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Engert

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[54] **DETACHABLE BUSHING**

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[52] **U.S. Cl.** ..... **174/152 R**, 339/126 R

[51] **Int. Cl.** **H01b 17/30**

[58] **Field of Search**..... 174/18, 151, 152 R, 152 G, 174/153 R, 163 R, 167; 285/12, 158, 177, 205, 206, 208; 339/126 R, 129, 130 R

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[57] **ABSTRACT**

A mounting clamp is provided for detachably securing an electrical bushing upon the wall of an electrical transformer tank in sealing relationship therewith. The clamp is securable to the tank is different dispositions so as to be cooperable with bushings of differing sizes and configurations in detachably mounting same to the tank.

2 Claims, 7 Drawing Figures

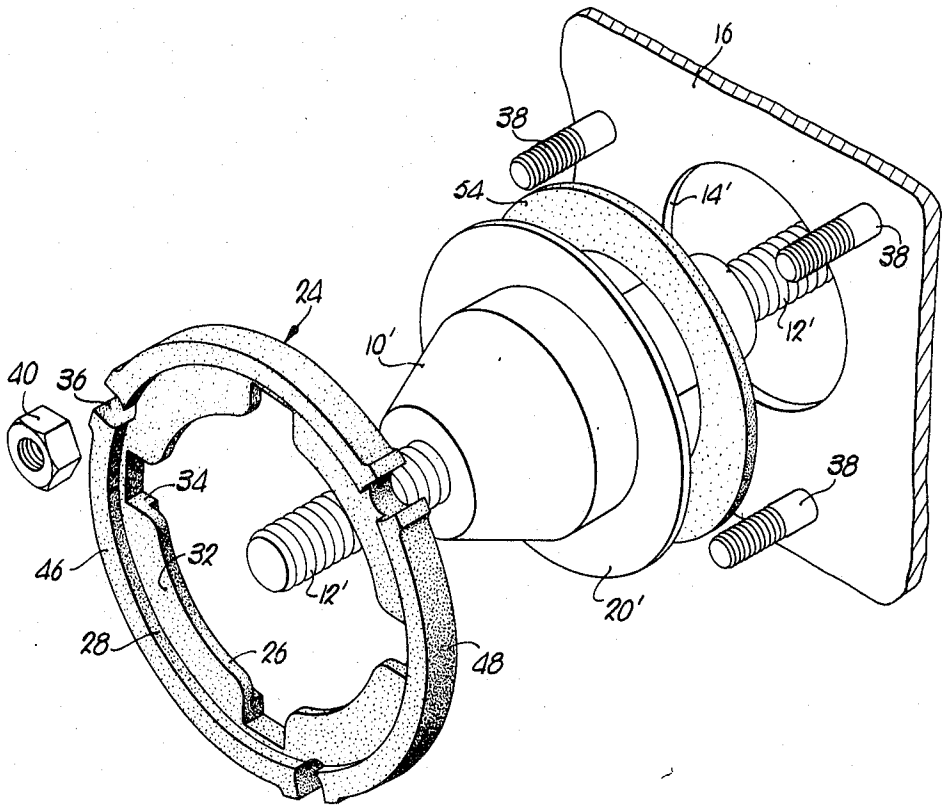
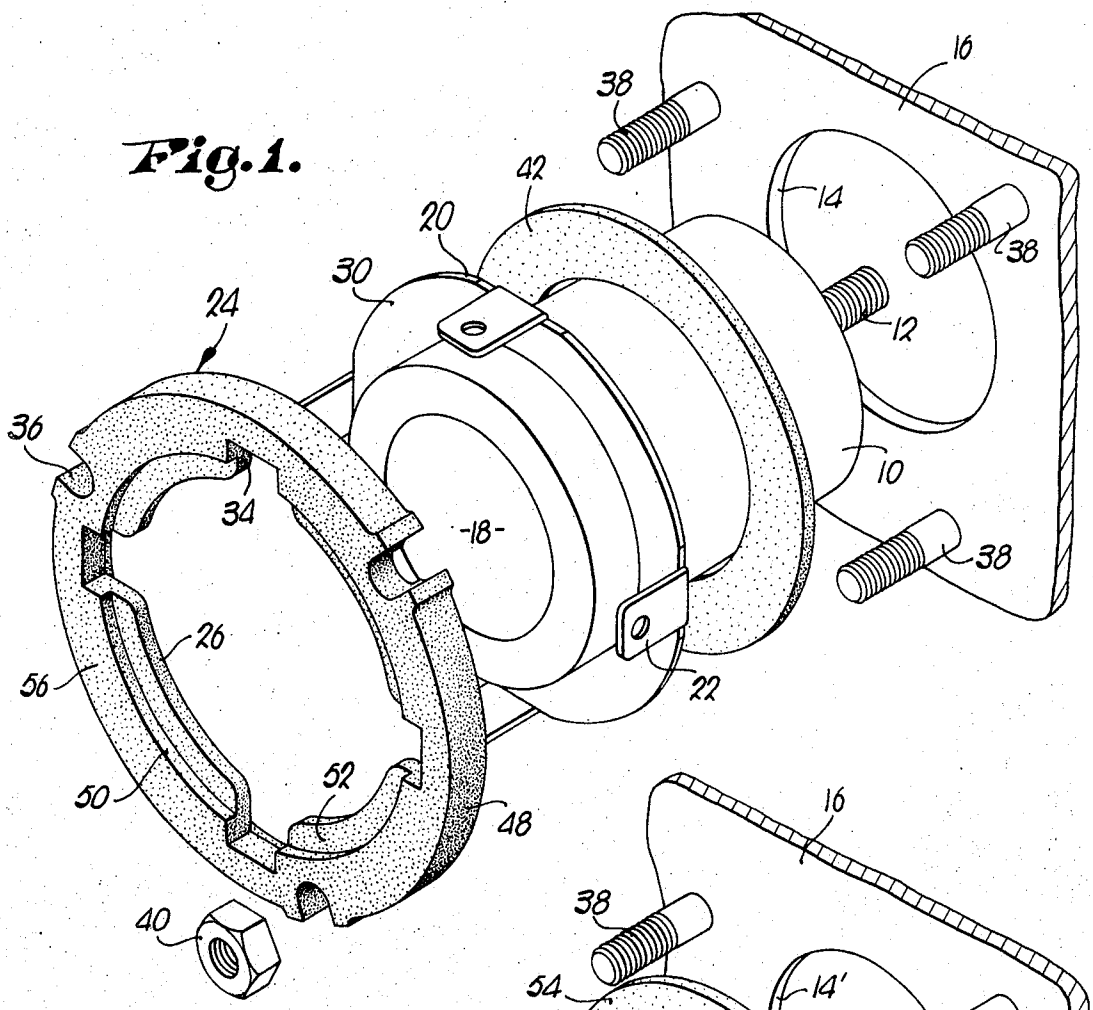


