HIGH SPEED CARPET LOOM AND METHOD OF WEAVING

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Fig. 2

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This invention relates to fly shuttle looms of the type known as a Sulzer loom and more especially to a novel apparatus and method for weaving pile fabrics on looms of this character.

Various types of looms are currently in use for weaving cut and loop pile fabrics, such as rugs, carpets, and the like. Some looms, known as the Wilton type, utilize weftwise pile wires which are inserted in the shed formed of the ground warps and pile yarns for forming loops over the pile wires.

Other looms, known as the Clark type, utilize warpwise extending, stationary or movable pile wires which extend through an oscillating reed. Pile wires are interwoven with the ground fabric by means of vertically and laterally movable pile yarn guides which, subsequent to each double weft yarn being inserted by a reciprocating needle, move upwardly out of the shed, over the tops of respective pile wires and ground warps and then downwardly into the shed on the other side of the pile wires so that another double weft yarn may be inserted over the looped lower portions of the pile yarns. Single-shot and multiple-shot carpet fabrics are woven in this manner.

Both types of looms mentioned above must operate relatively slowly due to the fact that, among other things, the Wilton type loom has required the insertion and withdrawal of transverse pile wires at frequent intervals, and the Clark type loom has required that an elongated, cantilever-supported, reciprocating needle be used for inserting double weft yarns with each pick of the loom. The Clark loom has also required that the tension in the pile yarns be carefully controlled and maintained at all times during the weaving operation.

It is an object of this invention to provide an improved apparatus for and method of weaving loop pile fabrics which comprises inserting warpwise pile yarns and respective pile yarn guides between certain adjacent ground warps while passing a single strand of weft yarn through the shed and over the pile yarns, raising and shortening the guides over and across respective pile wires and groups of warps while beating up the single strand of weft yarn, and then repeating the steps prescribed in weaving a length of fabric. This produces a pile fabric at a much faster speed than has been obtainable on prior looms.

As is well known, looms of the Clark type have a cantilever-supported, reciprocating needle and are devoid of a lay, due to the fact that the pile yarns must be inserted downwardly; by pile yarn guides, through the warp shed a sufficient distance so that the weft yarns may be inserted above the pile yarns. The presence of a lay would obstruct the downward movement of the pile yarn guides through the shed. It follows, therefore, that conventional cop-carrying or bobbin-carrying shuttles could not be used with pile yarn guides of the character described, since the stroke of the pile yarn guides would not be sufficient to move the pile yarns below the path of travel of the shuttle because of the obstruction of the lay.

With the foregoing in mind, it is another object of this invention to provide a loom having a free-flight shuttle guided by a shuttle race which will permit pile yarns to be inserted downwardly through the shed and sufficiently so the yarn carried by the shuttle may be inserted above the pile yarn.

It is a more specific object of this invention to provide apparatus for weaving pile fabric in which a ground fabric is woven from ground warps with weft threads inserted in the shed from one side only of the loom by means of projectile-like gripping shuttles which pass through a race formed of a weftwise row of closely spaced hook-shaped shuttle guides. Concurrently with the weaving of the fabric, pile yarns are inserted downwardly through the shed, between the shuttle guides and below the path of the weft, which is then inserted over the pile yarns.

To our knowledge, carpet and rug fabrics could not be woven on Sulzer looms heretofore, not only because no way had been conceived for inserting and shortening pile yarns on this type of loom, but because the prior art projectile-like shuttles were incapable of efficiently grasping and pulling jute and similar weft yarns through the shed, since such weft yarns would slip out of the grippers provided on such prior art gripper shuttles. However, we have overcome this defect by providing the shuttles with grippers having serrated or irregular mating surfaces which will tightly grip the jute, as disclosed in our co-pending United States application, Serial No. 826,830, filed July 13, 1959, now abandoned, and entitled Gripper Shuttle.

