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PILE FABRIC AND METHOD OF MAKING THE SAME

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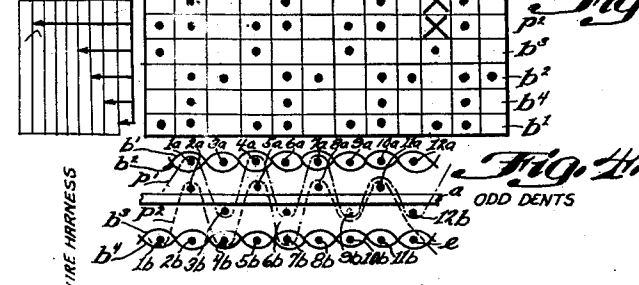
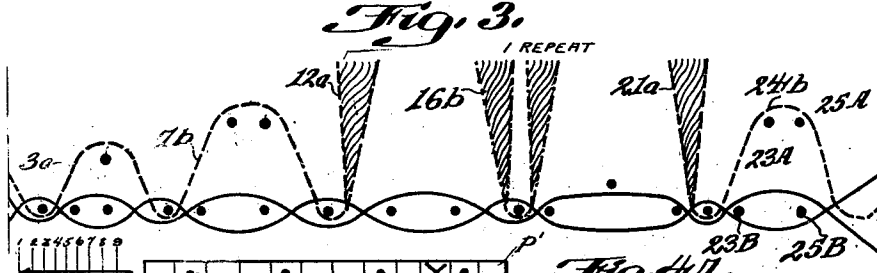
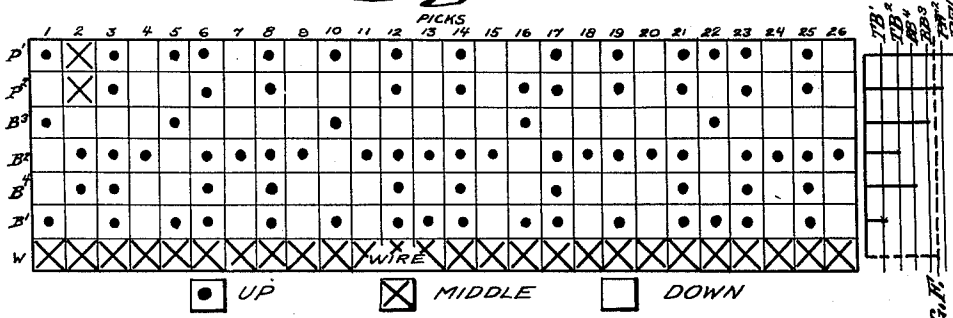
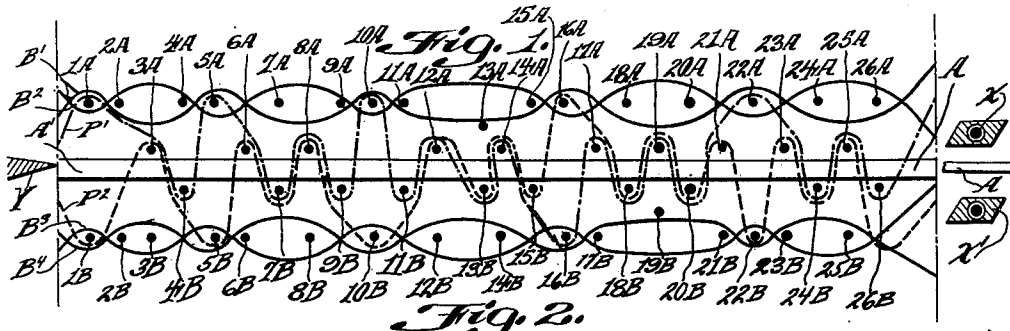
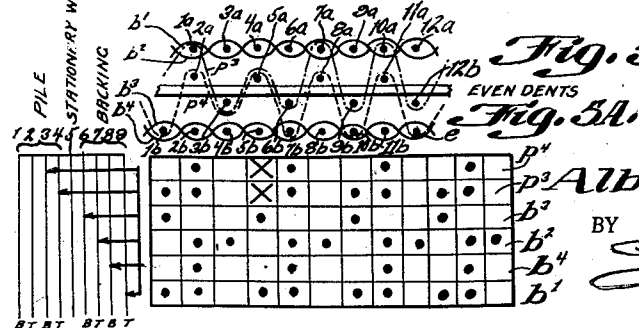
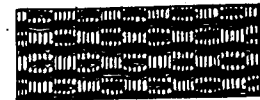
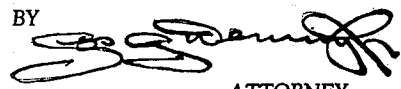


Fig. 6.



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PILE FABRIC AND METHOD OF MAKING THE SAME

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12 Claims. (Cl. 139—397)

My invention is an improvement in the manufacture of pile fabrics by which two fabrics may be woven face to face at the same time with self-separating loops of different lengths and
5 which may be floated over the same or different numbers of ground wefts.

The loops may be left uncut so as to provide rows of narrow loops and rows of wide loops transversely of the fabric, or the warps in dents of adjacent groups may be so staggered as to produce a row or groups of rows of narrow loops in juxtaposition to a row of wide loops transversely of the fabric, and the wide loops may be utilized to draw together face wefts which
10 also support rows of narrow loops so as to give a chain-like or linked effect transversely of the fabric. If desired, the longer loops may be sheared to provide cut pile tufts as high or higher than the uncut loops so as to simulate cut and
15 uncut velvets made in a single piece on a wire loom.

