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EXHAUST STEAM HOUSING FOR LOW PRESSURE STEAM TURBINES

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Fig. 1

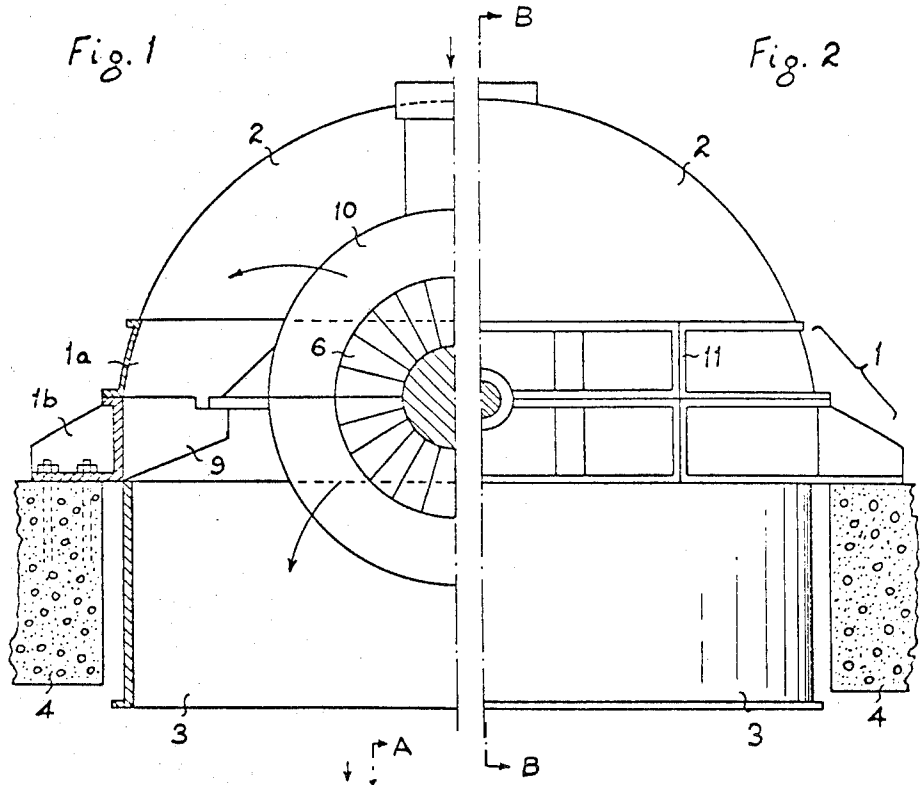
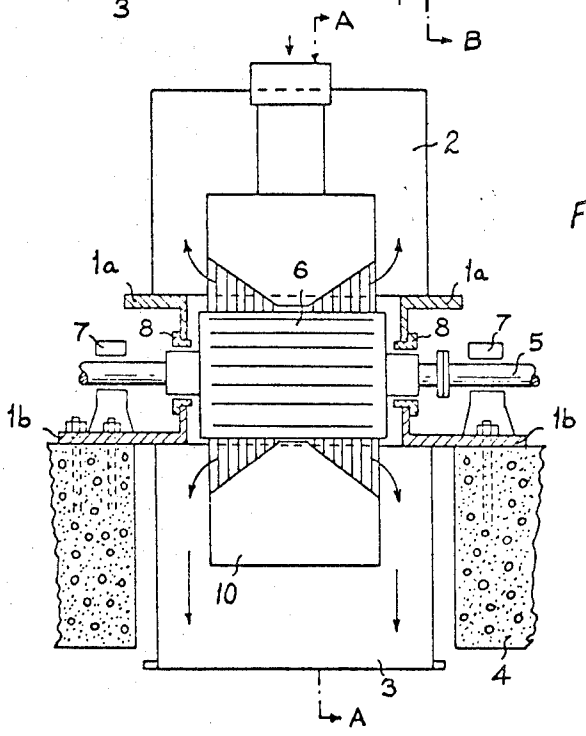


