

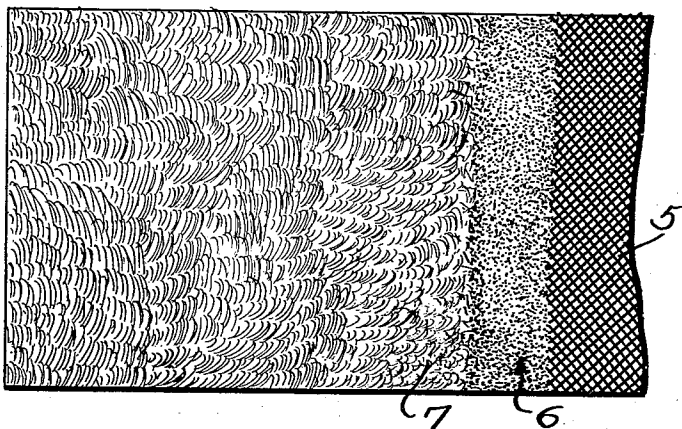
Nov. 8, 1938.

H. K. LEA
ELASTIC FABRIC

2,135,901

Filed March 28, 1935

Fig. 1.



FLOCK
CEMENT
CLOTH

Fig. 2.

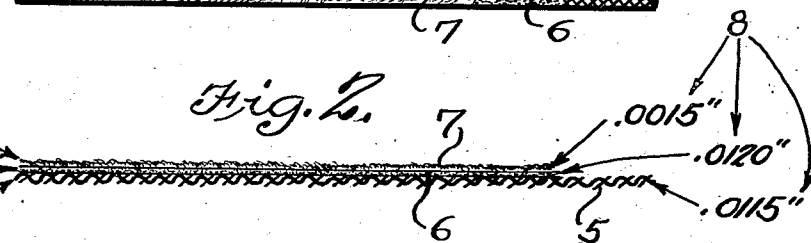
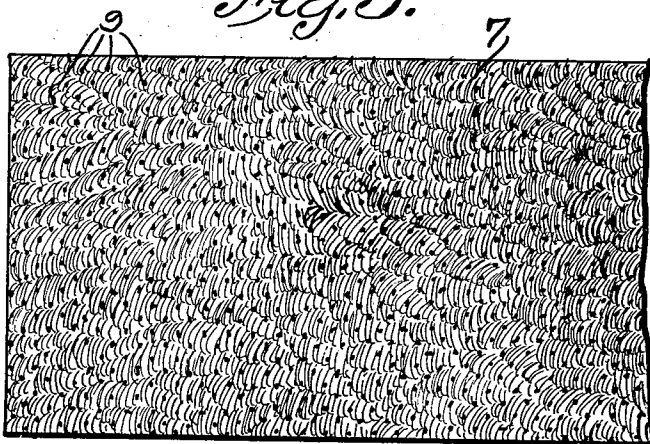


Fig. 3.



Inventor
Harry H. Lea.

By

Briggs & Morgan
Attorneys

UNITED STATES PATENT OFFICE

2,135,901

ELASTIC FABRIC

Harry K. Lea, Johnstown, N. Y., assignor to Ken-
lea Manufacturing Corporation, Johnstown, .
N. Y.

Application March 28, 1935, Serial No. 13,576

1 Claim. (Cl. 28-1)

This invention relates to certain new and useful improvements in a knitted elastic fabric for use in the manufacture of various articles.

Elastic fabrics have been produced, but in the majority of such cases, the fabric is of the woven type and is possessed of a minimum of stretch in either direction of the fabric and while attempts have been made to produce an elastic knitted fabric by adhesively applying preformed rubber sheets thereto, such attempts have in general been unsuccessful in view of the loose weave of knitted fabric and the fact that it is difficult to maintain a knitted fabric in a flat or unwrinkled condition while applying such preformed rubber sheet.

It is therefore the primary object of this invention to provide a knitted elastic fabric in which the fabric to be treated may be of such material as jersey and cotton, wool, silk, artificial silk or the like with such material possessing increased stretching qualities that have an adhesive or rubber cement of a particular type applied thereto in a semi-fluid condition and evenly spread thereover with flocking material applied to the adhesive or rubber cement before vulcanization to produce a smooth and soft velvety finish on one side of the fabric.

A still further object of the invention is to provide a knitted elastic fabric of the foregoing character with a multiplicity of minute perforations therein that are normally concealed at the fabric side of the material, but clearly viewable at the flocked side thereof and effective for breathing and ventilation when the knitted elastic fabric is manufactured into articles of wearing apparel.

