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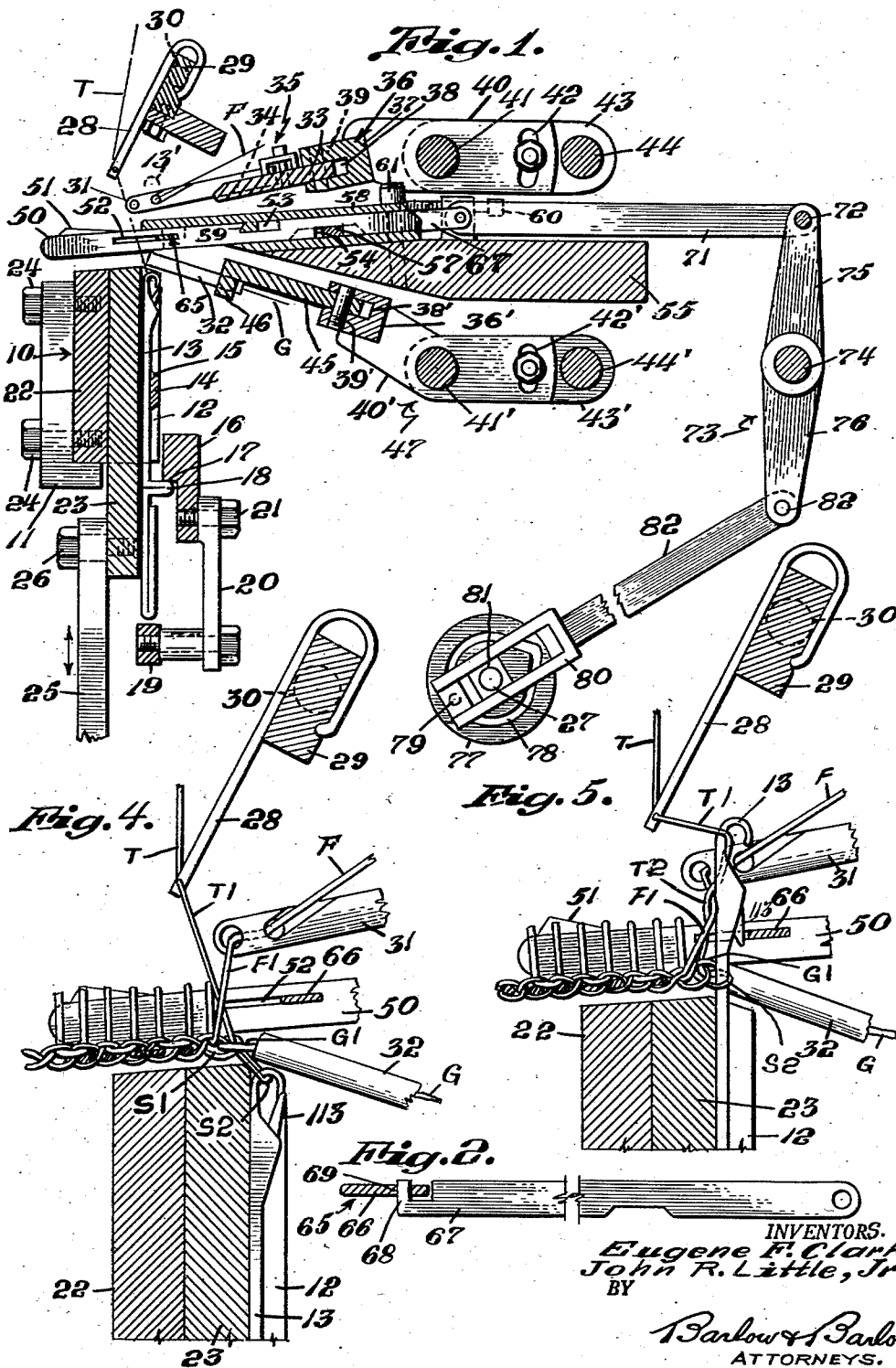
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KNITTING MACHINE

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2 Sheets-Sheet 1



1

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KNITTING MACHINE

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This invention relates to a warp knitting machine, particularly a so-called flat knitting machine in which a loop former is held stationary in the space between needles and over which former face warps are laid so as to produce loops which appear as pile on the surface of the fabric.

