Dec. 31, 1929. M. SEDLMEIR 1,741,957

COOLING DEVICE FOR THE REVERSING STATOR BLADES OF TURBINES

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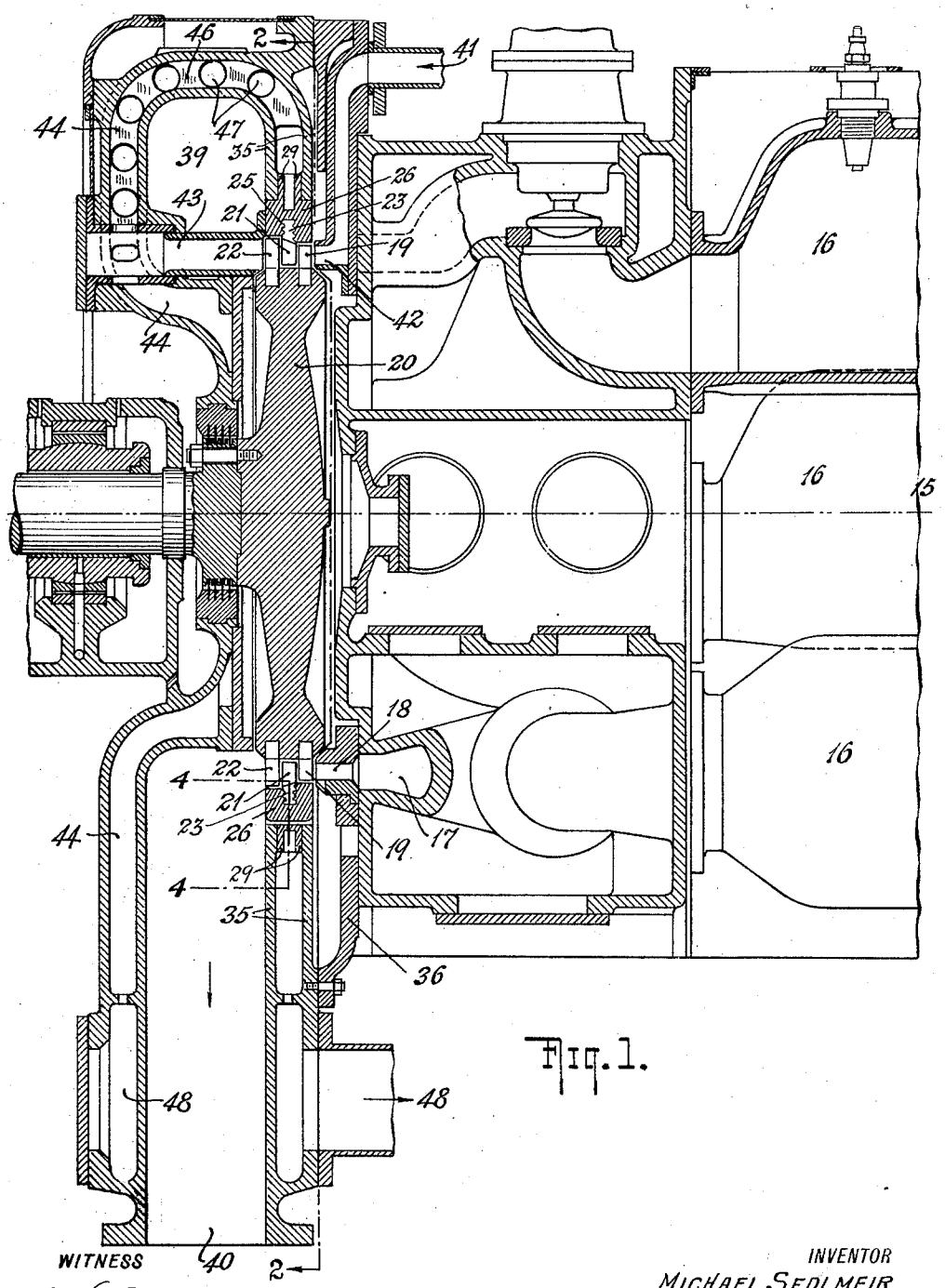


Fig. 1.

