27 which are advantageously of the labyrinth type and which comprise parts fixed to the stationary turbine parts 28 and 29, respectively. Parts 28 and 29 extend in generally radial direction outwardly from the shafts and are flanged as at 30 and 31 to support, respectively, parts 32 and 33. Parts 32 and 33 in turn support an annular outer ring of guide blades 34 through which motive fluid flows from the blade system of the turbine to the outlet chamber 35.

Parts 32 and 33 support the axially outer plates 36 and 37 of two radially extending labyrinth packings 38 and 39, the inner plates 40 and 41 of which are carried by the discs 15 and 16.

The stationary turbine parts 28, 29, 32 and 33 provide annular chambers 42 and 43 and within these chambers are respectively situated the hollow distributing members 44 and 45. The distributing members 44 and 45 are preferably annular in form and are provided with outlets directed toward the apertures 20 and 21 in the turbine discs. These outlets are advantageously annular but may be divided into peripherally spaced nozzles. The outlets are advantageously provided with a plurality of guide blades 46 and 47 for directing motive fluid in the desired direction toward the apertures in the turbine discs.

The distributing members 44 and 45 are movably mounted with respect to the stationary parts of the turbine and are preferably held in position by a plurality of radially arranged studs, one of which is indicated at 48. It will be observed that the distributing members are spaced from the walls defining the chambers 42 and 43 and the movable mounting of the distributing members permits them to expand and contract freely under the influence of variations in temperature.

Motive fluid may be conducted to each of the distributing chambers through one or a number of supply pipes, which pipes may be arranged in the same longitudinal plane or staggered with respect to each other. In the turbine illustrated, one admission pipe is shown for each distributing member and the admission pipes are shown in staggered arrangement.

Each of the chambers 42 and 43 is provided with admission pipes corresponding in number and arrangement to the admission pipes delivering motive fluid to the distributing chambers. In the arrangement shown, motive fluid is admitted to chamber 42 by the admission pipe 49, the inner end of which is secured to the flange 30 of part 28 and motive fluid is admitted to chamber 43 by pipe 50, the inner end of which is secured to the flange 31 of part 29.

In the type of turbine illustrated, the usual practice is to mount generators, compressors or like utilities in overhung relation from the casing of the turbine and in the present embodiment, the casing part 14 has been shown as comprising axially spaced web portions 14*a* and 14*b* connected by an outer cylindrical portion 14*c*. It will be evident, however, that this construction may be varied.

Pipes 49 and 50 extend through the portion 14*c* of the casing. Expansion of these pipes relative to the casing may be compensated for by any suitable known form of sliding joint or expansion connection.

Motive fluid is admitted to distributing chamber 44 through an admission pipe 51 situated within and spaced from the admission pipe 49 and fixed at its inner end to the distributing member. Pipe 51 is advantageously centered with respect to pipe 49 by a plurality of lugs 52 fixed to one of the pipes and slidable with respect to the other to permit relative longitudinal movement between the pipes. An admission pipe 53 similar to pipe 51 and arranged within pipe 50 serves to admit motive fluid to the distributing member 45.

The distributing members 44 and 45 and the admission pipes 51 and 53 are made of heat resistant material which is capable of withstanding extremely high temperatures without deterioration. For this purpose an alloy such as Silcrome, containing chromium, silicon and aluminum is suitable.

Shields 54 and 55 are preferably mounted in apertures 20 and 21, these shields being spaced from the walls of the apertures and advantageously being made of high temperature resistant material.

Motive fluid of relatively low temperature is supplied to the admission conduit 49 through the inlet 56 and high temperature motive fluid is supplied through the admission pipe 51. For purposes of illustration, an arrangement for supplying motive fluid comprising combustion gases has been shown diagrammatically. In this arrangement, the inlet 56 is connected to a suitable source of air or gas at relatively low temperature and fuel is injected through pipe 57 to the nozzle 58, which fuel by combustion with the air or gas entering pipe 51 serves to heat the gaseous medium within this pipe to a high temperature. It will be evident that insofar as the present invention is concerned, the form and arrangement of the means for supplying high temperature motive fluid to pipe 51 and motive fluid of lower temperature to pipe 49 is subject to wide variation. When the high temperature motive fluid is produced by internal combustion, the temperature may, for example, be from 1300° F. to 1450° F. or even higher.

