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Otto

[11] **3,750,267**

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[54] **METHOD FOR PRODUCING A RESILIENT MOUNTING ARRANGEMENT FOR ROTATING MACHINES**

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[21] Appl. No.: **209,566**

Related U.S. Application Data

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[52] **U.S. Cl.** **29/507,** 29/450, 29/509, 29/523, 29/596, 310/42, 310/91

[51] **Int. Cl.** **B21d 39/00,** B23p 11/02

[58] **Field of Search** ..... 29/596, 523, 507, 29/509, 450; 310/42, 91, 51; 248/26; 285/258; 287/85 R

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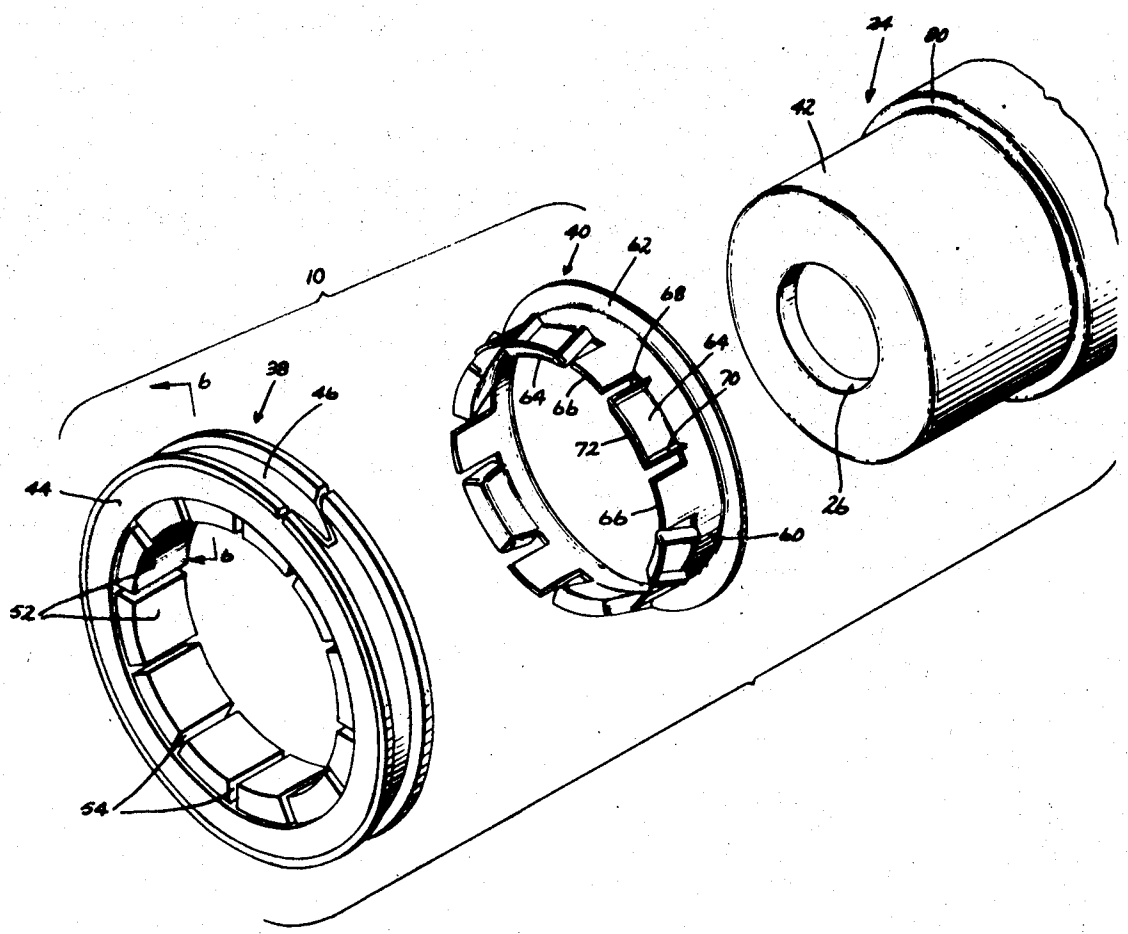
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[57] **ABSTRACT**

A method of producing a resilient mount attached to an end structure of a rotating machine, such as a dynamoelectric machine, in which in one form the resilient mount includes an annulus of resilient material and a rigid member formed with a plurality of angularly spaced apart flanged sections disposed about an axis. Initially the spaced apart flanged sections are disposed in the bore of the annulus and have free ends normally inclined toward the axis. These free ends are then forced outwardly, away from the axis of the rigid member, into interfitting engagement with the inner region of the annulus as the rigid member is being pressed into firm frictional engagement with the end structure. In the assembled structure there is provided restrained relative movement between the components; the annulus, the rigid member, and the structure on which the other two parts are attached, by a method which is relatively simple and inexpensive to practice.