G. V. Rasmussen

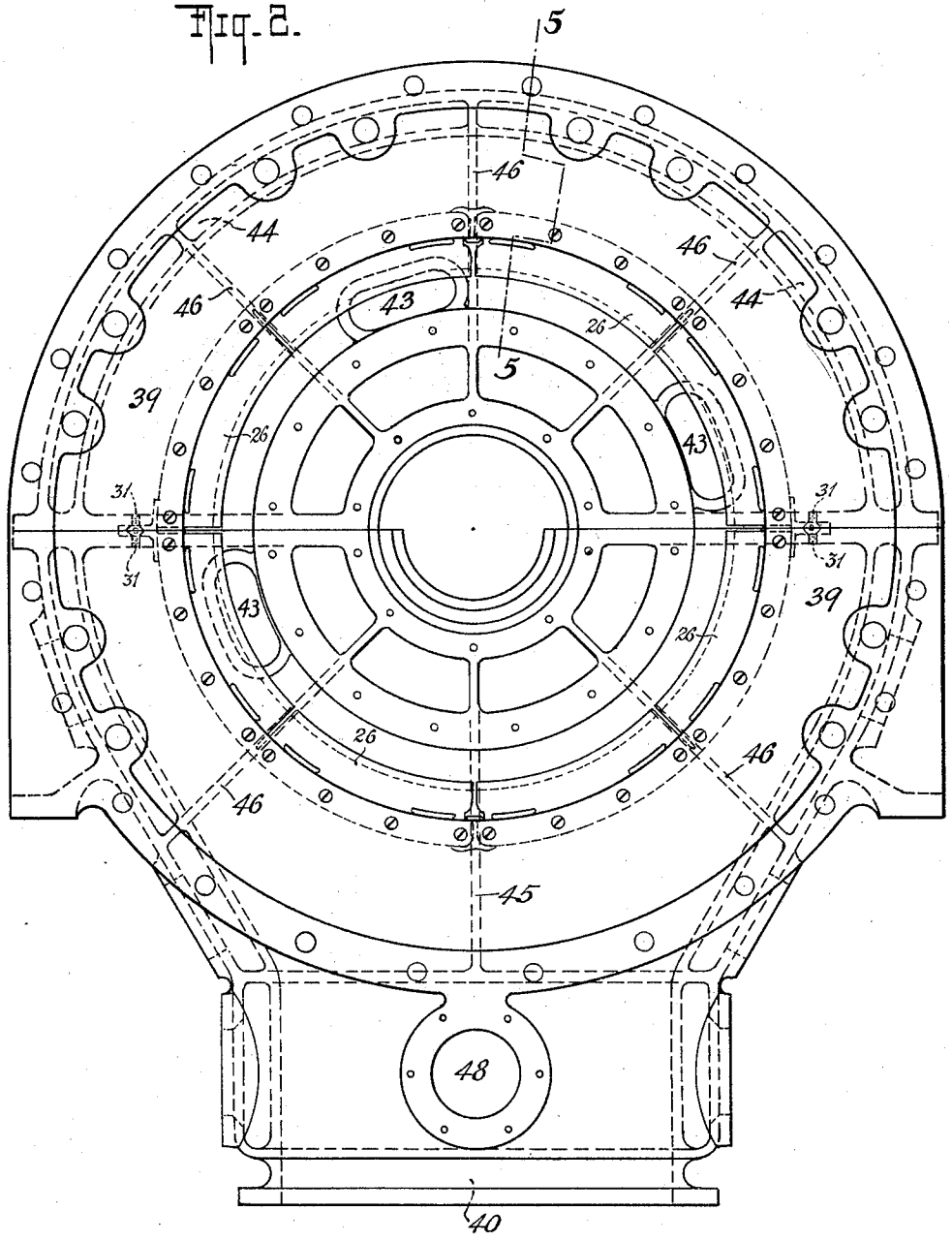
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Fig. 2.



