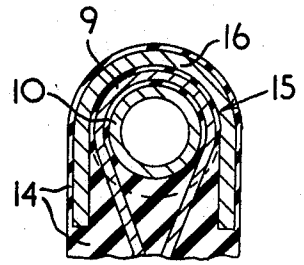
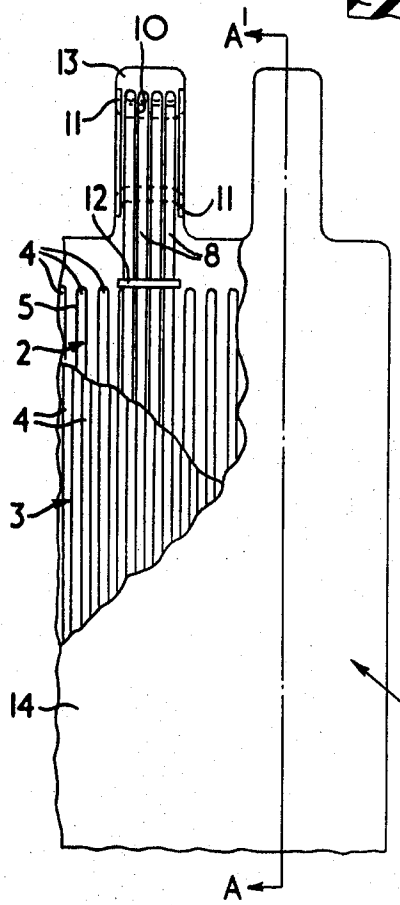
Feb. 13, 1968 P. J. JENKINS 3,368,417

