March 11, 1952 H. G. LUMBARD 2,588,859

PROCESS OF AND APPARATUS FOR SLITTING AND STRETCHING INSOLE MATERIAL

Filed June 5, 1947

Fig. 1

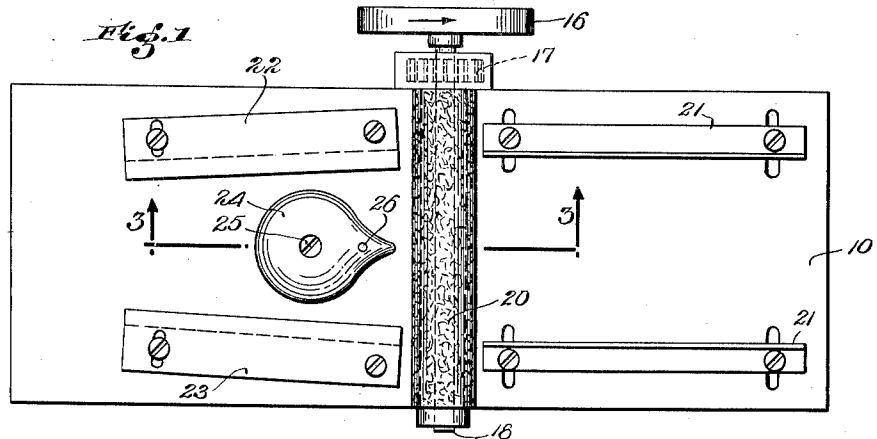



Fig. 2

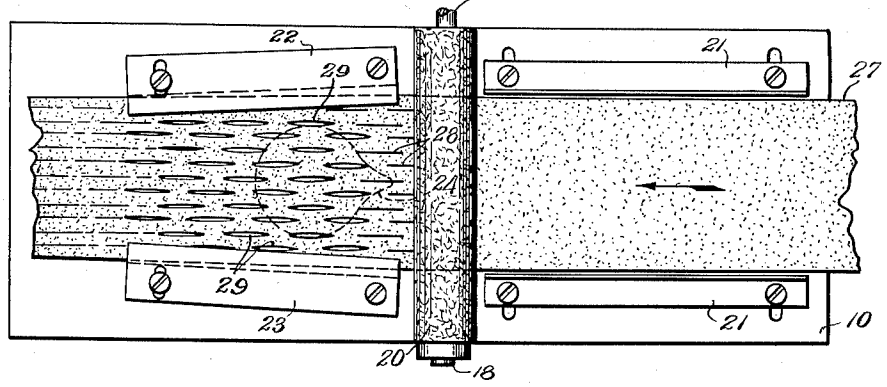



Fig. 3

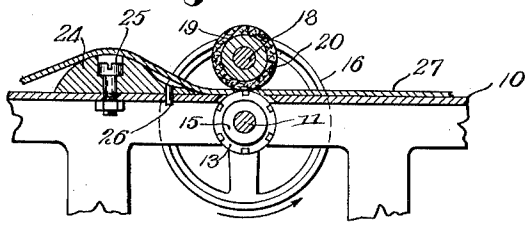



Fig. 5

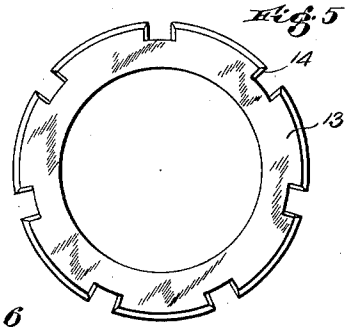



Fig. 4

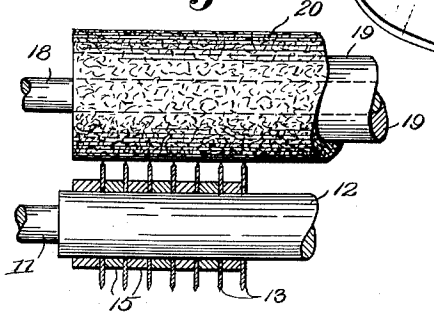
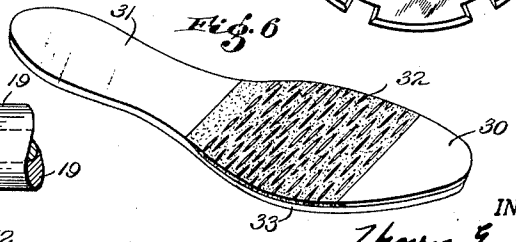



