F. L. HORTON.

METHOD OF MAKING CARBONIZED FABRIC.

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963,291.

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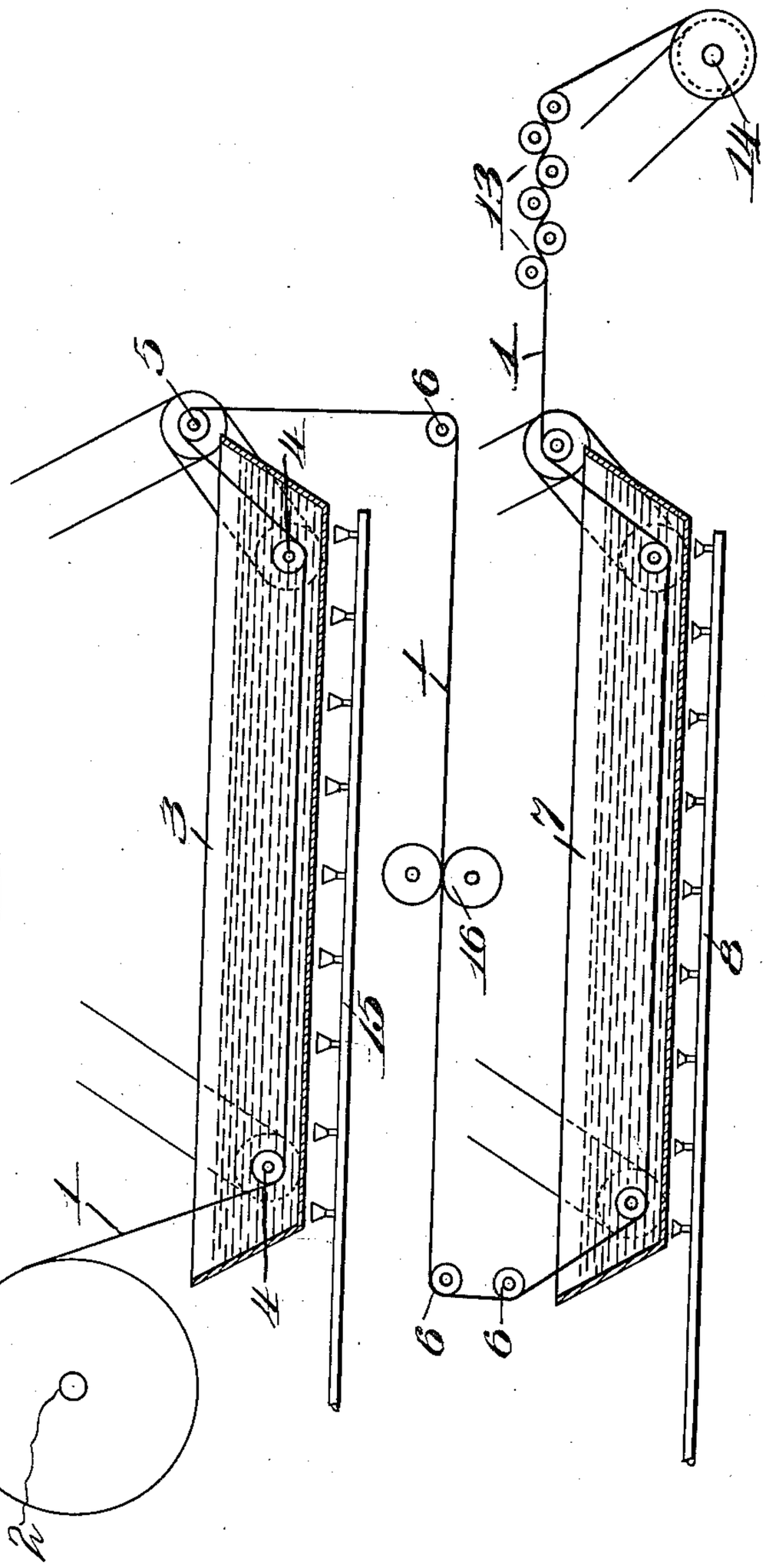

Fig. 1.

