United States Patent

Otto

[15] **3,685,773**

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[54] **RESILIENT MOUNTING ARRANGEMENT FOR ROTATING MACHINES AND METHOD OF PRODUCING SAME**

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[73] Assignee: **General Electric Company**

[22] Filed: **Oct. 24, 1969**

[21] Appl. No.: **869,147**

[52] **U.S. Cl.** **248/26**

[51] **Int. Cl.** **F16m 13/00**

[58] **Field of Search** 248/7, 15, 26, 358; 287/85; 285/258

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[57] **ABSTRACT**

A resilient mount for a rotary dynamoelectric machine comprising a resilient annulus having an inner region forming a bore and a rigid hoop member having an axis and as assembled disposed within the bore and in engagement with part of the machine. The member has a plurality of sections including angularly spaced apart flanged sections formed with free ends inclined inwardly toward the axis when disposed in normal preassembled positions. These flanged sections are interfitted with the inner region of the annulus when in the assembled position to restrain relative movement between the annulus and the member. Axially extending rigid finger sections, interposed between the flanged sections, are adapted to be engaged by a tool to press fit the resilient mount over the machine structure. At least some of the plurality of sections are urged into firm engagement with the machine structure to provide a nonrotatable mounting of the annulus relative to the structure. This mounting arrangement is produced by a method which is relatively simple and inexpensive to practice.

