

Dec. 10, 1940.

F. M. ALLEN

2,224,209

FLEXIBLE SMOOTH SURFACE COVERING

Filed May 11, 1939

Fig. 1.

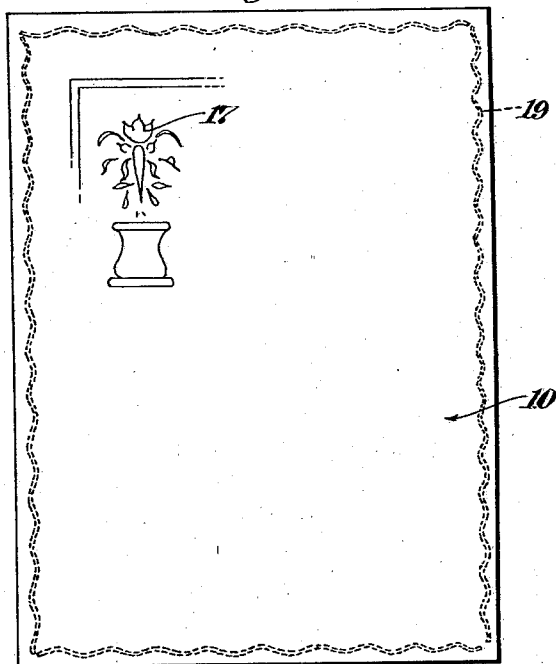


Fig. 2.

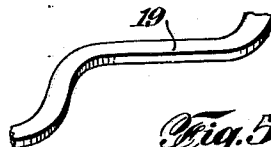
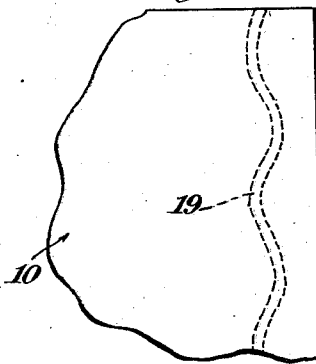


Fig. 5.

Fig. 3.

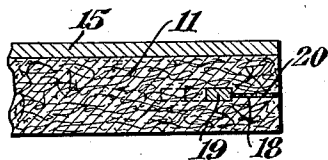


Fig. 4.

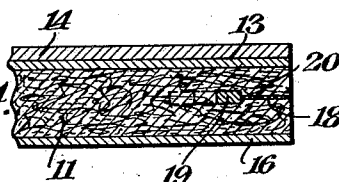


Fig. 7.

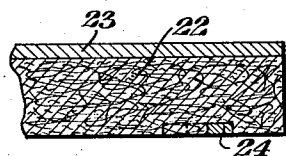


Fig. 6.

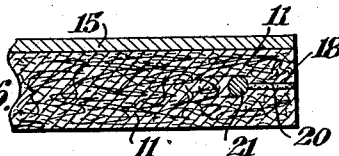


Fig. 8.

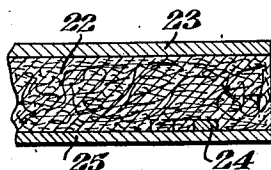


Fig. 10.

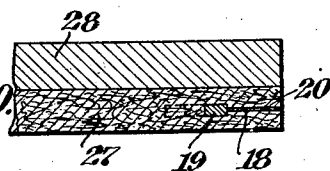
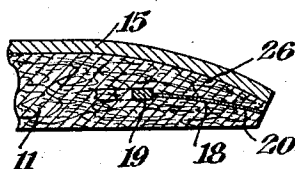


Fig. 9.



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2,224,209

FLEXIBLE SMOOTH SURFACE COVERING

Frank M. Allen, Summit, N. J., assignor to Congoleum-Nairn Inc., a corporation of New York

Application May 11, 1939, Serial No. 272,955

7 Claims. (Cl. 154—49)

This invention relates to flexible smooth surface rugs. This invention relates particularly to flexible smooth surface rugs having a base sheet comprising a fibrous material impregnated with water proofing material and suitable for covering floors and the like.

It is the purpose of this invention to afford a smooth surface rug of the character referred to having improved reinforcing means along the margin thereof adapted to increase the resistance of the rug to tearing strains applied at or adjacent the margin of the rug and adapted for use without injury to the rug upon expansion and contraction of the rug under conditions of varying humidity and temperature.

