United States Patent [19]

Bockau et al.

[11] **3,873,052**

[45] **Mar. 25, 1975**

[54] **SUPPORTING STRUCTURE FOR MOTORS OF VERTICAL CENTRIFUGAL PUMPS**

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[22] Filed: **Mar. 22, 1973**

[21] Appl. No.: **343,757**

[30] **Foreign Application Priority Data**

Mar. 22, 1972 Germany 2213852

[52] **U.S. Cl.** ..... **248/20,** 415/219 R

[51] **Int. Cl.** **F01d 25/28,** F16m 1/00

[58] **Field of Search** ..... 248/13, 17, 18, 19, 20, 248/23; 415/219 R; 416/244, 500

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[57] **ABSTRACT**

A supporting structure for the transmissions and/or electric motors of vertical centrifugal pumps wherein the foundation is formed with a polygonal opening and carries support points each of which is recessed into the foundation midway between two corner portions of the opening. A metallic frame of polygonal outline consists of profiled frame members which support and extend tangentially of a ring-shaped flange for connection to the motor of a centrifugal pump. The corners of the frame rest on and are secured to the support points so that the frame is angularly offset relative to the surfaces flanking the opening in the foundation. This reduces the length and weight of the frame members as well as the magnitude of bending stresses. The natural frequency of the frame is higher than the exciter frequency when the motor which is carried by the supporting structure is in actual use.