14 Claims, 16 Drawing Figures

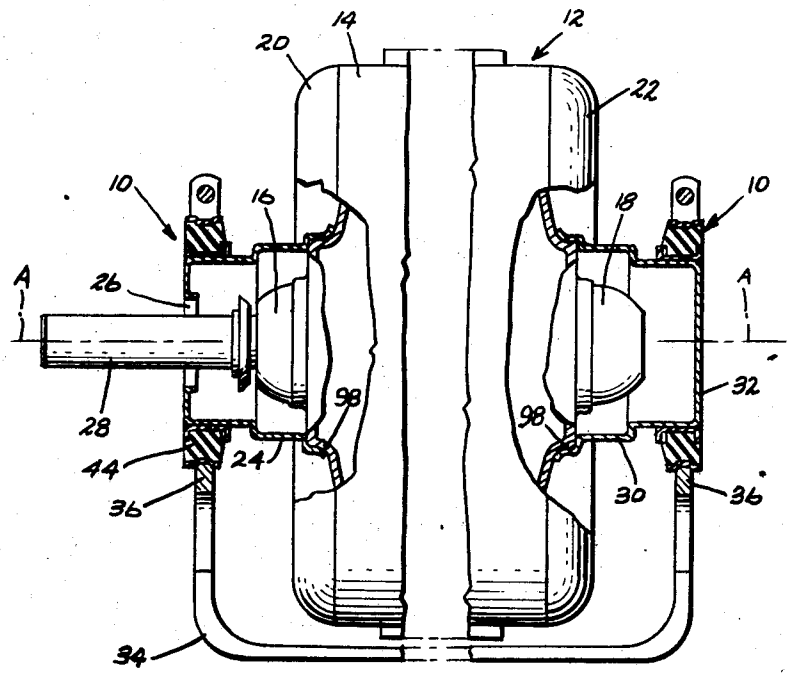

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FIG. 1

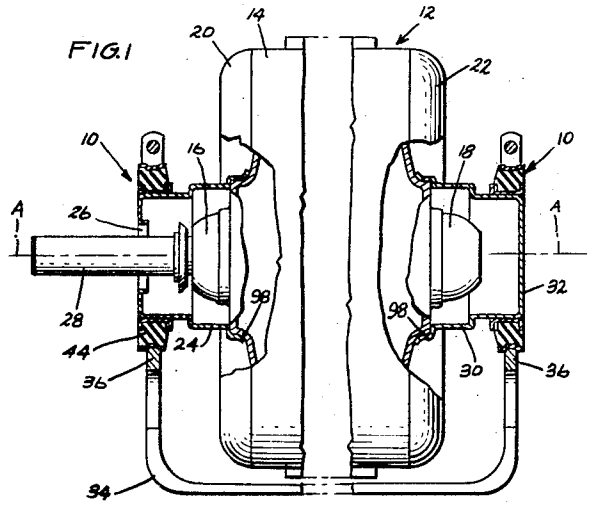


FIG. 3

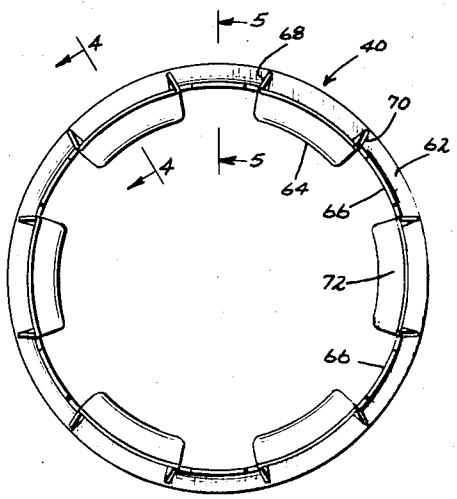
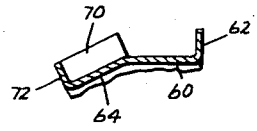


FIG. 4



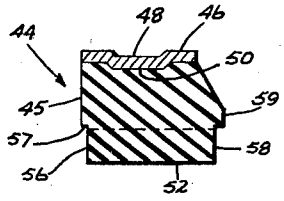


FIG. 6

FIG. 5

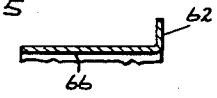


FIG. 2.