In the weaving of fabrics face to face in accordance with my invention, there is preferably utilized a double shuttle loom having a set of warpwise-extending members or pile gauges
20 which pass through the dent spaces of the loom reed and between the grounds of the two fabrics and provide a support between the grounds for face wefts on which are looped pile warps for forming self-separating pile loops attached to
25 the respective grounds.

The shorter pile loops on each ground are looped over picks disposed between the gauges and the ground of the other fabric, with the apex
30 of a short loop on one ground overlapping the apex of a short loop on the opposite ground. The longer loops of each fabric are looped on a pick laid between the gauges and the ground of the other fabric, then looped on a pick laid
35 between the gauges and the ground to which they are attached, and then looped on a weft laid between the gauges and opposite ground before being again secured in the ground from which they started by being looped on a ground weft
40 thereof. In forming the longer loops of the two grounds, certain of the wefts may be utilized as common supports for a loop on each ground.

Instead of having each pile warp returned to and secured in the ground from which it originates, the pile warps, or some of them, may, at certain sections of the fabric, be looped on wefts bearing against opposite sides of the gauges and then secured in the ground of the fabric opposite to the ground from which they originated. Such
45 ground-interconnecting warp sections may be

returned immediately to the ground from which they started and be looped on wefts on opposite sides of the gauges during their return passage, or such warps may be utilized to form long or short loops or both of them on the ground opposite to that from which they originated before
5 being returned to the latter. Instead of using the same warp ends for forming short loops, long loops, and ground interconnecting warp sections, different warp ends may be used for forming
10 loops and for forming ground-interconnecting warp sections.

When the pile made consists only of loops of different heights or widths, the fabrics are self-separating as they pass off the ends of the gauges
15 in weaving down toward the take-off rollers. When the grounds are interconnected by ground-interconnecting warp lengths, the additional length of the ground-interconnecting sections, resulting from looping them on wefts on opposite
20 sides of the gauges, permits the separation of the grounds, when the loops pass off the gauges, a distance in excess of the height of the gauges and equal to the distance diagonally across a gauge between a weft on one side and a weft
25 on the opposite side thereof on which interconnecting warp sections are looped. By suitably adjusting the height of the gauges, the grounds may be so separated that the apexes of the short loops, which were woven in overlapping relation,
30 are spaced sufficiently apart to permit the cutting of the interconnecting warp sections by the usual reciprocating cutter of a double shuttle loom, so as to form cut pile tufts of greater height than the height of the loops and provide a fabric
35 having a plurality of different heights of loops and cut tufts differing in height from all the loops, by which a large variety of attractive designs may be produced.

The height or diameter of the gauges controls
40 the heights of the pile loops relative to one another and the height of the cut pile relative thereto, hence the heights of the loops relative to one another and to the cut tufts may be varied by varying the height of the gauges and by varying
45 the number of wefts on opposite sides of the gauges on which the warps are looped or floated between their exit from a ground and entry into a ground. The actual height of the loops and cut tufts from the ground may be controlled by
50 the let-off mechanism of the loom independently of the height of the gauges, since the latter acts primarily as a connecting pin for supporting the wefts on which the warps are looped. Fabrics embodying my improvements may be made dou-
55

ble on a double shuttle loom having fixed pile gauges or may be made on a single shuttle loom having shedded pile gauges, the fabric being preferably woven single when made on a single shuttle loom.

The characteristic features and advantages of my improvements will further appear from the following description and the accompanying drawing in illustration thereof.

In the drawing, Fig. 1 illustrates diagrammatically the weaving face to face, in accordance with my invention, of fabric having low pile loops, high pile loops and ground-interconnecting warp lengths adapted to be cut to form pile tufts; Fig. 2 is a graph illustrating the drawing of the fabric warps in a dent through heddles mounted in suitable heddle frames and also showing the shedding of the fabric warps while each pair of picks is being laid simultaneously by the shuttles of a double shuttle loom; Fig. 3 illustrates diagrammatically a repeat of a fabric formed by cutting apart the fabric illustrated in Fig. 1; Fig. 4 illustrates diagrammatically the weaving double of a dent width of fabric in accordance with my invention having long pile loops and short pile loops only on each fabric; Fig. 4a shows graphs of a suitable draw and shedding sequence in weaving yarns as shown in Fig. 4; Fig. 5 illustrates diagrammatically the weaving of a dent width of fabric complementary to the dent width of fabric shown in Fig. 4 with which it may be used in suitable dent groupings to produce a fabric having a group of rows of narrow low loops and in widthwise juxtaposition thereto a row of wide high loops, which may be caused to so constrain the face wefts supporting the loops as to form a chain or link design widthwise of the fabric; Fig. 5a shows graphs of a suitable draw and shedding sequence in weaving yarn as shown in Fig. 5; and Fig. 6 is a top plan view of a fragmentary section of a fabric resulting from combining together in a fabric groups of dent widths woven in accordance with Figs. 4, 4a, 5 and 5a.

