

[54] **UNIT CONSTRUCTION FOR TURBINE
HOUSING BOTTOMS**

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[22] Filed: **Oct. 10, 1969**

[21] Appl. No.: **865,440**

[30] **Foreign Application Priority Data**

Oct. 11, 1968 Germany.....P 18 02 482.3

[52] U.S. Cl.....**415/219, 415/199**

[51] Int. Cl.....**F04d 29/40, F04d 29/00, F04d 1/06**

[58] Field of Search.....**415/219, 134, 135, 136, 182,
415/151, 199, 108; 60/102; 290/52; 310/112, 113**

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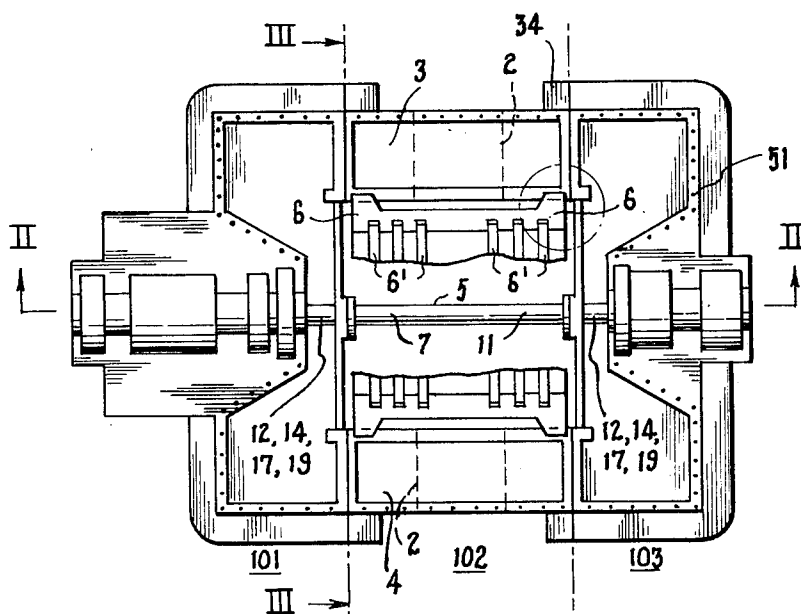
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[57]

ABSTRACT

A low-pressure turbine housing has a bottom portion composed of two separate end units joined to at least one middle unit. The units are prefabricated small enough for ease of shipment and are field assembled.