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FIG. 7A

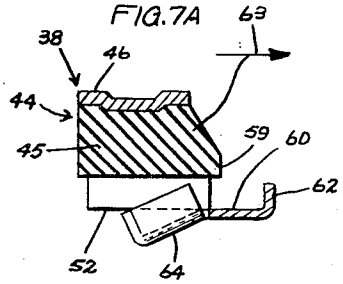


FIG. 7B

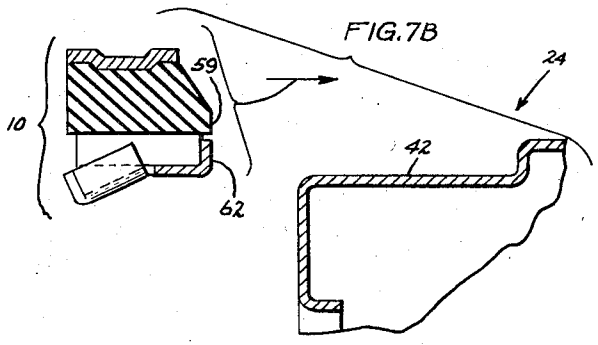


FIG. 7C

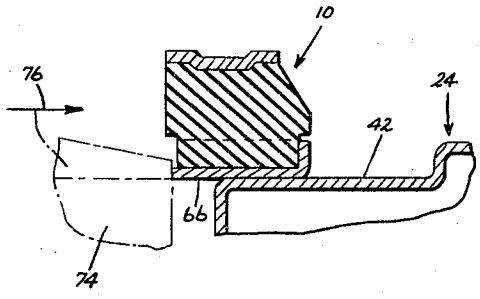


FIG. 7D

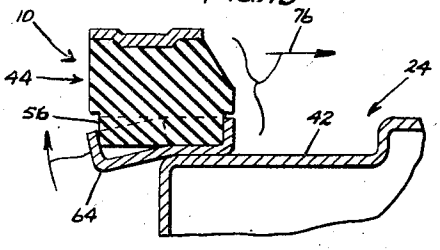


FIG. 11

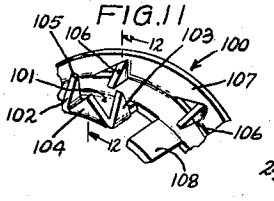


FIG. 7E

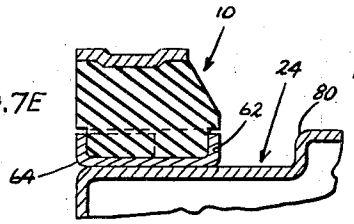


FIG. 8

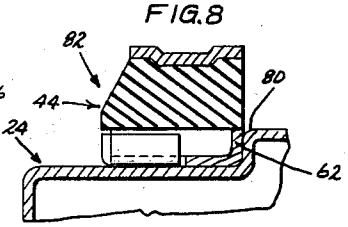
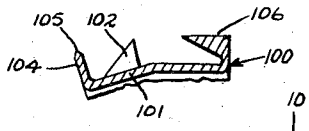
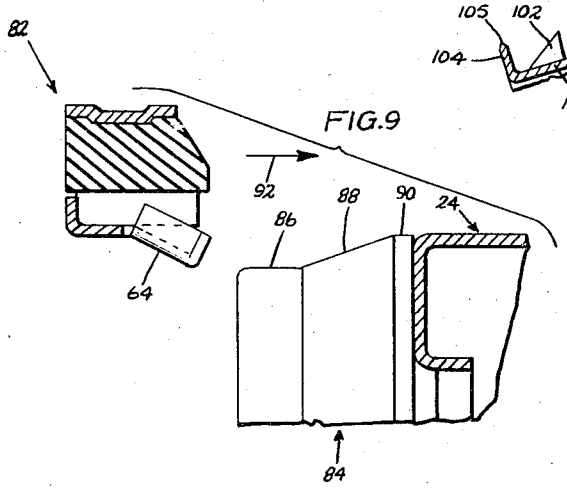


FIG. 12





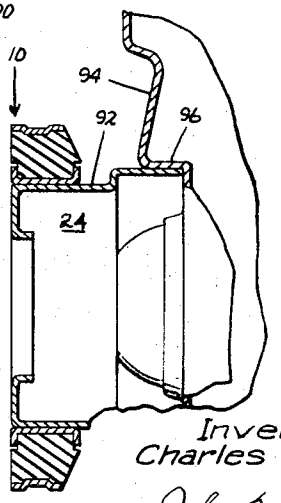


FIG. 10

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RESILIENT MOUNTING ARRANGEMENT FOR ROTATING MACHINES AND METHOD OF PRODUCING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the field of resilient mounting arrangements for rotary dynamoelectric machines.

2. Description of the Prior Art

The problem of isolating the vibration of an operating electric motor from the motor supporting structure is a well-known one. Furthermore, one of the well-known solutions is to provide resilient motor mounts on either end of the motor and then arrange the motor supporting structure to engage the resilient mounts rather than the motor casing itself. Motor mounts of this type are disclosed, for example, in U.S. Pat. Nos. 2,840,329, 2,904,289 and 3,235,207, all assigned to the assignee of the present application. Some motors have hubs or other suitable end structure upon which the motor mount can be fitted. However, very often these hubs are not the proper diameter for receiving a motor mount and, in such cases, an adaptor or end cap is fixed to the end structure of the motor to provide in effect an extension of the motor end structure with a diameter suitable for receiving an annular motor mount. Particularly when such adaptors are used, the problem arises as to the manner in which the motor mount is to be secured to the adaptor. Some prior art solutions are to form splines around the periphery of the adaptor, which splines are then received in corresponding slots in the motor mount. Another solution has been to use an adhesive to secure the motor mount to the cylindrical surface of the adaptor. However, such solutions are relatively expensive. For example, a splined adaptor costs more than one which is not splined, and in the case of the use of an adhesive, the adhesive material itself is expensive and, furthermore, requires an extra step when applying the motor mount to the adaptor.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved resilient mounting arrangement for rotary machines.

It is a further object of the invention to provide an improved vibration isolating resilient mounting arrangement which is simple and inexpensive to manufacture, is low in cost, is easily and quickly produced, and can be swiftly and readily attached to structures of standard rotary machines to control the transmission of vibration and noise producing forces to stationary supports.

In carrying out these objects in one form, I provide an improved vibration isolating resilient motor mount for a rotary dynamoelectric machine which has a resilient annulus and a rigid hoop member component. The latter member has a plurality of sections, including angularly spaced apart flanged sections formed with free ends inclined inwardly toward its axis when disposed in normal preassembled positions. These flanged sections are interfitted with an inner region of the annulus in the vicinity of the annulus bore when in the assembled positions to restrain relative movement between the annulus and the member. Axially extending rigid finger sections, interposed between the flanged sections, are adapted to be engaged by a tool to press fit the resilient mount over the machine structure, such as an end frame adaptor. At least some of the plurality of sections are urged into firm frictional engagement with the machine structure to provide a non-rotatable mounting of the annulus relative to the structure.

The annulus and rigid member may conveniently be assembled into the desired interfitted relation as the rigid member is pressed into firm frictional engagement with the end structure of the rotating machine. For example, a force may be applied to the finger sections by means of a suitable tool to force the hoop member over the end structure. As the member slides over the end structure, the flanged sections are forced outwardly away from their preassembled positions to their assembled positions where they tend to exert great inwardly directed radial forces, i.e., the flanged sections are biased or urged inwardly into tight frictional engagement with the outer surface of the end structure, thereby securely clamping the rigid member and end structure together. If desired, the finger sections may also have their free ends slightly inclined inwardly in their preassembled positions so that when they are disposed in the assembled positions they augment the clamping action between the rigid member and end structure.

