Dec. 2, 1941. E. D. DICKINSON 2,264,830

SHIP PROPULSION TURBINE ARRANGEMENT

Filed May 31, 1941 2 Sheets-Sheet 1

Fig. 1.

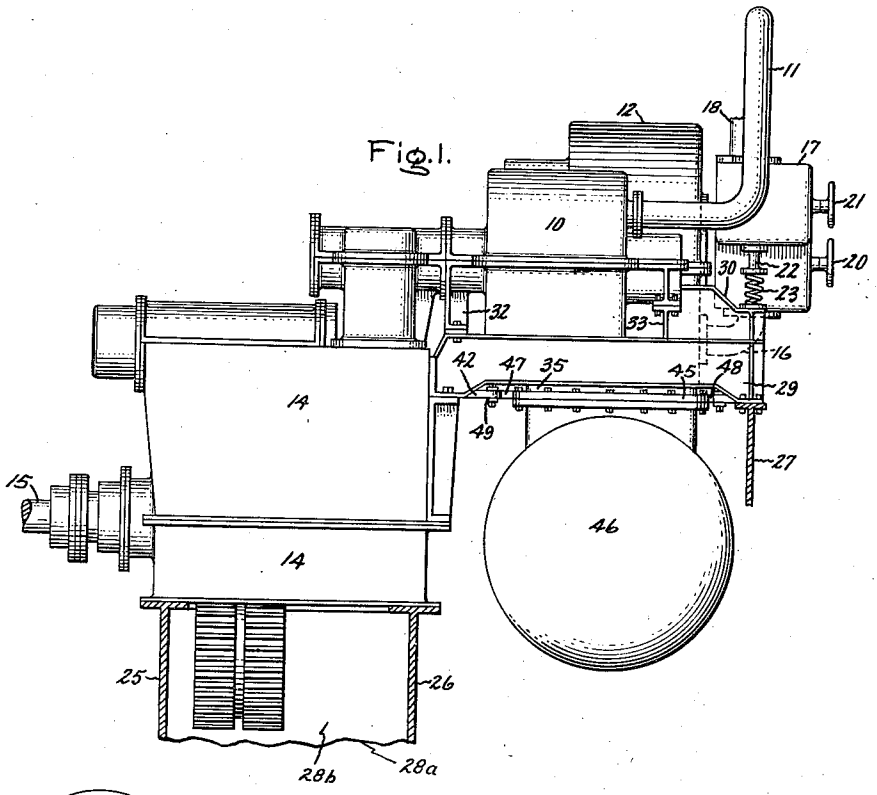
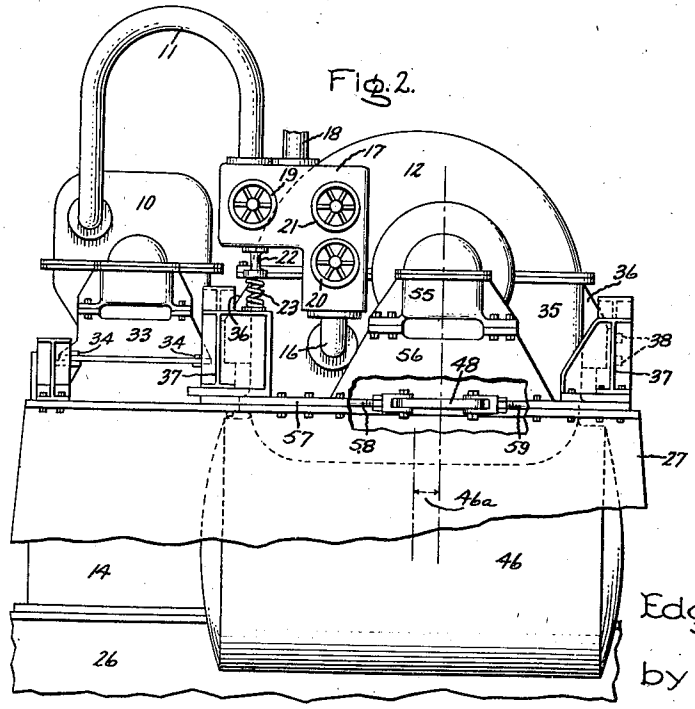


Fig. 2.



Inventor:
Edgar D. Dickinson,
by Harry E. Dunham
His Attorney.

