SHOE LINING AND STIFFENING MATERIALS

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Fig. 12

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This invention relates to a new stiffening and lining for portions of shoe uppers.

To preserve the shape of shoe uppers it is customary to provide a stiff sheet material as a layer in the toe or heel portions of shoes. These stiffeners have either been inelastic stiff, as for example the common fiber counter stiffener which is provided as areshaped stiff element, or have been materials softenable by heat or solvent to a condition in which they can be incorporated in a shoe upper and given the desired shape by lasting.

The perforated fiber stiffener must have at least approximately the shape required in the final shoe and therefore a large stock of fiber stiffener shapes is required. On the other hand, the heat or solvent softenable stiffener requires treatment to bring it to condition in which it can be incorporated in a shoe and it remains in moldable condition for only a limited time which imposes a definite time schedule on shoe making operations. Each of the conventional shoe stiffener materials is ordinarily inserted between the outer layer of the shoe and an inner lining of leather or fabric. This factor introduces assembly problems in certain types of shoes and provides a multiply construction which may have undesired bulkiness.

It is a feature of the present invention to provide a stiffener or liner material which is permanently dry, flexible and lastable at room temperature for easy assembly in a shoe upper and which under the action of heat combines with and stiffens the shoe. In preferred forms the material has a character suitable for exposure as the inner surface or lining of a shoe.

The shoe liner of the present invention includes a single base sheet of relatively open, matted, knitted or felted fibrous material capable of stretching sufficiently to conform to the contour of a last, and at least one face carried substantially solid unbroken, resiliently flexible, heat softenable adhesive coating localized substantially at the surface. When the material is to be used as a liner, a decorative coating or finish is applied to one face and the adhesive coating is applied to the other face, but if the material is to be interposed between the upper and liner of a shoe to provide a stiffener to take the place of a conventional counter, then both faces are provided with a resinous coating of the aforementioned character. The resultant sheet retains much of the flexibility and lastability of the fibrous sheet in uncoated condition since the adhesive coating is localized at the surface of the sheet and does not interfere with limited relative movement of the fibers in the interior of the sheet. The sheet is thus readily incorporated in a shoe upper, for example at the heel, vamp or toe, before the shoe is shaped on a form, e.g. lasted, and the shoe assembly containing the lining material may then be shaped by conventional means. After shaping of the shoe, heat is applied to the resinous adhesive layer to soften it. The relatively thick layer or layers of resinous adhesive, when in heat softened condition, is initially on the surface of the lining material and is available to bond rapidly and firmly to the interior of the shoe upper and/or liner as the case may be. At the same time, due to the tension of the upper against the form or last, the adhesive may penetrate into the fibrous sheet and surround a substantial portion of the fibers of the sheet particularly at areas of greater pressure as at the toe or heel to hold the fibers more firmly. After cooling and hardening, the lining material cooperates with the upper to provide a resilient stiffening or shape retaining action and "snap-back" characteristics through holding the fibrous base and the shoe upper stock in non-shifting piled relation. Also the fibers of the base itself are held more rigidly in the adhesive layer to give added stiffness.

The invention will be described further in connection with the drawings, in which,

FIG. 1 is a greatly enlarged section of one form of the lining and stiffener material of the present invention;

FIG. 2 is a plan view of a counter of the lining and stiffener material prior to incorporation in a shoe;

FIG. 3 is an angular view of a shoe upper with the counter of FIG. 2 stitched in place;

FIG. 4 is an angular view of a lasted shoe upper including the counter and showing a heater disposed to heat the upper and the resinous adhesive layer of the counter;

FIG. 5 is a greatly enlarged section taken on line V—V of FIG. 4 showing the counter after heating and cooling;

FIG. 6 is a greatly enlarged section of a second form of the lining and stiffener material of the present invention;

FIG. 7 is a plan view of an allower liner and stiffener for a shoe;

FIG. 8 is an angular view of a shoe upper with the allower liner of FIG. 7 stitched in place;

FIG. 9 is an angular view of a completed shoe upper including the allower liner and stiffener of FIG. 7;

FIG. 10 is a greatly enlarged section of a third form of the stiffener material of the present invention;

FIG. 11 is an angular view of a shoe upper with the stiffener material of FIG. 10 secured in place; and

FIG. 12 is a greatly enlarged section of a further form of the lining and stiffener material of the present invention.