Fig. 1.


16
38
42
14
20
30
38
12
24
36
34
10
-18-
38
26
56
22
50
52
48
40

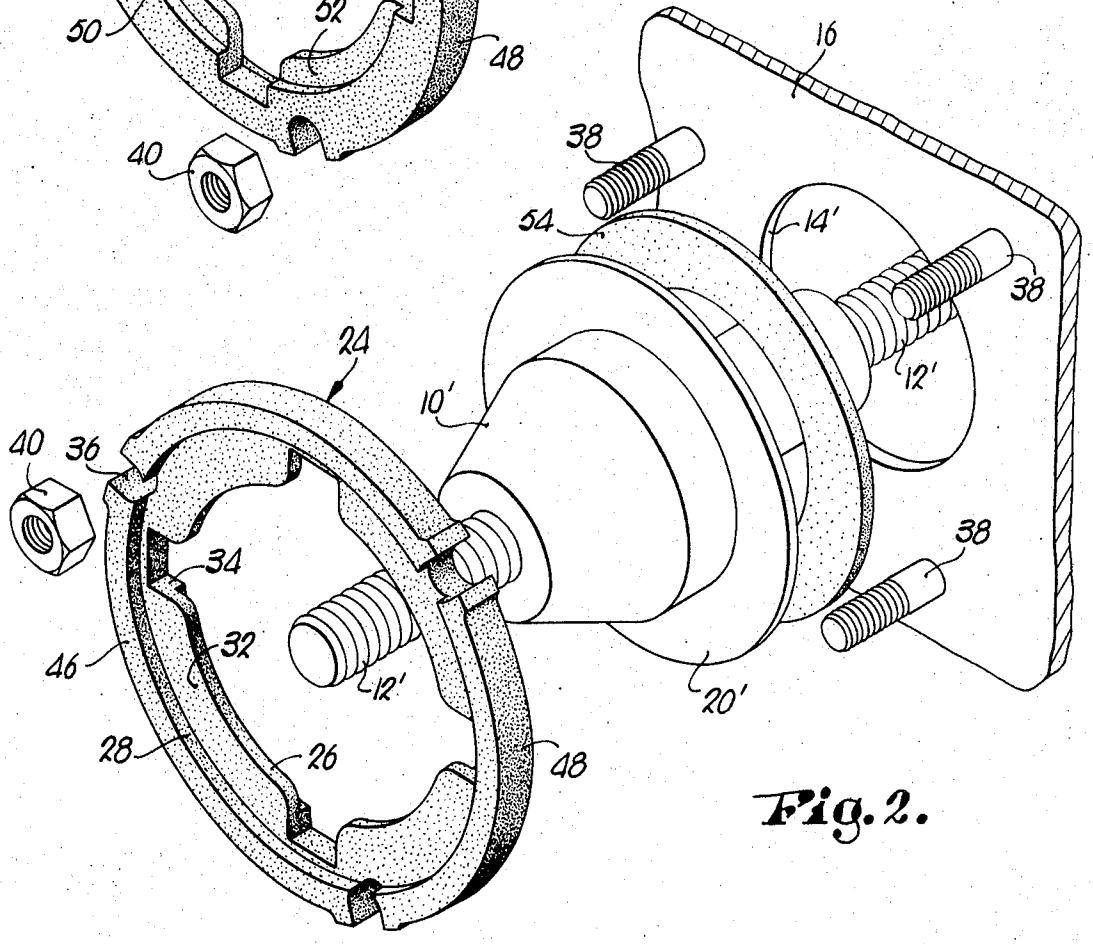

16
38
54
14'
38
24
10'
12'
40
36
38
34
46
32
12'
20'
28
26
48

Fig. 2.

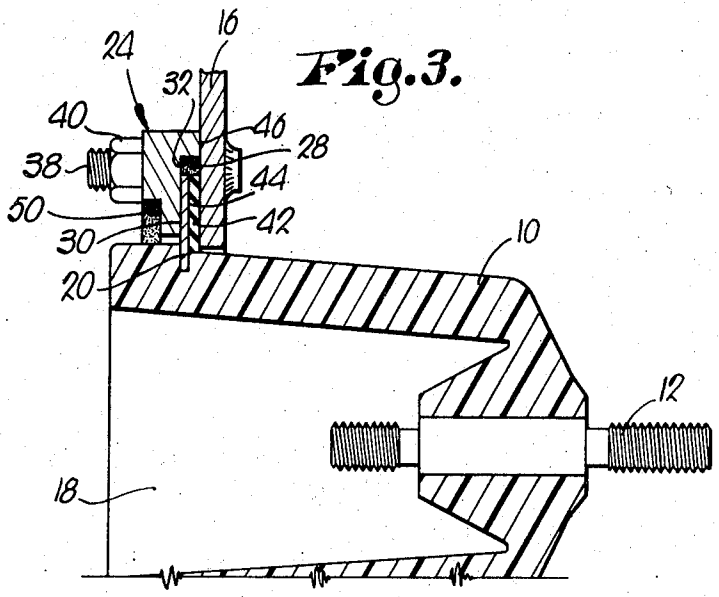


Fig.3.

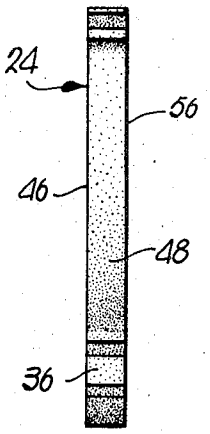


Fig.7.