Dec. 2, 1941. E. D. DICKINSON 2,264,830

SHIP PROPULSION TURBINE ARRANGEMENT

Filed May 31, 1941 2 Sheets-Sheet 2

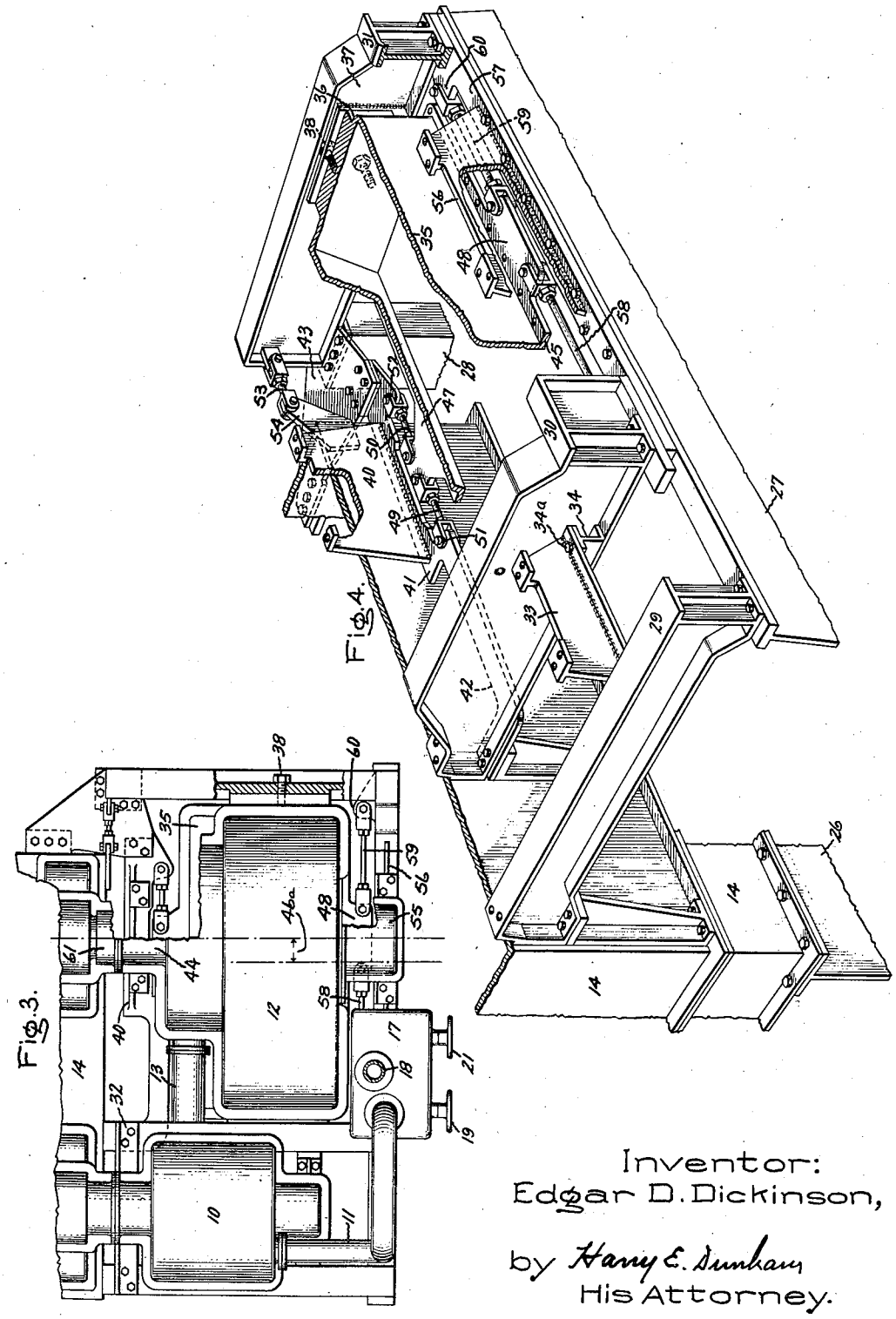


Fig. 4.

Fig. 3.

Inventor:
Edgar D. Dickinson,
by Harry E. Dunham
His Attorney.

