APPARATUS AND METHOD FOR WEAVING FABRIC WITH INTRICATE PILE FORMATIONS

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ABSTRACT

Utilizing the principle of hogging pile yarns above and across warpwise extending pile formers or wires in the weaving of pile fabrics, this invention is directed to a method and apparatus in which a plurality of weftwise rows of vertically movable and weftwise movable pile yarn guides are employed and wherein the rows of pile yarn guides and the respective pile yarns are hogged weftwise varying amounts independently of each other under control of a pattern mechanism.

51 Claims, 38 Drawing Figures
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The art of weaving pile fabrics on a loom by shogging pile yarns weftwise over stationary and/or movable warpwise extending pile formers or pile wires of uniform and/or variable heights is well known. Also, it is known to utilize two weftwise rows of pile yarn guides for shogging respective sets of pile yarns reciprocally across and above pile wires, and which dip into and out of the warp shed following each shogging movement thereof to form warwise rows of double pile loops which may be parallel or wherein one loop of each pair crosses over the other, as disclosed, for example, in Clark's U.S. Pat. No. Re. 24,949 dated Mar. 21, 1961.

We have now discovered that much more intricately variegated designs in pile arrangements may be produced in pile fabrics than have been known heretofore by constructing and controlling plural weftwise rows of pile yarn guides in such manner that each such row may be shogged varying amounts weftwise of the loom independently of and/or in unison with the other row or rows of pile yarn guides during continuous operation of the loom in accordance with a predetermined pattern.

It is therefore an object of this invention to provide an improved apparatus and method of weaving pile fabrics on a loom so as to produce many different pile patterns or designs which have not been obtainable heretofore to our knowledge.

It is another object of this invention to provide an improved apparatus and method for weaving novel variegated pile fabrics from different colors or kinds of pile yarns on a loom of the type in which pile yarn feed guides are utilized to shog pile yarns across and above pile formers and are dipped into and out of the ground warp shed during each pick or certain spaced picks of the loom, and wherein at least some or all of the pile yarns may be shogged weftwise of the loom varying distances during selected pile forming picks of the loom according to a predetermined pattern.

It is still another object of this invention to provide an improved apparatus and method for weaving on a loom of the character described, wherein at least two substantially parallel weftwise rows of pile yarn feed guides are so controlled that any one or more of the following different operations of the pile yarns being guided through the pile yarn guides may be effected in any desired sequence according to a predetermined pattern:

1. At times, shog all of the pile yarns simultaneously the same distance in the same weftwise direction, and at other times, shog some of the pile yarns weftwise relative to other of the pile yarns;
2. Shog certain pile yarns weftwise of the loom while maintaining certain other pile yarns stationary as to weftwise movement and/or vice versa during at least one pile-forming pick, and preferably during several successive pile-forming picks of the loom, so as to form floats of said certain pile yarns while forming pile loops of the certain other pile yarns;
3. Shog at least some of the pile yarns weftwise at times a given distance and at other times a different distance from the given distance during successive pile-forming picks of the loom;
4. Shog each of certain pile yarns weftwise over a greater number of pile formers than that over which each of certain other pile yarns are being shogged during a single pile forming pick or a plurality of successive pile-forming picks of the loom; and
5. Shog the pile yarns weftwise at times in unison, and at other times, shog certain of the pile yarns in one weftwise direction while shogging certain others of the pile yarns in the opposite weftwise direction.

Still another object of this invention is to provide a novel pattern mechanism for imparting the various shogging motions to pile yarns as described above.

In its preferred embodiment, the apparatus for carrying out the method of this invention is provided in combination with a loom and includes two weftwise extending, substantially parallel rows of spaced pile yarn feed guides mounted above a weftwise series of pile formers which are preferably in the form of elongate pile wires extending warwise through an oscillatable reed and forwardly of the fell of the fabric being woven. The ground warps of the loom are preferably divided into spaced groups with one of the pile wires being aligned with each group of ground warps. Pattern control means are provided for selectively shogging in two rows of pile yarn guides weftwise independently of each other across and above the groups of ground warps and corresponding pile wires in the course of each pile-forming pick of the loom.

It should be noted that a shogging motion of either or both rows of pile yarn guides may occur during each pick, or during each of certain spaced picks of the loom, referred to herein as a "pile-forming pick," depending upon whether a single-shot or a multiple-shot pile fabric is being woven. In any event, following each such shogging motion of either or both rows of pile yarn guides in effecting the corresponding pile forming operation, the pile yarn guides are dipped downwardly into the ground warp shed between the pile wires and forwardly of the reed to position pile yarns extending through eyelets of the guides beneath the path of a weft-inserting means. A shot of weft yarn then is inserted in the warp shed over the pile yarns, whereupon the pile yarn guides are withdrawn upwardly out of the shed to draw the pile yarns, under tension, upwardly between the pile wires to form continuous pile loops from all or certain of the pile yarns over corresponding pile wires and grounds of ground warps, with the pile yarns, or the certain pile yarns, as the case may be, looped beneath corresponding weft yarns.

All the pile yarns, or certain groups of the pile yarns may be of different colors, shades, and/or kinds with respect to each other, or all of them may be of the same color or kind, and/or alternate pile yarns may be of a different color or kind from the intervening pile yarns therebetween. Each pile yarn guide may have a single pile yarn or two or more pile yarns threaded therethrough, and each row of pile yarn guides may have one or more pile yarns threaded through each guide thereof and corresponding to each pile wire and/or group of ground warps. Alternatively, one row of pile yarn guides may be arranged to feed one or more pile yarns to each of certain alternately spaced pile wires and respective groups of ground warps with the other row of pile yarn guides being arranged to feed one or more other pile yarns to each intervening pile wire and respective intervening group of ground warps between the alternately spaced pile wires and groups of ground warps.

By arranging the pattern mechanism to cause the two rows of pile yarn guides to manipulate the pile yarns in various sequences such as have been described above, and by choosing and varying the arrangement of the pile yarns through the pile yarn guides substantially as indicated above, a wide range of variegated different designs of pile fabrics may be obtained many of which could only be produced on conventional Axminster or gripper-type looms heretofore. The range of pile designs may be further increased by utilizing pattern controlled warwise movable pile wires provided with pile supporting surfaces thereon of varying heights which are selectively moved into and out of pile forming position relative to the rows of pile yarn guides to form correspondingly varying heights of pile loops or pile loop areas in the fabric. Such pile wires also may be selectively withdrawn entirely from pile forming position so that corresponding pile yarn guides will form ground-engaging pile loops over respective groups of ground warps. Certain or all of the pile wires may be provided with cutting blades for severing the corresponding loops formed thereon, and where high loops are relative low or short loops are being formed in alternation over any particular pile wires, corresponding cutting blades thereon may be arranged so as to sever either or both the high and the low loops. It is also contemplated that shearing equipment may be employed for severing the entire pile surface of the fabric or for severing the pile surface of the fabric after the pile fabric has been removed from the loom. Of course, where the fabric includes pile loops of different heights, only the relatively high loops may be severed by such shearing equipment.
Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

FIG. 1 is a schematic side elevation of a loom embodying the invention, the right-hand side of this view illustrating the portion of the loom at which the cloth being woven is being taken up, and which shall be considered the front of the loom for the purposes of this disclosure;

FIG. 2 is an enlarged vertical sectional view, mostly in elevation, looking substantially along line 2—2 in FIG. 1, but wherein many of the parts are broken away for purposes of clarity;

FIG. 3 is a further enlarged transverse vertical sectional view through the loom taken substantially along line 3—3 in FIG. 2;

FIG. 4 is an enlarged perspective view of one of two heads of the pattern mechanism of the instant invention, looking in the general direction of the arrow indicated at 4 in FIG. 2;

FIG. 5 is an enlarged fragmentary plan view taken substantially along line 5—5 in FIG. 2, showing one of the pattern heads partially in cross section;

FIGS. 6, 7 and 8 are fragmentary vertical sectional views taken substantially along the respective lines 6—6, 7—7 and 8—8 in FIG. 5;

FIG. 9 is a fragmentary perspective view looking in the general direction of the arrow indicated at 9 in FIG. 5;

FIG. 10 is a fragmentary longitudinal vertical sectional view through the relatively axially movable shogging roller shafts for the pile yarn guide means, taken substantially along line 10—10 in FIG. 9;

FIG. 11 is a transverse vertical sectional view through the pile yarn guide means taken substantially along line 11—11 in FIG. 10;

FIG. 12 is a schematic perspective view of drive means for various movable components of the loom;

FIG. 13 is an enlarged fragmentary vertical sectional view taken substantially along line 13—13 in FIG. 9, wherein the guides for the two sets of pile yarns occupy a lowered position in the shed such that all the pile yarns are looped beneath the weft strands;

FIG. 13A is a warpwise fragmentary vertical sectional view through a portion of pile fabric produced by the arrangement of the pile yarn guides in FIG. 13;

FIG. 14 is a view similar to FIG. 13, but wherein the rear set of pile yarn guides is positioned on a higher level than the front set of pile yarn guides such that the respective pile yarn loops thereof straddle the lowermost of a pair of upper and lower weft inserts or needles, resulting in the lower bights of some of the pile tufts being positioned between upper and lower weft strands, and the lower bights of others of the pile tufts being positioned beneath all of the weft strands;

FIG. 14A is a warpwise vertical sectional view through a portion of pile fabric produced by the arrangement of the pile yarn guides in FIG. 14;

FIG. 15 is a view similar to FIGS. 13 and 14, wherein the positions of the pile yarn guides are such relative to the supporting bars therefor that all the pile yarns extend between the upper and lower weft inserts when the pile yarn guides occupy their lowermost positions, and so that the lower bights of all the pile tufts are positioned between the upper and lower weft strands in the resulting fabric;

FIG. 15A is a warpwise fragmentary vertical sectional view through the pile fabric produced by the pile yarn guides as arranged in FIG. 15;

FIGS. 16-19 are perspective views of various forms of pile wires over which pile loops may be formed in the weaving of various types of pile fabrics according to the instant invention;

FIG. 20 is a schematic plan view of a portion of pile fabric in which certain pile yarns are floated adjacent certain other pile yarns, and particularly illustrating how the floats may be bound intermediate their ends to the base fabric by crossing the said certain other pile yarns beneath the floats;

FIG. 21 is a perspective view showing the arrangement of only two of the pile yarns of FIG. 20 with one lower bight of that pile yarn from which loops are being formed extending beneath the floated portion of the adjacent pile yarn;

FIG. 22 is a fragmentary view similar to FIG. 21 showing how the pile yarn guides cause the pile yarn from which loops are being formed to extend across and beneath a medial portion of the float then being formed of the next adjacent pile yarn;

FIG. 23 is another schematic view of a portion of pile fabric illustrating a few variations of loop pile patterns which may be produced with the apparatus of this invention, this view also serving to aid in the description of the pattern mechanism controlling the pile yarn guides and;

FIGS. 24 to 35 are schematic views illustrating some of many different loop pile designs or patterns which may be produced individually or in various combinations according to the instant invention, but wherein only one of the pile yarns from each of the two sheets A, B are shown along with grids representing the groups of ground warps and the weft yarns so that the paths traced by each pile yarn in each sheet may be clearly understood.

Referring more specifically to the drawings, the loom for carrying out the method of the instant invention may be of the general type disclosed in Clark's said U.S. Pat. No. 24,949, and in Moberg's U.S. Pat. No. 2,860,666, dated Nov. 18, 1958, modified in a novel manner as will be later described. For purposes of brevity, many details of the loom are omitted from the drawings. Therefore, the disclosures of the Clark and Moberg patents, along with the disclosures of Clark's U.S. Pat. No. 2,860,666, dated Nov. 18, 1958, and Brannock's U.S. Pat. No. 2,890,725, dated June 16, 1959, are incorporated in the present disclosure by reference.