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:

FIGURE 1 is a perspective view of a Warner & Swayne-Sulzer loom, with parts broken away and showing the improved pile weaving apparatus in association therewith;

FIGURE 2 is a transverse vertical sectional view taken substantially along line 2--2 in FIGURE 1 and showing the pile yarn guides in lowered or pile-inserting position;

FIGURE 3 is a schematic elevation, partially in section and with parts broken away, looking rearwardly substantially along line 3--3 in FIGURE 2 and illustrating, in particular, preferred means for vertically reciprocating the pile yarn guides and for shortening the same;

FIGURE 4 is an elongated fragmentary plan view taken substantially along line 4--4 in FIGURE 3, and showing parts of the mechanism for shortening the pile yarn guides;

FIGURE 5 is a top plan view of the loom, partially in section, and being taken substantially along line 5--5 in FIGURE 3, with parts being broken away for purposes of clarity;

FIGURE 6 is a fragmentary vertical sectional view taken substantially along line 6--6 in FIGURE 3 and showing the parts of the mechanism for shortening the pile yarn guides;

FIGURE 7 is an enlarged, schematic, vertical sectional view similar to the central portion of FIGURE 2, showing the pile yarn guides in lowered or pile-inserting position.

FIGURE 8 is a view similar to FIGURE 7 showing the reed in beat-up position and the pile yarn guides starting to move upwardly;

FIGURE 9 is a view similar to FIGURE 7 showing the reed in a backward stroke, the pile yarn guides in raised position and a single strand of weft yarn inserted in the shed formed of the ground warps;

FIGURE 10 is a fragmentary isometric view, partially in section, showing the reed, shuttle guides and pile yarn guides in the position occupied thereby as a shuttle inserts a single weft yarn in the shed; and

FIGURE 11 is a fragmentary sectional view taken warwise of one example of the fabric and looking weft-
wise wherein the fabric is shown in the form of a two-shot fabric.

The present method is carried out on a loom of the type known as a Warner & Swasey-Sulzer weaving machine, many elements of which are constructed and operated substantially in the manner disclosed in U.S. Patent No. 2,099,627 granted to Rudolph Rossmann, November 16, 1937, and in other patents mentioned therein. Also, since many of the elements shown in the accompanying drawings are usual parts of a Warner & Swasey-Sulzer weaving machine or loom, only so much of such usual parts will be described as is necessary to a clear understanding of the present invention.

As best shown in FIGURES 1, 2, 3 and 5, the loom comprises a frame broadly designed at 10 and including left-hand and right-hand side frame members 11, 12 between which are mounted a ground warp beam 13, a rear guide roll or vibrator roll 14, a plurality of vertically movable harnesses or heddles 15, a front carrier roll 16 for the fabric F, a driven take-up roll or sand roll 17, a press roll 18, and a back beam 20, all of which are usual parts of a loom of this character.

The loom is equipped with a main drive shaft 22 journaled in a lay drive housing 28 and in frame members 11, 12. Housing 28 is mounted on a composite main girder 24 (FIGURES 1 and 2). Girder 24 supports a housing 25 within which a suitable mechanism is provided for imparting vertical reciprocatory movement to the heddles or harnesses 15.

Housing 28 has suitable gearing therein for transmitting rocking or oscillating motion to a rocker shaft 26 from the main drive shaft 22. Rocker shaft 26 is also journaled in frame members 11, 12 and bearings 25, only one of which is shown mounted on girder 24 in FIGURE 1. Shaft 26 has a plurality of rocker arms or swords 27 fixed thereon which support a transverse reed bar or lay 30 on which a row of closely spaced shuttle guides or shuttle hooks 31 and a row of corresponding reed splits 32 are fixedly mounted. Reed splits 32 collectively form a reed 33 which is peculiar to the present invention, as will be later described.

As best shown in FIGURES 7, 8, 9 and 10, each shuttle guide 31 is in the form of a hook having a hole or opening 34 therethrough. The holes 34 in shuttle guides 31 collectively form a shuttle race for guiding successive shuttles, such as shuttle 35 of FIGURE 10, through the shed formed of the warps 13c by the harnesses or heddles 15.