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Fig. 4.

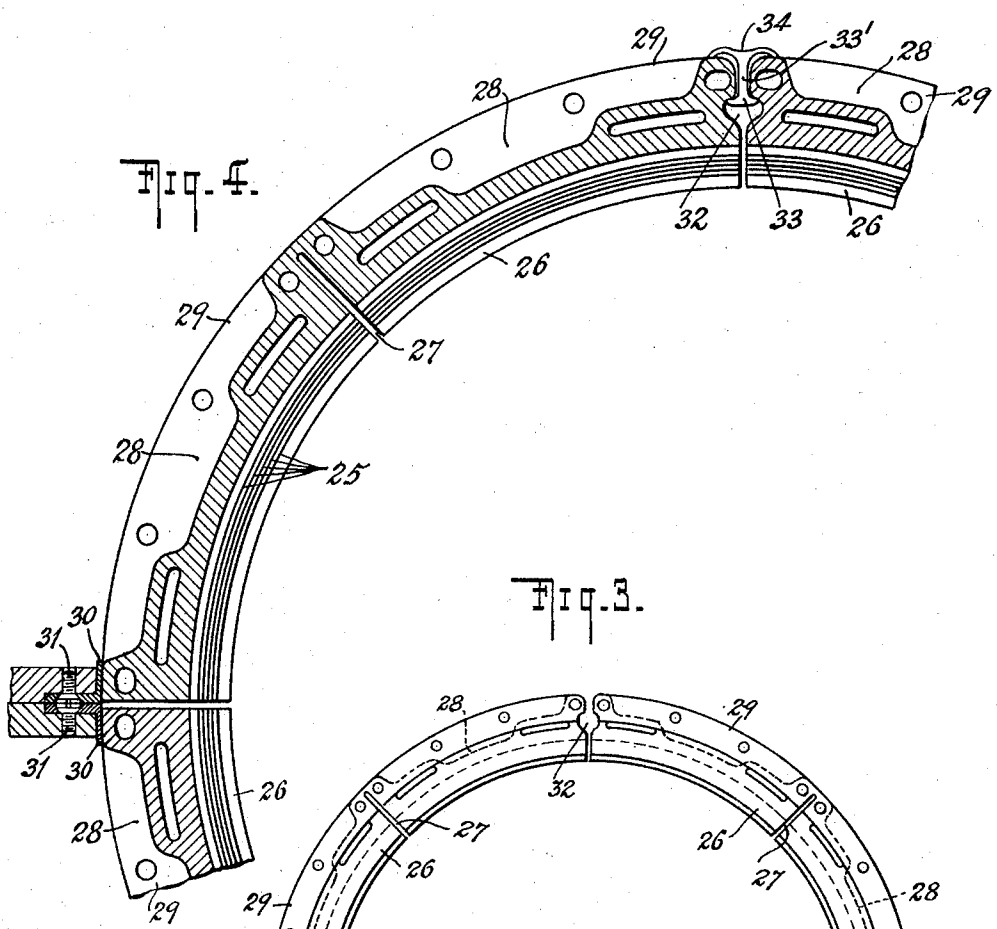
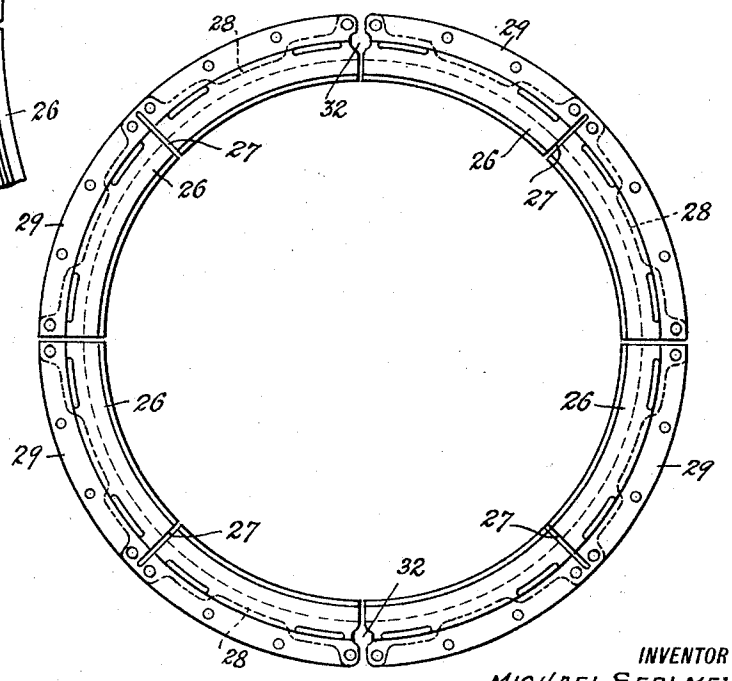


