J. M. C. HERRGOTT
ELECTRIC HEATING FABRIC.
APPLICATION FILED AUG. 12, 1902.

FOR MODEL.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

WITNESSES:

INVENTOR.

ATTORNEYS.

THE WMOHICK PRINTING CO., PHILADELPHIA, WASHINGTON, D. C.
To all whom it may concern:

Be it known that I, JOSEPH MICHEL CAMILLE HERRGOTT, engineer, of Villa de la Sablière, Valdoie, territory of Belfort, Republic of France, have invented an Electric Heating Fabric, of which the following is a full, clear, and exact description.

The invention has for its object a new description of electric heating fabric flexible like existing fabrics and characterized, namely, as follows: first, by the special arrangement of the electrothermic wire which enters its weft and constitutes the electrothermic circuit; second, by the arrangement of the selvages of the fabric, so as to permit of introducing therein collectors for the current. The special thread, both conductor and textile material, forming part of the weft of the fabric and not entering the selvages is thus completely buried without particular external appearance. Further, the collecting wire or wires inclosed in each of the selvages serve to unite the respective ends of the electrothermic circuit or circuits, the length of which is determined according to the heating to be obtained under the tension of the current employed, this heating being capable of variation up to its maximum by placing these simple or multiple circuits in derivation or in series or by any regulated resistance independent of the fabric.

The special thread forming the essential characteristic of my fabric is constituted in such manner as to fulfill at the same time the conditions required for a good textile thread and of an electric-current-conducting wire. It is composed of fine metallic wires, copper or tinned brass, aluminum or its various alloys, galvanized iron, &c., according to its destination, for the passage of the current and threads of silk, cotton, or hemp to insure tensile strength, to which the conducting-wires do not contribute.

In the drawings, Figure 1 shows a part of one of the conducting-wires. Fig. 2 is a diagram of the fabric. Fig. 3 is a sectional view on line A B of Fig. 2. Figs. 4 and 5 are diagrams of the fabric. Fig. 6 is a detail view showing the manner of connecting certain of the parts of the fabric. Fig. 7 shows the fabric in connection with a button for making electric contact. Fig. 8 is a plan view of part of Fig. 7. Fig. 9 is a detail view showing the arrangement of buttons and contact-strips.

With this object, as shown at Fig. 1 of the accompanying drawings, the conducting-wires, contrary to that which has hitherto been practiced, are wound in the form of a spiral layer c, which surrounds a central core of textile threads. The flock thus formed and lightly twisted is surrounded by a covering of hemp, cotton, or silk thread. This combination insures with the flexibility and strength required a textile thread and a conductor for the electric current sufficiently insulated by itself. The fabrics in the weft of which this special thread enters may be of various kinds or weavings; but I prefer to employ the special weaving represented at Figs. 2 and 3, which are respectively a longitudinal section of the fabric and a transverse section thereof on the line X Y, Fig. 2.

My special fabric is constituted by a double-faced weaving, carrying at its center the electrothermic wefts. (See Fig. 2.) I, II, III, IV, V, and VI represent the warps. The upper face comprises the wefts 3, 5, 9, 12, 15, and 18 and the lower face the wefts 2, 5, 8, 11, 14, and 17, while the wefts 1, 4, 7, 10, 13, and 16 represent the electrothermic wefts. These latter may, according to the length it is desired to give to the electrothermic circuit, be reduced either by a third, for example, by dispensing with the wefts 1 and 10 or 4 and 13 or 7 and 16, or by half by dispensing with the wefts 1, 7, and 13 or 4, 10, and 16, or by two-thirds by dispensing with the wefts 1, 4, 10, and 13 or 4, 7, 13, and 16 or 1, 7, 10, and 16. In these various cases for the electrothermic wefts eliminated there would be substituted wefts of like textile composition to that of the material inclosing the conducting-wire, unless by so doing two or more distinct electrothermic circuits are placed parallel. The composition of the fabric may be cotton, wool, jute, ramie, asbestos, silk, &c.—that is to say, of materials capable of variation according to taste and the requirements of use.

At Fig. 3 on the left are represented the two selvages e f and on the right the two selvages g h, forming lips for the purpose of inclosing and protecting the electrothermic collecting-wires, which lips can be united by sewing or other means. The wires of the electrother-
mic circuit end, therefore, at a certain distance from the selvages of the fabric, and between the two lips of the selvages are placed one or several flexible conducting-wires composed in an analogous manner to the electrothermic wires, but offering a sufficient conducting-section to avoid heating on the passage of the current in \( d, d' \), Fig. 3. These wires should be covered with a covering insuring a most perfect insulation. They serve to unite the ends of the partial electrothermic circuits, so that the wire or wires of a selvage form one pole and that or those of the second selvage the other pole, which can at will be connected with the source of electricity by means of known apparatus of interruption and security or well-conditioned fusible plugs. The introduction of the collecting-wires into the lips of the selvage may be effected after weaving, and the lips are then closed by sewing or other means, or the collectors may be placed in the loom and the lips be closed by weaving. To reduce to the minimum the number of derivation-joints of the partial circuits on the selvage-threads, they are made, by preference, quincunally, so that the end of one circuit and the commencement of the following form only one taking of current alternately from one pole and from the second. Further, in this manner the adjacent electrothermic wefts have only a very small difference of potential between them, thus avoiding all danger of an accidental short circuit. Figs. 4 and 5 show a diagram of this arrangement in which over-heating is already provided against by a fusible plug. \( c \) \( c' \) are the wires of the heating-circuits, and \( i \) \( k \) the collectors placed within the selvages and which may be simple or double, according as the electrothermic circuits are simple or double. At \( m \) and \( n \) are seen the points of connection of the various wire-joints.