As shown in FIGURE 10, each shuttle 35 is in the form of a small metal projectile having a rounded, tapered or pointed nose 36. Shuttle 35 is of hollow construction and contains a pair of yieldable gripping arms 37 which are biased toward each other and whose rear ends have a pair of irregular mating jaws or grippers 40 thereon which are exposed in an opening or notch 43 provided in the rear end of the projectile or shuttle 35. Shuttle 35 is also provided with an intermediate opening 43 therethrough which a usual spreading device (not shown) passes and spreads apart the gripper arms 47 for momentarily opening grippers 40 as each shuttle 35 is moved from an endless return conveyor mechanism 44 (FIGURE 2) and positioned in alignment with either or both of a pair of weft or filling yarns 46 (FIGURE 1) and within a shuttle feeding or picking box 47.

By means substantially as disclosed in FIGURES 5, 6, 7 and 8, said Rossmann Patent No. 2,099,627, the end of a filling or weft yarn 46 is positioned between the open jaws or grippers 40, which are then released to clamp the corresponding gripping shuttle through the shuttle guides 31 and the shed formed of the ground warps 13c. Such looms are usually provided with a picking lever which propels each successive shuttle 35 through the shed in timed relation to the operation of the harnesses or heddles 15.

As is peculiar with this particular type of loom, but which is a usual mechanism of such loom, energy is built up in the picking lever by twisting a torsion rod through a cam action in the picking box and then locking in its loaded position approximately four times a second. A shuttle is placed in firing position and the driving force is then released. The shuttle is then flipped or shot across the machine at high speed, carrying the filling with it. Such looms are normally equipped with a hydraulic dashpot which cushions the picking lever as it nears the end of each stroke. Since the picking lever and associated elements, including the means for returning the shuttles to picking position are usual parts of a Warner & Swasey-Sulzer weaving machine or loom and it is with such parts that the present method and apparatus are particularly adapted to be associated.

With the exception of a novel reed construction 33 being substituted for the usual reed construction, the parts hereof are described as usual parts of a Warner & Swasey-Sulzer weaving machine or loom and it is with such parts that the present method and apparatus are particularly adapted to be associated.

The present invention resides in a novel method and apparatus for interweaving yarns with a base fabric in which a single strand of weft yarn is inserted with each pick of the loom and all strands are inserted in one direction by means of successive gripper or gripping shuttles of the character hereinafore described, and wherein the pike yarns extend through a row of "dipping" pike yarn guides which move the pike yarns downwardly over the tops of pike wires and into the shed formed of the ground warps. This causes the pike yarns to extend from the pike wires downwardly and rearwardly at an angle and below the path of the weft yarn as it is being inserted through the openings 34 in the shuttle guides 31 (FIGURE 7). After, or at substantially the same time as, the corresponding weft yarn is beat-up against the fell of the cloth by the reed 33, the pike yarn guides move upwardly and then cross above the pike wires and again move downwardly preparatory to a succeeding weft yarn or pike being inserted through the shuttle guides 31.

In carrying out the present method, there is provided a pike yarn beam 70 from which pike yarn 71 are withdrawn. Pike yarn beam 70 is journaled in blocks 72 at opposite ends thereof. Blocks 72 are carried by respective A-frames 73, 74 which are suitably attached to the respective side frame members 11, 12 by respective substantially horizontal frame members 75, 76 (FIGURES 1, 2 and 3). Opposed ends of a heddle guide beam 80 are suitably secured to the upper portions of frame members 75, 76. The central portion of each frame member has a forwardly extending bar 81 thereon (FIGURE 2) from which a pair of guide plates 82 depends. Guide plates 82 straddle the upper portions of harness 15 to assist in guiding the pike yarns during vertical reciprocation therefor.

Mounted for vertical and lateral shcoggin motion forwardly of harnesses 15 is a substantially rectangular pike guide frame 85 which is similar to a conventional harness frame, but is devoid of any heddles. The pike guide frame 85 is best shown in FIGURES 2, 3, 5, 7 and 9 and comprises a pair of substantially upright side frame members 86, 87, a lower substantially horizontal frame member 89 and an upper transverse frame member or plate 91. Frame members 86, 87, 90, 91 of pike guide frame 85 are suitably interconnected.

