No. 607,454. Patented July 19, 1898.

F. W. OLIVER.

BELTING.

(Application filed Dec. 30, 1897.)

(No Model.)

Fig. 1.

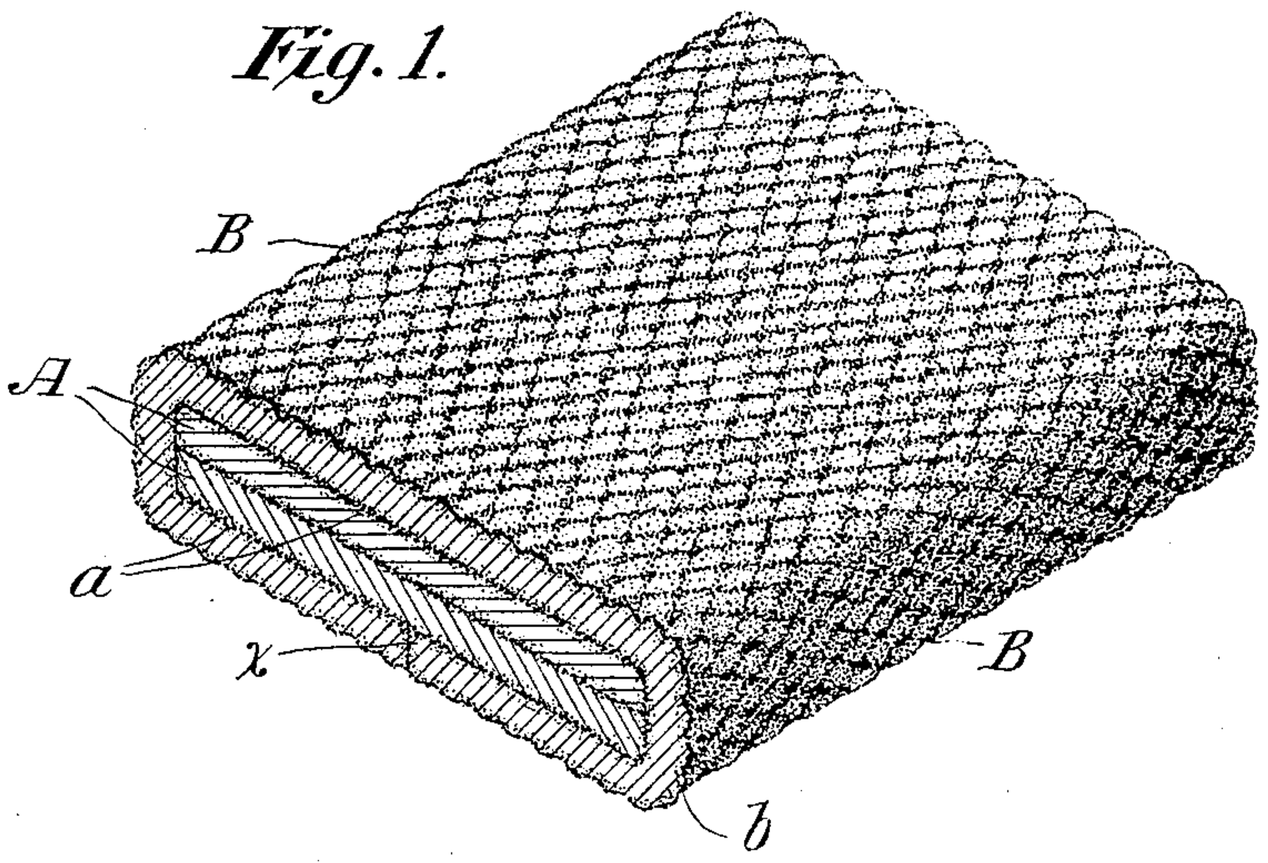
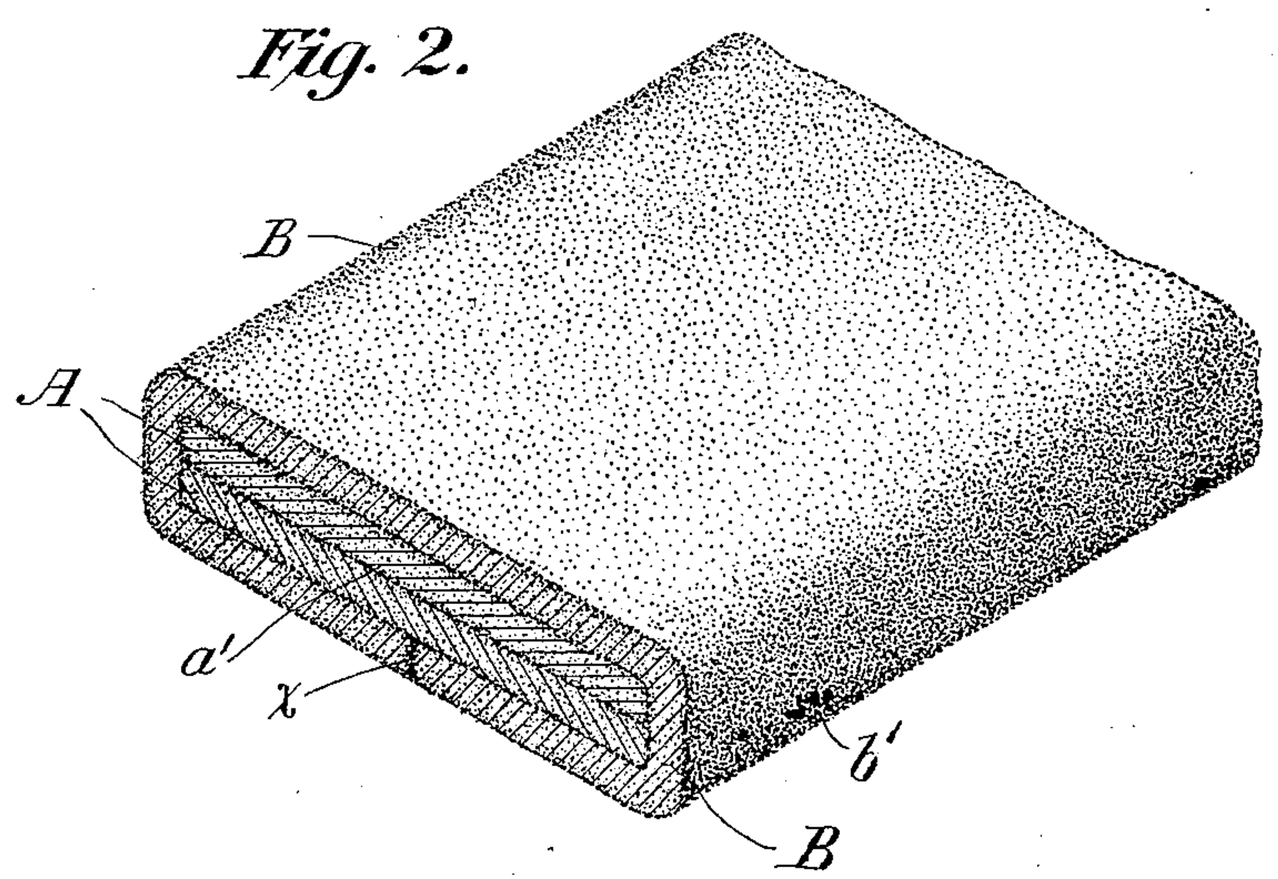