Fig. 2

Fig. 3



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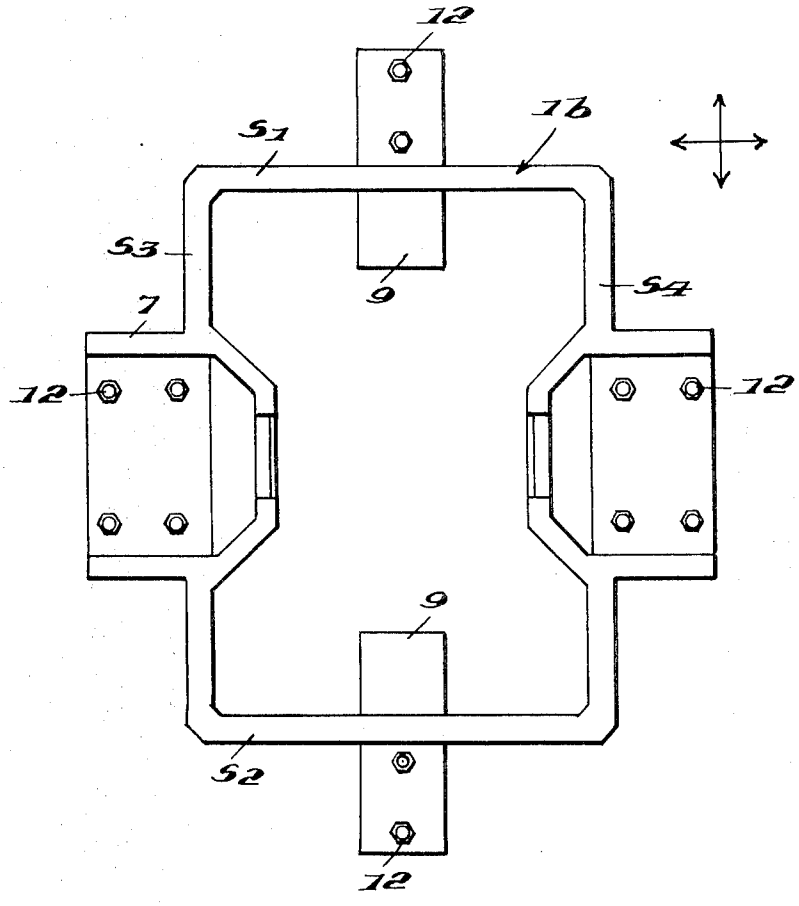
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Fig. 4.



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EXHAUST STEAM HOUSING FOR LOW PRESSURE STEAM TURBINES

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Continuation-in-part of application Ser. No. 679,436, Oct. 31, 1967. This application Jan. 14, 1969, Ser. No. 791,116

Claims priority, application Switzerland, Dec. 2, 1966, 17,293/66; Germany, Jan, 22, 1968, 1,601,841

Int. Cl. F01d 25/28

U.S. Cl. 415—134 7 Claims

ABSTRACT OF THE DISCLOSURE

The exhaust gas casing for the low-pressure section of a steam turbine is supported on the turbine foundation by way of a baseframe. In view of the relatively large dimensions involved, and in order to facilitate transport to the erection site, the baseframe is split along the horizontal axial plane of the turbine. The upper part of the frame is secured to the steam retaining jacket and the lower part of the frame is secured to the exhaust pipe. Moreover, the lower part of the frame which is essentially rectangular, is secured to the foundation at only four points intermediate respectively the four sides of the frame, the remaining portions of the frame being free to yield on the foundation in response to thermal expansion and contraction. The four fixing points are located at the oppositely disposed bearing blocks for the turbine rotor, and at the oppositely disposed supports for the stationary blade carrier.

This invention relates to an exhaust casing for the low-pressure section of a steam turbine, this section being supported on the turbine foundation by way of a baseframe, and the present application is a continuation-in-part of our copending application Ser. No. 679,436 filed Oct. 31, 1967, now abandoned.

Exhaust casings for the low-pressure section of steam turbines have in the past been made almost exclusively of grey cast iron, and this construction is still often used today. As the unit capacities of steam turbine sets have increased, so the dimensions of the exhaust casings have also become progressively larger. In consequence, their construction from grey cast iron has ceased to be economical and presents evermore serious difficulties. For the exhaust casings of high-capacity turbines therefore, it has become necessary to change over increasingly to welded construction.

Even this solution has not been satisfactory in the long term, as the construction of such large casings in welded form encountered ever greater manufacturing difficulties. The large dimensions necessitate large production machines, with correspondingly extensive workshops and powerful lifting gear, giving rising to considerable plant costs. Moving the unwieldly workpieces both in the factory and enroute to the site has also become progressively more difficult and expensive. It was found possible to avoid some of these difficulties by welding the exhaust casings together on site. Although this eliminates the need to transport very large pieces, the parts then require further working at the place of installation.

A steam-turbine casing is also known which is supported on a baseframe concreted into the foundation. With such a construction, the baseframe, which is restrained on all sides, is sensitive to thermal expansion which can lead to deformation of the frame and even serious damage to the foundation.

The principal object of the invention is to simplify transport of the exhaust casing from the place of manufacture to the erection site, eliminate on-site working and preclude deformation due to thermal expansion. In accordance with the invention this aim is achieved in that the baseframe is split in the horizontal axial plane of the turbine, the resulting upper part of the frame is attached by steamtight joints to the steam-retaining jacket, the lower part is attached also by steamtight joints, to the exhaust pipe and the lower part of the frame is fixed to the foundation at only four points, while its other parts are free to move in response to thermal expansion.

The invention is explained in more detail below with the aid of the accompanying drawings wherein:

FIG. 1 is a part of the radial section at A—A of FIG. 3;

FIG. 2 is a part of the front view;

FIG. 3 the axial section at B—B of FIG. 2; and

FIG. 4 is a plan view of the lower part of the essentially rectangularly configured baseframe showing the manner in which it is anchored to the foundation at only four points, these being at the mid-points of each of the four sides.