Patented Dec. 2, 1941 2,264,830

UNITED STATES PATENT OFFICE

2,264,830

SHIP PROPULSION TURBINE ARRANGEMENT

Edgar D. Dickinson, Beverly, Mass., assignor to General Electric Company, a corporation of New York

Application May 31, 1941, Serial No. 395,964

8 Claims. (Cl. 60—70)

The present invention relates to ship propulsion turbine arrangements of the kind which include high pressure and low pressure turbines connected to a speed-reducing gearing for driving a ship's propeller. More particularly, the invention relates to arrangements for supporting ship propulsion turbines to permit expansion of the turbine parts subject to high temperature changes and to maintain such parts in proper alignment with the gearing.

The object of my invention is to provide an improved construction and arrangement of ship propulsion turbine arrangements of the type aforementioned.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawings.

In the drawings, Fig. 1 illustrates a side view of a ship propulsion turbine arrangement embodying my invention; Fig. 2 is a front view of Fig. 1; Fig. 3 is a top view of Fig. 1; and Fig. 4 is a perspective view partly broken away of the arrangement shown in Figs. 1 to 3.

The arrangement shown in the drawings comprises a high pressure turbine 10 having an inlet conduit 11 and a low pressure turbine 12 having an inlet conduit 13 connected to receive elastic fluid exhausted from the high pressure turbine. The turbines are arranged adjacent each other with their shafts parallel and connected to a known type of speed-reducing gearing 14 having an output shaft 15 for driving a propeller, not shown. The low pressure turbine 12 includes a reversing stage to which high pressure fluid may be conducted through a conduit 16. The inlet conduit 11 for the high pressure turbine 10 and the conduit 16 for conducting elastic fluid to the reversing stage or element of the low pressure turbine 12 are both connected to a valve chest or casing 17 having an inlet conduit 18 for receiving high pressure elastic fluid from a boiler or like source, not shown. The valve chest 17 includes a valve 19 for controlling the flow of elastic fluid to the inlet conduit 11 of the high pressure turbine, a second valve 20 for controlling the flow of elastic fluid to the inlet conduit 16 of the reversing stage of the low pressure turbine 12 and a third or guard valve 21 which prevents entrance of elastic fluid into the reversing stage as long as it is closed. The valve casing when viewed in Fig. 2 has the shape of an inverted L. The right-hand portion of the casing is supported on the elbow-shaped inlet conduit 16 (Fig. 1), and the left-hand portion of the casing is yieldingly supported by a post 22 held on a compression spring 23.

The turbine arrangements with the gearing 14 are supported on structural members or beams 25, 26, 27 and a post 28 forming parts of a ship structure. The gearing, more specifically its casing, rests directly on the structural members 25 and 26 (Fig. 1). The support for the gearing 14 includes other beams 28a running crosswise to the beams 25 and 26, that is, lengthwise to the ship and connected to the beams 25 and 26 and to the bottom of the ship to form an oil tank 28b underneath the gearing casing. The high pressure and low pressure turbines are supported on the gearing casing and the structural member 27 by means including three parallel-arranged rails 29, 30 and 31. The rails 29 and 30 at one end are rigidly secured to and supported on the gear casing and at the other end are rigidly secured to the structural member 27. The rail 31 is rigidly fastened at one end to the post 28 and at the other end to the structural member 27.

The end of the high pressure turbine 10 adjacent the gearing 14 is rigidly fastened to the adjacent ends of the rails 29, 30 and accordingly to the gearing casing by means of a supporting member 32 which forms an integral part of the high pressure turbine casing and prevents relative movement between adjacent portions of the gearing and the turbine. The end of the high pressure turbine 10 facing away from the gearing is supported on a plate 33 extending transverse to the high pressure turbine shaft and secured to the rails 29, 30 by means including a Z-bar 34 and bolts 34a. The Z-bar extends in direction of and is supported on the rail 30. The Z-bar permits lateral expansion or movement of the rail 30 without disturbing the line-up of the high pressure turbine. The plate 33 is flexible in axial direction of the turbine and thereby permits expansion of the turbine casing during operation without setting up excessive stresses similar to the arrangement disclosed in the Patent No. 2,064,649 to J. H. Doran, issued December 15, 1936, and assigned to the same assignee as the present application.

The low pressure turbine 12 has an exhaust casing 35 (Fig. 4) with a supporting bracket 36 on each side. The supporting brackets 36 rest on ledges 37 formed on the adjacent sides of the rails 30 and 31. Central portions of the exhaust casing 35 are rigidly secured to the supporting

rails 30 and 31 by means of bolts 33 connected to the brackets 36. With this arrangement an intermediate side portion of the turbine casing is prevented from axial movement due to expansion during operation. Hence, axial expansion can take place only from said rigidly secured side portions towards the opposite ends of the turbine shaft. The rails 30, 31 are made very stiff against deflection in vertical direction but have sufficient flexibility athwart ships to permit lateral expansion of the low pressure turbine casing.