From one aspect this invention constitutes an improvement on the rug structure shown in my pending application Serial No. 99,168, filed September 2, 1936, for Flexible smooth surface rugs and method of making same, and in my subsequent application Serial No. 276,626 filed May 31, 1939, now Patent No. 2,184,970 issued December 26, 1939. In the application referred to a flexible smooth surface rug is shown having an elongated reinforcing element completely embedded in a recess extending into the fibrous base of the rug from adjacent an edge of the rug. According to the present invention, instead of using an elongated reinforcing element in the form of a straight wire or tape, as described in my said prior application, a reinforcing element is used which is characterized by being in the form of a series of bends so that the axial length of the reinforcing element along the margin of the rug is substantially greater than the longitudinal disposition of the element along the margin of the rug. While this invention is applicable in connection with a rug structure of the character shown in my applications Serial Nos. 99,168 and 276,626 above referred to (now Patent No. 2,184,970), it may also be employed in connection with other rug structures as will be described more in detail hereinbelow.

When a reinforcing element is employed which is in the form of a series of bends, I have found that there is a very pronounced increase in the resistance of the rug in which the reinforcing element is incorporated, to tearing. It is a further advantage of this invention that the use of a reinforcing element in the form of a series of bends eliminates distortion of the rug due to expansion and contraction thereof under varying and excessive or abnormal conditions of moisture, temperature and the like.

Further purposes, features and advantages of

this invention will be apparent in connection with the following description of certain illustrative embodiments thereof shown in the accompanying drawing wherein

Figure 1 is a plan view of a flexible smooth surface rug embodying this invention;

Figure 2 is a plan view, enlarged, of a marginal portion of the rug shown in Figure 1;

Figure 3 is a side sectional view of the marginal portion of a flexible smooth surface rug embodying this invention;

Figure 4 is a side section of a portion of a rug embodying this invention showing facing and backing layers for the rug;

Figure 5 is a plan view of one form of reinforcing element appropriate for use according to this invention, the reinforcing element being separated from the body of the rug; and

Figures 6, 7, 8, 9 and 10 are side sectional views similar to Figure 3 but of different modifications of this invention.

While this invention is applicable in connection with several different types of flexible smooth surface rugs, it will be described with respect to one type of rug in connection with which this invention is preferably practiced. A rug of the type referred to includes a base sheet consisting of water-laid felt of some suitable fiber such as rag fiber or the like impregnated with a suitable material which is adapted to increase the water resistance and strain resistance of the felt, such as a bituminous saturant having a melting point of about 160° F. To one surface of the water-proofed felt base sheet there is applied a sealing coat which is adapted to resist bleeding of the saturant in the base sheet therethrough and which may, for example, comprise a suitable vehicle such as a drying oil or resin, or both, together with a filler. Over the sealing coat a surface coating or layer of wear-resistant and decorative material is applied. This coating or layer may comprise a suitable binder material such as a drying oil, or a soluble cellulose derivative, or a resinous material, together with solid material in the nature of finely-divided pigment or inert filler, or both. This surface layer is usually applied in the form of paints of different color by means of a printing operation adapted to produce the desired surface design. While the surface of such a rug is referred to as "smooth," the term "smooth surface" is used to distinguish from rugs comprising heavy pile fabrics, for example, and may include rugs having a surface layer or coating of molded composition which contains irregularities in the surface.

Suitable decorative and wear-resistant coatings may, for example, comprise drying oil paint or enamel, cellulose ester lacquer, synthetic resin lacquer, or molded composition such as linoleum composition, or the like. Both the sealing coat and the surface coating or layer can be applied in one or more applications. The back of the rug is usually treated with some suitable protective composition such as the composition used for the sealing coat in order to render the back of the rug non-sticky and more attractive in appearance. Alternatively, the fibrous base of the rug may be impregnated with materials which render the surface decorative and wear resisting. In either case the rug may be regarded as comprising a unitary sheet of fibrous material (e. g., felt) and presenting a decorative and wear-resisting surface.

In referring to the drawing, it is to be understood that the rugs shown are not drawn to scale and that the different portions of the rug have been illustrated primarily from the point of view of clarity in indicating the different structural features of the rug without attempting to accurately show the dimensions, size or relative proportions of the elements of the rug.