The left-hand side frame member 86 of pike guide frame 85 has a laterally projecting portion 92 integral therewith or suitably secured thereto which is suited for vertical and horizontal sliding movement in a substantially vertically extending channel member 93. Channel member 93 is fixed on the inner end of a support 94 projecting inwardly from the horizontal portion 75 of A-frame 70.
The lower end of shaft 101 is journaled in a bearing block 102 fixed on a bar 103 projecting inwardly from and being suitably secured to the substantially horizontal frame member 76 of the right-hand A-frame 74.

The lower portion of shaft 101 is journaled in a bearing block or sleeve 185 (FIGURES 3, 4 and 6) whose flanged lower end is fixed to a gear housing 106 suitably supported by the main frame 24 (see FIGURE 6).

The lower end of shaft 101, within gear housing 106, has a bevel gear 107 fixed thereon which meshes with a bevel gear 110 fixed on a shaft 111. Shaft 111 extends outwardly from housing 106. A gear 112 fixed on the free end of shaft 111 engages a smaller gear or pinion 113 (FIGURES 4 and 6) which is fixed on one end of a jack shaft 114. Gear housing 106 has a rearwardly projecting arm 115 fixed thereto which supports a parallel frame member 116.

Frame member 116 is also supported by a substantially horizontal bar 117 projecting rearwardly from and being suitably secured to the top portion of housing 106. Jack shaft 118 is journaled in a pair of bearing blocks 120 suitably secured to the parallel frame member 116.

The end of shaft 114, remote from that end to which gear 112 is fixed, has a sprocket wheel 121 fixed thereon. Sprocket wheel 121 is engaged by an endless sprocket chain 122 which is also mounted on a sprocket wheel 123 fixed on the main drive shaft 22.

It is to be noted that main drive shaft 22 transmits rotation to vertical cam shaft 101 to rotate cam 100. Cam 100 thus engages and imparts STOPING movements or horizontal reciprocation to pile guide frame 85. Since pile guide frame 85 and pile reciprocates relative to shaft 101, the two brackets or arms 98 are each provided with a longitudinally extending slot 125 (FIGURE 5) through which shaft 101 loosely extends.

The front face of the upper plate or bar 91 of pile guide frame 85 is substantially vertical and, therefore, plate 91 is provided with a recess 126 in which the upper rear portion of a downwardly and forwardly inclined pile guide supporting plate 127 is suitably secured. Pile guide supporting plate 127 has a longitudinally extending groove 130 in its front surface adjacent the lower edge thereof, which receives a keyed portion 131 on a pile guide holder 132. Pile guide holder 132 has a plurality of downwardly and forwardly projecting pile yarn guides or gripping needles 133 thereon. The lower end of each guide 133 is provided for one or more corresponding pile yarns 71.

In order to impart vertical reciprocation to the pile yarn guides 133 in timed relation to the stopping motion imparted thereto by eccentric cam 100, it will be observed in FIGURE 4 that the lower horizontal bar 96 of pile guide frame 85 has a plurality of downwardly projecting frame members or links 134 suitably secured thereto, each of which is provided with a pin 137 for receiving a hooked upper portion 140 of a link 141.

The lower ends of links 141 are connected, by means of a link coupling 143, to one arm of a bell crank 144. Each bell crank 144 is pivoted, as at 145, on the housing 25 within which they are disposed. The other arms of bell cranks 144 are fixed to a common horizontally movable tappet rod or arm 147. One end of tappet rod 147 is pivotally connected to one end of a crank 150 fixed on a shaft 151 which is also suitably journaled in housing 25.

The other end of crank 150 has a link 152 extending therefrom to a crank or follower arm 153 disposed within a conventional tappet drive housing 154. Tappet drive housing 154 has a shaft 155 journaled therein on which a medial portion of follower arm 153 is journaled.
wires 170 and corresponding groups of ground warps to draw the pile yarns 71 over the pile wires 170 and form raised loops 716 (FIGURE 11). The mechanism in the lower portion of FIGURE 3 then causes the pile yarn guide 133 to move downwardly adjacent the other sides of the respective pile wires to again occupy substantially the position shown in FIGURES 2 and 7. However, the pile yarns will then extend from the upper edges of the respective pile wires 170 downwardly past the opposite sides thereof from that shown in FIGURE 7. Thereupon another single weft yarn 46 is inserted through the open end of the pile yarns. The process is then repeated in the course of which cam 190 causes the pile yarn guides to warp from left to right in FIGURE 3 or in the opposite direction from that in which they had last been shagged to form loops 71c and to complete a cycle in the operation of the apparatus. In this instance, warpwise rows of loops 71b, 71c may be formed over alternate groups of warps 13a, so that a group of warps devoid of loops may appear between each adjacent pair warpwise rows of loops 71b, 71c to facilitate cutting the fabric warpwise between adjacent rows of loops during installation thereof.

