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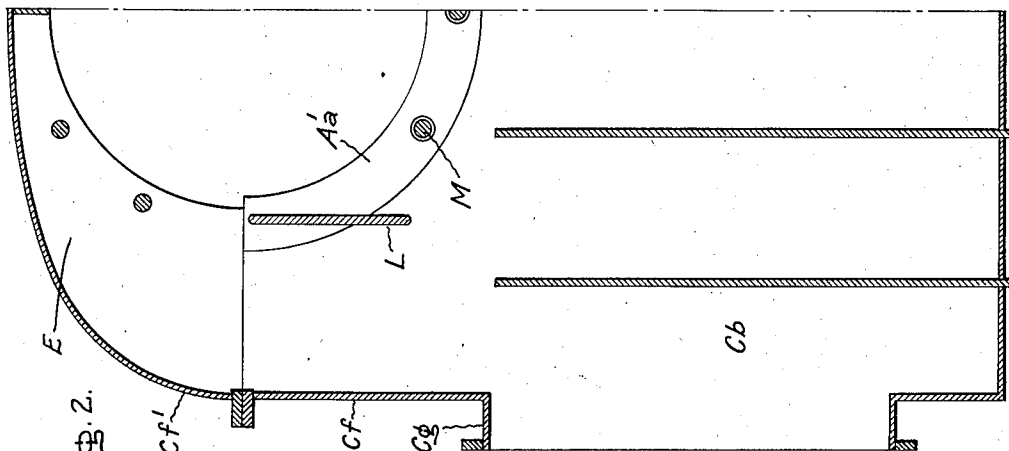
J. S. HALL

2,394,685

TURBINE INSTALLATIONS

Filed Feb. 28, 1944

3 Sheets-Sheet 1



Feb. 12, 1946.

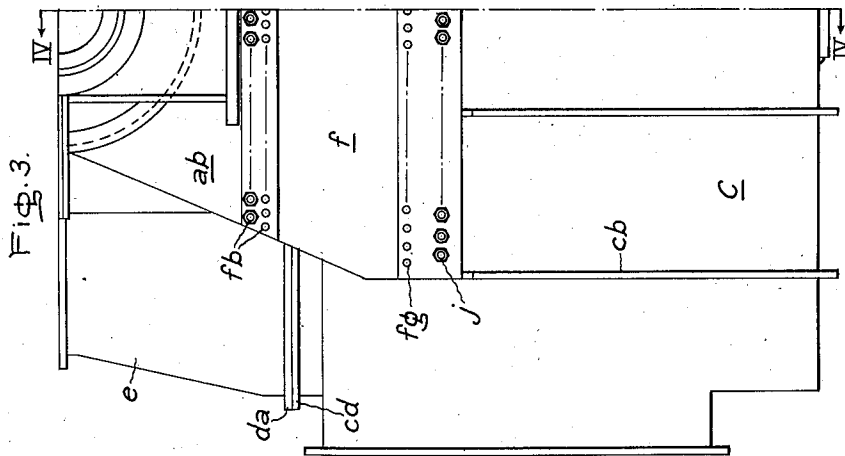
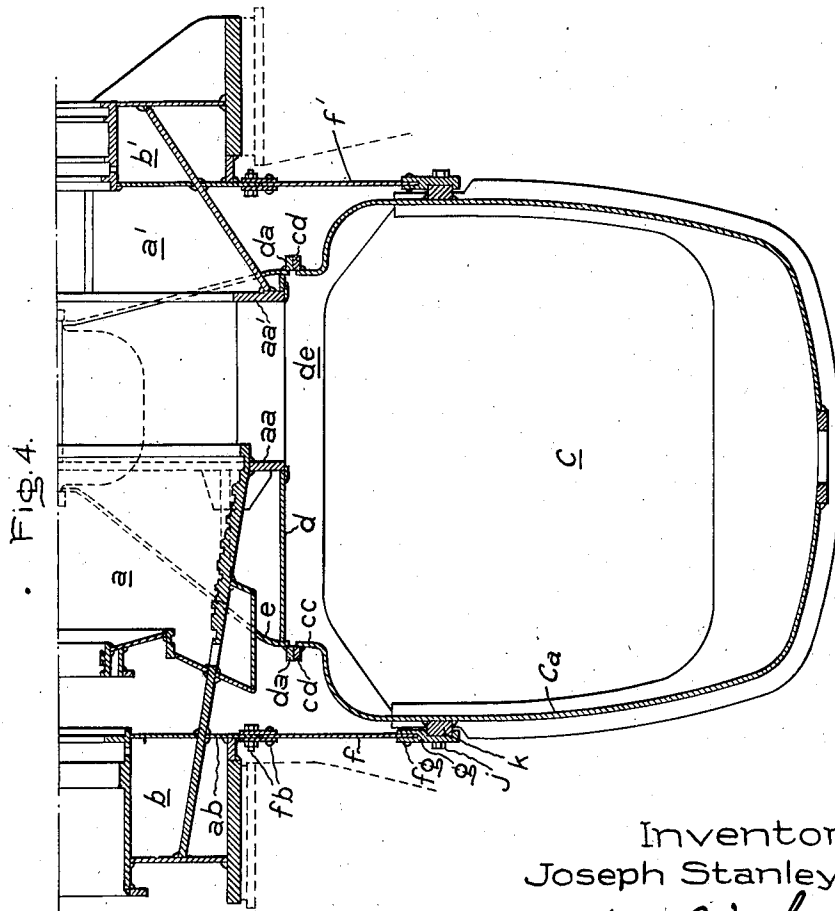
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TURBINE INSTALLATIONS

