

March 19, 1946.

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2,396,848

METHOD AND APPARATUS FOR GROUNDING TRACK LAYING APPARATUS

Filed Oct. 9, 1943

3 Sheets-Sheet 1

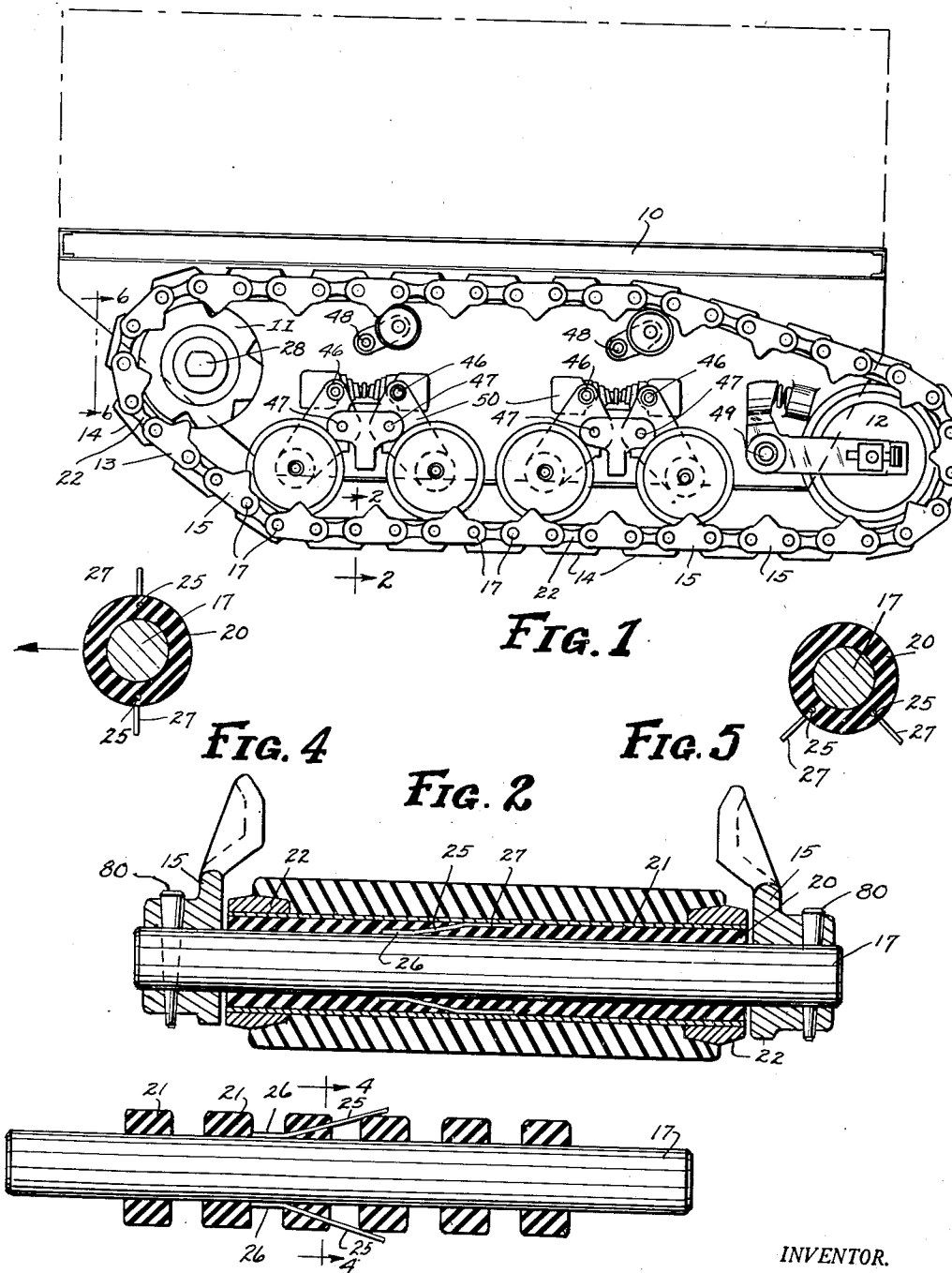


Fig. 3

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3 Sheets-Sheet 2

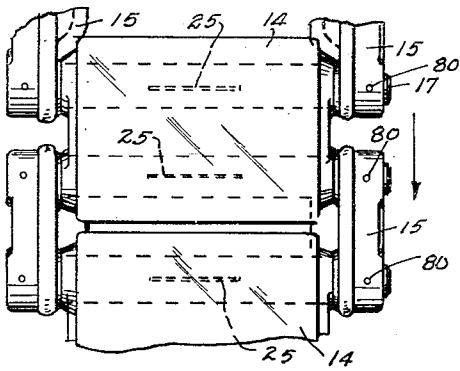


FIG. 6

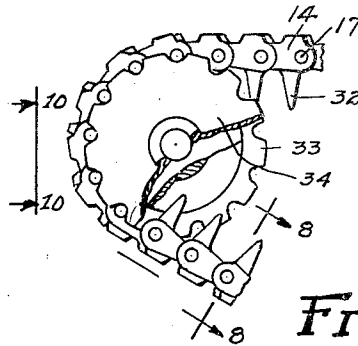


FIG. 7

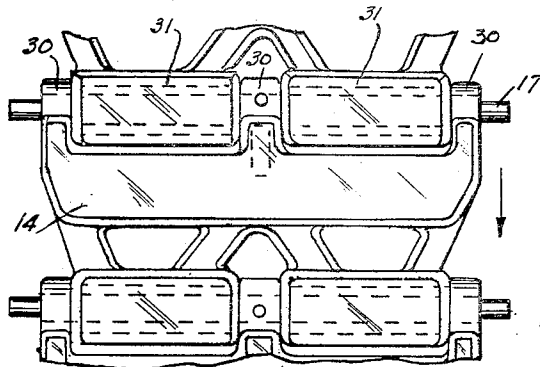


FIG. 10

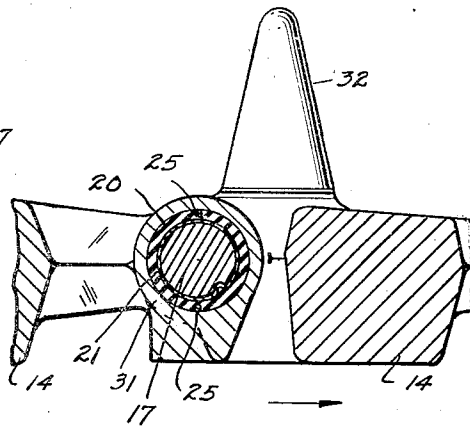


FIG. 9

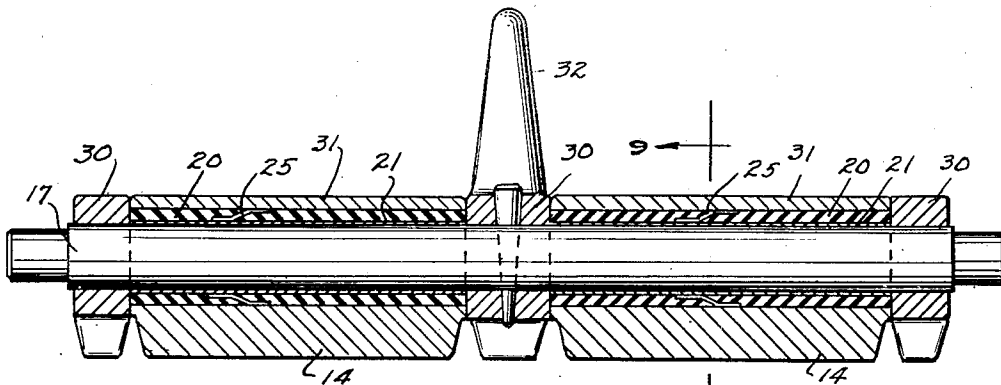


FIG. 8

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FIG. 11

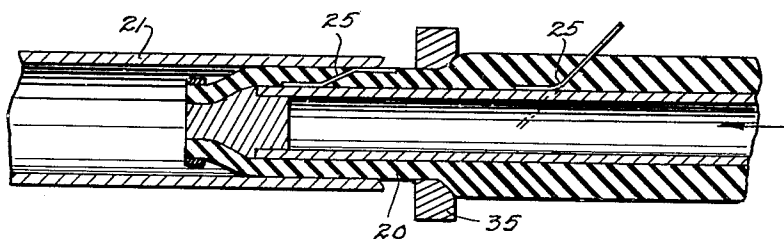


FIG. 13

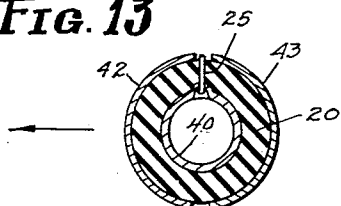


FIG. 12

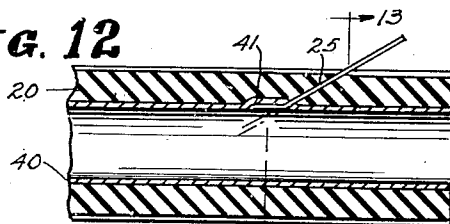


FIG. 15

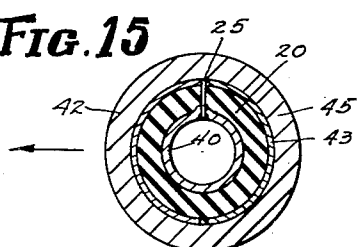


FIG. 14

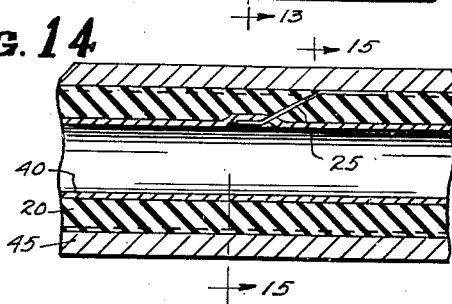


FIG. 17

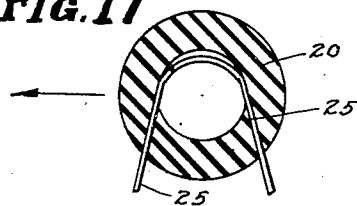


FIG. 16

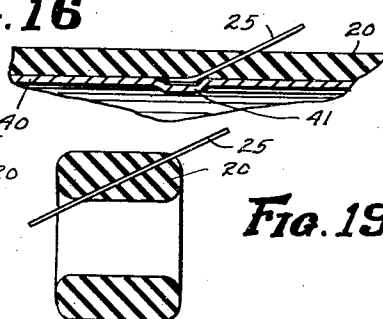


FIG. 18

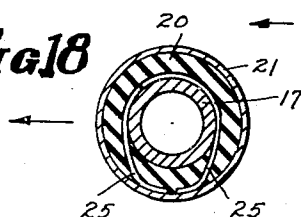


FIG. 20

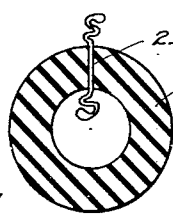


FIG. 19

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METHOD AND APPARATUS FOR GROUNDING
TRACK LAYING APPARATUS

Fred L. Haushalter, Akron, Ohio

