STEAM TURBINE PLANTS


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3 Claims. (Cl. 60—95)

This invention relates to steam turbine plants including steam turbines which exhaust into condensers that lie alongside the turbine as distinct from the more conventional arrangement in which the condenser is located beneath the turbine.

Apart from the improved exhaust efficiency with side mounted condensers there is also a considerable reduction in basement depth and specific loading on the foundations. These reductions represent a considerable saving in capital cost of block foundations and turbine house.

The main difficulty with side condenser schemes has been the provision of an effective and simple joint between the turbine cylinder cover and the exhaust which will permit easy removal of the covers for inspection and maintenance.

The object of the present invention is to provide a steam turbine plant including condensers arranged alongside the turbine or turbines in which the joint problem mentioned in the preceding paragraph is overcome or substantially reduced.

The invention consists in a steam turbine plant, having one or more steam turbines with one or more condensers arranged alongside the turbines, in which a plant a turbine exhaust is connected to a condenser by means of a duct the inlet of which is divided into two separate inlet portions, namely an upper inlet portion and a lower inlet portion, and with the upper inlet portion communicating with the turbine exhaust by means of a flexible duct which can be retracted in the direction of the axis of the duct to permit the upper half or cover of the turbine casing to be removed.

The invention also consists in a steam turbine plant in accordance with the preceding paragraph in which the condenser or condensers is or are mounted on rubber shear blocks.

The invention also consists in a steam turbine plant substantially as described below with reference to the accompanying drawings in which:

FIGURE 1 is an end elevation of a steam turbine plant in accordance with one embodiment of the present invention;

FIGURE 2 is a plan view of FIGURE 1;

FIGURE 3 is a section through a duct joining a turbine to a condenser being a section on line AA of FIGURE 4;

FIGURE 4 is a plan view of the duct arrangement shown in FIGURE 3; and

FIGURE 5 is a perspective view of one of the turbine casings of FIGURES 1 and 2 partially separated to show details of the connection between the turbine and the condenser.

In carrying the invention into effect in the form illustrated by way of example and referring to FIGURES 1 and 2, low pressure turbines 1 and 2 of a steam turbine plant exhaust into condensers 3 and 4 which are arranged alongside the turbines as shown. Each turbine, in the form illustrated, comprises two low pressure rotors connected "back to back" in tandem so that there are two exhausts for each turbine. The turbine exhausts are connected by ducts 5 and 6 to the condensers, duct 5 linking condenser 3 with the turbines and ducts 6 linking the condenser 4 with the turbines.

The ducts 5 and 6 are constructed in such a way that the inlet portion of each duct that is to say the portion nearest the turbine is divided into two inlet portions, namely an upper inlet portion and a lower inlet portion.

Referring to FIGURES 3 and 4 the turbine exhaust is shown at 7 and assuming that the section is through a duct 6, the upper inlet portion of the duct is shown at 6a and the lower portion at 6b.

Between the upper inlet portion 6a and the turbine exhaust 7 is a flexible duct 8 in which this duct 8 can be retracted in the direction of its axis to permit access to and removal of the upper covers of the turbines.

Bolts, rods or links 9 or a combination of these items are fitted to the opposing flanges of the duct 8 to provide means of retraction. During normal running of the turbine these bolts, rods or links transmit the vacuum load and thermal expansions between the turbine and the condenser thus relieving the bellows of these duties.

In FIGURE 5 the condensers are omitted and the upper cover 10 of the turbine removed. The parts of the turbine exhaust corresponding to parts 5a, 6a of the ducts 5 and 6 are shown at 7a and those corresponding to parts 5b and 6b at 7b.

The use of a bellows arranged as described enables the turbine covers 10 to be jointed on the turbine centre line without resorting to joints which involve simultaneous bolting of two joint faces in different planes. This also eliminates the need for highly accurate machining of corresponding faces and does not incorporate any rubber or other resilient jointing materials.

With the arrangement described above the lower parts of the ducts 5 and 6 form a rigid connection between the turbines and the condensers and expansion of the turbine casings and ducts 5 and 6 produces side thrusts on the condensers. As shown in FIGURE 1 the condensers are supported on foundation blocks 11 by means of rubber shear blocks 12 which allow for sideways movement of the condensers relative to the foundation blocks as a result of the aforesaid thrusts. Hot wells for the condenser are shown at 13.

We claim:

1. A steam turbine plant comprising at least one steam turbine, a removable upper cover for said turbine, at least one condenser arranged alongside said turbine, means defining an exhaust duct providing intercommunication between said turbine and said condenser, said mentioned means comprising wall means defining an upper inlet portion and a lower inlet portion, a flexible duct connecting the upper inlet portion to the upper cover of the turbine and means for retracting said flexible duct in the direction of its axis to permit removal of the upper cover.

2. A steam turbine plant as claimed in claim 1 and rubber shear blocks supporting said condenser.

3. A steam turbine plant including at least one steam turbine, a removable upper cover including wall means defining at least one turbine exhaust duct and one condenser arranged alongside said turbine, duct means providing an exhaust communication between said turbine and said condenser including wall means defining upper and lower portions, a flexible duct portion interposed between said upper portion and the turbine exhaust duct in said upper cover, adjustable means operable axially of said flexible duct portion for retracting said flexible duct portion in the direction of its axis to permit removal of said upper cover.

4. A steam turbine including at least one steam turbine, a removable upper cover for said turbine including wall means defining laterally spaced, oppositely-facing duct means, a condenser arranged on each side of said turbine, laterally-spaced duct means providing an exhaust communication between said turbine exhaust ducts and said condenser and each including wall means defining upper
and lower portions, a flexible duct portion interposed between each upper portion and the adjacent turbine exhaust duct in said upper cover, and means for retracting each flexible duct portion in the direction of its axis so as to permit removal of said upper cover from between said upper portions.

5. In a steam turbine plant at least one turbine comprising upper and lower housing portion including wall means defining oppositely directed pairs of upper and lower exhaust ducts, said upper housing portion being removable and including said upper exhaust ducts, a condenser arranged on each side of and spaced from said turbine and having openings therein in alignment with said exhaust ducts, laterally-spaced additional duct means providing intercommunication from said exhaust ducts and the opening in said condensers and including wall means defining upper and lower inlet channels for each condenser, flexible duct means interposed between and intercommunicating each upper inlet channel with each upper exhaust duct, and cooperatively related with each flexible duct means for retracting the same in the direction of its axis so as to permit removal of said upper housing portion from said lower housing portion.

6. In a steam turbine plant as claimed in claim 5 and supporting means for said condensers including rubber shear blocks which permit sideways movement of the condensers as effected by expansion of the respective housing portions and duct means.

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