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Brandt et al.

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[54] **TERMINAL ASSEMBLY**

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[52] **U.S. Cl.**.....**339/176 R,** 174/152 GM, 339/218 R

[51] **Int. Cl.**.....**H01b 17/26**

[58] **Field of Search**.174/50.59, 152 GM; 339/126 R, 339/126 J, 136, 144, 156, 176 R, 176 M, 192, 193, 195, 196, 198 C, 218

[56] **References Cited**

UNITED STATES PATENTS

3,160,460	12/1964	Wyzenbeek	339/176 R
3,465,284	9/1969	McManus	339/196 M
3,551,191	12/1970	Elbling et al.	117/229

FOREIGN PATENTS OR APPLICATIONS

1,152,169	8/1963	Germany	174/152 GM

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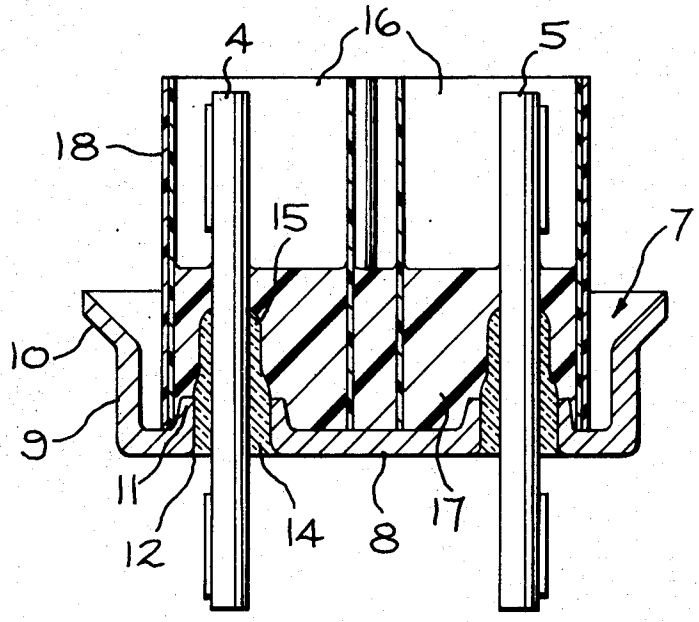
[57] **ABSTRACT**

An electric terminal assembly, particularly for heremetic compressors, comprising a plurality of conductor pins extending through a metal body member and secured thereto by glass-to-metal seals is provided with sleeves of insulating material surrounding the pins and a body of resinous material anchoring the sleeves to the body member and covering the glass seals.