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3 Sheets-Sheet 2



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Feb. 12, 1946.

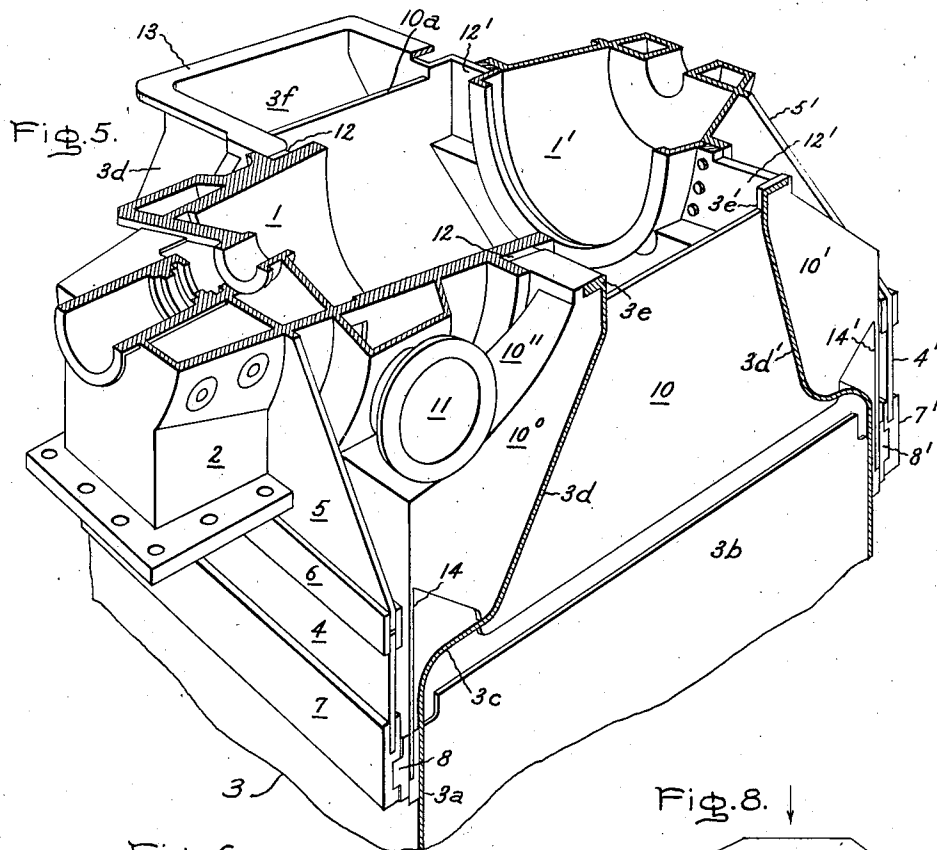
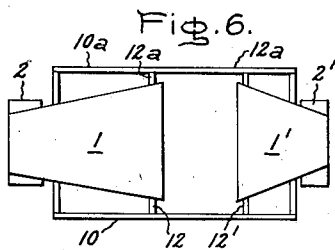
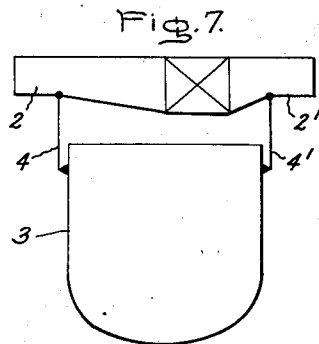
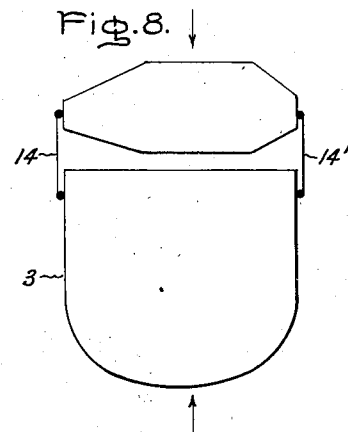
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TURBINE INSTALLATIONS

Filed Feb. 28, 1944.