Fig. 3.



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COOLING DEVICE FOR THE REVERSING STATOR BLADES OF TURBINES

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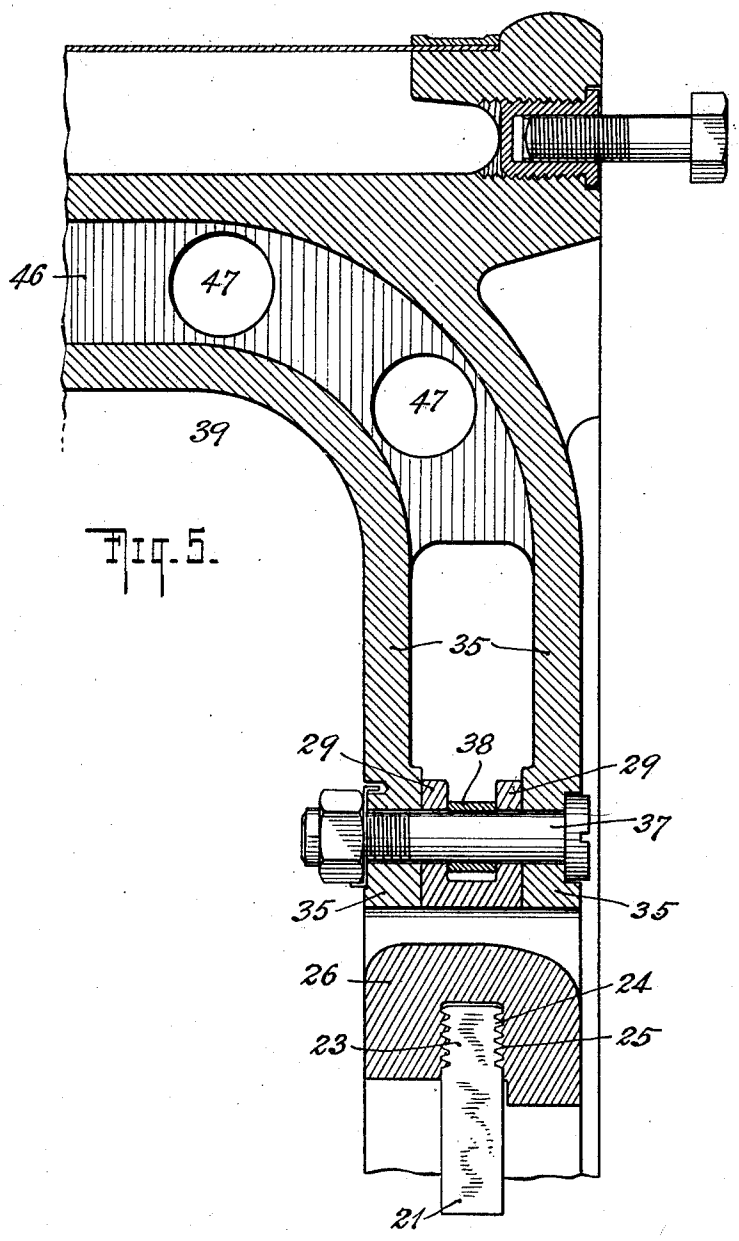


Fig. 5.