The manufacture of fabric in accordance with my invention may be carried out on a usual type of double shuttle loom having shuttles X and X' which are simultaneously operable in fixed planes to respectively lay weft above and below stationary warp-wise extending members or gauges A which may be supported by a stationary bar fixed to the frame of the loom or to a heddle frame indicated by the broken line marked "wire frame" in the diagram at the right of Fig. 2, and which remains stationary when operating the loom as a double shuttle loom but may be shedded when operating the loom as a single shuttle loom. The warpwise members A may consist of wires or of flat or round metal strips, which extend through the dent spaces of the reed and between the grounds of the fabric being woven a slight distance beyond the fell line.

The diameter or height of the warpwise members or gauges A regulate the relative heights of the short loops and long loops, and also regulate the heights of the cut tufts relative to the uncut loops when cut tufts are formed from ground-interconnecting pile warp sections. The actual heights of the short loops, of the long loops, and of the cut tufts above a ground are controlled by the coaction of the pile let-off mechanism of the loom with the warpwise members or gauges A, which latter act essentially as connecting pins and supports for face wefts, on which latter warps are looped to form the short loops, to form the long loops, and to elongate

the length of the sections of ground-interconnecting warps between their exit from a ground and entry into an opposite ground.

In weaving a fabric having short loops, long loops and cut tufts formed by ground-interconnecting warp lengths, there may be utilized the backing warps B, B' for the top fabric, the backing warps B³ and B⁴ for the bottom fabric, and the pile warps P¹, P², all of which are shedded in properly timed relation by suitable heddles and shedding mechanism.

In weaving the embodiment of my invention illustrated in Figs. 1 to 3 of the drawing, the warp ends in a dent space of the reed, may be drawn conveniently through heddles mounted in heddle frames TB, TB², BB⁴, BB³, PF², and PF¹ arranged as shown in the diagram at the right of Fig. 2. The gauges A may be mounted in a frame GF between the frames BB³ and PF².

In weaving a repeat of the fabric illustrated diagrammatically in Figs. 1 to 3, the cycle may be considered as starting with the simultaneous laying of the picks or wefts 1A and 1B by the upper shuttle X and the lower shuttle X' respectively; the weft yarns laid by both shuttles being preferably of the same size or count.

The positions occupied by the warp yarns during the laying of the wefts are indicated by the left hand diagram of Fig. 2 showing the "up", "middle" or "down" position of each warp during the laying of each pair of picks. The presence of a dot in a square indicates that the warp is in an "up" position; the presence of an "X" indicates that the warp is in a middle position; and a blank square indicates that the warp is in a down position. Each vertical row of squares of the diagram indicates the positions of the warp threads identified by the symbols at the left of the diagram. The resultant positions of the warps in the fabric are illustrated in Fig. 1.

During the laying of the picks 1A and 1B, the usual harnesses of the loom so position the heddles through which the warp yarns respectively pass as to hold in the upper pile position the warp threads P¹, hold in the down pile position the warp threads P², hold in the upper position of the top shed the ground warp threads B¹, hold in the lower position of the top shed the ground warp threads B², hold in the upper position of the bottom shed the ground warp threads B³, and hold in the lower position of the bottom shed the ground warp threads B⁴. The weft 1A therefore forms a ground weft in the upper fabric and secures thereto the pile warp threads P¹, while the weft 1B forms a ground weft in the bottom fabric and secures therein the pile warp threads P².

During the reverse movement of the shuttles X and X', to lay respectively the picks or wefts 2A and 2B, the harnesses so position the heddles as to hold in the middle pile position the pile warp threads P¹, P², hold in the upper position of the top shed the ground warp threads B², hold in the lower position of the top shed the ground warp threads B¹, hold in the upper position of the bottom shed the ground warp threads B⁴, and hold in the lower position of the bottom shed the ground warp threads B³. Consequently, the weft 2A will be laid to form ground weft in the upper fabric and the weft 2B will be laid to form a weft in the bottom ground.

During the laying of the wefts 3A and 3B by the shuttles X and X' respectively, the loom harnesses position the heddles so as to hold in the upper pile position the pile warp threads P¹, P²,

hold in the upper position of the top shed the ground warp threads B¹ and B², hold in the upper position of the bottom shed the ground warp threads B³, and hold in the lower position of the bottom shed the ground warp threads B⁴. Consequently the pick or weft 3B forms a ground weft in the bottom fabric and the pick or weft 3A lies between the top ground and the top of the gauges A and rests against the latter to form a support for the loop pile warp threads P².

On the next movement of the shuttles X and X', they respectively lay the ground weft 4A and the ground weft 4B, and during the laying of the weft 4A and 4B, the harnesses of the loom so position the heddles as to hold in the lower pile position the pile warp threads P¹, P², hold in the upper position of the top shed the ground warp threads B², hold in the lower position of the top shed the ground warp threads B¹, and hold in the lower position of the bottom shed the ground warp threads B³ and B⁴. Consequently the weft 4A forms merely a ground weft in the upper fabric. The weft 4B is laid between the lower fabric and the bottom of the gauges A and forms a support for the pile warp threads P¹.

During the laying of the wefts 5A and 5B by the respective shuttles X and X', the loom harnesses so position the heddles as to hold in the upper pile position the pile warp threads P¹, hold in the lower pile position the pile warp threads P², hold in the upper position of the top shed the ground warp threads B¹, hold in the lower position of the top shed the ground warps B², hold in the upper position of the bottom shed the ground warp threads B³, and hold in the lower position of the bottom shed the ground warp threads B⁴. Consequently the weft 5A forms a ground weft in the upper fabric and secures therein the pile warp threads P¹ which are looped over the weft 4B. The weft 5B forms a ground weft in the lower fabric and secures therein the pile warp threads P² which are looped over the weft 3A.