As shown in FIG. 1, the liner or stiffener material 10 comprises a fibrous base sheet 12, a decorative coating 14 on one face of the sheet and a relatively thick layer 16 of thermoplastic resinous adhesive on the other. The adhesive layer 16 is localized on the surface so that only the ends 18 of the fibers 20 of the base sheet are held in the resinous adhesive layer 16; and since the resinous coating 16 does not penetrate the fibrous sheet 12 relative movement of the fibers 20 in the interior of the fibrous sheet can occur. Because of this freedom of the fibers 20 to move relative to each other, the stiffness of the coated sheet 10 is substantially the sum of the stiffness of the decorative and resinous coatings 14 and 16 and the fibrous base sheet 12 itself. The coated sheet 10 can therefore bend and conform to a desired shape in the process of lasting without the necessity of heating it or treating it with solvent to soften it.

Fibrous sheets 12 in which the fibers 20 are in relatively loose relationship are desirable. Non-woven fibrous base sheets, particularly relatively free fiber sheets, offer advantages in two-dimensional stretchability to enable a lining using such basic material to conform to the irregular shape at the heel, toe and other parts of the last. At the same time, the adhesive layer 16 holds the ends of the fibers of the base sheet against displacement to give a more easily handled material. A fibrous base sheet material comprising fibers held in loosely matted relationship by a binder such as a synthetic polymer resin or synthetic polymer rubber has been found very satisfactory. In one suitable sheet, nylon and rayon fibers of “1” to “1½” in length and 1½ to 3 denier with 50% by weight of a butadiene-acrylonitrile synthetic rubber binder, based on the weight of the fibers, holding the fibers at their points of contact forms a resilient flexible sheet material capable of stretching sufficiently to conform to the con-
tour of a last. This sheet material has been found to possess desirable lasting characteristics enabling it to be conformed without objectionable wrinkling when subjected to lasting stress. Various thicknesses of the nylon fibrous sheet may be used but in general about 0.02 to about 0.1 inch gauge are preferred.

The resinosous adhesive layer 16 may be applied by melting the resinosous adhesive composition and spreading it either by means of a heated applying roll or by a heated doctor bar spreading device on a surface of the fibrous sheet 12. The thermoplastic material is heated to a temperature at which it is in relatively viscous condition so that the spreading operation does not cause substantial penetration of the molten resinosous material into the fibrous sheet. A spreading viscosity of from 6,000 to 60,000 centipoises has been found to give a desirable type of firmly adherent but non-penetrating coating. After spreading the molten resinosous composition on the fibrous sheet 12, the coated sheet 10 is allowed to cool to solidify the coating to substantially solid unbroken, usually transparent condition. The term "substantially solid unbroken" is employed herein to refer to a glossy continuous layer and to distinguish from discontinuous resinosous deposits obtainable by saturation of a base with linacry or other liquid dispersions of resin in a vehicle and coagulation or other treatment, e.g., mechanical working to give discontinuity to the deposits of resin.

A wide variety of resinosous adhesive compositions having desirable resilient stiffness may be prepared by chemists familiar with the compounding of thermoplastic resinosous and adhesive compositions by blending of resins, plasticizers and/or fillers. Compositions based on linear polymer resins such as polystyrenes, polyvinyl acetate and ethyl cellulose are readily compounded to have the necessary spreading viscosity in molten condition and the necessary stiffness and resilience at normal temperatures. The properties of compounded resins for this use include the characteristic that the material exhibits substantially no cold flow at temperatures of at least 120° F. and preferably at least 140° F. when subjected to minor stress such as would normally occur in the making, shipping or use of a shoe. Convenience in spreading calls for a melt viscosity in the desired range of 6,000 to 60,000 centipoises at a temperature of around 300° F. The adhesive resinosous material should also be relatively non-brittle at room temperature to facilitate application prior to incorporation in a shoe and possess the ability to wet and bond to the leather or fabric of the interior of a shoe in which the liner is to be used.