Generally, the looms disclosed in the above-mentioned patents are characterized by having at least one weftwise row of pile yarn guides which shog pile yarns weftwise back and forth above and across pile formers which extend warpwise of the loom in front of the harness or heddles and over respective groups of ground warps. Following each shogging motion of the pile yarn guides, they dip between the pile formers into the warp shed and a shot of weft is inserted through the open warp shed and above the pile yarns extending through the guides to the fell of the fabric. As the pile yarn guides subsequently are raised and withdrawn from the warp shed, they tighten the loops over the pile formers, and the loops and weft shot are beaten up against the floats. Such loops are adapted to weave one-shot, two-shot or three-shot fabrics in which one, two or three shots of weft are inserted in the warp shed and corresponding beat-ups of the reed are effected in forming each weftwise row of pile loops. The instant loom will be described hereinafter as adapted for weaving a one-shot pile fabric for purposes of illustration only, it being understood that the loom may be readily adapted to weave multishot pile fabrics, if desired. It should be noted that, in view of the fact that pile loops are formed completely during each pick of the loom in weaving a one-shot fabric, but are formed completely during only every second and only every third pick of the loom in weaving two-shot and three-shot fabrics, respectively, those particular picks of the loom which occur as the loops are being completely formed are termed in the description and the claims as "pile-forming picks."

Essentially, the loom comprises the usual weaving instrumentalities, namely, beating-up means embodied in an oscillatable reed 28, FIG. 3, shed forming means embodied in relatively movable harnesses 21, 22, and 23, which may take the form of a single weft inserter or needle, but preferably is in the form of a pair of closely vertically spaced or superposed lower and upper weft inserts or needles 22, 23. Although two double weft yarns 22A, 23A (FIGS. 13A, 14A and 15A) are inserted in the warp shed during each reciprocation of the weft inserts 22, 23, the illustrated fabric are each of a one-shot weave, since there are no weft strands below the upper bights of any of the pile loops; i.e., a
A weftwise row of loops is formed during each pick of the loom. Thereby, each set or pair of double weft yarns 22a, 22b may be termed collectively as a “single weft shot.”

A weftwise series of spaced pile formers, preferably in the form of elongate warpspace extending pile wires 24, and plural sets or rows of vertically movable pile wire guides cooperate with the weaving instrumentalities to weave pile fabric F from ground warps, weft yarns and pile yarns. Two weftwise rows of pile yarn guides 95, 96 are shown in the instant embodiment of the invention, although one or more additional independently controlled rows of pile yarn guides may be used if desired. The ground warps may include chenille warp wires 21, 22c. Binder warp wires 11 are represented by a warp beam 30 (FIG. 1), and relatively highly tensioned stuffer warps S taken from another source represented by a warp beam 31.

Ground warps C1, C2, S are guided forwardly from warp beams 30, 31 beneath suitable respective lower guide rolls 32, 33 (FIG. 3), then pass upwardly over respective whip rolls 34, 35, and then pass forwardly in a generally horizontal plane through harnesses 21 and reed 20 to the fell of the fabric F. The fabric F passes over a breast beam 36 and is taken up by a cloth takeup roll 37, from whence it is suitably guided to a suitably driven cloth roll 40 (FIG. 1). Since the stuffer warps S need not be shedded upwardly and downwardly, they need not extend through the eyes of the heddles. However, the chain warps C1, C2 extend through the eyes of corresponding heddles of the harnesses 21 to form a double warp shed in cooperation with the stuffer warps S. The use of stuffer warps S is not entirely necessary. However, when used, the stuffer warps S preferably extend forwardly between the two weft inserters 22, 23, as shown in FIG. 13, in their course to the fell of the fabric F.

With the exception of there being two weft inserters 22, 23 employed in association with the instant invention, the reed 20, the harnesses 21, the weft inserters 22, 23, the tension controls or letoff mechanisms for warp beams 30, 31, the pile wires 24, the takeup roll 37, and the fabric roll 40 may be constructed and operated in substantially the manner disclosed in said Moberg U.S. Pat. No. 2,860,666. Accordingly, only so much of such structures will be described as is deemed necessary to a clear understanding of the instant invention.

By way of example, it will be observed in FIG. 12 that a suitable motive means, in the form of an electric motor 43, drives the input shaft of a gear unit 44 having three output shafts 45, 46, 47. Output shaft 45 is operatively connected to cloth takeup roll 37 by means of a suitable intervening mechanism generally designated at 50. Suitable gearing 51 drivingly connects output shaft 46 to one end of a main camshaft 52, and output shaft 47 is connected, by suitable linkage 53, to a weft-inserter reciprocating mechanism 54, including a block 55 (FIG. 2) in which corresponding outer ends of weft injectors or needles 22, 23 are fixedly mounted, one above the other. The weft-inserter reciprocating mechanism 54 may be of the type disclosed in the aforementioned Branack or Moberg patents.

A harness cam 59, shown in the form of a face cam in FIG. 12, is fixed on main camshaft 52 and engaged by a follower 60 on a follower arm 61. The lower end of follower arm 61 is connected, by means of a link 62 and a crank 63, to a harness rocker shaft 64 having a pair of rocker arms 65 fixed thereon, only one of which is shown in FIG. 12, but the other of which is shown in the left-hand portion of FIG. 2. Connecting rods 66 are secured to harnesses 21 and are suitably guided for vertical reciprocation in the frame of the loom.

The lower ends of connecting rods 66 at each side of harnesses 21 are connected, as by links 67, to rocker arms 65. In this instance, only two harnesses 21 need be used, one of the harnesses being in the “up” or raised position, and the other of the harnesses being in the “down” or lowered position during the insertion of alternate shots of weft yarn in the double warp shed. During insertion of alternating shots of weft yarn into the warp shed, the harnesses occupy the reverse positions. It is apparent that additional harnesses may be employed or heddles, controlled by a dobby or a jacquard mechanism, may be employed in lieu of harnesses 21, without departing from the invention.

As shown in FIG. 3, reed 20 is carried by a lay or beam 70 mounted on a stationary fixed on a reed rocker shaft 72. Rocker shaft 72 has a crank or follower arm 73 fixed thereon whose follower 74 engages the groove of a face cam 75 fixedly mounted on main camshaft 52.

The front ends of pile wires 24 overlie breast beam 36 and the ground fabric or base formed of the ground warps C1, C2, S and the double-strand weft yarns 22a, 22c (FIG. 13A). The ground warps may be arranged in spaced groups of two or more, and a pile wire 24 usually overlaps each group of ground warps. In the weaving of the particular type of fabrics shown in FIGS. 13A, 14A and 15A, each group of ground warps may include one of each of the three ground warps C1, C2, S.

Pile wires 24 may be of uniform height as shown in FIG. 16, and/or they may be of the types such as are disclosed in Stovall’s U.S. Pat. No. 2,808,072, dated Oct. 1, 1957, wherein each of the pile wires has two or more pile-forming surfaces of different heights on the forward end thereof which are presented selectively to the loop-forming zone for forming successive loops of different heights according to a predetermined pattern. Typical pile wires having pile-forming surfaces of two different heights are indicated at 24a, 24b, 24c in respective FIGS. 17, 18 and 19. Also, such pile wires may be selectively withdrawn from the loop-forming zone to form ground-engaging loops of the corresponding pile yarns; i.e., loops whose upper bights engage corresponding groups of ground warps. Selected pile wires, or all the pile wires may be provided with suitable severing means or cutting blades thereon, such as are indicated at 24d, 24e in FIGS. 18 and 19, for severing all the pile loops, or only the relatively low pile loops. Other forms of pile wires with cutting blades thereon are described in detail in said Clark U.S. Pat. No. 2,860,666. Further, conventional shearing equipment may be employed for randomly or entirely shearing the tops of the loops after the fabric is removed from the loom. Of course, where the fabric includes loops of different heights, the shearing equipment would be used for severing relatively high loops only.

As shown in FIG. 3, pile wires 24 extend rearwardly through reed 20 and between the heddles of harnesses 21 and are suitably guided for longitudinal movement on a transverse frame member 80 extending between and being suitably secured to opposing substantially upright loom side frame members 81, 82 (FIGS. 1, 2 and 3). In order to present selected loop-forming surfaces of each pile wire to the loop forming zone forwardly of reed 20 in the event of pile wires of the type shown in FIGS. 17 and 18 being used, each pile wire may be connected, by a pliable element or cable 84 (FIG. 3), to a suitable main pattern device 85, such as a jacquard pattern mechanism (FIG. 1).

Pile yarns pass from a creel or other suitable source, not shown, through a suitable pile yarn tensioning or slack takeup device 90 (FIGS. 1 and 3) where they are split into primary and secondary sheets of pile yarns broadly designated at A, B. The slack takeup device 90 may be of a type such as is shown in FIG. 4—A or B—of said Moberg U.S. Pat. No. 2,860,664, for example. From the slack takeup device 90, the pile yarn sheets A, B extend rearwardly over and in engagement with respective transverse guide bars or rollers 91, 92 and then downwardly against respective guide bars or rollers 93, 94 and through eyelets in the lower portions of respective front and rear, primary and secondary, weftwise row or rows, 22a, 22b, 22c, which are elongate, substantially vertically disposed, pile yarn guides or dip needles 95, 96. Pile yarns A, B extend from guides 95, 96 to the fell of the fabric F.

During the weaving operation, guides 95, 96 are dipped downwardly from a raised or withdrawn position above the middle of the pile wires 24 and into the double warp shed below the path of at least the upper weft inserter prior to each
weft-inserting operation, assuming that the fabric F is to be a one-shot weave. Following withdrawal of the weft inserters 22, 23, the pile yarn guides 95, 96 then return to the withdrawn position to loop the tensioned pile yarns beneath and partially around corresponding weft yarns as reed 20 beats the last-inserted weft yarns 22a, 23a against the fell of fabric F. Such damping operation of pile yarn guides, coupled with the shearing thereof over pile formers during each pick or spaced picks of the loom, is conventional. The aforementioned Clark U.S. Pat. No. Re. 24,949 also discloses the use of two adjacent weftwise rows of pile yarn guides with manually adjustable, cam-operated, linkage for imparting simultaneous equal weftwise movement to both rows of pile yarn guides over pile formers, and wherein the two rows either move in the same weftwise direction in each instance or, by manual adjustment of the linkage, the two rows may move like amounts in opposite weftwise directions relative to each other. However, to our knowledge, prior looms of this type have been incapable of selectively shaving one row of pile yarn guides, at times, independently of another adjacent row, and at other times, shaving both rows of pile yarn guides unitarily, and/or shaving both rows varying distances relative to each other in accordance with a predetermined pattern and during uninterrupted weaving operation of the loom.

According to the instant invention, pattern control means are provided for selectively successively shaving the rows of pile yarn guides 95, 96 weftwise independently of each other according to the predetermined pattern referred to, for example, (a) each guide in either row may be shaved across and above one or more of the pile wires or groups of ground warps as the other guide row remains stationary as to weftwise movement thereof during a given loop forming pick of the loom or during each of a series of successive loop-forming picks of the loom; (b) each pile yarn guide in either row may be shaved weftwise over a greater number of pile wires or groups of ground warps in either direction than that number of pile wires or groups of ground warps over which any given guide of the other pile yarn guide row is shaved during a given loop-forming pick or series of successive loop-forming picks of the loom; (c) both pile yarn guide rows may move simultaneously in the same or opposite directions equal amounts; and/or (d) both guide rows may move in either the same or opposite directions with respect to each other and the same or different amounts during the weaving of any given series of successive picks of the loom. Additionally, the rows of pile yarn guides are mounted for adjustment relative to the supporting means therefor so that the extent to which each row is shaved, as indicated in FIG. 13 and 13A, may be predetermined. In this manner, all the pile yarns may be shaved into the shed below the path of the lowermost weft inserter 22 as in FIG. 13, or the pile yarn guides by one pile yarn guide row may be shaved into the shed below the level of the upper weft inserter 23 only, while the remaining pile yarns are shaved below the path of both weft inserters 22, 23 as shown in FIG. 14, or both rows of pile yarn guides may be shaved into the warp shed at an intermediate position to position all the pile yarns between the paths of travel of the two weft inserters 22, 23 as shown in FIG. 15.