7 Claims, 10 Drawing Figures



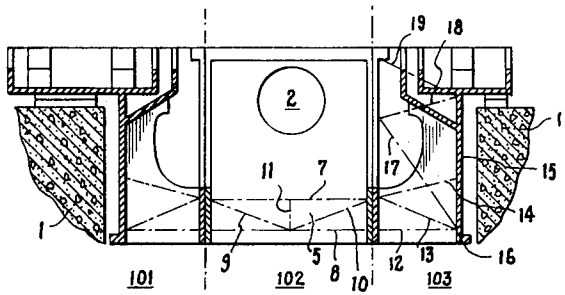


Fig. 2

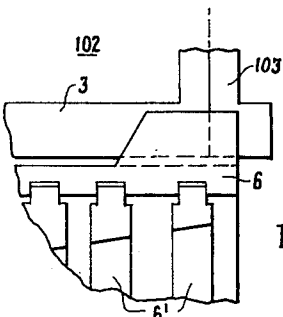


Fig. 4

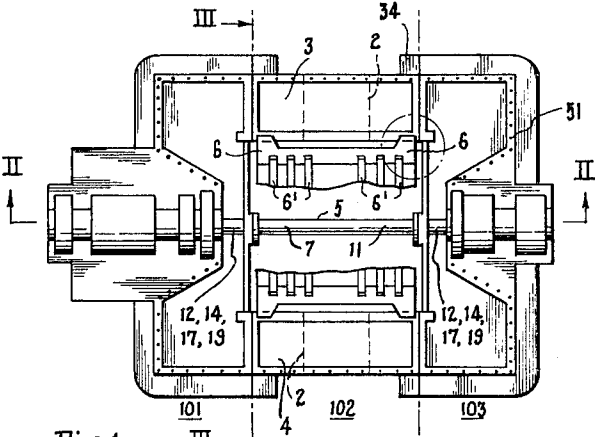


Fig. 1

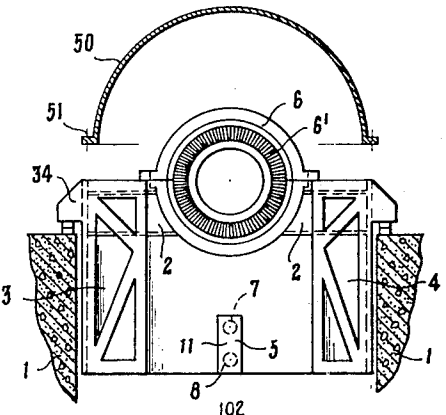


Fig. 3

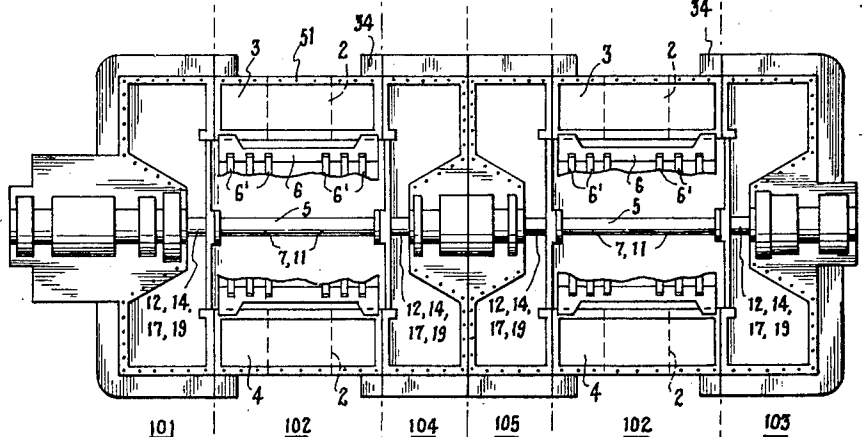


Fig. 5

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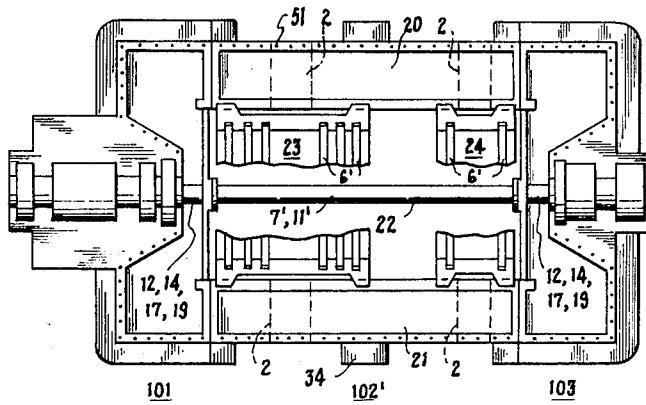


Fig. 6

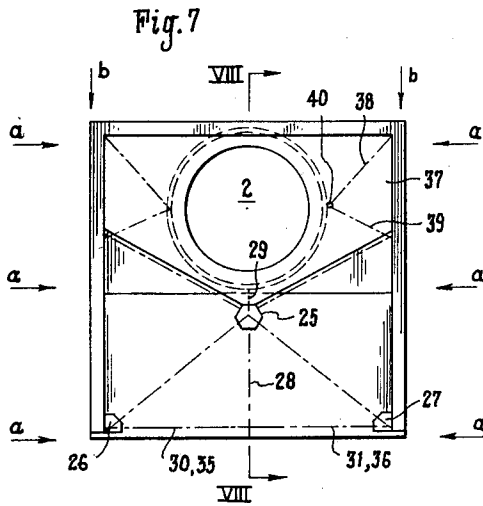


Fig. 7

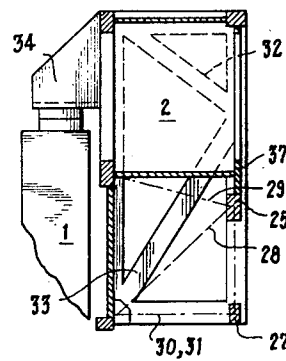


Fig. 8

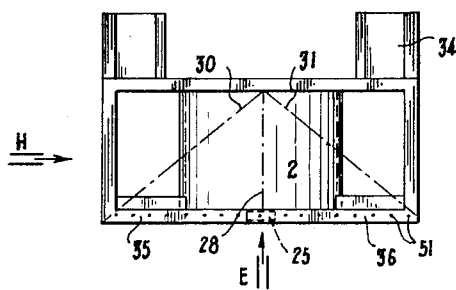


Fig. 9

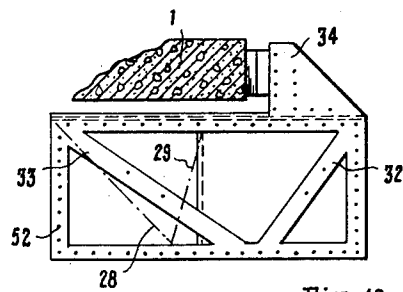


Fig. 10

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UNIT CONSTRUCTION FOR TURBINE HOUSING BOTTOMS

This invention relates to the lower or bottom portion of the outer housing for steam turbines, especially for low-pressure steam turbines which have at least two stages.