Application October 9, 1943, Serial No. 505,649

7 Claims. (Cl. 173—324)

This invention pertains to a device for preventing interference with radio reception on a vehicle, resulting from the building up of static charges of electricity incident to the relative movement of parts of the vehicle. More particularly, the device provides a grounding connection through an oscillating joint where a rubber bushing is utilized as a part of the joint.

The use of rubber bushings in the joints between relatively movable parts of a vehicle, such as the tread blocks of a track laying vehicle, as well as in the oscillating joints of the track suspension mechanism, is desirable to obviate the necessity for lubrication at such points, but it has been found that relative movement of the joint members builds up a static electrical charge which is discharged whenever the tread blocks reach the driving sprocket wheel. The result of such discharge is augmented as the vehicle speed is increased, with the result that radio reception on the vehicle is practically impossible of attainment. An effort has been made to overcome this defect by utilizing spaced annular rubber bushings on each joint and interposing a convolute ribbon around the inner cylindrical member or pin and the outer metallic casing for the rubber bushing. The constant movement of the joint sections with respect to each other, however, has had the effect of bending the ribbon back and forth and quickly causing sufficient fatigue in the metal to fracture the ribbon. Additionally, although such form of grounding connection could be utilized where spaced rubber bushings were employed, nevertheless it was not suitable for installations where a single continuous rubber bushing was employed, because there was no suitable way in which the band could be imbedded in the bushing in a manner that would permit stretching of the rubber in assembly and would assure a grounding connection between the inner and outer casings for the rubber.

An object of the present invention is to provide a simple grounding device which will be useful in joints wherein either spaced rubber rings are utilized or wherein a continuous cylindrical bushing is employed as part of the joint structure. Additionally, the invention contemplates an arrangement wherein the metal of the grounding device will not be fractured by the back and forth movement of one joint part with respect to the other, wherefore, the grounding connection will remain intact indefinitely.