6 Claims, 3 Drawing Figures



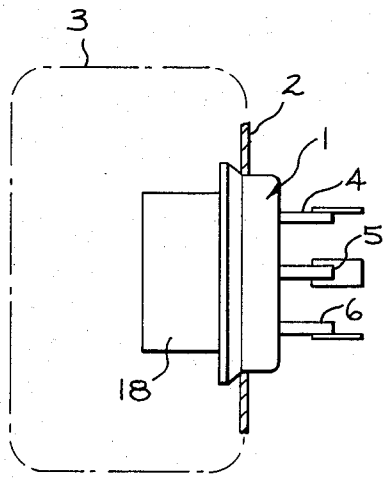


FIG. 1

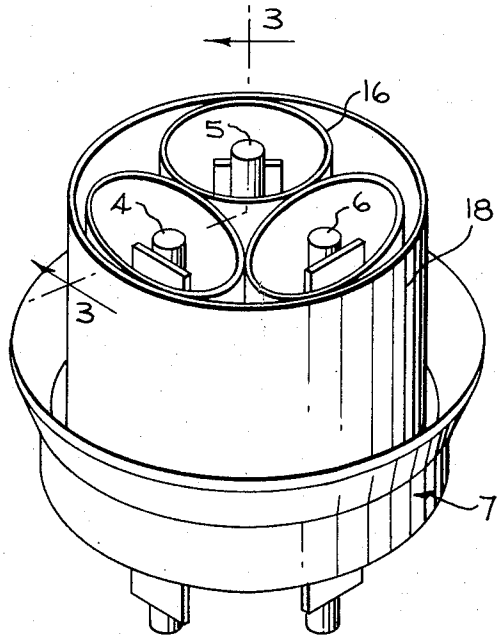


FIG. 2

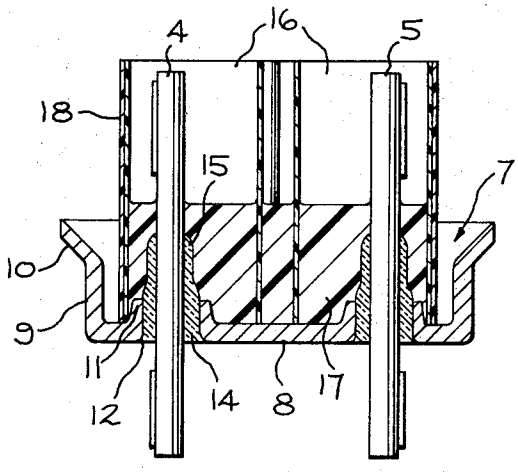


FIG. 3

TERMINAL ASSEMBLY

BACKGROUND OF THE INVENTION

Current terminal assemblies for making electrical connection to the motor component of a hermetic motor compressor unit include a plurality of conductor pins projecting through spaced apertures in a metal body portion and hermetically sealed thereto by glass-to-metal seals. These terminal assemblies, as described for example in U.S. Pat. No. 3,160,460-Wyzenbeek, include a cup-shaped metallic body portion adapted to be inserted in an opening in a hermetic casing with the open end facing the interior of the casing and the side walls hermetically attached to the casing as by resistance welding.

During operation of a hermetic motor compressor unit as part of a refrigeration system, metallic particles in the system are attracted to the surfaces of the glass insulator beads forming the glass-to-metal seals by a phenomenon known as electrophoresis and these particles can build up on the surface of the glass to the point that an electrical conductive path is established resulting in a short circuit causing a terminal failure. Other contaminants within the system, such as moisture and acidic components such as halogen acids resulting from a partial decomposition of the halogenated hydrocarbon refrigerant, may also directly attack the glass surfaces causing or contributing to the electrical breakdown.

For the purpose of preventing failures of the terminals through disintegration of the glass U.S. Pat. No. 3,551,191-Elbling et al. proposes coating at least the glass bead or bushing portions of the terminals with an impervious coating of an epoxy resin. While such a coating does protect the glass surfaces and prevent deterioration thereof by acidic disintegration, it does not materially decrease the potential tracking distances between terminals or prevent metallic particles from being attracted to the vicinity of the terminals with the formation of short circuiting electrically conductive paths.

It is a general object of the present invention to provide a simple and effective means for preventing short circuiting and terminal failure of glass-to-metal seal terminal assemblies.

It is a more specific object of the present invention to provide a multiple conductor pin terminal assembly including simple and low cost means for substantially increasing the over-surface distances between the terminals and the terminals and ground.

SUMMARY OF THE INVENTION

In accordance with the illustrated embodiment of the present invention, there is provided an electric terminal assembly including a metal body member adapted to be mounted on a wall of a hermetic compressor unit, this body member having a plurality of spaced apertures therein. Metal conductor pins project through these apertures and insulating glass seals are provided for hermetically sealing the pins to adjacent portions of the body member. In order to prevent contaminants within the compressor casing from establishing an electrical conductive path between terminals which could result in a short circuit causing terminal failure, sleeves of flexible insulating material are provided which surround each of the terminals in spaced relationship

thereto, these sleeves being anchored to the body member by means of a resinous material partially filling the sleeves and covering the surfaces of the glass seals. In accordance with the preferred embodiment of the invention these sleeves are contained within an outer tubular member of insulating material surrounding and in spaced relationship to all of the terminals.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing:

FIG. **1** is a side view of a terminal assembly incorporating the present invention as installed in a hermetic compressor casing wall;

FIG. **2** is an isometric view of a terminal assembly of the present invention; and

FIG. **3** is a sectional view of the terminal assembly taken generally along line **3—3** of FIG. **2**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The terminal assembly of the present invention, generally indicated by the number **1** in FIG. **1**, is intended to be installed in an aperture in a wall **2** of a hermetic compressor unit represented diagrammatically by the broken lines **3**. It will of course be understood that the casing contains a motor compressor unit forming part of a refrigeration system so that it also contains a refrigerant and oil atmosphere.