Fig. 2.



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UNITED STATES PATENT OFFICE.

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BELTING.

SPECIFICATION forming part of Letters Patent No. 607,454, dated July 19, 1898.

Application filed December 30, 1897. Serial No. 664,709. (No model.) Patented in England May 12, 1896, No. 10,104; in Germany July 9, 1896, No. 92,585; in Sweden November 6, 1896, No. 7,911; in France November 7, 1896, No. 261,082; in Belgium November 9, 1896, No. 124,491; in Switzerland November 19, 1896, No. 13,217; in Hungary November 23, 1896, No. 8,267; in Norway December 9, 1896, No. 5,658; in Austria December 12, 1896, No. 46/4,979; in Spain December 26, 1896, No. 19,921; in Italy December 31, 1896, No. 84,238; in Victoria January 8, 1897, No. 13,846; in New South WalesJanuary 11, 1897, No. 7,191; in India May 3, 1897, No. 437, and in Denmark August 24, 1897, No. 1,229.

To all whom it may concern:

Be it known that I, FREDERICK WEAVER OLIVER, a subject of the Queen of Great Britain, residing at 40 King street, Cheapside, London, England, have invented certain new and useful Improvements in Belting, of which the following is a specification.

This invention has been patented to me in Great Britain, No. 10,104, dated May 12, 1896; in Belgium, No. 124,491, dated November 9, 1896; in France, No. 261,082, dated November 7, 1896; in Hungary, No. 8,267, dated November 23, 1896; in Norway, No. 5,658, dated December 9, 1896; in Sweden, No. 7,911, dated November 6, 1896; in Switzerland, No. 13,217, dated November 19, 1896; in India, No. 437/96, dated May 3, 1897; in Austria, No. 46/4,979, dated December 12, 1896; in Denmark, No. 1,229, dated August 24, 1897; in Germany, No. 92,585, dated July 9, 1896; in Italy, No. 84,238, dated December 31, 1896; in Spain, No. 19,921, dated December 26, 1896; in New South Wales, No. 7,191, dated January 11, 1897, and in Victoria, No. 13,846, dated January 8, 1897.

The object of my invention is to produce belting or driving-bands for machinery that are waterproof, will not be effected by oils or ordinary acids or by any variations of temperature to which they would ordinarily be exposed, which shall stand long-continued use without impairment or material change in character, in which there will not be any material stretching in use, and which shall have a sufficient and proper degree of flexibility to work well around the pulleys to which they may be applied, and which will slip as little or even less than the belting ordinarily in use.

I have found by experiment and by practical use that belting having the above characteristics, as well as other advantageous features, may be produced by impregnating or saturating a suitable textile material of which the belt is to be composed with liquid celluloid. By "liquid celluloid" (which is well known in the art) I mean nitrocellulose or pyroxylin dissolved by the air of camphor or its equivalent in spirit—as, for instance, wood-alcohol or grain-alcohol. This solution may and preferably should contain castor-oil or its equivalent, which gives increased toughness and flexibility to the compound when dried by the evaporation of the volatile solvent or solvents. The degree of fluidity of the solution should be such with reference to the permeability of the material to which it is applied that the solution will sink into, saturate, or impregnate the face of the material to such depth as to surround, cement together, and take a firm hold upon the outer fibers; but the best results are obtained when the solution sinks into or impregnates the material to a considerable depth, if not to the point of complete saturation. The drying of the impregnated fabric may be assisted by artificial heat, if desired. Two or more bands or layers of the impregnated material may be pressed together before they are dried, being thus intimately united by the liquid celluloid, or if the impregnated materials have already become dry their surfaces to be united may be softened by a solvent of celluloid and then pressed together, or liquid celluloid may again be applied to the surfaces to act as a cementing medium.

The material to be employed in the production of the driving-belts of this application is a strong substantial textile material of the general character of what is ordinarily known as "canvas" and "duck." I therefore hereinafter use the term "canvas" in a general sense to include duck and material of the above character which is to be distinguished from lighter finer textile fabrics—such as cambrics, muslins, and cotton and linen cloths—of the character commonly used for domestic purposes.

The canvas is impregnated or saturated with a thin solution of celluloid applied, preferably, to both surfaces, so that there is a distinct penetration or saturation, as and for the purpose hereinbefore described. The mate-