My invention is illustrated in various forms in the drawings, wherein Fig. 1 is a side view of a track laying vehicle embodying my invention;

Fig. 2 is a section taken on a plane indicated by the line 2—2 in Fig. 1, but on a scale larger than that used in Fig. 1; Fig. 3 is a section showing the adaptability of my invention to a bushing having a plurality of rubber rings that are disposed between the inner and outer members of the joint; Fig. 4 is a section taken on a plane indicated by the line 4—4 in Fig. 3; Fig. 5 is a section similar to that of Fig. 4, but illustrating a modified form of grounding construction; Fig. 6 is an end view of the track laying blocks as shown by the line 6—6 in Fig. 1; Fig. 7 is a fragmentary view adjacent the driving sprocket of a track laying vehicle having a modified form of track block construction; Fig. 8 is a section taken on a plane indicated by the line 8—8 in Fig. 7, but on a scale larger than that shown in Fig. 7; Fig. 9 is a section taken on the plane indicated by the line 9—9 in Fig. 8; Fig. 10 is an end view of the track laying blocks as indicated by the line 10—10 in Fig. 7; Fig. 11 is a sectional view through an apparatus utilizable for inserting a ground connecting member in the form of a joint which has a continuous rubber bushing between the inner and outer members; Fig. 12 is a longitudinal section through a joint showing a modified form of connection for the grounding member; Fig. 13 is a section taken on a plane indicated by the line 13—13 in Fig. 12, and showing the outer members in the unsuppressed position; Fig. 14 is a section taken longitudinally through a joint having the construction illustrated in Figs. 12 and 13, but applied to a bearing; Fig. 15 is a section taken on the plane indicated by the line 15—15 in Fig. 14; Fig. 16 is a sectional view through an uncompleted joint, but showing a modified form of attachment for the grounding member; Fig. 17 illustrates a modified form of grounding member; Fig. 18 shows the grounding member of Fig. 17 in final assembled position; Fig. 19 shows an end view of one of the bushings of Fig. 3, and Fig. 20 is a section through the bushing of Fig. 19.

In Fig. 1, I have illustrated a track laying vehicle having a frame 10 on which is journaled a driving sprocket 11 and an idler wheel 12 around which the endless track, indicated in general at 13, extends. The track has tread blocks 14 which are connected by links 15 at pivoted joints 17 that are adapted to permit oscillation between the blocks and links. The blocks are grounded to the frame through metal to metal contact between the blocks and sprocket wheel and thence through the shaft 28 of the wheel to the frame. The links, however, are electrically insulated from

the block by means of rubber bushings, hence, this invention is concerned with means for grounding the links to the blocks through the rubber bushings.

Referring now to Fig. 2, each rubber bushing between the pivot pin 17 and the block 14 is indicated at 20 as being disposed between the pin and a metallic sleeve 21 which is rigidly attached to the metallic part 22 of the tread block. To ground the sleeve 21 to the frame, I utilize a grounding strip preferably in the form of a wire 25 which extends through the bushing 20 and has one end 26 thereof in contact with the pin 17, and the other end 27 thereof in contact with the sleeve 21. Thus, the metallic part of the tread block is grounded to the frame through the sleeve 21, the wire 25, pin 17, link 15, sprocket 11, sprocket shaft 28, and frame 10.

As shown in Fig. 2, I prefer to utilize two grounding wires, positioned at diametrically opposite points in the rubber bushing and preferably located in a plane normal to the direction of tension exerted on the bushing when the track is in operation and the inner and outer confining member for the rubber bushing is maintained, notwithstanding any sudden stress that may be placed upon the track during the operation of the vehicle. Each wire may be inserted by piercing a passageway through the rubber bushing in a direction extending obliquely to the axis thereof, as shown in Fig. 2, or the grounding wire itself may be forced through the bushing and thereby make its own passageway. A pointed end on the wire facilitates this operation. The latter method assures a close fitting engagement between the wire and the material of which the bushing is made. Additionally, the wire preferably has spring-like characteristics, so that it tends normally to press against the inner and outer confining members for the bushing and thereby assure firm contact therewith.

