March 6, 1973 H. N. HOFFMAN 3,719,045

TURBINE-GENERATOR AND CONDENSER BASE FOR SHIPBOARD INSTALLATION

Filed March 26, 1971

FIG.1

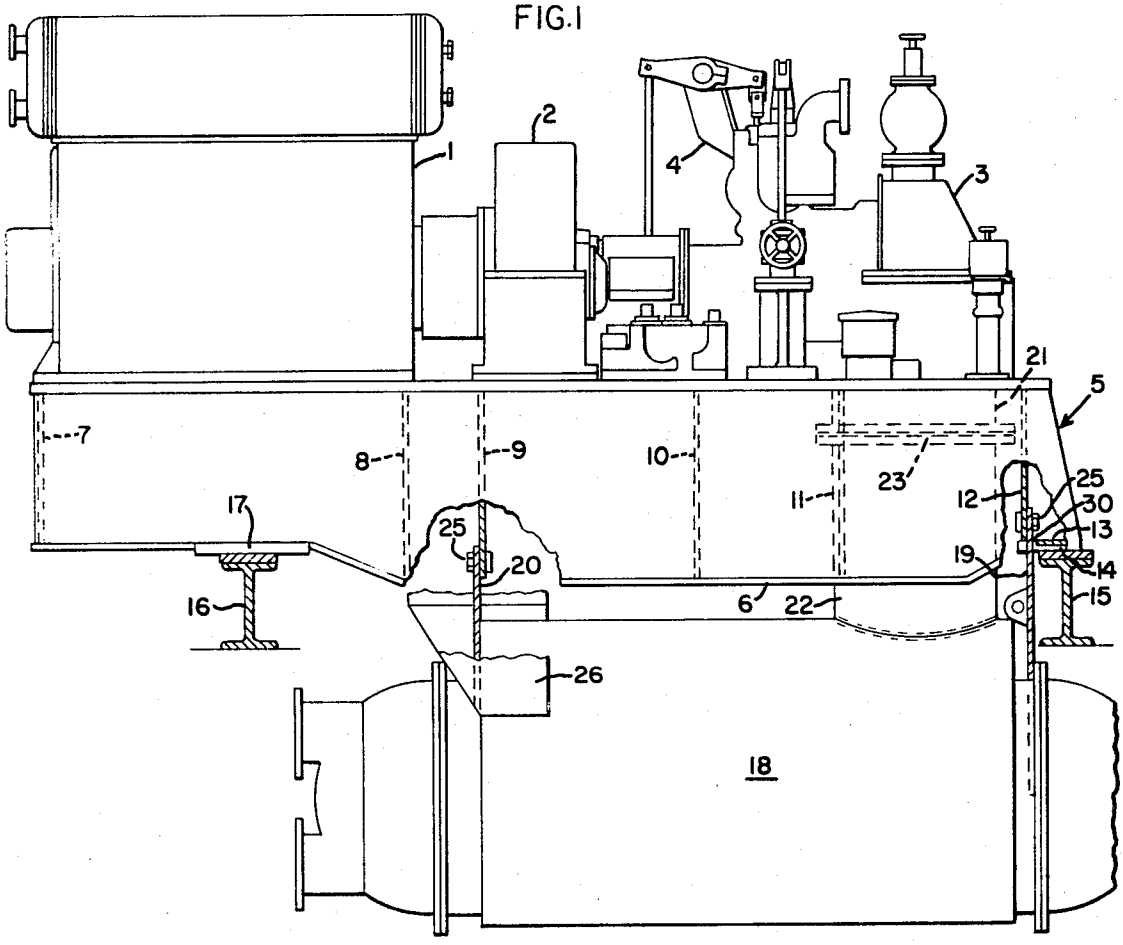
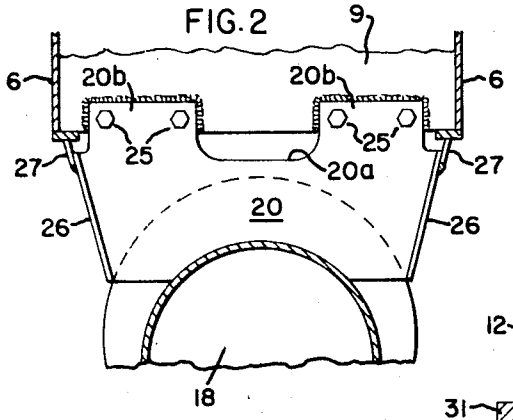