The rug shown in Figs. 1, 2 and 3 may for the purpose of affording a preferred illustration of the practice of this invention be of the type described generally hereinabove. The rug is indicated generally by the reference character 10 and consists of a base sheet 11 of felt impregnated with a waterproofing material. By waterproofing material any material which is adapted to impart increased resistance to water of the fiber in the base sheet is referred to. A bituminous material of an asphaltic character is usually desirable, although other waterproofing materials such as bodied drying oils, soluble cellulose compositions, solutions of synthetic resins or the like may be used.

Integral with the upper side of the felt base sheet is a wear-resistant and decorative layer 15. In this embodiment of my invention the surface layer such as layer 15 may, as shown in Figure 4, consist of a sealing coat 13 and a decorative and wear-resistant coating or layer 14. Moreover, a suitable backing coat 16 may be employed, as is also shown in Figure 4. Hereinabove mention has been made of suitable materials which may be used for the wear-resistant and decorative surface layer, the sealing layer, and the backing coat. In the drawings other than Figure 4, e. g., in Figure 3, the decorative and wear-resistant surface layer is shown as a single layer 15 but it is to be understood that this is done for convenience in the description and clarity in the drawing and that the decorative and wear-resistant layer in the drawing, such as the layer 15, may comprise one or more coatings as may be desired and may include coatings of different material. Likewise it is to be understood that the modifications of this invention other than the embodiment shown in Figure 4, may include a backing coat applied in one or more layers of the same or different materials, although for convenience in the description and clarity in the drawing this backing layer is omitted. The decorative and wear-resistant layer may include a desired design such as the design 17, part of which is shown in Figure 1.

In the edge of the base sheet 11 is a recess or slit 18 in which is embedded the reinforcing element 19. The reinforcing element may, for example, be about $\frac{1}{4}$ to $\frac{3}{4}$ inch from the mouth of the recess or slit 18.

According to this invention, the reinforcing element is not straight but is in the form of a series of bends and may, for example, be of the general form shown in Figures 2 and 5. The reinforcing element is preferably undulatory, that is, in the form of a series of waves or reverse bends. It is to be noted that the axial length of the reinforcing element, that is, the length of the element following the various bends therein is substantially greater than the longitudinal disposition of the element along the margin of the rug.

In the embodiment shown in Figure 3 the reinforcing element is embedded in the recess 18 and the opposed faces of the recess 18 are maintained in juxtaposition by a water-resistant adhesive 20. Preferably such adhesive is of the thermoplastic type, fluid at elevated temperatures but adapted to harden quickly upon cooling to a tough flexible film that will not become embrittled. Furthermore, it should possess such viscosity when heated or such immiscibility with the waterproofing material in the felt that it will not be absorbed excessively into such felt. Selected bituminous and pitch compounds, synthetic resins as, for example, the alkyd resins, paracoumarone resin, plasticized chlorinated rubber, natural resins as, for example, ester gum, or various mixtures thereof, with or without solvents, have been found satisfactory as adhesives. An example of a preferred adhesive is as follows:

	Parts
Phenol modified alkyd resin (plastic solid at 75° F.—fluid at 100° F.)	50
Chlorinated rubber (130 C. P.)	7
Paracoumarone resin (M. P. 80° F.)	43
	100

The reinforcing element can be embedded in the margin of the rug in any suitable way. For example, the rug can be slit so as to form a recess extending laterally into the rug from the edge thereof. The reinforcing element is then positioned at the base of the recess and the opposed faces of the recess are pressed together with a suitable adhesive of the character above-mentioned, for example, therebetween, so as to retain the reinforcing element permanently within the body of the rug. A more complete description of a preferred method and apparatus for inserting a reinforcing element in the margin of a flexible smooth surface rug is found in my application Serial No. 99,168 referred to hereinabove.

In the embodiment of this invention shown in Figure 3 the reinforcing element not only is in the form of a series of bends, but also is flat, namely, has substantially greater cross-sectional width in one direction than in the direction at approximately a right angle to the width and may comprise a flat narrow band of rust-resistant metal having high tensile strength. In the embodiment shown in the drawing, the undulations in the reinforcing element consist of a series of reverse bends. Preferably as shown, all of the bends are in approximately the same plane and this plane is preferably approximately the same as the plane of greater cross-sectional width when the reinforcing element is flattened. The reinforcing element is preferably placed in the rug so that the plane of the reverse bends or undulations and the plane of greatest cross-sectional width of the reinforcing element are substantially the same as the plane of flatwise disposition of the body portion of the rug. The reinforcing element is preferably at approximately the neutral axis of the

rug, namely, at the plane of the rug which is intermediate the thickness thereof and at which the material of the rug is neither stretched nor compressed substantially upon flexing the rug.