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,394,685

TURBINE INSTALLATION

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Application February 28, 1944, Serial No. 524,210
In Great Britain March 29, 1943

7 Claims. (Cl. 60-95)

This invention relates to turbine installations and in particular to structural improvements therefor.

In the case of turbine installations employed in marine propulsion systems, circumstances may arise, especially in wartime, where the turbine structure is liable to be subjected to appreciable inertia forces due for instance to rapid acceleration under shock conditions. The present invention is directed, in certain aspects, to structural improvements in turbine installations, which are intended more particularly to confer upon the turbine installation great structural strength to resist such large inertia forces. However, although the invention is eminently suited in its application to turbine installations employed in marine propulsion systems, it is not limited to such application, the structural improvements being in fact advantageously applicable to turbine installations in general, and especially to such installations where fabricated construction is adopted, not only as regards increasing the inherent strength of the structure but also for securing other advantages as to accessibility and freedom from distortion in operation.

Stated generally, in a steam turbine installation according to the invention, the condenser is arranged to be supported, either wholly or mainly, by the turbine structure from locations adjacent the supports for the turbine structure.

In practising the invention, with a turbine structure in which the turbine cylinder or cylinders or equivalent casing or casings is/are arranged to be supported with the turbine axis horizontal between end mountings, the condenser may be suspended from the turbine structure by means of substantially vertical, preferably relatively flexible, plates extending transversely of the turbine axis and attached to the turbine cylinder(s) or casing(s) at locations adjacent to said end mountings. An important advantage of this arrangement is that, with the turbine structure thus virtually constituting a loaded beam which is loaded near its ends as well as end-supported, a relatively low bending-moment is assured in the region of the turbine structure substantially midway between the end mountings, namely, in the case where two turbines are mounted side by side to operate on a common horizontal axis between end mountings, that place where the turbine structure is discontinuous by reason of the turbine cylinders or casings being separated in order to form the exhaust opening.

The turbine cylinder or cylinders or equivalent casing(s) may be releasably secured to the condenser structure, as for instance being bolted to a vertical face or faces on the condenser casing, or by means of joint flanges on the turbine cylinder or casing and the condenser casing which are bolted together to form a horizontal joint, or said turbine cylinder(s) or casing(s) may be formed integrally with said condenser casing or formed separately and permanently attached thereto as by welding. However, with the condenser casing suspended from the turbine cylinder or casing and supported therefrom as described, by means of flexible plates, almost complete freedom of relative expansion and contraction in the axial direction is allowed without distortion, because of the flexibility of said plates.

The invention also provides a combined turbine and condenser structure in which the turbine casing or casings, whilst having the condenser casing connected to it either releasably or integrally so as to be supported jointly therewith between end mountings, is/are also connected to said condenser casing by flexible plates extending transversely of the turbine axis and attached to the turbine casing(s) adjacent said end mountings. With this arrangement, and the connecting plates suitably proportioned to carry inertia loads and to give the required flexibility, said plates will perform the additional function of resisting the action of atmospheric pressure tending to crush the condenser casing and turbine casing(s) together.

In carrying out the invention, the flexible plates connecting the turbine casing(s) and condenser casing as aforesaid, may be rigidly and permanently attached to the one part as by welding but releasably attached to the other part as by means of bolts or keys, or alternatively may be attached to each such part by a combination of welding and bolting or keying, whereby to permit of adjustment during assembly.

The plates for supporting the condenser structure may be as wide as desired at the part where they are attached to the condenser casing so as to provide adequate support for said condenser and, where attached to the turbine casing(s), may be made to conform with the width of the seating, be it relatively narrow, as is generally the case in marine practice, or relatively wide.

The aforesaid and other structural improvements according to the invention are eminently applicable to low pressure steam turbine installations such for instance as are commonly used in marine propulsion plant, namely of the type

in which two turbines, say one for ahead running and the other for astern running, are arranged facing each other on a common axis between end mountings and so that both turbines discharge into the same exhaust space.

In turbine installations of the type just referred to, however, where the condenser is arranged to be supported from the turbine cylinders or casing, it is important that the gap between the cylinders or portions of casing for the respective turbines should be bridged in a manner which, whilst ensuring the necessary structural strength, yet involves minimum impediment to the flow of exhaust steam from the turbines. With this end in view, according to a feature of the invention stiffening ribs in the form of plates arranged vertically and elongated in the axial direction of the turbines may be rigidly attached, as by welding, to that part of the turbine casing which overhangs into the exhaust space proper; in an alternative, but equivalent, arrangement the two cylinders or portions of the casing enclosing the respective turbines may be connected together by means of one or more tie-bars; in some cases the desired result can be achieved by a combination of stiffening ribs and tie-bars. However, in some cases the necessary structural strength may be obtained without the use of stiffening ribs and tie-bars but by a special construction hereinafter to be described. Usually the condenser structure will include "sagging" plates. Accordingly, where vertical stiffening ribs are provided as aforesaid, it is important that they should be so mounted in the exhaust space as to have clearance with the condenser sagging plates and so that such clearance shall be maintained in spite of expansion of the stiffening plates since the latter may well become appreciably hotter than the condenser casing and outer structure, especially when for instance the astern turbine is in operation.