Fig. 6




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# UNITED STATES PATENT OFFICE

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## PROCESS OF AND APPARATUS FOR SLITTING AND STRETCHING INSOLE MATERIAL

Henry G. Lumbard, Auburn, Maine

Application June 5, 1947, Serial No. 752,768

2 Claims. (Cl. 93—1)

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This invention consists in a new and improved process and apparatus of slitting and stretching fibrous sheet material in order to render it flexible for use in insoles. The invention also includes within its scope a novel machine or apparatus whereby the process may be carried out.

One important field for my novel process is in preparing the fibrous sheet material which constitutes the forepart of the well-known "Lumflex insole," that is to say, an insole in which the forepart is provided with a series of rows of short, transverse, through-and-through slits which have been opened by stretching the slitted stock sufficiently to give clearance to the opposed edges of the slits in the normal flexing of the insole under the foot of the wearer.

As disclosed in my prior U. S. patent No. 2,181,787 dated November 28, 1939, the attempt has been made to slit and stretch the stock simultaneously by employing beveled edge blades, but this procedure is not entirely satisfactory in that the stock is compressed between beveled blades when they are arranged in the desired close proximity and the desired stretching effect is not always attained. I have found that a more satisfactory and uniform product can be prepared at a higher rate of speed and under more economical manufacturing conditions by first forming rows of short slits in the fibrous strip and subsequently stretching the slitted strip transversely in longitudinally progressing areas.

Going more into detail, I have found it advantageous from the manufacturing standpoint to slit the fibrous strip by the operation of a gang of rotary cutters and then, as the strip is advanced by the action of the cutters and in an area adjacent thereto, temporarily bulging the slitted stock into convex curvature thus progressively stretching the stock and opening the slits.

These and other characteristics of my novel process will be best understood and appreciated from the following description of one form of mechanism by which it may be carried out, selected for purposes of illustration and shown in the accompanying drawings in which:

Fig. 1 is a plan view of one form of apparatus which may be used in carrying out the process of my invention,

Fig. 2 is a similar view showing a piece of stock in process,

Fig. 3 is a fragmentary view in longitudinal section on the line 3—3 of Fig. 1,

Fig. 4 is a fragmentary view on an enlarged scale of the cutting and platen rolls.

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Fig. 5 is a detailed view showing one of the cutters in full scale, and

Fig. 6 is a view in perspective of an insole including in its structure the material produced by the process herein disclosed.

The apparatus herein shown for purposes of illustration will first be described, it being understood that the process is in no sense limited to the employment of the illustrated apparatus but may be successfully carried out by any mechanism capable of performing the slitting and stretching steps in the desired sequence. The illustrated apparatus comprises a frame supporting a horizontal work table 10 at convenient height. In the frame are provided journals for a driving shaft 11 having a roll 12 upon which is mounted a series of uniformly spaced disc cutters 13. The knives are symmetrically beveled to form a sharpened circumferential cutting edge, and in the edge of each knife is provided a series of notches 14, for example, seven notches approximately ⅛" in width. The notches interrupt the cutting edge of the disc and in operation leave the material uncut. The disc knives are uniformly spaced by washers 15 and the whole assembly of knives and washers is clamped in operative position upon the roll 12, this being belt driven by a pulley 16 on the outer end of the drive shaft 11.

The drive shaft 11 carries gearing 17 through which a platen shaft 18 is positively driven at the same speed as the drive shaft. The platen shaft 18 carries a roll 19 upon which is secured a platen sleeve 20 of hard fiber or the like. The disc knives 13 and the platen sleeve 20 are so related that the platen sleeve is indented by the knives and any sheet material passed between them is provided with parallel rows of through-and-through slits.

Edge gauges 21 are adjustably secured to the work table 10 in position to direct sheet material in a path at right angles to the rolls of the machine. Beyond the rolls hold-down edge gauges 22 and 23 are also secured to the work table with provision for suitable adjustment. The gauges 22 and 23 comprise bars which are undercut or flanged at their opposite edges so that they have a hold-down function as well as a guiding function.

