

Feb. 5, 1924.

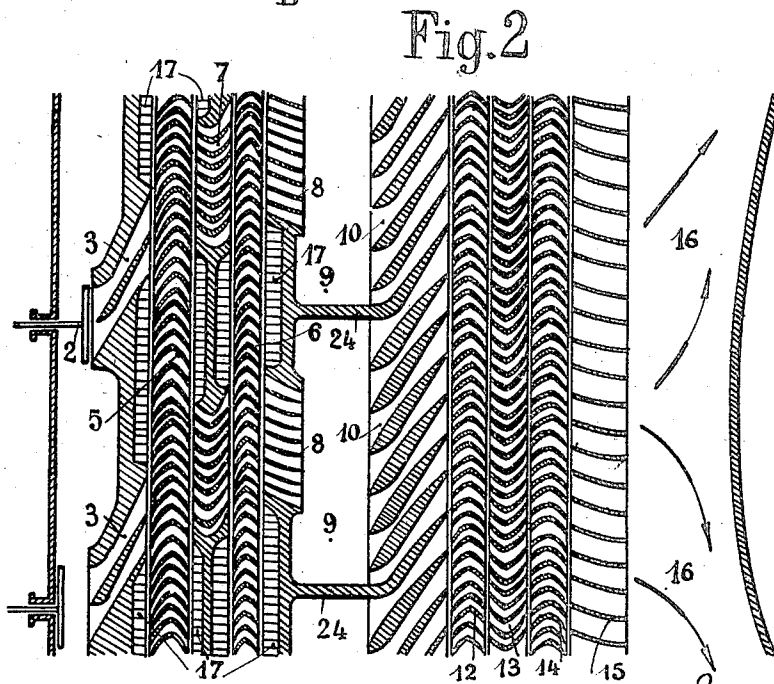
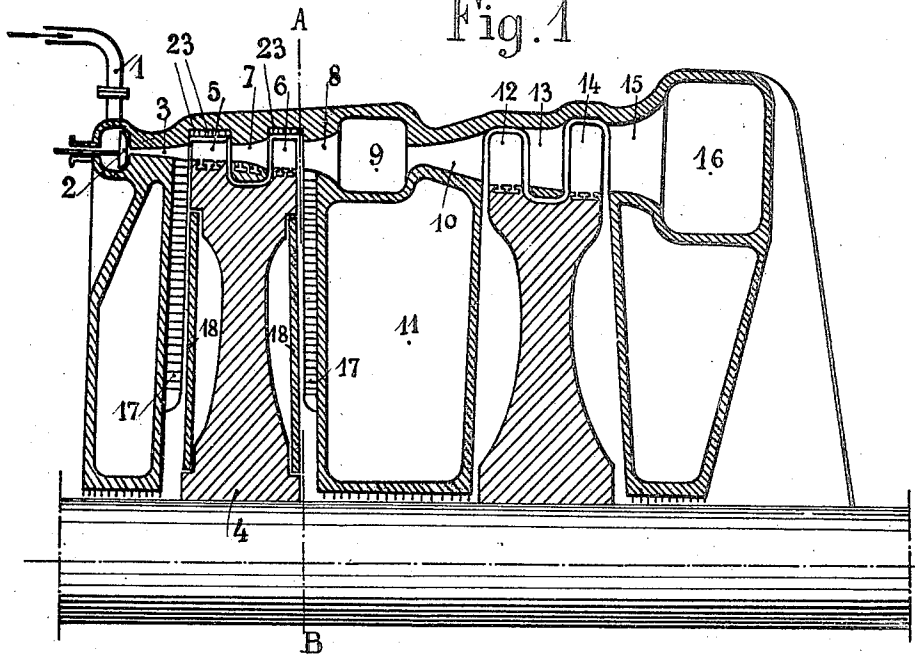
1,482,602

M. DE CONINCK

STEAM TURBINE

Filed March 9, 1921

2 Sheets-Sheet 1



Inventor:
Marcel De Coninck
by *W. H. Beeken*
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2 Sheets-Sheet 2

