H. J. HOPE.

PILE FABRIC AND METHOD OF MAKING THE SAME.

APPLICATION FILED OCT. 18, 1917.

1,317,704. Patented Oct. 7, 1919.

Fig. 1.

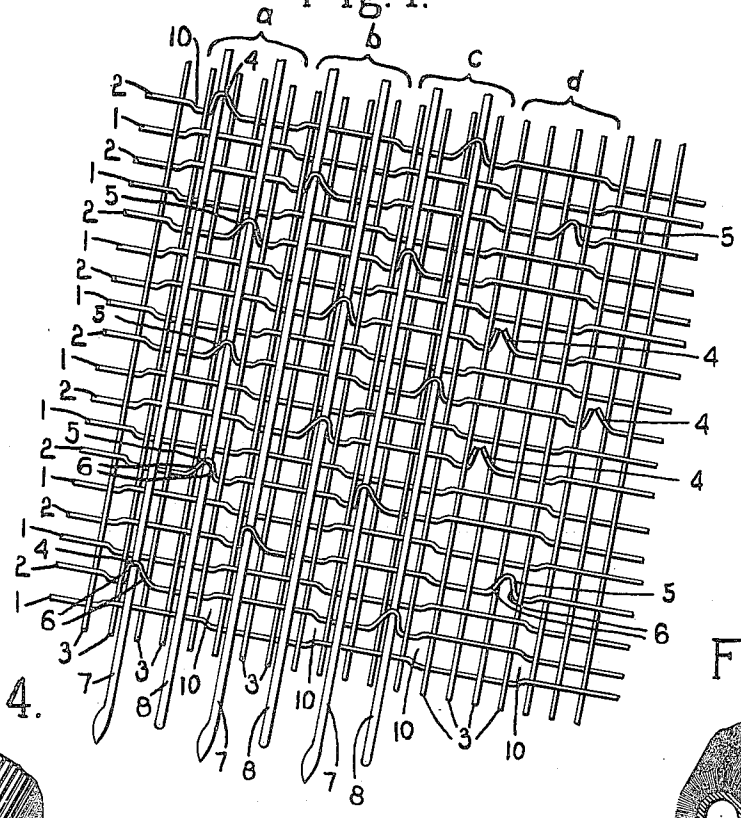


Fig. 4.



Fig. 5.

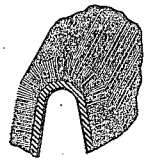


Fig. 2.

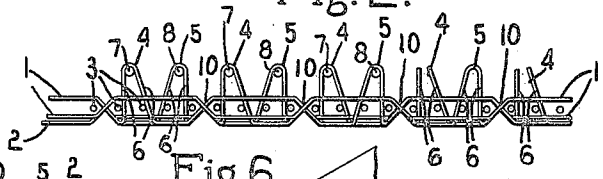


Fig. 3.

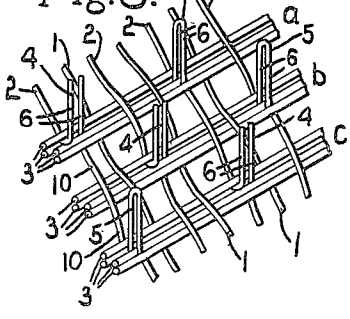
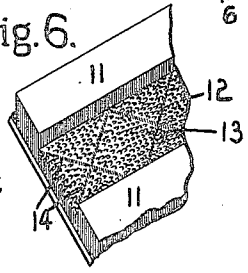


Fig. 6.



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UNITED STATES PATENT OFFICE.

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PILE FABRIC AND METHOD OF MAKING THE SAME.

1,317,704. Specification of Letters Patent. Patented Oct. 7, 1919.

Application filed October 18, 1917. Serial No. 197,338.

To all whom it may concern:

Be it known that I, HERBERT J. HOPE, a citizen of the United States, residing at Sanford, county of York, State of Maine, have invented an Improvement in Pile Fabrics and Methods of Making the Same, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to pile fabrics and the method of making the same and has for its general objects to provide a novel pile fabric which can be woven on a pile wire loom, and which may have one or all of the following characteristics:

First: the pile surface is so formed as to practically eliminate any spaces between the different transverse rows of pile loops whereby the ribbed appearance which the ordinary pile fabric has is eliminated.