8 Claims, 16 Drawing Figures



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SHEET 1 OF 2

FIG. 1

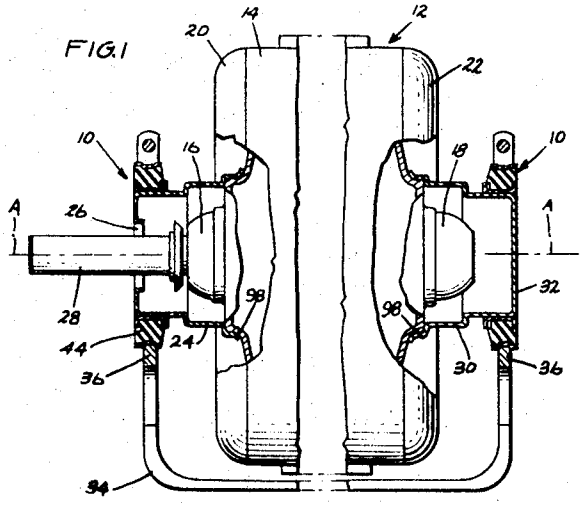


FIG. 3

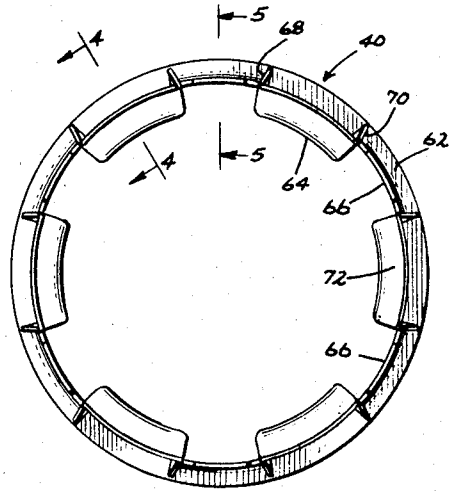
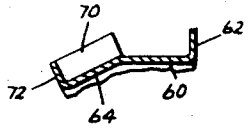


FIG. 4



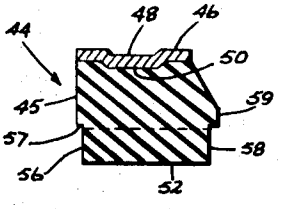


FIG. 6

FIG. 5

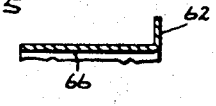


FIG. 2.

