May 30, 1944. F. H. MACKENZIE 2,349,975

REINFORCEMENT AND MOLDED ARTICLE CONTAINING THE SAME

Filed June 27, 1942

Fig. 1.

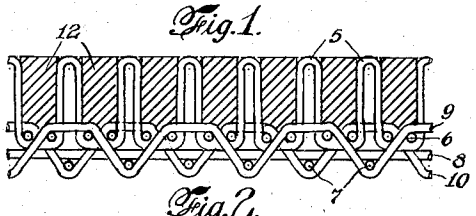


Fig. 2.

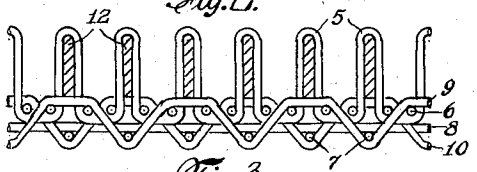


Fig. 3.

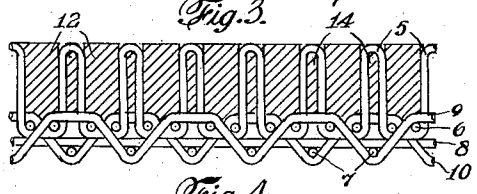


Fig. 4



Fig. 5.

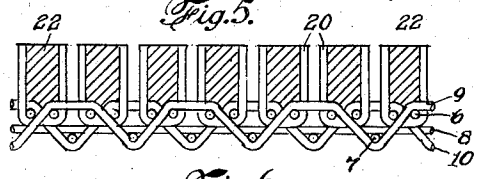


Fig. 6.

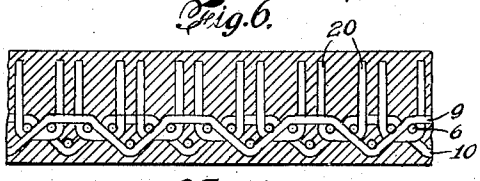
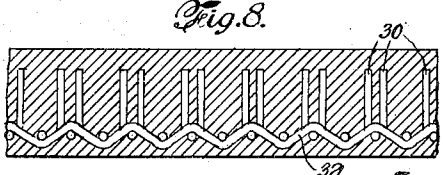


Fig. 7.



Fig. 8.



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REINFORCEMENT AND MOLDED ARTICLE CONTAINING THE SAME

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Application June 27, 1942, Serial No. 448,802

23 Claims. (Cl. 28—80)

This invention relates to pile fabrics, and more particularly to a pile fabric for use as a reinforcement or support in rubber articles, as well as the rubber articles containing said reinforcement.

The nature and objects of the instant invention will become clear from the following description, appended claims, and accompanying drawing forming a part of this specification and wherein:

Figures 1, 2 and 3 are exaggerated diagrammatic cross-sections of several modifications of fragments of pile fabrics embodying the principles of this invention;

Figure 4 is a cross-section of a fragment of a rubber article reinforced by the pile fabrics shown in Figures 1–3 inclusive;

Figure 5 is a diagrammatic cross-section of another modified form of pile fabric embodying the principles of this invention;

Figure 6 is a cross-section of a rubber article reinforced by the pile fabric shown in Figure 5;

Figure 7 is still another modification of a pile fabric embodying the principles of this invention; and

Figure 8 is a rubber article wherein the pile fabric of Figure 7 is employed as a reinforcement.

In accordance with the principles of this invention, I produce a pile fabric in which the pile is arranged in rows preferably extending transversely of the base and a filler cooperating with the pile for reasons which will become apparent from the following description.