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UNITED STATES PATENT OFFICE

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COOLING DEVICE FOR THE REVERSING STATOR BLADES OF TURBINES

Application filed September 21, 1927. Serial No. 220,874.

In turbines of a certain type, the rotor is provided with a plurality of annular sets of blades on which the driving fluid acts successively, and it is customary to arrange between adjacent sets of rotor blades, a set of stator blades the function of which is to deflect or reverse the flow of said medium as it passes from one set of rotor blades to the next. The object of my present invention is to provide efficient cooling of such reversing stator blades and of the carriers or segments on which they are mounted.

Without desiring to restrict myself to the particular details illustrated, I will now describe a typical and satisfactory form of my present invention, with reference to the accompanying drawings, in which Fig. 1 is an axial section of a turbine embodying my invention; Fig. 2 is a cross-section on line 2—2 of Fig. 1; Fig. 3 is a fragmentary cross-section on an enlarged scale; Fig. 4 is a circumferential section on line 4—4 of Fig. 1; and Fig. 5 is a section on line 5—5 of Fig. 2.

At 15 I have indicated a generator of combustion gases, which may be of any suitable construction, for instance it may comprise a plurality of explosion chambers 16 with any approved conduits and valves for controlling the admission of air and fuel to said chambers and the ignition of the combustible mixture (as disclosed, for instance, in the patent to Holzwarth No. 877,194), as well as the discharge of the combustion gases through valved passages 17 to the stationary nozzles 18. From these nozzles the jets of combustion gases are delivered against the first set of rotor blades 19, secured in any suitable fashion to the rotor body 20. After passing in contact with said blades 19, the gases strike the stationary blades 21, of an inclination opposite to that of the rotor blades, so as to alter or reverse the direction of the combustion gases, and cause them to be delivered against the second set of rotor blades 22, in substantially the same manner as against the first set 19. In its general features, the employment of such reversing blades is well known in the art. The manner of supporting and cooling these blades and their carrier is however a novel feature of the construction illustrated herein.

The reversing blades 21 have attaching portions or feet 23 made at opposite sides with wedge-shaped projections or ribs 24 which are fitted into corresponding grooves 25, concentric with the rotor axis, provided in the opposing faces of inwardly-open annular chambers formed on the segments 26. The blade feet 23 are driven into place with a tight fit, so as to insure a good contact with the segments 26, which is important in order to obtain an efficient transference of heat from the blade feet to the segments 26, and a further dissipation of the heat thus transferred, as will be explained below. In the particular instance illustrated, there are four like segments 26, placed end to end to form an annular carrier for the reversing blades 23. Midway between its ends, each of these segments is provided with a slit 27 extending in an axial plane from the inner edge of the segment but terminating short of its outer edge. The inner or blade-holding portion of each segment is of much greater width than its outer portion. The latter is solid from one side to the other adjacent to the slit 27 and also at the two ends of the segment, as will be seen best from Fig. 4, but between such portions the outer surface of the segment is recessed, as indicated at 28, thus forming two parallel flanges 29. Tight joints are obtained between the ends of adjoining segments in the following manner: At two of the four joints, the adjacent ends of the segments are shown plane (in axial planes), and against these ends L-shaped packing members 30 are secured, as by screws 31. At the other two joints, the ends of the segments are recessed, as at 32, to receive the enlarged base 33 of a T shaped packing member the stem or web 33′ of which

is fitted between the outer portions of said ends while its head 34 extends over the outer surfaces of the segments, as shown in Fig. 4.