The end of the low pressure turbine adjacent the gearing 14 is supported on a plate 40 extending transverse to the turbine shaft and having a lower portion fused to a flange 41. The left-hand end of the flange 41 when viewed in Fig. 4 is provided with an extension 42 rigidly secured to the casing of the gearing 14 and to the rail 30. The right-hand end of the flange 41 is bolted to a supporting plate 43 for connecting the flange 41 to the gearing casing and to the post 26. The plate 43 is sufficiently flexible to permit expansion in vertical direction of the gearing casing. The plate 40 is flexible in axial direction of the low pressure turbine. The plate 40 acts as a support for the turbine bearing casing 44 adjacent the gearing, which bearing casing is rigidly secured to and forms a part of the turbine casing 35. The lower portion of the turbine exhaust casing 35 forms a flange 45 rigidly secured to and forming the sole support for a condenser 46.

During operation the heavy weight of the condenser exerts considerable bending and twisting forces on the casing 35, particularly when operated on a ship subject to rolling. In the present arrangement the center of the turbine shaft does not coincide with the center of the turbine casing or, from another viewpoint, the bearing support for the turbine rotor is eccentrically secured to end portions of the turbine casing. The eccentricity between the vertical plane through the center of the turbine rotor and the vertical plane through the center of the exhaust opening of the turbine casing is designated in Figs. 2 and 3 by a reference character 46*a*. The eccentric arrangement of the turbine casing is at times necessary for reasons such as space limitation on a ship. It creates or considerably augments the aforementioned bending and twisting forces exerted on the turbine support. In order to reduce these forces or, from another viewpoint, to stabilize the casing structure, means are provided for connecting portions of the flange 45 to the support.

In a preferred embodiment of my invention, as shown in the drawings, portions of the flange 45 near a vertical plane through the turbine axis are provided with extensions 47 and 48. The extension 47 which extends towards the plate 40 has opposite portions connected by tie bolts 49 and 50 to ears 51 and 52 respectively formed on the flange 41. The tie bolts extend substantially transverse to the turbine axis. In order to reduce bending forces on the rail 31 a similar tie bolt 53 is provided connecting the rear end of the rail when viewed in Fig. 4 to a plate 54, which latter is rigidly fastened to the casing of the gearing 14.

The end of the low pressure turbine 12 facing away from the gearing 14 has a bearing 55 with a casing rigidly secured to the turbine casing 35 and supported on a plate 56 extending crosswise to the turbine shaft and having a lower end with a flange 57 bolted to the structural member 27. The ends of the flange 57 are extended and located between the member 27 and the ends of the rails 30 and 31 respectively. The casing 35 is additionally stabilized against bending and twisting forces caused by the rolling of a ship by means of tie bolts 58 and 59 connecting opposite portions of the flange extension 48 to ears 60 formed near the ends of the extended flange 57.

The flexible plates 40 and 56 and the pairs of tie bolts 49, 50 and 58, 59 permit axial expansion of the turbine and at the same time hold the turbine casing fixed along a vertical plane through the axis of rotation. The turbine casing expands in opposite direction from a central portion rigidly secured to the side rail supports. Expansion of the low pressure turbine end adjacent the casing of the gearing 14 is taken up by a sliding coupling 61 connecting said end to the gearing 14. No such sliding coupling is needed for connecting the high pressure turbine to the gearing because, as stated above, the end of the high pressure turbine adjacent the gearing is rigidly secured to the gearing casing and therefore prevented from expansion.

Summarizing, a ship propulsion turbine arrangement according to my invention comprises a high pressure and a low pressure turbine having shafts arranged in parallel and connected to a gearing. The turbines are supported on three parallel rails which at one end are secured to a structural member of the ship and at the other end are secured to a gearing casing and a post. The end of the high pressure turbine adjacent the gearing is rigidly supported on the rails whereas its other end is supported by a plate extending transverse to the turbine shaft and connected to the rails and being flexible in axial direction of the turbine to yield during expansion thereof.

