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TREATMENT OF SYNTHETIC FIBERS
AND APPARATUS THEREFOR
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Fig. 1.

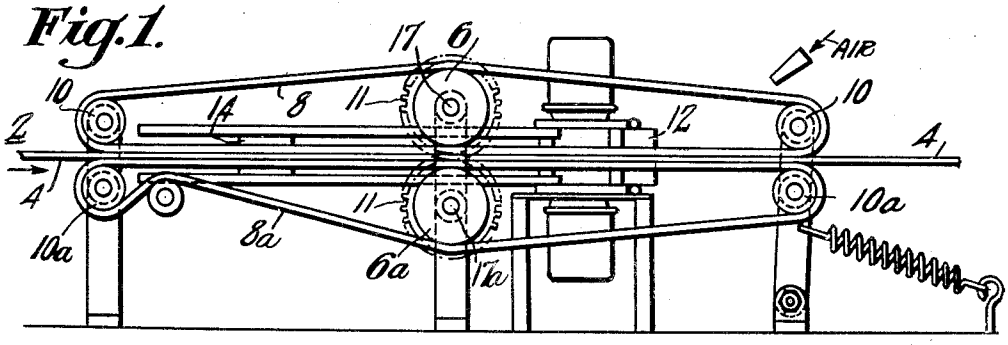


Fig. 2.

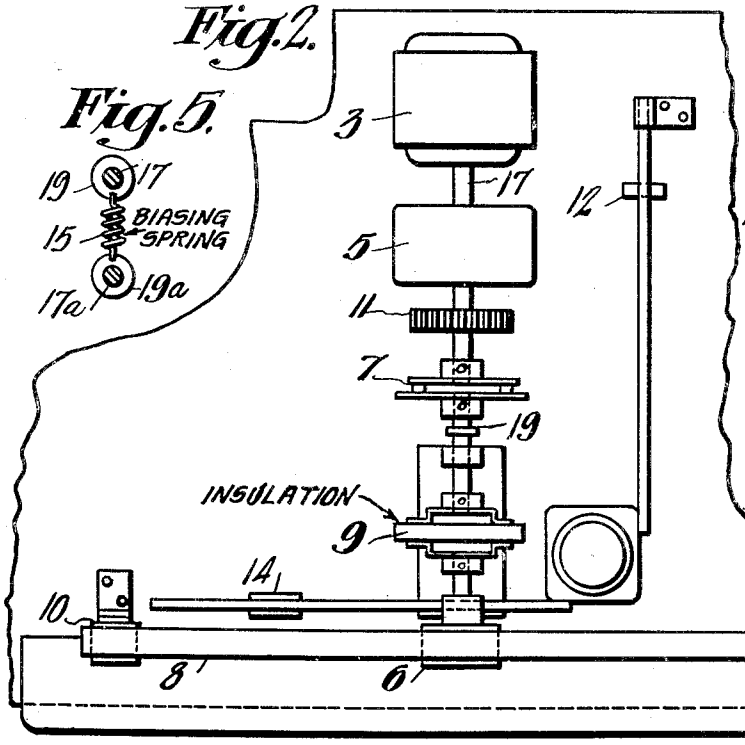


Fig. 4.

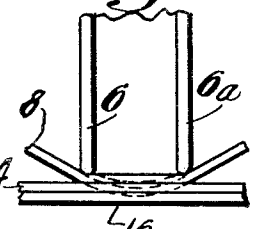


Fig. 5.

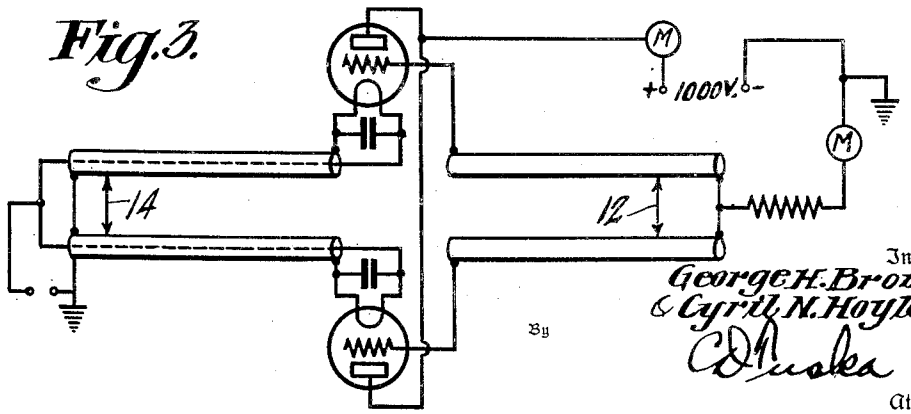
Fig. 6a.