In weaving the two-shot fabric shown in FIGURE 11, the pile yarn guides 133 are prewound with alternate picks and remain raised with intervening picks. It follows, therefore, that shaft 101 and the operation of the pile guide frame lifting means of FIGURE 3 must then operate at half the speed of main drive shaft 22. However, it is well within the scope of the present invention to change the speeds of the shafts 101, 163 to produce one-shot or three-shot fabrics, if desired, without departing from the spirit of the invention.

Now, one important reason why it is not necessary that a certain predetermined tension be maintained in the pile yarns 71 between beam 70 and the pilot yarn guides 133 is due to the fact that the substantially vertical and rotary movement of the pile yarn guides 133 is substantially perpendicular to the normal path or plane of the pile yarns 71 passing through the eyes 134 of the pile yarn guides 133. Also, since the lower surfaces of the pile wires 170 extend at an angle relative to the immediate fall of the cloth, the pile yarns actually raise the base fabric immediately adjacent the fell thereof as the pile yarn guides 133 dip into the shed formed of the ground warps 13a. Thus, the pile yarn is tightened against the lower surfaces of the individual weft yarns 46 immediately after each weft yarn is beat-up by reed 33 so the pile yarns are tightly secured in the fabric immediately upon each succeeding pick being inserted and beat-up at the fell of the cloth.

It will be noted that, since the loom operates at relatively high speeds of 240 picks per minute or even more, the use of the gripping shuttles, due to their small size, is particularly compatible with the reciprocating pile yarn guides 133, since the pile yarn guides 133 need only reciprocate with relatively short strokes in opposite directions in order to insure that the pile yarns are inserted below the plane of the weft yarns 46 as they are cast. Also, pile yarn guides 133 need only raise a relatively short distance in order to position the same above the pile wires to shog the pile yarns over the pile wires. Thus, the present gripping and shogging apparatus, embodied in the pile yarn guides 133 and the operating means therefor, are used with the particular type of weft inserting means, embodied in the shuttles 35, without any sacrifice in the speed of the loom and corresponding rate of production of the loom.

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

We claim:

1. A method for interweaving ground warps and pile wires into a fabric a fly shuttle type loom having
from pile yarns, ground warps and weft yarns, means to form said warps into a succession of sheds transversely of said ground warps and said loom, a row of hook-shaped shuttle guides extending transversely of the loom, at least one projectile-like shuttle adapted to be picked through said shuttle guides, means for picking the shuttle from one side only of the loom, said shuttle guides being so positioned as to be disposed within the shed formed of said ground warps, a plurality of warpswise pile wires above said row of shuttle guides, means operable automatically preceding the insertion of a weft yarn through said shuttle guides and said shed for moving said pile yarns downwardly in the shed between the shuttle guides and below the path of travel of the weft yarn so inserted, and said last-named means being operable to raise the pile yarns and shog the same over the pile wires and again insert the same prior to a certain succeeding weft yarn being inserted.

7. The combination with a fly shuttle type loom having weft gripping shuttles, means for picking the shuttles from one side only of the loom, closely spaced shuttle guides for the shuttles and a reed oscillatable immediately rearwardly of and in synchronism with said shuttle guides, of a series of substantially vertically reciprocable pile wire guides having pile yarn extending therethrough, pile wires extending through the reed and terminating rearwardly of the fell of the fabric being woven, means for raising and lowering said pile yarn guides in timed relation to the operation of said reed and said shuttles, means for shogging said pile yarn guides when in raised position first in one direction and then in the other direction in alternation with beat-up strokes of said reed whereby said pile yarn guides insert pile yarn between said shuttle guides and below the path of successive shuttles, then raise the pile yarns beneath the weft yarn thus inserted and shog the same over the corresponding pile wires and warps and again insert the pile yarns below the path of a succeeding shuttle and then raise the pile yarns upwardly and shog them back over the same pile wires and warps to complete a cycle.