The manner in which the pile yarn guide rows 95, 96 are supported and mounted so as to permit relative shaving movement, along with the predetermined pattern means for controlling the various shaving movements of the pile yarn guides according to this invention will now be described. As best shown in FIGS. 9, 10, 11 and 13, the upper ends of the primary and secondary rows of pile yarn guides 95, 96 are fixedly mounted in respective series of blocks 100, 101. Ground material 101 may be plastic material or metal molded about the upper portions of groups of the guides 95, 96, and each such block usually has about 10 pile yarn guides depending therefrom. The rear face of each block 100 and the front face of each block 101 have respective elongate, substantially horizontally disposed keys or tongues 102, 103 projecting therefrom to facilitate positioning blocks 100, 101 at the desired level relative to respective front and rear, lower yarn guide support bars 104, 105, in a manner to be presently described. The support bars 104, 105 are parts of respective primary and secondary mating supporting frames and may take the form of rigid metal angle bars. Bars 104, 105 may be of a length about equal to the width of the fabric F being woven.

The front face of front support bar 104 and the rear face of rear support bar 105 are provided with respective pairs of vertically spaced, longitudinally extending, lower keyways or grooves 106, 107 and 108, 109 for snugly receiving therein the respective keys 102, 103 of blocks 100, 101. As shown in FIGS. 9, 11 and 13, the keys 102, 103 of blocks 100, 101 are positioned in the lower keyways 107, 109 of the respective support bars 104, 105, and the blocks 100, 101 are removably secured against the respective front and rear faces of the respective support bars 104, 105 by suitable screws 112. Thus both rows of pile yarn guides 95, 96 then occupy their lowermost positions with respect to the support bars 104, 105.

It is apparent, by referring to FIGS. 14 and 15, that either or both rows of pile yarn guides 95, 96 may be positioned to occupy relatively high positions with respect to support bars 104, 105 by positioning the keys 102, 103 of blocks 100, 101 in the upper keyways 107, 109 and securing the blocks 100, 101 in the corresponding positions with respect to support bars 104, 105 by means of the screws 112.

Referring to FIG. 13, it will be observed that, when both rows of pile yarn guides 95, 96 occupy their lowermost positions with respect to support bars 104, 105 and the pile yarn guides are shaved into the warp shed, this positions all the pile yarns A, B below the paths of both the lower and upper weft inserters 22, 23. By referring to FIG. 14, it will be seen that, when the rear row of pile yarn guides 96 occupies a relatively high position with respect to support bars 104 and 105, and the pile yarn guides 95 are shaved into the warp shed with respect to support bar 104, the pile yarns A are lowered beneath the path of lower weft inserter 22 and the pile yarns B are lowered between the paths of the weft inserters 22, 23 when the pile yarn guides 96, 95 are shaved into the warp shed. The extent to which the pile yarns A, B project into the base fabric may thus be varied to suit the customer. It may be desirable to have all the pile yarns A, B looped beneath the lower weft yarns 22a, as in FIGS. 13 and 13A, to enhance the appearance of the back of the pile fabric, especially when such fabric is to be used in the manufacture of carpet material which may be moved from place to place, such as "throw rugs." To reduce the cost of the pile fabric, it is apparent that, by looping the pile yarns A, B between the lower and upper weft yarns 22a, 22b, as in FIGS. 15 and 15A, the length of pile yarn forming each tuft of given height above the base fabric may be less than that required to loop the pile yarns beneath the lower weft yarns 22a, as in FIGS. 13 and 13A.

The arrangement of the pile yarn guides 95, 96 shown in FIG. 14 and the resulting fabric of FIG. 14A may be particularly desirable in the event of the pile yarns of one sheet being of different size from the pile yarns of the other sheet, since in the fabrics of FIGS. 13A and 14A, relatively large pile yarns might be gripped more firmly between the adjacent weft yarns than would adjacent relatively small pile yarns. Thus, tufts of the relatively small pile yarns might be easily pulled out of the base fabric unintentionally at least until the usual backzizing material has been applied to the lower yarn. A suitable fabric for the base fabric. Accordingly, in FIGS. 14 and 14A, the pile yarns A are looped beneath the lower weft yarns 22a, and the pile yarns B are looped beneath the upper weft yarns 23a and between the lower and upper weft yarns 22a, 23a. Assuming that primary pile yarn A are larger than secondary pile yarns B and that all the pile yarns A, B are larger than the ground warps, it can be seen that the lower bights of the smaller pile yarns will be
gripped firmly between each respective pair of lower and upper weft yarns 22a, and 23a, and the legs of all the larger pile yarns will be gripped firmly between successive adjacent weft shifts or pairs of weft yarns 22a, 23a.

By constructing the fabric as shown in any of FIGS. 13A, 14A and 15A, a one-shot pile fabric is produced having the weight per unit length of a conventional two-shot pile fabric woven of yarns of similar weights. Also, each of the fabrics of FIGS. 13A, 14A and 15A may be woven at the same speed as a conventional one-shot fabric, but the base fabrics thereof may be nearly twice as heavy per unit length as a conventional one-shot pile fabric woven of yarns of similar weights, as is desirable.

The front and rear lower sacking support bars 104, 105 are mounted for relative longitudinal movement welfwise of the loom. Accordingly, the rearwardly projecting upper flanges of the support bars 104, 105 are provided with respective longitudinally spaced ears or projections 114, 115 thereon penetrated by a common guide bar or rod 116 spaced between the upper flanges of support bars 104, 105. Guide bar 116 may be suitably secured to one or other of the ears 115 and may be loosely positioned in the ears 114. Each end portion of the upper flange of front support bar 104 has the front lower portion of a substantially L-shaped crank arm 120 suitably secured thereto, and the upper rear portions of crank arms 120 are fixedly secured to a primary, external or tubular shogging roller shaft 121 which extends substantially throughout the width of the loom and is mounted for both axial and angular motion in suitable bearings 122 carried by the loom side frame members 81, 82 (FIGS. 2 and 5).

An internal or secondary sacking roller shaft 123, preferably of somewhat greater length than external roller shaft 121, is mounted for longitudinal or axial sliding movement within primary sacking roller shaft 121. Each end of the upper flange of rear support bar 105 also has a front lower portion of a crank arm 125 pivotally connected thereto which extends upwardly and rearwardly at an angle and is suitably secured to a cuff member 126 which surrounds and is mounted for longitudinal sliding movement on primary sacking roller shaft 121. Each cuff member 126 is spaced outwardly from the adjacent crank arm 120.

The row of secondary pile yarn guides 96 must be jogged transversely of the cloth being woven in fixed relation to secondary shaft 123. External roller shaft 121 also must be free to move axially to shog the front or primary pile yarn guides 95 transversely of the loom relative to the rear or secondary pile yarn guides. However, both rows of pile yarn guides 95, 96 are substantially unison. Therefore, means are provided for transmitting axial shogging movement from inner roller shaft 123 to cuff members 126 relative to external roller shaft 121 and for transmitting pivotally or angular motion from crank arms 120 through external roller shaft 121 to cuff members 126. To this end, and as best shown in FIGS. 9 and 11, each cuff member 126 has one end of a composite bracket 127 welded or otherwise suitably secured thereto. Each bracket 127 extends upwardly from the corresponding cuff member 126 over and across the corresponding crank arm 120 and then downwardly and has its inner end portion welded or otherwise suitably secured to a key member 130. Each key member is slidably mounted in a corresponding elongate key slot 131 in external roller shaft 121 and has its inner portion suitably secured to internal shaft 123.

In the weaving of a one-shot pile fabric, pile yarn guides 95, 96 are lowered from a raised, inactive position to a lowered, active position in the warp shed in front of reed 20 (FIG. 3) and rearwardly of the paths of weft inserters 23, 24 during each rearward stroke of reed 20. Also, guides 95, 96 are returned to inactive position above the level of reed 20 and warps C1, C2, S during each beat-up stroke of reed 20. Accordingly, the upper end of a link 133 is pivotally connected to each crank arm 120 (FIGS. 2, 3, 9 and 11) and has its lower end pivotally connected to a corresponding crank arm 134. Crank arms 134 extend forwardly from links 133 and are fixedly mounted on reed roller shaft 72. Thus, the reed oscillating cam 75 also serves to lower and raise the pile yarn guides 95, 96 during respective rearward and forward or beat-up strokes of reed 20.

If the desired fabric is to be a two-shot weave or a three-shot weave, separate cams may be used for oscillating the reed and moving the pile yarn guides 95, 96 into and out of the warp shed so that the guides will be dipped into and out of the shed during alternate picks only or during every third pick only of the loom.

Pattern means is provided for shogging the primary and secondary pile yarn guide roller shafts 121, 123 longitudinally of their axis to effect corresponding shogging movements of pile yarn guides 95, 96 while they occupy raised positions above the level of pile wires or formers 24. Such pattern means is shown in the form of a dual pattern mechanism comprising two substantially identical, but oppositely positioned, first and second or primary and secondary pattern heads broadly designated at 140, 140'. Primary pattern head 140 is carried and extends outwardly from side frame member 81 adjacent one end of the sacking roller shafts 121, 123 (FIG. 2) and secondary pattern head 140' is carried and extends outwardly from loom side frame member 82 adjacent the other end of sacking roller shafts 121, 123. Since both the primary and secondary pattern heads 140, 140' may be of identical construction, except being opposite hand to each other, only the primary pattern head 140 will be described in detail, and similar parts of secondary pattern head 140' shall bear the same characters, where applicable, in order to avoid repetitive description.

As best shown in FIGS. 4 and 5, each pattern head 140 comprises a composite carriage 141 mounted for inward and outward substantially horizontal movement on a pair of slide bars 142, 143 whose inner ends are suitably secured to a plate 144 secured to side frame member 81 of the loom. Slide bars 142, 143 also are carried by an outboard plate 145 secured to suitable braces 146 which extend downwardly and inwardly in FIGS. 2 and 4 and are suitably secured to the corresponding loom side frame member 81. Inner and outer pattern shafts 150, 151 are journaled in pairs of bearings 152, 153 suitably secured to opposing side rails of carriage 141. Substantially rectangular sprocket wheels 155, 156 are fixed on shaft 150, 151 and are engaged by an endless pattern member or pattern chain 157.

Each link of pattern chain 157 is in the form of a substantially flat rectangular plate and has a pair of pattern lugs 160, 161 removably secured to and projecting outwardly therefrom. Thus, pattern chain 157 has two pairs of pattern lugs thereon, one for each sacking roller shaft 121, 123. The pattern lugs 160, 161 may be threaded into or otherwise removably secured to corresponding links of pattern chain 157. As each successive pair of pattern lugs 160, 161 occupies a ready position adjacent the inner surface of the inner sprocket wheel 155, corresponding lugs 160, 161 are aligned substantially with, and are adapted to be moved inwardly to active position against, the respective primary and secondary sacking roller shafts 121, 123. Accordingly, the lugs 160, 161 may be termed as "primary" lugs and the lugs 161 may be termed as "secondary" lugs.

Means are provided for moving carriage 141 inwardly from a normally inactive position to an active position during that portion of each corresponding pick of the loom in which pile yarn guides 95, 96 occupy lowered position above the level of the pile wires or formers 24. During the course of each such inward movement of carriage 141, pattern chain 157 moves inwardly with carriage 141 to move the then innermost or ready pair of pattern lugs 160, 161 into engagement with the corresponding ends of sacking roller shafts 121, 123, as will be more fully described hereinafter.

To effect movement of carriage 141, opposing sides of carriage 141 are provided with vertically grooved blocks 163 engaged by respective followers 164 on the lower ends of follower arms 165. Medial portions of follower arms 165 have
respective followers 166 thereon positioned in the grooves of respective face cams 167. The upper ends of follower arms 165 are mounted on opposing end portions of a shaft 170 (FIG. 4) journaled in bearings 171 carried by a pair of brackets 172 suitably secured to and projecting outwardly from side frame member 81. Face cams 167 are fixedly mounted on a camshaft 173 journaled in brackets 172. The rear end of camshaft 173 is connected to the output side of a suitable gear unit 175.