In Fig. 3, I have illustrated a bushing having a plurality of spaced rubber rings in the undeformed shape, which would be prior to the time that the pin 17 and the ring which are normally bonded thereto are inserted into the sleeve 21. Prior to such assembly, it will be noted that the outer ends of the wires project in the same direction as the portion which passes through the rubber, due to the spring-like characteristics of the metal. However, as soon as the bushing is inserted in the outer sleeve, the wires are automatically bent and caused to assume the shape shown in Fig. 2. Figs. 19 and 20 show the position of the wire in the bushing prior to the insertion of the pin 17. In Fig. 19, the end portions of the wire are bent transversely and flattened to give a greater area of contact with the confining sleeves.

In Figs. 2 to 4, I have shown the grounding wires as being disposed diametrically opposite each other in a plane normal to the direction of tension, as illustrated by the arrow in Fig. 4, but in Fig. 5, I have shown a plurality of grounding wires which are disposed in different planes, but the planes preferably extend radially of the bushing and are spaced apart preferably not more than 90°. The arrow in Fig. 5 shows the direction of track tension, and although the wires are not disposed in a plane normal to such direction, nevertheless they are sufficiently close thereto to assure adequate grounding contact.

In the modification of Figs. 7 to 10, the track construction is different from that illustrated in Fig. 1, in that each track block is pivotally con-

nected directly to the adjacent block, thus obviating the necessity for links as a connecting medium therebetween. Accordingly, each block has trunnions 30 at one end thereof which receive forked ends 31 of an adjacent block and are connected together by the pivot pin 17. In this form there are two rubber bushings, each designated 20, but disposed in tandem relationship. Each bushing has a ground wire 25 extending therethrough, and the bushings are separated by a guide pin 32 that extends between sprocket wheels 33 and 34, as shown in Fig. 7. The grounding wires in Fig. 8 extend between the sleeves 21 and the tread block 14 which in this case is made of metal and, therefore, acts as the confining member for the bushing 20.

In Fig. 11, I have shown a method of inserting the grounding wires in such installations where the bushing is inserted into the sleeve by movement thereof in an axial direction after passing through a reducing die 35. In such arrangement, the grounding wires are inserted into the bushing material before the inner sleeve or pin 17 is assembled. In such instance, the angle between the central portion of the wire and the axis of the bushing preferably is 45° or less, wherefore, the amount of bend between the central and the end portions of the wire is relatively slight. The insertion of the rubber into the outer sleeve 21 causes a reduction of the angle of inclination of the wire with respect to the axis, as shown in the right hand portion of Fig. 7, where the angle is greater than 30°, so as to allow for an inclination thereof as the rubber is stretched during the inserting operation into the sleeve 21.

In Figs. 12 to 15, I have shown a modified form of grounding connection, wherein the inner sleeve 40 which corresponds to the pin 17 of Fig. 2, has an outwardly deformed portion that provides a groove 41 that is adapted to receive the inner end of the wire 25. If desired, the wire may be soldered or otherwise rigidly attached to the sleeve. In this modification, the outer sleeve is shown as a split cylinder having parts 42 and 43 which, prior to assembly, are spaced apart sufficiently to provide clearance for the outer end of the wire 25, as shown in Fig. 13. When, however, such unit is assembled into a bearing or casing, indicated at 45 in Fig. 15, the sections 42 and 43 are forced toward each other and the rubber in the bushing 20 is deformed and operates at such time to force the outer ends of the wire 25 into contact with the enclosing member 45. This assures adequate grounding contact with the enclosing member.

Fig. 16 illustrates a modification of the grounding connection shown in Fig. 12 in that the inner sleeve 40 is deformed inwardly to provide the groove 41 instead of outwardly as in Fig. 12, but in all other respects the assembly is the same as in Fig. 12.

The modification of Figs. 17 and 18 embodies two wires 25 which extend approximately tangentially to the inner wall of the bushing, whereas the outer ends are inclined toward each other when the outer sleeve 21 is added to the assembly. In each of the modifications in Figs. 13, 15, 17, and 18, the direction of tension is shown by an arrow and in each instance the grounding wires are shown as being disposed either in planes normal to the direction of tension as shown in Figs. 13 and 15, or substantially normal, as shown in Figs. 17 and 18.