The pile fabric comprises a ground or base to which the pile is suitably secured, as by being interwoven therewith or by being adhesively secured thereto. The pile can be cut or uncut and of various construction textures, depending on the purpose. In that embodiment of the invention wherein the pile fabric is of the type in which the ground or base is formed of interwoven warp and weft threads and the pile is formed of warps interwoven with said ground, the construction of the pile fabric may be of the type usually employed in the manufacture of floor coverings, such as, for example, 2-shot, 2-shot through the back, 3-shot, etc., and the pile may be either of the looped (uncut) or cut type. In that embodiment of the invention wherein the pile fabric is of the type in which the pile is adhesively secured to the ground or base, the lower end of the pile is adhesively secured to the base by an adhesive and preferably penetrates the surface of the adhesive. If desired, the pile or ground yarns may be colored to produce any desired colored yarn.

The pile is formed of individual yarns, plied yarns, doubled yarns, rovings, strands, etc., all hereinafter called "yarns," of materials having a high abrasive resistance, such as cotton, rayon, nylon, wool, mixtures thereof, etc. The materials forming the backing or the ground may likewise be formed of yarns of materials having a high abrasive resistance, such as, for example, cotton, rayon, nylon or other materials such as are now used to form the tire cord or fabric of automobile tires.

The number of pile tufts per square inch is governed by and dependent on the size of the materials used for the pile and the performance requirements of the rubber article in which the pile fabric is to serve as a reinforcement, as hereinafter more fully explained. Since, in the preferred embodiment of the invention, the rubber article is to have a high resistance to abrasion, the pile must have high resistance to abrasion, and this is secured by making the pile of great density. The appropriate pile density is secured by using appropriate weight of yarn and number of tufts per square inch. Thus, the desired pile fabric may be achieved with a low number of tufts per square inch and a very heavy pile yarn, or with a large number of tufts per square inch and a lighter pile yarn.

The height of the pile depends on the size and use of the final article in which it is to serve as a reinforcement.

The filler is formed of a material which is preferably resilient and flowable (will flow under heat and/or pressure) and, in the presence of heat, will be compatible with rubber or other materials which are to be reinforced. Rubber (natural or synthetic), reclaimed rubber, vinyl resins, urea formaldehyde resins, phenol formaldehyde resins, etc. are illustrative examples of which the filler material may be made.

The filler is so disposed in the pile fabric that, when the latter is to be incorporated in the final article which it is to reinforce, it (the filler) will, under laterally applied pressure, with or without heat either prior to or during the molding operation, flow and fill the voids between the piles and to a more or less degree impregnate the individual pile tufts. Upon application of heat, for example such as is necessary to vulcanize a rubber article in which the pile fabric is to serve as a reinforcement, the filler will blend with the rubber and aid in forming a firm bond between the rubber and the reinforcement and at the

same time substantially inhibit the flattening of the pile.

The expression "flowable material" is used herein to define a material which will flow under heat and/or pressure.

The precise form of the filler and the disposition thereof in the pile fabric depend on the nature of the pile fabric which is to constitute the reinforcement. In the preferred embodiment of the invention, the filler is formed of a strip material and so positioned either in warp-wise or weft-wise direction in the fabric and with respect to the pile as to effect the aforementioned desired results. The filler may be preformed and positioned in place either in a weft-wise or warp-wise direction during or subsequent to the weaving of the pile fabric. Alternatively, the filler may be formed in situ in the fabric by introducing at the desired places, either during or subsequent to the weaving operation, the flowable material in the form of a plastic mass or a solution or dispersion of desired viscosity in an appropriate liquid medium, and thereafter causing the composition to set in any convenient manner as by the elimination of the liquid medium. When the pile fabric is of the type in which the pile is interwoven with the ground and is looped, the filler strips may be positioned transversely of the fabric and between the transverse rows of pile. In this embodiment, the pile fabric will have alternate rows of pile and strips of filler.

In another embodiment of the invention wherein a looped pile is utilized, a filler strip is disposed transversely of the ground and positioned within and extends through the loops of each transverse row of looped pile.

If desired, the two aforementioned modifications may be combined, with the result that there will be produced a pile fabric having alternate rows of looped pile and filler strips extending transversely of said fabric, together with a second filler strip positioned within and extending through the loops of each of said rows of looped pile.