As best shown in FIG. 12, both gear units 175 of the two pattern heads 140, 140' are interconnected by a shaft 176 connecting one output portion of the gear unit 175 of secondary pattern head 140' to the input side of gear unit 175 of primary pattern head 140. The input shaft of gear unit 175 of secondary pattern head 140' is driven from the main camshaft 52 through intervening sprocket wheels 180-183 and corresponding endless sprocket chains 184, 185. It will be observed in FIG. 12 that a jackshaft 187, on which sprocket wheels 181, 182 are fixedly mounted, also has a sprocket wheel 190 fixed thereon engaged by a sprocket chain 191 drivenly connected to the main pattern device or Jacquard mechanism 85 so that the operation of the main pattern device is maintained in proper relation to the operating components of the loom, including the shogging pattern heads 140, 140'. It is apparent that the cams 167 associated with each shogging pattern head 140, 140' are driven to rotate a single revolution during each pick of the loom so as to impart an inward stroke and then an outward stroke to each carriage 141 and its respective pattern chain 157 each time that the pyle yarn guides 95, 96 are withdrawn upwardly out of the ground warp shed. Both pattern carriages 141 move inwardly at the same time and move outwardly at the same time.

As will be later described, the pattern lugs in each row extending longitudinally of pattern chain 157 are of varying thicknesses or effective heights relative to each other, according to the desired pattern of pile loops of different aesthetic characteristics to be formed in the fabric. Such different aesthetic characteristics may include different colors, textures, twists, or other characteristics of certain pile yarns relative to other pile yarns such as to produce certain pile loops of different or contrasting appearance with respect to other adjacent pile loops in the fabric being woven.

Means are provided for imparting a stepwise movement to each pattern chain 157 during each pick of the loom. Since sprocket wheel 155 (FIG. 7) is of rectangular configuration, a quadrant revolution may be imparted to shaft 150 during each outward stroke of carriage 141. Accordingly, the cam 175 (FIGS. 5 and 8) is fixed on shaft 150 and has four equally circularly spaced pins 195 projecting axially therefrom which are adapted to be engaged, one at a time, by the hook 196 of a main indexing pawl or latch 197 (FIG. 8) during each or certain selected outward strokes of carriage 141. The inner end of indexing pawl 197 is pivotally mounted on an angle bracket 200 suitably secured to plate 144.

A cam surface 201 on indexing pawl 197 normally rests against one of the pins 195 so that, during each inward stroke of carriage 141, the latter pin 195 slides against cam surface 201 until such pin 195 moves inwardly beyond the hook 196 of indexing pawl 197, during the corresponding movement of the disc 194 and shaft 150 with carriage 141, to the dotted line position of FIG. 8. Thereupon, hook 196 drops into registration with the latter pin 195 so that, during the next succeeding outward stroke of carriage 141, the latter pin 195 is engaged by hook 196 and substantially a quarter revolution is thus imparted to pattern chain 157 by the time the carriage 141 has reached the raised position.

To ensure that the succeeding link of pattern chain 157 and the corresponding lugs 160, 161 thereon are properly located in the ready position for subsequent engagement with the adjacent ends of shogging rocker shafts 121, 123, shaft 150 also has a substantially rectangular block 203 fixed thereon, provided with chamfered corners, the adjacent peripheral surfaces of which ad 204 on a locking arm 205 is biased by a tension spring 206 (FIG. 6). Locking arm 205 is pivotally mounted, as at 207, on an inner portion of carriage 141. The inner end of tension spring 206 is connected to the upper end of locking arm 205, and the outer end of tension spring 206 is connected to a spring anchor rod 210 which loosely penetrates a post 211 carried by carriage 141. A nut 212 is threaded onto the front portion of spring anchor rod 210 to facilitate adjusting the pressure applied to rectangular block 203 by tension spring 206.

As long as main indexing pawl 197 occupies operative position with respect to the pins 195 of disc 194, a quarter revolution will be imparted to pattern chain 157, in a forward direction, during each successive outward stroke of carriage 141. However, main indexing pawl 197 is connected by a cord or cable 215 to main pattern device 85 so that the main pattern device may raise pawl 197 out of operative relation to rotor pins 195 to enlarge upon the patterning capacity of each pattern chain 157 without the necessity of increasing the length thereof. Since it is unlikely that a particular pattern of pile loops being formed would ever call for both rows of pile yarn guides to remain in the same positions with respect to the weftwise direction during formation of any two immediately successive weftwise rows of pile loops, an auxiliary, pattern reversing, indexing pawl 216 is raised from a normally inoperative position into operative relation to rotor pins 195 (FIG. 8) whenever main indexing pawl 197 is raised to an inoperative position.

Auxiliary indexing pawl 216 is of similar construction to pawl 197 and it is also pivotally mounted on angle bracket 200. A link 217 interconnects indexing paws 197, 216. The hook 218 on the outer portion of pawl 218 is adapted to engage a corresponding pin 195 on rotor 194 to impart a reverse stepwise movement of one-quarter of a revolution to pattern chain 157 during each outward stroke of carriage 147 occurring during such times as main indexing pawl 197 is withdrawn or raised to inoperative position. Thus, it can be seen that each pattern chain 157 may be moved alternatively in the forward and reverse directions and with one of such movements occurring during each pick of the loom.

As heretofore stated, the pattern lugs 160, 161 forming each row on each pattern chain 157 are of varying heights or thicknesses according to the desired pattern of pile loops to be formed in the fabric. There are instances, however, in which two or more immediately successive lugs brought into ready position in a given row may be of the same effective height, such as in the weaving of multishot pile fabrics or in floating corresponding pile when there is a variation in the height of two immediately successive lugs in either row of each pattern chain 157, the difference in the height of such two immediately successive lugs may be termed as one "gauge" or a multiple thereof.

The term "gauge" is used herein to indicate that distance between the centers of any two immediately adjacent pile wires or pile formers 24. In some instances, but not in all instances, the loom would be provided with the same number of pile yarn guides 95, 96 in each row as there are pile formers 24. Obviously, the "gauge" of the pile fabric F being produced also indicates that distance between centers of two immediately adjacent warwise rows of pile loops, the gauge of most carpet fabrics being about three-sixteenths inch to one-fourth inch. In the particular portions of fabrics shown in Figs. 13A, 14A and 15A, a group of three ground warps, each group including one of each of the warps C1, C2, S, is positioned between each adjacent pair of warwise rows of pile loops and, accordingly, the gauge of the fabric also may be defined as that distance between the centers of two immediately adjacent groups of ground warps defining a warwise row of loops therebetween.

In weaving some fabrics, such as that shown at F= in FIG. 23, one or more pile yarns are threaded through each pile yarn guide 95, 96, there is a pile former 24 corresponding to each group of ground warps, and there is a pile yarn guide 96 corresponding to each pile former 24.
Other pile fabrics may be woven by omitting alternate pile yarn guides in each row or, preferably, by simply omitting alternate pile yarns in each sheet A, B so that one or more ends of pile yarn A are threaded through each alternate primary guide 95, and one or more ends of pile yarn B are threaded through each intervening secondary guide 96. In either event, and as is preferred, the guides 95 through which pile yarns extend are arranged in alternating relation to the guides 96 through which pile yarns extend. There are other instances in which it may be desirable to omit pile forms 24 and corresponding pile yarns A, B at certain welfwise spaced groups of ground warps and to arrange the loop pattern so that none of the pile yarns will cross over such certain spaced groups of ground warps. Thus, when the pile fabric is being installed in a building, it may be cut along such certain spaced groups of ground warps, as needed, without cutting any pile loops of the fabric.

FIGS. 20 and 23-35 illustrate schematically some of the many different loop pile patterns which may be produced on the loom by appropriate arrangements of the pattern lugs 160, 161 on the chains 157 of pattern head 140, 140'. An illustrative pattern arrangement of lugs 160, 161 will now be given with reference to the fabric F-A shown in FIG. 23. Although certain immediately successive lugs in either row may be of the same effective height, and although there normally is only one gauge difference in the relative height between any two adjacent pattern lugs 160 or 161, it is important to note that any given series of lugs in each row may be of progressively increasing or progressively decreasing heights. To explain further, assume, for illustrative purposes, that the majority of the pile yarns of each set A, B are grey and that the yarns A', B' extending through the centermost pile yarn guides 95, 96 in each row are of different colors; e.g., red and blue. Assume further that "zero-gauge" indicates the optimum or centermost position of the respective rows of pile yarn guides 95, 96. Many forms of pattern lines of red and blue pile loops may be interspersed with the grey background loops of the fabric by various arrangements of the pattern lugs 160, 161 on each pattern chain 157, it being understood that lugs 160, 161 of secondary pattern head 140 must complement the pattern lugs of primary pattern head 140.

More specifically, in the portion of pile fabric F-A shown schematically in FIG. 23, the straight vertical lines each represent a group of ground warps C1, C2, S and the straight horizontal lines each represent a weft shot each of which may include the two-strand upper and lower weft yarns 22a, 23a (FIG. 13A). To form fabric section F-3 of FIG. 23, the lugs of a first series of pattern lugs in each row are arranged in alternating zero-gauge and one-gauge heights with both lugs 160, 161 of each pattern chain link in the same relative position in each instance. Thus, during alternate pile-forming picks of the loom, both rows of pile yarn guides 95, 96 will be shogged simultaneously the same distance and in the same welfwise direction with each pile yarn guide being shogged above and across a single corresponding pile wire or former 24. Also through intervening pile-forming picks of the loom, both rows of pile yarn guides will be shogged simultaneously the same distance and together in the opposite welfwise direction with each pile yarn guide being shogged above and across the same respective single pile wire or former 24. Following each such shogging motion of the pile yarn guides 95, 96 the eyelets of the pile yarn guides are dipped into the warp shed, a weft shot then is inserted in the warp shed over the pile yarns, and the pile yarn guides are withdrawn from the warp shed as the reed beats the corresponding weft shot against the fell of the fabric. This will form double parallel loops of complementary pairs of pile yarns A, B throughout fabric section F-3.

To distinguish the pile loops formed from primary pile yarns A from the pile loops formed from secondary pile yarns B in FIG. 23, each pile loop formed from a primary pile yarn A is not shaded, and each pile loop formed from a secondary pile yarn B is shaded by diagonal lines. Also, the effect or contrast of pile loops formed from the red and blue pile yarns A', B' of the respective sheets A, B are shown in heavy lines as compared to the background loops formed from the grey pile yarns. Thus, it can be seen that the parallel double loops of effect yarns A', B' define a zigzag line or row of red and blue pile loops wavywise along the center of fabric section F-1 in FIG. 23.

In order to form the third fabric section F-3 of FIG. 23, it is necessary, in producing the illustrated patterns, to first cross each one of the pile yarns of one sheet over a corresponding pile wire 24, or at least over a corresponding group of ground warps, without crossing the pile yarns of the other sheet over the pile wires or groups of ground warps. In other words, the primary row of pile yarn guides 95 would remain in a fixed vertical plane during shogging of the secondary row of pile yarn guides 96. Thus, a second fabric section F-2 is formed in which the blue yarn B' crosses over the centermost pile wire 24 as the red yarn A' remains on one side of the same pile wire and is formed as a float beneath or within the base fabric. The second fabric section may embrace several welfwise rows of loops or, as shown, a single welfwise row of loops. In this instance, a single link of pattern head 140 having a zero-gauge lug 160 and a one-gauge lug 161 thereof needs to be moved into ready position, assuming that both of the lugs 160, 161 of the immediately preceding link previously occupying ready position were of zero-gauge height. Upon forming the welfwise row of loops in fabric section F-2, each pile yarn guide 95 is now positioned adjacent the opposite side of each respective pile wire 24 from that of the respective pile yarn guides 96, preparatory to forming the third fabric section F-3.