With the turbine cylinder(s) and exhaust casing connected to the condenser casing as described, it may in some cases be desirable to make provision for some degree of relative contraction and expansion in the vertical direction between the turbine casing and the condenser casing transversely of the turbine axis. According to a subsidiary feature of the invention, such provision is made in the form of a substantially horizontal strip extending all round the upper wall of the condenser casing with which it is attached, or integral, this strip being also attached to the turbine casing and being sufficiently flexible to "breathe"; with the greater freedom for vertical differential expansion and contraction thereby enabled, the tendency for distortion will be minimized.

In some cases the shell or outer casing of the condenser may be continued up to the horizontal turbine joint in order to meet the exhaust belt of the upper half cylinder, the wall of the exhaust space being thus virtually integral with the condenser shell. However, in other instances it may be convenient or desirable to provide horizontal joint flanges on the condenser shell and the turbine exhaust passage, which flanges may be welded or bolted together.

Certain of the above and other features of the invention are embodied in combined turbine and condenser structures hereinafter described and particularised in the appended claims.

In order that the invention may be fully understood and carried into effect, three specific embodiments thereof will now be described, by

way of example, with reference to the accompanying somewhat diagrammatic drawings, in which:

Figure 1 is an axial section of one form of combined turbine and condenser structure in accordance with the invention, and

Fig. 2 is a transverse section taken along the line II—II of Fig. 1;

Fig. 3 is a half end elevation, and Fig. 4 a transverse section along line IV—IV of Fig. 3, for another form of combined turbine and condenser structure according to the invention, as seen with the part above the turbine axis omitted; and

Fig. 5 is a partly broken perspective view of another form of combined turbine and condenser structure according to the invention, parts above the turbine axis being omitted, while

Figs. 6, 7 and 8 are respective line diagrams explanatory of the structure shown in Fig. 5.

It will be appreciated that in the interests of clarity, the rotational parts, and others, of the turbines have been omitted from the drawings, their construction being well understood and their detailed description being considered unnecessary for the purpose in view.

Referring first to Figs. 1 and 2, at A is indicated, somewhat generally, the upper and lower half-cylinders, or casing, of a low pressure steam turbine, while at A' is represented, also somewhat generally, the upper and lower half-cylinders, or casing, of a high pressure turbine; as shown, the turbine casings A, A' are mounted in side-by-side relationship between supporting end pedestals B, B' respectively so that the turbines operate about a common horizontal axis and discharge into a common exhaust opening, for which purpose said casings A, A' are attached in customary manner at their outer ends to said pedestals B, B' respectively so that the turbines operate about a common horizontal axis and discharge into a common exhaust opening, for which purpose said casings A, A' are attached in customary manner at their outer ends to said pedestals B, B' while being arranged at their inner ends to form said exhaust opening.

It will be appreciated that the turbines represented by casings A and A' respectively may, for example, be such as commonly employed in marine propulsion installations, the high pressure turbine A' generally to provide the drive for ahead running and the low pressure turbine to provide the drive for running astern.

Located vertically beneath the turbines is a condenser C, represented by its side wall or shell Ca and customary sagging plates Cb, for receiving, and condensing, the steam exhausted from the turbines. In the embodiment shown, that portion Cc of the condenser shell at the top has attached to it two upstanding flanges Cd and Cd' respectively bounding the opposite axial ends of opening Ce through which the exhaust steam passes into the condenser; the flange Cd is releasably secured along a vertical face by studs D to a vertical face of a flange Aa attached to the lower half-cylinder of turbine casing A, while the flange Cd' is likewise secured by studs D' to a flange Aa' attached to the lower half-cylinder of turbine casing A'. On opposite sides of the turbine axis, the condenser shell Ca is continued from the upper wall Cc to provide a wall Cf bridging the gap between the lower half-cylinders of casings A, A' and extending up to the level of the turbine axis where it terminates in a joint flange adapted for attachment to a like

flange in which terminates a wall *Cf'* extending across the gap separating the inner ends of the upper half-cylinders of casing *A, A'*, the arrangement being such as to provide an exhaust steam belt *E* all around the inner ends of the turbine cylinders for ducting exhaust steam through exhaust opening *Ce* into the condenser *C*.