With the above and other objects in view that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawing and claimed.

In the drawing:—

Figure 1 is a fragmentary plan view of the piece of knitted elastic fabric constructed in accordance with the present invention and showing the successive layers of knitted fabric, adhesive or rubber cement and flocking material;

Figure 2 is a fragmentary sectional view graphically naming the layers and disclosing the calibrations; and

Figure 3 is a fragmentary plan view of the flocked side of the fabric with the minute breathing perforations therein being viewable.

It is now common practice to coat woven

fabric with a rubber cement or adhesive and to apply flocking material to the rubber cement or adhesive because the handling of woven fabric during such treatment does not present any difficulty. There is a minimum of stretch in woven fabric and for this reason, the same can be maintained in a taut condition while the adhesive is being applied thereto and also the flocking material with the latter evenly distributed thereover. Numerous difficulties have heretofore been encountered in the handling of knitted material, such as jersey, due to the unusual stretching qualities possessed by such knitted fabric, but the value of a knitted elastic fabric having a flocked coating is well appreciated in the art because a fabric can be produced which possesses increased tensile strength within the limits of the normal stretch of the knitted fabric and to present on the flocked side a smooth and soft velvety finish that renders such material especially suited for the manufacture of articles of wearing apparel, such as girdles, corsets, and brassières. The increased tensile strength inherent in the treated knitted fabric permits free body movement when the material is embodied in a garment and the elasticity thereof which evidences an increased pull would to some extent perform the service of a reducer. The knitted elastic fabric is provided with a multiplicity of minute perforations extending throughout which are concealed at the fabric side of the article and clearly viewable at the flocked side thereof which permits abundant circulation for air when the fabric is made into a garment.

The reference character 5 designates a strip of knitted fabric or cloth that may be of the character of Jersey silk, cotton, wool, silk, artificial silk or the like which possesses inherent stretching qualities. An adhesive or rubber cement 6 is then spread onto the knitted fabric and while the adhesive or rubber cement is in a tacky state, comminuted material or flock indicated by the reference character 7 is applied to the adhesive or rubber cement for adherence thereto. The adhesive or rubber cement is applied to the knitted fabric by means of a spreader blade or knife and in the absence of pressure application of any character with the result that the adhesive or rubber cement adheres to the surface of the knitted fabric and is not forced into the interstices thereof. Graphic calibrations of the relative thicknesses of the knitted fabric, adhesive or rubber cement and the flocking material are indicated by the reference character 8 in Figure 2.

The laminated structure is then subjected to a drying operation for the removal of moisture from the adhesive or rubber cement and the latter is allowed to become substantially dry. At this time a multiplicity of minute openings are formed in the structure for the purposes of ventilation and as these openings are formed in the structure, including, of course, the adhesive or rubber cement while the latter is in a substantially dry and plastic condition, and before vulcanization, the openings permanently maintain the form imparted thereto. The laminated structure is then subjected to a vulcanization process and the knitted elastic fabric is completed and ready for use in the manufacture of various articles.

As will be understood, the fabric thus formed presents a number of characteristic features. For instance, the opposite faces of the fabric are formed of zones of material of dissimilar type. The face zone 5 is of knitted fabric, free from elasticity excepting that provided by the knitted characteristic of the material itself—no rubber strands being incorporated within the zone—and thus distinguishing from the usual elastic fabrics; at the same time, the knitted characteristic of the zone, permits stretching in all directions corresponding to the plane of the zone and fabric, a condition that is not present with woven fabrics. In other words, the face 5 has the characteristics of the usual knitted fabrics, such as Jersey cloth, silk, etc., with the advantages which accrue to such type of fabrics.

It is in this respect that the present fabric provides its greatest difficulty in production. Due to the fact that the zone 5 is stretchable in all directions, it is of a type that is considered to be "flimsy" for use in connection with complete fabrics which involve machine activity on the zone fabric after the latter has been fashioned. Because of the flimsy nature of the fabric, it becomes readily stretched during machine operation, but such stretching is limited to a single direction, so that when treated in producing the completed fabric, the treatment will present a condition that the fabric is stretched in one direction and unstretched in the transverse direction, so that the treatment leaves the fabric lacking in uniformity of stretching possibilities such as are found in knitted fabrics.