The other face of the fibrous sheet may be provided with any suitable decorative coating 14 possessing the necessary resistance to temperature and moisture conditions encountered in the interior of a shoe in shoe making and in being worn. In the material illustrated in FIG. 1 the decorative coating is a layer of flock fibers 22 secured in upstanding relation to the sheet by a layer 24 of flocking adhesive. The flock fiber coating provides a "non-slip" action which may be desirable in certain types of shoes. Where the decorative coating 14 includes flock fibers 22 it preferably is applied to the fibrous base sheet 12 before coating with the thermoplastic resinosous adhesive layer 16. Conventional flocking procedure is followed in which a layer 24 of solution type synthetic rubber base flocking adhesive is spread on a face of the fibrous sheet base 12 and flock fiber 22 is spread on the adhesive surface by vibrating the fibrous sheet 12 as by means of a rotating hexagonal beater bar on the opposite face of the fibrous sheet.

Other decorative coatings 14 (see FIGS. 6 and 7) such as inks, e.g., printing inks and pigmented resinosous or cellulose derivative finishes may be used. The coatings may be printed on in various designs and colors suitable for their intended purpose. In the application of finishes other than the flocking type finish it is usually immaterial whether the finish be applied before or after spreading on the resinosous adhesive coating.

As noted above the liner material 10 of the present invention may be employed in various parts of the interior of a shoe as the vamp and counter portions or indeed may form a complete lining for a shoe. For purposes of illustration the use of the material as a stifferener in the counter portion of a shoe will be described first. For stiffening the counter of a shoe, there is died out a counter stifferener blank 26 comprising a rear portion extending from the heel base substantially to the upper line at the back seam of a shoe 28 and portions of decreasing height extending forward towards the shank portion 30 of the shoe 28. If desired, the side portions may extend forward to include portions of the vamp. The lower edge 32 of the stifferener blank 26 is provided with notches 34 at suitable intervals to reduce or eliminate the bunching and wrinkling of the stifferener blank below the heel seat of the shoe 28 when the shoe containing the stifferener blank is formed over a last 36.

The died out stifferener blank 26 is incorporated in the stitched together upper of a shoe in any convenient manner, suitably by setting it in place in the stitching room. As shown in FIG. 3, the stifferener material is sufficiently flexible to bend readily with the shoe upper making it easy both to stitch in place and to place the upper with the stifferener on a last (see FIG. 4). The shoe 28 is then laced and a notched lower edge 32 of the stifferener blank 26 will be found to wipe readily around the bottom edge of the last 36.

At any point thereafter, whether immediately after lasting or up to completion of the shoe 28 but before removal of the last 36, the portion of the shoe 28 containing the stifferener blank 26 is subjected to heat. Heat may be applied either by means of an electric or by means of high-frequency heating, or a radiant heat source such as the electrically heated rod 40 shown in FIG. 4. The electrically heated rod 40 is bent to conform roughly to the shape of the back of the shoe at two levels and a reflector 41 is disposed behind the rod to insure that heat is radiated evenly over substantially the entire area containing the stifferener blank 28. Heat may be applied by means of an electrically or otherwise heated band or strap (not shown) stretched around the outside of the shoe portion containing the stifferener blank, and this procedure gives the additional force to conform the shoe to the mold or form, e.g., the last 36. High-frequency electric or magnetic devices may also be used to generate the desired heat within the resinosous adhesive layer 16.

After the steps of heating and conforming the shoe to the last or other form the adhesive layer 16 is allowed to cool and harden while the shoe is held in shape on the last or form by the tension of the shoe or by the pressure of the band or strap. It is found that substantial stiffening is obtained in the resulting shoe when sufficient heat has been applied in the heating stage to soften the resinosous adhesive layer 16 to a degree at which it will establish a firm bond to the interior of the upper 28 (see FIG. 5). Improved stiffness is obtained where the heating is for a time or to a temperature which renders the resinosous adhesive somewhat fluid and causes it to flow into the fibrous sheet and more fully into engagement with the interior of the shoe upper.

The stiffening action of the material of the present invention is due at least in part to a laminating action in which the fibrous sheet 12 is held firmly to the interior of the shoe. Further resilient stiffness appears to be due to the fact that the ends 20 of the stifferifer individual fibers of the fibrous sheet are held against movement in the relatively thick resinosous adhesive layer 16 and provide the equivalent of a truss or lattice resiliently bracing the heel portion of the shoe 28 against distortion. Where the stifferened portion has been subjected to heat sufficient to cause flow of the resinosous adhesive around the fibers of the sheet 12, there is an additional locking of the fibers
against relative movement which increases the stiffness of the assembly.