Second: Each transverse row of pile loops, by which is meant the row of loops between adjacent crossings of the warp threads, may be either all cut loops or all uncut loops, or partially-cut loops and partially-uncut loops, depending on the character of the fabric which it is desired to produce. This enables a pile fabric to be made in which the cut and uncut loops are so arranged relative to each other as to produce any desired figure or pattern in the fabric. The body of the fabric may be formed with the uncut loops and the figure with the cut loops or vice versa.

Third: The fabric may be woven so as to present separate sections or zones extending longitudinally of the fabric, some of which have a longer pile than others, and the sections or zones having the relatively-short pile may be made with any desired figure or pattern by properly arranging the cut and uncut loops as above described.

Other characteristics will be more fully hereinafter set forth.

In weaving a pile fabric on an ordinary pile wire loom, it is customary to insert a pile wire in every third shed so that there will be two filling threads between any two adjacent pile wires, and it is also customary to cross the warp threads between every shed. As a result there will be two filling threads and the corresponding number of crossings of the warp threads between each transverse row of pile loops, and when the fabric is beaten up, the presence of these two filling threads between each row of loops tends to separate the rows to such an extent that the spaces between the rows are observable, specially when the fabric is bent sharply in a direction transverse to the warp threads. Moreover, in a pile fabric as commonly woven on a pile wire loom, all of the loops in any row of loops must be either uncut loops or cut loops, this being so because all of the loops of each row are formed over the same pile wire, and if any pile wire is in the nature of a knife wire, then when it is withdrawn all the loops which are formed thereover will be cut, while if the pile wire is a plain wire, then all the loops which are formed thereover will be uncut. For this reason it has not heretofore been feasible to produce a pile fabric presenting a pattern which is made by a relative arrangement of cut and uncut loops such as can be produced by means of my invention.

In order to produce a fabric in which the spaces between adjacent rows of loops are eliminated to such an extent as not to be visible and also to provide a pile fabric in which each row of loops may be made partially of cut loops and partially of uncut loops, I propose to arrange and manipulate the filling threads in groups of four or more and to interweave these filling threads with the warp threads so that the crossings of the warps will take place between the groups of filling threads. That is to say, there will be four or more filling threads between each crossing of the body warp threads so that each body warp thread will pass alternately over and under four or more filling threads. The pile warp threads are also crossed between the groups of filling threads. The pile wires are inserted at every third pick, as usual in the making of pile fabrics on pile wire looms, and as the filling threads are arranged in groups of four, there will, therefore, be two pile wires inserted for each group of filling threads. The pile loops or portions of the pile warp threads from which the pile is made are brought up from those parts of the pile warp threads which pass under each group of four or more filling threads, and preferably the pile loops will be so formed over the pile wires that each row of loops when formed will have one filling thread extending through the loops. The

pile loops may be formed over one or both of the two pile wires corresponding to any group of filling threads, and when the fabric is beaten up and the pile wires are withdrawn, the four or more filling threads of any group are compacted closely together so as to bring all of the pile loops that are formed over both pile wires for said group of filling threads into substantially the same line. Moreover, since there is only one crossing of warp threads between the pile loops corresponding to each group of filling threads, the pile loops will be forced so closely together that no appreciable space or rib will be presented between successive rows. Since the pile loops which eventually constitute each row of pile loops are formed over two separate pile wires, it is possible to make the loops which are formed over one pile wire in the nature of cut loops by using a knife wire, and the other loops in the nature of uncut loops by using a plain wire so that each row of loops may be made partially of cut and partially of uncut loops directly from the loom. By this means and by properly controlling the pile warp thread it is possible to produce any desired figure or pattern in the completed fabric. The arrangement of stripes or longitudinal zones presenting relatively long and relatively short pile can be produced by placing a greater tension on the warp threads constituting the zone or zones from which the short pile is formed, the greater tension drawing the loops closer and thus producing a shorter pile.