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FIG.7A

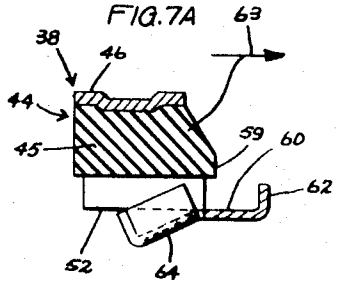


FIG.7B

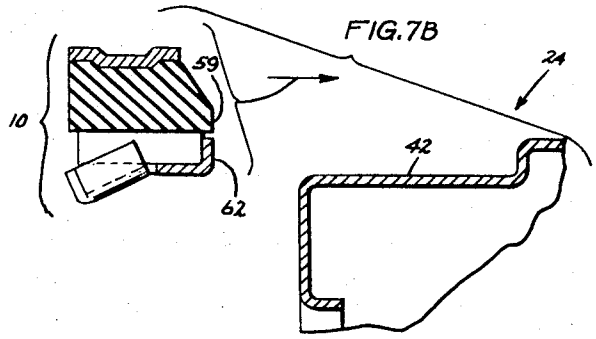


FIG.7C

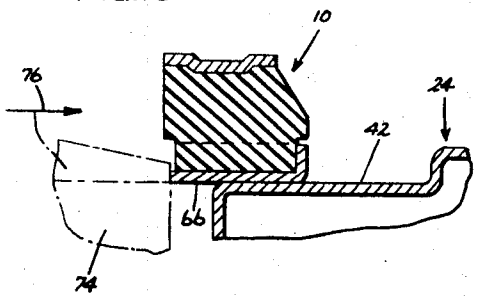


FIG.7D

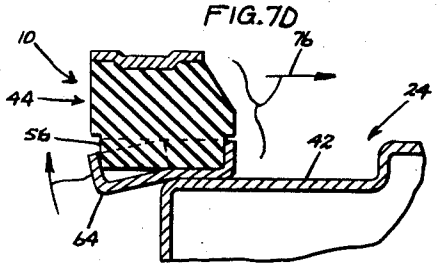


FIG.11

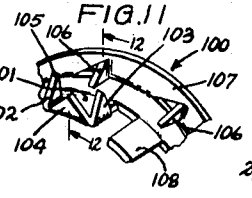


FIG.7E

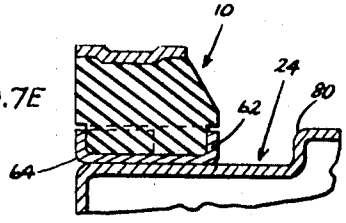


FIG.8

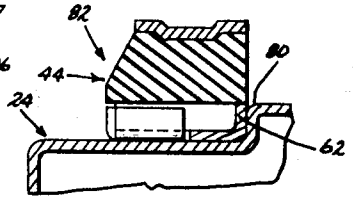
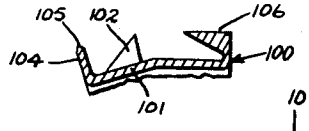


FIG.12



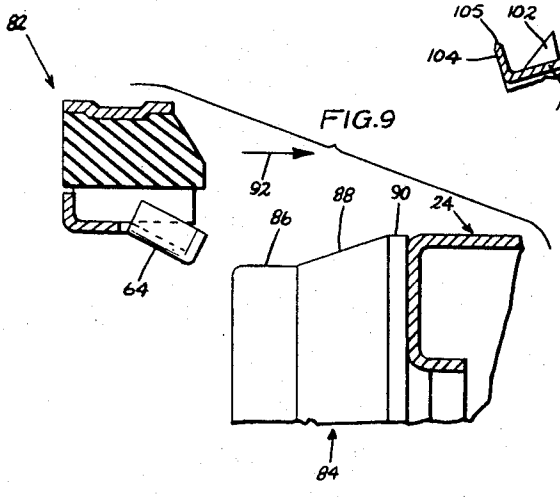


FIG.9

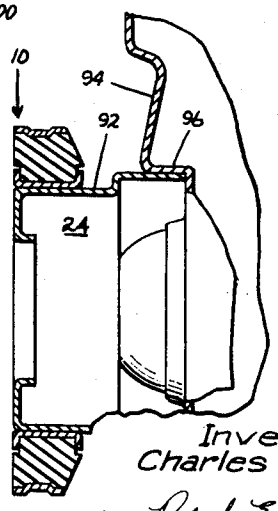


FIG.10

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METHOD FOR PRODUCING A RESILIENT MOUNTING ARRANGEMENT FOR ROTATING MACHINES

CROSS-REFERENCE TO RELATED APPLICATION

This is a division of my co-pending application Ser. No. 869,147, filed Oct. 24, 1969 now U.S. Pat. No. 3,685,773.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the field of producing 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 method of producing resilient mounting arrangement for rotary machines.

It is a further object of the invention to provide an improved method of producing, in an easy and quick manner, a low cost resilient mounting arrangement which has a resilient member which 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 method of producing a resilient mounting arrangement for rotating machines 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.

The annulus and the 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.

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 a resilient mount by one form of the present invention;

FIG. 2 is an exploded perspective view of one form of the resilient mount of the invention shown with and 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 interspacd 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 in more detail of the 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 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

Turning now to a more detailed description of FIGS. 1-6 inclusive and in particular to FIG. 1, there is illustrated one manner in which two resilient mounts 10 are assembled on opposite end structures of a rotary dynamoelectric machine, for example, electric motor 12 of standard construction. 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. More specifically, 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 are 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. Member 40 is relatively rigid as exemplified.

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.

Considering now FIGS. 7A–7E, there is illustrated the preferred steps in one method of producing the resilient mounting arrangement by assembling the cushion ring 38 and the hoop member 40 to form the motor mount 10 and also by assembling the cushion ring onto 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, nor-

mally 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 a motor mount which may be employed in the present method, the mount being identified by numeral **82**. In this form of the invention, the cushion ring **38** is turned **180°** before it is assembled with the hoop member **40**. The motor mount **82** may be assembled on the adaptor **24** in the same manner as already described in connection with 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 a resilient mount, 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 method of producing a resilient mounting arrangement for rotating machines which is simple and inexpensive to manufacture, is low in cost and is easily and quickly practiced, and wherein resilient mounts 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 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 method of producing a resilient mount for a rotatable machine from an annulus of resilient material formed with an inner region having a bore and a rigid member formed with a plurality of sections about an axis with a number thereof being angularly spaced apart flanged sections having free ends normally in-

clined inwardly toward the axis and upstanding projections, the method of producing the resilient mount comprising the steps of: arranging the angularly spaced apart flanged sections in the bore of the annulus; and forcing the flanged sections arranged in the annular bore outwardly away from the axis of the rigid member so that the upstanding projections become interfitted with the inner region of the annulus to provide restrained relative movement between the annulus and rigid member.