It will be evident that with the above described arrangement the motive fluid is divided into two separate streams, one of which is heated to a high temperature and the other of which is at relatively lower temperature. The high temperature stream is conducted through a conduit comprising the pipe or pipes 51 and the distributing member 44 to adjacent the central admission chamber 19, which conduit is surrounded by the conduit formed by the admission pipe or pipes 49 and the walls of the chamber 42. The motive fluid of lower temperature flows through this latter conduit and forms an insulating medium preventing the stationary parts of the turbine through which the inner conduit passes from overheating due to the high temperature motive fluid within the inner conduit. The motive fluid in the outer conduit absorbs a certain amount of heat from the walls of the inner conduit thus tending to cool the latter to some extent but the temperature of the motive fluid in the outer conduit is maintained at a relatively low value because of the rapidity of flow of fluid therethrough. The heat absorbed by the motive fluid in the outer conduit is not lost because of the fact that this motive fluid, together with the high temperature motive fluid, is finally delivered to the admission chamber 19 from whence it flows through the blade system of the turbine.

It is of advantage to protect the labyrinth packing and the shaft packings of the turbine from excessive temperatures and it will be evident that by the arrangement illustrated, this protection is secured through flow of the relatively low temperature motive fluid past the shaft packings 26 and 27 and through the apertures 24 and 25 into the chamber 19 and by the flow of relatively low temperature motive fluid past the inner ends of the labyrinth packings 38 and 39 to the spaces provided between the shields 54 and 55 and the adjacent portions of the walls of the apertures 20 and 21 in the turbine discs. The channels provided between shields 54 and 55 and the adjacent portions of the aperture walls provide protection for the walls of the apertures which would otherwise be impinged by the high temperature combustion gases as they flow from the outlets of the distributing members into the first blade ring of the turbine blading.

In addition to the protection afforded to the packings in the turbine, the flow of relatively low temperature motive fluid around the turbine shafts tends to minimize heat transmission through the shafts to the shaft journals which obviously it is desirable to keep at as low a temperature as possible.

It will thus be evident that the arrangement described provides for efficient protection of those parts of the turbine which require protection against excessive temperatures, there being no parts of the turbine exposed to high temperature motive fluid except the special heat resistant walls of the inner conduits and the turbine blade rings. The latter are ordinarily made of material adapted to withstand temperatures corresponding to the initial temperature of the motive fluid.

Turning now to Fig. 2, another form of turbine is illustrated in which the general form of construction is similar to that described in connection with Fig. 1. Like reference characters designate like parts in the two figures.

In the present embodiment, the admission pipes **49**, **50**, **51** and **53** are arranged in the same longitudinal plane and the pipes **51** and **53** instead of being slidably mounted within pipes **49** and **50** are fixed relative thereto and connected to the distributing members **44** and **45** by means of suitable slip joints **59** and **60** so as to permit the necessary freedom of movement to compensate for expansion and contraction of the parts.

Furthermore, in this embodiment the apertures **20** and **21** in the turbine discs have mounted therein tubular shields **54a** and **55a** which serve to completely protect the walls of the apertures from impingement by high temperature motive fluid and which advantageously may be shaped to provide nozzles for directing the high temperature motive fluid into the first blade ring of the blade system. This arrangement assists in preventing the conduction of heat from the high temperature motive fluid to those rotating parts of the turbine which are not well adapted to withstand high temperatures and is particularly useful in protecting the inner shaft parts from excessive temperatures. Shields **54a** and **55a** are made of high temperature resistant material.