In the drawings in which I have shown one embodiment of my invention, Figure 1 is a perspective view of a pile fabric made in accordance with the invention, said view being somewhat of a diagrammatic view and showing the warp, and filling threads considerably separated from each other so as to better illustrate the manner in which said threads are interwoven;

Fig. 2 is a sectional view taken longitudinally of the warp threads, said view showing the filling threads widely spaced to better illustrate the construction;

Fig. 3 is a diagrammatic view showing how the two rows of loops for any group of filling threads are brought into alinement with each other when the filling is beaten up in the weaving of the cloth;

Figs. 4 and 5 are views indicative of the difference between an ordinary pile fabric woven on a pile wire loom and a fabric embodying my invention;

Fig. 6 is a perspective view of a fabric embodying my invention.

In the fabric illustrated, 1 indicates the body warp threads, 2 indicates the pile warp threads, and 3 indicates the weft or filling threads. The pile warp threads and body warp threads may have any relative arrangement and are herein shown as being alternately arranged. The filling threads 3 are woven into the fabric in groups of four or more, four being the number in each group in the illustrated embodiment of the invention.

The successive groups of four filling threads are indicated at *a*, *b*, *c*, *d*, etc. In weaving the fabric, each body warp thread 1 is floated over the filling threads of one group and then passes under the filling threads of the next group, etc., the arrangement being such that of any two adjacent body warp threads 1, one of them will pass over a group of filling threads, while the other passes under the same group, the warp threads crossing between the groups.

This is illustrated in Figs. 1 and 2 wherein the body warp threads are crossed at the points 10 between the adjacent groups *a*, *b*, *c*, *d* of filling threads. The pile warp threads 2 are also crossed between the groups *a b*, *c*, etc., of filling threads so that each pile warp thread will pass over the four or more filling threads of one group and then under the filling threads of the next group. The pile loops are indicated at 4 and 5 and are formed in the portions of the pile warp threads which pass under the groups of filling threads. These pile loops are formed in the usual way by inserting pile wires 7 and 8 in the appropriate sheds. I propose to insert a pile wire in every third shed, as usual in weaving pile fabric on a pile wire loom, so that there will be two filling threads 3 between each two adjacent pile wires. Since there are four filling threads in each group, there will consequently be two pile wires for each group of filling threads, and these are so inserted that they come between the end filling threads of each group and the central filling threads of the group, as clearly seen in Figs. 1 and 2. The pile loops 4 and 5 may be brought up between any of the filling threads 3 constituting each group, and if the pile loops 4 from some of the pile warps are formed over the pile wires 7, and the pile loops 5 from other pile warp threads are formed over the pile wires 8, then the fabric as it is woven will present two rows of pile loops for each group of filling threads, the loops of one row being indicated at 4 and those of the other row at 5. This is clearly shown in Figs. 1 and 2 wherein the fabric is purposely illustrated open with the threads separated. In forming the pile loops 4 and 5, the pile warp threads are held raised not only while the pile wire is being inserted as usual, but also while a pick of filling thread is being inserted, so that each row of pile loops 4 or 5 will have a filling thread 3 extending therethrough. As a result, the two legs 6 of each pile loop will be situated on opposite sides of a filling thread which extends through the loop and

this has the advantage that it tends to eliminate the objectionable ribbed appearance of the fabric.

It will be understood that in weaving the fabric the lay beats up the filling after each pick and after the insertion of each pile wire, and that each pile wire is woven into the fabric and remains in the fabric for several picks before it is withdrawn, as usual in weaving pile fabrics on pile wire looms. Inasmuch as all of the warp threads cross simultaneously between the groups of filling threads and consequently there is no crossing of either the pile warp threads or body warp threads except between the groups of filling threads, the operation of beating up the fabric will cause the pile wires and the filling threads of each group to bunch together somewhat, as shown in Fig. 3, and this bunching-up operation will tend to cause the two rows of pile loops for any group of filling threads to come into alinement with each other. When the pile wires for any group of filling threads are withdrawn, then the bunched condition of the filling threads for said group together with the tension on the fabric will cause the pile loops of the two rows produced by the two pile wires to come into substantial alinement so that they produce in effect only a single row of loops. Moreover, the successive groups of filling threads, each of which has a double row of pile loops, will be beaten closely together because there is only one crossing of warp threads between each adjacent group, and this construction brings the double rows of pile loops for the various groups of filling threads so closely together as practically to eliminate any ribbed appearance which is usually produced by the space which must exist between the adjacent rows of pile loops in the ordinary pile fabric.