Fig. 3

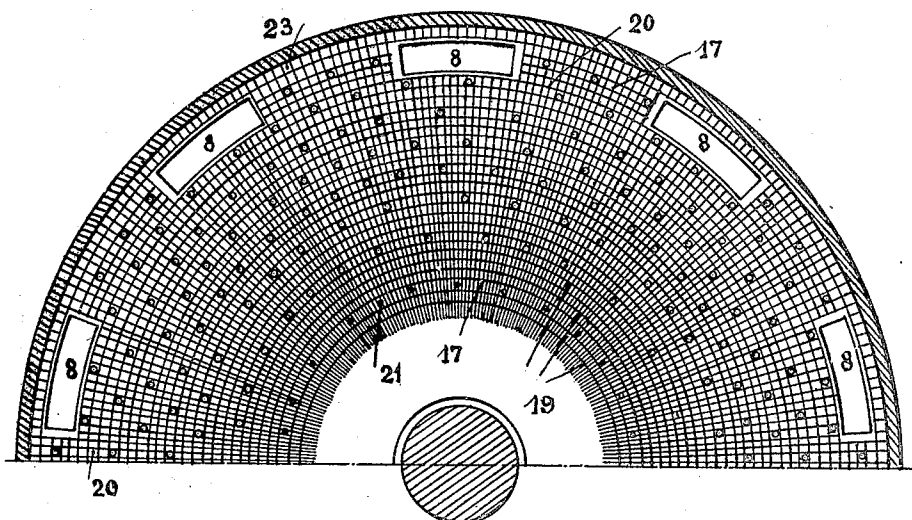
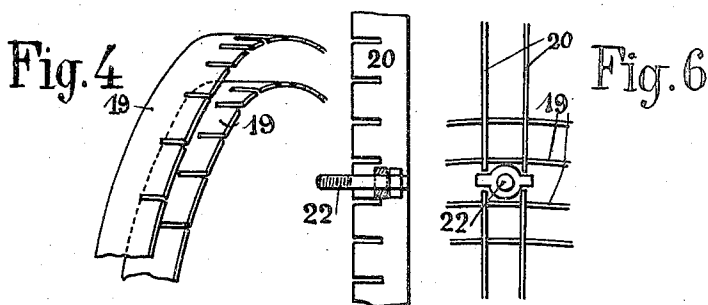


Fig. 5



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UNITED STATES PATENT OFFICE.

MARCEL DE CONINCK, OF LE HAVRE, FRANCE.

STEAM TURBINE.

Application filed March 9, 1921. Serial No. 450,864.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, MARCEL DE CONINCK, of Le Havre, Seine-Inferieure, France, have invented new and useful Improvements in Steam Turbines (for which I have filed an application in France March 5, 1920, Patent #511,142), which improvements are fully set forth in the following specification.

This invention relates to improvements in steam turbines.

According to this invention the power of the turbine is regulated by admitting steam to the turbine in a number of distinct jets and varying the number of jets in action. For this purpose at the inlet to each jet is arranged a valve or other shut-off arrangement. The power of the turbine can thus be regulated within wide limits while retaining its efficiency.

In a turbine as now made by an initial regulation of the steam as above described the object desired would not be obtained because the jets of steam are not really independent but mingle along their passage through the turbine. The speed of the steam varies with the load, unless each jet is provided at each stage of the turbine with a control valve, which would lead to great mechanical complication.

In order to obviate this and according to this invention I ensure in practice a relative independence between the different jets and limit leakage of steam between movable and fixed parts of the turbine by employing a cellular covering of the partitions between stages. The steam which may leak between the movable and fixed parts gradually loses its pressure as it travels from the acting jets towards the closed jets in which latter the pressure is approximately equal to the vacuum of the condenser.

This invention is particularly applicable to turbines having blades of great width whose high efficiency allows the turbine to be formed with a small number of pressure stages. In such turbines the losses at the blades are very small owing to the large radius of curvature of the blades; the changes in direction of the moving fluid take place more progressively and with less loss due to internal friction and shock at the inlet to the blades. The present invention allows, even at light loads for a high speed of steam being used, without prohibi-

tive impairing of the efficiency. Owing to the fact that the jets are practically independent, each jet substantially preserves during its passage along the turbine, the same flow as at full load and therefore the speed of the steam at any stage will be maintained nearly constant at all loads.

As the sum of the cross sections of the jets in such turbines is already large at the end of the first expansion, owing to the small pressure in the first stage, the jets may be subdivided without reducing the cross section of any of them too greatly, which would lead at light loads, to undue relative leakage.

On the other hand, the difference in pressure causing such leakage between jets under pressure and those which are shut off, is only a small fraction of the total drop of pressure, because the pressure drop in the first expansion nozzles represents a very large portion of it. The efficiency of the first expansion is substantially constant at the different steps of load corresponding to the different numbers of jets utilized. In the case of a two stage turbine for example, the work performed by the first expansion may represent about 50% of the total work. Leakage between the jets only affects the second expansion, that is it affects the efficiency of only about a half of the total power.