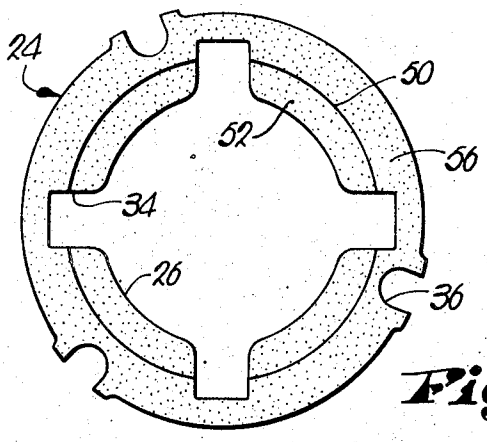


Fig.5.

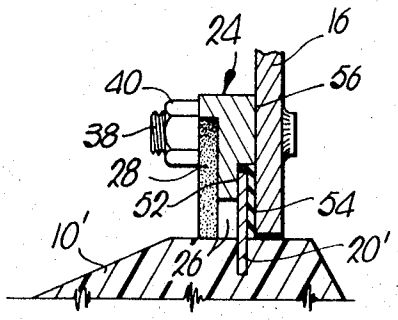


Fig.4.

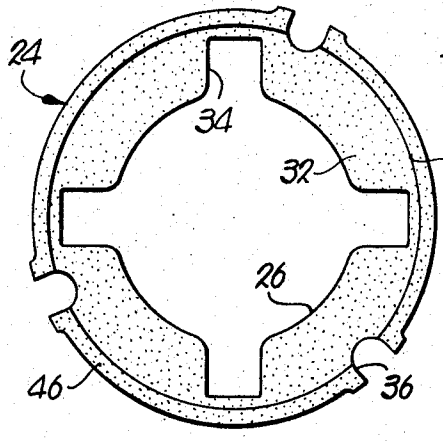


Fig.6.

DETACHABLE BUSHING

This invention relates to electrical bushings which are secured upon transformer tanks or like sealed container electrical equipment so as to present electrical terminals extending from the interior of the tank.

Electrical bushings of the type described are presently produced in various types of configurations so as to be permanently affixed upon an electrical transformer tank such as by welding process or the like. The bushing presents an electrical conductor which extends through an opening in the wall of the transformer tank into the interior thereof which is normally filled with transformer oil. An opposite end of the bushing conductor is disposed for interconnection with an electrical terminal input or output line as the case may be. Conventionally, the bushings are provided with an insulative component and an exterior mounting flange affixed upon the component, which flange is adapted to be welded upon the transformer tank in order to permanently affix the bushing to the tank in a manner sealing the opening therein.

Examples of such bushings are commonly referred to as "primary" and "secondary" bushings utilized in step-down transformers of electrical power systems. A typical transformer will be provided with one or a pair of primary bushings which provide interconnection of the fluid-filled interior of the transformer with high voltage power input lines, and a trio of secondary bushings presenting output terminals from the tank so as to permit 110 or 220 volt power to be drawn from the transformer. Typically, the primary and secondary bushings are produced in quite different sizes and configurations in accordance with the current, voltage and other performance characteristics required thereof.

Some primary and secondary bushings are normally welded upon the transformer tank, thereby sacrificing the ability of the bushing or transformer to be easily repaired or replaced. Due to occurrence of various malfunctions, accidents of nature or the like, it becomes necessary from time to time to repair or replace the bushings, and in the past this has required extensive labor and possibly complete replacement of the transformer. Further, the welding process may occasionally not completely seal the transformer tank, and the resulting leakage will not be detected until the final stages of manufacture when corrective measures are costly.

Electrical conductor bushings are similarly affixed upon other types of sealed container electrical equipment such as air interrupter or other switchgear, fuse boxes, and the like. In any instance where such equipment must be effectively sealed, the above described problems associated with welded bushings will be prevalent.

It is an important object of the present invention to provide a clamp assembly for mounting an electrical bushing in sealing relationship to a sealed container to eliminate leakage at the bushing receiving openings therein.

Another object of the invention is to provide a clamp assembly for detachably mounting an electrical bushing to the container to facilitate subsequent repair and replacement work, said assembly being cooperable with presently available bushings of standardized design without requiring any alteration or modification thereof in firmly, detachably securing these bushings in a corresponding opening in the tank wall.