In forming the third fabric section F-3 (FIG. 23), a third set or series of pattern lugs in each row is again arranged in alternating zero-gauge and one-gauge heights, but with the lugs of each pattern chain link in such third series being of relatively different heights. That is, the first lug 160 of the third series would be zero-gauge and the first lug 161 of the third series would be zero-gauge. The second lugs 160, 161 of the third series would be zero-gauge and one-gauge, respectively etc. Therefore, each primary pile yarn guide 95 and its pile yarn A then will be shogged in one welfwise direction above and across a single respective pile wire or pile former 24, and each secondary pile yarn guide 96 will be shogged a like amount in the opposite welfwise direction during alternate picks of the loom and the direction of shogging the respective pile yarn guides 95, 96 will be reversed during each intervening pick of the loom. Here again, at the end of each shogging stroke of the pile yarn guides 95, 96 in each direction, the pile yarn guides will be dipped into and then out of the warp shed. Thus, the arrangement of the third series of pattern lugs as described will result in the formation of a series of rows of loops in which the loops formed of pile yarn A may extend diagonally across the loops formed of the respective pile yarns B. It is apparent that the red and blue yarns A', B' then would form a single welfwise row of crisscrossing double loops along a corresponding central portion of the fabric section F-3 with each red loop crossing a blue loop. Generally, the pile yarns A are guided over the pile yarns B because of the relative positions of the guides 95, 96 as shown in FIGS. 13, 14 and 15.

It is apparent that in weaving a one-shot pile fabric the first and third series of pattern lugs 160, 161 may, in each instance, comprise only two adjacent links of each pattern chain 157 being alternately moved into ready position by alternating the position of the two indexing pawls 197, 216 (FIG. 8) from pick to pick of the loom under control of main pattern device 88.

As heretofore stated, the pattern lugs 160, 161 of secondary pattern head 140 must complement the pattern lugs 160, 161 of primary pattern head 140. To explain further in this respect, whenever either row of pile yarn guides 95, 96 is to be shogged to the right in FIG. 9, this is effected by shogging the respective shogging rocker shafts 121, 123 to the right in FIG. 5. Conversely, whenever either row of pile yarn guides 95, 96 is to be shogged to the left in FIG. 9, this is accomplished by
shogg ing the respective shogg ing rocker shafts 121, 123 to the left in Fig. 5.

Now, if primary shogg ing rocker shaft 121 is to be shogg ed from left to right, the effective height of the then ready positi oned pattern lug 160 of pattern head 140 should be one gau ce higher than the immediately previously ready positioned pattern lug 160 of the same pattern head 140 and it should also be one gauge higher than the then ready positioned lug 160 of the secondary pattern head 140'. Thus, as the carriages of the two pattern heads 140, 140' move in wardly toward each other, the ready positioned pattern lug 160 of pattern head 140 pushes primary shogg ing rocker shaft 121 a distance of one gau ce to the right and against the then ready positioned pattern lug 160 of secondary pattern head 140'. The carriages of both pattern heads then move out wardly to inactive positions during the corresponding pick of the loom.

It is apparent that secondary rocker shaft 123 and its pile yarn guides 96 may be shogged from left to right under control of corresponding pattern lugs 161 of the two pattern heads 140, 140' in substantially the same manner as that just described with respect to primary shogg ing rocker shaft 121.

Now, if primary shogg ing rocker shaft 121 and its pile yarn guides 95 are to be shogged from right to left in FIGS. 5 and 9, the effective height of the then ready positioned pattern lug 160 of pattern head 140 should be one gauge less than that of the immediately previously ready positioned pattern lug 160 of the same pattern head 140 and it also should be at least one gauge less than that of the then ready positioned lug 160 of the secondary pattern head 140'. Thus, as the carriages of the two pattern heads 140, 140' move inward toward each other, the then ready positioned pattern lug 160 of secondary pattern head 140' pushes primary shogg ing rocker shaft 121 a distance of one gau ce to the left and against the then ready positioned pattern lug 160 of primary pattern head 140, whereupon the carriages of both pattern heads again may move outwardly to inactive positions.

Here again, it is apparent that secondary rocker shaft 123 and its pile yarn guides 96 may be shogged from right to left under control of corresponding pattern lugs 161 of the two pattern heads 140, 140' in substantially the same manner as that last described with respect to primary shogg ing rocker shaft 121.

Now, referring again to FIG. 23 and the foregoing illustra tion in which complementary centrally disposed pile yarn guides 95, 96 of each row forming respective red and blue pile yarns A', B' extending through the fall of the fabric being woven, the two outwardly diverging diagonal lines of respective red and blue pile loops may be formed and interspersed with grey pile loops, as in fabric section F-4, by arranging a fourth series of pattern lugs in each row on each pattern chain 157 in progressively varying heights. Assuming that each diagonal line of pile loops is to embrace three warpswise rows of pile loops in addition to the common or central warpswise row, with the loops of the red pile yarn A' diverging from left to right and the loops of the blue pile yarn B diverging from right to left, the effective heights of the first, second and third primary pattern lugs 160 of the primary pattern head 140 to be successively moved into ready position would be minus one-gauge, minus two-gauge and minus three-gauge, respectively. The heights of the first, second and third secondary pattern lugs 161 in this fourth series on pattern head 140 would be two-gauge, three-gauge and four-gauge, respectively.

Thereafter the corresponding series of three pile-forming picks of the loom utilizing the aforementioned fourth series of pattern lugs 160, 161, and notwithstanding the fact that all the primary pile yarn guides 95 move unitarily and all the secondary pile yarn guides 96 move unitarily but independently of the pile yarn guides 95, the particular guide 95 through which the red pile yarn A' extends would be shogged from left to right against the corresponding pile yarn guide 96 in this series, above and across the first pile wire 24 to the right of center, as the blue pile yarn B' and the corresponding pile yarn guide 96 are shogged from right to left and above across the first pile wire 24 to the left of center.

The pile yarn guides are then dipped into the warp shed, the weft inserters 22, 23 (FIG. 13) insert corresponding weft yarns in the shed, the pile yarn guides 95, 96 are then raised to inactive position, and a beat up of the reed 20 occurs. On the second pile-forming pick of the loom in particular utilizing the aforementioned fourth series of pattern lugs 160, 161, the red yarn A' extending through a pile yarn guide 95 is again shogged to the right across and above the second pile wire 24 to the right of the aforementioned centermost pile wire, as the blue pile yarn B' extending through a pile yarn guide 96 is again shogged to the left across and above the second pile wire to the left of the aforementioned centermost pile wire (FIG. 23). Similarly, during the next succeeding pick of the loom, the red pile yarn A' is shogged over the third pile wire to the right of the aforementioned centermost pile wire, as the blue pile yarn B' is shogged over the third pile wire to the left of the centermost pile wire.

At this point, it may be desirable to produce two converging diagonal lines of pile loops of the two contrasting pile yarns, as in the fabric section F-5 in FIG. 23. In this case, a fifth series of pattern lugs 160, 161 may be utilized on each pattern head 140, 140' with the heights of the first three lugs in each row varying in the reverse order as compared to the heights of the three successive primary lugs 160 of each row forming the aforementioned fourth series.

It is to be noted that, in fabric section F-5 the diagonal lines of contrasting loops cross one another over the centermost pile wire and group of warps, and the diagonal line of the blue loops embraces a lesser number of warpswise and weftwise rows of pile loops than that embraced by the red loops. Also the blue loops return to the left to define a short diagonal line of blue loops parallel with a portion of the diagonal line of red loops in the upper portion of fabric section F-5. Accordingly, the fifth series of pattern lugs in each row on pattern chain 157 of primary pattern head 140 may include seven pattern lugs. The first three lugs in rows 160, 161 would be arranged in the reverse order of the fourth series, and the gauge heights of the next four lugs 160 (controlling the red yarn guide 95) would be one-, two-, three- and four-gauge, respectively. The gauge heights of the corresponding four lugs 161 (controlling the blue yarn guide 96) would be zero-, minus one-, zero- and one-gauge, respectively. Of course, the grey pile yarns extending through the pile yarn guides 95, 96 are shogged in like manner to the respective red and blue pile yarns A', B' during each pile-forming pick of the loom. Following each shogging step, the pile yarn guides 95, 96 also are dipped into and out of the warp sheds to the extent heretofore described with respect to FIGS. 13, 14 or 15.

In weaving fabric section F-6, the red loops are again formed as a converging diagonal line as the blue yarn is shogged to and fro across a common pile wire, the lugs 160, 161 on each pattern chain 157 being appropriately arranged so that the red and blue yarns ultimately return to and cross the respective first and second pile wires to the left of the centermost pile wire and group of ground warps. The manner of arranging the lugs 160, 161 to produce the pattern of fabric section F-6, as well as many other patterns, is believed to be quite clear from the foregoing description of the fabric sections F-1 to F-5. Accordingly, a further description of the patterning of the lugs 160, 161 is deemed unnecessary.

It is to be understood that the particular pattern arrangement varies in a manner similar to that of the fabric in FIG. 23; namely for the purpose of produc ing a clear description of the pattern heads 140, 140' as they relate to the pile yarn guides 95, 96, since a wide range of different loop pile patterns and sequences of patterns may be produced such as are shown in FIGS. 24 to 35. The patterns in the fabric of FIG. 23 and many other variations of pile patterns may be produced by: (1) varying the arrangement of different heights of lugs 160, 161; (2) varying the pattern device 85 in controlling the indexing pawls 197, 216 (FIG. 8); (3) varying
the patterning of the main pattern device 85 in selectively controlling the position of pile formers or pile wires which have respective variant-height loop forming surfaces thereon (see FIG. 17); (4) providing certain or all of the pile wires with respective pile loops thereon as in the aforementioned Clark and Moberg patents (see FIGS. 18 and 19); (5) shearing the tops of some or all the loops previously formed in a particular fabric; (6) providing various colors and/or kinds of pile yarns in either or both sheets A, B; (7) omitting certain pile yarn guides 95, 96 in either row or corresponding pile yarns A, B in either sheet; (8) omitting certain pile formers or pile wires, and/or (9) providing certain as immediately successive pattern lugs 160, 161 in either or both rows or the pattern chain 157 which vary in relative heights by two or more gauges so any given pile yarn guide 95, 96 will be shogged above and across two or more pile wires 24 and/or groups of ground warps during a selected pick or selected picks of the loom.

FIGS. 24 to 35 illustrate schematically various other novel loop pile patterns which may be produced in pile fabric, either individually or in various combinations, according to this invention. However, to avoid confusion as to the paths of each of the pile yarns, only the effect yarns A', B' are shown in FIGS. 24-35 as respective relatively heavy and relatively light lines superimposed upon grids representing weft shots crossing groups of ground warps. For descriptive purposes, it may be assumed that a pile wire or former 24 extends over each group of ground warps, and that each pile fabric is a one-shot weave. The background pile loops are omitted in FIGS. 24 to 35 for purposes of clarity.

The fabric of FIG. 24 is similar to the fabric sections F-1, F-3 of FIG. 23, but differs therefrom in that pile yarns A', B' are shogged back and forth above and across separate pile formers and groups of ground warps in the upper portion of FIG. 24. In the upper portion of FIG. 24 both pile yarns A', B' are shogged in unison in the same direction in each instance. In the central portion of FIG. 24 it will be noted that pile yarn B' has been shogged to the left so that, in the lower portion of FIG. 24, both pile yarns A', B' are shogged in relatively opposite directions back and forth across a common pile former and group of ground warps. The fabric of FIG. 25 is similar to the fabric of FIG. 24 in that both pile yarns A', B' are shogged in unison in the upper portion in FIG. 25, and they are shogged in relatively opposite directions in the lower portion of FIG. 25. However, in the upper portion of FIG. 25 both pile yarns A', B' are shogged across and above a common pile wire and group of ground warps, and in the lower portion of FIG. 25, the pile yarns A', B' are shogged above and across separate pile wires and groups of ground warps. Throughout the patterns of FIGS. 24 and 25, it will be noted that the pile yarn A' is shogged over only a single pile former.

The fabric of FIG. 26 illustrates, in the upper portion thereof, the shogging of the effect pile yarns A', B' above and across respective single pile formers and groups of ground warps. Additionally, in the central portion of FIG. 26 each of the pile yarns A', B' is shogged successively over a greater number of pile wires than is the case in the extreme upper and lower portions of FIG. 26. In the present arrangement of the loop pattern in the central portion of FIG. 26, it will be observed that the pile yarns A', B' have been dipped into the warp shed following each shogging thereof over a single respective pile former so that the lower heights of the loops extend beneath the corresponding weft yarns between each stepwise shogging movement of the pile yarns above and across a group of ground warps.