Fig. 6b.



Fig. 3.



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TREATMENT OF SYNTHETIC FIBERS AND APPARATUS THEREFOR

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11 Claims. (Cl. 18—1)

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This invention relates to the treatment of fabric composed of synthetic fibres, and particularly to the problem of preventing such fabric from curling at the selvage edges.

Materials composed of synthetic fibres when woven, knitted or otherwise fabricated tend to curl at the edge. The formation of a selvage, by "starching" or otherwise stiffening the edges of the material, is effective in preventing such curling. The invention will be described with particular reference to the material known to industry as acetate tricot, though it is not, in any sense, limited to this material. Acetate tricot is ordinarily fabricated in sheets from 10 to 12 feet wide. Curling may be prevented by stiffening a width of one-half inch at each edge. The stiffening of the edges is also helpful in preventing raveling or dissociation of a material because of its fibrous, open structure.

Prior to this invention, it was proposed to stiffen the edges of such material by using starch or other chemicals. This treatment was impractical because the chemicals tended to run into the rest of the material. Heating the edges by means of a hot iron was not satisfactory because if the iron was too hot or was applied for a longer period than was necessary, it was liable to stick to the material. In extreme cases, too hot an iron may melt or otherwise spoil the cloth.

It is an object, therefore, of our invention to provide an improved method of and apparatus for stiffening materials continuously which is free from the defects hereinbefore mentioned, and particularly an improved method and apparatus in which the heat to be used in the stiffening and the period for which it is applied may be adequately controlled, and in which spoilage of material is prevented.

According to our invention, the material upon fabrication is fed continuously between a pair or pairs of electrodes which are connected to a source of high frequency electrical energy. Because of its dielectric losses the material is heated to the temperature required for stiffening, and means are adopted for preventing heat so developed from unduly heating the electrodes. The application of slight pressure completes the stiffening process. This method and apparatus enable the operator to maintain a degree of control far superior to any which were obtainable by methods known to the prior art, and waste of material is completely eliminated.

The invention and its novel features will be best understood from the following description of two embodiments thereof, when read in con-

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junction with the accompanying drawing, in which

Figure 1 is a sectional view in elevation of apparatus suitable for carrying out the invention;

Figure 2 is a plan view of the apparatus of Figure 1;

Figure 3 is a simplified diagram of a high frequency generator employed in the invention;

Figure 4 shows an alternative arrangement of electrodes;

Figure 5 is a side view of the biasing arrangement hereinafter mentioned;

Figure 6*a* is a plan view of a portion of one of the endless belts hereinafter mentioned, including a design to be impressed on a selvage edge, and

Figure 6*b* is a plan view of a portion of selvage edge on which the design shown in Figure 6*a* has been impressed.

Referring to Figure 1, **2** represents the output end of a knitting or weaving machine (not shown) or other apparatus for the fabrication of sheets of material composed of synthetic fibres. In the case of acetate tricot, the knitting or weaving speed is usually 8 inches per minute. The material **4** is preferably fed continuously as it emerges from the machine, between a pair of rotating circular electrodes **6**—**6***a*. The electrodes may be biased mechanically by a spring **15** which urges the electrodes toward each other whereby pressure is exerted upon the material between them. As shown in Figure 5, spring **15** is connected to shafts **17**—**17***a* by a pair of sliding collars **19**—**19***a* within which the shafts rotate freely. The electrodes may be located near the point where the material leaves the knitting machine, or otherwise as close to the point of fabrication as may be convenient. Ordinarily there will be two pairs of electrodes, each pair adapted to receive one edge of the emerging sheet. In the embodiment shown, one of the electrodes **6** of a pair is rotated by a motor **3** which is connected through a reduction gear **5**, a universal joint **7** and an insulated coupling **9**. The other electrode **6***a* of the pair is also connected through an insulated coupling, a universal joint (which are not shown) and through a reversing gear **11** which is connected to the motor **3** through the gear box **5**. The electrodes rotate in opposite directions, together with heat insulating belts (hereinbefore described). The belts may act as a driving means for feeding the material to be treated. However, if desired the electrodes may be stationary or "free wheeling" and appropriate means (which may be a part of the knitting ma-