SEGMENTAL BELTING

Original Filed Aug. 26, 1964 2 Sheets-Sheet 1

FIG. 3





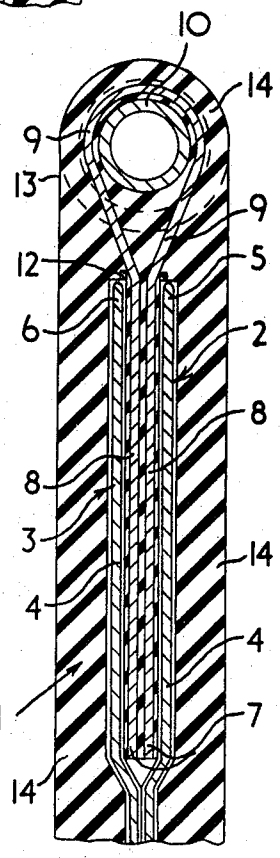


FIG. 1 FIG. 2

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FIG. 4

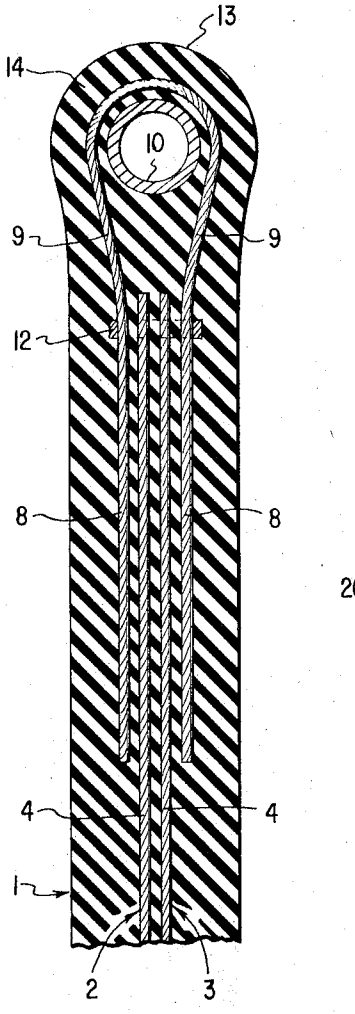
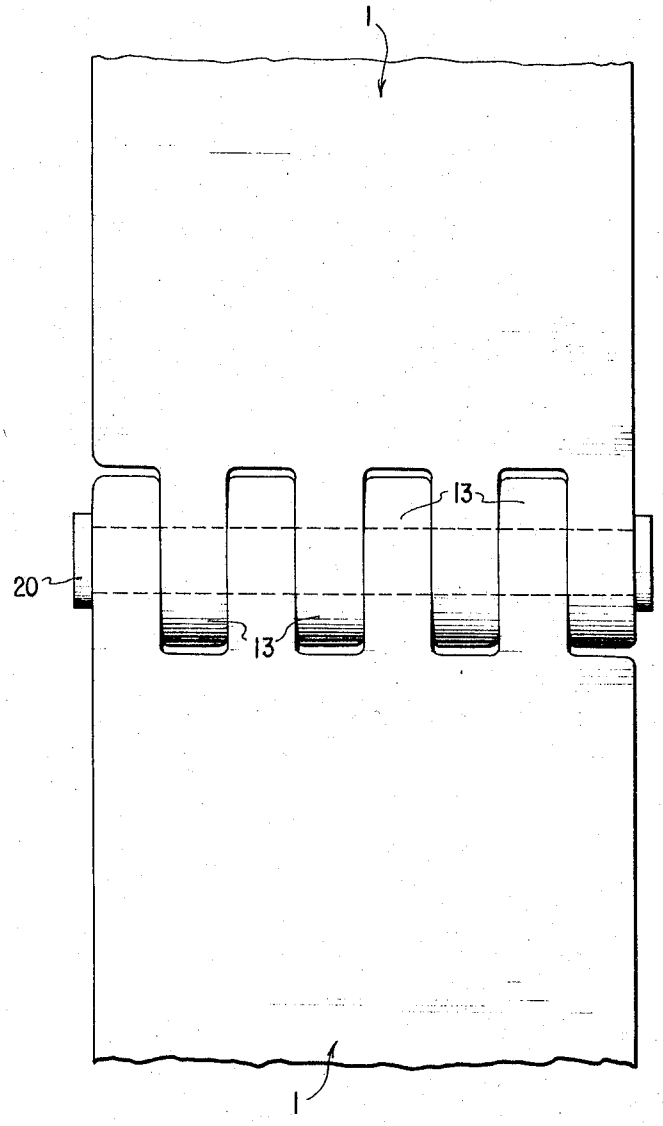


FIG. 5



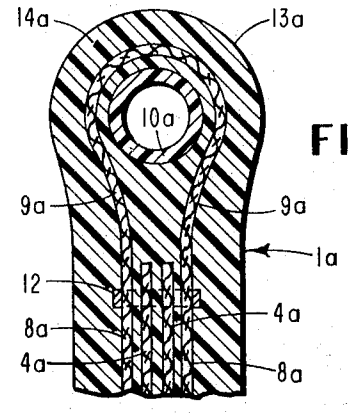


FIG. 6

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3,368,417

SEGMENTAL BELTING

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Continuation of application Ser. No. 392,237, Aug. 26, 1964. This application May 31, 1966, Ser. No. 554,219
Claims priority application Great Britain, Sept. 12, 1963, 35,914/63; Aug. 12, 1964, 32,816/64
21 Claims. (Cl. 74—237)
The portion of the term of the patent subsequent to Oct. 19, 1982, has been disclaimed.

ABSTRACT OF THE DISCLOSURE

A segment member for segmental belting with a reinforcement layer of fabric or steel having an extensibility of at least 4 percent being disposed substantially parallel to the longitudinal axis of the segment member and embedded in a flexible material. The segment member has castellated ends with ferrules enclosed by substantially inextensible cords. The ends of the cords extend a short distance into the segment member either inside or outside of the reinforcement layers.

This application is a continuation of application Ser. No. 392,237, filed Aug. 26, 1964, now abandoned.

This invention relates to segment members for segmental belting and to segmental belting comprising such segment members.

According to the present invention a segment member for segmental belting comprises a reinforcement (as hereinafter defined) embedded in a flexible material and has castellated ends comprising ferrules each of which is enclosed by substantially inextensible cords the ends of which extend a short distance into the segment member parallel to the longitudinal axis of the segment member, the ferrules being arranged in aligned relationship transverse the segment member to receive a tie-bar.

By the term "reinforcement" as used in this specification there is meant a reinforcement comprising one or more layers of a woven or non-woven textile fabric or of steel cords having an extensibility at break of at least 4 percent, the warp yarns of the woven fabric, or the yarns of the non-woven textile fabric, or the steel cords being disposed substantially parallel to the longitudinal axis of the segment member. It is to be understood that in addition to the reinforcement layers defined above, other layers of non-woven textile fabrics or of steel cords may be incorporated into the reinforcement. For instance, when the reinforcement comprises textile cords or steel cords which are disposed parallel to the longitudinal axis of the segment member, then the reinforcement preferably also contains non-woven textile cords or steel cords which are disposed at right angles to the longitudinal axis of the segment member. When the reinforcement comprises several layers of non-woven fabric or of steel cords, then it is preferred to have a layer of cords which are disposed at 90° with respect to the longitudinal axis of the segment member between adjacent reinforcement layers as hereinbefore defined.