From the foregoing it will be appreciated that with the arrangement provided by the present invention the only parts of the turbine proper which are exposed to the initial temperature of the high temperature motive fluid are the blades in the first expansion stage or stages of the blade system. These blades are ordinarily made of material capable of withstanding high temperatures and it will be evident that due to the heat drop in the blade system, the blades of subsequent expansion stages, which are subjected only to lower temperatures, may be made of ordinary and less expensive material.

Among the advantages to be derived from the present invention the following may be mentioned. Due to the fact that the turbine parts are well protected against the initial temperature of the motive fluid, this temperature can be raised to whatever value the heat resisting material employed is capable of withstanding and may be above the temperature for which the blade system is designed because of the fact that the high temperature motive fluid has its temperature reduced to some extent at the inlet of the turbine blading by admixture therewith of the motive fluid of lower temperature. Heat loss due to leakage through the packings consists substantially entirely of this low temperature fluid.

It will be understood that the high temperature motive fluid supplied to the distributing members and the motive fluid of lower temperature supplied to the space surrounding these chambers may be derived from different sources, in which event the inner and outer admission pipes will be entirely separated from each other. When the two streams of motive fluid are derived from different sources, it will be evident that they may comprise different gases.

The two streams of motive fluid of different temperature should be at substantially the same pressure. It is advantageous to have the motive fluid of lower temperature at a pressure slightly in excess of the pressure of the high temperature motive fluid in order to prevent a possibility of leakage of the high temperature motive fluid to the space or spaces surrounding the channel through which it is admitted to the inlet of the turbine blading.

What is claimed is:

1. In a turbine, stationary turbine parts, moving parts providing a blade system having an inlet for motive fluid, some of said parts providing a chamber for full admission of motive fluid to said blade system, a conduit for conducting high temperature motive fluid to said chamber and means for conducting motive fluid of lower temperature to said chamber separately from the high temperature motive fluid and in a stream enveloping said conduit and insulating the parts of the turbine between the exterior thereof and said chamber from the high temperature motive fluid.

2. In a radial flow turbine having a blade system and a central admission chamber for full admission of motive fluid to the inlet of said blade system, means for conducting motive fluid to said central admission chamber comprising a conduit extending from the exterior of the turbine to said chamber and a second conduit enveloping the first named conduit and extending from the exterior of the turbine to said chamber, the first mentioned conduit conducting high temperature motive fluid to said chamber and the second conduit conducting motive fluid of lower temperature to said chamber in an envelope protecting the turbine parts adjacent to said conduits from the heat of the high temperature motive fluid.

3. In a turbine, a casing, means providing a blade system having an inlet for full admission of motive fluid to moving turbine blading located near the axis of rotation of the turbine, stationary turbine parts, stationary means for continuously conducting motive fluid to said blade system comprising an open unregulated conduit for high temperature motive fluid extending from the exterior of the casing to a place adjacent to said inlet and spaced from said stationary turbine parts, and means for continuously conducting an envelope of motive fluid of lower temperature through the space between said conduit and said stationary parts to protect the stationary parts from contact with the high temperature motive fluid, said conduit and said space being in communication with said inlet adjacent thereto to permit the high temperature motive fluid and the low temperature motive fluid to enter said blade system.

4. In a turbine, a casing, means providing a blade system having an inlet for full admission of motive fluid to moving turbine blading located near the axis of rotation of the turbine, stationary turbine parts, stationary means for continuously conducting motive fluid to said blade

system comprising an open unregulated conduit for high temperature motive fluid extending from the exterior of the casing to a place adjacent to said inlet and spaced from said stationary turbine parts, said conduit comprising a hollow annular distributing member for motive fluid mounted to permit freedom of expansion and contraction of the distributing member within the turbine casing and non-rotatably mounted with respect to said stationary parts, and means for continuously conducting motive fluid of lower temperature to the space between said distributing member and said stationary parts, the outlets of said distributing member and of said space being in communication with said inlet adjacent to the inlet to permit the high temperature motive fluid and the low temperature motive fluid to enter said blade system, and said outlets being arranged so that the fluid emitted from said space envelopes the fluid emitted from said member.