When the ordinary pile fabric is bent sharply back on itself, as shown in Fig. 4, the rows of loops separate from each other, but with a fabric made in accordance with my invention this separation is not apparent even when the fabric is bent back on itself, as shown in Fig. 5, especially when the loops are all cut loops.

My invention has the further advantage that it makes possible the weaving of a figured pattern where the figure is formed by an arrangement of cut and uncut loops. If, for instance, the pile wires 7 are knife wires and the pile wires 8 are plain wires, then when the pile wires are withdrawn in the weaving of the fabric, the loops 4 which are formed over the pile wire 7 will be cut, while the loops 5 which are formed over the pile wires 8 will remain uncut. When the fabric is beaten up, as shown in Fig. 3, the row of cut loops 4 and the row of uncut loops 5 for each group of filling threads will be brought into substantial alinement thereby to produce a row of loops which are partially cut and partially uncut. By actuating the harness mechanism which manipulates the pile warp threads by a suitable pattern mechanism it is possible to arrange the pile loops 4 and 5 over the pile wires so as to produce any desired arrangement of cut and uncut loops in double row of loops corresponding to each group of filling threads, and this enables me to weave any desired pattern where the figure is produced by a relative arrangement of cut and uncut loops. For instance, in Fig. 6, I have shown a portion of a pile fabric which presents the longitudinal zones or stripes 11 of cut pile and the intermediate longitudinal stripes 12 having a pattern thereon which is produced by an arrangement of cut and uncut loops. The uncut loops are indicated at 13 and the cut loops by the shaded portions 14. The cut loops which produce the portion 14 will be formed over the knife pile wires 7, while the loops which form the portion 13 will be formed over the plain wires 8. This figured effect may be produced over the entire body of the fabric or only over portions thereof, as desired. In the fabric shown in Fig. 6, the stripes or zones 11 thereof have a longer pile than the intermediate zones 12, and this is produced by applying a greater tension to the pile warp threads in the zone 12 than is applied to the pile warp threads constituting the zones 11. The pile warp threads from which the pile in the zone 11 is formed may be taken from one warp beam and the other pile warp threads from another warp beam, suitable means being provided to apply greater tension to the last-named pile warp threads. The application of the greater tension to the pile warp threads draws the pile loops closer and produces a pile of less height. By means of my invention, therefore, it is possible to produce a fabric having a striped effect in which the stripes are produced by relatively long and relatively short pile, and also to form a figure or pattern in one or both of the zones by a combination and arrangement of cut and uncut loops, or, if desired, the pile may be made of uniform height throughout the fabric, and some or any portion of the fabric may be made with the arrangement of cut and uncut loops which will produce the desired figure.

I claim:

1. A pile fabric having its filling threads arranged in groups of four or more and both its pile warp threads and its body warp threads crossing between said groups and also having both cut and uncut pile loops formed from portions of the pile warp threads that are brought up through the filling threads of each group.

2. A pile fabric comprising body warp threads, pile warp threads and filling

threads, said fabric having all of its warp threads crossed at every fourth or more pick and having two sets of pile loops formed from pile warp threads drawn up through the filling threads that are situated between each crossing of the body warp threads, the pile loops of one set being drawn up between different filling threads than those of the other set.

3. A pile fabric having its body warp threads crossed at every fourth or more pick and having two sets of pile loops drawn up through the filling threads that are situated between each crossing of the body warp threads, each set of pile loops having a filling thread extending therethrough.

4. A pile fabric comprising interwoven body warp threads, pile warp threads and filling threads, the filling threads being arranged in groups of four or more and all of the warp threads of the fabric crossing between the groups of filling threads, and some of the pile warp threads being drawn up between the filling threads of each group and said filling threads of each group being held in close juxtaposition by the crossed body warp threads and being separated only by loops of pile warp threads.

5. The method of making on a pile wire loom a pile fabric comprising pile warp threads, body warp threads and filling threads, which method consists in crossing all of the warp threads of the fabric simultaneously at every fourth or more pick of filling threads and forming the pile loops from portions of the pile warp threads that are drawn up between the filling threads included between each two successive crossings of body warp threads.