FIG.2



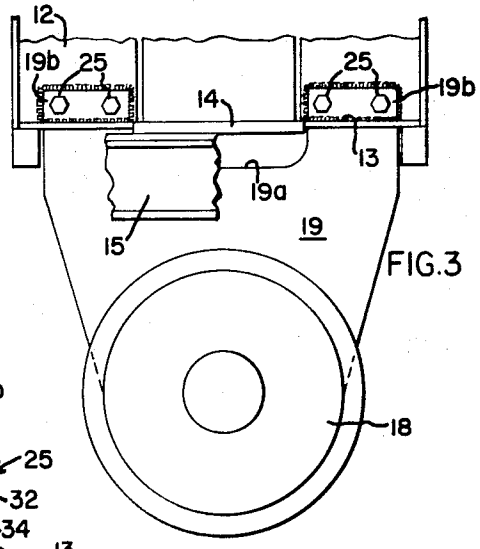
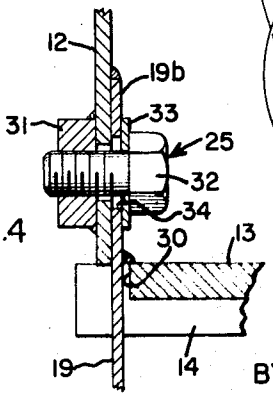


FIG.3

FIG.4



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TURBINE-GENERATOR AND CONDENSER BASE FOR SHIPBOARD INSTALLATION

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ABSTRACT OF THE DISCLOSURE

A design of an attachment of a condenser to the base structure of a turbine-generator set whereby the condenser provides torsional rigidity to the base, the design being such that no accurate machining or accurate fitting of the attachment surfaces is required and such that the assembly of the condenser to a completely assembled turbine-generator set can be performed with the latter resting on its intended foundation, such as the hull of a ship.

BACKGROUND OF THE INVENTION

This invention relates generally to lightweight turbine-generator and condenser supports intended for field assembly in congested locations such as shipboard installations. More particularly the invention relates to an improved two-piece condenser base design, wherein the condenser structure adds torsional rigidity to the base frame and adapted for final connection between the two elements after the parts are in their approximate final positions.

There is described in U.S. Pat. 2,531,178 issued to F. H. Van Nest, on Nov. 21, 1950, a frame structure for turbine-generator sets, in which a rectangular base framework is supported on three points from the ship's framework and which has a condenser integrated with the base framework in order to lend the torsional rigidity of the condenser to the base, this being known as a "condenser base" design. In the Van Nest patent, the condenser is hung from two transverse plate members providing flexibility for relative thermal expansion along a longitudinal axis while serving to resist torsional movements of the base.

While the Van Nest patent is very useful for providing compact and lightweight bases for turbine-generator sets, particularly for shipboard installation, the necessity for alignment of all the parts requires that the condenser be preassembled with the turbine-generator already on its base and the parts carefully machined and hand-fitted. Designs for condenser base turbine-generator sets are known in which the condenser supporting structure is provided with machined connections intended for bolting to the turbine-generator base framework. Preassembly of the parts is necessary to insure alignment when the members are later reassembled on the relatively inaccessible supporting members within a ship's hull.

Accordingly, one object of the present invention is to provide an improved two-piece condenser base turbine-generator set arranged for easy assembly at the final location.

Another object of the invention is to provide an improved arrangement for connecting together a condenser and a turbine-generator base structure without

pre-assembly of the parts or necessitating machined surfaces.

Another object of the invention is to provide an improvement over U.S. Pat. 2,531,178 to Van Nest providing a two piece arrangement for connection of the condenser after the turbine-generator set is in position in a ship's hull.

