Dec. 22, 1959 R. ABRAMS 2,918,521

ELECTRICALLY INSULATING DEVICES

Filed Feb. 11, 1957 2 Sheets-Sheet 1

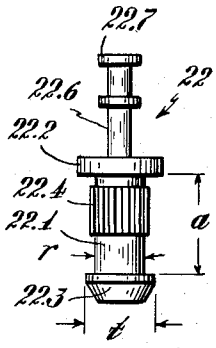

Fig. 1

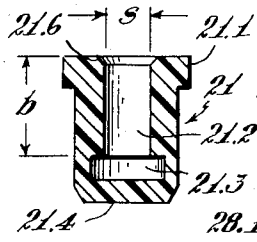

Fig. 2

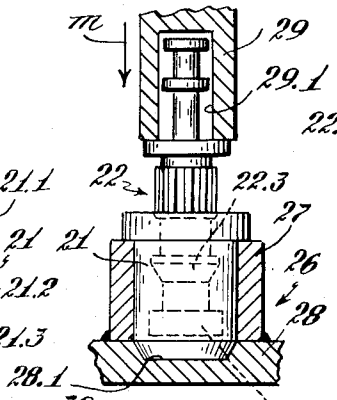

Fig. 3

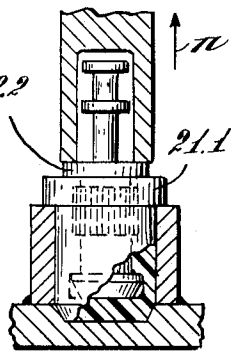

Fig. 4

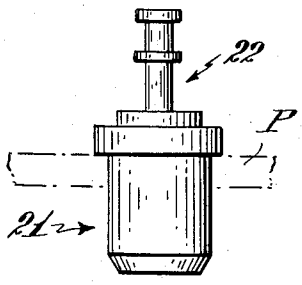

Fig. 5

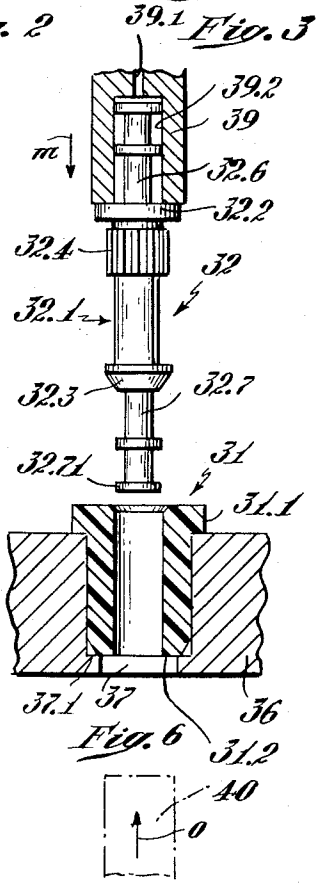

Fig. 6

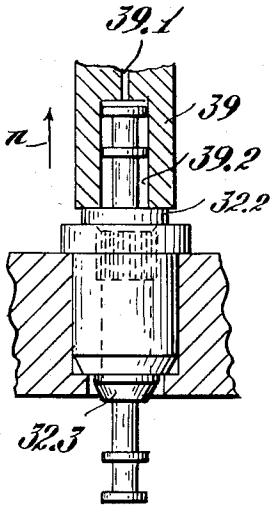

Fig. 7

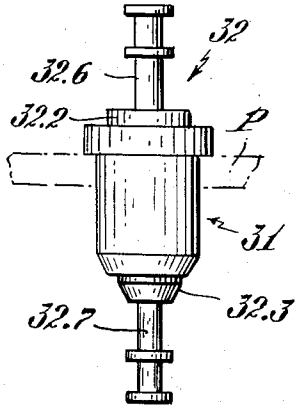

Fig. 8

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ELECTRICALLY INSULATING DEVICES

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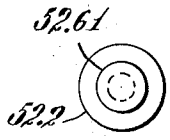