Thus, the present invention provides an improved vibration isolating resilient mounting arrangement which is simple and inexpensive to manufacture, is low in cost, is easily and quickly produced, and can be swiftly and readily attached to structures of standard rotary machines to control the transmission of vibration and noise producing forces to stationary supports.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view, partially in section and partially cut away, of a dynamoelectric machine including end structures having adaptors of end structures on each of which is assembled one form of the novel resilient mount of this invention;

FIG. 2 is an exploded perspective view of one form of the resilient mount of the invention shown with an end structure upon which the resilient mount is assembled;

FIG. 3 is an end view of the inner hoop member of the resilient mount prior to its assembly with the resilient annulus and end structures;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 3 and shows the configuration of one of the inclined flanged sections of the hoop member;

FIG. 5 is a cross-sectional view taken along line 5—5 of FIG. 3 and shows the configuration of one of the rigid finger sections interspaced between the flanged sections of the hoop member;

FIG. 6 is a cross-sectional view taken along line 6—6 of FIG. 2 and shows the shape of the resilient annulus and encircling ring of the resilient mount;

FIGS. 7A–7E illustrate one form of a method of producing the annulus, hoop, and end structure together, including the sequential steps of inserting the hoop member in the annulus and then assembling the resulting resilient mount on the adaptor of the end structure of a motor;

FIG. 8 illustrates an alternative construction of the resilient mount;

FIG. 9 illustrates an alternative method of producing the resilient mounting arrangement;

FIG. 10 illustrates another type of adaptor on which the resilient mount of the invention may be assembled;

FIG. 11 is a partial perspective view showing another form of the inner hoop member; and

FIG. 12 is a cross-sectional view taken along line 12—12 in FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One form of the invention is best exemplified by the resilient mount 10 illustrated in FIGS. 1–6 inclusive.

FIG. 1 illustrates the manner in which two of these resilient mounts are assembled on opposite end structures of a rotary dynamoelectric machine, for example, the electric motor 12. The motor contains a casing 14 which encloses a stator (not shown) and a rotor having hubs 16 and 18 formed on the motor end structures or shields 20 and 22, respectively. Fixed to the end shield 20 is an adaptor 24 having an opening 26 through which the rotor shaft 28 extends. Fixed to the end shield 22 is an adaptor 30 having a solid end 32. The motor is secured to a suitable mounting base 34 by means of a pair of upright supports 36 on opposite ends thereof on which the resilient mounts 10 are suitably clamped.

The purpose of the adaptors 24 and 30 is to provide extensions of the end shield hubs which extensions are of proper diameter for receiving the resilient mounts 10, although in other motor constructions the mounts could be attached directly to the frame of the machine.

As illustrated, the resilient mounts 10 are identical, and the only difference between the adaptors 24 and 30 is that adaptor 24 has an opening 26 in the end thereof whereas the other has a solid end wall 32. Therefore, I will limit the following description to the mount attached on the adaptor 24.

The exploded view of FIG. 2 and the other views in FIGS. 3, 4, 5 and 6 illustrate the details of the resilient mount 10.

The resilient mount 10 comprises two separable components: a cushion ring 38 and a rigid hoop member 40 which is interfitted with the annulus. The function of the cushion ring is to provide the resilience necessary for reducing the noise and vibrations in the motor 12 when the motor is mounted in the supports 34 as illustrated in FIG. 1. The hoop member 40 is designed to have a press fit on the cylindrical surface 42 of the adaptor 24 and prevents both axial and rotary movement of the resilient mount relative to the adaptor. The hoop member may be made of any suitable material, having the desired characteristics, for example, stamped out of 0.025 inch sheet steel material and bent or otherwise formed into the illustrated configuration.

As best shown in FIGS. 2 and 6, the cushion ring 38 consists of an annulus 44 made of resilient material, such as rubber. Encircling the outer periphery of the annulus and bonded thereto by a suitable adhesive is a rigid metal ring 46 having a circumferential indentation 48 which is received in a complementary circumferential groove 50 formed in the outer periphery of the annulus 44. Formed around the inner periphery of annulus 44 and a plurality of teeth 52 which form the inner wall of a radially inner region of the annulus, the wall defining the central bore of the cushion ring 38. The teeth are separated by a plurality of slots 54. The teeth 52 have an axial dimension less than that for the main body 45 of the annulus 44, thereby forming recesses 56 and 58 on the opposite end faces of the annulus.