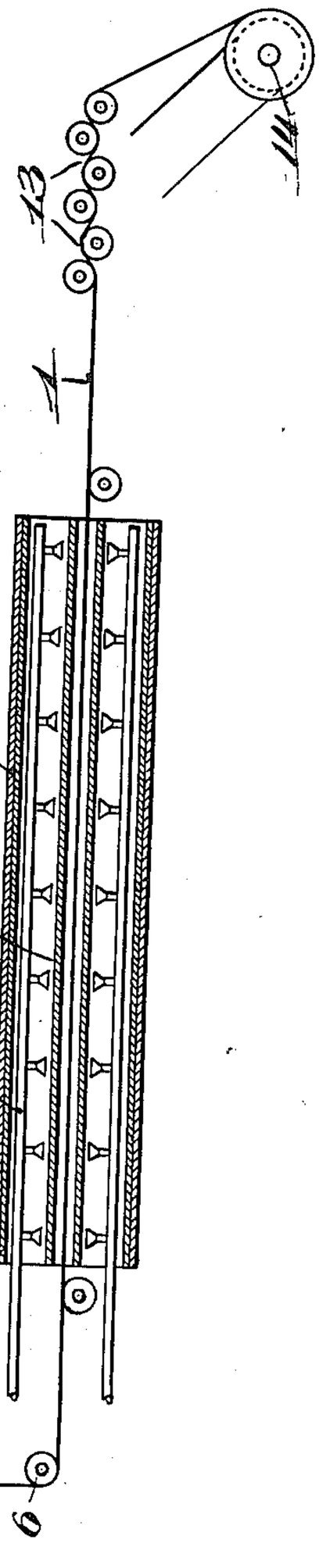

Fig. 2.

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METHOD OF MAKING CARBONIZED FABRIC.

963,291. Specification of Letters Patent. Patented July 5, 1910.

Original application filed August 18, 1909, Serial No. 513,388. Divided and this application filed March 4, 1910. Serial No. 547,235.

To all whom it may concern:

Be it known that I, FREDERIC L. HORTON, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Methods of Making Carbonized Fabric; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This application is a division of my pending application filed August 18, 1909, Serial No. 513,388, for an improvement in carbonized fabrics and method of and apparatus for producing the same.

The invention forming the subject-matter of the present application has for its object the production of a method of making carbonized fabric in which a woven or other fabric of fibrous material is partially or wholly permeated with carbonized matter. Such a carbonized product may be employed for a great variety of uses; among others it is especially adapted for use as a lining for brake bands for automobile brakes. It may also be used for a fireproof covering for fire-hose.

In the drawings: Figure 1 shows in diagram one form of apparatus capable of carrying out my method of making carbonized fabric; and Fig. 2 shows a modified form of carbonizing apparatus.

In carrying out my method a suitable fabric is first impregnated with some carbon compound capable of being carbonized, and the treated fabric is then subjected to a carbonizing process. Various means may be adopted for treating the fabric. Preferably I employ a fibrous material in woven, knit or other fabricated form, so that the carbon compound may be applied in the form of a liquid bath thoroughly to saturate the fabric and permeate the fibers thereof. The fabric treated in this manner may be carbonized in any suitable way, but one of the most practical and convenient, when a fabric is employed with suitable heat-resisting qualities, is to subject it to a temperature sufficiently high to carbonize the absorbed liquid carbon compound, producing thereby a fabric permeated and coated with a hard, heat and wear resisting carbon having a high co-efficient of friction.

While various materials may be employed and the process carried out in different ways and by widely different apparatus, for the sake of illustrating one concrete embodiment of the invention, I have shown in the drawings one form of apparatus which may be employed for carrying out the process and producing the fabric of the type described.