The principal object of the present invention is to provide a mounting clamp assembly for detachably securing an electrical bushing to the wall of a transformer tank in different dispositions, in one disposition the clamp assembly cooperating with a first bushing of standard design and in a second disposition cooperating with another standard bushing of different size and design, in order to present a single clamp assembly which may be utilized in detachably mounting either one of the different bushings to the transformer.

These and other more particular objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment of the invention when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is an exploded, isometric view of a primary bushing and a clamp assembly constructed in accordance with the present invention;

FIG. 2 is an exploded, isometric view similar to FIG. 1 and illustrating a secondary bushing in conjunction with the clamp assembly;

FIG. 3 is a transverse, fragmentary, cross-sectional view of the components illustrated in FIG. 1 when secured upon the transformer tank;

FIG. 4 is a cross-sectional view similar to FIG. 3 and illustrating the components of FIG. 2 when secured upon the transformer tank;

FIG. 5 is an elevational view of the side of the mounting clamp which accepts the secondary bushing;

FIG. 6 is an elevational view of the side of the mounting clamp which accepts the primary bushing; and

FIG. 7 is a side elevation of the mounting clamp.

A typical electrical primary bushing of conventional design is illustrated in FIGS. 1 and 3, which bushing includes an insulative component 10 in which is rigidly affixed a centrally disposed electrical conductor 12. The major portion of component 10 is received through an opening 14 of an electrical tank transformer wall 16 so that the inner end of conductor 12 is exposed to the transformer oil normally carried within the interior of the transformer tank. The primary bushing illustrated is often termed a bushing well as it is of the female type having a hollow interior portion 18 adapted to receive a male electrical terminal for interconnection with the outer end of the conductor 12 which is disposed within interior 18.

The primary bushing is also normally provided with an annular, metallic mounting flange 20 affixed upon component 10 and protruding exteriorly thereof. Mounting flange 20 is of substantially larger diameter than transformer opening 14 so as to contact wall 16 and, as has heretofore been conventional practice, to permit welding of the mounting flange to wall 16. Normally, the entire mounting flange 20 is welded in order to effect complete sealing of opening 14 and prevent leakage of oil from the interior of the transformer tank. Mounting flange 20 may also be provided with a plurality of axially extending means in the form of tangs 22 that may be coupled with resilient means normally carried by the male electrical terminal received by the primary bushing.

Instead of welding flange 20 to wall 16, the present invention provides a detachable clamp assembly which includes an annularly shaped, clamp body 24 which is cooperable with flange 20 in detachably securing the primary bushing to the transformer tank. Clamp body 24 has a central opening 26 for receiving the compo-

nent **10** of the primary bushing and has a recess **28**, FIG. **6**, on one side thereof which conforms substantially in shape and size to the front surface **30** of the mounting flange **20**. The clamp thereby presents a somewhat extensive and substantially continuous recess surface **32** for firmly contacting the flange front surface **30**. Cooperating, symmetrically spaced indentures **34** may be provided in clamp **24** for receiving the tangs **22**. A plurality of angularly spaced, symmetrically disposed apertures **36**, open at the exterior of clamp **24**, align and receive threaded studs **38**. The three apertures **36** are spaced from the four indentures **34** in a manner maintaining maximum strength of clamp **24**.

By orienting clamp **24** with flange **20** between it and the tank wall so that recess surface **32** is in engagement with flange front surface **30**, the primary bushing may be detachably mounted upon the tank simply by screwing nuts **40** onto the threaded studs **38** of the tank. An elastomeric sealing member **42** of substantially the same size and shape as flange **20**, is interposed between tank wall **16** and the rear surface **44** of flange **20** so that upon tightening of nuts **40**, the member **42** compresses into firm sealing interengagement with the flange and the tank wall to positively seal tank opening **14**.

The depth of recess **28** is somewhat greater than the axial thickness of flange **20**, but less than the combined thickness of the flange **20** and sealing member **42** when the latter is uncompressed. This permits the clamp to be drawn up to tank wall **16** until a raised surface **46** presented by the thicker, outer rim portion **48** of the clamp **24**, contacts tank wall **16**. In this manner, uniform pressure will be exerted across the entirety of flange **20** and sealing member **42** in order to uniformly compress member **42** and thereby effect proper and complete sealing of opening **14**. At the same time, recess **28** is sufficiently deep to captively receive flange **20** and sealing member **42** to hold same in proper alignment and facilitate handling and mounting of the assembly upon the tank.