rial thus impregnated or saturated, if treated in large webs or sheets, is then cut into strips of the required length, and the desired number of such strips, if more than one, cemented together in the manner above suggested, and a strip slightly wider than double the width of these strips, and also preferably impregnated or saturated by application to both surfaces, may be folded over the core formed by the strip or strips, with its edges abutting or scarfed in the middle of the face, which is preferably to be the inner face or side of the belt, and in like manner cemented to the inclosed strips. When the canvas is thus impregnated, the impregnating compound extends down into it beneath its surface and surrounds and attaches itself to the individual fibers and strands. The surface film of the celluloid that may remain upon the face of the canvas may be very attenuated and does not obliterate the characteristic appearance of its pearl, weave, or grain. In a belt so made the celluloid is really incorporated into the substance of the canvas, and belts of this character have all the advantages above stated. They do not stretch. They adapt themselves to the pulleys, forming a good working contact and taking a good working grip thereon. They are waterproof and are not affected by oils, ordinary acids, or any ordinary variations of temperature. An unimpregnated canvas would of course stretch considerably, and it might be supposed that the incorporation of the celluloid into it would not sufficiently prevent such stretching, but such is not the fact. The celluloid, being incorporated into the respective faces of the respective strips, cements the fibers together, unites with the fibers and strands, and holds them in a firm embrace, which gives to the belt firmness or solidity of structure and prevents the fibers of the impregnated portions from sliding or moving relatively to each other. Thus stretching of the belt when in use is practically prevented, which result is also assisted by the layers of celluloid lying between the strips and cementing them together. Of course if the impregnated material of which the belt is composed were subjected to successive applications of the liquid celluloid a distinct surface or coating of celluloid could be built up upon the face of the fabric, and a belt so made would in use in great degree still possess the peculiar characteristics and behavior stated. Still such a belt would not be desirable or beneficial in my judgment, and, moreover, the cost of production would be unnecessarily increased. However, if it were done it would be apparent that such a coating could not be separated from the canvas, both because it would be intimately welded to that part of the compound extending down and incorporated into, or, in other words, impregnating, the canvas and because the canvas treated as described has practically no stretch. It is apparent that when the celluloid is combined with or incorporated into the canvas by impregnation, as described, there is such an intimate union and blending between the substance of the canvas and the impregnating celluloid that constant flexure and wear will not disintegrate the belt or cause a separation of the impregnating compound from the strands and fibers of the canvas, and these characteristics are preserved during exposure of all ordinary kinds for long periods of time.

In the accompanying drawings, Figure 1 is a cross-section of a belt constructed in accordance with my invention, and Fig. 2 is a similar view.

In the drawings, A represents the interior strips of impregnated canvas, of which there may be one, two, or more, and B represents the enveloping strip that is folded around the interior strips. The drawings are made upon an enlarged scale to indicate the impregnation or saturation of the canvas by the celluloid. Thus in Fig. 1 the stippling or shading *a* indicates the presence within the body of the canvas of the impregnating celluloid in the interior strips, and *b* represents the impregnating celluloid contained in the body of the envelop or outer strip.

In Fig. 2 the stippling or shading *a'* is carried entirely across the sections of the interior strips to indicate complete saturation, and the shading *b'* similarly indicates complete saturation of the envelop or outer strip. The joint *x* of the envelop is thoroughly protected by the celluloid, which, being applied in liquid form, may completely fill it and saturate or impregnate the abutting edges. As before suggested, when castor-oil or its equivalent is used in the liquid-celluloid compound the compound when dried has more toughness and flexibility. I have therefore generally used it in practice. Good practical belts of the character described have been made by me when about six gills of castor-oil per pound of dry nitrocellulose are used. Where the layers of canvas are cemented together by a solution of celluloid, I prefer that the solution should contain less oil, and I have generally used three gills per pound of dry nitrocellulose.

The degree of fluidity of the impregnating compound may be that of olive-oil at ordinary temperatures or even thinner, depending in a measure upon the hardness and density of the canvas to be impregnated.

It is obvious that the impregnation or saturation hereinbefore described will be more rapid and thorough where the pores, fibers, and interstices of the material to be impregnated are not clogged by size or similar compositions.

I am aware that driving-belts having a textile body like canvas have been superficially coated with rubber and then vulcanized. It is apparent, however, that such a belt does not possess the advantages or characteristics of my improved belt. Thus it is well known

that the rubber is injuriously affected by oils, acids, &c., rots or deteriorates when exposed to the atmosphere for any considerable length of time, and becomes sticky or tacky when exposed to the action of steam or to such high temperatures as it might be exposed to adjacent to steam engines or boilers.

If a belt of textile fabric were coated with celluloid applied in the form of a paste or dough, it would lie as a mere superficial coating or layer upon the face of the fabric. It is apparent that in a belt so prepared the fabric retains all its original flexibility, while the coating of celluloid is relatively very much less flexible. The constant flexure of the belt therefore tends to disrupt the imperfect union between the coating and the surface of the fabric. Furthermore, the layer of celluloid lying independently upon the face of the fabric is liable to injury that will expose the absorbent textile material, which will then absorb moisture, and also the layer of celluloid will in use crack and break away from the fabric, and where such a layer of celluloid is applied the surface of the belt is necessarily one of celluloid—that is to say, the characteristic surface of the canvas or duck is covered or obliterated. It is therefore apparent that such a belt is not the same as my improved belt and does not possess its marked advantages.

