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A. W. DROBILE

METHOD OF WEAVING FRIEZE PILE FABRICS

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Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

HEDDLES UP
HEDDLES DOWN
HEDDLES MIDDLE

INVENTOR.

Albert W. Drobile

ATTORNEY.
My invention is a method of simultaneously weaving in superposed relation a plurality of frieze pile fabrics having self-separating loops of different lengths woven face to face on a double shuttle loom having a pair of sets of shedded pile gauges extending warpwise. In accordance with my invention, the shuttles of a double shuttle loom are picked simultaneously to lay the rectangular pairs of weft threads, and the sets of gauges, and the warp threads are so shedded that the picks laid by the upper shuttle form a row of wefts above the top set of gauges and a row of wefts between the gauges and the picks laid by the bottom shuttle form a row of wefts between the gauges and a row of wefts below the bottom gauges, the gauges being shed together or toward one another when the wefts are being laid above and below the gauges and the sets of gauges being shedded apart when the rows of wefts are being laid between the gauges. The sets of gauges operate on the minding principle, that is they have two positions, a horizontal position and a deflected position. The upper set of gauges is moved upwardly and the lower set downwardly from their horizontal positions. The warp threads are so shedded during the laying of the picks that most of the wefts in the row above the gauges are interlaced with the ground warp threads to form the ground of the upper fabric and to secure in the ground pile warp threads looped over the upper row of wefts between the gauges to form short loops on the upper fabric, and to also secure to the upper ground pile warp threads which are looped over certain of the wefts between the lower gauges and the lower ground to form long pile loops on the upper ground. Similarly, ground warps interface the wefts below the gauges, excepting those looped within long loops of the upper fabric, to form the ground of the lower fabric and secure thereto pile warp threads looped over the remaining or lower wefts between the gauges and also secured to the lower ground the long loops formed by pile warp threads passing over the wefts above the top gauges which are not interlaced with the upper ground. Preferably the rows of loops of different heights on each fabric adjoin one another in regular repeat or in pattern formation and the pile loops may be united with the ground in a loose pile of V-tuft construction, or the pile loops may be united with the ground in a tight pile of W-tuft construction. Where the W-tuft construction is used, the intermediate portion or knee of the W-tuft may pass over one ground weft only or may pass over two or more ground wefts. In any of these types of construction, the ground may be composed of two series of tight warp threads with uniform take-up or may be composed of one series of tight warps and one series of slack warps so as to vary the appearance and erectness of the pile loops. The low loops and high loops on each fabric may be formed from the same series of pile warp threads or may be formed from two different series of pile warp threads, one forming the low loops and the other forming the high loops, which may be led off by two delivery mechanisms.

Fabrics having a surface pattern or figure composed of high and low loops according to a pre-arranged design may be woven in accordance with my method by so shedding the pile warps that a high pile loop or a low pile loop, or both of them, can be formed on any ground weft or wefts, as required or desired for the production of the desired design or figure. During the weaving of the fabrics and at the fell of the cloths where the wefts are beaten up, the two fabrics are interlocked due to the intertwining of the pile yarns therefor over and between the two sets of shedded warpwise gauges, which act as retaining or coupling pins and co-operate with the let-off mechanism to regulate the length of the long pile loops. After the fabrics move down toward the take-off rollers, the wefts slide off of the ends of the gauges to permit the self-separating of the loops and the separation of the fabrics by merely cutting the few connecting threads at the selvages.

The characteristic features and advantages of my improvements will further appear from the following description and the accompanying drawings in illustration thereof. In the drawings, Fig. 1 is a diagrammatic fragmentary view illustrating the weaving of superposed pile fabrics in accordance with my invention and the separation of the pile loops thereof as they move down off the ends of the warpwise extending gauges; Fig. 2 is a diagrammatic fragmentary view illustrating the weaving of superposed pile fabrics in modified form in accordance with my invention and the separation of the pile loops thereof as they move down off of the ends of the warpwise extending gauges; Fig. 3 is a diagrammatic view illustrating the weaving of superposed pile fabrics in a further modified form in accordance with my invention and the separation of the pile loops thereof as they move down off the ends of the warpwise extending gauges; Fig. 4 is a diagrammatic frag-
mentary view illustrating the weaving of superposed pile fabrics with tight and slack ground warp threads in accordance with my invention and the separation of the pile loops thereof as they move down off the ends of the warpwise extending gauges; Fig. 5 is a diagrammatic fragmentary view illustrating the weaving of superposed fabrics with high and low loops over the same ground weft; Fig. 6 is a fragmentary diagram view illustrating the fabric woven in accordance with Fig. 5 after the removal of the pile supporting wefts; Fig. 7 is a "drawing-in" diagram for drawing in the warps for weaving the fabric illustrated in Fig. 5 and Fig. 8 is a diagram illustrating the shedding of the warps during the weaving of a repeat of the fabric illustrated in Fig. 5.