FIGS. **2** and **4** illustrate the mounting clamp **24** in cooperation with a secondary bushing of different, yet conventional design, which secondary bushing includes an electrical conductor member **12'** and component **10'** that are of substantially different size and design as compared to primary bushing conductor **12** and component **10**. The mounting flange **20'** associated with the secondary bushing is of substantially smaller design than the corresponding flange **20** of the primary bushing. Like the primary bushing, the secondary bushing is insertable within an opening **14'** of the tank transformer wall **16** to expose the inner end of conductor **12'** to the transformer oil while its outer end is exteriorly located for interconnection with an electrical terminal.

Clamp **24** is provided with a secondary recess **50**, FIG. **5**, and associated recess surface **52** at a side thereof opposite the side that is provided with recess **28**. This second recess is configured in shape and design for receiving the front surface of the secondary bushing flange **20'**, the recess surface **52** presenting a substantial area for contacting secondary bushing flange **20'**.

Relative to its cooperation with the primary bushing, the bushing clamp **24** may be reversely disposed so as to receive the secondary bushing flange **20'** within recess **50**. In this disposition, the mounting clamp may be detachably secured to the tank wall with flange **20'** and a seal member **54** located between the flange and the tank wall so as to effect detachable securement of the secondary bushing on the tank wall **16**. The elastomeric seal member **54**, conforming in size and design to secondary bushing flange **20'**, is located intermediate the tank wall and the flange **20'** in sealing interengagement therewith upon securement of the secondary bushing to the tank wall. The recess **50** defines a peripheral raised surface **56** on the side of rim **48** opposite raised surface **46**, this raised surface **56** being adapted to firmly and uniformly contact the tank wall **16** upon securement of clamp **24** thereto in this reversed disposition. Recess **50** is of a depth intermediate the thickness of secondary flange **20'** and the combined thickness of this secondary flange and seal member **54**, so that recess **50** captively receives the flange and sealing member while assuring proper sealing compression of member **54** when the raised surface **56** is drawn into contact with the tank wall **16**.

The stud and nut arrangement utilized is of the type that is easily releasable from clamp **24** in order to permit easy, straightforward detachment of the primary or secondary electrical bushing from the transformer tank. Various forms of securing means may be utilized in conjunction with clamp **24**, the stud and nut arrangement being chosen in view of its ruggedness and simplicity.

The incorporation of through apertures **36** at rim **48** in non-interfering relationship to the flanges and sealing members, permits use of the nuts **40** in either disposition of the mounting flange **24**. This, in conjunction with the two recesses **28** and **50** on the opposite side of the clamps, presents a single clamp assembly which is capable of detachably securing either the primary or the secondary bushing to the tank wall, even though these bushings are of markedly different design.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with a transformer tank having an electrical bushing extending through an opening provided therefor in a wall of the tank, a clamp assembly comprising:

an annular sealing ring of compressible material circumscribing said bushing and in engagement with said tank wall;

a thin, flat, metallic, annular flange of radial diamensions substantially identical to that of said sealing ring and positioned against the face of of the latter remote from said tank wall;

an intergral, annular metallic body circumscribing said bushing in covering disposition to said flange and sealing ring, said body having an annular, outermost rim of radial and axial dimensions to cover the circumferential edges of said flange and sealing ring in in a closely fitting manner with the radial leading edge of the rim adapted to engage said tank wall, there being radially inwardly extending lip means on said rim rearward from the leading edge thereof in contact with the face of said flange remote from said sealing ring, the axial distance between the contact face on said lip means and the leading edge of said rim being greater than the axial thickness of said flange but less than the combined thicknesses of the flange and sealing ring when the latter is uncompressed; and

means for releasably moving said body into sealing engagement with said flange, whereby the latter

bears against said sealing ring to compress the same and effect a seal about said bushing with the leading edge of said body engaging said tank wall.

2. The combination of claim 1 wherein said rim extends axially rearwardly from said lip means to define a secondary recess on the face of said body remote from said flange, said recess being of different dimensions than the recess on the remaining side of said body and being adapted for use with a complementary bushing of different configuration.

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