According to the invention also, a segmental belt comprises one or more segment members according to the immediately preceding paragraph, and a tie-bar to connect adjacent segment ends, said segment member or members being arranged so that the castellations on one segment end to be connected are staggered with respect to the castellations on the adjacent segment end to be connected.

The ends of the substantially inextensible cords, such as steel cords, enclosing the ferrules extend a short distance into the segment member parallel to the longitudinal axis of the segment member. Usually the reinforcement of the segment member comprises at least two reinforcement layers, and in this case the ends of the substantially inextensible cords enclosing the ferrules enclose or are enclosed by the ends of the reinforcement layers.

Preferably the ends of the cords enclosing the ferrules are enclosed by the ends of the reinforcement layers, and in such a case the ends of the reinforcement layers may be provided with a chafer strip. The chafer strip should preferably be of a material which can be easily bonded to the flexible composition and the chafer strip should be easily penetrated by the flexible composition. A suitable material for the chafer strip is an open-woven nylon fabric.

The reinforcement comprises one or more layers of woven or non-woven textile fabric or of steel cords having an extensibility at break of at least 4 percent which are disposed parallel to the longitudinal axis of the segment member. In the case where the reinforcement consists of woven fabric, then the warp threads of the fabric are disposed parallel to the longitudinal axis of the segment member and are made of a substantially inextensible material such as nylon. The weft threads of the woven fabric are disposed at 90° to the warp threads. The weft threads may also be of nylon or they may be of any other textile material. A particularly useful weft thread comprises nylon yarns and cotton yarns doubled together and in this case the cotton assists in bonding the fabric to the flexible material in which the reinforcement is embedded. In the case where the reinforcement comprises non-woven fabric, then the cords are disposed parallel to the longitudinal axis of the segment member, and these cords can be made of a textile material such as nylon but are preferably made of steel and have an extensibility at break of at least 4 percent. Steel cords having an extensibility at break of 4 percent or more can be produced by overtwisting the cords during their manufacture. A particularly suitable cord is one having a construction in which the strand twist and the cable twist is the same, and steel cords having this construction usually have an elongation at break of from 8 percent to 12 percent. The ferrules, which are enclosed by substantially inextensible cords, such as steel cords or textile cords, which preferably have an extensibility at break of less than 4 percent to form the castellations preferably have external flanges at each end, and the substantially inextensible cords, which are arranged in side by side relationship and disposed parallel to the longitudinal axis of the segment member, enclose the ferrule between the flanges. In this manner, inadvertent transverse movement of the ferrules is prevented. The ferrule should be made of a rigid material and can be a metal ferrule such as a stainless steel ferrule or can be made of a rigid polymer.

The substantially inextensible cords, such as steel cords, enclosing each ferrule should preferably be stronger than the substantially inextensible cords forming the reinforcement layers so that when adjacent segment ends are connected, the joint produced will have a strength at least equal to the strength of the segment member.

The substantially inextensible cords enclosing each ferrule are embedded in the flexible composition which forms the working surfaces of the segment member, so that each castellation has a covering of flexible composition, The flexible composition may engage directly around the substantially inextensible cords enclosing the ferrule, or a U-shaped insert may be interposed between the substantially inextensible cords and the flexible material, with the arms of the U-shaped insert projecting into the segment member and extending a short distance into the segment member. The insert should preferably be of

width equal to the length of the ferrule so that the edges of the insert enclose the flanges at each end of the ferrule and in this way the substantially inextensible cords enclosing the ferrule are protected. The U-shaped insert should be of rigid material and metal inserts, such as stainless steel inserts, are preferred, although inserts made of rigid polymers can be used.

The ferrules are arranged in aligned relationship transverse the segment member so that a tie-bar may be inserted through the ferrules. The ferrules should preferably be of equal length, and in such a case the gap between the ends of adjacent ferrules, i.e. the gap between adjacent castellations, is of a width slightly greater than the length of a ferrule so that the castellations on one segment end to be connected can fit within the gaps between the castellations on the other segment end to be connected.