During the laying of the wefts 6A and 6B by the respective shuttles X and X', the loom harnesses so position the heddles as to hold in the upper pile position the pile warp threads P¹, P², hold in the upper position of the top shed the ground warp threads B¹ and B², hold in the upper position of the bottom shed the ground warp B⁴, and hold in the lower position of the bottom shed the ground warp B³. The weft 6A is laid between the tops of the gauges A and the upper ground and rests upon the gauges A to provide a support for pile warp threads P². The weft 6B is laid in the ground of the lower fabric.

During the laying of the wefts 7A and 7B by the respective shuttles X and X', the loom harnesses so position the heddles as to hold in the lower pile position the pile warp threads P¹, P², hold in the upper position of the top shed the ground warp threads B², hold in the lower position of the top shed the ground warp threads B¹, hold in the lower position of the bottom shed the ground warp threads B³ and B⁴. The weft 7A is laid in the ground of the top fabric and the weft 7B is laid between the bottom ground and the gauges A, against which it bears to support the pile warp threads P¹ and P².

During the laying of the wefts 8A and 8B by the respective shuttles X and X', the loom harnesses so position the heddles as to hold in the upper pile position the pile warp threads P¹ and P², hold in the upper position of the top shed the ground warp threads B¹ and B², hold in the

upper position of the bottom shed the ground warp threads B⁴, and hold in the lower position of the bottom shed the ground warp threads B³. Consequently, the weft 8A lies between the upper ground and the gauges A and supports the pile warp threads P¹ and P². The weft 8B merely forms a ground weft in the lower fabric.

During the laying of the wefts 9A and 9B, the ground warp threads B¹, B², B³ and B⁴ and the pile warp threads P¹, P² occupy the same positions as during the laying of the wefts 4A and 4B, consequently the weft 9A forms a ground weft in the upper ground and the weft 9B is supported against the gauges A between such gauges and the bottom ground and supports the pile warp P¹.

During the laying of the wefts 10A and 10B, the pile warp threads and the ground warp threads all occupy the same positions as during the laying of wefts 1A and 1B, and the weft 10A forms a ground weft in the top ground and secures the pile warp threads P¹ therein. The weft 10B forms a ground weft in the lower fabric and secures the pile warp threads P² therein.

During the laying of the wefts 11A and 11B, the pile warp threads and ground warp threads occupy the same relative positions as they do during the laying of the wefts 4A and 4B. The weft 11A merely forms a ground weft in the upper fabric while the weft 11B lies between the lower ground and the gauges A and bears against the latter to support the pile warp threads P¹.

During the laying of the wefts 12A and 12B, the ground warps B¹, B², B³ and B⁴ and the pile warps P¹, P² occupy the same positions as during the laying of the wefts 8A and 8B. The weft 12A lies between the gauges A and the upper ground and supports the pile warp threads P¹ and P². The weft 12B forms a ground weft for the bottom fabric.

During the laying of the wefts 13A and 13B, the pile warp threads P¹ and P² are in the lower pile position, the ground warp threads B¹ and B² are in the upper position in the top shed, and the ground warp threads B³ and B⁴ are in the lower position in the bottom shed. This results in the laying of the pick 13B between the ground of the bottom fabric and the gauges A. The weft 13B engages the gauges A and forms a temporary support for a loop formed by sections of the pile warps P¹ and P², which are subsequently cut to form tufts. The pick 13A is laid between the gauges A and the ground of the top fabric, and when the section of the pile P¹ looped over the weft 13B is subsequently cut the weft 13A is pulled out and wasted. This wastage is to maintain the balance and symmetry of the ground of the fabric in which two ground wefts are laid between each ground weft over which pile warp is looped.

During the simultaneous laying of the picks 14A and 14B the pile warps are in the same position as during the laying of the wefts 12A and 12B, with the consequent formation of a further row of temporary loops by the pile warps P¹ and P² bent over the weft 14A, and the laying of the ground weft 14B in the ground of the bottom fabric.

During the simultaneous laying of the picks 15A and 15B, the pile warps are in the same positions as during the laying of the wefts 11A and 11B, with the consequent laying of the weft 15A in the ground of the top fabric and the laying of the weft 15B between the gauges A and the ground of the bottom fabric. The weft 15A, however, forms a support for a loop formed by the

bending thereover of the pile warp P^2 , instead of forming a loop from a section of the pile warp P^1 , which latter is carried downwardly into the bottom ground on the next movement of the loom.

During the laying of the wefts 16A and 16B, the pile warp P^1 is held in the lower pile position to effect its engagement in the bottom ground by the weft 16B and the pile warp P^2 is held in the upper pile position to effect its engagement in the upper ground by the ground weft 16A. The ground warp B^1 and B^2 and the ground warps B^3 and B^4 are in the same position as during the laying of the wefts 10A and 10B and interlace the wefts 16A and 16B in the respective grounds.

From this onward the warps are so shedded as to cause the pile warp P^1 to form in reverse on the bottom fabric the tufts and loops which it has just formed on the top fabric, and to cause the pile warp P^2 to form in reverse on the top fabric the tufts and loops which it has just formed on the bottom fabric.