Fig. 9

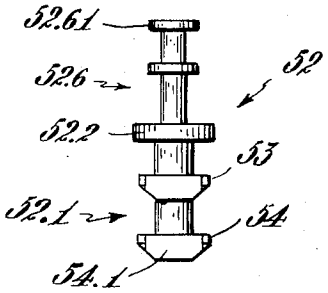

Fig. 10

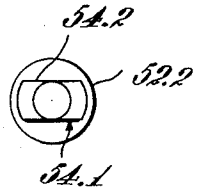

Fig. 11

Fig. 12

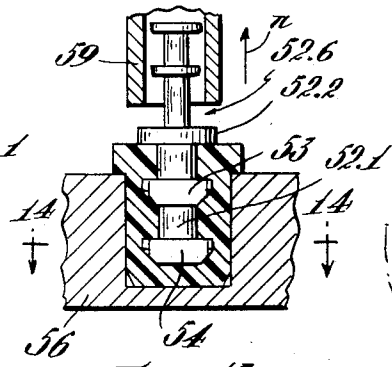

Fig. 13

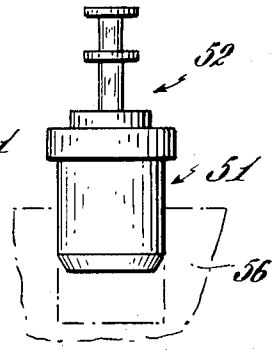

Fig. 15

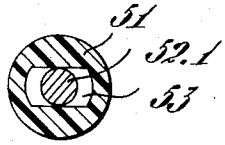

Fig. 14

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2,918,521

ELECTRICALLY INSULATING DEVICES

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Application February 11, 1957, Serial No. 639,576

6 Claims. (Cl. 174—152)

This invention relates to insulating mounts for use in electrical installations, generally speaking of the lead through and stand off types which can be fastened in apertures of supports such as panels or chassis and which are capable of carrying and receiving therewithin conducting and connecting means.

The principal object of the invention is to provide devices of the above character which are especially suited for insulation with electrically superior insulating materials of the types exemplified by polyfluoroethylene polymers which have little elastic tendency or memory to return to an original shape after having been more or less suddenly deformed, or at least a tendency to become permanently deformed under continuous stress below a certain pressure, but which on the other hand have a comparatively high tendency to flow upon application of a higher pressure, due to low internal or molecular friction. Such materials are ill suited for incorporation in conventionally designed and fabricated devices of the above type so that it was found to be quite important to find techniques for providing, in a commercially acceptable way, assemblies which permit the safe use of such insulating materials in the simplest possible manner while taking advantage of the above-mentioned superior electrical characteristics thereof.

Other objects are to provide improved insulated assemblies or insulating mounts which can be manufactured with a minimum amount of molding, machining and assembling operations, to provide improved insulated stand off and lead through insulators which incorporate unconfined insulating material of the above type without danger of losing shape and which lend themselves for assembly with metal parts according to simple and inexpensive mass production techniques, to provide such devices which can be easily assembled or mounted on panels of widely varying types and thickness, and to provide insulating devices of this type which lend themselves especially well to miniaturizing.

A brief summary indicating the nature and substance of the invention, for attaining the above objects, characterizes its principal aspects as follows.

Insulating mounts according to the invention have a metal insert which is freely surrounded by an insulator body having an axial cavity between two transverse faces which correspond to transverse shoulders extending from the insert, and are manufactured by preforming the average distance between the faces of the body slightly greater than the average distance between the shoulders of the insert, by performing the average outer diameter of the insert slightly greater than the inner diameter of the cavity, and by preforming the average outer diameter of the shoulders appreciably greater than the inner diameter of the cavity; and by assembling the insulator body and the insert by axially pressing the insert into the cavity of the insulator with the forward shoulder passing the cavity opening and penetrating the cavity until the faces and shoulders interengage while the outside of the insulator body is being kept under restraint against deformation

during such assembly; whereby the cavity is temporarily deformed by the flow of the material around the forward shoulder during assembly at comparatively high pressure without permanent deformation of the insulator, and whereby the insulator firmly engages the insert without elastic return after removal of the restraint.

In important practical embodiments, the insulator body has a closed recess with or without a widened cavity with faces for receiving flange portions of the metal insert, which flange portions define the above-mentioned shoulders of the insert. In other embodiments, the body recess is open on both sides and the transverse outer faces receive shoulders of the insert. In further embodiments, the insert has anchor shaped projections with flattened sides or polygonal portions, for preventing rotatory disengagement; the anchor portions can provide the aforementioned shoulders which prevent axial disengagement, and also the aforementioned polygonal shapes which prevent rotatory disengagement of insulator body and metal insert.

In a practically very important aspect, the insulator recess is preformed without faces on cavities and the insert with its preformed flanges and shoulder portions is pressed thereinto while the insulator body is confined within a form; in accordance with this aspect of the invention, the confined insulator body is caused to flow around the metal portions that are pressed thereinto whereas, upon release of the inserting pressure and removal of the insulator with the metal insert from the form, the insulator indefinitely retains its shape, interiorly closely fitting the insert while exteriorly preserving its original outer configuration that conforms to that of the form wherein it was confined during assembly.