Because of this condition, fabric of this type has had its treatment more in the nature of what is termed a "dipping" process, in which the knitted fabric is treated by placing the material into a receptacle rather than treatment in the flat, the receptacle carrying the treating material. In such cases, the opposite surfaces of the zone fabric are coated or treated—depending on the character of the complete fabric—so that the natural appearance of the knitted fabric is changed, if the coating is permitted to remain; if the coating is removed, the treatment reaches only to the interior of the fabric, and is more in the nature of the treatment of the strands of the fabric as individuals.

In the present fabric, however, the zone 5 has its exposed face presenting the natural appearance of the knitted fabric, the rubber cement zone 6 not reaching to the face—it being concealed—so that the appearance on one side of the composite fabric is that of the normal knitted fabric. This is made possible by the development of a process which enables this knitted fabric to be subjected to machine operation with

the fabric maintained flat, but without subjecting the fabric to stretching operation in any direction during treatment, so that the treatment itself is provided while the fabric is in its normal and natural condition. The process and apparatus referred to are the subject-matter of separate applications hereinafter identified.

The opposite face zone 7 is formed of flocking material to provide a face of a "soft" characteristic and which can be worn in contact with the skin of the user with great comfort. Since the flocking material is neither felted nor woven, it permits complete freedom of movement of the composite fabric in all of its directions of stretch.

These opposite face zones are united together by the rubber cement zone 6, the latter uniting the two face zones together in the composite fabric, and without providing any interconnection of the material of one face zone with that of the other zone. In other words, it serves to render the opposite zones individual as to material and texture, but at the same time unites them permanently so that the two zones are inseparable. And since neither zone presents a material that is stretchable laterally of its plane, and the rubber uniting layer is too thin to permit of any material stretch in such direction, the stretchability of the composite fabric is limited to movements in the plane of the fabric itself. Since this layer lies intermediate the two face layers or zones, the rubber layer is hidden from view by the face zones, so that the composite fabric has the appearance only of the opposite faces each having a natural appearance.

In the production of the composite fabric the knitted fabric is advanced without stretch, and during the advance receives the rubber cement from a supply, the cement being delivered and spread over the top surface of the knitted fabric without any material pressure; as a result the cement is not pressed into the fabric itself; this can be understood from the fact that the fabric is unstretched at the time so that the fabric has its normal appearance with the threads in the usual contacting arrangement. Hence, the cement does not pass through the fabric but lies on the surface, conforming to the surface characteristics and adheres to the fabric. As will be seen from Fig. 2, the thickness of the cement layer at least equals the thickness of the knitted fabric. Since the cement is capable of flowing at the time of application, it can be readily spread. As the knitted fabric, now carrying the cement layer, continues its advance, the flocking material is applied to the top surface of the cement layer, thus causing the flocking material to become adherent to the applied cement to form the opposite face of the composite fabric. The embryo composite fabric then continues its advance through a drying chamber, to remove moisture, during which the excess flocking material is brushed off, and drying continued, after which the fabric passes to a puncturing station in which a multitude of small openings are made through the rubber cement layer by a cylinder carrying a large number of pins which pass through the fabric. The dried fabric is later vulcanized, either as a continuation of the fabric advance to the receiving roll, or by separate action.

This statement of the manner of producing the fabric is based on the disclosure of my companion applications identified herein, and is given in order that the characteristics of the composite

fabric, now to be referred to, will be better understood.

As will be understood, a layer of the rubber cement thus applied, would not only provide for an adherent relation to the opposite face zones, but would, when vulcanized, provide an imperforate sheet-like structure in the absence of the pin-hole perforations referred to; since the latter are provided prior to vulcanization, they will be retained in the vulcanized structure, and, in service, can serve as "breathing" openings to permit passage of air through the fabric. However, they provide an additional service, as will be indicated by the following:

As will be understood, a vulcanized layer or sheet such as indicated at 6, is capable of stretching in all directions in its plane. But while this elasticity is present in this layer, it is somewhat different from that which is present in the knitted fabric, the rubber layer offering greater resistance to stretch than does the fabric, and is thus less "flimsy". This effect is reduced to a material effect by the pin-hole perforations, these permitting stretching of the rubber layer with an ease approaching somewhat that of the knitted fabric, so that the composite fabric has more of the characteristic of the type of elastic fabrics in which strands of rubber are woven into and as a part of the fabric itself, the present structure having the advantage over this type in that the rubber of the present fabric is continuous and thus does not have the difficulties which come when the rubber strands of the woven type break under the stretch conditions. In addition, the present structure, under stretch, would tend to temporarily enlarge the pin holes, thus increasing the breathing characteristic.