The requisite shedding for accomplishing this will be clearly apparent from the diagrams, from which it will be seen that by the warp shedding sequence the pick 17A is supported by the gauges A and supports a looped section of the pile warp P^1 and the pick 17B forms a ground weft in the lower fabric; the pick 18A forms a ground weft in the upper fabric and the pick 18B is supported against the gauges A opposite the pick 17A and forms a support for looped sections of the pile warps P^1 and P^2 ; the weft 19A is supported against the gauges A opposite the pick 18B and supports looped sections of the pile warps P^1 and P^2 and the pick 19B is wasted between the gauges and the bottom fabric, similarly to the wastage of the pick 18A; the pick 20A forms a ground weft in the upper fabric and the pick 20B is supported against the gauges A and forms a support for looped sections of the pile warps P^1 and P^2 ; the pick 21A is supported against the gauges A and forms a support for looped sections of the pile warp P^2 and the pick 21B forms a ground weft in the bottom fabric; the pick 22A forms a ground weft in the upper fabric and secures therein a pile warp P^1 and the pick 22B forms a ground weft in the bottom fabric and secures therein the pile warp P^2 ; the pick 23A is supported on the gauges A and supports a looped section of the pile warp P^2 and the pick 23B forms a ground weft in the bottom fabric; the pick 24A forms a ground weft in the top fabric and the pick 24B is supported against the gauges A and supports looped sections of the pile warps P^1 and P^2 ; the pick 25A is supported on the gauges A and supports looped sections of the pile warps P^1 and P^2 and the pick 25B forms a ground weft in the bottom fabric; the pick 26A forms a ground weft in the top fabric and the pick 26B is supported against the gauges A and supports a looped section of the pile warp P^1 . The warps are then moved into position to begin the repetition of the cycle.

As the fabrics so woven move down toward the take-off rolls the wefts supported against the gauges slip off the ends thereof and permit the self-separation of the fabrics until the point is reached where the pile warp threads P^1 pass from the upper fabric to the bottom fabric and the pile warp threads P^2 pass from the top fabric to the bottom fabric, and vice versa. These ground interconnecting thread lengths are severed by the cutter Y so as to form tufts, as shown in Fig. 3. It will be noted that by my method of weaving

there are formed on each fabric short loops 3a resulting from the passage of a pile warp section over but a single gauge supported weft before being secured to the ground, longer loops 7b formed by the looping of warp sections on picks on opposite sides of the gauges A, tufts 12a formed by cutting warp sections passing from one ground to the other and passed back and forth across the gauges and looped on wefts on opposite sides thereof during the passage of the warps from one ground to the other; double cut tufts 16b formed by cutting pile warp threads passing from one ground to another and back again and supported during each passage back and forth across the gauges A and looped on wefts on opposite sides thereof; cut tufts 21a formed by cutting a continuation of the pile warp forming the tuft 12a and long loops 24b similar to the long loops 7b. The fabric is thus provided with uncut loops of double lengths, one of which is higher than the distance between the grounds during weaving and with cut tufts longer than the uncut loops. By suitably looping the loops and tufts a wide variety of attractive designs may be produced complementary to the colors of the yarns or independently thereof.

In accordance with my invention as illustrated in Figs. 4, 4a, 5, 5a, and 6, the loops of warp threads in adjacent dents of the reed are staggered so that pile warps in certain dent spaces form short narrow loops over a group of wefts and pile warps in other of the dent spaces form long wide loops over the same group of ground wefts, and vice versa. To effect this staggered arrangement a larger number of heddle frames are required.

The arrangement of the heddle frames and the draw and shedding of the warps in one group of dent spaces is shown in Fig. 4a and the draw and shedding of the warps in the other groups of dent spaces is shown in Fig. 5a, and the loops formed on each fabric by the warp threads in each group of dents are shown in Fig. 4 and in Fig. 5 respectively.

As illustrated in these diagrams, the pile warps p^1 , p^2 , p^3 and p^4 are threaded through heddles in the respective heddle frames 1, 2, 3 and 4; the top backings b^1 and b^2 are threaded in heddles in the respective heddle frames 9 and 7, and the bottom backings b^3 and b^4 are threaded in heddles in the respective heddle frames 6 and 8. The gauge wires a may be threaded through heddles fixed to the heddle frame 5 or fixed to a cross-bar thereon or on the frame of the loom.

During the simultaneous laying by the shuttles X and X' of the picks 1a and 1b, the pile warps p^1 and p^3 are in the upper pile position and the pile warps p^2 and p^4 are in the lower pile position; the upper ground warp threads b^1 are in the upper position in the top shed, the ground warps b^2 are in the lower position in the top shed, the ground warps b^3 are in the upper position in the bottom shed, and the ground warps b^4 are in the lower position in the bottom shed. Consequently the weft 1a forms a ground weft in the upper ground and secures therein the pile warps p^1 and p^3 and the weft 1b forms a ground weft in the lower ground and secures therein the pile warps p^2 and p^4 .

During the laying of the picks 2a and 2b, the heddles hold the pile warps p^1 , p^2 , p^3 and p^4 in the upper pile position, hold the ground warps b^1 and b^2 in the upper position in the top shed, hold the ground warps b^4 in the upper position in the bottom shed, and hold the ground warps 75

b^3 in the lower position in the bottom shed. The weft $2a$ is therefore laid between the ground of the top fabric and the gauges a and bears against the latter to support the pile warps p^2 and p^4 .