The construction of the hoop member 40 in its preferred form is best illustrated in FIGS. 2, 3, 4 and 5.

The hoop member includes a cylindrical portion 60 having a diameter approximately the same as the bore of the cushion ring 38. Around one edge of the cylindrical portion 60 and integral therewith is an upright circumferential flange 62 whose width is such that the flange fits in the recess 58 below the shoulder 59 on the annulus 44.

On the opposite edge of cylindrical portion 60 and integral therewith are a plurality of sections including a number of peripherally, angularly spaced apart flanged sections 64 which in their normal preassembled positions are bent inwardly about equal distances from the cylindrical surface of the portion 60 toward the center or axis A of the hoop member 40. Between each pair of flanged sections 64 is interposed a rigid finger section 66 made integral with the cylindrical portion 60. These finger sections are extensions of the surface of the cylindrical portion 60 and if desired may be slightly inclined inwardly, although they are not so bent as illustrated to simplify the manner in which the member is forced into place on the adaptor.

On the opposite ends of each flanged section 64 are a pair of fins or projections 68 and 70 which are integral with the section and which extend generally radially away from the center of the bore of the hoop member. When member 40 is assembled within the cushion ring 38, these projections are received in the slots 54, thereby restraining or tending to prevent relative rotation of the hoop member and the annulus. Formed on the free end of each flanged section 64 is an upstanding flange or projection 72 integral with the associated section and also extending generally radially away from the center of the bore of the hoop member 40 but in a transverse direction to projections 68, 70. Flanges 72 are dimensioned such that they fit in the recess 56 located below the shoulder 57 on the resilient annulus 44 when resilient mount 10 is assembled on the adaptor 24 as illustrated in FIG. 1.

The free ends of the rigid finger section 66 form spaced circumferential surfaces which may be engaged by a suitable pressing tool to force the motor mount 10 onto the cylindrical surface 42 on the adaptor 24 after the flanged sections 64 have been inserted into the bore of cushion ring 38 to form the assembled motor mount.

FIG. 3 is an end view of the hoop member 40 as viewed from the left in FIG. 2, FIG. 4 is a cross-sectional view taken through one of the flanged sections

64 along the line 4—4 in FIG. 3, and FIG. 5 is a cross-sectional view of one of the rigid finger sections 66 taken along the line 5—5 in FIG. 3.

FIGS. 7A–7E illustrate the preferred form of the motor mount 10 and the steps of one method of assembling the cushion ring 38 and the hoop member 40 to form the motor mount 10 and also of assembling the cushion ring on the adaptor 24.

In FIGS. 7A–7E, the cushion ring 38 and hoop member 40 are to be assembled in the manner indicated in the exploded view in FIG. 2. The cushion ring 38 is placed over the flanged sections 64 with the projections 68 and 70 aligned with corresponding complementary slots 54 formed in the resilient annulus 44 as indicated in FIG. 7A. The cushion ring 38 is then moved toward the flange 62 as indicated by arrow 63 until the flange is received in the recess 58 located below the shoulder 59 of the body 45 of the resilient annulus 44. As illustrated in FIG. 7B, when the cushion ring 38 is assembled on the hoop member 40, the flanged sections 64 are still in their preassembled positions, that is, normally inclined towards the center of the member. When assembled in this manner, the annulus of the cushion ring and hoop member are firmly locked together by the upstanding projections 68 and 70 against relative rotation with respect to each other.

The bore of the motor mount 10 is then aligned with the cylindrical surface 42 of the adaptor 24, and a suitable pressing tool 74 is brought into engagement with the free ends of the finger sections 66 as illustrated in FIG. 7C. Assuming that adaptor 24 is fixed to the motor end shield as illustrated in FIG. 1 and that the motor is stationary, force is then applied to the tool 74 in the direction indicated by the arrow 76 to force the motor mount 10 over the cylindrical portion 42. As illustrated in FIG. 7D, the relatively rigid flanged sections 64 are forced upwardly away from axis A and into the recess 56 of the resilient annulus 44 as the motor mount 10 is forced over the cylindrical surface 42. As illustrated in FIG. 7E, when the motor mount 10 is assembled on the cylindrical surface 42 of the adaptor 24, the flanged sections 64 are forced into alignment with the cylindrical surface of the portion 60 of the hoop member 40. These flanged sections in their assembled positions are in effect biased toward the center of the motor mount and exert a tremendous force directed inwardly against the outer surface of adaptor 24, thereby providing an extremely tight friction fit between the motor mount 10 and adaptor 24. With such an arrangement, the resilient mount 10 is locked against both rotational and axial movement relative to the adaptor for all operating conditions of the motor. The resilient mount 10 may be left at the free end of the adaptor 24 as illustrated in FIG. 7E or else it may be forced further to the right until the flange 62 abuts the shoulder 80 of the adaptor.