In addition to the connection between the condenser *C* and the turbine casings *A, A'*, as just described, the condenser *C* is connected to the turbine casings *A, A'* in a manner such that the weight of the condenser is almost wholly taken up by the turbine casings *A, A'* at locations whereat said casings are themselves supported by the end pedestals *B, B'*. For this purpose, there depends, substantially vertically from the location at which the lower half-cylinder *A* is attached to pedestal *B*, a plate *F* disposed with its general plane extending transversely of the turbine axis, said plate *F* being of such composition as to be appreciably flexible in the direction transverse to its general plane, and terminating at its lower end in a transverse reinforcement *G* which is releasably attached, by a horizontal key *H* and studs *J*, to a bar *K* fast with the side wall *Ca* of the condenser; likewise, at the other end of the turbine axis there depends from the location of attachment of the lower half-cylinder *A'* to the end pedestal *B'*, a preferably flexible plate *F'* terminating in reinforcement *G'* which is attached by key *H'* and studs *J'* to a bar *K'* fast with the condenser side wall *Ca*.

It will be understood that the plates *F, F'* will be appropriately sized for the purpose in view, preferably being each of width such as to extend over substantially the whole dimension of the condenser *C* in the direction transverse to the turbine axis and being shaped at the upper end to conform with the shape of the turbine casing *A* or *A'* at the location of attachment of the latter to the end pedestal *B* or *B'*.

With the turbine structure supported at its ends and loaded by the condenser structure near the turbine end supports, the combined turbine and condenser structure may virtually be considered as a beam supported at its ends and loaded at or near its end supports, an arrangement having an inherently low bending moment centrally of the supports, which, be it noted, is the region where the turbine casing is virtually discontinuous inasmuch as the turbine casing *A, A'* are separable parts though connected by the exhaust belt. Moreover, by connecting the condenser to the turbine structure through the vertical plates *F, F'*, and at the vertical faces of flanges *Cd* and *Cd'*, the turbine structure can as a whole freely expand and contract relatively to the condenser structure in the general direction of the turbine axis. Further, the plates *F, F'* have an important function in increasing the resistance of the structure to collapse under the tendency of atmospheric pressure to crush the turbine casing and the condenser casing together.

In the construction shown in the drawings, the side portion *Ca* of the condenser casing is joined with the condenser upper wall *Cc* and exhaust belt wall *Cf* through a preferably integral intermediate and substantially horizontal strip portion *Cg* extending all around said upper wall. With this substantially horizontal strip *Cg* formed so as to be sufficiently flexible as to be capable of flexing or "breathing" during relative contraction and expansion in the vertical direction between the turbine casings *A, A'* on the one hand,

and the condenser casing *Ca* on the other hand, the tendency for the structure to become distorted due to such contraction and expansion is minimised.

With a view to improving the strength of the structure whilst involving but minimum impediment to the flow of steam from the turbines through the exhaust belt *E* into the condenser opening *Ce*, the turbine casings *A, A'* may be connected together internally by stiffening ribs *L* each in the form of a plate arranged with its general plane substantially vertical and having opposite ends rigidly attached, as by welding, to the casings *A, A'* where they overhang the exhaust space *Ce*.

Where such vertical stiffening plates *L* are provided as described, they are mounted as shown so as to have appreciable clearance with the tops of the condenser sagging plates *Cb* and so that such clearance shall be maintained notwithstanding expansion of the stiffening plates *L* in the downward direction; this is essential since the stiffening plates *L* may well become appreciably hotter than the condenser structure as for example when the exhaust turbine is alone in operation as for astern running.

As an alternative, but preferably in addition, to the provision of the stiffening plates *L*, the turbine casings *A* and *A'* may be connected together by means of tie-bars *M* extending in the direction of the turbine axis, one or more such tie-bars *M* being conveniently arranged as shown to connect together the aforesaid flanges *Aa* and *Aa'* attaching the condenser to the turbine structure.

It is to be understood that the drawings are purely diagrammatic as to the details of the turbine structure and its supports and that the turbine casings *A, A'* as well as the supporting pedestals *B, B'* may be either of cast construction, or fabricated, the benefits of the invention being secured with either method of construction.

The embodiment of the invention illustrated in Figs. 3 and 4 is substantially similar to that just described, in that it involves two turbine casings *a, a'* mounted side-by-side to provide a common horizontal turbine axis, between supporting end pedestals *b, b'*, and a condenser *c* suspended beneath the turbine casings with its weight mainly taken up by, preferably flexible, plates *f, f'* depending, with their general planes substantially vertical and transverse to the turbine axis, from the locations whereat the casings *a, a'* are attached to the pedestals *b, b'*; as shown, plate *f* is attached at its upper end by rivets and bolts *fb* to a plate *ab* which takes part in the attachment of casing *a* to the pedestal *b* and extends substantially up to the level of the turbine axis and, with the plate *f*, is tapered to conform with the shape of the lower half-cylinder of casing *a*, while said plate *f*, at its lower end, is attached by rivets *fg* to a reinforcement *g* which extends over an appreciable width of the condenser *c* (Fig. 3) and is, in turn, attached by bolts *j* to a bar *k* fast with the side wall *ca* of the condenser casing; attachment of plate *f'* is effected in similar manner.