8. A fly shuttle type loom for weaving pile fabrics from ground warps, weft yarns and pile yarns, said loom having a plurality of shed-forming heddles through which the ground warps pass to the fabric being woven, at least one shuttle for inserting weft yarns in the shed, means for picking the shuttle from one side only of the loom, and a shuttle race for guiding said shuttle in its flight through the shed; the combination thereof of a transverse row of pile yarn guides through which said pile yarns pass to the fell of the fabric being woven, said shuttle race having a plurality of slots therein complementing said pile yarn guides, a plurality of warpswise extending pile wires adapted to extend forwardly and rearwardly of the fell of the fabric, means for lowering said pile yarn guides from a position above the level of the pile wires to a position such that portions of the pile yarns extend through said slots in the shuttle race and below the path of travel of the shuttle whereby the shuttle inserts a weft yarn over the pile yarns with movement of the shuttle through the shed, said means being operable to raise said pile yarn guides upwardly above the level of the pile wires, means to shog the pile yarn guides across and above respective pile wires while in raised position, and an oscillatable reed for beating up successive weft yarns as they are inserted in the manner described.

9. A structure according to claim 8 in which said shuttle race comprises a plurality of hook-shaped shuttle guides which are spaced from each other to define said slots therebetweeen.

10. A structure according to claim 8 including means for feeding said pile yarns to the pile yarn guides from a position rearwardly of said heddles and in substantially parallel relation to the path of the ground warps to said heddles, and said feeding means maintaining said pile wires extending in the same general direction as the ground warps and pile yarns, means for picking shuttles from one side only of the loom and also having spaced-apart shuttle guide hooks forming a shuttle guide; said method comprising forming a shed of ground warps, positioning pile yarns above the pile wires with portions of the yarns extending downwardly between the pile wires and between the shuttle guide hooks, then passing a shut- tle through the shuttle guide to carry and insert a weft yarn therethrough, through the shed and over the pile wires, beating up the inserted weft yarn, raising the pile yarns above the shuttle guide, and repeating the steps as prescribed.

2. A method of weaving pile fabrics on a fly shuttle type loom having means for picking shuttles from one side only of the loom, an oscillating reed and spaced shuttle guide hooks forwardly of the reed; which comprises weaving a base fabric by forming a shed of ground warps, inserting a single weft yarn through the shuttle guide hooks and the shed and over pile yarns extending upwardly from the woven fabric over warpswise pile wires and downwardly between the pile wires, beating up said single weft yarn, raising the pile yarns above the shuttle guide hooks and shogging the pile yarns in one direction over and across respective warpswise pile wires and respective ground warps, then inserting the pile yarns downwardly between the pile wires, the ground warps and the shuttle guide hooks, inserting another single weft yarn, in the same direction as the first-mentioned weft yarn, through the shed and the hooks and above the pile yarns, then again beating up the weft yarn, drawing the pile yarns upwardly between the pile wires, shogging the pile yarns over and across the pile wires in the opposite direction from said one direction, and then again inserting said pile yarns downwardly between the pile wires, the ground warps and the hooks.

3. A method of interweaving ground warps and pile yarns into a pile fabric on a fly shuttle type loom having pile wires extending in substantially the same direction as the ground warps and pile yarns, means for picking shuttles from one side only of the loom, and utilizing a shuttle race provided with transverse slots complementing the pile yarns; said method comprising forming a shed of ground warps, positioning pile yarns above the pile wires with portions of the pile yarns extending to the fell of the fabric being woven, moving the pile yarns downwardly through the shed with portions of the pile yarns extending over the upper edges of the pile wires, beating up the pile wires and into said slots, passing a shuttle along said shuttle race to carry and insert a weft yarn through the shed and over the portions of pile yarns in said slots, beating up the inserted weft yarn and raising the pile yarns above the pile wires, shogging the pile yarns across and above said pile wires, and repeating the steps prescribed.