In the practice of my invention as illustrated in Fig. 1, a double shuttle loom having the simultaneously operable shuttles X and X' and a usual reed Y is provided with warpwise extending gauge wires A, A' which may have their rear ends connected with a cross-bar Z.

The gauges A and A' preferably consist of round resilient wires which pass through and are shedded by heddle in suitable heddle frames (not shown) and pass through the reed spaces between the reed dents and slightly past the fell of the fabric being woven.

The loom is also provided with suitable heddle frames and harness mechanism for shedding in desired sequence the pile warp P1 and the ground warps B1 and B2 for forming the upper fabric and the pile warp P2 and the ground warps B1 and B2 for forming the bottom fabric.

The cycle of weaving a repeat of the fabric may be considered as starting with the simultaneous laying of the wefts 3a and 3b which are laid by the shuttles X and X' respectively above the set of gauges A and below the set of gauges A' while the gauges are both shedded toward one another by the heddle and harness mechanism of the loom. The weft 3a is laid between the ground warp threads B1 and the ground warp threads B2 and the pile warp threads P1 and for forming a ground weft in the upper fabric and secures thereto the pile warp threads P1. The weft 3b is laid between the ground warp threads B1 and the ground warp threads B2 and pile warp threads P2 and forms a ground weft in the lower fabric and secures therein the pile warp P2.

After the beating up of the wefts 3a and 3b by the lay and the crossing of the respective pairs of ground warp threads, the shuttles X and X' lay the respective wefts 2a and 2b between the gauges A, A' while the gauges are shedded apart by a heddle and harness mechanism to permit the passage of the shuttles. During the laying of the picks 2a and 2b the pile warp threads P1 and the pile warp threads P2 are shedded to the middle pile position and the ground warp threads of the upper fabric are shedded above the shuttle X and the ground warp threads of the upper fabric are shedded above the shuttle X and the ground warp threads of the lower fabric are shedded below the shuttle X. Consequently, the shedding of the pile warp threads P1 and P2, the weft 2a is drawn against the upper fabric and the weft 2b is drawn against the gauges A' and a short loop is formed on the bottom fabric.

Before the pile warps P1 and P2 are shedded, however, to form the short loops, the gauges A, A' are shedded toward one another to permit the laying of the weft 3a by the shuttle X above the gauges A and to permit the laying of the weft 3b by the shuttle X' below the gauges A'. The weft 3a is laid between the pile warp threads B1 and B2 to form merely a ground weft in the upper fabric. The weft 3b is laid between the approximately shedded ground warp threads B1 and B2 and forms merely a ground weft in the lower fabric. The normal operation of the loom will beat up the wefts 3a, 3b into substantial vertical alignment with 2a, 2b respectively.

While the gauges A and A' are still shedded toward one another the shuttle X lays a further weft 4a above the gauges A and the shuttle X' lays a further weft 4b below the gauges A'. During the laying of the weft 4a the ground warp threads B1 and the pile warp threads P1 are shedded in the upper positions in the upper shed and the ground warp thread B2 is shedded in the lower position of the upper shed. Consequently the weft 4a forms a ground weft in the upper fabric and secures therein the pile warp P1 to complete the formation of the short loops over the weft 2a. During the laying of the weft 4b the ground warp threads B1 are shedded in the upper position of the bottom shed and the ground warp threads B2 and pile warp threads P2 are shedded in the lower positions in the bottom shed so that the weft 4b forms a ground weft in the bottom fabric and secures therein the pile warp threads P2 to complete the formation of short loops over the weft 2b.

During the laying of the wefts 5a and 5b by the shuttles X and X', the set of gauges A are in their middle position so that the weft 5a is laid above such gauges and between the ground warp threads B1 and B2 to form a ground weft in the upper fabric. The set of gauges A', however, are shedded to their upper or horizontal position so that the weft 5b is laid above the gauges A' but above the plane of the warps of the bottom shed and above the pile warp threads P2 which are shedded to their lowermost position. Consequently the weft 5b is not engaged in the bottom ground but is drawn against the gauges A' to form a support for a row of long loops on the top fabric.

During the laying of the wefts 6a and 6b respectively by the shuttles X and X', the set of gauges A is shedded downwardly to a lower or horizontal position and the warps of the upper fabric and the pile warp threads P2 of the lower fabric are all shedded to an upper position so that the weft 6a is not engaged with the warps of the upper fabric but lies beneath the pile warp threads P2 of the lower fabric and is drawn through against the gauges A to form a loop on the lower fabric. The set of gauges A' is shedded to its middle position so that the weft 6b is laid beneath the same and within the shed formed by the spaced warp threads B1 and B2 and forms a ground weft in the lower fabric.