As I have above mentioned, the selvage-wires can be placed in the loom with the warp. The joints, Fig. 6, of the electrothermic wires \( c \), forming part of the weft, may be made alternately on one or the other of these selvage-wires without any being cut, but only uniting the conducting-wires \( a \) at the desired place after a determined number of throws of the shuttle to give to the partial circuits in weaving the desired lengths. It will be understood that I thus obtain a fabric capable of being manufactured in various widths and lengths and that at the ends of the piece are the selvage-wires which permit of introducing the electric current uniformly throughout its extent. The ends of the piece thus made also have lips like the selvages, completely inclose and protect every conducting-wire. These special threads are thus absolutely imprisoned, and wear cannot reach them nor cut them. The fabric constituted as above explained may be used in the manufacture of furniture and hangings, and it may be combined for this purpose with various fabrics, carpets, or tapestries. It can also be employed as it is, and its constitution enables it to be employed in the manufacture of endless cloth for industrial purposes. In this case, as shown in section at Fig. 7 and in exterior view at Fig. 8, each of the joints of the partial circuits \( e \) on the collecting-wires \( k \) is furnished with a metallic disk or button \( h \), which is inserted into the interior of the fabric and on the exterior thereof has the form of a contact-stand. In these two Figs. 7 and 8, \( e \) and \( f \) represent the lips of the selvages of the fabric, and \( r \) and \( s \) the two faces of this fabric. The arrangement of the disks or buttons on my fabric enables the current to be easily connected with it (see Fig. 9) by means of rubbing contacts \( u \), placed at conveniently-chosen points to cause each of the collecting-wires \( k \) to communicate with the different poles of the electric circuit. The rubbers \( u \) have a length slightly greater than the distance of two disks or buttons from the collecting-wire to be put in communication, so that the constant delivery of the current is insured to the endless cloth in movement or when stopped by the fixed rubbing contact-plates \( r \) rubbing against the movable disks or buttons and by the collectors of selvages \( k \), which are also endless to the partial electrothermic circuits to determine the uniform heating of the entire. This arrangement in the case of the combination in partial parallel circuits with several selvage-wires also permits all the combinations in derivation or in series by the lines of parallel disks or buttons by combining their respective rubbing contacts.

My electrothermic fabric may be raised to a uniform temperature more or less elevated, according to its electric resistance and the intensity of the current which is conveyed to it. It may also be applied to industrial heating, particularly to drying, and may serve for endless cloths of weaving apparatus for paper-making machines, to finishing-machines, and in dyeing. At less elevated temperatures this fabric may be applied to domestic heating by carpet, cushions, foot-warmers, &c., or to local heating of various parts of the body. At the tension of current for which it is calculated this fabric cannot exceed the temperature of the maximum fixed. Further, it is not only flexible, but possesses the flexibility of ordinary fabrics, the appearance of which it retains. It may be impermeable, non-inflammable, or coated. It may not only be printed, but even dressed, dyed, or decorated in any desired manner. I claim—

1. In electric heating fabrics, weft-threads forming both textile material and conductor of electricity in which an insulated metallic conducting element is wound spirally around a central core of textile material such combination having the desired qualities of conductivity, flexibility and strength.

2. In electric heating fabrics the combination of insulated electric conducting weft-
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threads, double selvages forming lips, and
electrothermic collecting-wires connected to
the electrothermic circuit of the fabric and
introduced between the lips or selvages which

latter are afterward connected together to re-
tain such collecting-wires substantially as

herein set forth.

3. In electric heating fabrics the combina-
tion of electric conducting-threads, electro-
thermic collecting-wires and means connected
with the collecting-wires and adapted to re-
ceive by rubbing contact the supply of elec-
tricity from any given source, substantially

as described.

4. In electric heating fabrics used as end-
less cloths in drying or dressing machines the

combination of insulated electric conducting

wires, double selvages forming lips, electro-
thermic collecting-wires connected to the

electrothermic circuits of the fabric and

introduced and secured between the lips or

selvages, and electric conducting disks or

buttons connected with the collecting-wires

and adapted to receive by rubbing contact the

supply of electricity from any given source

substantially as herein set forth.

The foregoing specification of my electric

heating fabrics signed by me this 31st day of

July, 1902.

JOSEPH MICHEL CAMILLE HERRGOTT.

Witnesses:

EDWARD P. MACLEAN,

MAURICE H. PIGNET.