5 The pick $2b$ forms a ground weft in the bottom fabric.

10 During the laying of the wefts $3a$ and $3b$, the pile warps p^1 , p^2 , p^3 and p^4 are all held in the lower warp position; the ground warps b^2 are held in the upper position in the top shed, the ground warps b^1 are held in the lower position in the top shed, the ground warps b^3 and b^4 are held in the lower position in the bottom shed. The pick $3a$ forms a ground weft in the top fabric and the weft $3b$ is laid between the bottom fabric and the gauges a and bears against the latter to support pile warp threads p^1 , p^3 and p^4 . The pile warp threads p^2 are thereby caused to form loops having apexes projecting oppositely to the apexes of the loops formed by the pile warp threads p^4 on the wefts $2a$.

20 During the laying of the picks $4a$ and $4b$, the pile warp threads p^1 are in the upper pile position, the pile warp threads p^3 and p^4 are in the intermediate pile position, and the pile warp threads p^2 are in the lower pile position; the ground warp threads b^1 are in the upper position in the top shed, the ground warp threads b^2 are in the lower position in the top shed; the ground warp threads b^3 are in the upper position in the bottom shed, and the ground warp threads b^4 are in the lower position in the bottom shed. The pick $4a$ therefore forms a ground weft in the top fabric and secures therein the pile warp threads p^1 to complete the formation of narrow short loops on the top fabric which are temporarily supported by the engagement of the wefts $3b$ with the gauges a . The picks $4b$ form ground wefts in the bottom fabric and secure therein the pile warp threads p^2 to complete the formation of the short narrow pile loops by the pile warp threads p^2 on the bottom fabric, which are temporarily supported by the engagement of the wefts $2a$ with the gauges a . The apexes of the loops over the wefts $2a$ and $3a$ project beyond or overlap one another but are self-separating when withdrawn from the gauges a .

35 During the laying of the picks $5a$ and $5b$, the pile warp threads p^1 , p^2 , p^3 , and p^4 are all held in the upper pile position, the ground warp threads b^1 and b^2 are held in the upper position in the top shed, the ground warp threads b^4 are held in the upper position in the bottom shed, and the ground warp threads b^3 are held in the lower position in the bottom shed. The pick $5a$ is therefore laid between the top ground and the gauges a and rests on the latter to support the pile warp threads p^2 , p^3 and p^4 . This permits the formation of another row of low loops by the pile warp threads p^2 on the bottom fabric and permits the continuation of the floating of the pile warp threads p^3 and p^4 back and forth across the gauges between the fabrics so as to provide for the formation of long and wide loops on the respective fabrics. The pick $5b$ forms a ground weft in the bottom fabric.

40 During the laying of the picks $6a$ and $6b$, the ground warps p^1 , p^2 , p^3 and p^4 are all in the lower pile warp position, the ground warp threads b^2 are in the upper position in the top shed, the ground warp threads b^1 are in the lower position in the top shed, the ground warps b^3 and b^4 are in the lower position in the bottom shed. The pick $6a$ forms a ground weft in the top fabric.

and the gauges a and rests on the latter to support the pile warps p^1 and p^3 , the former forming another short loop and the latter being in the process of forming a long wide loop on the top fabric.

5 During the laying of the picks $7a$ and $7b$, the pile warp threads p^1 and p^3 are in the upper pile warp position, the pile warp threads p^2 and p^4 are in the lower pile warp position; the ground warp threads b^1 are in the upper position in the top shed, the ground warp threads b^2 are in the lower position in the top shed, the ground warp threads b^3 are in the upper position in the bottom shed, and the pile warp threads b^4 are in the lower position in the bottom shed. The picks $7a$ therefore form a ground weft in the top fabric and secure thereto the pile warp threads p^1 to complete the formation of a row of short narrow loops and secures thereto the pile warp threads p^3 to complete the formation of wide long loops on the upper fabric. The pick $7b$ forms a weft in the lower fabric and secures therein the pile warp threads p^2 to complete the formation of short narrow loops and secures thereto the pile warp threads p^4 to complete the formation of long wide loops on the bottom fabric. It will be observed that while the wefts $3b$ and $5a$ act simultaneously as supports for apexes of long loops on both the bottom and top fabric this does not result in the interlacing of the fabrics together but permits their self-separation when withdrawn from the gauges a .

25 During the laying of the picks $8a$ and $8b$, the pile warp threads p^1 , p^2 , p^3 and p^4 are all held in the upper pile position, the ground warp threads b^1 and b^2 are held in the upper position in the top shed, the ground warp threads b^4 are held in the upper position in the bottom shed, and the ground warp threads b^3 are held in the lower position in the bottom shed. Consequently the pick $8a$ is laid between the upper ground and the gauges a and rests on the latter to support the pile warp threads p^2 and p^4 . The pick $8b$ forms a ground weft in the lower fabric.

30 During the laying of the picks $9a$ and $9b$, the pile warps p^1 , p^2 , p^3 and p^4 are all held in the lower pile warp position, the ground warp threads b^2 are held in the upper position in the top shed, the ground warp threads b^1 are held in the lower position in the top shed, the ground warp threads b^3 and b^4 are held in the lower position in the top shed. The pick $9a$ forms a ground weft in the top fabric. The pick $9b$ is laid between the bottom fabric and the gauges a and bears against the latter to support the apexes of the loops being formed from the pile warp threads p^1 and p^2 and to support the apexes of loops being formed from the pile warp threads p^3 . The apexes of the loops formed over the wefts $9b$ project oppositely to the apexes of the loops formed over the loops $8a$.