An additional feature of the present fabric that is of material advantage lies in the fact that the rubber layer is applied and vulcanized on to the knitted fabric while the latter is unstretched. As a result, the positions of repose of both the rubber layer and the knitted fabric are equal so far as stretch is concerned—both are in the normal natural condition. In this respect the composite fabric is somewhat of the characteristic of the fabric which includes the rubber strands in woven form, although, in the latter, it is difficult to provide the weaving action without placing more or less stretch on the rubber strands, so that the fabric portion, in repose, does not always present the natural woven appearance due to the tendency of the strands to assume their normal unstretched condition; in such cases, the tendency is to crowd the fabric weave when the composite fabric is in repose. This is avoided in the present fabric through the fact that the knitted fabric receives its rubber cement while the fabric is unstretched and while the cement is in non-stretchable condition, so that the two are brought into co-operative relation while under conditions of repose. Hence, with the resistance to stretch characteristic between the two layers brought into closer relation, freedom of stretch is increased by permitting greater freedom of the knitted fabric to have its normal stretch action in all directions of the fabric plane.

Hence, the present fabric has freedom of elasticity comparable to that of elastic fabrics of the woven type which have the rubber strand woven into the fabric, but with the freedom extending in all directions of the fabric plane, and without the liability of breakage of rubber strands; at the same time, assurance is had that when the

fabric is in repose, it will present its knitted fabric face in its natural appearance form, since the rubber layer is also in its repose condition at such time.

Since the rubber layer does not penetrate through the knitted fabric layer, the appearance of the latter is unchanged by the presence of the rubber layer, the latter being concealed, excepting possibly at the edges, by the overlying face zones, thus distinguishing from the dipped type of fabrics in which the coatings are retained; where the coatings are not retained, the dipping operation becomes individual upon the knitted fabric threads, so that the elasticity of the fabric is simply that of the knitted fabric itself, thus providing only the resistance to stretch that is provided by the knitting alone and which is insufficient to set up the conditions of an efficient elastic fabric.

In view of the inherent stretching characteristics of knitted fabric, such as Jersey material or the like, it has heretofore been practically impossible to coat a knitted fabric with an adhesive or rubber cement and to apply flocking material to the adhesive or rubber cement while in a plastic condition with the adhesive or rubber cement and flocking material evenly and smoothly distributed over the knitted fabric. The process employed in the manufacture of this knitted elastic fabric and the apparatus for practicing the process are shown and described in co-pending applications filed by Harry K. Lea on Mar. 28, 1935, and Apr. 20, 1935, Serial Numbers 13,575 and 17,527, respectively.

A material of this character may be embodied in the manufacture of various articles and when used in the manufacture of garments, such as girdles, brassières or corsets, the minute perforations afford sufficient breathing with the normal elimination of perspiration in the presence of the adhesive or rubber cement. The knitted fabric which is rubberized and flocked possesses its inherent and natural stretching characteristics and the tensile strength imparted thereto by the adhesive or rubber cement application provides an increased "pull" for retaining the confined parts of the body of the wearer in position. The flocked side of the laminated structure presents a smooth and even velvety finish and as the flocked side of the material when made in a garment is presented to the body of the wearer, the minute perforations are hidden from view and the fabric side of the garment that is exposed presents the natural appearance of the material originally treated.

From the above detailed description of the invention, it is believed that the characteristics thereof will at once be apparent and while there is herein shown and described the preferred embodiment of the invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

I claim:—

An elastic fabric of composite type having its opposite sides presenting faces differing in appearance, with the material of the opposite faces individual to the zone of such face and with the material of one of the face zones free from interconnection with that of the other, said face zones being united permanently by a uniting material possessing elasticity and located intermediate of and concealed by said face zones, the completed fabric being characterized by its non-similarity in appearance of its opposite faces, by its perma-

nent connection of the material of one face with that of the other to prevent separation of the faces, and by the ability of the fabric to stretch in all directions corresponding to the plane of the fabric but non-stretchable in directions normal to such plane, the fabric being further characterized in that the opposite face zones are

respectively of a knitted fabric and flocking material, the uniting material being of rubber characteristic, said knitted fabric and uniting material being united in a form to place both as untensioned when the composite fabric is in repose.

HARRY K. LEA.