In embodiments wherein the recess of the insulator body has no internal cavity faces or is otherwise not especially preformed to receive the forward shoulder of the insert, the face for the latter is formed during assembly.

These and other objects and aspects of novelty in addition to those contained in the above summary of the nature and the objects of the invention will appear from the following description of several typical embodiments illustrating its novel characteristics. This description refers to drawings in which

Fig. 1 is an elevation of the metallic insert or pin of the insulating mount according to one embodiment of the invention;

Fig. 2 is a longitudinal section of the insulating shell component of that embodiment;

Fig. 3 is an elevation showing the components according to Figs. 1 and 2 respectively, during assembly, also showing in longitudinal section a tool which is used for purposes of the method for assembling the two components;

Fig. 4 is a representation similar to Fig. 3, but with the metal pin fully inserted and with the insulating shell partly in longitudinal section to indicate the placement of the metal core therein;

Fig. 5 is a side elevation of the finished device, indicating its fixation to a panel;

Fig. 6 shows the metal insert as well as the insulating body, the latter in longitudinal section, of a second embodiment of the invention and also a step of the method of assembly, with the metal pin not yet contacting the insulator body;

Fig. 7 shows the fully assembled device according to this embodiment of the invention, with the device not yet removed from the form;

Fig. 8 is an elevation similar to Fig. 5 of the fully assembled device, mounted on a panel or similar support;

Figs. 9, 10 and 11 are top view, side elevation and bottom view respectively of the metal insert of a third embodiment of the invention;

Fig. 12 is a longitudinal section of the insulating body of this third embodiment;

Fig. 13 shows the fully assembled device, still within the form, similar to Fig. 4;

Fig. 14 is a section on lines 14—14 of Fig. 13; and

Fig. 15 is a side elevation of the fully assembled device.

Figs. 1 and 2 illustrate the essential components of insulating devices according to the invention, namely an insulator body **21** and an insert pin **22**.

The insulator body **21** is generally speaking of cylindrical shape and has in this embodiment a flange **21.1**, a cylindrical recess **21.2** and a cylindrical cavity **21.3** which is somewhat wider than the recess **21.2**. In this embodiment the insulator body also has a bottom **21.4** and the recess **21.2** is preferably provided with a chamfer **21.6**.

The insert pin **22** has a shank portion **22.1** between a collar **22.2** and a chamfered flange **22.3**. The shank has a polygonal portion, in this instance a knurled section **22.4**. On the other side of the collar **22.2** is a lug portion **22.6** which may be provided with annular ridges **22.7** for facilitating the soldering thereto of electrical conductors. It will be evident that the solder lug portion **22.6** can be replaced by other suitable conductor connecting means.

Figs. 3 and 4 illustrate the assembly process according to the invention, which takes place as follows.

The insulator body **21** is inserted into a form or confining jig **26** which may be simply a tube section **27** welded or otherwise fastened to a baseplate **28** having a recess **28.1** that fits the chamfered bottom **21.4** of the insulator body **21**. The pin is then placed with its chamfer **22.3** on the chamfer **21.6** of the insulator body and thereupon pressed home by means of a hollow pressing tool **29** which can be a simple pin with a tubular recess **29.1** that loosely fits the lug or other outer portion of the insert pin. Fig. 3 indicates the pin in the course of being pressed into the insulator body, in the direction of arrow *m*. After having been stopped by the contacting of flanges **21.1** and **22.2**, the pressing tool is withdrawn from the completed assembly, as indicated by arrow *n* of Fig. 4. The assembled mount is then removed from the jig which is easily possible since the insulating material of the above described type slides easily and with little friction. Instead of first separately seating the pin on the insulator, it can be moved onto it with the tool as will be described with reference to Fig. 6 for another embodiment. As indicated above, Fig. 3 illustrates the intermediate stage during which the insert pin is forcibly pressed into the insulating material until the flange **22.3** reaches the cavity **21.3** and so to speak snaps thereinto or anchors itself therein, as shown in Fig. 4.

It was found that the above characterized polymer material flows easily around the flange **22.3** and the polygonal section **22.1** during the comparatively rapid insertion of the pin at comparatively high pressure within the form **26** and that, due to the confinement of the insulator body during this pressurable insertion, the external configuration is not appreciably distorted, although portions thereof might be displaced during the insertion process.