The castellations on the ends of the segment member or members are of substantially the same length, which length is such that when adjacent segment ends are connected the ferrules on one end are in aligned relationship with the ferrules on the other end, so that a tie-bar may be inserted through the ferrules to connect said segment ends.

The tie-bar is preferably made of metal, and a suitable tie-bar is one made of cabled die-formed steel wires.

The invention will now be illustrated by way of example only with reference to the accompanying drawings in which:

FIGURE 1 shows a plan view of a segment end with various components cut away to show the construction in detail.

FIGURE 2 shows a section through a segment end taken along the line A—A' of FIGURE 1.

FIGURE 3 shows a section through a castellation illustrating an alternative construction to that shown in FIGURES 1 and 2.

FIGURE 4 shows a sectional view of an alternative embodiment with the inextensible cords outside the reinforcement layers.

FIGURE 5 shows a plan view of two castellated ends interconnected by a tie-bar; and

FIGURE 6 shows alternate materials used for the ferrules and reinforcement.

Referring to FIGURES 1 and 2, a segment member **1** has a reinforcement consisting of two reinforcement layers **2** and **3** of rubber-coated steel cords **4**, the cords in each layer **2** and **3** being arranged in side by side relation and disposed parallel to the longitudinal axis of the segment member **1**. The ends **5** and **6** of the steel cords **4** enclose the ends **7** of a strip **8** of rubber-coated steel cords **9** which enclose a stainless steel ferrule **10**. The stainless steel ferrule **10** is provided with external flanges **11** and the steel cords **9** enclose the ferrule **10** between the flanges **11**. A steel wire staple **12** holds together the ends of the strip **8** of cords **9** which are disposed parallel to the longitudinal axis of the segment member. The purpose of the steel wire staple **12** is to hold the cords **9** around the ferrule **10** during manufacture of the segment member. The reinforcement and the castellations **13** have a covering of a vulcanised rubber composition **14** which forms the working surfaces of the segment member.

A belt comprises one or more segment members constructed as shown in FIGURES 1 and 2, adjacent ends of the segment member or members being connected by means of a cabled, die-formed steel tie-bar. Adjacent segment ends are arranged so that the castellations on one end to be connected are staggered with respect to, and fit within the gaps between, the castellations on the other end to be connected.

In manufacturing a segment member as shown in FIGURES 1 and 2, a stainless steel ferrule **10** having external flanges **11** is enclosed between the flanges **11** by a strip **8** of rubber-coated steel cords **9** (4 ends of 21 x 0.0058" steel wire arranged in side by side relationship and cold calendered with a natural-rubber/cobalt linoleate compound). A steel wire staple **12** is looped around the strip **8** of cords **9** to hold the cords **9** around the ferrule **10**.

A number of such assemblies is made.

Two reinforcement layers **2** and **3** of rubber-coated steel cords **4** (9 x 0.0058" zinc-plated steel wire, the cords being arranged in side by side relationship and cold calendered with a natural-rubber/cobalt linoleate composition) in which the cords are disposed parallel to the longitudinal axis of the layer are laid one upon the other. The ends **7** of the strip **8** of rubber-coated steel cords **9** enclosing a ferrule are placed between the ends **5** and **6** of the reinforcement layers **2** and **3** so that the ferrule **10** and a short length of the cords **9** project from the end of the reinforcement, to form a castellation **13**. This procedure is repeated to produce a number of castellations extending from each end of the reinforcement, the castellations on one end being staggered with respect to the castellations on the other end. The castellations **13** are of substantially the same length and the distance between castellations is slightly greater than the length of a ferrule **10**. The reinforcement layers **2** and **3** are then pressed together.

The assembly, including the castellations, is covered with sheets of a vulcanisable rubber composition **14** of width slightly greater than the width of the reinforcement layers **2** and **3**, and the covered assembly is moulded under heat and pressure to vulcanise the rubber composition **14**, mould inserts being used to produce the gaps between castellations. The assembly is moulded so as to produce shaped ends to the segment member so that the thickness at the castellations is slightly greater than at the centre of the segment member.

In manufacturing a segmental belt, one or more segment members are assembled end to end so that the castellations on one end to be connected fit within the gaps between the castellations on the adjacent end to be connected, and a cabled die-formed steel tie-bar **20** is inserted through the aligned ferrules. The tie-bar preferably has a length equal to the width of the segment member.