35 During the laying of the picks $10a$ and $10b$, the pile warp threads p^3 are in the upper pile warp position, the pile warp threads p^1 and p^2 are in the intermediate pile position, and the pile warp threads p^4 are in the lower pile warp position; the ground warp threads b^1 are in the upper position in the top shed, the ground warp threads b^2 are in the lower position in the top shed, the ground warp threads b^3 are in the upper position in the bottom shed, and the ground warp threads b^4 are in the lower position in the bottom shed. The pick $10a$ forms a ground weft in the top fabric and secures thereto the pile warp threads p^3 to complete the formation of

75 The pick $6b$ is laid between the bottom fabric

short narrow loops therefrom on the top fabric. The pick 10b forms a ground weft in the bottom fabric and secures thereto the pile warp threads p^4 to complete the formation of short narrow loops therefrom on the bottom fabric.

During the laying of the picks 11a and 11b the pile warp threads p^1 , p^2 , p^3 and p^4 are in the upper pile warp position; the ground warps b^1 and b^2 are in the upper position in the top shed, the ground warps b^4 are in the upper position in the bottom shed, and the ground warps b^3 are in the lower position in the bottom shed. The pick 11a is laid between the top fabric and the gauges *a* and rests on the latter to support the apexes of loops formed from the pile warp threads p^1 , p^2 , and p^4 . The pick 11b forms a ground weft in the bottom fabric.

During the laying of the picks 12a and 12b the pile warp threads p^3 and p^4 are in the upper pile warp position, the pile warp threads p^1 and p^2 are in the lower pile warp position, the ground warps b^2 are in the upper position in the top shed, the ground warps b^1 are in the lower position in the top shed, and the ground warps b^3 and b^4 are in the lower position in the bottom shed. The pick 12a forms a ground weft in the top fabric. The pick 12b is laid between the bottom fabric and the gauges *a* and rests against the latter to support loops formed from the pile warps p^1 and forming long wide loops on the top fabric and support the pile warp threads p^3 forming narrow short loops on the top fabric. The pile warps p^1 and p^3 are secured in the top fabric and one of the initial picks of the next repeat and the pile warp threads p^2 and p^4 are secured in the bottom fabric by the other of the initial pair of picks in the next repeat, to complete the formation of long wide loops on the bottom fabric from the pile warp threads p^2 and to complete the formation of short narrow loops on the bottom fabric from the pile warp threads p^4 .

As the fabrics pass down toward the take-up rolls the wefts engaging the gauges *a* slip off the ends thereof and thereby permit the self-separation of the top and bottom fabrics by merely severing the wefts along the selvages.

When the fabrics are separated, the bottom fabric, for instance, will have in staggered relation to one another long and wide loops formed by the pile warp threads p^4 looped over and supported by the wefts 2a and 5a and long and wide loops formed by the pile warp threads p^2 looped over and supported by the wefts 8a and 11a. The first named wide and long loops will have in alignment therewith the short and narrow loops formed by the looping of the pile warp threads p^2 to form individual loops over the wefts 2a and 4a, and the second group of long and wide loops will have in alignment therewith relatively short and narrow loops formed by the looping of the pile warp threads p^4 over the wefts 8a and 11a to form individual loops. By appropriately grouping the long and short loops formed by the pile warp threads there may be formed patterns such as shown in Fig. 6 in which a chain-like pattern is produced by the intersection of the ends of pairs of short narrow loops spaced by recesses by groups of long wide loops.

Having described my invention, I claim:

1. A pile fabric having a repeat including in sequence a row of uncut loops, a second row of uncut loops differing in height from the first row and forming a continuity of the pile warp threads forming the first row of loops, a row of cut tufts forming a continuity of pile warp

threads forming said rows of uncut loops, a pair of rows of cut tufts connected together by bights, a further row of cut tufts, and a row of uncut loops forming a continuity of the pile warp threads forming said last named row of cut tufts.

2. In the manufacture of pile fabrics on a loom provided with warpwise extending gauges, the steps which include forming a ground parallel with the plane of said gauges, laying a weft on the face of said gauges opposite said ground, looping warp threads secured to said ground about said weft, laying a weft between the gauges and ground, looping said warp threads about said weft between said weft and the ground, laying a weft on said face of said gauges opposite said ground, looping said warp threads about said weft and securing said warp threads in said ground.

3. In the manufacture of pile fabric face to face with the ground of one fabric on one side of warp-wise extending members and the ground of the other fabric on the other side of the warp-wise extending members, the steps which consist in securing a pile warp in a ground, looping such pile warp over a weft between said members and the opposite ground, securing said pile warp in the ground to which it was first secured, looping said pile warp on a weft between said members and the opposite ground, looping said warp on a weft between said members and the ground to which it was first secured, looping said warp on a weft between said members and ground opposite to that to which it was first secured, and securing said warp to the ground to which it was first secured.

4. In a frieze pile fabric having a ground containing ground wefts and ground warps, warp loops of different lengths secured to said ground and looped over wefts which are free from interlacing with the ground warps, said warp loops of different lengths being looped over different numbers of such free wefts and over the same number of ground wefts regardless of the length of the warp loops.