In this embodiment, the condenser side wall *ca* is formed all around its upper edge with a vertical flange *cc* terminating in a horizontal joint flange *cd*. The horizontal joint flange *cd* is attached, by welding or otherwise, to a corresponding flange attached to a substantially horizontal wall *d* apertured to provide exhaust opening *de* for admitting exhaust steam into the condenser, said opening being bounded at opposite axial ends

by flanges aa and aa' fast with the turbine casings a and a' respectively; a wall e extends from the joint flange da and bridges the gap between the inner ends of the turbine casings a, a' so as to form the exhaust belt leading to the upper half-cylinders of casings a, a' .

It will be understood that the turbine casings a, a' may be rigidly connected together by stiffening ribs and/or the bolts as described for the embodiment illustrated in Figs. 1 and 2; moreover, the details of the turbine casings and their supports may be carried out either in cast or fabricated construction. The principles of construction, and attendant advantages, specifically referred to in connection with the embodiment illustrated in Figs. 1 and 2, except as regards the special provision (Figs. 1, 2) for enabling relative movement of the turbine and condenser structures in the vertical direction, apply to the embodiment illustrated in Figs. 3 and 4.

In the embodiment of the invention shown in Fig. 5 and to which the explanatory diagrams of Figs. 6, 7 and 8 relate, a low pressure steam turbine and a high pressure steam turbine, as represented by their lower half-cylinders 1, 1' respectively, are mounted in side-by-side relationship and so as to have a common horizontal axis, between respective end pedestals 2, 2' (of which only the pedestal 2 appears in Fig. 5) and arranged to discharge into a common exhaust space. Thus, the half-cylinders 1, 1' are attached at their outer ends in customary manner to the supporting end pedestals 2, 2' whilst between their inner ends is a gap which is bridged in manner later to be described so as to form the exhaust space. It will be realised that the turbine casings and the pedestal supports may be either of fabricated or cast construction.

Located beneath the turbine casings 1, 1' is a condenser 3 for receiving exhaust steam discharged from the turbines, said condenser having a casing consisting of side wall 3a (shown broken away in the foreground of the drawings to reveal sagging plate 3b), a substantially horizontal, and conveniently integral, strip 3c extending all around the upper edge of the side wall, together with, conveniently integral, walls 3d, 3d' converging together as they rise substantially to the level of the turbine axis where they terminate in flanges 3e, 3e'; the walls 3d and 3d' are joined with the inner ends of the lower half-cylinders of casings 1, 1' thus to flank the gap between same, and the wall 3d is joined to the wall 3d' on opposite sides of the turbine axis so as to bridge said gap and form an enclosing belt for conducting exhaust steam into the condenser (part of this exhaust belt is shown at 3f, the part which would normally appear in the foreground of the drawings being broken away at the sectioned parts of the condenser casing 3a and its extensions 3d, 3d').

The condenser 3 is suspended from the turbine casings 1, 1' by means of flexible plates 4, 4' disposed at opposite axial ends of the turbine structure with their general planes substantially vertical and transverse to the turbine axis, said plates 4, 4' being attached by vertical webs 5, 5' respectively to the respective turbine casing half-cylinders 1, 1' adjacent the locations at which the latter are themselves attached to the end pedestals 2, 2'; more particularly, as shown for the plate 4, the latter is attached at its upper end to a transverse reinforcing bar 6 in which terminates the web 5. The plates 4, 4' terminate at their lower ends in transverse reinforcing bars 7, 7'

which are keyed horizontally to bars 8, 8' which, in turn, are secured to the side wall 3a of the condenser at opposite axial ends thereof; the attachment of the plates 4, 4' to the bars 8, 8' may also involve screws, rivets or welded joints.

As shown, the vertical plates 4, 4' extend over an appreciable dimension of the condenser 3 transversely of the turbine axis and it is contemplated that they will be of such size as to be capable of carrying between them substantially the whole weight of the condenser; they are moreover preferably flexible in the direction of their general planes, that is in the longitudinal direction of the turbine axis.