4. In a fly shuttle type loom for weaving pile fabrics from ground warps, pile yarns and weft yarns, and having a plurality of shuttles, means for picking the shuttles from one side only of the loom, spaced-apart shuttle guide hooks forming a shuttle guide for controlling the flight of the shuttles, and an oscillatable reed positioned immediately rearwardly of the shuttle guide; the combination thereof of a series of pile wires extending through the shed and beyond the shuttle guide and terminating forwardly of the fell of the fabric being woven, and means for raising and lowering the pile yarns in alternation above the pile wires and between the shuttle guide hooks forming the shuttle guide and below the weft yarns carried by the shuttles to form pile loops.

5. A loom in accordance with claim 4 wherein said means for raising and lowering the pile yarns comprises means for shogging the pile yarns across adjacent pile wires when in raised position to position the pile yarns over adjacent pile wires.

6. In a fly shuttle type loom for weaving pile fabrics
yarns under a minimum of tension in their course to the pile yarn guides.

11. In a fly shuttle type loom for weaving pile fabrics from ground warps, weft yarns and pile yarns, said loom having a plurality of shed-forming healds through which the ground warps pass and a plurality of gripper shuttles for inserting independent weft yarns in the shed, means for picking the shuttles from one side only of the loom, and a shuttle race for guiding each successive shuttle in its flight through the shed; the combination therewith of a row of pile yarn guides through which said pile yarns pass to the fell of the fabric being woven, said shuttle race comprising a row of spaced hook-shaped guides defining a plurality of slots therebetween complementing said pile yarn guides, a plurality of warpwise extending pile wires extending forwardly above said guides and to the fell of the fabric, means for lowering said pile yarn guides from a position above the level of the pile wires to a position such that portions of the pile yarns extend through said slots in the shuttle race and below the path of travel of the shuttle whereby the shuttle inserts a weft yarn over the pile yarns with movement of the shuttle through the shed, said means being operable to raise said pile yarn guides upwardly above the level of the pile wires, means to shog the pile yarn guides across and above respective pile wires while in raised position, an oscillating reed for beating up successive weft yarns as they are inserted in the manner described, said means for lowering and raising said pile yarn guides comprising a frame mounted for substantially vertical movement in substantially parallel relation to said harnesses and disposed between said harnesses and said reed, means for supporting said frame for lateral movement on said loom, a cam adjacent at least one side of said frame, means driving said cam in timed relation to said harness movement, and follower means on said frame engageable with said cam whereby rotation of the cam imparts lateral movement to said frame to, in turn, shog said pile yarn guides.

14. In a loom for weaving pile fabrics from ground warps, weft yarns and pile yarns, said loom having a plurality of shed-forming healds through which the ground warps pass, a plurality of gripper shuttles for inserting independent weft yarns in the shed, each in the same direction, and a shuttle race for guiding each successive shuttle in its flight through the shed; the combination therewith of a row of pile yarn guides through which said pile yarns pass to the fell of the fabric being woven, said shuttle race comprising a row of spaced hook-shaped guides defining a plurality of slots therebetween complementing said pile yarn guides, a plurality of warpwise extending pile wires extending forwardly above said guides and to the fell of the fabric being woven, said means for lowering said pile yarn guides from a position above the level of the pile wires to a position such that portions of the pile yarns extend over said pile wires, downwardly through said slots in the shuttle race, and below the path of travel of each shuttle whereby each shuttle inserts a weft yarn over the pile yarns with movement of each shuttle through the shed, said means being operable to raise said pile yarn guides upwardly above the level of the pile wires, means to shog the pile yarn guides across and above respective pile wires while in raised position, an oscillating reed for beating up successive weft yarns as they are inserted in the manner described, said means for lowering and raising said pile yarn guides comprising a frame mounted for substantially vertical movement in substantially parallel relation to said harnesses and disposed between said harnesses and said reed, means for supporting said frame for lateral movement on said loom, a cam adjacent at least one side of said frame, means driving said cam in timed relation to said harness movement, and follower means on said frame engageable with said cam whereby rotation of the cam imparts lateral movement to said frame to, in turn, shog said pile yarn guides.