By the continued repetition of the foregoing cycle, there are produced upper and lower fabrics each having loops of unequal height which slide off the ends of the gauges A, A' and permit the self-separation of the fabrics. Such fabrics may be expeditiously woven and have well covered grounds since there is a loop supported by a supplementary weft over every other ground weft of the fabric.

When it is desired to interlace the pile warps in the ground with a W interlacing, instead of
the V interlacing shown in Fig. 1, this may be done as illustrated in Fig. 2 by providing one set of warp ends for each fabric to form the short loops thereon and a second set of warp ends for each fabric to form the long loops thereon.

In weaving such a fabric, as illustrated in Fig. 2, the warp ends 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6a and 6b are laid in the same way as in Fig. 1 and the respective ground warps B1, B2, B3 and B4 are interlaced with the ground-welts in the same way as in Fig. 1. The pile warp ends P100 and P300 are shedded to form short loops over the warps 2a and 2b of the upper and lower fabrics respectively, but instead of the pile warp ends P100 being looped over the warps 5b, such ends are drawn into the upper ground and interlaced tightly therein over the ground warps 6a. Similarly the pile warp ends P300, instead of being looped over the supplementary weft 6a, are interlaced tightly with the warps 6b.

Additional sets of pile warp ends P101 and P301 are provided to form long loops respectively on the upper and lower fabric. The pile warp ends P111 are shedded with a W interlacing around the warps 1a, 3a and 4a and are then looped over the weft 5b between the gauges A and the ground of the bottom fabric and then interlaced with the top fabric for a further W interlacing with the ground thereof. The pile warp ends P211 are first looped by a W interlacing with the bottom fabric ground and are then looped over the weft 6a disposed between the gauges A and the ground of the upper fabric before being returned to the lower ground for a further W interlacing thereon.

When the fabric so woven is moved down off the ends of the gauges A and A', the fabrics automatically separate and there is thus provided two fabrics each having alternating rows of short pile loops and long pile loops spaced from one another by but a single ground weft and with both the long pile loops and the short pile loops held in the respective grounds by a W-type interlacing.

Where close coverage of the ground by the loops is not requisite, the intermediate portions of the pile warp threads in the ground of the pile wefts may be floated over a plurality of ground wefts, as shown in Fig. 3, instead of over a single ground weft as shown in Fig. 2. The ground warps are here provided to form the ground of construction, as shown in Fig. 3, and the additional wefts 7a and 8a are inserted in the top fabric on opposite sides of the weft 5a and additional wefts 7b and 8b are inserted in the ground of the bottom fabric on the opposite sides of the weft 6b. Pile warps P100, forming the short loops on the upper fabric, are interlaced in the ground thereof over the weft 6a, under the warps 7a, 8a, 7b and 8b over the weft 1a before being looped over the weft 2a. Similarly the pile warp ends P100, forming the short pile loops on the lower fabric, are interlaced in the ground thereof under the weft 4b, over the warps 7b, 8b and under the weft 1b before being looped over the weft 2b thereof. The pile warp ends P111, forming on the upper fabric loops supported by the supplementary wefts 5b, are interlaced in the ground thereof over the weft 5a, under the warps 7a, 8a, 7b and 8b over the weft 1a. The pile warp ends P1011, forming on the lower ground the long pile loops supported by the supplementary wefts 5b, are interlaced in the lower ground under the wefts 5a, over the warfts 1b, 2b, 3b and under the weft 7b.

Instead of the ground warps B1, B2, B3 and B4 being under equal tension, as in Figs. 1, 2 and 3, one of the ground warps in the upper ground may be placed under tight tension and the other ground warp in the lower ground may be placed under slack tension. Similarly one of the ground warps in the lower ground may be placed under tight tension and the other ground warp in the lower ground placed under slack tension. The application of tight and slack tensions to the respective ground warps of the weave shown in Fig. 3 is illustrated in Fig. 4 where the ground warps B1 and B2 are under tight tension and the ground warps B3 and B4 are under slack tension, thereby shifting the rows of loops closer toward one another.