The terminal assembly **1** provides means for furnishing electrical power to the motor component of the compressor unit through conductor pins or leads **4**, **5** and **6**, three such leads or pins being required for a capacitor-start, capacitor-run motor, a permanent split-capacitor motor or a three-phase motor.

The terminal assembly thus far described is of the general structure illustrated for example in Wyzenbeek U.S. Pat. No. 3,160,460. This basic structure forming the background for the present invention comprises, as shown in FIGS. **2** and **3** of the drawing, a metal body member **7** including a flat end wall **8** bounded by a cylindrical side wall **9** terminating in a mounting flange **10** which can be welded to the compressor case **2**. The end wall **8** of the body member **7** includes three inwardly extending collars **11** defining a plurality of spaced apertures **12** for respectively receiving the conductor pins **4**, **5** and **6**. These conductor pins are secured to the body and electrically insulated therefrom by means of glass beads or bushings **14** which is fired to effect a glass-to-metal seal between the pins and the collars **11**. In many commercially available terminal assemblies, the portion of the glass seal on the inner side of the terminal assembly is somewhat cone shaped as indicated by the numeral **15** or, in other words, extends somewhat inwardly from the inner ends of the collars **11**.

It has been found that such commercially available terminal assemblies for hermetic motor compressor units lack sufficient electrical terminal spacing as provided by the glass seals. During operation of the motor compressor, metallic particles present within the hermetic casing are attracted to the vicinity of the terminals and particularly to the exposed surfaces of the glass insulating beads and build upon the surface of the glass to a point that one or more electrical conductive paths are established between the conductor pins or the

pins and the grounded inner surfaces of the body member 7. The minimum conducting path has a length equal to the shortest distance between an exposed or uninsulated portion of conductor pin and the adjacent portion of the body member 8 or, more specifically, a collar 11 surrounding a pin.

While the application of an insulating and protective coating to the inner surfaces of the terminal assembly, as proposed in the aforementioned U.S. Pat. No. 3,551,191, serves to protect the exposed glass surfaces from acidic attack and also lengthens the possible conductive paths formed by the collection of metallic particles to the surfaces between adjacent terminals or the terminals and the adjacent surfaces of the body member 8, such coatings have not completely solved the short circuiting problem, because over-surface spacing is not substantially increased and through air space is relatively unchanged. Cracking of the coating can occur during installation due to welding heat if the coating is in contact with side wall 9.

In accordance with the present invention, means are provided on the inner side of the terminal assembly for substantially increasing the over-surface spacing from electrically live to dead metal components of the assembly. This means comprises, as shown in FIGS. 2 and 3 of the drawing, electrically insulating sleeves 16 surrounding and in spaced relationship with each of the terminals 4, 5 and 6 and these sleeves, as shown in FIG. 3 of the drawing, extend from the end wall 8 of the body member 9 to a point slightly beyond the inner ends of the conductor pins. For anchoring these sleeves to the body 7 there is further provided a potting compound, such as an insulating epoxy resin compound, which is cured within these sleeves, this body of resinous material generally indicated by the numeral 17 filling the sleeves to a level such that it covers the inner surfaces of the glass beads 14.

In accordance with the preferred embodiment of the invention, the sleeves 16 are enclosed by and wedged within a tubular member 18 encompassing all of the terminal conductor pins 4, 5 and 6. This tubular member 18 also engages the end wall 8 of the body member 7 in slightly spaced relationship with the side walls 9 in order to position the sleeves and the resinous body 17 in spaced relationship to the portions of the side wall 9 which are to be welded to the casing wall 2. The body of resinous material 17 also fills the spaces between the sleeves and the tubular member 18 as shown in FIG. 3 of the drawing. Such spacing between sidewalls and tubular member 15 provides additional over-surface spacing and helps prevent cracking of potting compound during installation in the casing 2.