I am not aware that any practical driving-belt coated with celluloid has been made, nor do I believe it possible except by my method, because the textile portion of the belt will stretch in use much more than a superficial coating of celluloid, as when the celluloid is applied as a paste. This will bring practically all the driving strain onto the superficial coating, which must crack and disintegrate until the strain is taken up by the fabric. While rubber adapts itself by its own elasticity to the stretch of the textile basis of the belt, celluloid has not such adaptability, and for this reason the problem of making a rubber-coated belt does not present the conditions and difficulties of a belt composed of canvas and celluloid.

The article of this application is a driving-belt of textile material of the character described so impregnated or saturated with celluloid, applied in thin solution, as to have the following characteristics:

First. When the celluloid has dried, the fibers of the impregnated textile material are so bound together that they can no longer change their positions in relation to one another, in consequence of which the belt cannot stretch.

Second. The celluloid is mainly imprisoned within the body of the canvas itself, the surface coating being a mere incident of the impregnation or saturation and not a superficial layer, such as results from coating with a paste. Thus the celluloid binds the fibers together and the fibers bind the celluloid, each aiding the other to attain the desired result. Thus the surface coating is just sufficient to make the belt water, oil, and acid proof. It is part of the impregnation or saturation and is therefore anchored firmly not only to but also within the body of the belt.

There is thus a radical difference between the belt of the application and the paste-coated belts of the prior art, which rely upon a substantial superficial coating.

The belting illustrated in the drawings is not what may properly be called a "coated" belt, but is, on the contrary, a canvas belt which, while having celluloid incorporated into its substance, retains the characteristic surface appearance and inequalities of the fabric. Such a belt is a desirable product for many reasons. As has been fully explained, it may readily be obtained by combining the celluloid with the canvas, as I do, but cannot be produced by the application to the canvas of celluloid in the form of a paste. This fact illustrates what must be already apparent—*i. e.*, that a belt produced according to my plan is in fact radically different from one produced by the application of a paste to a fabric to form a superficial coating.

I have used the term "celluloid" herein to indicate that compound of nitrocellulose variously termed "celluloid," "xylonite," "ivorite," and "parkesine" and which has practical qualities that I have discovered specially adapt it to the purpose herein described. "Celluloid," properly so called, is obtained by dissolving nitrocellulose and camphor in alcohol; but it is obvious that a solution of any other cellulose derivatives which has the same practical qualities as "celluloid," properly so called, will lend itself equally well to my invention even though of different chemical constitution or method of production, and by the term "celluloid" I wish to be understood as including such bodies.

I claim as my invention—

1. The herein-described driving-belt composed of canvas impregnated with, and having its fibers cemented together by, celluloid.

2. The herein-described driving-belt composed of canvas impregnated with, and having its fibers cemented together by, celluloid containing castor-oil.

3. The herein-described driving-belt composed of strips of canvas impregnated with, and whose fibers are cemented together by, celluloid, and the strips of which are cemented together by celluloid, substantially as set forth.

4. The herein-described driving-belt composed of strips of canvas impregnated with, and whose fibers are cemented together by, celluloid containing castor-oil, and the strips of which are cemented together by celluloid, substantially as set forth.

5. A driving-belt consisting of one or more strips of canvas impregnated with celluloid and enveloped in a wrapper of canvas im-

pregnated with celluloid, the wrapper and core, or the component parts of the core, being all united or cemented together by celluloid, substantially as set forth.

6. A driving-belt consisting of one or more strips of canvas impregnated with celluloid containing castor-oil, and enveloped in a wrapper of canvas impregnated with celluloid containing castor-oil, the core, or the component parts of the core, and the wrapper being all united or cemented together by celluloid, substantially as set forth.

7. The herein-described driving-belt consisting of canvas having celluloid incorporated into it, and also a thin film of celluloid upon its face integrally united with the celluloid incorporated into the canvas and conforming to the inequalities of the face of the canvas without concealing or obliterating its characteristic surface.

In testimony whereof I have hereunto subscribed my name.

FREDERICK WEAVER OLIVER.

Witnesses:

FREDERICK SYDNEY PINÉ,

W. W. HAURS.