5. In a turbine, a blade system having an inlet adjacent to the axis of rotation of the turbine, an outer casing, a central admission chamber for full admission of motive fluid through said inlet to the moving blading of the turbine, stationary turbine parts defining a channel for flow of motive fluid of relatively low temperature extending from said casing to said chamber and a conduit within said channel and spaced from the walls thereof, said conduit extending to a place adjacent to said inlet for conducting high temperature motive fluid thereto in a stream insulated from said stationary turbine parts and enveloped by the relatively low temperature motive fluid in said channel.

6. In a turbine, a blade system having an inlet adjacent to the axis of rotation of the turbine, an outer casing, a central admission chamber for full admission of motive fluid through said inlet to the moving blading of the turbine, stationary turbine parts defining a channel for flow of motive fluid of relatively low temperature extending from said casing to said chamber and a conduit within said channel and spaced from the walls thereof, said conduit extending to a place adjacent to said inlet for conducting high temperature motive fluid thereto in a stream insulated from said stationary turbine parts and enveloped by the relatively low temperature motive fluid in said channel, said conduit being movably mounted to permit expansion and contraction thereof relative to said stationary turbine parts.

7. In a radial flow turbine having a central admission chamber, a shaft, a blade-carrying disc fixed to said shaft, stationary turbine parts around said shaft providing a chamber around said shaft, a distributing member for motive fluid within said second mentioned chamber and spaced from the walls thereof, a conduit for conducting motive fluid of relatively low temperature to said second mentioned chamber, a second conduit for conducting high temperature motive fluid to said distributing member, said second mentioned conduit being within said first mentioned conduit and spaced therefrom and said second mentioned chamber and said distributing member having outlets in communication with said central admission chamber.

8. In a radial flow turbine having a central admission chamber, a shaft, a blade-carrying disc fixed to said shaft, stationary turbine parts around said shaft providing a chamber around said shaft, a distributing member for motive fluid movably mounted within said second mentioned chamber and spaced from the walls thereof, a conduit for conducting motive fluid of relatively low temperature to said second mentioned chamber, a second conduit for conducting high temperature motive fluid to said distributing member, said second mentioned conduit being movably mounted within said first mentioned conduit and spaced therefrom and said second mentioned chamber and said distributing member having outlets in communication with said central admission chamber.

9. In a radial flow turbine of the double rotation type, two shafts adapted to rotate in opposite directions, apertured turbine discs carried by said shafts, each of said discs carrying a plurality of radial flow blade rings providing a radial flow blade system, there being a central admission chamber radially within said blade system, stationary turbine parts providing annular chambers around each of said shafts and situated axially outside of said discs, the apertures in said turbine discs providing communication between the central admission chamber and said annular chambers, a distributing member for motive fluid situated in each of said annular chambers and spaced from the walls thereof, conduits for delivering motive fluid of relatively low temperature to said annular chambers and conduits for delivering high temperature motive fluid to said distributing members, said last mentioned conduits being within the first mentioned conduits and spaced therefrom and said distributing members having outlets for delivering high temperature motive fluid through the apertures in said discs to said central admission chamber.

10. In a radial flow turbine of the double rotation type, two shafts adapted to rotate in opposite directions, apertured turbine discs carried by said shafts, each of said discs carrying a plurality of radial flow blade rings providing a radial flow blade system, there being a central admission chamber located axially between said shafts and radially within said blade system, stationary turbine parts providing annular chambers around each of said shafts and situated axially outside of said discs, said annular chambers being in communication with said central admission chamber through apertures in said shafts, a distributing member for motive fluid situated in each of said annular chambers and spaced from the walls thereof, a conduit for delivering motive fluid of relatively low temperature to each of said annular chambers and a conduit for delivering high temperature motive fluid to each of said distributing members, said last mentioned conduit being within the first mentioned conduit and spaced therefrom and said distributing members having outlets for delivering high temperature motive fluid through the apertures in said discs to said central admission chamber.