Material 10 according to the present invention may form a complete lining of a shoe. In this relation the material enables the use of a greater range of shoe upper materials without further backing and provides substantial advantages in the assembly and manufacture of the shoe. The stiffening effect of the material eliminates the need for a stiffening insert which would be required between the upper and conventional lining materials. Likewise, provision of a complete lining of the material eliminates difficulties in assembly as may be encountered with conventional backed or combined upper materials.

For all-over shoe linings it is ordinarily desirable that the decorative surface coating 14 (see FIGS. 6 and 7) be on the exposed surface of the material be relatively smooth, as for example a single ink printing 42 as shown for example in FIGS. 6 and 7. An all-over liner 43 is cut or die cut out of the liner material as shown in FIG. 7. Assembly with the upper 44 may be achieved by stitching the material to the upper along the edges 46 to provide a unit (see FIG. 8) which can be handled easily in subsequent shoemaking steps. Alternatively, it is possible to join the liner to the upper in the flat by application of only sufficient heat and pressure to establish a relatively weak bond between the adhesive of the liner and the insole. The composite of liner and upper may be cut or die cut and stitched, and assembled with other necessary shoe elements in the fitting room. The resin can also be used as a combining cement for combining in continuous length the upper to the lining in place of cutting the linings individually.

The shoe upper 44, whether assembled by stitching together or lightly bonding together the upper material and the liner stiffener material, may be placed on a last and shaped thereon with no difficulty. Heating to effect a more permanent union of the liner stiffener and the upper may be carried out before or after shaping the assembled shoe upper to the last. It has been found that after cooling, a shoe upper (FIG. 9) provided with an all-over lining of the stiffener liner material assumes and retains a shape more closely following the last than has heretofore been obtained in shoemaking where the shoe is removed from the last with a short time after the lasting or the lasting operation. This treatment gives the shoe the property known to the shoemaker as "character," i.e., the exact reproduction in the shoe of the lines of the last. It will be understood that for use as an all-over liner the liner stiffener material will ordinarily be chosen of a grade somewhat less firm than the materials which may be more desirable for use only in stiffening the counter or toe portions of a shoe. Nevertheless, the liner stiffener does provide resilient snap back type shape retention throughout the shoe.

In a further modification of the invention (see FIG. 10) resinous adhesive layers 16 may be applied to both surfaces of the fibrous base sheet 12 in a manner to ensure that the molten resinous adhesive composition remains substantially on the surface of the fibrous sheet 12 and does not penetrate substantially into the sheet. Double-surface adhesive coated sheet material 48 may be used in counters or toe portions to provide even greater stiffness. It will be understood that these materials will be used in shoes 50 having a lining or counter pocket 52 (see FIG. 11) and will be disposed between the upper 50 and the lining or counter pocket 52. On heating a bond will be created between the upper 50 and the adhesive coated sheet and between the adhesive coated sheet 48 and the lining or counter pocket 52. Particularly with this double-surface coated material 48 which provides somewhat greater stiffness than the single adhesive coated material, it may be desirable to extend the stiffener material the full length of the quarter and down under the arch to give improved arch supporting action. Many other variations are possible in materials and structures including the fibrous base sheet and the surface coating or coatings of thermoplastic resinous adhesive, for example a relatively thick coating of vinyl or other comparable resinous coating finish (not shown) embossed to resemble a leather lining, may be provided on the surface of the fibrous sheet opposite the resinous adhesive layer. Again, thin suede leather "skive" 54 (see FIG. 12) may be adhered to one side of the fibrous sheet 12 to provide a material useful as a combination counter and non-slip, where service conditions or other factors render a flokked surface not acceptable. Accordingly, it is to be understood that the invention is not restricted to the particular materials and procedures shown except as defined in the claims.