Drawing

The subject matter which is regarded as the invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. The invention, however, both as to organization and method of practice, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawing, in which:

FIG. 1 is a horizontal elevation drawing of the "condenser-base" turbine-generator with portions broken away to show the essential means of support and manner of connection between the condenser and the base,

FIG. 2 is a partial end view showing the condenser-base connections from the generator end,

FIG. 3 is a partial end view from the opposite direction or turbine end, and

FIG. 4 is an enlarged detail showing a typical condenser-base joint.

SUMMARY OF THE INVENTION

Briefly stated, the invention provides for transverse plate supports disposed in overlapped relationship with plate cross members in the base and having clearances around bolted connections to provide for alignment. Subsequent to alignment, side filler plates are added and all joints are rigidly welded in place to obtain the desired integrated structure.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 of the drawing, a turbine-generator set, including a generator **1**, reduction gear **2**, turbine **3**, and control mechanism **4** are mounted on a rectangular fabricated base structure shown generally as **5**. The base **5** is made up of two longitudinal side members **6** which are flanged and relatively deep in vertical dimension in order to support the weight of the components **1–4** located on the frame. A number of transverse plates such as **7–12** extend between the side members **6**, the location and placement of the plates being dependent upon the particular design. Also extending between side members **6** on the turbine end of frame **5** is a horizontal cross member **13**. A mounting pad **14** comprised of a heavy plate section near the middle of cross member **13** rests on a supporting element such as an I-beam member **15** forming part of a ship's structure. A similar I-beam support **16** on the other end of the turbine-generator base serves to support mounting pads **17**, one on each of the longitudinal side members **6**. Thus the frame **5** is mounted on three supports of small area in a known manner so that the distortional forces that are transmitted to frame **5** by the deflection and twisting of I-beam **15** and **16** are minimal.

A condenser **18** is mounted directly below frame **5** and hangs from two transverse vertical plates **19, 20** on the turbine and generator ends respectively. A turbine ex-

haust pipe **21** and a condenser inlet **22** are joined together at a flange **23** in a manner known in the art.

Referring together to FIGS. 1 and 2 of the drawing, the supporting plate **20** has a cutout portion **20***a* in the center to provide flexibility in the two upwardly extending fingers **20***b* arranged in overlapping relationship with cross plate **9** of the frame so that they can be pulled into contact with plate **9** when condenser is in proper alignment with the base. Bolted connections **25** with ample clearances for alignment provide a means for pulling these overlapping members into contact with plate **9**.

Affixed to the side edges of plate **20** are longitudinal stiffener plate members **26** which are welded to the condenser structure along a bottom seam and extend toward the frame at the top, but do not reach all the way to the frame. Field mounted filler plates **27** which are affixed at final assembly in a manner to be described, bridge the space between the upper termination of stiffener plates **26** and the side members **6**.

Referring to FIGS. 1 and 3 of tthe drawing, the plate **19** is provided with a cutout **19***a* to provide clearance for support pad **14** and to insure flexibility of the plate in a longitudinal direction. Upwardly extending end terminations **19***b* are arranged in overlapping relationship with transverse plate **12** and bolted connections **25** are provided as before with clearances for alignment. In order to allow the extensions **19***b* to overlap plate **12**, slits or spaces **30** are provided between horizontal plate **13** and transverse plate **12**.

FIG. 4 shows a detail of a typical bolted connections **25**. The detail is taken from the connection of the overlapped plates **19** and plate **12** on the turbine end, but the same general details regarding clearances and attachment of the plates after alignment is typical of the bolted connections at the generator end between overlapped plates **20** and **9**. In each of the bolted connections **25**, a tapped block **31** is welded to the transverse frame cross plate such as **12** and provided with a bolt **32** and washer **33**. The extending plate portions from the condenser, extensions **19***b* in this case, are provided with extra large clearance holes **34** so that the overlapping plate members can slide a subtantial amount relative to one another during the aligning process. Welded connections are made along the overlapped joints subsequent to alignment as indicated.