The completed mount is shown in Fig. 5 which also illustrates the possibility of affixing it to a panel such as indicated at *p*, simply by press fitting it into a perforation thereof.

The embodiment illustrated in Figs. 6, 7 and 8 is quite similar to the one described above, with the difference that the insert pin has here two solder lugs, representing by way of example plural conduit attachment devices, one on each side of the insulator body, which requires the latter to be open on both sides. The two components are indicated at **31** and **32** of Fig. 6 which also illustrates a modified first assembly step. The insert pin **32** has again a core portion **32.1** with a polygonal section **32.4**, and an anchor collar **32.3**. The two solder lugs are indicated at **32.6** and **32.7**, and the rearward collar at **32.2**.

In this instance the insulator body is put into the forming jig as before, but the insert **39** is initially fed to the pressing tool wherein it can be held by slight friction and, if desirable, with the aid of a slight vacuum applied through perforation **39.1**. The assembly operation proper takes place essentially as described above with reference to Figs. 3 and 4, namely by pressing the insert **32** into the core **31** until the collar **32.2** rests on the core flange **31.1**. For obvious reasons, the form **36**, which corresponds to the form **26** indicated in Figs. 3 and 4, has in this instance an opening **37** accommodating the solder lug flanges **32.71** but forming a shoulder **37.1** leading into the main cavity which just accommodates the insulator body **31**. The pressure for sealing the collar **32.2** on the flange **31.1** suffices to snap the collar **32.3** underneath the lower face **31.2** of the insulator.

Fig. 6 illustrates the assembly step just prior to the insertion of the metal pin **32** into the polymer body **31**, and Fig. 7 shows the assembly within the form, prior to lifting the tool **39** with the assembly, in the direction of arrow *n*.

Due to the slight surface friction of the polymer material involved, the finished assembly can be removed from the form **36** by pulling the tool and holder **39** upwardly, whereupon the completed assembly can be easily pulled from the recess **39.2**, after releasing the vacuum at **39.1** and, if desirable, applying slight air pressure instead. If the process is carried out as described above with reference to Figs. 3 and 4, with the completed assembly remaining in the jig, then the former can be ejected from the latter by means of a pushing tool such as indicated at **40**, moving in the direction of arrow *o*. It will be evident that the above described process steps can be performed by means of conventional automatic machinery as well as by hand.

Fig. 8 shows the completed mount and the manner in which it can be affixed to a panel *p*, and it will be noted that the anchor flange **32.3** is here outside of the insulator body which is held between this anchor flange **32.3** and the upper flange **32.2**.

Figs. 9 to 15 illustrate a third embodiment wherein the insert pin **52** has a single connecting portion such as a solder lug **52.6** and wherein the insulator body is of the general type shown in Figs. 1 and 2, with closed bottom. However, instead of incorporating a cylindrical anchor flange such as **22.3** of Fig. 1 in combination with a polygonal portion such as the knurled part **22.4** of Fig. 1 for preventing axial displacement, this embodiment has one or more portions which serve the purpose of both anchor flange and polygonal portion. As shown in Figs. 10, 11 and 13, the insert pin **52** has a core portion **52.1** and an attachment portion **52.6**, and therebetween a collar **52.2**. The core portion has two flattened anchor portions **53** and **54** which, as indicated in Figs. 9 and 11 are obtained by appropriately profiling round stock and then machining it to obtain the flat faces indicated at **54.1** and **54.2** of Fig. 11.

The insulator body **51** has a flange **51.1**, a recess **51.2** and a bottom **51.4**. It was found that the assembling method according to the invention does not necessarily require cavities such as **21.3** of Fig. 2 for receiving the anchor portions or portion of the insert and, accordingly, the cavity **51.2** is here simply a smooth recess.

The assembly operation is quite similar to that described above with reference to Figs. 3, 4, 6 and 7. Assuming that a loose pressing tool is used as in Figs. 3 and 4, Fig. 13 indicates the step just following that indicated in Fig. 4, prior to removal of the completed assembly from the form **56**. Figs. 13 and 14 indicate how the polymer material flows practically completely around the anchor portions **53** and **54**, while Fig. 15 indicates that no deformation is noticeable upon removal of the final

assembly from the form 56. As mentioned before, the end of the pressing step manifests itself by the resting of the flange 52.2 on the flange 51.1 of the insulator body.