The following examples are given to illustrate the material of the present invention more fully:

Example 1

A 0.027" thick, 6 oz. per square yard, non-woven sheet of blended 1½ to 3 denier nylon and rayon fibers averaging about 1" long and containing about 75% by weight of the sheet of a synthetic polymer rubber binding the fibers at their points of contact was flokked by conventional flocking procedure involving the steps of spreading on 0.020" wet thickness coating of a conventional non-prep flocking cement, depositing 0.5 mm. long rayon flock fibers on the adhesive coating and vibrating the sheet by bringing the uncoated side in contact with a rapidly rotating hexagonal beater bar. The flokked fabric was dried and the flocking cement cured by passing the fabric through an oven in accordance with conventional procedure for making flokked products.

After hardening of the flocking cement the uncoated side of the nylon fiber base sheet was coated with an 0.01" thick coating of a thermoplastic resinous adhesive.

The coating operation involved blending 5 parts by weight of mixed ortho and para-N'-toluenesulfonamides with 100 parts by weight of a polyamide formed by the reaction of dimerized soybean oil fatty acid with ethylene diamine and having an amine value of 1.9 milligrams of NH₃ per gram of resin, an acid number of about 7, an ash content of 0.10 maximum, a specific gravity of 0.917, an average molecular weight of 3000 to 6500, and a ball and ring softening point (ASTM) of 105° to 115° C.

The molten resin mixture was brought to a temperature of about 150° C. and spread on the base sheet using a knife spreader of which the knife temperature was 160° C. The applied resin hardened promptly after application to a transparent, brownish, stiffly flexible film.

A counter stiffener blank was cut from the coated base sheet material in an outline as shown in FIG. 2 including notches along the lower edge. The counter stiffener was stitched into a shoe upper by a row of stitches extending along the curved upper edge of the blank and the assembly was then placed on a last.

The shoe upper assembly including the stiffener blank was pulled over and lasted without heating. No difficulty was encountered in this operation. The heel end of the lasted shoe was then heated to a temperature of about 100° C. by disposing it approximately one inch from a shaped electrical heating unit and the upper was held at this temperature for about 30 seconds.

The upper cooled in about 3 to 4 minutes. Further shoemaking operations including sole attaching, heel, etc. were carried out on the shoe and the shoe was removed from the last. The portion of the shoe containing the stiffener was resiliently flexible but sufficiently stiff to retain in large measure the shape imparted to the shoe by the last. The shoe was cut open and it was observed that the resin coating had flowed into intimate adhesive contact with the interior of the shoe upper and formed a strong bond to it. This action appears to be aided by the pressure of the upper against the last due to tension resulting from the lasting operation. It is also considered that the leather upper may have shrunk to a limited ex
tent during the application of heat and created additional pressure squeezing the counter stiffener between the shoe upper and the last. The fibers of the nylon fiber base sheet had penetrated somewhat further into the resin coating and it appeared also that the resin had flowed somewhat into the interior of the base sheet. The flock fibers remained in upstanding relationship in the flocking adhesive.

Other shoes prepared in the same manner were worn and it was found that the upstanding flock fibers provided the desirable non-slip action on the heel of the foot to hold the shoe against undesired motion relative to the heel.

Example II

Flocked and resin coated counter stiffener blanks were incorporated in a shoe upper and the upper disposed on a last and lasted as in Example I. Thereafter air from a hot air gun at a temperature of about 190° C. was directed against the portions of the shoe underlyng the stiffener blank. The air blowing was continued until the temperature of the leather reached about 180° C. and was then discontinued. It was found that a satisfactory union of the counter stiffener and shoe upper was obtained.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A normally flexible, lastable shoe material comprising a relatively open two-dimensionally stretchable non-woven fibrous sheet base from 0.02 to 0.1 inch in thickness of which the individual fibers are held in loosely matted relationship and a substantially solid continuous layer of heat softenable, stiff, resilient thermoplastic adhesive localized substantially at the surface of said base, projecting ends of fibers of said fibrous sheet being embedded in and held against displacement by said layer of adhesive and portions of the fibers in the interior of said fibrous sheet being capable of limited movement relative to each other, said layer of adhesive having a substantial thickness relative to the thickness of said base sufficient to penetrate said base and surround substantial portions of the fibers of said base when said adhesive is softened by heat and an assembled shoe and stiffener are stretched against a form in the shaping of a shoe.