2. The method of claim **1** including the further step of attaching the resilient mount to a portion of a rotatable machine by pressing against finger sections, interposed between the flanged sections, to force the resilient mount into firm frictional engagement with the portion of the rotatable machine.

3. A method of producing a resilient mount attached to an end structure of a rotatable machine, with the resilient mount including an annulus of resilient material formed with an inner region having a bore and a rigid member formed with a plurality of sections about an axis, a number of the sections being angularly spaced apart flanged sections, the method including the steps of: disposing the angularly spaced apart flanged sections in the bore of the annulus with the flanged sections having free ends normally inclined inwardly toward the axis; and forcing the flanged sections disposed within the bore outwardly away from the axis of the rigid member into interfitted engagement with the inner region of the annulus while pressing the rigid member into firm frictional engagement with the end structure of the rotatable machine, whereby restrained relative movement between the annulus and rigid member and a firm mounting of the rigid member on the end structure are attained.

4. A method of producing a resilient mount attached to an end structure of a rotatable machine with the resilient mounting including an annulus of resilient material formed with an inner region having a bore defined at least in part by surfaces of a plurality of teeth separated from one another by slots, and with the resilient mounting including a rigid member formed with a plurality of sections about an axis, a number of the sections being angularly spaced apart flanged sections with at least some of the flanged sections including at least one generally radially directed projection adapted to interfit with one of the slots; the method including the steps of: disposing the angularly spaced apart flanged sections in the bore of the annulus with the flanged sections having free ends normally inclined inwardly toward the axis; and forcing the flanged sections outwardly away from the axis of the rigid member into interfitted engagement with the inner region of the annulus which forcing includes moving the at least one generally radially directed projection radially relative to at least one of the teeth adjacent thereto as the rigid member is being pressed into firm frictional engagement with the end structure of the rotatable machine, whereby restrained relative movement between the annulus and rigid member and a firm mounting of the rigid member on the end structure are attained.

5. A method of producing a resilient mount for a rotatable machine from a body of resilient material formed with an inner region having a set of annularly disposed teeth defining a bore, and a rigid member formed with a plurality of angularly spaced apart flanged sections inclined inwardly toward a generally centrally disposed axis of the rigid member with at least some of the flanged sections including a generally upstanding projection, the method of producing the resilient mount comprising the steps of: arranging at least a part of the rigid member in the bore of the body of resilient material; and forcing the generally upstanding projections outwardly away from the axis of the rigid member so that the upstanding projections become interfitted with the annularly disposed teeth of the inner region of the body of resilient material to provide restrained relative movement between the body of resilient material and the rigid member.

6. A method of producing a resilient mount on a rotatable machine from a body of resilient material formed with an inner region having a set of annularly disposed teeth defining a bore, and a rigid member formed with a plurality of angularly spaced apart flanged sections inclined inwardly toward a generally centrally disposed axis of the rigid member with at least some of the flanged sections including generally upstanding projections, said rigid member further including finger sections interposed between at least some of the generally upstanding projections; the method of producing the resilient mount comprising the steps of: arranging at least a part of the rigid member in the bore of the body of resilient material; forcing the generally upstanding projections outwardly away from the axis of the rigid member so that the upstanding projections become interfitted with the annularly disposed teeth of the inner region of the body of resilient material to provide restrained relative movement between the body of resilient material and the rigid member; and attaching the resilient mount to a portion of the rotatable machine by pressing against the finger sections and forcing the resilient mount into firm frictional engagement with the portion of the rotatable machine.

7. The method of claim **5** wherein the rotatable machine is provided with at least one portion having a mounting surface and the method further comprises relatively positioning the body of resilient material and rigid member, and pressing the rigid member along the mounting surface of the rotatable machine.

8. The method of claim **7** wherein the rigid member includes other angularly spaced apart generally upstanding projections with each of the other generally upstanding projections being associated with and angularly disposed relative to a different one of the first mentioned generally upstanding projections and wherein the method further comprises forcing the other angularly spaced apart generally upstanding projections outwardly away from the axis of the rigid member while pressing the rigid member along the mounting surface of the rotatable machine.

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