As illustrated in Figs. 5 to 8 inclusive, fabrics may be woven face to face in accordance with my invention with a long loop or a short loop or both over any particular ground weft or wefts of each fabric. In accordance with this modification, a repeat having the foregoing characteristics consists of two ground wefts and two pile supporting wefts and two ground warps and two pile warps in each fabric. The first pair of wefts and are simultaneously laid by the devices of a double shuttle loom Rebecca's above the gauge A and below the gauge A'. The weft 1a is laid in a shed formed by the backing warp threads B1, B2, and under the pile warps P100 and P1002. The weft 1b is laid in a shed formed by the ground warp threads B2 and B3 and above the pile warps P100 and P1002. Before the laying of the next pair of wefts 2a and 2b, the sheds are reversed as shown in Fig. 7 by shedding the warps so that the weft 2a is laid in the top ground formed by the ground warps B1, B2 and above both pile warps P100 and P1002. The weft 2b is laid above the bottom fabric and beneath the pile warp P100 and the gauge A'. The backing warps and gauges have only two weaving positions. Before the laying of the next pair of wefts 3a and 3b, the gauges A and A' are shedded so that the weft 3a is laid between the gauges A and the pile warp P1002 and the weft 3b is laid between the gauge A' and the pile warp P1002, the pile warp P1002 forming on the upper fabric, and the pile warp P1002, forming the short loops on the upper fabric, are interlaced in the ground thereof over the weft 6a, under the warps 7a, 8a, 7b and 8b over the weft 1a. Similarly the pile warp ends P111, forming on the upper fabric loops supported by the supplementary wefts 5b, are interlaced in the ground thereof over the weft 5a, under the warps 7a, 8a, 7b and 8b over the weft 1a. The pile warp ends P111, forming on the lower ground the long pile loops supported by the supplementary wefts 5b, are interlaced in the lower ground under the wefts 5a, over the warfts 1b, 2b, 3b and under the weft 7b.

Having described my invention I claim:

1. In the simultaneous manufacture of a plurality of fabrics having a plurality of sheds, each shed comprising a set of shed pile wefts, a set of warp threads, and a set of sheds with supporting pile warps, each shed comprising a set of shed pile wefts, a set of warp threads, and a set of sheds with supporting pile warps, each shed comprising a set of shed pile wefts, a set of warp threads, and a set of sheds with supporting pile warps, each shed comprising a set of shed pile wefts, a set of warp threads, and a set of sheds with supporting pile warps, each shed comprising a set of shed pile wefts, a set of warp threads, and a set of sheds with supporting pile warps.
porting free short loops on the respective fabrics, looping pile warp threads secured to the respective grounds over the respective wefts between the gauges, shedding the gauges together and laying simultaneously a pair of picks outside the gauges, one of which forms a ground weft in one of the fabrics and the other of which is laid between the gauges and a ground of the other fabric to form a face weft for a free long pile loop on one of the fabrics in which the complementary pick forms a ground weft looping a warp thread from the fabric more removed therefrom about said face weft and securing said pile warp into the fabric of its origin.

2. In the manufacture simultaneously of a plurality of frieze pile fabrics having superposed grounds on a double shuttle loom having a plurality of gauges extending warwise of the loom, the steps which include laying a row of weft above the gauges and a row of wefts below the gauges, and two rows of wefts between the gauges, interlacing ground warps with some but not all of the row of wefts above the gauges, interlacing ground warps with some but not all of the row of wefts below the gauges which are not interlaced with the bottom ground warps and looping pile warp threads secured to the bottom ground over some of the wefts between the gauges and over the remaining wefts below the gauges which are not interlaced with the bottom ground warps.

3. In the manufacture simultaneously of two frieze pile fabrics face to face on a double shuttle loom having two sets of superposed shedded gauges between the grounds of the fabrics and extending warwise of the loom, the steps which include setting both gauges to their horizontal positions, shedding the ground warps and pile warps and simultaneously inserting wefts in the sheds formed thereby so that the pile warps lie at the back of their respective fabrics, then closing the sheds and beating up the wefts into position, forming a second set of sheds and simultaneously inserting wefts so that some of the pile threads of one of the fabrics are supported by a weft over the gauges more remote from the back of such fabric and the other weft is inserted in the ground of the same fabric to which the said pile is bound, closing the sheds and beating up the second set of wefts into position, forming a third shed and moving the gauges in opposite directions from each other, simultaneously inserting a third set of wefts between the gauges so as to act as a support for other pile warps from both fabrics, closing such shed and beating up the third set of wefts into position, forming a fourth shed and returning the gauges to their horizontal position, then simultaneously inserting a set of wefts so that the remaining pile threads are supported only by a weft over the 20 gauges more remote from the back of the fabric to which the pile threads are bound, the other weft being inserted in the ground of said fabric, closing the shed, and beating up the fourth set of wefts preparatory to repeating the cycle.

4. In the simultaneous manufacture of self-separating frieze fabrics having pile loops of two different heights face to face on a double shuttle loom having two sets of shedded warwise extending gauges spaced between the grounds of the two fabrics, the steps which comprise positioning the sets of gauges in substantially parallel relation, maintaining a portion of each of the gauges in such position during weaving by the supporting wefts of the long and short loops of opposite fabrics, shedding the gauges away from their parallel position and laying the short loop supporting wefts between the gauges, returning the gauges to their parallel positions and laying the long loop supporting wefts outside the 40 gauges and free from the ground warps between the selvages.

ALBERT W. DROBILE.