chine) may drive the fabric with respect to the electric field.

As shown in Figure 1, each pair of electrodes has associated with it a pair of endless belts 8—8a, made of cotton webbing or other heat-insulating material. They are held on idler rollers 10—10a. The endless belts are interposed between each surface of the material 4 and the electrodes 6—6a. The belts heat insulate the electrodes so that the electrode temperatures will not be unduly raised as the material is heated. If the belts were omitted, the electrodes, because of their contact with the heated material, would gradually become heated. When the temperature of the electrodes is raised, the material becomes tacky and sticks to the electrodes in the absence of the belts. In order that the power, which is applied through the belts, should not heat the belts, they are preferably made of a material having very low dielectric losses. In any event the belts, being in contact with the heated material, will be heated by such contact. The belts will quickly radiate such heat, if they are made relatively long and are exposed so that the heat is not confined.

If short belts are required because of space limitations, their radiation may be increased by directing an air stream or other coolant on the belts. It should be understood that belts may include any desired pattern which may be impressed upon the selvage edge. Figure 6a shows a portion of a belt bearing a design in intaglio, and Figure 6b a portion of selvage edge on which that design has been impressed in cameo.

Electrodes 6—6a are connected to an oscillator or other source of high frequency electrical energy. Figure 2 is a diagram of such an oscillator. Frequencies of from 200 to 300 megacycles per second have been found practical for this application, though the operation is not limited to those frequencies. However, if such frequencies are employed, it is possible to keep the voltage applied to the electrode within convenient limits, so that the possibility of voltage breakdown is eliminated. Two 826 tubes are connected in a "push-pull" arrangement, and the electrodes are coupled to the filament circuit. The grid and filament circuits may be tuned by connecting bars or links 12, 14.

High frequency electric energy from the oscillator establishes an electric field between the electrodes. The material passing between the electrodes, because of the dielectric losses of the material, becomes uniformly and quickly heated. The application of slight pressure as before described in addition to the heat causes the edge of the material to become stiff, and in this way, prevents the material from curling.

While the edge of the material to be stiffened should pass through the field set up between the electrodes, it may often be convenient to have both electrodes engage one surface only of the material. Figure 4 shows such an arrangement. The electrodes 6—6a engage only one surface of the material 4, which may be supported, as by the table top 16. In this arrangement only one endless member 8 need be employed. The material cuts lines of force (shown by dotted lines) set up between the electrodes, and heat is developed therein as before described.

We have described an improved process and apparatus for preventing sheets of material composed of synthetic fibre from curling, by passing the edges of the sheet, continuously upon fabrication, through a high frequency electric field,

and thereby developing heat within such edges, which with the aid of slight pressure, stiffens them. Our invention is not, however, limited to this specific application. Any portion of the material, or all of it, may be stiffened by passing it through a field as aforesaid; and material not composed of synthetic fibre may be stiffened by the incorporation therein of fibre having sufficiently high dielectric losses and appropriate stiffness characteristics upon being heated.

We claim as our invention:

1. Apparatus for stiffening a portion of a fabric sheet woven from synthetic fibers which become tacky when raised to a certain temperature, said apparatus comprising a pair of unheated electrodes, a source of high frequency electricity, means connecting said electrodes to said source for the production of an electrostatic field thereadjacent and therebetween, a belt consisting of heat and electrical insulating material contacting a surface of said electrodes, means including said electrodes and said belt for passing a portion of said fabric sheet through said electric field, in contact with a surface of said belt but out of contact with said electrodes, and means including said electrodes for exerting a predetermined pressure on a portion of said fabric sheet being subjected to said electric field.