It will be noted that, while not all steps of assembly are shown for each one of the embodiments, a complete and detailed illustration of the assembly steps is provided by the figures read in the sequence Fig. 6; Fig. 3 and Fig. 13; Fig. 4; and Fig. 15.

The relative dimensions of the inserted portions of the pin and of the corresponding portions of the insulator body are of some significance. These should slightly vary, but no definite rule for exact dimensional relationships can be given. However the following values for the dimensions of an actual embodiment, indicated in Figs. 1 and 2 will be sufficient as a guide for the proper preforming of the interengag ng proportions of such assemblies, as follows: $a=0.277''$, $b=0.282''$, $r=0.095''$, $s=0.089''$, $t=0.125''$.

While it is difficult to develop a fully satisfactory theoretical explanation of the behavior of the above characterized polymers in assemblies and assembly processes of this type, it appears that according to the invention, the flowing properties at elevated pressures within confined spaces can be taken advantage of for momenta ily deforming the insulator body during assembly whi e the lack of elasticity and flow at lower pressures prevent a change of configuration subsequently to removal from the confining means and long range deformation thereafter so that not only is the outer shape of the insulator body preserved, but the interior configuration which was established during the pressurable assembly is likewise permanently preserved; at any rate it has been confirmed by ample experience that composite articles which are preformed and assembled in the manner described with reference to the above three embodiments retain their shape and effectiveness through any use for which such permanency can be reasonably expected. This behavior makes it possible to dispense with metallic members which wholly or partly confine the outer surface of insulator bodies made of the herein utilized polymer material. While the outside configuration of the insulator body is always essentially preserved, a very slight essentially uniform increase in diameter of the insulator might take place; it will be evident that this can be easily taken care of by appropriate preforming of the insulator.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims. More particularly, it will be evident that certain features of the above described embodiments can be interchanged or combined, for example double ended mounts can be made with anchors according to Figs. 9 to 14, insulator bodies according to Fig. 2 can be preformed intern lly smooth as in Fig. 12, and preformed cavities as in Fig. 2 can be provided for anchors according to Fig. 10. Such modifications and particularly also the preformed dimensions of the insulator body depend a good deal upon the shapes and relative sizes in each individual embodiment; the insulator cavity should be dimensioned such that the insulating material which is displaced by penetrating parts of the insert will be approximately accommodated in cavity portions that are not occupied by insert portions.

I claim:

1. The method of making a composite article such as an insulating mount which has a metal insert with a core between transverse shoulder means, within an insulator body with an axial recess between two transverse faces at least one of which extends at the opening of the recess and being made of insulating material which has physical properties characteristic of polyfluoroethylenes such as appreciable tendency to flow due to low internal friction and little tendency elastically to return after deformation to an original shape, said method comprising the steps of: preforming the distance between said faces to be slightly greater than the distance between said shoulder means; preforming the average diameter of said core to be slightly greater than the diameter of said recess; preforming the periphery of said shoulder means to be appreciably greater than the diameter of said recess; and axially pressing said insert into said recess of said insulator body with the forward shoulder means passing said opening face of the recess and penetrating the body until the second shoulder means engages the opening face, the outside of the insulator body being restrained to its preformed configuration against deformation during such assembly; whereby the recess is temporarily deformed by the flow during assembly of said insulating material around the forward shoulder means wtihout permanent deformation of the insulator body, and the insulator body firmly engages the core and the shoulder means without elastic return upon removal of the restraint.

2. The method of making a composite article such as an insulating mount which has a metal insert with a core between transverse shoulder means, within an insulator body with an axial recess extending essentially smoothly from a transverse face at an opening of the recess and being made of insulating material which has physical properties characteristic of polyfluoroethylenes such as appreciable tendency to flow due to low internal friction and little tendency elastically to return after deformation to an original shape, said method comprising the steps of: preforming said recess and that portion of said insert which is embedded in the cavity such that the volume of said portion is approximately equal to the volume of said recess prior to assembly; and axially pressing said insert into said recess of said insulator body with one shoulder means passing said opening face of the recess and penetrating the body until the other shoulder means engages said opening face, the outside of the insulator body being restrained to its preformed outside configuration against deformation during such assembly; whereby the recess is temporarily deformed by the flow during assembly of said insulating means around the forward shoulder means without permanent outside deformation of the insulator body, and the insulator body firmly engages the core and the shoulder means without elastic return upon removal of the restraint.