This invention further relates to the production of bottom portions for steam turbine housings and especially for low-pressure turbines having very high capacities and the production of such bottom portions in such shapes and dimensions that, for purposes of being transported, they do not exceed certain loading sizes so that it will no longer be necessary to have ready particular and costly transportation means. This is especially true for axial turbine engines having a capacity of 200 MW and more.

The dimensions of the lower portions of the ND, that is low-pressure turbine housings are substantially increased with any increase in the capacity of the turbine with the result that great difficulties are encountered in obtaining large enough transport means for the size of the turbines. Also, heretofore, another disadvantage existed in that special preparations were required for working on and mounting such large turbine housings and involving costly expenses and space.

The object of this invention is to produce a bottom portion for a low-pressure turbine housing which is composed of a plurality of units which can be prefabricated and field assembled.

In general, these objects are obtained in this invention in that the bottom portion of the housing is longitudinally subdivided into at least three independent structural units which, when the units are connected together, a middle unit lies between two front end units and is used for the reception of the interior housing and/or housings for the guide beams or several support members for the guide vanes. The individual bottom portions of the ND housing so produced can be transported without any trouble and with the normal and customary transportation means. The units can be combined without any trouble and without special preparation as desired to accommodate one, two and three or more stages or combinations of such turbines by assembling housings of the present invention longitudinally aligned according to the principle of using building blocks. In addition to the above advantages, a result is that, because of subdividing the bottom portion of the turbine housing, it is now possible to construct the individual units of the housing in an easy manner so that they are prefabricated and transferred to the job site where they can be field assembled without any additional time-consuming preparatory work involving welding which, in turn, could produce the disadvantage of warping the housing and producing internal stresses. In this invention, the individual structural units can be put together easily and can be taken apart at any time.

In the individual units of this invention, the stresses are absorbed by the inherent weight of the individual housing parts and the forces to which they are subjected are absorbed by installing axial, radial, spatial or truss reinforcing systems.

In another embodiment of this invention, two or more central structural units adjacent one another are positioned between a pair of middle units which, in turn, are joined to the front end units. In a further embodiment of this invention, the central structural unit can be made for receiving either a two stage or a two stage plus a one stage internal housing. Consequently, the ability to make such combinations or units makes it possible to keep a few of the units in storage inasmuch as they have the same form and the same dimensions.

The means by which the objects of this invention are obtained are described more fully with reference to the accompanying schematic drawings in which:

FIG. 1 is a plan view of the bottom portion of a two stage ND turbine housing;

FIG. 2 is a cross-sectional view taken on the line II—II of FIG. 1;

FIG. 3 is a cross-sectional view taken on the III—III of FIG. 1;

FIG. 4 is an enlarged fragmentary detail view of how the internal housing is positioned according to FIG. 1;

FIG. 5 is a plan view of a modified form of a ND turbine housing composed of six units;

FIG. 6 is a plan view of a modified form of the invention showing a three stage turbine housing;

FIG. 7 is a view of a modified form of the unit 3 taken in the direction of the arrow E in FIG. 9;

FIG. 8 is a cross-sectional view taken on the line VIII—VIII of FIG. 7;

FIG. 9 is a side view of FIG. 7; and

FIG. 10 is a view taken in the direction of the arrow H in FIG. 9.

The bottom portion of the ND turbine housing rests on a foundation 1 and, as shown in FIGS. 1 to 3, this bottom portion is composed of two front end units 101 and 103 and a middle unit 102 which has a steam entrance opening 2. Unit 102 is composed of the individual structural members 3, 4 and 5 which are of equal length and which receive the internal housing 6 which is schematically shown in the drawings and used for holding the guide vane support members which are not shown.

In the enlarged detail view of FIG. 4, the internal housing 6 is shown positioned to be supported by the structural member 3 of the unit 102 and on the unit 103.