Located on opposite sides of the turbine axis are plates 10 and 10a respectively, said plates being disposed with their general planes substantially vertical and parallel with the turbine axis. As shown for the plate 10 in the drawing, each such plate is relatively deep, extending substantially from the level of the turbine axis down to the level of the horizontal portion 3c of the condenser casing but somewhat short of the top edge of the sagging plate 3b. Moreover, as shown for the plate 10, the plates are continued fore and aft beyond the inclined extension walls 3d, 3d' of the condenser casing; in some instances each such plate may be formed in one piece although in other instances they may be formed each in three separate pieces represented in the drawings for plate 10 by a main central piece terminating at the inclined walls 3d, 3d' and fore and aft flanking pieces 10⁰ and 10' respectively extending to locations just short of the vertical webs 5 and 5'. The plates 10 and 10a are of general hog-back shape so as to clear the steam inlet pipes to the turbines; in the drawings, the flanking piece 10⁰ is shown as clearing the steam inlet 11 associated with turbine casing 1.

The fore-and-aft plates 10, 10a are secured to the inner ends of the turbine casings 1, 1' by respective plates 12, 12', conveniently of substantially inverted yoke, or saddle, shape, disposed with their general planes transversely of the turbine axis and conveniently attached by bolts to flanges on the respective lower half-cylinders 1, 1'.

With the arrangement described, it will be seen that the fore-and-aft plates 10, 10a, together with transverse plates 12, 12' bridge the gap between the inner ends of the turbine casings 1, 1' in manner to confer mechanical strength to the turbine structure in the fore-and-aft direction of the turbine axis. Moreover, said plates 10, 10a, being flanked by the condenser casing extensions 3d, 3d', act therewith to close the gap between the turbine casings 1, 1' and form that part of the aforesaid exhaust belt for ducting exhaust steam from the lower half-cylinders of the turbine casings 1, 1' into the condenser 3; also, said plates 10, 10a, together with the extensions of casing walls 3d, 3d' lying on the outer sides of said plates, form therewith that part 3f of the exhaust belt for ducting exhaust steam from the upper half-cylinders of casings 1, 1' into the condenser 3.

The transverse plates 12, 12' for attaching the fore-and-aft plates 10, 10a to the turbine casings 1, 1' need only be short horizontally, and being therefore practically free from bending transversely of the turbine axis, can be relatively shallow; with casings 1, 1' thus attached to the fore-and-aft plates 10, 10a near to the turbine horizontal joint, said casings 1, 1' are substantially free to expand downwardly relatively to said

plates 10, 10a, a desirable feature inasmuch as the casings will generally be at higher temperatures than said plates 10, 10a.

In the interests of lateral rigidity, the top run of the fore-and-aft plates 10, 10a lying outside the exhaust belt may be flanged as shown at 10''; also, the top run of the intermediate part of said plates 10, 10a, that of the transverse plates 12, 12', together with the top run of condenser wall extensions 3d, may be consolidated in a flange 13 adapted to be joined to a corresponding flange on the part of the exhaust belt for the upper half-cylinders of casings 1, 1'.

The fore-and-aft plates 10 and 10a terminate at one end in a plate 14 which is disposed, with its general plane substantially vertical and transverse to the turbine axis, just inside the vertical plate 4, and is attached at its lower end to the bar 8 fast with the condenser casing 3a, that is, substantially at the level at which the outer vertical plate 4 is attached to said casing 3a. Likewise, said plates 10, 10a terminate at the other end in plate 14' disposed, with its general plane substantially vertical and transverse to the turbine axis, just inside the vertical plate 4', and attached at its lower end to bar 8' fast with the condenser casing 3a. In the drawings, plates 14, 14' are shown as integral with plates 10, 10a but it will be appreciated that they may be formed separately and joined thereto as by welding. In some instances, the inner plates 14, 14' may be constituted merely by upward extensions of the vertical sides 3a of the condenser casing. It is preferred that the inner transverse vertical plates 14, 14' be flexible in the direction of the turbine axis, thus not to impede relative expansion and contraction between the turbine casings on the one hand and the condenser on the other hand.

From the foregoing, and as indicated diagrammatically in Fig. 6, it will be seen that the fore-and-aft vertical plates 10, 10a flanking the turbine casings 1, 1' on opposite sides of the turbine axis, together with transverse plates 12, 12' and transverse inner plates 14, 14' attaching said plates 10, 10a to the turbine casings 1, 1', provide a rigid turbine structure supported on end pedestals 2, 2'. Moreover, as diagrammatically illustrated in Fig. 7, this rigid turbine structure supports the condenser 3 through transverse outer plates 4, 4' attached to said structure at the locations of its attachment to the end supports 2, 2', thus ensuing low bending moment in the portion of the structure lying centrally of the supports 2, 2'. Further, as represented diagrammatically in Fig. 8, the inner transverse plates 14, 14' attaching the condenser 3 to the turbine structure act to resist the tendency for the turbine structure and condenser to be crushed together under the atmospheric load.