The fabric of FIG. 27 illustrates the shogging of both of the pile yarns A', B' over a common pile former and group of ground warps in the upper and lower portions of FIG. 27. However, in the central portion of FIG. 27, the pile yarn B' is floated beneath corresponding weft yarns (five weft shots in this instance), thus resulting in loops of only one of the yarns, namely, pile yarn A', being present in the central portion of FIG. 27. It should be noted that, if both effect yarns A', B' are of the same size, the central portion of the fabric of FIG. 27 would be about one-half as dense as the upper and lower portions of FIG. 27.

In the fabric of FIG. 28 both of the pile yarns A', B' are shogged over a common pile wire and group of ground warps in warpwise spaced areas. In one of the intervening areas between the spaced areas, the pile yarn A' is floated beneath corresponding weft yarns so that loops are formed from the pile yarn B' only. In another of the intervening areas of FIG. 28, the pile yarn B' is floated beneath corresponding weft yarns as loops are formed from the pile yarn A' only.

The fabric of FIG. 29 is similar to the fabric of FIG. 28 with the exception that the pile yarns A', B' are shogged over separate pile wires and respective groups of ground warps in each instance.

FIG. 30 illustrates the pile yarns A', B' shogged in opposite directions with respect to each other in each instance, and wherein each pile yarn is shogged over a plurality of pile formers and respective groups of ground warps in succession during a plurality of pile-forming picks of the loom. In other words, pile yarn A' in FIG. 30 is shogged in one weftwise direction a distance at least about equal to the center-to-center distance between three adjacent pile formers concurrently with the shogging of the other pile yarn B' in the opposite weftwise direction a distance at least about equal to the center-to-center distance between three adjacent pile formers.

FIG. 31 is similar to FIG. 26 in that, in the upper portion of FIG. 31, the pile yarns A', B' are shogged as being shogged in unison back and forth across separate pile formers. However, in the lower portion of FIG. 31, the pile yarns A', B' are shogged in relatively opposite directions over a plurality of pile wires in a manner similar to the pattern of FIG. 30.

In FIG. 32 the pile yarns A', B' are shown shogged in relatively opposite directions during each shogging movement of the pile yarns. In the upper portion of FIG. 32, the yarns A', B' are shogged back and forth over separate pile formers, and in the lower portion of FIG. 32, each of the pile yarns A', B' is shogged successively over a plurality of pile formers.

The fabrics of FIGS. 33 and 34 illustrate loop pile patterns similar to the respective fabrics FIGS. 31 and 32 with the exception that, in FIG. 33, the pile yarn B' is shogged successively over a greater number of pile formers than the pile yarn A'. Also, in FIG. 34, pile yarn A' is shogged successively over a greater number of pile formers than pile yarn B'.

The fabric of FIG. 35 is especially provided to illustrate that either pile yarn A' or B' may be shogged over a plurality of pile formers and corresponding groups of ground warps during a single loop forming pick of the loom. For example, in the uppermost portion of FIG. 35 it will be observed that pile yarn A' is shogged back and forth over a single pile former and group of ground warps, but the pile yarn B' is shogged over two pile formers and corresponding groups of ground warps during weaving of each of the first two uppermost pile forming picks. This is also true with respect to the lower portion of FIG. 35. In one of the picks of the central portion of FIG. 35, on the other hand, it will be observed that the pile yarn A' is shogged over two pile formers and corresponding groups of ground warps while the pile yarn B' is being shogged over only a single pile wire and group of ground warps.

As indicated earlier herein, many variations of the pile designs shown in FIGS. 23-35 may be produced by varying the height of some loops relative to other loops, utilizing many variations in colors, kinds or weights of pile yarns, varying the number of pile yarn ends being fed by each of certain pile yarn feed guides relative to other pile yarn feed guides, feeding at least one pile yarn end through the pile yarn guides of each row to each of the pile formers, feeding pile yarn ends through one row of guides to alternate or certain spaced pile formers while feeding other pile yarn ends through the other row of guides to intervening pile formers only, cutting or shearing some or all of the pile loops, combining two or more of the designs of FIGS. 24-35 in a single fabric, weaving the fabric as...
a multiple-shot fabric, varying the gauge or pitch; i.e., the number of pile yarn guides and/or corresponding pile yarns, per given width of a particular fabric relative to another fabric, varying the number of weftwise rows of pile tufts per given length of a particular fabric relative to another fabric, etc.

As heretofore indicated, the apparatus of the invention is capable of weaving pile fabrics including one or more weftwise pile areas which are of varying density with respect to one or more other adjacent pile areas, as shown in FIGS. 26, 28 and 29. Also, the pile fabric may include certain weftwise extending pile areas whose pile faces are formed of different pile yarns from those employed in forming the pile faces of the other adjacent pile areas. For example, successive pile areas of relatively varying density may be produced by forming pile tufts of all the pile yarns in alternately warpswise spaced weftwise areas, and by forming pile tufts of alternate pile yarns only in intervening warpswise spaced weftwise areas while floating the other, intervening, pile yarns in such intervening areas.

Very pleasing aesthetic effects may be produced in the weaving of such variable density pile fabrics by threading a first type of pile yarn through all the primary pile yarn guides 95 or at least through a group of adjacent primary guides 95, and threading a second type of pile yarn through all the secondary pile yarn guides 96 or at least through a group of adjacent secondaries. The face of the fabric thus formed may be composed of groups of primary guides. Assuming, for example, that the first type of pile yarn is brown and the second type is tan and that one of each of the two types of pile yarns is provided for each pile former, a first pile area may be woven by forming raised loops from both colors of pile yarns over respective pile formers for a plurality of pile forming picks as in the upper portion of either FIG. 27 or FIG. 28.

A succeeding, second, pile area then may be woven by forming raised loops of the brown pile yarn only while floating the tan pile yarns in the base fabric for a plurality of pile forming picks as in the central portion of FIG. 27. Then a succeeding, third, pile area may be woven in the manner described for the latter first area, whereupon a succeeding, fourth, pile area may be woven similar to the second area, but wherein the loops are formed from the tan yarns and the floats are formed from the brown yarns. Such cycle of patterning may be repeated several times, as desired.

It is apparent that the pile loops in the first and third areas would be about twice as dense as the pile loops in the second and fourth areas, and although pile loops of different pile yarns appear in the first and third areas, all the pile loops in each second area would be brown and all the pile loops in each fourth area would be tan. The appearance of such areas may be further enhanced by cutting or shearing the pile loops thereof. It should be noted that all the floats thus formed may extend entirely beneath the weft yarns 22a, 22b (see FIGS. 13 and 13A), or the floats of one type pile yarn may extend between the weft yarns 22a, 22b with the floats of the other type pile yarn extending beneath both weft yarns (see FIGS. 14 and 14A), or the floats of both types of pile yarns may extend between the weft yarns (see FIGS. 15 and 15A), as desired.

Pile fabrics having alternate areas whose pile faces are formed of one pile yarn, for example, and having intervening areas whose pile faces are formed of another, different, pile yarn are similarly produced by forming pile tufts of said one pile yarn only while floating the other pile yarn during the weaving of the alternate areas, and by forming pile tufts of said other pile yarn only while floating said one pile yarn during the weaving of the intervening areas. During the weaving of either of the types of fabrics last described, those areas in which certain yarns are being floated while other yarns are being formed into pile tufts may be of such warpswise length that floats formed on the bottom of the fabric might bow or sag away from the face of the alternate areas, and by forming pile tufts of said other pile yarn only while floating said one pile yarn during subsequent handling and processing of the pile fabric.

To aid in overcoming such a problem, it has been found that at least those floats being formed of pile yarn being guided through the front or primary pile yarn guides 95 may be firmly bound to the bottom of the base fabric by other adjacent pile yarns of which pile loops are then being formed, simply by crossing the latter adjacent pile yarns beneath the floats being formed as shown in FIGS. 20, 21 and 32.

In this regard, FIG. 20 illustrates a portion of pile fabric F-8b whose base may be formed of groups of the ground warps C1, C2, S interwoven with pairs of the double weft yarns 22a, 23a. In the lowermost portion of FIG. 20, it will be observed that both pile yarns A, B are formed into a weftwise row of double pile loops extending over the respective groups of ground warps. As the weaving progresses upwardly from the bottom of this view, the primary pile yarns A are floated and thereby formed into floats A′ extending beneath the base fabric as each secondary pile yarn B is jogged back and forth above and across a respective group of ground warps and respective pile formers. The pile formers have been omitted in FIGS. 20 and 21 for purposes of clarity, but are shown in FIG. 22.

Following each jogging of each secondary pile yarn B, in either weftwise direction, both sheets of pile yarns A, B are dipped into the warp shed and a shot of weft yarns 22a, 23a is inserted in the shed over both sheets of pile yarns A, B. As shown in the central portions of FIGS. 20 and 21, following the formation of a plurality of loops of each pile yarn B, which loops define a portalet group of warps, each secondary pile yarn B is again dipped into the warp shed beneath the path of the weft-inserting means, a weft shot is inserted into the shed over both sheets of pile yarn, and the pile yarn guides 95, 96 are withdrawn from the shed. However, in order to bind the floats A′ against the bottom of the base fabric, each secondary pile yarn B is then jogged above and across a different pile former and corresponding group of ground warps from that over which it was jogged previously during weaving of the lower portion of the fabric in FIG. 20.

As each secondary pile yarn B is stepped weftwise so as to form a loop thereof over a different pile wire from that over which loops were previously formed from each pile yarn B, the corresponding lower bight of each pile yarn B is positioned above and across and beneath the float of the respective primary pile yarn A, thus forming a binder strand portion B′ of each pile yarn B which binds a medial portion of the corresponding float A′ against the bottom of the corresponding weft shot 22a, 23a. Thereafter, a warpswise row of a plurality of loops is formed of each secondary pile yarn B over the aforementioned different group of warps appearing in the upper portion of FIG. 20, while each pile yarn A is being floated. Finally, as shown in the uppermost portion of FIG. 20, the formation of loops of primary pile yarns A is resumed to complete formation of the floats A′.

By referring to FIG. 22, it will be seen why the binder strand B′ of each pile yarn B passes beneath the adjacent float A′. As there shown, upon formation of the last pile loop of the pile yarn B over one of the pile formers (shown in solid lines in FIG. 22), the two complementary yarns A, B are both positioned on the same side of the latter pile former 24, and the corresponding complementary pile yarn guides 95, 96 are raised or withdrawn from the base fabric with both of them positioned in the vertical plane between a common adjacent pair of pile formers. Since the pile yarn guide 96 shown in FIG. 22 is positioned rearwardly of the pile yarn guide 95, as the latter pile guide 96 is shifted to the left above and across the other adjacent pile former 24 shown in broken lines in FIG. 22, the pile yarn A is jogged back over pile yarn A. Thus, as the two pile yarn guides 95, 96 of FIG. 22 subsequently dip into the warp shed and a corresponding weft shot is inserted in the warp shed over the two pile yarns A, B of FIGS. 21 and 22, the latter pile yarn A then overlies and extends across the binder strand portion B′ as shown in FIGS. 20 and 21. It is apparent that, where the floats A′ are of considerable length, each pile yarn guide 96 may be set in a position for jogging the respective pile yarn B over two adjacent pile wires.
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so as to provide additional binder strand portions B" along the length of the float A" as desired.

Summarizing the invention, it can be appreciated that the pattern heads 140, 140' provide means for controlling the weftwise rows of pile yarn guides 95, 96 independently of each other to change the position of either or both rows of pile yarn guides in a weftwise direction during each pile-forming pick, or during certain pile-forming picks of the loom, and during continuous weaving operation of the loom. During any selected pick of the loom, or any selected series of successive pile-forming picks of the loom, either row of pile yarn guides may be maintained in a fixed vertical position or each pile yarn guide thereof may be shogged in either weftwise direction above and across one or more groups of two or more ground warps, independently of the other row of pile yarn guides. Also, the extent to which each row of pile yarn guides 95, 96 is lowered into the warp shed is readily adjustable relative to the guide support means so that, where two superposed weft inserters 22, 23 are used, the pile yarns A, B may be positioned either below the paths of both weft inserters 22, 23 or between the paths of the weft inserters, or one sheet of pile yarn may be positioned below the path of the lower weft inserter 22 while the other sheet of pile yarn is positioned between the paths of weft inserters 22, 23.