2. A normally flexible, lastable shoe liner comprising a relatively open two-dimensionally stretchable non-woven fibrous sheet base from 0.02 to 0.1 inch in thickness of which the individual fibers are held in loosely matted relationship, a decorative surface on one face of said base and a substantially solid continuous layer of heat softenable, stiff, resilient thermoplastic adhesive localized substantially at the surface of said base, projecting ends of fibers of said fibrous sheet being embedded in and held against displacement by said layer of adhesive and portions of the fibers in the interior of said fibrous sheet being capable of limited movement relative to each other, said layer of adhesive having a substantial thickness relative to the thickness of said base sufficient to penetrate said base and surround substantial portions of the fibers of said base when said adhesive is softened by heat and an assembled shoe and liner are stretched against a form in the shaping of a shoe.

3. A normally flexible, lastable shoe liner comprising a non-woven, two-dimensionally stretchable, fibrous sheet base from 0.02 to 0.1 inch in thickness, a decorative surface coating on one face of said base and a substantially solid continuous layer of heat-softenable, stiff, resilient thermoplastic adhesive localized substantially at the surface of the other face of said base, said fibrous sheet base including a binder holding the individual fibers in relatively open, loosely matted relationship substantially only at their points of contact, projecting ends of fibers of said fibrous sheet being embedded in and held against displacement by said layer of adhesive and portions of the fibers of said base when said adhesive having a thickness relative to the thickness of said base of the order of 0.01 to 0.027 whereby said adhesive will penetrate said base and surround substantial portions of the fibers of said base when said adhesive is softened by heat and an assembled shoe and liner are stretched against a form in the shaping of a shoe.

4. A normally flexible, lastable shoe liner comprising a two-dimensionally stretchable, non-woven fibrous sheet base from 0.02 to 0.1 inch in thickness and substantially solid continuous layers of heat-softenable, stiff, resilient thermoplastic adhesive localized substantially at the surfaces on the faces of said base, said fibrous sheet base including a binder holding the individual fibers in relatively open, loosely matted relationship substantially only at their points of contact, projecting ends of fibers of said fibrous sheet being embedded in and held against displacement by said layer of adhesive and portions of the fibers in the interior of said fibrous sheet being capable of limited movement relative to each other, said layer of adhesive having a thickness relative to the thickness of said base of the order of 0.01 to 0.027 whereby said adhesive will penetrate said base and surround substantial portions of the fibers of said base when said adhesive is softened by heat and an assembled shoe and stiffener are stretched against a form in the shaping of a shoe.

5. A normally flexible, lastable shoe liner comprising a relatively open non-woven, two dimensionally stretchable, fibrous sheet base from 0.02 to 0.1 inch in thickness, a coating of flocking cement on one face of said base, flock fibers held in upstanding relation to said sheet by said coating of cement, and a substantially solid continuous layer of heat softenable, stiff, resilient, thermoplastic adhesive localized substantially at the surface on the other face of said base, said fibrous sheet base including a binder holding the fibers in relatively open, loosely matted relationship substantially only at their points of contact, projecting ends of fibers of said fibrous sheet being embedded in and held against displacement by said layer of adhesive and portions of the fibers in the interior of said fibrous sheet being capable of limited movement relative to each other, said layer of adhesive having a thickness relative to the thickness of said base of the order of 0.01 to 0.027 whereby said adhesive will penetrate said base and surround substantial portions of the fibers of said base when said adhesive is softened by heat and an assembled shoe and liner are stretched against a form in the shaping of a shoe.

6. A normally flexible, lastable shoe liner comprising a relatively open two-dimensionally stretchable non-woven fibrous sheet base from 0.02 to 0.1 inch in thickness of which the individual fibers are held in loosely matted relationship, a layer of flexible, lastable shoe material adhered to one face of said base, and a substantially solid unbroken coating of heat softenable, stiff, resilient thermoplastic adhesive localized substantially at the surface on the other face of said base, projecting ends of fibers of said fibrous sheet being embedded in and held against displacement by said coating of adhesive and portions of the fibers in the interior of said fibrous sheet being capable of limited movement relative to each other, said layer of adhesive having a thickness relative to the thickness of said base of the order of 0.01 to 0.027 whereby said adhesive will penetrate said base and surround substantial portions of the fibers of said base when said adhesive is softened by heat and an assembled shoe and liner are stretched against a form in the shaping of a shoe.

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