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(54) DIELECTRIC MOULDED PLASTICS SELF-LOCKING STRAIN RELIEF BUSHING

(71) We, HEYMAN MANUFACTURING COMPANY, a corporation organised and existing under the laws of the State of New Jersey, United States of America, of North Michigan Avenue, Kenilworth, New Jersey, 07033, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to dielectric moulded plastics strain and flexure relief bushing.

The demand for effective safe electrical appliances has created a need for strain relief bushings which easily lock into wall apertures and absorb strain at the bushing. Bushings of this sort are in use today by the multimillions of units.

Another important problem encountered in the use of wire, cord, cable and similar items having flexibility, which may generally be referred to hereinafter as "cable", particularly as used in electrical appliances, has been wear and breakage due to flexure stress and/or abrasion of cable, particularly near an aperture from which cable extends. Past solutions to flexure stress combined with strain relief have been surprisingly complicated. They include expensive springs extending from plugs such as in the typical plug of a toaster or an iron, flared extensions from an opening to limit movement and flexure of cable, flexible rubber sheaths in lieu of springs on cable extending from electric plugs, and many more.

As effective as strain relief bushings have been, paradoxically, flexure stress has been a prime source of problems. Cable, properly held by a conventional moulded plastics self-locking strain relief bushing has traditionally failed after normal use due to flexure stress at the active face of the bushing. For instance, the cable held only by a strain relief bushing in a vacuum cleaner is still subject to flexure and thus failure at the strain relief bushing after prolonged use due to stress.

Previously known combined strain and flexure relief bushings which attempted to solve the combined problem of strain relief and flexure stress relief have had the disadvantage of being relatively expensive, complicated or impracticable. Combination solutions such as engaging a spring in a strain relief bushing still bear the cost of assembly and the cost of the spring. Solutions such as that found in U.S. Patent No. 2,724,736 in a strain relief bushing with an integral moulded plastics spring for flexure relief still bear the cost of a relatively large amount of plastics material and complicated dies, moulds and difficulty of moulding. Almost twenty years after U.S. Patent No. 2,724,736, a simpler, less expensive solution to combined flexure and strain relief was proposed in the disclosure of U.S. Patent No. 3,749,818.

Even U.S. Patent No. 3,749,818 was found to require complicated moulds. The webbing used for flexure relief itself has been found to be subject to some flexure stress and the protrusion for flexure relief was subject to damage from bumping into objects while in use.

Expedients such as is disclosed in Fig. 5 of U.S. Patent No. 3,749,818 were gropings of the prior art toward simplicity and effectiveness in providing combined strain relief and flexure relief in a strain relief bushing by using extending fingers to alter the bending angle of cable. The fingers of Fig. 5, while promoting benefit, were not effective enough to prevent wear and effective stress relief.

An object of the present invention is to obviate or mitigate the disadvantages of the aforementioned bushings.

According to the present invention there is provided a moulded plastics dielectric strain and flexure relief bushing and comprising a shank which has first and second portions, integral means on at least one of the shank portions to lock the shank in position when engaged in an aperture, the shank portions being mutually engageable to define between them a passageway for receiving cable and being arranged so that in use when in said aperture the portions co-operate within the aperture to provide cable strain relief by clamping the cable between them, and integral stress relief means in the form of a regularly-flared portion on one of the shank portions apertured for communication with the passageway and flaring from a smaller diameter to a greater diameter, the greater diameter being spaced away from said smaller diameter longitudinally of the bushing by a distance of no less than .25 of said smaller diameter, and said greater diameter being no less than 1.5 times said smaller diameter.

The present invention makes it possible to extend the useful life of cable against flexure stress at an active face of a self-locking strain relief bushing whether the shank portions are separated, or joined by webbing or straps.

The combined strain and flexure relief bushing of the present invention now offers an additional stress relief in what was formerly only a strain relief bushing with only simple additional construction.

The combined strain and flexure relief bushing of the present invention substitutes for electrically conductive flared metal fittings of the past which often had to be screw set and which may or may not have included strain relief characteristics and for the non-conductive stress relief fittings which required cable to have secondary strain relief facilities.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a plan view of a stress and flexure relief bushing of the present invention.

Fig. 2 is a front elevation corresponding to Fig. 1.

Fig. 3 is a sectional side elevation of the bushing of Figs. 1 and 2 engaged in an aperture.

Fig. 4 is a side elevation of the bushing of Figs. 1 to 3 engaged with cable in an aperture.

Fig. 5 is a plan view of another embodiment of the stress and flexure relief bushing of the present invention.

Fig. 7 is a plan view of another embodiment of the stress and flexure relief bushing of the present invention.

Figs. 6 and 8 are details of exemplary bushing locking means for locking bushings in an aperture.