6. The method of making a pile fabric on a pile wire loom which consists in crossing the body warp threads at every fourth or more pick and forming between each crossing of body warp threads a plurality of rows of pile loops from pile warp threads, and then bringing said rows into substantial alinement as the cloth is beaten up.

7. The method of making a pile fabric on a pile wire loom which consists in crossing the body warp threads at every fourth or more pick and forming between each crossing of body warp threads a plurality of rows of pile loops from pile warp threads, cutting the pile loops of one row in each plurality of rows, and then bringing into substantial alinement the rows of pile loops between each crossing of warp threads.

8. The method of weaving a pile fabric on a pile wire loom which consists in inserting a pile wire for every two picks of filling thread, forming over each pile wire pile loops from pile warp threads and crossing all the warp threads of the fabric at every fourth or more pick.

9. The method of weaving a pile fabric on a pile wire loom which consists in inserting a pile wire for every two picks of filling thread, forming over each pile wire pile loops from pile warp threads, crossing the body warp threads at every fourth or more pick, withdrawing the pile wires, and beating up the cloth to bring into substantial alinement all the pile loops between any two adjacent crossings of the warp threads.

10. The method of weaving a pile fabric on a pile wire loom which consists in crossing the body warp threads at every fourth pick of filling, inserting two pile wires between the adjacent crossings of body warp threads, forming pile loops over the pile wires from the pile warp threads, and cutting the loops which are formed over one of the two wires between the adjacent crossings of body warp threads.

11. The method of weaving a pile fabric on a pile wire loom which consists in crossing the body warp threads at every fourth pick of filling, inserting two pile wires between the adjacent crossings of body warp threads, forming pile loops over the pile wires from the pile warp threads, cutting the loops which are formed over one of the two wires between the adjacent crossings of body warp threads, and bringing the two rows of loops between adjacent crossings into substantial alinement.

12. The method of weaving on a pile wire loom a pile fabric comprising body warp threads, pile warp threads and filling threads, which method consists in crossing all the warp threads of the fabric simultaneously at every fourth pick of filling thereby dividing the filling threads into groups of four and forming two sets of pile loops from portions of the pile warp threads that are drawn upwardly through the filling threads of each group, the pile loops of each set being drawn up between different filling threads than the pile loops of the other set.

13. The method of weaving a pile fabric on a pile wire loom which consists in crossing the body warp threads at every fourth pick of filling thereby dividing the filling threads into groups of four, and forming two sets of pile loops from pile warp threads for each group of filling threads, each pile loop being formed from a portion of a pile warp thread which is drawn upwardly through the filling threads of the group, and then bringing the two sets of pile loops for each group of filling threads into substantial alinement.

14. The method of weaving a pile fabric on a pile wire loom which consists in crossing the body warp threads at every fourth pick of filling thereby dividing the filling threads into groups of four, forming two sets of pile loops from pile warp threads for each group of filling threads, each pile loop

being formed from a portion of a pile warp thread which is drawn upwardly through the filling threads of the group, cutting the pile loops of one set for each group of filling threads, and then bringing into substantial alinement both sets of pile loops for each group of filling threads.

15. A pile fabric divided into longitudinal stripes or zones and having a longer pile in some stripes or zones than in others, the pile of some of the stripes or zones being formed of both cut and uncut pile loops.

16. A pile fabric comprising body warp threads, pile warp threads and filling threads and having its filling threads arranged in groups of four or more and having all its warp threads except the pile warp threads floated over and under all the filling threads of each group and crossing between said groups and also having each pile warp thread floated over alternate groups and drawn up between the filling threads of the other groups.

17. A pile fabric comprising filling threads and pile warp threads, characterized in that the filling threads are arranged in groups of four or more and in that the pile warp threads cross between the groups and there is a row of both cut and uncut pile loops between each crossing of the pile warp threads.

18. A pile fabric comprising filling threads, body warp threads and pile warp threads, characterized in that the filling threads are arranged in groups of four or more and in that the pile warp threads cross between adjacent groups of filling threads and there is a row of pile ends for each group of filling threads, some of the pile ends of each row being brought up between certain filling threads of the group and other pile ends being brought up between other filling threads of the group.

In testimony whereof, I have signed my name to this specification.

HERBERT J. HOPE.