The power of the turbine may be regulated between two successive steps of load by known arrangements for throttling the inlet of steam. If the stages are fairly close together, that is if the number of jets in the turbine is sufficiently high, the values of the relative speeds, angles of incidence on the blades, etc., will not be greatly modified for the intermediate loads and the efficiency of the blades will remain satisfactory.

The invention is illustrated in the accompanying drawing as applied to a turbine having blades of great width, with two pressure stages. In the drawing, Fig. 1 is a diagrammatic half section taken through the axis of a two stage pressure turbine. Fig. 2 is a cylindrical section through the middle of the blades showing two of the steam jets. Fig. 3 is a section on the line A—B of Fig. 1. Figs. 4, 5, 6, are detailed views of the cellular covering.

The path taken by one of the jets of steam may be seen in Fig. 1.

Steam from the pipe 1 flows past the valve 2 and expands in the nozzles 3, the cross section of which at first decreases and then increases according to the law adopted in convergent divergent nozzles.

The kinetic energy stored in the steam at its outlet from the nozzle 3 is transformed into mechanical power in the wheel 4 which comprises for example two sets of blades 5 and 6, of the action type, with intermediate fixed blades 7. At its exit from the last movable blades of the wheel 4 the steam passes to the diffusing blades 8 which transforms the greater portion of the remaining speed into pressure thus reducing the losses of head caused by the change in direction of the steam in the intermediate chamber 9. The employment of such diffusing blades further allows the ratio of the tangential speed of the movable blades to the speed of expansion of the steam to be reduced without increasing the number of blade rows on the wheel. The diffusing blades 8, the intermediate chamber 9 and the blades 10 may be formed in one with the partition 11. The intermediate chambers 9 of the different jets are separated by cross partitions 24.

The steam then undergoes a second expansion in the nozzles 10, which may cover the whole periphery of the turbine.

The kinetic energy of the steam is transformed into mechanical work by blades 12, 13, 14, in the same manner as for the first expansion. After having passed through diffusing blades 15 the steam is led to the condenser through a pipe 16.

In order to prevent, so far as it is possible, steam which has entered by a nozzle whose valve is open, from penetrating to a nozzle whose valve is closed where a vacuum prevails substantially equal to the vacuum in the condenser, those walls of the stationary parts of the turbine against which the rotor moves are formed of a large number of cells 17 in which any steam which may leak between the fixed walls and the rotor gradually loses its pressure. The wheel 4 is provided with two cheeks 18 forming two faces substantially parallel to the fixed walls. For a given clearance between the wheel and the cellular cov-

ering the loss due to leakage decreases as the number of cells increases. The partitions may be formed, for example, as shown in Figs. 3 to 6, by cylindrical and radial strips of sheet metal 19, 20, slotted and fitted together to form a cellular partition secured to the fixed walls at a number of points 21 by means of screws 22.

Leakages at the periphery of the wheel are limited in the same manner by means of cellular structures 23 (Fig. 1).

At the last stage, the cellular structures may be smaller and may even be omitted, as partitioning is only required there to limit leakage due to a small pressure drop along the diffusing blades and the acting blades.

Fig. 1 shows a two pressure stage turbine, but the arrangement is also applicable to a turbine having a greater number of stages. The number of velocity stages of the wheels may also be different. The wheels may be thick and thus little liable to vibration. They may carry a certain difference of pressure between their two faces and do not therefore require apertures for equalizing the pressure which often cause cracks to start.

Claims:

1. In a steam turbine, the combination with a number of admission nozzles, of a bladed rotor, a partition having in it groups of diffusing blades, another set of directing nozzles, intermediary chambers between the said partition and the second set of directing nozzles and communicating with the said diffusing blades and with the said directing nozzles, and radial partitions between two adjacent chambers.

2. In a steam turbine, the combination with a number of admission nozzles, of a bladed rotor, a partition having in it groups of diffusing blades, another set of directing nozzles, intermediary chambers between the said partition and the second set of directing nozzles and communicating with the said diffusing blades and with the said directing nozzles, radial partitions between two adjacent chambers, and a cellular structure between two adjacent groups of diffusing blades.

In testimony whereof I have signed this specification.

MARCEL DE CONINCK.