Referring now to the drawings, in which like reference numbers denote like parts in the various figures, a preferred embodiment of the combined strain and flexure relief bushing 10 of the present invention is shown in Figs. 1 to 4. The strain and flexure relief bushing 10 includes a shank having a main portion 11 and a gripblock portion 12 joined by a strap 13 and moulded from plastics material. The shank main portion 11 and gripblock 12 in effect fit together to function as a unitary bushing shank and to define a passageway between them. At one end of the main portion 11 is a flared portion 14 having an opening 15 through it. A cable 16, as shown in Fig. 4, can extend through the opening 15 and the passageway between the shank portions 11, 12 which are locked in an aperture 17 in a wall 18. The bushing 10 is self-locking, engaging the wall in the slots 19, 20 in the shank gripblock portion 12 and main portion 11, respectively. The opening 15 flares outwardly from a smaller diameter A as indicated by the arrows in Figs. 2 and 3 to a greater diameter B as indicated by the arrows in Figs. 2 and 3. A lip 21 is in the same plane as the diameter B. The length L from the commencement of the flaring of the flared portion 14 at A to the greater diameter B is indicated by the arrow in Fig. 3.

In Fig. 5, a modified embodiment comprises a bushing 30 having a shank main portion 31, a gripblock portion 32, which function together as a unitary shank joined by a strap 33 or webbing, with a flared portion 34 extending from the gripblock portion 32. The bushing in closed position is indicated in phantom.

The bushing 50 as shown in Fig. 7 is another modified embodiment of the present invention. The bushing 50 includes a shank main portion 51 and a gripblock portion 52. A flared portion 53 extends from the shank main portion 51. The main portion 51 and gripblock portion 52 are linked by a strap 55. Aperture grasping fingers 56 extend from the shank main portion 51 for self-locking the bushing 50 into an aperture.

In Figs. 6 and 8, self-lock shank camming fingers 61, 62 are shown engaging an aperture 17 in a wall 18.

In use, a cable 16 is passed through the opening 15 of the flared portion 14 as shown in Figs. 1 to 4. With the shank gripblock portion 12 engaged, the bushing 10 may be pushed into the aperture 17. The wall 18 of the aperture 17 cams against the camming surfaces 22, 23, enforcing a strain relief grip on the cable 16. The bushing 10 is ultimately locked in the wall 18, engaged in the slots 19, 20 while maintaining a strain relief grip on said cable 16.

The cable 16 in normal free movement is protected against flexure stress since it cannot bend sharply from the point of exit from the bushing 10 at the smaller diameter A to the greater diameter B of the flared portion 14. The flexure of the cable 16 at the smaller diameter A is relieved by limiting the bending of the cable 16 between the smaller diameter A and the greater diameter B. The lip 21, while of greater diameter than the greater diameter B, and being in the same plane as the greater diameter B, has little or no effect on reducing the flexure stress at the smaller diameter A.

The regularity of the flaring of the portion 14 provides a smooth non-abrasive surface to further protect cable 16.

Where the diameter B of the flared portion 14 is at least 1.5 times larger than the diameter A with a regular flaring D as indicated at arrow D in Fig. 3, and where the distance L between the diameter A and diameter B is no less than .25 times the diameter A, flexure tests on cable in an appliance with a combined strain and flexure relief bushing 10 of the present invention for use in 120-volt 60-cycle current have shown that such electric cable can be flexed over 50,000 cycles at an angle of 180° on a cable length of two to three feet without the cable showing unusual wear or abrasion where such cable extends from such flared portion 14 of a strain and flexure relief bushing 10 of the present invention.

Larger dimensions of L and B of course extend the flexure stress life of a cable.

The bushings 30, 50 of Figs. 5 and 7 are variants employing flared portions 34, 53 constructed as set forth above.

The bushing 50 as shown in Fig. 7 has fingers 56 illustrative of variant wall 18 grasping means. The cam fingers 61, 62 of Figs. 6 and 8 are illustrative of further typical wall 18 grasping means on a bushing 10, 30, 50 of the present invention.

WHAT WE CLAIM IS:—

1. A moulded plastics dielectric strain and flexure relief bushing and comprising a shank which has first and second portions, integral means on at least one of the shank portions to lock the shank in position when engaged in an aperture, the shank portions being mutually engageable to define between them a passageway for receiving cable and being arranged so that in use when in said aperture the portions co-operate within the aperture to provide cable strain relief by clamping the cable between them, and integral stress relief means in the form of a regularly-flared portion on one of the shank portions apertured for communication with the passageway and flaring from a smaller diameter to a greater diameter, the greater diameter being spaced away from said smaller diameter longitudinally of the bushing by a distance of no less than .25 of said smaller diameter, and said greater diameter being no less than 1.5 times said smaller diameter.