11. A radial flow elastic fluid turbine comprising oppositely rotating shafts, discs carried by each of said shafts and carrying a plurality of blade rings forming a radial flow blade system, said discs having apertures therein radially inwardly of said blade system and there being a central admission chamber axially between said discs, stationary turbine parts providing annular chambers around said shafts axially outside of said discs, radially extending labyrinth packing between said discs and certain of said stationary turbine parts, said labyrinth packing being in communication with said annular chambers, distributing members for motive fluid mounted in each of said annular chambers and spaced from

the walls thereof, means for conducting high temperature motive fluid to each of said distributing members and means for conducting motive fluid of lower temperature to each of said annular chambers, said first mentioned means being within and spaced from said second mentioned means, said distributing members having outlets for directing high temperature motive fluid through the apertures in said discs and said annular chambers delivering motive fluid of lower temperature through said apertures and to said labyrinth packing.

12. In a turbine, a shaft, a blade-carrying rotor disc mounted on said shaft and having a plurality of apertures therein for passage of motive fluid through the disc radially outwardly of said shaft to the inlet of the turbine blading, shields extending through said apertures and spaced from the walls thereof, means for supplying motive fluid of relatively low temperature to said inlet through said apertures to one side of said shields and means for supplying high temperature motive fluid to said inlet through said apertures on the opposite side of said shields, the relatively cool motive fluid flowing through the spaces between the shields and the adjacent portions of the walls of the apertures.

13. In a turbine, a shaft, a blade-carrying rotor disc mounted on said shaft and having a plurality of apertures therein for passage of motive fluid through the disc radially outwardly of said shaft to the inlet of the turbine blading, tubular shields extending through said apertures and spaced from the walls thereof, means for supplying high temperature motive fluid to said inlet through said shields, and means for supplying motive fluid of relatively lower temperature through the spaces provided between the shields and the walls of said apertures.

14. In a turbine, a blade-carrying rotor disc having apertures therein for passage of motive fluid through the disc to the inlet of the turbine blading, stationary turbine parts providing a chamber in communication with said apertures for admission of motive fluid of relatively low temperature and a distributing member for high temperature motive fluid situated in said chamber and spaced from the walls thereof, said distributing member having an outlet for discharging high temperature motive fluid through said apertures and there being guide blades in said outlet.

15. In a turbine, a blade system, parts forming an admission chamber for said blade system, parts forming a second chamber for admission of motive fluid of relatively low temperature to said admission chamber, a distributing member for high temperature motive fluid located in said second chamber and spaced from the walls thereof, said distributing member having an outlet in communication with said admission chamber and guide blades in said outlet.

16. In a turbine, stationary turbine parts forming a chamber for motive fluid of relatively low temperature, an admission pipe communicating with said chamber, a distributing member for high temperature motive fluid movably mounted in said chamber and spaced from the walls thereof and a second admission pipe communicating with said distributing member, said second admission pipe being fixed to the distributing member and located within and spaced from the first mentioned admission pipe, said admission pipes being slidable relative to each other.

17. In a turbine, stationary turbine parts forming a chamber for motive fluid of relatively low temperature, an admission pipe communicating with said chamber, a distributing member for high temperature motive fluid movably mounted in said chamber and spaced from the walls thereof, a second admission pipe communicating with said distributing member, said second admission pipe being fixed within said first mentioned admission pipe and spaced therefrom, and means providing a joint permitting relative movement between said second admission pipe and said distributing member.

18. In a turbine having a central admission chamber, a shaft, a blade-carrying rotor disc on said shaft, stationary turbine parts, packing between the shaft and the stationary parts axially to one side of the disc, labyrinth packing between the disc and the stationary parts, said labyrinth packing being on the same side of the disc as the shaft packing and means for conducting motive fluid to said central admission chamber comprising an inner channel for high temperature motive fluid and an outer channel for low temperature motive fluid enveloping the inner channel, said channels passing between said packings and the outer channel being in communication therewith.