9 Claims, 2 Drawing Figures

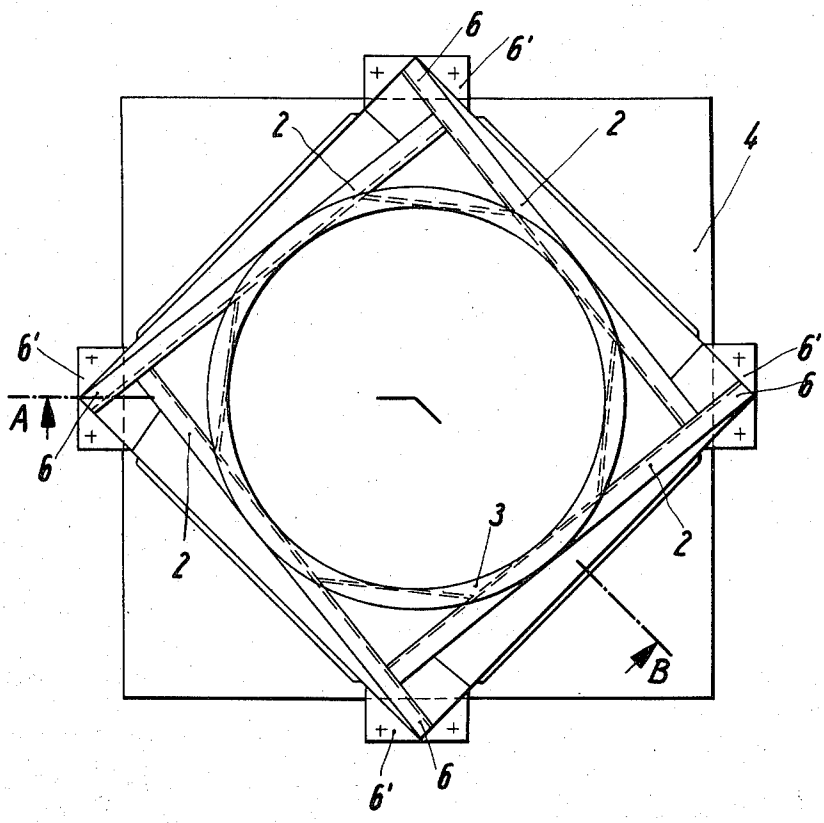


Fig.2

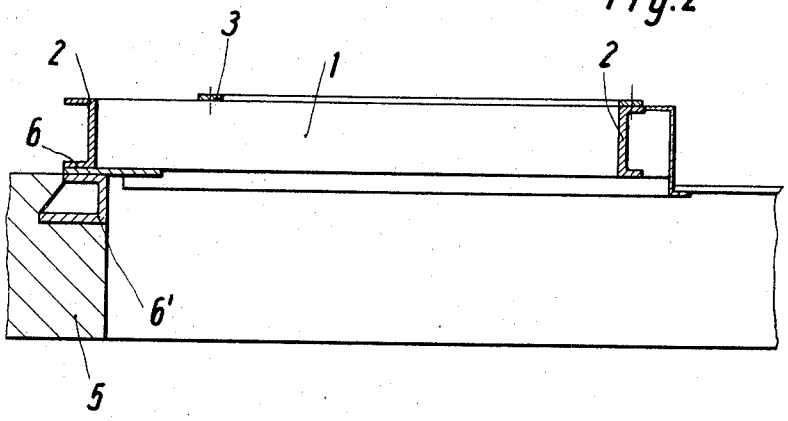
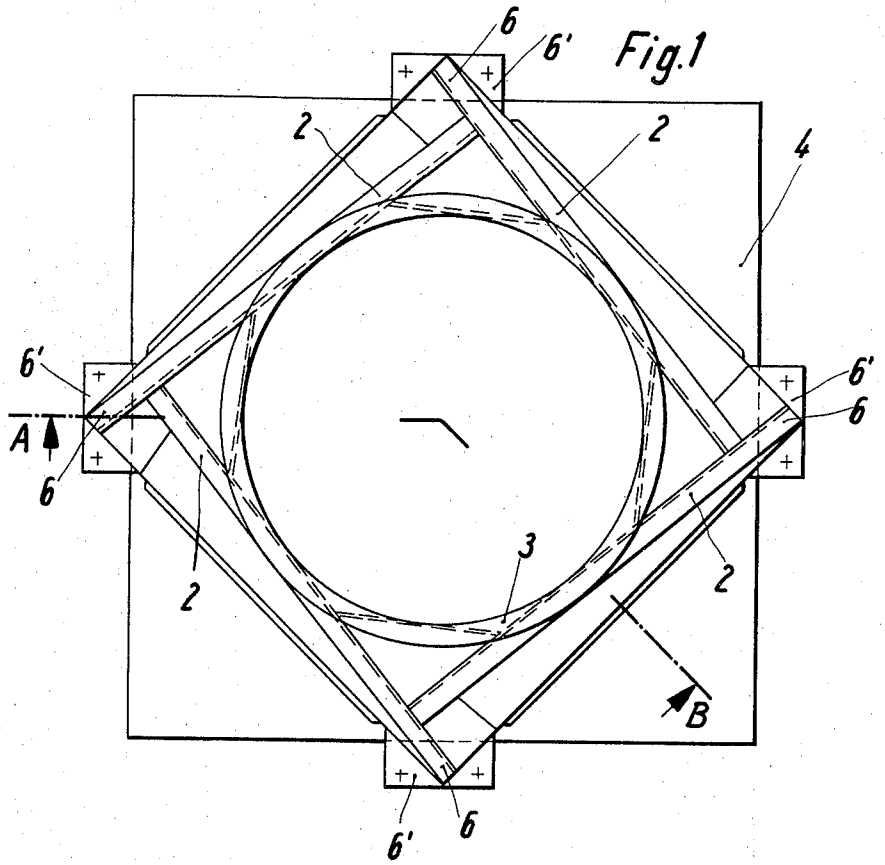


Fig.1



SUPPORTING STRUCTURE FOR MOTORS OF VERTICAL CENTRIFUGAL PUMPS

BACKGROUND OF THE INVENTION

The present invention relates to improvements in supporting structures for prime movers of fluid-operated machines, especially vertical centrifugal pumps. More particularly, the invention relates to improvements in supporting structures for the transmissions and/or electric motors which serve to drive vertical centrifugal pumps.

Vertical centrifugal pumps are often mounted in the floor or roof of a plant and are used to circulate a liquid coolant, clean water or waste water. The prime movers of such pumps are mounted on supporting structures which normally include a foundation (e.g., the floor or the roof in a plant) and a metallic frame. A drawback of presently known supporting structures is that they tend to vibrate when the pump is in use and that the extent of their vibration in actual use cannot be calculated in advance with a sufficient degree of accuracy.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved supporting structure for prime movers of hydraulic machines, especially for transmissions and/or electric motors which are used to drive vertical centrifugal pumps for the circulation of coolant, clean water, waste water and/or other liquids.

Another object of the invention is to provide a supporting structure whose behavior in actual use can be calculated in advance with a high degree of accuracy and whose natural frequency can be made so high that it invariably exceeds the normal exciter frequencies.

A further object of the invention is to provide a supporting structure consisting of a foundation and a metallic frame wherein the parts of the frame are subjected to negligible torsional stresses and to bending stresses which are much lower than the bending stresses upon the frame parts of conventional supporting structures.

An additional object of the invention is to provide a supporting structure wherein the static and dynamic forces are transmitted to the foundation by way of bending moments and free of torsion.

Still another object of the invention is to provide a novel and improved mounting of the frame on the foundation of a supporting structure for the electric motors of vertical centrifugal pumps.

The invention is embodied in a supporting structure for prime movers of hydraulic machines, especially for transmissions and/or electric motors of vertical centrifugal pumps. The supporting structure comprises a foundation which may constitute the floor or roof of a plant, at least three spaced-apart support points provided on or in the foundation, a polygonal frame including a plurality of preferably profiled metallic frame members which are rigidly connected (preferably welded) to each other at the corners of the frame, and a substantially annular motor carrier (preferably a ring-shaped flange) which is supported by the frame so that the frame members are disposed substantially tangentially of the carrier. Each of the support points in or on the foundation serves as a rest for a different corner of the frame so that, when the motor which is supported by the carrier is in use, the static and dynamic forces to which the frame members are subjected are transmitted to the foundation directly by way of bending moments and free of torsion.