2. A bushing according to Claim 1, wherein the greater diameter of the flared portion is spaced away from the smaller diameter longitudinally of the bushing by a distance of 0.25 of the smaller diameter, and the greater diameter is 1.5 times the smaller diameter.

3. A strain and flexure relief bushing substantially as hereinbefore described with reference to and as shown in Figs. 1 to 4 of the accompanying drawings.

4. A strain and flexure relief bushing substantially as hereinbefore described with reference to and as shown in any one of Figs. 5, 6, 7 and 8 of the accompanying drawings.

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1571344 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

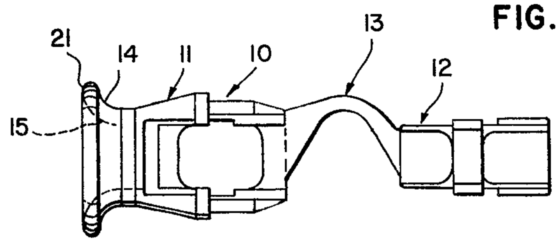

FIG.1

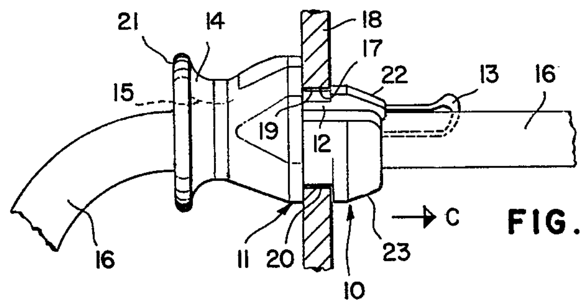

FIG.4

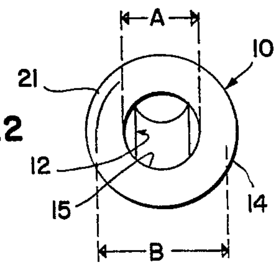

FIG.2

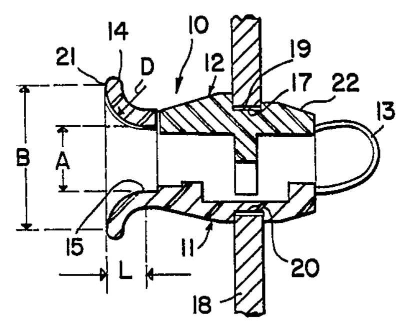

FIG.3

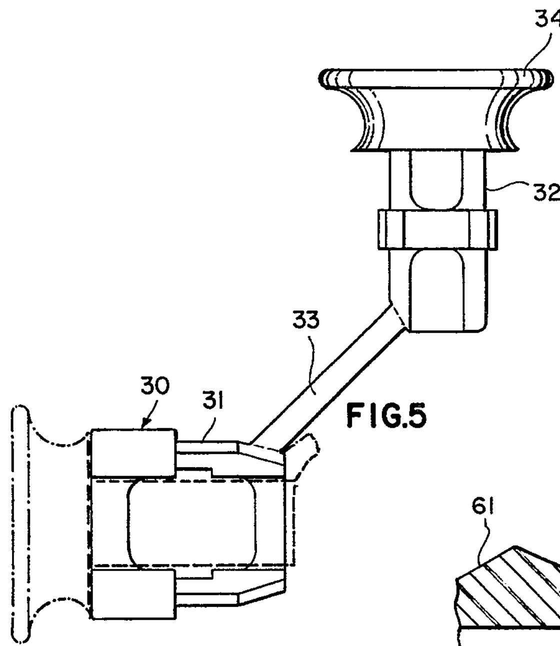

FIG.5

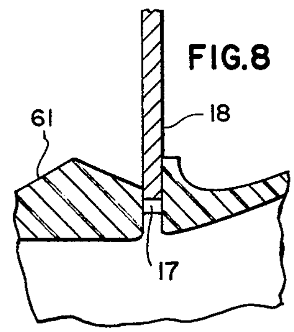

FIG.8

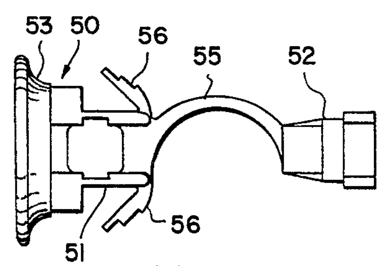

FIG.7

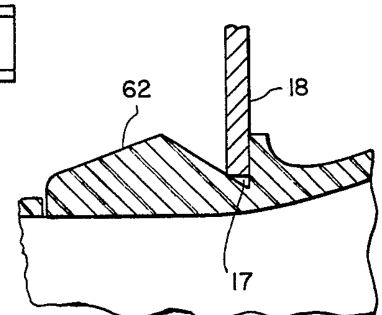

FIG.6