In the form of the invention wherein the pile is secured to the ground by means of an adhesive, the filler strips may be positioned so as to produce an alternate relationship with respect to the transverse rows of pile.

In that form of the invention wherein the pile is interwoven with the ground and is cut, the filler strip may be disposed transversely of the fabric and positioned in and between the legs of the cut piles.

In any of the modifications previously described, the strip filler snugly fits between the pile and extends from the top of the ground to a height substantially equal to the height of the pile. If desired, the filler may be adhesively secured to the ground.

The pile fabric hereinbefore described is primarily intended for use as a reinforcement in rubber articles. The term "rubber" is employed herein to include natural and synthetic rubbers of all types and rubber-like materials. It is, however, to be understood that the reinforcement may be used in articles formed of materials other than rubber, such as resins (natural or synthetic), plastics, etc.

In order to more fully explain the invention, the invention will now be described in connection with a reinforced article which is preferably formed of reclaimed rubber and in which the filler strips are also formed of reclaimd rubber.

Referring now to the accompanying drawing, wherein like reference numerals designate like parts, the reference numeral 5 designates a looped pile which is interwoven as a warp with the base or ground consisting of the filler yarns 6 and 7, the spacer warp 8 and the chain binding warps 9 and 10. The looped pile 5 extends transversely across the fabric in rows. Alternating with each row of pile 5 there is provided the filler 12 which is formed of a strip of reclaimed rubber. The filler 12 is positioned between two succeeding rows of pile 5 and normally maintains the pile in a substantially upright position. It is of a height, as shown in Figure 1, substantially equal to the height of the exposed pile. Normally, the pressure of the pile is sufficient to maintain the filler strips 12 in position. If desired, however, the lower edge of the filler strip 12 may be caused to be adhesively secured to the ground.

Referring now to Figure 2 wherein a modified form of the invention is shown, it will be noted that the filler 12 is disposed transversely of the fabric and positioned within and extends through the loops of each transverse row of pile. In this embodiment, the filler 12 is of a height so as to normally maintain the pile in substantially upright position.

Referring now to Figure 3 which illustrates a modification embodying the features of both the forms illustrated in Figures 1 and 2, two groups of fillers are employed. One group of the filler strips 12 is positioned so as to alternate with the transverse rows of pile, and the other group 14 is positioned in and extends through the loops of each transverse row of pile.

In order to produce a rubber article, any of the previously described pile fabrics (together with the filler) is disposed intermediate two sheets of reclaimed rubber having vulcanizing agents and accelerators incorporated therein, and in this condition introduced into a mold wherein heat and pressure are applied until the desired vulcanization has been obtained. Upon the application of the heat and pressure, the sheets of the reclaimed rubber disposed on the top and bottom of the pile fabric are caused to flow and intimately conform to the mold and reinforcement, and then thereafter vulcanized by reason of the vulcanizing ingredients incorporated in the sheets of reclaimed rubber disposed on top and bottom of the pile fabric. When the reclaimed rubber constituting the filler strips is laterally compressed and/or heated, it will flow and seek to fill the voids between the individual piles and, in many instances, also impregnate the pile elements to a more or less extent. When the filler has assumed the position which it has been forced to by virtue of the heat and pressure, it will also, since it is compatible with the reclaimed rubber employed in the manufacture of the rubber article, coalesce or blend therewith and form a substantially homogeneous body which completely envelops and adheres to the pile fabric reinforcement. Because of the lateral pressure exerted on the filler strips during the aforementioned operation, the filler strips also tend to inhibit the flattening of the pile, with the result that in the final product the pile is in a substantially upright position. A rubber article formed as immediately hereinbefore described is illustrated in Figure 4. The thickness of the reclaimed rubber sheets between which the pile fabric is positioned depends on the size and use of the ultimate product.