Midway between the gauges 22 and 23 and spaced a short distance behind the bite of the rolls, is located a convex pear-shaped stretching member 24, this being held permanently in place upon the work table by a countersunk bolt 25 and a dowel pin 26. The stretching member 24

has a flat undersurface fitting upon the work table. Its operative convex surface has a smooth compound curvature on its leading side in order that sheet material forced against it may be made to ride smoothly over it and bulge upwardly into conformity therewith.

In carrying out the process of my invention I may employ any sheet material suitable for the formation of insoles such as that known to the industry as Onco or Darex. This is readily available in sheet form and in various thicknesses, for example, from 2 to 6 irons. A strip **27** of such stock, first cut to the desired width, is represented as being passed between the gauges **21** to the rolls of the machine. As soon as it reaches the bite of the rolls, the disc knives **13** begin to positively advance it and at the same time form rows of short through-and-through slits **27**. While still controlled by the rolls and positively advanced by the disc knives, the stock **27**, now provided with slits **28**, is forced against the pear-shaped stretching member **24** and bulged upwardly over the same. Meanwhile both the edges of the stock are held down upon the table **10** by the hold-down gauges **22** and **23**. The effect of the transverse stretching of the stock is to open the slits **28** into elongated diamond-shaped apertures **29**. These are opened to their maximum width in passing over the stretching member **24**, and due to the resiliency of the stock, tend to close to some extent in the stock as it passes beyond the stretching zone. However, sufficient permanent set is imparted to the stock so that the opposite edges of the opened slits clear each other in transverse flexing of the stock corresponding to that to which it might be subjected in wear.

The perforated strip as it comes from the slitting and stretching operation may now be united with unslitted strips of the same or a harder fiber material, and from the composite strips thus formed insoles are cut out of the general character illustrated in Fig. 6. In these insoles the toe portion **30**, together with the shank and heel portion **31**, are formed from the relatively stiff components of the composite strip, while the forepart **32** which is of course repeatedly flexed in wear is formed from the slitted and stretched stock shown in Fig. 2.

As herein shown and as an optional feature, the forepart of the insole includes a thin cover ply **33** of unslitted stock, perhaps 1 or 2 irons in thickness.

It will be understood from the foregoing description that the strip stock **27** is presented to the machine in flat condition upon the work table **10** and that it remains in substantially flat condition while it is subjected to the action of the slitting knives **13** and the platen sleeve **20**. Then, while still under the control of the rolls and positively advanced by the action of the notched knives **13**, the stock is forced toward and through the stretching zone formed by the stretching member **24**. In the stretching operation it is bulged upwardly out of its initial plane although its side edges are maintained in straight flat position by the gauges **22** and **23**.



The slits **28** leave the gang of rotary knives **13** in substantially unstretched condition. Then, as the stock is forced past the stretching member and after the knives have been withdrawn from the stock, the slits are opened to their maximum width by transverse tension in the stock. Finally, as the stock passes beyond the stretching zone, the slits contract somewhat but remain open to an extent that provides clearance between their edges. The dashes in the left-end of the stock as shown in Fig. 2 indicate that the partially open slots extend in that condition throughout the length of the treated stock.

Having thus disclosed my invention and described in detail an illustrative manner in which it may be put into practice, I claim as new and desire to secure by Letters Patent:

1. The process of rendering flexible a fibrous strip of insole material, which is characterized by advancing the strip in unheated condition by the rotation of a series of notched concentric rotary slitting knives and thus forming longitudinal slits therein, and stretching the slitted strip transversely in longitudinally progressive areas and opening the slits therein by passing it over a stationary convex former located closely adjacent to said slitting knives while the stock is advanced and still controlled by the knives.

2. A machine for rendering flexible fibrous strips of insole material by a continuous process, including in its structure a flat work table, a rotary gang of notched cutters disposed to slit stock advanced thereto upon the table, means for driving said cutters, a curved stationary stretching member located beyond and adjacent to the bite of said cutters and shaped convexly to stretch the slitted stock transversely while the strip is forced against the stretching member by the action of the rotary cutters, and edge gauges positioned on either side of said stretching member for holding both edges of the stock upon the work table during the stretching operation.

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