5 A specific illustration of a typical reinforcing element according to this invention may be referred to for the purpose of exemplification. The reinforcing element is made of stainless steel comprising about 18% chromium and about 8% 10 of nickel, the alloy having a tensile strength per square inch of about 200,000 pounds. Such a metal is strong and tough and is corrosion-resistant. The metal is first prepared in the form of an .018 inch diameter round wire which is sub- 15 jected to a bending or crimping operation which results in undulatory wavy wire that has about 5 to 7 pitches or waves per inch and that has an overall width (that is, the total lateral extent or amplitude between the outer surfaces of opposite 20 crests of the reinforcing element) of about .060 inch. The bends or pitches in the wire are substantially in the same plane. The wire is then flattened in the same plane as the plane of the pitches or bends so that the thickness of the wire 25 perpendicular to this plane is reduced to about .010 inch.

When a reinforcing element of the character described is embedded in the margin of a smooth surface rug of the character above-mentioned 30 as described hereinabove, I have found that the resistance of the margin of the rug to tearing is greatly increased as compared with a similar rug which contains a reinforcing element which is identical with the reinforcing element de- 35 scribed, except for the fact that it is straight and is not of undulatory form. I have found that when the solid metal wire or tape is in waved or crimped form an increased resistance to tearing of about 50% to 100% is afforded as com- 40 pared with a reinforcing element of the same cross-sectional area and shape which is straight. Notwithstanding that the reinforcing element is in the form of a relatively thin wire, the rein- 45 forcing element, when made in a series of bends or in an undulatory form as referred to herein- above, strengthens the margin of the rug in which it is embedded so that the rug is made resistant to any tearing strains to which it would be likely 50 to be subjected. Even an abnormally strong man intentionally trying to tear the rug with his hands would encounter very great difficulty in tearing the rug.

The importance of increasing the strength of a flexible smooth surface rug so that it may be 55 highly resistant to tearing is apparent. One of the most serious difficulties incident to flexible smooth surface rugs is that of insufficient resistance to tearing from the margin or edge portion of the rug. According to the present invention, 60 the resistance of the margin of the rug to tearing can be increased so as to meet even the most severe service conditions.

Using a straight reinforcing element, e. g., a straight wire or tape, it is impossible as a practi- 65 cal matter to increase the strength of the margin of a flexible smooth surface rug to the extent that is possible using an undulatory reinforcing element. In order to achieve the strength that is possible using an undulatory reinforcing element, 70 according to this invention, it would be necessary, if a straight reinforcing element were used, to increase the thickness of a straight reinforcing element to such an extent that it would constitute an objectionable ridge in the face of the rug.

75 While applicant does not wish to be bound by

any theories as to why an undulatory reinforcing element achieves the markedly increased resistance to tearing referred to above as compared with the employment of a straight reinforcing element, it is believed that the undulatory or 5 waved type of reinforcing element permits the reinforcing element to be locally straightened out whenever a shearing or twisting force is applied to the margin of the rug so as to afford an excess 10 of the reinforcing element at the point or zone where the force is applied with the result that the load placed on the reinforcing element is pre- dominantly one of tension. When, on the other 15 hand, a straight reinforcing element is used, the shearing or twisting force applied to the edge of the rug is concentrated at the point or zone of application and imposes a strain or load which is predominantly one of shear. The resistance of 20 metallic bodies such as wires, tapes or the like to tensile strains is normally greater than the resistance to shear. Further along the same line, the fact that the undulatory reinforcing element tends to straighten out when a sudden shearing or twisting force is applied to the margin of the 25 rug affords a finite interval of time during which the wire straightens out, thereby cushioning the shock. The force or strain can be simply com- puted by the formula

$$F = \frac{VM}{T} \quad 30$$

wherein F is the force or strain, M is the mass, V the velocity, and T the time. Doubling the time during which the moving object is checked 35 by the reinforcing element halves the strain thereon required for checking the movement of the object.