In order to provide a heat resisting fabric, so that heat may be employed for the carbonizing process and the completed fabric, moreover, may present heat resisting qualities to the highest degree, I preferably employ a fabric formed of asbestos fiber. Such fabric may be produced by a well-known process of crushing the asbestos to procure the individual fibers, which latter are then mixed with a small proportion (for example 5% by weight) of cotton, the mixed fiber being then treated to the usual steps of spinning and weaving in all substantial respects like the ordinary process of weaving cotton cloth. In producing an asbestos fabric of this kind, preferably a selection is made of the long fibers of the asbestos, since this not only produces a strong fabric, but one presenting greater flexibility when carbonized. A woven asbestos fabric of this kind may be produced of any desired thickness, width, mesh or texture, and may be woven with or without reinforcing wires or other stiffening members. The asbestos fabric is next treated with a solution of a carbon compound or a liquid or liquefied carbon compound so that the fabric may be thoroughly impregnated therewith. The invention contemplates the use of such a carbon compound as may be carbonized at a temperature below that at which the material of the fabric breaks down. Carbohydrates are the most available carbon compounds for this purpose, and for practical purposes common molasses may be employed, being preferably diluted with a suitable quantity of water to cause it better to enter and permeate the fibers of the fabric. The amount of carbonized material deposited in the fabric will depend upon the extent to which the molasses is diluted; when diluted the more, a less amount of carbonized material is incorporated in the fabric. To produce a serviceable lining for a friction brake, for example, common molasses may be diluted with fifty per cent., by bulk, of water.

The molasses or other carbohydrate employed may be used free from mixture with

other ingredients, but preferably, in order to prevent oxidation of the carbon during the carbonizing process, I add some reducing agent, such as a small quantity (for example ½ of 1%) of sulfur, the latter being first dissolved in a suitable solvent, such as a suitable quantity of lye and ammonia.

The asbestos fabric, having been thoroughly permeated with the molasses solution as above described, is dried and then subjected to a carbonizing process, as by heat applied either directly to the fabric from the flame of a torch or other burner, or by submerging the cloth in a heated bath or by other suitable means. A temperature ranging from 700° to 800° F. has been found to give excellent results, although a wide range of temperature is possible, the time required to carbonize the compound depending not only on the temperature but on the composition and strength of the carbon compound and the thickness or body of the fabric.

Referring to the drawings, I have shown in diagrammatic elevation an apparatus adapted to carry out the described process. The fabric 1 is drawn as required from the feed roll 2 and carried slowly through a bath of diluted molasses contained within the tank 3. The fabric, which is shown as formed in a continuous strip, passes beneath suitably driven guide rollers in the tank, the tank having a sufficient extent and the travel of the fabric being such as to cause a thorough saturation of the latter with the molasses. The saturation of the fabric is materially assisted by heating the molasses bath to a temperature preferably slightly less than the boiling point and a burner 15 is therefore employed for this purpose. From the tank the fabric strip passes over the guide roller 5 and thence about other guide rollers 6 to afford the absorbed liquid opportunity to dry. The strip then passes to the carbonizing apparatus, the latter being shown in Fig. 1 as consisting of a second tank 7 in which is provided some suitable liquid, such as linseed oil, which is capable of being raised to a high temperature. Linseed oil when employed also serves the useful purpose of water-proofing the resultant carbonized fabric. The linseed oil bath is heated to a temperature above 400° F. by a series of underlying burners 8 supplied with gaseous fuel from any suitable source. The fabric strip passes into the bath at one end of the tank, being withdrawn therefrom at the other end.

In Fig. 2, in place of the liquid containing tank 7, I have there shown a tube 9, preferably of metal, through which the fabric strip 1 is caused to travel. The tube is raised to a high temperature by means of the upper and lower burner pipes 10 and 11 which are contained within the outer tube 12, the latter preferably having an asbestos lining.