In FIG. 5, the front end units 101 and 103 are combined with a pair of middle units 102 between which are two central units 104 and 105. As shown in FIG. 5, the units 102 are similar to those disclosed in FIGS. 1 to 3 and again consist of the structural members 3, 4 and 5 which are combined into one complete unit 102.

The structural members 3, 4 and 5, as shown in FIGS. 1 to 3, as well as the units 101 to 105 in FIG. 5, consist of struts formed into triangular trusses with the struts attached to gusset plates which can be positioned in the direction of the forces and stresses arising from the exterior and/or coming from adjacent units. Such bridge struts may extend most frequently in the direction of the longitudinal axis of the turbine or even diagonally to the surface plane of the side or transverse walls of the units or of their structural parts.

The structural member 5, as shown in FIGS. 2 and 3, for example, is composed of an upper chord 7 and a lower chord 8 with diagonal struts 9 and 10 and of the vertical posts 11. The front end units 101 and 103 likewise have one or more longitudinal chords 12 as well as diagonal struts 13 and 14 and with the chords 12 extending in the same direction as the chords 8 and with the diagonal struts 13 and 14 meeting at the same level as the upper end of chord 7 in member 5 and extending to the sidewall 15 of unit 101 or 103 and to a fixed point in a gusset plate 16 for connecting struts 12 to wall 15. FIG. 2 shows other truss members 17, 18 and 19 in unit 103. The struts in the other units 101 to 105 in the embodiments of FIGS. 1 to 6 are correspondingly arranged.

The bottom portion of the turbine housing in FIG. 6 is composed of units 101 and 103 between which is a middle unit 102' having structural members 20, 31 and 22 and thus has a larger axial length than the bottom portion shown in FIG. 1 so that it can receive a two stage internal housing 23 plus a one stage internal housing 24 so that it is, in effect, a three stage construction. The structural members 20, 21 and 22 in this embodiment can either be individually produced for field assembly or can be combined as a complete unit.

In FIGS. 7 to 10, the structural member 3 of the middle unit 102 of FIGS. 1 to 3 is shown resting on a foundation 1 and having the steam inlet opening 2 leading to the ND internal housing.

As shown in FIG. 7, longitudinal forces and/or stresses *a* are directed to the middle unit 102 and thus toward the structural members 3, 4 and 5, these forces coming from the two front end units 101 and 103. Other radial or transverse forces *b* are transferred by the internal housing, not shown, onto the structural members 3 and 4, such forces being produced by the inherent weight of the structural members and also by atmospheric pressure. Structural member 5 as in FIGS. 1 to 3 and 5 or member 22 in FIG. 6 are subjected first of all to lon-

gitudinal axial forces. Gusset plates 25, 26 and 27 are joined to struts 28 and 29 while the struts 30 and 31 are also joined to the gusset plates. Struts 32 and 33 extend at the same time to the sidewalls which are provided with bolt holes for connecting adjacent units together or to structural members. Supporting arm 34 of unit 3 or 4 rests on foundation 1. Chords 35 and 36 are at the bottom of the unit. FIGS. 7 and 8 show the wall 37 reinforced by struts 38 and 39 which are welded to the wall and which are connected by a joint 40 on the cylinder surrounding steam opening 2.

Having now described the means by which the objects of this invention are obtained;

I claim:

1. A steam turbine outer housing lower half bottom portion, especially for double flow and multiflow low-pressure steam turbines, comprising lower half bottom in its longitudinal extent being subdivided into at least three self-contained modular units (I, II, III) in a manner that the center unit (II) is arranged between the two end units (I, III) and to which at least one internal housing (6 or 23, 24 respectively) is joined for holding the turbine guide beams and supporting members for guide vanes.

2. A bottom portion as in claim 1, said middle unit (II) being comprised of equal length individual structural members (3, 4, 5 or 20, 21, 22) positioned between said front end units (I, III).

3. A bottom portion as in claim 2, further comprising reinforcing strut means in said individual structural members for receiving outside forces and turbine operating stresses and strains.

4. A bottom portion as in claim 3, said individual structural members (3, 4, 5 or 20, 21, 22) being combined into a single-middle unit (II).

5. A bottom portion as in claim 4, said middle unit (II) being shaped to receive multiple-stage turbine units.

6. A bottom portion as in claim 4, further comprising central units (IV, V) positioned between a pair of middle units (II).

7. A bottom portion as in claim 3, said reinforcing strut means comprising diagonal struts extending between and joined by gusset plates to top and bottom chords, and with the struts and chords of adjacent units being aligned with each other.

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