Considering the combined turbine and condenser structure as a whole from the point of view of mechanical strength, particularly in the vertical direction, the fore-and-aft plates 10 and 10a, in addition to being attached to the turbine casings 1 and 1' by the transverse plates 12, 12' are also attached to said casings 1, 1' by being attached to the inner transverse plates 14 and 14' extending downwardly to the condenser 3 and in turn attached through the condenser casing 3a to the outer transverse plates 4, 4' fast with the casings 1, 1'; whereas this method of attachment of the fore-and-aft plates 10 and 10a to the turbine casings 1, 1' provides great strength vertically it is specially advantageous in that, with the transverse plates 4, 4' and 14, 14'

sufficiently flexible in the longitudinal direction of the turbine axis, differential expansion and contraction between the turbine casings and the condenser casing is allowed but without resulting distortion of the structure; such distortionless expansion and contraction is further assisted by the inclusion of the horizontal strip portion 3c in the upper casing wall of the condenser.

Although the embodiments of the invention illustrated are of the type in which two turbines are combined in a common turbine structure, it is believed that the manner in which the principles of construction can be applied to installations having a single turbine will readily be understood.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A turbine and condenser assembly including a turbine casing arranged with its axis substantially horizontal, pedestals for supporting the assembly associated with the respective ends of the casing, a condenser arranged beneath the casing, and means supporting the condenser from the casing including a pair of vertical plates fastened to the casing adjacent each pedestal, the plates being arranged transversely of the axis of the casing and having flexibility in an axial direction.

2. A turbine and condenser assembly including two turbine casings arranged on a common horizontal axis with their exhaust ends in adjacent but spaced relation, a support pedestal associated with each casing, a condenser arranged below the casings, means supporting the condenser including vertical plates fastened to the casings adjacent the pedestals and arranged transversely of the axis of the casings, and walls secured to the casings and to the condenser defining an exhaust collector passage surrounding the adjacent spaced ends of the casings and communicating with the condenser.

3. A turbine and condenser assembly including a turbine casing with its axis substantially horizontal, a pedestal for supporting the assembly associated with each end of the casing, a condenser arranged beneath the turbine casing, means supporting the condenser including a plate arranged transversely of the axis of the casing and adjacent a support pedestal, means securing the upper portion of the plate to the turbine casing and means securing the lower portion of the plate to the condenser, at least one of said securing means being readily detachable.

4. A turbine and condenser assembly including a turbine casing with its axis substantially horizontal, a pedestal for supporting the assembly associated with each end of the casing, a condenser arranged beneath the casing, and means supporting the condenser from the casing including vertical plates fastened to the casing adjacent the respective support pedestals, the plates being arranged transversely of the axis of the casing and designed to carry substantially all the weight of the condenser, the plates also being shaped at their upper ends to conform to the width of the turbine structure at the place where the plates are secured to the turbine casing and shaped at their lower ends to extend over an appreciable dimension of the condenser structure transverse to the turbine axis.

5. A turbine and condenser assembly including two turbine casings arranged on a common horizontal axis with their exhaust ends in adjacent but spaced relation, members rigidly interconnecting the turbine casings, a support pedestal associated with each casing, a condenser ar-

ranged below the casings, means supporting the condenser including vertical plates fastened to the casings adjacent the pedestals and arranged transversely of the axis of the casings, and walls secured to the casings and to the condenser defining an exhaust collector passage surrounding the adjacent spaced ends of the casings and communicating with the condenser.

6. A turbine and condenser assembly including two turbine casings arranged on a common horizontal axis with their exhaust ends in adjacent but spaced relation, a support pedestal associated with each casing, a condenser arranged below the casings, connecting means rigidly joining the turbine casings and including substantially vertical plates on opposite sides of and parallel to the axis of the casings, said plates being attached to the inner ends of the casings by transverse members and attached to the outer ends of the casings by transverse vertical plate members which extend downwardly to constitute extensions of the condenser side walls, means supporting the condenser including other vertical plates

fastened to the casings adjacent the pedestals and arranged transversely of the axis of the casings, and walls secured to the casings and to the condenser defining an exhaust collector passage surrounding the adjacent spaced ends of the casings and communicating with the condenser.

7. A turbine and condenser assembly including a turbine casing arranged with its axis substantially horizontal, pedestals for supporting the assembly associated with the respective ends of the casing, a condenser arranged beneath the casing and adapted to be supported therefrom, means supporting the condenser including vertical plates having flexibility in an axial direction arranged transversely of the axis of the casing and fastened to the casing adjacent the respective pedestals, and walls defining a passage between the turbine casing and the condenser, said walls including flexible portions arranged to permit longitudinal and vertical displacements of the condenser relative to the turbine casing.

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