The carrier constituted by the segments 26 is held between two walls 35 of the exhaust casing which are parallel and perpendicular to the rotor axis. This casing is secured in any suitable manner to the body or ring 36 in which the nozzles 18 are provided. The segments 26 are shown fastened to the walls 35 by nuts cooperating with bolts 37, and those bolts which extend through the flanges 29 are surrounded by sleeves 38 fitted between said flanges, to prevent the latter from being bent toward each other.

The combustion gases issuing from the passages between the rotor blades 22 are discharged into an exhaust chamber 39 having an outlet 40 through which such gases are led to the atmosphere or to a device for utilizing the heat remaining in such gases, as shown in the copending application of Hans Holzwarth Serial No. 47,422, filed August 1, 1925. The exhaust chamber is practically surrounded by a chamber to which a cooling agent is supplied as will be set forth presently. The cooling agent generally employed by me is steam, the temperature of which, while high according to ordinary standards, is still considerably below that of the hot combustion gases. This steam, from any suitable source, is admitted through a pipe 41 to a nozzle 42 (or preferably a series of such nozzles, alternating with the combustion gas nozzles 18, after the type shown in the said copending application of Hans Holzwarth, Serial No. 47,422) so that the steam is discharged against the rotor blades 19 and then passes in contact with the reversing blades 21 and the other rotor blades 22, cooling all of these blades and, if the pressure of the steam be sufficient, also exerting a driving action on the turbine. Only one steam nozzle 42 is shown to avoid confusing the drawing, but it will be understood that a plurality of such nozzles may be used. As the steam issues from the passages between the rotor blades 22, it enters a catch nozzle 43, or a plurality of such nozzles, if a plurality of nozzles 42 are employed, and thus reaches the cooling chamber 44 which, as stated above, practically surrounds the exhaust chamber 39, being substantially U-shaped in axial section, as shown in Fig. 1. The exhaust casing in which the chambers 39 and 44 are contained, is made in an upper half and a lower half, and in each of these three axial partitions extend across the cooling chamber 44 to subdivide it into a plurality of compartments or sectors. One of these partitions, 45, is imperforate, but the others, 46, are made with perforations 47, preferably evenly spaced, as shown in Fig. 1. The steam entering one of these compartments through the catch nozzle 43 (or a pluraliity of such compartments, if more than one catch nozzle is provided) is thus allowed to pass to and through the other compartments. Such steam, after exerting a cooling action in the chamber 44, leaves the latter through an outlet 48 and may then be utilized further. It will be noted that the steam coursing in the chamber 44 is led quite close to the feet 23 of the reversing blades 21, particularly since the recesses 28 enable such steam to reach the interior of the ring carrying the stator blades, so that a very thorough cooling effect is obtained, as regards those blades.

Various modifications may be made without departing from the nature of my invention as set forth in the appended claims.

I claim:

1. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the blades of the same set, a stator having a set of reversing blades arranged to direct the driving medium on its way from one set of rotor blades to the next, and conduits for leading into proximity to the stator blades, the cooling medium which has traveled in contact with both stator and rotor blades.

2. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the blades of the same set, a stator having a set of reversing blades arranged to direct the driving medium on its way from one set of rotor blades to the next, a catch nozzle arranged to receive the cooling medium which has traveled in contact with both stator and rotor blades, and conduits for carrying the cooling medium from said catch nozzle into proximity to the stator blades, to exert a further cooling action thereon.

3. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, a stator having a set of reversing blades arranged between two sets of rotor blades, a nozzle for discharging a cooling medium against a set of rotor blades, toward said set of stator blades, and conduits for leading into proximity to the stator blades, the cooling medium which has traveled in contact with said stator blades and with the rotor blades at each side of said stator blades.

4. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, a stator having a set of reversing blades arranged between two sets of rotor blades, a nozzle for discharging a cooling medium against a set of rotor blades, toward said set of stator blades, a catch nozzle for receiving the cooling medium from a set

of rotor blades on the side of the stator blades opposite to the side on which is arranged the set of rotor blades against which such cooling medium is discharged, and conduits for carrying the cooling medium from said catch nozzle into proximity to the stator blades, to exert a further cooling action thereon.

5. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, a stator having a set of reversing blades arranged between two sets of rotor blades, a nozzle for discharging a cooling medium against a set of rotor blades, toward said set of stator blades, a casing provided with an exhaust chamber to receive the driving medium after it has passed in contact with the turbine blades, and with a cooling chamber surrounding said exhaust chamber and arranged to receive the cooling medium after it has passed in contact with the turbine blades, said cooling chamber extending into the vicinity of the stator blades whereby said cooling medium is directed toward said stator blades to cool the same.

6. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the rotor blades, a stationary casing provided with an exhaust chamber to receive the driving medium after it has passed in contact with the turbine blades, and with a cooling chamber surrounding said exhaust chamber and arranged to receive the cooling medium after it has passed in contact with the turbine blades, an annular carrier secured to said casing and forming a wall of said cooling chamber, and reversing stator blades secured to said carrier and arranged between adjacent sets of rotor blades so that both the driving medium and the cooling medium, during their passage from one set of rotor blades to the next, will come in contact with said stator blades.

7. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the rotor blades, a stationary casing provided with an exhaust chamber to receive the driving medium after it has passed in contact with the turbine blades, and with a cooling chamber surrounding said exhaust chamber and arranged to receive the cooling medium after it has passed in contact with the turbine blades, an annular carrier secured to said casing and forming a wall of said cooling chamber, the latter being provided with partitions subdividing it into sectors yet permitting the cooling medium to reach all of said sectors, and reversing stator blades secured to said carrier and arranged between adjacent sets of rotor blades so that both the driving medium and the cooling medium, during their passage from one set of rotor blades to the next, will come in contact with said stator blades.

8. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the rotor blades, a stationary casing provided with an exhaust chamber to receive the driving medium after it has passed in contact with the turbine blades, and with a cooling chamber surrounding said exhaust chamber and arranged receive the cooling medium after it has passed in contact with the turbine blades, an annular carrier secured to said casing and forming a wall of said cooling chamber, the latter being provided with axial partitions subdividing it into sectors, one of said partitions being imperforate while the others have openings by which adjacent sectors communicate with each other, and reversing stator blades secured to said carrier and arranged between adjacent sets of rotor blades so that both the driving medium and the cooling medium, during their passage from one set of rotor blades to the next, will come in contact with said stator blades.

9. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the rotor blades, a stationary casing provided with an exhaust chamber to receive the driving medium after it has passed in contact with the turbine blades, and with a cooling chamber surrounding said exhaust chamber and arranged to receive the cooling medium after it has passed in contact with the turbine blades, an annular carrier secured to said casing and forming a wall of said cooling chamber, said carrier being composed of segments arranged end to end and packing members at the joints between adjacent segments, and reversing stator blades secured to said carrier and arranged between adjacent sets of rotor blades so that both the driving medium and the cooling medium, during their passage from one set of rotor blades to the next, will come in contact with said stator blades.

10. In a turbine, a rotor having a plurality of annular sets of blades, a nozzle for discharging a driving medium against the blades of one of said sets, another nozzle for discharging a cooling medium against the rotor blades, a stationary casing provided with an exhaust chamber to receive the driving medium after it has passed in contact with the turbine blades, and with a cooling chamber surrounding said exhaust chamber and arranged to receive the cooling medium after it has passed in contact with the turbine blades, an annular carrier secured to said casing and forming a wall of said cooling chamber, said

carrier being recessed in its outer face to enable the cooling medium to reach the interior of the carrier, and reversing stator blades secured to said carrier and arranged between adjacent sets of rotor blades so that both the driving medium and the cooling medium, during their passage from one set of rotor blades to the next, will come in contact with said stator blades.

In testimony whereof I have hereunto set my hand.

MICHAEL SEDLMEIR.