FIGURE 3 of the accompanying drawings shows a section through a castellation **15** having a similar construction to the castellations **13** shown in FIGURES 1 and 2. In the castellation **15** shown in FIGURE 3 a U-shaped metal insert **16** is provided to protect the steel cords **9** where these pass around the ferrule **10**. The ends of the U-shaped insert **16** extend a short distance into the segment member and the insert **16** is embedded in the flexible covering material **14**. The width of the insert **16** is substantially equal to the length of the ferrule **10** so that the edge of the insert **16** engage the external flanges **11** on the ferrule **10**.

FIGURE 4 illustrates an embodiment wherein the substantially inextensible steel cords **9** enclosing the ferrules **10** are placed outside the reinforcement layers **2** and **3** as previously described. FIGURE 5 illustrates the positioning of the steel tie-bar **20** in relation to the castellations **13**.

FIGURE 6 illustrates the use of alternate materials as previously described such as a woven fabric reiforcement layer **4***a*, a polymeric ferrule **10***a* with a woven inextensible cord **9***a* enclosing it and embedded in a synthetic resin composition. The reference numersals are similar to those previously used with the letter "*a*" subscript added.

Segmental belting constructed in accordance with the present invention is advantageous in that the segment members forming the belting are easily connected whilst the joint formed can have a strength at least equal to the strength of the segment members. Thus the present invention obviates the difficulty hitherto encountered that the joint formed between segment members has been weak and liable to failure. A further advantage of the present invention is that if the joint fails due to damage

to the tie-bar, a new tie-bar can be simply and economically inserted or if a segment is damaged a new segment can be inserted quickly without splicing. This is particularly so in the case of conveyor belting where long delays in joint repairs results in a great loss of transmitted material.

I claim:

1. A segment member for segmental belting comprising reinforcement means embedded in a flexible plastic material and castellated portions, said portions comprising ferrules each of which is enclosed by substantially inextensible cords, the ends of which extend a short distance into said segmental member parallel to the longitudinal axis thereof, said ferrules being arranged in aligned relationship transverse to the segment member for receiving a tie bar therein.

2. A segmental member according to claim 1 in which the reinforcement means comprises at least two reinforcement layers and in which the ends of the substantially inextensible cords enclosing the ferrules are enclosed by the ends of the reinforcement layers.

3. A segment member according to claim 1 in which the ends of the inextensible cords enclosing the ferrules enclose therein the ends of at least one reinforcement layer.

4. A segment member according to claim 1 in which said reinforcement means comprises steel cords which are disposed substantially parallel to the longitudinal axis of the segment member.

5. A segment member according to claim 1 in which said reinforcement means comprises a woven fabric in which the warp threads are disposed substantially parallel to the longitudinal axis of the segment member.

6. A segment member according to claim 5 in which the warp threads are made of a substantially inextensible material.

7. A segment member according to claim 1 wherein the substantially inextensible cords enclosing the ferrules are steel cords.

8. A segment member according to claim 1 in which the substantially inextensible cords enclosing the ferrules are textile cords.

9. A segment member according to claim 1 in which the cords enclosing the ferrules are stronger than the cords forming the reinforcement means.

10. A segment member according to claim 1 wherein said ferrule is made of metal.

11. A segment member according to claim 1 wherein said ferrule is made of stainless steel.

12. A segment member according to claim 1 in which the ferrule comprises a solid polymeric material.

13. A segment member according to claim 1 in which each ferrule is provided at its ends with external flanges.

14. A segment member according to claim 13 in which the substantially inextensible cords enclosing the ferrule engage the ferrule between the flanges.

15. A segment member according to claim 13 in which a U-shaped insert of a width substantially equal to the length of the ferrule is interposed between the flexible covering material and the substantially inextensible cords enclosing the ferrule.

16. A segment member according to claim 1 in which the flexible material is a natural rubber composition.

17. A segment member according to claim 1 in which the flexible material is a synthetic rubber composition.

18. A segment member according to claim 1 in which the flexible material is a synthetic resin composition.

19. A segment member according to claim 18 in which the synthetic resin composition is based on polyvinyl chloride.

20. A segment member according to claim 1 wherein the ends of the segment member are shaped to produce a thickness at the castellated ends which is slightly greater than the thickness at the center of the segment member.

21. A segmental belt comprising a plurality of segment members each according to claim 1 and a tie bar connecting adjacent segmental ends, said segmental members being arranged so that the castellated ends on one end are connected in staggered relationship with respect to the castellated ends on the adjacent segmental ends.

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