As previously mentioned, it is not essential that the pile be of the looped type. Figure 5

discloses a pile fabric, the construction of which is substantially the same as that shown in Figures 1, 2 and 3 except that the pile **20** is of the cut type and substantially U-shaped. In the embodiment of the invention utilizing a pile fabric of the type shown in Figure 5, filler strips **22** of reclaimed rubber are positioned transversely of the fabric and interposed between the legs of the U-shaped pile. The pile fabric, together with the filler just described, upon being molded with reclaimed rubber in the manner described above in connection with Figures 1–4, results in a rubber article as shown in Figure 6. In the emmodiment of the invention shown in Figures 5 and 6, the strip fillers **22** serve and function in substantially the same manner as the fillers **12** in the preceding embodiment.

The invention is not restricted to the use of a pile fabric in which the pile is interwoven with the ground, as previously described in connection with certain illustrative embodiments of the invention. If desired, the pile **30** may be secured to a woven base **32** by means of a layer of adhesive **34** in which the lower end of the pile **30** is caused to penetrate, as shown in Figure 7. In this embodiment, reclaimed rubber filler strips **36** are positioned transversely of the fabric and between adjacent rows of the pile **30**, wherein the reinforcement comprises alternate rows of pile and filler comparable to that disclosed in Figure 1. The pile fabric, together with the filler shown in Figure 7, when molded and incorporated in a reclaimed rubber article in the manner previously described in connection with the other embodiments, produces a rubber article of the type shown in Figure 8.

As is clearly shown in Figures 4, 6 and 8, when a pile fabric provided with a filler, as herein described, is utilized as a reinforcement in a rubber article, the rubber completely envelops and firmly adheres to the reinforcement. Because of the function of the filler, the voids between the respective piles are substantially completely filled and indeed the piles themselves are to a more or less degree impregnated, while flattening of the pile is substantially inhibited. Due to the fact that the filler is formed of a material compatible with the rubber, the filler and the rubber coalesce or blend together.

Because of the pile fabric reinforcement, the quantity of rubber which is employed in the manufacture of the rubber article is approximately 40% to 60% less than that quantity which would have to be used in the event the reinforcement was omitted.

By virtue of the construction of the rubberized article, it possesses good tensile strength, high traction, good flexing resistance, and good resiliency. The rubber article shown in Figures 4, 6 and 8 is admirably suitable in the manufacture of re-treads for automobile tires. When the rubber article is to be used as a re-tread for automobile tires, the pile fabric, together with the filler, is made of such dimensions that when formed into an annular band it will fit the periphery of the tire which is to be re-capped.

The rubber article shown in Figures 4, 6 and 8 can also be used for tires, belting (transmission and conveyor), heels and soles for shoes, rubber tiles, mats, insulating blocks and mountings, etc.

Since it is obvious that various changes and modifications may be made in the above description without departing from the nature or spirit thereof, this invention is not restricted thereto except as set forth in the appended claims.

I claim:

1. An article of manufacture for use as a reinforcement in molded articles comprising a pile fabric having a filler cooperating with the pile thereof to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of a flowable material which is compatible with the material to be molded and will flow to substantially fill the voids between the pile.

2. An article of manufacture for use as a reinforcement in molded articles comprising a pile fabric having rows of pile and a plurality of fillers, each of said fillers cooperating with at least one of said rows of pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, each of said fillers being formed of a flowable material which is compatible with the material to be molded and will flow to substantially fill the voids between the pile.

3. An article of manufacture for use as a reinforcement in molded articles comprising a pile fabric having rows of pile extending transversely of the fabric and a plurality of fillers, each of said fillers extending transversely of said fabric and cooperating with at least one of said rows of pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, each of said fillers being formed of a flowable material which is compatible with the material to be molded and will flow to substantially fill the voids between the pile.