In Fig. 4 the grounding wires are shown in a vertical plane, whereas the direction of tension is illustrated by the arrow as being in a horizon-

tal plane. In practice, however, the wires are adapted to move to the right or left of the vertical position dependent upon the extent to which the torsional effect alters the angular position of the pin 17 with respect to the outer sleeve 21. For best results, the links are assembled so that when the belt is straightened the rubber is under a torsional strain. For instance, where the total arcuate movement about the pin 17, due to the travel of the belt about its driving sprocket, is say 30°, the belt is assembled so that the rubber is under a 15° torsional strain in a direction reverse to the arcuate movement about the pin as it moves around the sprocket. Thus, as the link moves about its sprocket the bushing returns to a normal condition after 15° of the arcuate movement has been reached, and is placed under torsional strain of 15° in the opposite direction as 30° of arcuate movement takes place. This materially reduces the fatigue of the bushing and the life of the ground wire. For best results, I have found that the angle which the wire makes with the axis of the pin 17 should be such that the bending of the contact portions of the wire do not stress the wire beyond its elastic limit. I have found that where the angle of torsional movement of the outer sleeve 21 with respect to the pin 17 is 27°, then the angle which the wire makes with the axis of the pin 17 as it passes through the bushing should be about 20°.

While I have illustrated the invention in its various modifications as utilizing a single strand wire for the grounding member, I may, if desired, use a multi-strand strip either in braided or twisted form and I may apply it in any of the ways illustrated for a single strand in the drawings. The multi-strand may, under certain conditions, have a greater resistance to fracture resulting from repeated bending operations.

An important advantage of a grounding device made according to my invention is the fact that there is no danger of fracture thereof resulting from repeated oscillation of the joint and yet there is adequate bonding contact between the ends of the wire and the retaining members for the rubber bushing. The invention has been described primarily with an oscillating joint between the tread blocks of a track laying vehicle, but it is likewise adapted for use in the joints of a track suspension mechanism, such as indicated in general at 50, in Fig. 1. In each suspension apparatus, rubber bushings may be utilized in the oscillatable joints 46, 47, 48, and 49, and each joint may be grounded in any of the ways hereinbefore set forth in connection with the track block joint.

I claim:

1. A grounding connection for two current conducting members that are separated by a layer of electrical insulating flexible material, comprising a current conducting spring wire that extends diagonally through the insulating material and has its end portions contiguous to the current conducting members.

2. A grounding connection for two current conducting members that are separated by a cylindrical bushing of electrical insulating flexible material, comprising a current conducting spring

wire that extends through the bushing at an angle obliquely to the axis of the bushing and that has the end portions thereof in contact with the current conducting members.

3. A method of making a grounding connection between inner and outer current conducting members that are separated by a layer of electrical insulating flexible material, comprising forcing a current conducting wire through the bushing obliquely to the axis thereof so that portions of the wire project beyond the inner and outer confines of the bushing, forcing an inner member into the bushing and forcing the bushing together with the inner member into the outer member and in a direction extending in the general longitudinal direction of the wire.

4. A grounding connection for an endless track having a direction of tension and having a series of track units each comprising two current conducting inner and outer members that are separated by a cylindrical bushing of electrical insulating flexible material wherein the bushings during use are subjected to stress in the direction of tension of the track, each of said connections comprising a current conducting wire extending through the bushing in the general direction of the axis thereof and having the ends projecting through the bushing and lying against said inner and outer members respectively, said wires being disposed out of the plane of the direction of tension of the track.

5. A method of making a grounding connection between inner and outer current conducting members that are separated by a layer of electrical insulating flexible material comprising forcing a current conducting wire through the bushing obliquely to the axis thereof so that one end portion of the wire projects beyond the outer confines of the bushing for engagement with the outer member and the other end portion of the wire engages the inner member tangentially thereto and forcing the bushing together with the inner member into the outer member and in a direction extending in the general longitudinal direction of the wire.

6. A method of making a grounding connection between inner and outer current conducting members that are separated by a layer of electrical insulating flexible material comprising bonding the layer of insulating material on to the inner member forcing the current conducting wire through the bushing obliquely to the axis thereof so that the outer end of the wire projects beyond the outer confines of the bushing and the inner end of the wire extends along the inner member and is contiguous thereto and forcing the bushing together with the inner member and wire into the outer member in the direction extending in the same general longitudinal direction of the wire.

7. A grounding connection for two current conducting members that are separated by a cylindrical bushing of electrical insulating flexible material comprising a current conducting spring wire extending through the bushing obliquely to the axis thereof and having the outer end contiguous with the outer member and having its inner end bonded to the inner member.

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