15. In a loom for weaving pile fabrics from ground warps, weft yarns and pile yarns, said loom having a plurality of shed-forming healds through which the ground warps pass, a plurality of gripper shuttles for inserting independent weft yarns in the shed, each in the same direction, and a shuttle race for guiding each successive shuttle in its flight through the shed; the combination therewith of a row of pile yarn guides through which said pile yarns pass to the fell of the fabric being woven, said shuttle race comprising a row of spaced hook-shaped guides defining a plurality of slots therebetween complementing said pile yarn guides, a plurality of warpwise extending pile wires extending forwardly above said guides and to the fell of the fabric being woven, said means for lowering said pile yarn guides from a position above the level of the pile wires to a position such that portions of the pile yarns extend over said pile wires, downwardly through said slots in the shuttle race, and below the path of travel of each shuttle whereby each shuttle inserts a weft yarn over the pile yarns with movement of each shuttle through the shed, said means being operable to raise said pile yarn guides upwardly above the level of the pile wires, means to shog the pile yarn guides across and above respective pile wires while in raised position, an oscillating reed for beating up successive weft yarns as they are inserted in the manner described, said means for lowering and raising said pile yarn guides comprising a frame mounted for substantially vertical movement in substantially parallel relation to said harnesses and disposed between said harnesses and said reed, means for supporting said frame for lateral movement on said loom, a cam adjacent at least one side of said frame, means driving said cam in timed relation to said harness movement, and follower means on said frame engageable with said cam whereby rotation of the cam imparts lateral movement to said frame to, in turn, shog said pile yarn guides.
13 mechanical connections between said frame and said harness motion.

17. In a loom for weaving pile fabrics from pile yarn, ground warps and ground weft yarns, said loom having means for forming the warps into a succession of sheds, means to insert wefts into the sheds, and a plurality of warpwise extending pile wires carried by the loom and having their forward ends terminating adjacent the fell of the fabric being woven; the combination therewith of a plurality of pile yarn guides, means to shog said guides across and above said pile wires and for lowering and raising said guides comprising a frame rigidly supporting said guides, means supporting said frame for lateral movement on said loom, a cam adjacent at least one side of said frame, means driving said cam in timed relation to said means for forming the sheds, follower means on said frame engageable with said cam, whereby rotation of the cam imparts lateral movement to said frame to, in turn, shog said pile yarn guides, and means for imparting downward and then upward movement to said frame following each lateral movement thereof.

18. In a loom for weaving pile fabrics from pile yarns, ground warps and weft yarns, means for forming the ground warps into a succession of sheds comprising a plurality of relatively vertically movable harnesses and a harness motion for imparting vertical movement to said harnesses, a plurality of warpwise extending pile wires adapted to extend forwardly and rearwardly of the fell of the fabric, and means to insert weft yarns into the sheds; the combination of a transverse row of pile yarn guides through which said pile yarns pass to the fell of the fabric being woven, means for lowering and raising said guides between a position above the level of the pile wires and a position below the weft yarn inserting means comprising a frame mounted for lateral and substantially vertical movement in substantially parallel relation to said harnesses, means on said frame for supporting said row of pile yarn guides, means operatively connecting said harness motion to said frame to thereby effect said lowering and raising of said pile yarn guides, means to shog said guides including cam means adjacent at least one side of said frame, means driving said cam means in timed relation to said harness motion, and follower means carried by said frame engageable with said cam means, whereby rotation of the cam means imparts lateral movement to said frame to shog said pile yarn guides, said cam means being so arranged as to shog the pile yarn guides across and above respective pile wires while said guides occupy raised position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,042,081

July 3, 1962

John T. MacIsaac, Jr., et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 25, for "waft" read -- weft --; line 26, for "wove" read -- move --; column 8, line 74, for "method for" read -- method of --; column 9, line 75, for "shutter" read -- shuttle --.

Signed and sealed this 30th day of October 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

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