The use of a reinforcing element which is in the form of a series of bends or crimps such as the series of reverse bends or waves shown in the drawing is of value not only because of the in- 40 creased resistance to tearing which is afforded thereby, but also because the rug is rendered less subject to injury due to varying and excessive or abnormal conditions of temperature and dampness. Under conditions of extreme damp- 45 ness such as may occur, for example, when a rug is placed on concrete which is in direct contact with the ground, the felt base of the rug expands a substantial amount, sometimes as much as 1/4 50 inch for each 12 feet. A reinforcing element in the form of a straight wire, for example, tends to resist any such expansion of a rug and sometimes imparts a so-called "tight edge" to the margin of the rug with resultant ripple effect in 55 the body portion of the rug adjacent the margin containing the reinforcing element. When the reinforcing element is of an undulatory or waved type, as has been described hereinabove, the re- 60 forcing element can be stretched or contracted with accordion-like action and affords comparatively little resistance to such changes in overall longitudinal extent along the margin of the rug. According to preferred practice, the reinforcing 65 element is crimped or bent to such an extent that it can be distended or lengthened by about 10% or more of its overall length. It is apparent, therefore, that when an undulatory or waved re- 70 forcing element is used, no "tight edge" effect occurs upon expansion and contraction of the rug under varying conditions of temperature and dampness.

While this invention has been described in connection with a specific type of waved re- 75 forcing element, it is apparent that the reinforcing element may take many different forms. In

the usual case it is preferable to employ a metal reinforcing element. However, certain advantages of this invention can be gained by using a reinforcing element made of some other material than metal, such, for example, as a cord or tape of fibrous material having a high tensile strength, the reinforcing element being disposed in an undulatory or wavy form rather than being disposed so as to lie straight along the margin of the rug. Particularly when a metallic reinforcing element is used, it is preferable to employ a reinforcing element which is produced in a series of bends which has an overall width that is about 2 to 4 times the maximum cross-sectional dimensions of the element. Preferably for ordinary flexible smooth surface rugs there are about 3 to 10 pitches per inch. In connection with metallic reinforcing elements the use of elements within the following range affords a very satisfactory result:

Width	-----inch	.005 to .04
Thickness	-----do	.005 to .015
Pitches per inch	-----	3 to 10
Overall width of element	-----inch	.02 to .10

While the employment of a flat reinforcing element is preferable according to this invention, the reinforcing element may be round, as shown in Figure 6, wherein a round reinforcing element 21 is embedded in recess 18 in the body portion 11 of the rug having the surface layer 15. Reinforcing elements of other forms may also be used. For example, the cross section of the reinforcing element may be in the form of an ellipse with the maximum cross sectional dimension preferably in the plane of the body portion of the rug. Moreover, when a round wire is flattened as above-described, the reinforcing element may have flat upper and lower surfaces and be somewhat rounded or bulging along the sides.

In Figure 7 a smooth surface rug is shown comprising a body portion 22 and a surface layer 23. Adjacent the margin of the rug is a reinforcing element 24 which is embedded in the bottom of the rug, the lower surface of the element being flush with the bottom of the rug. The rug shown in Figure 8 is identical with that shown in Figure 7, except that there is an additional backing layer 25 at the bottom of the rug, the reinforcing element being sandwiched between the layer 25 and the layer 22. The layer 25 may be in the form of heavy paper, an additional sheet of felt impregnated with waterproofing material, or a backing fabric of desired weight and strength, as may be desired. The sheet 25 may cover the entire bottom of the body portion of the rug, or alternatively, may be disposed along the marginal portion only of the rug. The sheet 25 can be bonded to the body portion 22 in any suitable way, as for example, by an adhesive.

In Figure 9 a smooth surface rug is shown which is similar to that shown in Figure 3, except that the rug has a tapered portion 26 at the margin thereof. The tapered portion may be of the character referred to more in detail in my above-mentioned applications Serial Nos. 99,168 and 276,626 (now Patent No. 2,184,970). It may be of increased density as it decreases in thickness progressing toward the edge of the rug, or the tapered portion may decrease in thickness and weight progressing toward the edge of the rug as by cutting away a portion of the felt and bending it downwardly along the margin of the rug.