The cushion ring 38 is clamped between the circumferential flange 62 and the individual transverse projections 72, thereby locking the cushion ring against relative axial movement with respect to the hoop member 40. When the resilient mount is positioned on the adaptor so that it abuts the adaptor shoulder 80, then flange 62 is not required, since the cushion ring 38 is then locked between the shoulder 80 and transverse projections 72.

FIG. 8 illustrates another form of the invention as exemplified by the motor mount 82. In this form of the invention, the cushion ring 38 is turned 180° before it is assembled with the hoop member 40. However, the motor mount 82 is assembled on the adaptor 24 in the same manner as already described in FIGS. 7C–7E.

FIG. 9 illustrates another manner in which the motor mount 82 of FIG. 8 can be assembled on the adaptor 24. In this case, the entire motor mount 82 is turned 180° so that the flanged sections 64 are pointing towards the adaptor 24 upon which the motor mount is to be assembled. Since the flanged sections 64 will not slide over the outer surface of the adaptor 24 in this position, a mandrel 84 may be used in the assembling process. The mandrel has a cylindrical surface 86 which is of smaller diameter than the smallest diameter formed by the free ends of the flanged sections 64. The mandrel also has an inclined cylindrical surface 88 which terminates in another cylindrical surface 90 having substantially the same diameter as the diameter of the adaptor 24. The motor mount 82 is then moved in the direction indicated by the arrow 92 so that the flanged sections 64 first slide over the surface 86 and are then pushed upwardly by the inclined surface 88 so that the entire resilient mount can be forced over the cylindrical surface 90 onto the cylindrical surface of the adaptor 24.

FIG. 10 illustrates one of the resilient mounts of this invention, for example the resilient mount 10, assembled on an adaptor 92 which is different from the adaptors 24 or 30 illustrated in FIG. 1. Adaptor 92 is designed for use with a motor having an end shield 94 which is different from the end shields 20 and 22 illustrated in FIG. 1. In this arrangement, the fixed end of the adaptor is designed to be received within a recess formed by a wall 96 of the end shield 94 rather than fitting over a projecting portion 98 of the end shield 20 illustrated in FIG. 1.

FIGS. 11 and 12 reveal another form of the rigid member, denoted by numeral 100. This member differs principally from the previously described rigid hoop members in that it has angularly spaced apart flanged sections 101 constructed with upstanding projections 102, 103 and transverse projection 104 in the forms of tangs which terminate in sharp points 105. Projections 106 in the form of similar tangs may be cut and bent at angularly spaced apart locations on circumferential flange 107. If desired, finger sections 108, inclined slightly inward as shown, may be interposed between the flanged sections for the purposes mentioned in connection with finger sections 66 of the first embodiment.

With this construction the projections may become interfitted with the inner region of an annulus which does not need preformed recesses and slots as illustrated in annulus 44 of the first embodiment. With the projections formed in the manner just described, projections 102, 103 and 106 primarily tend to restrain relative rotation or angular movement between the annulus and the rigid member, while projections 104 and circumferential flange 107 primarily tend to prevent relative axial movement between the two components. The resilient mount may be attached to the end structure of a rotary machine as already outlined.

Therefore, the present invention provides an improved vibration isolating resilient mounting arrange-

ment which is simple and inexpensive to manufacture, is low in cost, is easily and quickly produced, and can be swiftly and readily attached to structures of standard rotary machines to control the transmission of vibration and noise producing forces to stationary supports.

It should thus be apparent to those skilled in the art that while I have shown and described what at present is considered to be the preferred embodiments of my invention in accordance with the Patent Statutes, changes may be made in the embodiments disclosed without actually departing from the true spirit and scope of this invention, and I therefore intend to cover in the following claims all such equivalent variations as fall within the invention.