OPERATION

Prior to assembly, the condenser **18** with the attached plates **19, 20** is lowered into the ship's hull between I-beams **15, 16** and temporarily supported. Next the turbine-generator base **5** with the pre-aligned turbine-generator components **1–4**, is lowered into place on the three support pads comprising the centerline pad **14** and the two side pads **17**.

After making necessary tests to insure later proper alignment of the turbine-generator components on the frame, the condenser **18** is raised into place and the bolted connections **25** loosely made. Thereafter, the condenser **18** may be shifted and adjusted up or down to properly align the turbine and condenser steam connections at flange **23** and to distribute the weight. Since all adjustments are in a vertical plane, with the exception of small longitudinal adjustments which can be afforded by flexibility of plates **19, 20**, it is very easy to properly align the elements.

As soon as the two-piece assembly is properly aligned, welds are made along the overlapping joints of fingers **19***b* and plate **12**, as well as fingers **20***b* and plate **9**. Side filler pieces **27** are added and welded in place, the alignment of these members not being critical since they are also in overlapped relation with the stiffener plates **26** as shown. Upon carrying out the foregoing procedure, a completely unitized and aligned turbine-generator with torsionally resistant condenser base is provided in the manner of the aforesaid Van Nest patent, with the exception that all final assembly has been easily accomplished without prefitting of the parts.

While there has been shown what is considered to be the preferred embodiment of the invention, it is understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed as new and desired to secure by Letters Patent of the United States is:

1. In a turbine-generator set having a substantially rectangular supporting base and a condenser having substantial torsion rigidity depending therefrom so as to lend torsional rigidity to said base, the improvement comprising:

first and second longitudinally spaced vertical plate portions extending transversley across said base and forming a part thereof,

third and fourth longitudinally spaced vertical plate members extending transversely beneath said base and attached across opposite ends of said condenser, each of said third and fourth plate members being adapted for sliding contact with said first and second plate portions respectively in an overlapping arrangement,

at least one of said plate members having a pair of transversely spaced extensions overlapping said respective plate portions and defining a cutout to provide flexibility, and

temporary fastening bolts for clamping said overlapping extensions to said plate portions and arranged in enlarged bolt holes to provide for limited sliding aligning movements of the condenser with respect to the base, whereby a permanent welded connection may be made between overlapping members subsequent to alignment.

2. The combination according to claim **1**, wherein each of said third and fourth plate members include a pair of said transversely spaced extensions overlapping said first and second plate portions respectively and also each having said temporary fastening means.

3. The combination according to claim **2** and further including fifth and sixth longitudinally extending stiffener plates affixed to opposite edges of said fourth plate member and to said condenser, and further including seventh and eighth longitudinal filler plate members welded to said base and welded in overlapping relationship to said fifth and sixth plate members respectively for communicating torsional resistance of the condenser to the base.

4. A condenser-base turbine-generator set adapted for field assembly of the condenser to the base comprising:

a rectangular base structure having longitudinal side members and longitudinally spaced transverse plate members extending between said side members,

a plurality of turbine-generator components mounted on said base and aligned with one another,

a substantially cylindrical condenser member disposed below said base and having an inlet steam connection aligned with and connected to an outlet steam connection of one of said components on the base,

third and fourth transverse vertical flexible plate members affixed to opposite ends of said condenser, each of said plate members having transversely spaced extensions disposed in overlapping relationship with said first and second plates on the base,

a plurality of bolted connections between said overlapped extensions and base plate portions, said overlapped members being provided with substantial clearances around the bolts arranged to permit limited sliding aligning movements,

a pair of longitudinal stiffener plate members affixed to transversely opposite edges of the fourth plate member and to said condenser, and a pair of longitudinally extending filler plate members extending between said side members and said pair of longitudinal stiffener plate members in overlapping rela-

tionship, whereby all of said overlapped plate members may be permanently welded subsequent to alignment of the condenser with respect to the base.

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29—470.5, 493