The wide range of pattern variations obtainable and the ease with which pattern lugs 160, 161 may be removed from and secured to the links of pattern chains 157 are desirable features of the novel pattern mechanism embodied in the pattern heads 140, 140'. However, in some instances, it may be desirable to utilize a shogging motion of the general type disclosed in the prior art, e.g., U.S. Pat. Nos. 2,960,665, 2,960,666, 2,960,667, 2,960,668, 2,960,669, 2,960,670, and 2,960,671, assigned to the assignees of the present invention, and various other mechanisms for controlling each of the rocker shafts 121, 123 of the instant invention.

In the drawings and specification there has been set forth a preferred embodiment of the invention and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

We claim:

1. A loom for weaving pile fabrics from weft yarns, groups of warps and pile yarns, said loom having an oscillatable reed, weft-inserting means, a weftwise series of spaced pile formers extending warwise over respective groups of ground warps, at least two, substantially parallel, weftwise rows of spaced pile yarn guides adapted to be shogged weftwise of the loom above and across said pile formers and having eyelets therein through which pile yarns extend to the fell of the fabric being woven, and dipping means for moving said pile yarn guides downwardly into and upwardly out of the shed formed from the ground warps and between corresponding pile formers to position the eyelets of said pile yarn guides forwardly of the reed and beneath the path of said weft-inserting means during each successive pile-forming pick of the loom, the combination therewith of pattern control means operable during continuous operation of the loom for, at times, shogging both rows of pile yarn guides weftwise simultaneously the same distance and in the same direction to form pile loops from all of the pile yarns over corresponding groups of ground warps, and at other times, shogging one said rows of pile yarn guides weftwise relative to the other row of pile yarn guides to form pile loops over corresponding groups of ground warps from at least those pile yarns extending through said one said rows of pile yarn guides.

2. A structure according to claim 1, wherein said pattern control means includes means for, at times, shogging each pile yarn guide of said one or two rows of pile yarns respectively adjacent to each other, into the warp shed, and for raising said bars, and means adjustably securing said one or two rows of pile yarn guides to one or said bars.

3. A structure according to claim 2, wherein at least some of the pile yarn guides of said one or two rows are closely adjacent respectively to pile yarn guides of said other row, and wherein said least-numbered means includes means for shogging each said one row back and forth in alternate order and above a single corresponding pile former during a plurality of successive pile-forming picks of the loom whereby those loops formed from the pile yarns extending through said one of the guides of said one row are positioned closely adjacent the floats being formed from those pile yarns extending through said respective guides of said other row.

4. A structure according to claim 1, wherein said pattern control means includes means for shogging each pile yarn guide of said one row in one weftwise direction and across at least one pile former concurrently with shogging each pile yarn guide of the other row in the opposite weftwise direction and across at least one pile former to effect said shogging of said one row of guides relative to said other row of guides whereby loops then are formed over corresponding pile formers from the pile yarns extending through both rows of guides.

5. A structure according to claim 1, wherein said pattern control means includes means to shog said pile yarn guides weftwise to such extent that each guide of said shogged across and above a greater number of pile formers during a given plurality of successive pile-forming picks of the loom than that over which each guide of said other row is being shogged in effecting said shogging of said one row of guides relative to said other row of guides.

6. A structure according to claim 1, wherein said pattern control means includes means operable during certain intervals of operation of the loom to shog each guide of at least one row of said pile yarn guides weftwise and above at least one pile former, and said pattern control means also including means to operable during certain other intervals to shog each guide of the last-numbered row weftwise across and above a greater number of pile formers than that across which they are shogged during said certain intervals.

7. A structure according to claim 1, wherein said pattern control means includes means to selectively shog weftwise said pile yarn guide rows in a stepwise manner varying distances with respect to each other during successive pile-forming picks of the loom in effecting said shogging of said one row of guides relative to said other row of guides, and wherein each step of each of said rows is at least about equal to the center-to-center distance between immediately adjacent pile formers.

8. A structure according to claim 1, wherein said pattern control means comprises a separate weftwise extending rocker shaft for each row of pile yarn guides and mounted for axial and angular movement on the loom above and rearwardly of said pile yarn guides, and means connecting each row of pile yarn guides for axial and angular movement in fixed relation with its respective rocker shaft, said dipping means including means to impart repeated angular movement to said shafts to move the respective rows of pile yarn guides downwardly into and upwardly out of the warp shed, and said pattern control means also including pattern means operatively associated with said rocker shafts for selectively imparting predetermined axial movement to said rocker shafts independently of each other to shog the respective rows of guides weftwise of the loom in timed relation to angular movements of said shafts.

9. A structure according to claim 1, wherein said weft-inserting means includes superposed lower and upper weft inserters, frame means for said pile yarn guides and including a pair of substantially parallel support bars, said pattern control means including means for shogging said support bars longitudinally relative to each other, said dipping means including means for moving said support bars downwardly to a predetermined lowered position adjacent and above the shed of the loom and for raising said bars, and means adjustably securing one of said rows of pile yarn guides to one of said bars and for
adjustably securing the other row of pile yarn guides to the other of said bars for vertically adjusting said rows of pile yarn guides relative to each other and relative to the respective support bars to thereby adjustably vary the extent to which each row of pile yarn guides is moved downwardly into the shed of the loom such that each row of pile yarn guides may be positioned alternately to guide the corresponding pile yarn path between the paths of the weft inserters or beneath both weft inserters when said support bars are moved to said lowered position.

10. In a loom for weaving pile fabrics from ground warps, weft yarns and pile yarns, said loom having an oscillatable reed, weft-inserting means including a pair of upper and lower weft inserters movable during each pick of the loom in substantially horizontal paths into and out of a shed formed of the ground warps, and a weftwise series of warpwise extending pile formers; the combination therewith of first and second weftwise extending substantially parallel rows of pile yarn guides having eyelets adjacent their lower ends through which pile yarns extend, frame means including first and second support bars supporting the respective first and second rows of pile yarn guides thereon, means for imparting substantially vertical movement to said frame means such as to move said guides downwardly into and upwardly out of the warp shed, said support bars occupying a predetermined lowered position adjacent and above the warp shed and in front of the rear edge where said frame means is moved downwardly, means to shog said support bars and said guides weftwise above and across the pile formers, and means adjustably securing said rows of pile yarn guides to said support bars for relative vertical adjustment thereon such that, when said frame means occupies said lowered position, each of said rows of pile yarn guides may alternatively occupy a position guiding respective pile yarns between the paths of said upper and lower weft inserters or a position guiding respective pile yarns beneath both weft inserters.

11. A structure according to claim 10, wherein said means adjustably securing said rows of pile yarn guides to said support bars comprises first and second block means to which the respective first and second rows of pile yarn guides are fixedly secured, each block means having a substantially horizontal key means projecting from one face thereof, said support bars each having a lower keyway in one face thereof and an upper keyway spaced above the respective lower keyway, the key means of said first and second block means being adapted to fit alternately in the lower and upper keyways of the respective first and second bars whereby, when the key means of said first and second block means are positioned in the lower keyways of the respective first and second bars, the respective first and second rows of pile yarn guides will occupy a relatively low position with respect to said support bars, and when the key means of said first and second block means are positioned in the upper keyways of the respective first and second support bars, said first and second rows of pile yarn guides will occupy a relatively high position with respect to said support bars, and means removably securing said first and second block means in the desired positions to the respective first and second support bars.

12. In a loom for weaving pile fabrics from ground warps, pile yarns and weft yarns, said loom including an oscillatable reed, weft-inserting means, and a weftwise row of warwise extending pile formers, the combination therewith of first and second weftwise extending substantially parallel rows of pile yarn guides corresponding to said pile formers and through which pile yarns are formed and from a source of the fill of the fabric being woven, first and second rocker shafts mounted for pivotal and angular movement on the loom above and rearwardly of said rows of pile yarn guides, means connecting said first and second rows of guides to the respective first and second shafts for axial and angular movement in fixed relation therewith, means to impart repeated angular movement to said shafts to lower said guides repeatedly from a raised position and to return said guides to said raised position, and means operatively associated with said shafts for selectively imparting predetermined axial movement to said shafts independently of each other to shog the respective first and second rows of pile yarn guides selectively across and above the pile formers prior to each descent of said guides into the warps according to a predetermined pattern.

13. A structure according to claim 12, wherein said first rocker shaft is tubular and said second rocker shaft extends axially within said first shaft, and said pattern means includes a pattern chain positioned adjacent each end of said shafts, each pattern chain having first and second rows of variant height pattern lugs thereon, means for intermittently moving said pattern chains to present successive first and second pattern lugs of each chain in ready positions aligned with and spaced from corresponding ends of the respective first and second shafts, means operable prior to each descent of said pile yarn guides and between successive intermittent movements of said chains to move both of said chains inwardly and outwardly in strokes of predetermined length, and said pattern lugs on said chains being arranged so that the first and second lugs on either chain will selectively engage corresponding ends of the respective first and second shafts and push the same to move the other ends of the shafts against respective first and second lugs of the other chain, and vice versa, during selected inward strokes of said chains according to variations in the height of successive lugs presented to the ready position.

14. A structure according to claim 13, wherein said means for intermittently moving said pattern chains includes means responsive to each outward stroke of each pattern chain for imparting a stepwise movement to the respective pattern chain.

15. A structure according to claim 13, including a pattern shaft supporting each pattern chain thereon, said means for intermittently moving said pattern chains comprising a rotor fixed on each pattern shaft and having a plurality of circularly spaced projections thereon, and separate latch means carried by the loom and engageable with projections on the respective rotors during outward strokes of said pattern chains and effectively to impart stepwise movement to each chain during such outward strokes of said chains.

16. A structure according to claim 15, wherein each latch means comprises a pair of latches alternatively movable into operative relation to the respective rotor, pattern control means for effecting alternative movement of said latches into operative relation to the respective rotor, and said latches being arranged so that, when one of them is disposed in operative relation to the respective rotor, it will impart movement in one direction to the respective pattern chain and, when the other latch is in operative relation to the respective rotor, it will impart movement in the opposite direction to the respective pattern chain during corresponding outward strokes of said pattern chains.

17. In a loom for weaving pile fabrics from weft yarns, groups of ground warps, and pile yarns, wherein said loom comprises an oscillatable reed, weft-inserting means, a weftwise series of spaced warwise extending pile formers, at least two weftwise rows of pile yarn guides for guiding pile yarns from a source to the fill of the fabric being woven, said rows of guides being movable weftwise across and above said pile formers, and means for holding said pile yarn guides downwardly and upwardly out of the shed of the ground warps and between said pile formers to position pile yarns extending through said guides beneath the path of said weft-inserting means during each pile forming pick of the loom; the improvement comprising pattern control means for, at times, shogging each pile yarn guide of one of said pairs of pile yarn guides along a weftwise direction a distance at least about equal to the center-to-center distance between three adjacent pile formers and for concurrently shogging each pile yarn guide of the other of said rows in the opposite weftwise direction a distance at least about equal to the center-to-center distance between three adjacent pile formers other than the third from any of the pile yarn guides in the same weftwise direction.
18. In a loom for weaving pile fabrics from ground warps, pile yarns and weft yarns, said loom including an oscillating reed, weft-inserting means, and a weftwise series of spaced warwise extending pile formers, at least two warwise extending substantially parallel rows of pile yarn guides substantially vertically movable downwardly into and upwardly out of the shed of the loom between the pile formers to position pile yarns extending therethrough beneath the path of travel of the weft-inserting means, and both of said rows of guides being movable weftwise above and across the pile formers; the combination therewith of pattern control means for shogging each pile yarn guide of one of said rows weftwise of the loom above and across at least one respective pile former while maintaining the other of said rows of pile yarn guides stationary as to weftwise movement thereof during at least one pick of the loom whereby, upon movement of said pile yarn guides into and out of the shed, the pile yarns extending through the guides of said other row will form respective floats in the fabric being woven.