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

1. A resilient mounting arrangement for a rotating machine having an end structure comprising an annulus of resilient material having an inner region forming a bore, and a rigid member having an axis and in an assembled position being partly disposed within the bore and in engagement with the end structure, said rigid member being formed with a plurality of sections extending from a central section, a number of said plurality of sections being angularly spaced apart and being provided with upstanding portions in the vicinity of free ends to form flanged sections including free ends at least some of which are forced to the assembled position thereof from positions inclined inwardly toward the axis, said flanged sections having the upstanding portions interfitted with the inner region of said annulus when disposed in the assembled position to restrain relative movement between said annulus and member, and at least some of the plurality of sections being urged into firm engagement with the end structure to provide a nonrotatable mounting of the annulus relative to the end structure.

2. The resilient mounting arrangement of claim 1 in which the plurality of sections include axially extending rigid finger sections interposed between said flanged sections to assist in mounting the member onto end structure.

3. The resilient mount of claim 1 in which at least said flanged sections of said member include upstanding projections which interfit with the inner region of said annulus to provide the restrained relative movement.

4. The resilient mounting arrangement of claim 1 in which the inner region of the annulus includes a number of spaced apart axially extending slots and an end wall having at least one recess transverse to the slots, and the flanged sections of said member include projections interfitted with the slots and the at least one recess.

5. The resilient mounting arrangement of claim 4 in which the member has an upstanding flange in engagement with an end wall of the inner region remote from the recessed end wall of said annulus.

6. In a resilient mount for a rotating machine including an annulus of resilient material having an inner region forming a bore, a rigid member having an axis and being adapted to be disposed partly within the bore and in engagement with the rotating machine in an assembled position, said member being formed with a plurality of sections, a number of said plurality of sections being angularly spaced apart and being formed with portions extending outwardly adjacent free ends thereof to provide flanged sections with the free ends having normal preassembled positions inclined inwardly toward the axis, said flanged sections being adapted to be interfitted with the inner region of the annulus when disposed in the assembled position to restrain relative movement between the annulus and said member, and at least some of the plurality of sections being adapted to be biased into firm engagement with the rotating machine.

7. The structure of claim 6 wherein the plurality of sections include axially extending rigid finger sections being interposed between said flanged sections being adapted to augment the securement of the member to the rotating machine.

8. The structure of claim 6 wherein at least said flanged sections thereof further include upstanding projections which are adapted to interfit with the inner region of the annulus to provide restrained relative movement therebetween.

9. A resilient mounting arrangement for a rotating machine having an end structure including; an annulus of resilient material including a plurality of angularly spaced apart teeth defining a bore with a plurality of angularly spaced apart slots extending outwardly therefrom; a rigid member including a cylindrical portion with a plurality of angularly spaced apart sections extending therefrom; said rigid member, in an assembled position, being at least partly disposed within the bore and in engagement with the end structure; at least some of said sections being nonplanar and, in an assembled position, being at least partly received in corresponding slots thereby to provide relative large surfaces for engagement with corresponding ones of said teeth for restraining relative rotational movement of said annulus and said rigid member.

10. A resilient mounting arrangement as set forth in claim 9 wherein said at least some of said sections include projections which extend generally radially of the bore and are received in corresponding slots.

11. A resilient mounting arrangement as set forth in claim 9 wherein other of said sections are rigid and extend axially between adjacent ones of said at least some of said sections to augment securement of said member to the rotating machine.

12. A resilient mounting arrangement for a rotating machine having an end structure comprising a first member having an inner region forming a bore and a second member having an axis and in an assembled position being partly disposed within the bore and in engagement with the end structure, said second member being formed with a generally encircling section and with a plurality of angularly spaced apart sections extending axially away from the generally encircling section, a number of the plurality of sections being formed with upstanding flanges, said number of sections being interfitted with the inner region of said first member to restrain relative movement between said first and second members, and at least some of the plurality of sections being in firm engagement with the end structure to produce a non-rotatable mounting of the first member relative to the end structure.

13. The resilient mounting arrangement of claim 12 in which the plurality of sections include sections ex-

tending axially away from the generally encircling section disposed between at least several pairs of said number of sections to assist in mounting the first and second members onto the end structure.

14. The resilient mounting arrangement of claim 12 in which at least some of the number of sections have more than one upstanding projection adjacent free edges thereof which interfit with the inner region of said first member to assist in restraining relative rotation between said first and second members.

* * * * *