With reference to FIG. 3 of the drawing, it will be seen that the sleeves 16 substantially increase the over-surface spacing between conductor pins 4, 5 and 6 and, in combination with 18, between these pins and the inner surface of the body member 7. This increased surface distance is supplied by the inner and outer surfaces of the exposed portions of the sleeves 16 and/or 18. In addition to providing an increased over-surface spacing between conducting parts of opposite polarity or different electrical potential, the sleeves which completely enclose the remaining exposed portions of the terminals 4, 5 and 6 also increase the through space distance between these terminals.

Preferably, both the tubular member 18 and the sleeve 16 are made of flexible polyethylene teraphthalate resin, such as DuPont "Mylar," or other resinous material resistant to the environmental conditions within the compressor case.

When the outer tubular member 18 is employed, a convenient method of manufacturing the assembly comprises positioning the tubular member 18 in spaced relationship with the side wall 9 and thereafter introducing the potting resin into the tubular member in the form of a thermosetting or heat curable powdered or liquid mass. Preferably the potging material is of the epoxy resin composition which can be introduced in liquid or powder form and thereafter cured in place to form a solid mass.

After the potting composition is introduced into the tubular member 18, the individual sleeves 16 are inserted and pressed downwardly through the potting compound into contact with the end wall 8.

Preferably these sleeves 16 initially of cylindrical shape are of a diameter of such that they are slightly deformed and wedged within the tubular member 18 in engagement with adjacent sleeves and with the tubular member. To facilitate assembly, the sleeves may first be positioned within a suitable tubular fixture having a diameter slightly smaller than the diameter of the tubular member 18 and slid from this fixture into the tubular member 18. After insertion of the sleeves 16, the entire assembly is heated to a temperature sufficient to cure the potting composition. After curing, the sleeves and tubular member are firmly bonded in place and the assembly is then ready to be mounted on the compressor case.

Accelerated life tests on the basic terminal assembly and such assemblies provided with the sleeves and potting compound have shown the reliability improvement of the terminals of the present invention. In these tests, twenty times the normal amount of metal chip and powder contaminates resulting from 5 years of compressor operation was added to the compressors before life testing was begun. Both locked rotor and running life tests were run. Results indicated significant improvement in terminal reliability when terminal physical clearances were increased. Whereas all four standard terminal assemblies failed within 300 hours of testing, all four of the improved terminal assemblies successfully completed 1,000 hours of testing. Similar results were recorded on the locked rotor life tests. Two standard terminal assemblies failed in three cycles or less while three compressors with the improved terminal assemblies cycled for 20 days completing approximately 1,000 cycles without failure before testing was terminated.

From these tests, it is apparent that terminal assembly failures are the direct result of electrically conductive contaminants that bridge the small physical clearances between the current carrying pins and the grounded case. Since the contaminants are usually metallic particles, their quantity increases during the life of the compressor because loose wear particles from moving metallic compressor components are constantly formed. Since such contaminant formation is inevitable, the physical clearances provided by the present invention within the terminal assembly provide effective means of reducing the probability of forming conductive paths.

While there has been shown and described a specific embodiment of the present invention it will be understood that it is not limited thereto and it is intended by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

We claim:

1. In an electric terminal comprising a cup-shaped metal body member including a side wall and an end wall having a plurality of spaced apertures therein, metal conductor pins projecting through said apertures and insulating glass seals hermetically sealing said pins to adjacent portions of said body member; the improvement comprising:

a tubular member of insulating material positioned in said cup-shaped member with one end thereon engaging said end wall,

sleeves of insulating material surrounding and in spaced relationship with each of said pins within said tubular member,

and a body of resinous material cured in place within said tubular member and sleeves to anchor said tubular member and sleeves to said terminals, said resinous material covering said glass seals.

2. An electric terminal according to claim 1 in which each of said sleeves are in contact with adjacent sleeves and with said tubular member.

3. An electric terminal according to claim 2 in which said sleeves are flexible and are wedged within said tubular member.

4. An electric terminal according to claim 2 in which said tubular member and sleeves are composed of a resinous material.

5. An electric terminal according to claim 4 in which said resinous material is polyethylene teraphthalate resin and said body of resinous material comprises an epoxy resin.

6. An electric terminal according to claim 1 in which the tubular member spacing spaced from the side walls of the cup-shaped member.

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