19. In a radial flow turbine of the double rotation type having a central admission chamber, two oppositely rotatable shafts, rotor discs on said shafts, said discs being adapted to rotate in opposite directions and carrying blades forming a radial flow blade system to which motive fluid is admitted from said central admission chamber, stationary turbine parts, shaft packing between each of said shafts and said stationary turbine parts, labyrinth packing between each of said discs and said stationary turbine parts, said discs being apertured at their radially inner parts and means for conducting motive fluid to said central admission chamber through the apertures in said discs comprising a channel for high temperature motive fluid leading from the exterior of the turbine to adjacent said apertures and channels for low temperature motive fluid extending from the exterior of the turbine to adjacent said apertures and surrounding the first mentioned channels whereby to insulate the stationary turbine parts and said packings from the heat of the high temperature motive fluid.

20. A radial flow elastic fluid turbine comprising oppositely rotating shafts, discs carried by each of said shafts and carrying a plurality of blade rings forming a radial flow blade system, said discs having apertures therein radially inwardly of said blade system and there being a central admission chamber axially between said discs, and means for conducting motive fluid from the exterior of the turbine to said apertures comprising inner conduits for high temperature motive fluid and an outer conduit enveloping each of the inner conduits for conducting low temperature motive fluid, whereby to protect the turbine parts adjacent to the inner conduits from the heat of the high temperature motive fluid.

21. In a turbine, a rotor comprising a shaft and turbine blades including a blade row of relatively small diameter having an inlet for full admission of motive fluid to the turbine blading, stationary turbine parts providing a chamber around said shaft axially to one side of said inlet and in communication therewith, a stationary hollow distributing member for high temperature motive fluid located in said chamber and spaced from the walls thereof, said distributing member having an outlet at the side thereof adjacent to said

inlet for supplying said high temperature motive fluid to the turbine blading, and said chamber having an inlet for relatively low temperature motive fluid.

22. In a turbine, a rotor comprising a shaft and turbine blading including a blade row of relatively small diameter having an inlet for full admission of motive fluid to the turbine blading, stationary turbine parts providing a chamber around said shaft axially to one side of said inlet and in communication therewith, a hollow distributing member for high temperature motive fluid located in said chamber and spaced from the walls thereof, said distributing member having an outlet at the side thereof adjacent to said inlet for supplying said high temperature motive fluid to the turbine blading and said chamber having an inlet for relatively low temperature motive fluid, and radially extending stationary guide blades for guiding motive fluid discharged from the outlet of said distributing member.

23. In a turbine, a rotor comprising a shaft and turbine blading including a blade row of relatively small diameter having an inlet for full admission of motive fluid to the turbine blading, stationary turbine parts providing a chamber around said shaft axially to one side of said inlet and in communication therewith, packing around the shaft for preventing leakage of fluid from said chamber, and a hollow distributing member for high temperature fluid located in said chamber and spaced from the walls thereof, said distributing member having an outlet at the side thereof adjacent to said inlet for supplying said high temperature motive fluid to the turbine blading, and said chamber having an inlet for admitting relatively low temperature motive fluid to the space in said chamber around said distributing member whereby to protect said stationary turbine parts and said packing from the heat of the high temperature motive fluid in the distributing member.

24. In a turbine, a rotor comprising a shaft and turbine blading including a blade row of relatively small diameter having an inlet for full admission of motive fluid to the turbine blading, stationary turbine parts providing a chamber around said shaft axially to one side of said inlet and in communication therewith, a stationary hollow annular distributing member for high temperature motive fluid located in said chamber and extending around said shaft and spaced from the walls of the chamber and from the shaft, said distributing member having an outlet at the side thereof adjacent to said inlet for supplying said high temperature motive fluid to the turbine blading and said chamber having an inlet for admitting relatively low temperature motive fluid to the space in said chamber around said distributing member whereby to protect said stationary turbine parts from the heat of the high temperature motive fluid in the distributing member.

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