19. In a loom for weaving pile fabrics from ground warps, pile yarns and weft yarns, said loom including an oscillating reed, weft-inserting means, a weftwise series of spaced warwise extending pile formers, a plurality of pile yarn guides therethrough extending from a source extending to the fell of the fabric being woven and adjacent the pile formers, and means to lower said guides repeatedly from a raised position above the pile formers into the warps beneath the path of the weft-inserting means and to return said guides to said raised position; the combination therewith of pattern control means operable during continuous operation of the loom for, at times, shogging at least some of said pile yarn guides weftwise a given distance across and above corresponding pile formers, and for, at other times, shogging some of said pile yarn guides weftwise relative to others of the pile yarn guides across and above corresponding pile formers a different distance from said given distance to form pile loops over the corresponding pile formers from the pile yarns extending through said guides.

20. A structure according to claim 19, wherein said pattern control means includes means to shog all of said pile yarn guides in the same weftwise direction during at least one pile-forming pick of the loom.

21. A structure according to claim 19, wherein said pattern control means includes means to shog certain of said pile yarn guides in the opposite weftwise direction from that of certain others of said pile yarn guides during at least one pile-forming pick of the loom.

22. In a loom for weaving pile fabrics from ground warps, pile yarns and weft yarns, said loom including an oscillating reed, weft-inserting means, and a weftwise series of spaced warwise extending pile formers; at least two warwise extending substantially parallel rows of pile yarn guides substantially vertically movable downwardly into and upwardly out of the shed of the loom between the pile formers to position pile yarns extending therethrough beneath the path of travel of the weft-inserting means, said guides being moveable weftwise above and across the pile formers, and pattern control means for shogging each pile yarn guide of one of said rows weftwise above and across at least one pile former concurrently with shogging each pile yarn guide of the other of said rows weftwise above and across a greater number of pile formers than that over which each pile yarn guide of said one row is being shogged during weaving of a portion of pile fabric.

23. A structure according to claim 22, wherein said pattern control means includes means to shog said one row of guides in the opposite weftwise direction from said other row of guides during at least one pile-forming pick of the loom.

24. A structure according to claim 22, wherein said pattern control means includes means to shog said one row of guides in the opposite weftwise direction from said other row of guides during at least one pile-forming pick of the loom.

25. A structure according to claim 22, wherein said pattern control means includes means to shog each guide of said other row above and across said greater number of pile formers during a single pile-forming pick of the loom.

26. A structure according to claim 22, wherein said pattern control means includes means to shog each guide of said other row in a stepwise manner above and across a corresponding number of pile formers concurrently with a corresponding number of successive pile-forming picks of the loom.

27. In a method of weaving pile fabrics on a loom in which pile yarns are woven into a base of weft yarns and spaced groups of ground warps by shogging the pile yarns weftwise of the loom above and across pile formers extending warwise over respective groups of ground warps and by dipping the pile yarns downwardly into and upwardly out of a shed of the warps between the pile formers and corresponding groups of the warps below the path of weft-inserting means in the formation of pile loops, the steps during continuous operation of the loom of, at times, shogging all the pile yarns simultaneously in the same weftwise direction for the same distance to form pile loops from all of the pile yarns over corresponding groups of warps, and at other times shogging certain of the pile yarns weftwise relative to certain other of the pile yarns to form pile loops over corresponding groups of warps from at least said certain pile yarns.

28. A method according to claim 27, wherein said weft-inserting means includes a lower weft inserter, and including an additional, upper, weft inserter positioned closely adjacent the lower weft inserter, and said method further including dipping the pile yarns into and out of the warp shed below the path of both the lower and upper weft inserters following each shogging of any of the pile yarns weftwise of the loom.

29. A method according to claim 27, wherein said weft-inserting means includes an upper weft inserter, and an additional, lower, weft inserter closely adjacent and below the upper weft inserter, and said method further including dipping said pile yarns into and out of the warp shed to a level between the paths of the upper and lower weft inserters following each shogging of any of the pile yarns weftwise of the loom.

30. A method according to claim 27, wherein said weft-inserting means includes an upper weft inserter, and an additional, lower, weft inserter closely adjacent and below the upper weft inserter, and said method further including dipping said certain of the pile yarns into and out of the warp shed to a level below the paths of the upper and lower weft inserters following each shogging of any of the pile yarns weftwise of the loom.
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36. A method according to claim 35, further comprising successively shogging each of said certain other pile yarns above and across at least one respective pile former in the opposite weftwise direction from said certain other pile yarns sequentially with said shogging of each of said certain pile yarns in said one weftwise direction above and across said plurality of pile formers.

37. A method according to claim 27, in which the step of shogging certain of the pile yarns relative to certain other pile yarns includes inserting the end of said certain other pile yarns first in said one weftwise direction above and across the respective pile formers whereby pile loops are formed from said certain pile yarns while maintaining said certain of the pile yarns stationary as to weftwise movement thereof during a plurality of pile-forming picks of the loom, and dipping said certain other of the pile yarns and said certain pile yarns into and out of the warp shed below the path of the weft-inserting means following each shogging of each of said certain pile yarns and said certain other pile yarns into and out of the warp shed beneath the path of the weft-inserting means following each shogging of each of said certain pile yarns above and across the respective pile formers whereby pile loops are formed from said certain pile yarns as floats are formed from said certain other pile yarns.

38. A method according to claim 2, further comprising the steps of shogging said certain of the pile yarns weftwise above and across the respective pile formers while maintaining said certain of the pile yarns stationary as to weftwise movement thereof during a plurality of pile-forming picks of the loom, and dipping said certain other of the pile yarns and said certain pile yarns into and out of the warp shed below the path of the weft-inserting means following each shogging of each of said certain pile yarns and said certain other pile yarns into and out of the warp shed below the path of the weft-inserting means following each shogging of each of said certain pile yarns into and out of the warp shed beneath the path of the weft-inserting means following each shogging of each of said certain pile yarns above and across the respective pile formers.

39. A method according to claim 36, which includes the steps of projecting said certain and said certain other pile yarns into the warp shed beneath the path of the weft-inserting means, inserting a shot of weft yarn in the warp shed over the pile yarns, then drawing the pile yarns upwardly between the pile formers, and beating up the pile yarns thus looped beneath the corresponding shot of weft yarn following each shogging of each of said certain and said certain other pile yarns over each respective pile former.

40. In a method of weaving pile fabrics on a loom in which pile yarns are woven into a base of warps and weft yarns by shogging pile yarns over warwise extending pile formers and projecting the pile yarns into and out of the warp shed between the pile formers and corresponding groups of warps below the path of a weft-inserting means in the formation of loops over and across the pile formers and beneath weft yarns; the method further comprising shogging each of certain pile yarns over a greater number of pile formers than that over which each of certain other pile yarns are being shogged during weaving of a portion of the fabric.

41. In a method of weaving pile fabrics on a loom in which pile yarns are woven into a base of ground warps and weft yarns by shogging the pile yarns weftwise of the loom above and across warwise extending pile formers and corresponding groups of ground warps and moving the pile yarns into and out of a shed of warps between the pile formers and corresponding groups of the warps below the path of a weft-inserting means to form pile loops; the step of shogging certain of the pile yarns weftwise of the loom across and above corresponding groups of ground warps while maintaining certain other of the pile yarns stationary as to weftwise movement thereof during at least one pick of the loom.

42. A method according to claim 41, wherein said certain and said certain other pile yarns are arranged in alternating weftwise relationship, and in which the step of shogging certain of the pile yarns above while maintaining certain other of the pile yarns stationary comprises shogging each of said certain pile yarns above and across a corresponding pile former during each of corresponding pile-forming picks of the loom, and dipping said certain pile yarns and said certain other pile yarns into and out of the warp shed beneath the path of the weft-inserting means following each shogging of each of said certain pile yarns above and across the respective pile formers whereby pile loops are formed from said certain pile yarns as floats are formed from said certain other pile yarns.

43. A method according to claim 42, further comprising the steps of shogging said certain other of the pile yarns with respect to said certain pile yarns, inserting a shot of weft yarn in the warp shed over the pile yarns, then drawing the pile yarns upwardly between the pile formers and beating up the pile yarns thus looped beneath the corresponding shot of weft yarn following each shogging of each of said certain pile yarns and said certain other pile yarns into and out of the warp shed beneath the path of the weft-inserting means following each shogging of each of said certain pile yarns into and out of the warp shed beneath the path of the weft-inserting means following each shogging of each of said certain pile yarns above and across the respective pile formers whereby pile loops are formed from said certain pile yarns as floats are formed from said certain other pile yarns.

44. A method according to claim 41, wherein the shogging of certain of the pile yarns includes shogging each of the same above and across a plurality of pile formers, and dipping the certain pile yarns into and out of the warp shed below the path of the weft-inserting means following each shogging of each of said certain pile yarns above and across each respective pile former.

45. A method according to claim 42, wherein the shogging of certain of the pile yarns includes shogging each of the same above and across a plurality of pile formers, and dipping the certain pile yarns into and out of the warp shed beneath the path of the weft-inserting means following each shogging of each of said certain pile yarns above and across each respective pile former.

46. In a method of weaving pile fabrics on a loom in which pile yarns are woven into a base of ground warps and weft yarns by shogging pile yarns weftwise of the loom above and across warwise extending pile formers and moving the pile yarns into and out of the warp shed between the pile formers and corresponding groups of the warps and below the path of weft-inserting means in the formation of pile loops above and across the pile formers and beneath weft yarns; the steps of, at times, shogging only some of the pile yarns weftwise a given distance, and at other times, shogging at least some of the pile yarns weftwise a different distance from said given distance during continuous weaving operation of the loom.

47. In a method of weaving pile fabrics on a loom in which pile yarns are woven into a base of ground warps and weft yarns by arranging the pile yarns in at least two separately shoggable sets and shogging the pile yarns weftwise of the loom above and across warwise extending pile formers and moving the pile yarns into and out of the warp shed between the pile formers and corresponding groups of the warps and below the path of weft-inserting means in the formation of pile loops above and across the pile formers and beneath weft yarns; the steps of, at times, shogging all of the pile yarns of both sets weftwise a given distance above and across the pile formers, and at other times, shogging the pile yarns of only one of said sets weftwise above and across the pile formers a different distance from said given distance during continuous operation of the loom.

48. A method according to claim 47, wherein the step of, at times, shogging all the pile yarns of both sets a given distance, includes shogging all the pile yarns in the same weftwise direction.

49. A method according to claim 47, in which the step of, at times, shogging all the pile yarns a given distance, includes shogging one set of the pile yarns in one weftwise direction while shogging the other set of pile yarns in the opposite weftwise direction.

50. A method according to claim 47, in which the step of shogging all the pile yarns a different distance from said given distance includes shogging one set of the pile yarns a greater weftwise distance than the other set of pile yarns.

51. In a method of weaving pile fabrics on a loom in which pile yarns are woven into a base of ground warps and weft yarns by shogging pile yarns weftwise of the loom above and across warwise extending pile formers and moving the pile yarns into and out of the warp shed between the pile formers and beneath weft yarns, the steps of, at times, shogging all of the pile yarns of both sets weftwise a given distance above and across the pile formers, and at other times, shogging the pile yarns of only one of said sets weftwise above and across the pile formers a different distance from said given distance during continuous weaving operation of the loom.

52. A method according to claim 47, wherein the step of, at times, shogging all the pile yarns a given distance, includes shogging all the pile yarns in the same weftwise direction.

53. A method according to claim 47, in which the step of, at times, shogging all the pile yarns a given distance, includes shogging one set of the pile yarns in one weftwise direction while shogging the other set of pile yarns in the opposite weftwise direction.

54. A method according to claim 47, in which the step of shogging all the pile yarns a different distance from said given distance includes shogging one set of the pile yarns a greater weftwise distance than the other set of pile yarns.
and corresponding groups of the warps and below the path of
weft-inserting means in the formation of pile loops above and
across the pile formers and beneath weft yarns; the steps of, at
times, shogging all of the pile yarns weftwise a given distance
above and across the pile formers, and at other times, shogging some of the pile yarns a greater weftwise distance
than that at which the other pile yarns are being shogged dur-
ing continuous operation of the loom.