In Figure 10 another form of flexible smooth surface rug is shown which is similar to that

shown in Figure 3, except that the surface layer, instead of being relatively thin, may be a layer of substantial thickness such as a layer of linoleum composition. In this figure the rug is shown as comprising a base sheet 27 having integral with the upper surface thereof a wear-resistant and decorative surface layer 28 which is relatively heavy and which may be composed of a linoleum composition, for example.

While this invention has been described in connection with flexible smooth surface rugs of the type having a decorative and wear-resistant surface layer in addition to a base sheet, many features of this invention are applicable when the wear-resistant and decorative layer is omitted, or when the base sheet itself constitutes a wear-resistant and decorative surface. Thus many of the features of this invention may be availed of in connection with flexible smooth surface coverings comprising fibrous materials such as felt impregnated with a waterproofing material, e. g., bituminous material, drying oils, cellulose lacquers, synthetic resins or the like, whether or not the covering has a separate and distinct surface layer or layers integral with one or both surfaces thereof and whether or not the fibrous base sheet may have a decorative design imprinted therein, and the terms "flexible smooth surface rug" and "rug body" are applicable to any such coverings.

While this invention has been described in connection with certain illustrative embodiments thereof, it is to be understood that this has been done merely for exemplification and that the scope of this invention is to be limited only by the language of the following claims.

What I claim is:

1. A flexible smooth surface rug which comprises a sheet of felt impregnated with a waterproofing material and reinforced along a margin thereof without substantially increasing the thickness of said rug adjacent thereto, with an elongated tear-resistant element, said tear-resistant element being embedded in said rug and being in the form of a flat metallic tape having approximately 3 to 10 reverse bends to the inch substantially in the plane of maximum cross-sectional dimension, the maximum overall width of said tape in said plane being approximately 2 to 4 times the cross-sectional dimension of said tape in said plane.

2. A flexible smooth surface rug which comprises a sheet of felt impregnated with a waterproofing material and reinforced along a margin thereof with an elongated metallic tear-resistant element embedded therein, said tear-resistant element having about 3 to 10 pitches to the inch disposed approximately in a single plane corresponding to the plane of said sheet, the cross-section of said element being between about .005 to about .040 inch in width and about .005 to about .015 inch in thickness and said tear-resistant element having an overall width in said plane of about .02 to about .10 inch.

3. A flexible smooth surface rug which comprises a sheet of felt impregnated with a waterproofing material, which presents a decorative and wear-resisting upper surface, and in which is embedded along and adjacent a margin thereof without substantially increasing the thickness of said rug adjacent thereto an elongated metallic tear-resistant element, said element having a maximum cross-sectional dimension of approximately .005 to .04 inch and being disposed in the form of a series of reverse bends with approximately 3 to 10 pitches to the inch so that the

maximum overall width of the element is approximately .02 to 0.1 inch and so that the bends are disposed in a plane at least approximately paralleling that of the body portion of the rug.

5 4. A flexible smooth surface rug according to claim 3 wherein the tear-resistant element is completely embedded in a recess extending laterally into said felt sheet and wherein a layer of decorative and wear-resisting material is integral with a surface of said sheet.

10 5. A flexible smooth surface rug comprising a fibrous sheet impregnated with a waterproofing material and reinforced along a margin thereof by a tear-resistant element embedded
15 therein along and adjacent an edge thereof without substantially increasing the thickness of said rug adjacent said element, said element being in the form of a series of reverse bends disposed so as to have about 3 to 10 pitches to
20 the inch, having a maximum cross-sectional dimension of approximately .04 inch and having a maximum overall width of approximately 4 times said maximum cross-sectional dimension.

6. A flexible smooth surface rug according to

claim 5 wherein the tear-resistant element is a flattened wire disposed approximately at the neutral axis of the rug.

7. A flexible smooth surface rug which comprises a fibrous sheet impregnated with a water-
proofing material and an elongated undulatory
5 tear-resistant element embedded therein along and adjacent an edge of said rug without substantially increasing the thickness of said rug
10 adjacent said element, said tear-resistant element being approximately coextensive with the lineal dimension of said edge and said tear-resistant element being disposed in undulations so
15 that said tear-resistant element as a whole is at substantially uniform proximity to said edge continuously along said lineal dimension thereby affording tear resistance at substantially similar
proximity to said edge at all points along said
lineal dimension and the undulations of said
20 tear-resistant element being sufficient so that the overall length of said tear-resistant element can be distended by at least about 10%.

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