3. A composite article such as an insulating mount, comprising: an insulator body of material having physical properties characteristic of polyfluoroethylenes such as appreciable tendency to flow due to low internal friction and little tendency elastically to return after deformation to an original shape, said insulator having an axial recess between two transverse faces at least one of which extends at the opening of the recess; and a metal insert having a core between two transverse shoulder means which extend outwardly from the core; the distance between said faces being slightly greater than the preformed distance between said shoulder means, the preformed average diameter of said core being slightly greater than the preformed diameter of said recess, the preformed average diameter of said shoulder means being appreciably greater than the preformed diameter of the recess, and said insulator body being conditioned through assembly with said metal insert by axially pressing said insert into said recess of said insulator body with the forward shoulder means passing said opening face of the recess and penetrating the body until the second shoulder means engages the opening face, while restraining the outside of the insulator body to its preformed configuration against deformation during such assembly; whereby the recess is temporarily deformed by the flow during assembly of said insulating material around the forward shoulder means without permanent deformation of the insulator body, and the insulator body firmly engages the core and

the shoulder means without elastic return upon removal of the restraint.

4. A composite article such as an insulating mount, comprising: an insulator body of material having physical properties characteristic of polyfluoroethylenes such as appreciable tendency to flow due to low internal friction and little tendency elastically to return after deformation to an original shape, said insulator having an axial recess and an enlarged cavity at one end of the recess between two transverse faces one extending at the opening of the recess and the other face extending between the recess and the cavity; and a metal insert having a core between a transverse shoulder and an end flange; the preformed distance between said faces being slightly greater than the preformed distance between said shoulder and said flange, the preformed average diameter of said core being slightly greater than the preformed diameter of said recess, the preformed average diameter of said flange being appreciably greater than the preformed diameter of said recess but slightly smaller than that of said cavity, and said insulator body being conditioned through assembly with said metal insert by axially pressing said insert into said recess of said insulator body with said flange passing said opening face of the recess and penetrating the body until the second shoulder engages the opening face and the flange engages said other face, while restraining the outside of the insulator body to its preformed configuration against deformation during such assembly; whereby the recess is temporarily deformed by the flow during assembly of said insulating material around the flange without permanent deformation of the insulator body, and the insulator body firmly engages the core, the flange and the shoulder without elastic return upon removal of the restraint.

5. A composite article such as an insulating mount, comprising: an insulator body of material having physical properties characteristic of polyfluoroethylenes such as appreciable tendency to flow due to low internal friction and little tendency elastically to return after deformation to an original shape, said insulator having an axial bore between two transverse faces at the openings of the bore; and a metal insert having two connecting means one on each side of a core between two transverse shoulders which extend outwardly from the core; the preformed distance between said faces being slightly greater than the preformed distance between said shoulders, the preformed average diameter of said core being slightly greater than the preformed diameter of said bore, the preformed average diameter of said shoulders being appreciably greater than the preformed diameter of said bore, and said insulator body

being conditioned through assembly with said metal insert by axially pressing said insert into said bore of said insulator body with the forward shoulder passing an opening face of the bore and penetrating the body until the second shoulder engages the opening face and the forward shoulder reaches the other face, while restraining the outside of the insulator body to its preformed configuration against deformation during such assembly; whereby the recess is temporarily deformed by the flow during assembly of said insulating material around the forward shoulder without permanent deformation of the insulator body, and the insulator body firmly engages the core and the shoulders without elastic return upon removal of the restraint.

6. A composite article such as an insulating mount, comprising: an insulator body of material having physical properties characteristic of polyfluoroethylenes such as appreciable tendency to flow due to low internal friction and little tendency elastically to return after deformation to an original shape, said insulator having an axial recess between two transverse faces one at the opening of the recess and the other forming the bottom thereof; and a metal insert having a core between a transverse shoulder and an anchor flange which extend outwardly from the core, the anchor flange having a flattened portion; the preformed distance between said faces being appreciably greater than the preformed distance between said shoulder and said flange, the preformed average diameter of said core being slightly greater than the preformed diameter of said recess, the preformed average diameter of said shoulder and said flange being appreciably greater than the preformed diameter of said recess, and said insulator body being conditioned through assembly with said metal insert by axially pressing said insert into said recess of said insulator body with the anchor flange passing said opening face of the recess and penetrating the body until the shoulder engages the opening face, while restraining the outside of the insulator body to its preformed configuration against deformation during such assembly; whereby the recess is temporarily deformed by the flow during assembly of said insulating material around the anchor flange which becomes embedded therein without permanent deformation of the insulator body, and the insulator body firmly engages the core and the shoulder and flange without elastic return upon removal of the restraint.

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