2. Apparatus according to claim 1 characterized by the addition thereto, and in combination therewith, of means for absorbing heat developed in said belt.

3. Apparatus according to claim 1 characterized by the addition of means associated with said belt for simultaneously impressing a pattern on a portion of said fabric being subjected to said electric field.

4. Apparatus for stiffening a portion of a fabric sheet woven from synthetic fibers which become tacky when raised to a certain temperature, said apparatus comprising a pair of unheated electrodes positioned side by side and adapted to be pressed against only one side of said fabric sheet, a source of high frequency electricity, means connecting said electrodes to said source for the production of an electrostatic field thereadjacent and therebetween, a belt consisting of heat and electrical insulating material contacting a surface of said electrodes, means for passing a portion of said fabric sheet through said electric field in contact with a surface of said belt but out of contact with said electrodes, and means including said electrodes for exerting a predetermined pressure on a portion of said fabric sheet being subjected to said electric field.

5. Apparatus of claim 1 in which said electrodes are narrow rollers and said fabric feeding means is adapted to pass only a narrow edge portion of said fabric sheet through said electric field.

6. A method of forming a stiffened selvage on sheets of woven fabric material made of synthetic fibers which become tacky when raised to a certain temperature, said method comprising subjecting an edge portion of said sheets to the heating effect of a high frequency electric field of a frequency and intensity sufficient to raise said portion to a temperature just below the point at which it becomes tacky, and applying predetermined pressure to said heated portion whereby to stiffen it and prevent edge-curling.

7. A method of stiffening a portion of a fabric sheet woven from synthetic fibers which become tacky when raised to a certain temperature, said method comprising establishing between a pair

of electrodes a high frequency electric field of an intensity and frequency sufficient to raise said portion to a temperature just below the point at which it becomes tacky, moving said portion of said sheets through said field whereby to raise said portion to the desired temperature, heat insulating said portion from said electrodes, and applying predetermined pressure to said portion while it is being heated, in order to stiffen it.

8. The method of claim 6 in which said portion is an edge portion.

9. The method of forming a stiffened selvage with an embossed pattern on sheets of fabric woven from synthetic fibers which become tacky when raised to a certain temperature, said method including forming a stiffened selvage on said sheets by subjecting an edge portion of said sheets to the heating effect of a high frequency electric field of a frequency and intensity sufficient to raise said portion to just below the point of tackiness, and applying embossing pressure to said portion while in said heated state.

10. Apparatus for stiffening a portion of a sheet material composed of fibers which become tacky when raised to a certain temperature, said apparatus comprising unheated rollers having sheet contacting surfaces for exerting pressure upon the sheet, resilient means for urging said rollers in a direction normal to the direction of travel of a sheet through the apparatus, means forming a high frequency electric source, means connecting said rollers as electrodes to said source for the production of an electric field therebetween and thereadjacent, a belt consisting of heat and electrical insulating material for thermally and electrically insulating said sheet from said rollers, and means including at least one of said rollers and said belt for advancing sheets to be treated through said electric field and in contact with said belt.

11. In a method of forming a stiffened selvage on woven fabric material composed of fibers which become tacky when raised to a certain temperature, said method comprising generating sufficient heat within an edge portion of the material so that its temperature is raised to a point just below the point at which the fibers become tacky, and subjecting the heated portion of the fabric to predetermined stiffening pressure by unheated rollers which also serve as electrodes between which high frequency electric field is established for generating said heat within the fabric, the improvement which consists in thermally insulating the fabric from the rollers whereby said rollers are prevented from becoming heated and the fabric is prevented from being heated to the point of tackiness.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
211,009	Hagerty	Dec. 17, 1878
869,895	Goldman	Nov. 5, 1907
1,803,672	Lardy	May 5, 1931
1,954,635	Leonard, Jr.	Apr. 10, 1934
2,319,174	Wilson	May 11, 1943
2,324,068	Crandell	July 13, 1943
2,423,902	Peterson	July 15, 1947