The frame is preferably rectangular and most preferably square, and the foundation is preferably provided with four support points, one for each corner of the rectangular or square frame.

In accordance with a presently preferred embodiment of the invention, the foundation is provided with a polygonal opening and the support points are recessed into the foundation in such a way that each thereof is located intermediate (preferably exactly midway) between two corner portions of the opening. Thus, if the opening and the frame have a square outline, the frame can be angularly offset by 90° relative to the opening.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved supporting structure itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of a supporting structure which embodies the invention; and

FIG. 2 is a vertical sectional view as seen in the direction of arrows from the line A–B of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The supporting structure which is best shown in FIGS. 1 and 2 comprises a foundation 5 having a polygonal opening 4, here shown as a square opening 4. The foundation 5 is provided with four built-in or recessed support points 6′ each of which is adjacent to the opening 4 and is located intermediate, preferably exactly midway, between two neighboring corner portions of the opening.

The supporting structure further comprises a metallic frame 1 which is also of polygonal outline and is shown in the form of a square including four welded-together profiled metallic frame members 2 which extend tangentially of and support a round carrier or flange 3 for the transmission and/or electric motor (not shown) which drives a vertical centrifugal pump, not shown. The foundation 5 may constitute the floor or the roof of a shop where the centrifugal pump is mounted to circulate liquid coolant, fresh water or waste water.

The frame members 2 meet at the four corners 6 of the frame 1 and each of the four corners 6 is supported by and is secured to one of the support points 6′ in the foundation 5. Due to the fact that the profiled frame members 2 extend tangentially or substantially tangentially of the flange 3, the weight of the parts which are secured to the flange 3 and the exciting forces which develop when the centrifugal pump is in use produce stresses which are transmitted to the frame 1 in such a way that the frame is not subjected to any torsional stresses and only to moderate bending stresses. It will be noted that the members 2 of the frame 1 form a square which is angularly offset by 90° relative to the side surfaces of the foundation which surround the opening 4. In many presently known supporting structures for vertical centrifugal pumps, the frame mem-

bers of the frame are parallel to the surfaces bounding the opening in the foundation. An advantage of the improved supporting structure is that the length of the frame members **2** can be reduced to approximately 70 percent of the length of frame members in conventional supporting structures. The weight of the bending moment upon the frame members is also reduced to 70 percent. The extent of flexing in the central portions of frame members **2** is reduced to 35 percent of the extent of flexing of frame members in conventional supporting structures. This results in a rise of natural frequency to about 170 percent of natural frequency of conventional supporting structures.

It has been found that the improved supporting structure provides a superior, safer and vibration-free carriage for the transmissions and/or electric motors of centrifugal pumps. All static and dynamic forces are transmitted directly to the frame **1** with accurately determinable bending moments and free of torsion. The savings in material are substantial even though the weight of the frame is less and its rigidity is higher than that of frames in conventional supporting structures.

If desired, the frame can be provided at little additional cost with reinforcing or stiffening means (not shown) to further increase the natural frequency.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic or specific aspects of our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A supporting structure for prime movers of hydraulic machines, especially for transmissions and/or electric motors of vertical centrifugal pumps, comprising a foundation; at least three spaced apart support points provided on said foundation; a polygonal frame including a plurality of metallic frame members, each of said frame members being secured at one end to one of said support points and at the other end to another of said frame members spaced from the end of the latter which is secured to another corresponding support point; and a substantially annular motor carrier supported by said frame, said frame members being substantially tangential to said carrier and the static and dynamic forces to which said frame members are subjected being transmitted to said foundation directly by way of bending moments and free of torsion.

2. A supporting structure as defined in claim **1**, wherein said frame has a substantially rectangular outline and the number of said support points is four so that each of said support points serves as a rest for a different corner of said frame.

3. A supporting structure as defined in claim **2**, wherein said frame has a substantially square outline.

4. A supporting structure as defined in claim **1**, wherein said frame members are profiled.

5. A supporting structure as defined in claim **1**, wherein said foundation has an opening of polygonal outline having a plurality of corner portions, each of said support points being recessed into said foundation intermediate two corner portions of said opening.

6. A supporting structure as defined in claim **5**, wherein said opening and said frame have square outlines and said frame is angularly offset by 90° relative to said opening.

7. A supporting structure as defined in claim **1**, wherein said carrier is a ring-shaped flange which is connected to each of said frame members.

8. A supporting structure as defined in claim **1**, wherein the number of support points exceeds three.

9. A supporting structure as defined in claim **1**, wherein said foundation has an opening of rectangular outline and a plurality of corner portions, each of said support points being located intermediate said corner portions, and each of said frame members being angularly offset relative to said opening in said foundation.

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