4. An article of manufacture for use as a reinforcement in molded articles comprising a pile fabric having alternate rows of pile and filler strips, said filler strips maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler strips being formed of a flowable material which is compatible with material of the final article and will flow to substantially fill the voids between the pile.

5. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having a filler cooperating with the pile thereof to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

6. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having rows of pile and a plurality of fillers, each of said fillers cooperating with at least one of said rows of pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, each of said fillers being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

7. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having rows of pile extending transversely of the fabric and a plurality of fillers, each of said fillers extending transversely of said fabric and cooperating with at least one of said rows of pile to maintain said pile in a substantially

upright position prior to and during incorporation in the production of the molded article, each of said fillers being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

8. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having alternate rows of pile and filler strips, said filler strips maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler strips being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

9. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having alternate rows of pile and filler strips extending transversely of the fabric, said filler strips maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler strips being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

10. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having rows of looped pile extending transversely of the fabric and a filler positioned within and extending through the loops of each row of looped pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

11. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having alternate rows of looped pile and a filler extending transversely of said fabric, a second filler positioned within and extending through the loops of each of said rows of looped pile, said fillers maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said fillers being formed of a flowable material which is compatible with rubber and will flow to substantially fill the voids between the pile.

12. An article of manufacture for use as a reinforcement in rubber articles comprising a ground of interwoven warp and weft yarns, rows of pile interwoven with said ground, said pile being cut, and a filler extending transversely of the fabric and positioned between the legs of the cut pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of a flowable material which is compatible with rubber.

13. An article af manufacture for use as a reinforcement in rubber articles comprising a pile fabric having alternate rows of pile and filler strips, said filler strips maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler strips being formed of rubber.

14. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having alternate rows of pile and filler strips extending transversely of the fabric, said filler strips maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler strips being formed of rubber.

15. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having rows of looped pile and a filler positioned within and extending through the loops of each row of looped pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of rubber.

16. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having rows of looped pile extending transversely of the fabric and a filler positioned within and extending through the loops of each row of looped pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of rubber.

17. An article of manufacture for use as a reinforcement in rubber articles comprising a pile fabric having alternate rows of looped pile and a filler extending transversely of said fabric, a second filler positioned within and extending through the loops of each of said rows of looped pile, said fillers maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said fillers being formed of rubber.

18. An article of manufacture for use as a reinforcement in rubber articles comprising a ground of interwoven warp and weft yarns, rows of pile interwoven with said ground, said pile being cut, and a filler extending transversely of the fabric and positioned between the legs of the cut pile, said filler maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of rubber.

19. An article of manufacture for use as a reinforcement in molded reclaimed rubber articles comprising a pile fabric having rows of pile and a plurality of fillers, each of said fillers cooperating with at least one of said rows of pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, each of said fillers being formed of reclaimed rubber.

20. An article of manufacture for use as a reinforcement in molded reclaimed rubber articles comprising a pile fabric having rows of pile extending transversely of the fabric and a plurality of fillers, each of said fillers extending transversely of said fabric and cooperating with at least one of said rows of pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, each of said fillers being formed of reclaimed rubber.

21. An article of manufacture for use as a reinforcement in molded reclaimed rubber articles comprising a pile fabric having alternate rows of pile and filler strips, said filler strips maintaining said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler strips being formed of reclaimed rubber.

22. An article of manufacture for use as a reinforcement in molded reclaimed rubber articles comprising a pile fabric having alternate rows of pile and filler strips extending transversely of the fabric, said filler strips maintaining said pile in a substantially upright position prior

to and during incorporation in the production of the molded article, said filler strips being formed of reclaimed rubber.

23. An article of manufacture for use as a reinforcement in molded reclaimed rubber articles comprising a pile fabric having rows of looped pile and a filler positioned within and extending through the loops of each row of looped pile to maintain said pile in a substantially upright position prior to and during incorporation in the production of the molded article, said filler being formed of reclaimed rubber.

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