With woven material, if the weave is close or the saturating solution rich with carbon, it may be necessary to break up the hard carbon contained in its meshes if it is desired that the completed fabric should possess any material degree of flexibility. For this purpose herein I have shown a series of steel rollers 13 arranged in staggered relation, so that the fabric is caused to pass between them in a sinuous path, these acting as breaking rollers to break up the carbon in the mesh of the fabric and to secure a flexible product. These or their equivalent may or may not be employed, according to the use to which the fabric is to be put. From the breaking rollers 13, the fabric passes to the winding-on roll or beam 14, preferably driven from any suitable source of power so as to wind thereon the carbonized fabric at a suitably slow rate of speed. Unless specially treated to produce flexibility and especially when richly carbonized, the resultant fabric consists of a hard, definitely formed body partly or wholly permeated with carbon. Articles which have been woven or otherwise fabricated into a definite shape and then carbonized as above described, or which have been formed into some definite shape after being saturated with the molasses, may be made permanently to retain such shape. As an example of the production of a predeterminate formation in the carbonized product, I have shown in the apparatus of Fig. 1 means consisting of the two steel rollers 16, between which the fabric tape is caused to pass after emerging from the molasses bath and when in a semi-plastic state. These rollers may be suitably shaped to impress the thin plastic tape with any desired formation, such for example as one or more grooves or channels lengthwise the tape. These rollers leave a permanent impression in the plastic tape, so that the latter when in the carbonizing apparatus emerges therefrom with the hard and permanent characteristic formation imparted by the rollers.

While ordinarily no difficulty will be experienced in keeping the heat within such limits as to prevent the oxidation of the carbon when the tape emerges from the carbonizing apparatus, if it has a tendency immediately to turn white, thereby indicating oxidation of the carbon, it can be easily remedied by applying to the surface of the emerging tape a coating of molasses, meanwhile taking care that the temperature of the furnace is reduced.

While I have shown and described one specific form of apparatus, with a single modification thereof, the present invention, is not limited to the use of such illustrated

apparatus, as it may be carried out by any other suitable apparatus or devices capable of performing the particular steps and operations described in the specification, and more particularly defined in the claims.

I make no claim in this application to the article of manufacture produced by the herein described process, nor to the apparatus used in carrying out such process, as such article of manufacture and apparatus are claimed in my pending application Serial No. 513,388.

Having thus defined the nature and scope of the present invention, what I desire to claim and secure by Letters Patent is:—

1. The method of producing a carbonized woven asbestos fabric which consists in saturating woven asbestos fabric with a carbohydrate and thereafter carbonizing the compound, substantially as described.

2. The method of producing a carbonized woven asbestos fabric which consists in saturating woven asbestos fabric with a carbohydrate and thereafter subjecting the said fabric to a carbonizing heat without excess of air, substantially as described.

3. The method of producing a carbonized woven asbestos fabric which consists in forming a fabric of woven asbestos, saturating the said fabric with a carbohydrate and subjecting the said fabric to a carbonizing heat without excess of air, substantially as described.

4. The method of producing a carbonized fabric which consists in impregnating the fabric with a carbon compound, and thereafter immersing the fabric in a bath heated to a carbonizing heat to carbonize the compound, substantially as described.

5. The method of producing a carbonized, water-proof fabric which consists in saturating the fabric with a carbon compound, immersing the same in a water-proofing bath and subjecting the fabric to a carbonizing heat without excess of air, substantially as described.

6. The method of producing a carbonized, water-proof fabric which consists in impregnating the fabric with a carbon compound, and thereafter immersing the treated fabric in a bath of water-proofing material heated to a carbonizing heat, substantially as described.

7. The method of producing a carbonized fabric which consists in impregnating the same with a hard carbon coating and thereafter bending the fabric to render the same flexible, substantially as described.

8. The method of producing carbonized woven fabric articles having a predetermined shape which consists in saturating a woven fabric with a carbohydrate solution, imparting the predetermined shape to the saturated fabric and carbonizing the fabric in such shape, substantially as described.

9. The method of producing a fabric permeated with hard wear-resisting carbon, which consists in forming a fabric of asbestos, saturating the fabric with molasses, drying or partially drying the molasses, and immersing the fabric in a bath of linseed oil heated to a carbonizing heat to carbonize the molasses, substantially as described.

10. The method of producing a carbonized fabric which consists in immersing the fabric in a solution of molasses and sulfur, and thereafter subjecting the treated fabric to a carbonizing heat without excess of air, substantially as described.

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