5. A woven pile fabric having uncut pile face loops of graduated heights and enclosing different numbers of loop-supporting wefts and cut pile formed from tufts higher than the uncut loops aforesaid.

6. In the manufacture of pile fabric on a loom provided with warp-wise extending gauges having free ends, the steps which include forming a ground parallel to the plane of the gauges, looping a pile warp thread over a weft supported by said gauges to form a loop having both legs secured to said ground and an apex projecting from said ground, looping said pile warp successively over wefts positioned on opposite sides of said gauges and spaced from said ground to form a plurality of loops having oppositely extending apexes all spaced from said ground, securing said warp threads to said ground, looping said pile warp successively over wefts positioned on opposite sides of said gauges to form loops having oppositely extending apexes all spaced from said ground, securing said pile warp in said ground, and cutting the warp section forming said last named group of loops to form a cut tuft.

7. In the manufacture of pile fabrics, the method of forming elongated pile loops having both legs secured in a common ground which includes—forming a ground by interlacing ground warps and ground wefts, concurrently therewith positioning sets of pile-warp-support-

ing wefts in several planes spaced from one another in a direction normal to the plane of the ground and free from interlacing with the ground warps, and taking pile-forming warp secured to said ground and looping it about wefts in the several planes so that said pile-forming warp crosses the distance between said planes at least four times without interlacing with the wefts of said ground, and then securing said pile-forming warp in said ground.

8. In the manufacture of pile fabrics, the steps which include—interlacing ground warps and ground wefts to form a pair of grounds spaced apart, concurrently therewith positioning two sets of loop-forming wefts between said grounds in planes spaced from one another in a direction normal to said grounds and free from interlacing with the ground warps thereof, the wefts in one plane being staggered warpwise of the fabric relatively to the wefts in the other plane, securing pile warp threads in one of said grounds, looping said pile warp threads in oppositely turned loops first about weft in one plane, then about weft in the other plane, then about weft in the first plane so that said pile warp threads cross the distance between said planes at least four times without interlacing with the ground wefts of either of said grounds, then securing said pile warp threads in said first named ground, then looping said pile warp threads in oppositely turned loops first about weft in one of said planes, then about weft in the other of said planes so that said pile warp threads cross the distance between said planes an uneven number of times without interlacing with ground wefts of either ground, and then securing said pile warp threads in the second ground.

9. In the manufacture of pile fabrics face to face the steps which include—interlacing ground warps and ground wefts to form a pair of grounds spaced apart, concurrently therewith positioning two sets of loop supporting wefts between said grounds in planes spaced from one another in a direction normal to said grounds and free from interlacing with the ground warps thereof, looping a set of pile-forming threads secured in one ground about loop-supporting weft in one of said planes, and free from interlacing with ground wefts, looping some of said set of pile forming threads about loop-supporting weft in the second of said planes and free from interlacing with ground wefts and securing other of said set of pile forming threads in the ground from which they started, looping a second set of pile-forming threads, which are secured in the second ground, about the second named loop-supporting weft and free from interlacing with ground weft, the pile-forming threads of both sets which are looped about the second named loop-supporting weft passing around it in the same direction, securing some of the second set of pile-forming threads in the ground from which they started, looping

about further weft in the first named plane all the pile-forming threads of the first set, and also pile-forming threads of the second set which were last looped about weft in the second named plane, all of the loops about the third named weft passing around it in the same direction and being free from interlacing with ground wefts, securing all the pile-forming threads of the first set in the first ground, looping about further weft in the second plane all the pile forming threads of the second set, and securing all the pile-forming threads of the second set in the second ground.

10. In the manufacture of pile fabrics, the steps which include—forming a ground, concurrently therewith laying loop-supporting wefts in two planes spaced from one another in a direction normal to said ground and free from interlacing with the ground warps thereof, the wefts in one plane being staggered relative to the wefts in the other plane, securing a pile-forming warp to said ground looping said pile-forming warp about a weft in the upper plane, then directly and before interlacing with the ground about a weft in the lower plane and then about a second weft in the upper plane.

11. In the manufacture of pile fabrics face to face, the steps which include—weaving a plurality of grounds spaced from one another, concurrently therewith laying two sets of wefts, free from interlacing with the ground warps, between said grounds and in planes parallel with said grounds and spaced from one another in a direction normal to the grounds, the wefts in one plane being staggered relative to the wefts in the other plane warpwise of the fabric, looping a pile-forming warp secured to one of the grounds about a weft in the plane more remote from such ground, then looping such pile-forming warp and pile-forming warp secured to the second ground about a weft lying in the plane nearer to the first named ground, both of said warps looping in the same direction about the same side of said weft, then looping said second named warp about a weft lying in the plane more remote from the first ground, and thereafter securing said warps in said grounds, each of said warps crossing the distance between the planes of said sets of wefts at least four times between the points where said warps are secured in the grounds, said warps being self-separating.

12. In the manufacture of pile fabrics, the method of forming elongated pile which includes securing a pile-forming yarn to a ground of the fabric temporarily forming a plurality of sequential loops, free of interlacing with the ground, in such yarn and supporting said loops at their bights in different planes which are spaced from one another in a direction normal to the ground, securing said pile-forming yarn to the fabric ground and then releasing said supports for the loops.

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