The low pressure turbine has a casing flanged to and supporting a condenser. The shaft bearings of the low pressure turbine are eccentrically secured to casing end portions and form part of the casing. The bearings in turn are engaged and supported on plates extending crosswise to the turbine shaft and having lower flanges secured to structural members and to the gearing casing respectively. The sides of the low pressure turbine casing have brackets resting on ledges secured to the rails. Central portions of the brackets are rigidly fastened to the rails. The eccentric support of the bearings on the turbine casing causes considerable bending forces and twisting of the casing, especially during rolling of the ship. In order to reduce these forces and to stabilize the casing, portions of the casing ends symmetrical with the central vertical plane through the turbine shaft are connected by tie bolts to the supporting structure.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

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

1. Elastic fluid turbine arrangement for ship propulsion comprising a high pressure and a low pressure turbine having shafts arranged in parallel, a gearing having a casing and being connected to the shafts, the connection of the gear-

ing with the low pressure turbine including a sliding coupling, the low pressure turbine including a reversing element, means for conducting high pressure elastic fluid to the high pressure turbine and to the reversing element comprising a valve chest having a valve for controlling the flow of elastic fluid to the high pressure turbine, another valve for controlling the flow of elastic fluid to the reversing element and a guard valve, open means for yieldingly supporting the valve chest, and means for supporting the turbines comprising rails rigidly secured to the gearing casing, plates extending transverse to the low pressure turbine shaft and being flexible in axial direction of the low pressure turbine shaft for yieldingly supporting the ends of the low pressure turbine, the low pressure turbine having a casing with central side portions fixed to the rails and tie bolts connecting central end portions of the casing to the rails.

2. Elastic fluid turbine arrangement for ship propulsion comprising a high pressure turbine, a low pressure turbine connected to receive fluid exhausted from the high pressure turbine and including a reversing element, a valve chest, conduits including an elbow connected to an end portion of the valve chest for conducting elastic fluid to the turbines, and means for supporting the valve chest comprising said elbow and a spring support engaging another portion of the valve chest.

3. Elastic fluid turbine arrangement comprising a turbine having a casing with a flanged exhaust end, a condenser flanged to and entirely supported on the exhaust end, turbine bearings supported on end portions of the casing off the vertical central planes through the casing, and means for supporting the turbine with the condenser comprising rails supporting side portions of the casing and rigidly secured to central parts of said side portions, plates extending transverse to the turbine shaft and being yieldable in axial direction of the shaft for supporting the bearings and means including tie bolts extending transverse to the turbine shaft and connecting central end portions of the casing to the rails.

4. Elastic fluid turbine arrangement comprising a turbine having an exhaust casing, shaft bearings rigidly secured to end portions of the casing, and means for supporting the turbine comprising rails engaging side portions of the casing and bolts fixing central parts of the side portions to the rails, means supporting the bearings and being yieldable in axial direction and tie bolts securing central end portions of the casing to the rails.

5. Elastic fluid turbine arrangement comprising a turbine having an exhaust casing, turbine shaft bearings eccentrically secured to end portions of the exhaust casing, means including rails for supporting side portions of the casing, and means yieldingly supporting the bearings, and tie bolts connecting end portions of the casing to the rails.

6. Elastic fluid turbine arrangement comprising a casing having a flanged exhaust end, a condenser flanged to and supported on the exhaust end, shaft bearings eccentrically supported on end portions of the casing, means including plates extending transverse to the turbine shaft and flexible in axial direction for supporting the bearings, and means including tie bolts connecting portions of the flanged exhaust end near the vertical plane through the center of the shaft bearings to the rails.

7. Elastic fluid turbine arrangement comprising a casing having side portions with brackets, a pair of rails having ledges engaging the brackets to support the casing, shaft bearings eccentrically secured to end portions of the casing, means yieldable in axial direction and stiff in transverse direction of the turbine shaft for supporting the bearings, and tie bolts extending substantially transverse to the turbine shaft and connecting the last-named means to portions of the turbine casing symmetrical with a vertical plane through the center of the bearings.

8. Elastic fluid turbine arrangement comprising a turbine having an exhaust casing, a condenser flanged to and supported on the exhaust casing and means for supporting the turbine comprising a rail on each side of the turbine having a side portion with a ledge rigidly secured to an adjacent side portion of the turbine casing, the rails being stiff in vertical direction but having sufficient flexibility in lateral direction to permit lateral expansion of the turbine casing, and means including plates extending transverse to the turbine shaft and secured to the rails for supporting end portions of the turbine casing and permitting axial expansion thereof.

EDGAR D. DICKINSON.