As can be seen from the diagram, an exhaust housing for the low-pressure section of a steam turbine in accordance with the invention consists essentially of a baseframe **1**, a steam-retaining jacket **2** and an exhaust pipe **3**. Dividing the baseframe along the horizontal axial plane of the turbine results in an upper part **1***a*, which is attached by steamtight joints to steam-retaining jacket **2**, and a lower part **1***b*, which is attached by steamtight joints to exhaust pipe **3**. The exhaust casing thus consists of two parts which are designed to be self-supporting. The lower part of the frame is supported on the turbine foundation **4**.

The turbine shaft **5**, with the bladed rotor **6**, is supported on bearing blocks **7** which are attached to the lower part of the frame **1***b*. Glands **8** for sealing the exhaust housing where the shaft passes through are mounted in the baseframe **1**, which also includes the fixed-blade carrier **10** of the low-pressure section of the turbine. Arrows not otherwise identified indicate the flow directions of the steam.

As is evident from FIG. 4, the lower part **1***b* of the essentially rectangular frame is anchored to the turbine foundation **4** at only four points: at each of the bearing blocks **7** of the turbine shaft **5** midway between two opposite sides S1, S2 of the baseframe and at the two supports **9** of blade carrier **10** located midway between the other two frame sides S3, S4. The anchoring screw bolts are indicated at **12**. With this approximately cross-wise arrangement of the points of attachment the four principal points of support intermediate along the frame sides are permitted to retain their fixed position during operation, even when thermal expansion occurs, while the remaining parts of the lower frame between these four fixing points are free to move. To avoid bending due to weight or due to forces resulting from the vacuum these parts either rest on the foundation over their whole length, or are supported only at individual points, e.g. the corners. By creating fixed points, deformation of the baseframe in the elastic mode can in no way affect the interaction between the rotor and the other components.

The baseframe is so constructed that it includes all matched surfaces for bearings, glands, etc. It is machined before the exhaust casing is assembled, and then transported to the site. The remaining parts of the exhaust casing, particularly the steam-retaining jacket and the exhaust pipes, require no special treatment; they can be erected on site and there connected to the relevant parts of the baseframe, e.g. by welding. Subsequent working is

not necessary. The two parts of the frame 1*a* and 1*b* bear on one another and are sealed in the usual way.

It is substantially simpler and cheaper to transport the baseframe in two parts than to transport the whole exhaust casing. Should the upper and lower parts of the frame still be too large and unwieldly, they are further divided as shown in FIG. 2 preferably along vertical planes **11**. These smaller parts can be fully machined with comparatively small machine tools and their transport presents no difficulties. They are joined by steam-tight seals on site, bolted together, for example, and welded internally along the joints. The two parts of the baseframe constructed in this way are subsequently treated as though they had been made in one piece.

Dividing the baseframe also greatly facilitates installation of the turbine. If the bearings and glands are contained in the baseframe, they can be designed as a single unit and there can occur no problems of alignment due to differential thermal expansion.

We claim:

1. An exhaust chamber structure for the low-pressure part of a steam turbine comprising a rigid essentially rectangular base frame which provides the support for the entire structure, a steam jacket and exhaust steam pipe, said base frame being initially sub-divided along the horizontal axial plane of the turbine thereby to form upper and lower rigid and self-supporting frame parts respectively to facilitate transport to the erection site, said upper and lower frame parts being joined together at the erection site in a steam-tight manner, said steam jacket and said exhaust steam pipe having essentially no supporting function as related to the overall exhaust chamber structure and being structurally designed only to absorb the pressure difference between the interior and exterior surfaces thereof and being joined respectively to said upper and lower base frame parts, stuffing glands carried by said base frame at opposite ends thereof for sealing the shaft of the turbine rotor, and bearings for the shaft mounted on said lower base frame part at the opposite ends thereof.

2. An exhaust chamber structure as defined in claim **1** for the low-pressure part of a steam turbine wherein said lower part of said base frame rests upon the foundation provided for the steam turbine.

3. An exhaust chamber structure as defined in claim **1** for the low-pressure parts of a steam turbine wherein one or both parts of said base frame are initially further sub-divided into sections which are thereafter connected together in a steam-tight manner.

4. An exhaust chamber structure as defined in claim **3** for the low-pressure part of a steam turbine wherein said further sub-division of the parts of said base frame takes place along vertical planes.

5. An exhaust chamber structure as defined in claim **1** for the low-pressure part of a steam turbine wherein said base frame is provided with support structure for the guide vane carrier component of the turbine.

6. An exhaust chamber structure as defined in claim **1** and which further includes means anchoring said lower base frame part to a foundation only at four points intermediate respectively the four sides of said essentially rectangular base frame, the remaining portions of said base frame being free to yield in response to thermal expansion and contraction.

7. An exhaust chamber structure as defined in claim **6** wherein said four anchoring points for said lower base frame part are located respectively at the bearings which are disposed intermediate two sides of the base frame part and at supports for a turbine blade carrier located respectively intermediate the other two opposite sides of the base frame part.

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