In making pile fabric on a machine of the above type, the pile yarn is laid over the former and tied into the fabric on each side of the former by a knit stitch. The loops thus formed are tightly held about the former with the ground of the fabric held against the under side of the former. The loops are moved along and off of the former as the fabric is advanced forwardly by the action of the fabric take-up mechanism directing pull through the ground. There is an undesirable tendency to stretch the loops by the pull of the ground of the fabric as well as placing an undesirable strain on the said ground. In a fabric in which a filler yarn is laid weft fashion, the spacing between the needle bed and the former must be sufficient so as to provide space for the guide of said filler yarn to travel in laying the filler yarn in back of the needles or across the warps. This also creates an undesirable condition in that the fabric made is not properly supported, which results in non-uniform length of stitches and an irregular line of stitches crosswise of the fabric.

An object of the invention is to provide a knitting machine of the above character so constructed as to overcome the undesirable conditions heretofore mentioned.

A more specific object of the invention is to provide, in a knitting machine of the above character, means for engaging and moving the loops along the former in a manner to avoid stretching the loop as the same are formed.

Another object of the invention is to provide for holding the previously formed fabric against movement during the tightening of a knit stitch.

With these and other objects in view, the invention consists of certain novel features of construction as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a sectional side elevational view of a fragmental portion of a knitting machine embodying our invention;

Figure 2 is a side elevational view partially in section of two related elements of the machine shown in Figure 1;

Figure 3 is a plan view of a fragmentary portion of the former bed or support with former elements in position;

Figure 4 is a sectional view on an enlarged scale of a portion of the machine shown in Figure 1;

Figure 5 is a view similar to that of Figure 4 and showing a different relation of parts;

Figures 6, 7, and 8 are views similar to Figure 4 and showing various relative positions of elements in making one course of knitting.

2

The knitting machine according to the present invention comprises a knitting needle support or bed which is slidably mounted for vertical movement. A loop former is held stationary in the space between adjacent needles and the leading end thereof extends a substantial distance beyond the needles. A reed which is actuated in timed relation with the fabric take-up mechanism engages and moves the loops along the former as the fabric made is advanced forwardly by the fabric take-up mechanism. There is also provided the usual guides for the warp which are oscillated and laterally moved in the known manner to guide the knit warps to the needles. A set of lower guides lays a ground weft beneath the former while a set of upper guides lays a face weft over the former. The timing of the various elements is such that as the needles are lowered to draw a new stretch of warp in the hooks thereof and the old loops, previously formed on the needles, are cast off the needles, the bed is moved upwardly to engage and hold the formed fabric against the under side of the former elements. This will hold the fabric against movement and assure uniform length of stitches extending in a straight line across the fabric at each course of knitting. Upon the forming and tightening of the stitch, the bed is lowered to provide clearance for the now advancing lower weft guides and at the same time provide clearance for the forward advance of the fabric by the action of the take-up mechanism supplemented by the action of the reed acting on the loops as previously described.

Referring to the drawings, particularly Figure 1, the needle bed or support designated generally 10 is held on supports 11 and has a plurality of vertical needle grooves 12 which extend inwardly from the inner side of the bed. A usual latch needle 13 is slidably received in each of the grooves 12 and held therein by means of a dovetail bar 14 which is received in a complementary groove 15 which extends lengthwise of the bed and intersects the plurality of said grooves 12. The needles are reciprocated in unison by means of an inverted L-shaped bar 16 providing a shoulder 17 which is adapted to engage the upper side of the usual abutment 18 which is formed on the shank of the needle. The bar 16 extends in a horizontal direction and is arranged to be reciprocated in a vertical direction by mechanism (not shown). Upon a downward movement of the bar 16, the shoulder 17 will engage the abutment 18 and thereby lower the needles from the raised position as shown in broken lines at 13' in Figure 1, to the lowered position as shown in full lines in this Figure 1. A horizontal bar 19 is attached to the bar 16 by straps 20 as at 21. The bar 19 is positioned beneath the lower ends of the needles in line therewith and is spaced from one shoulder 17 a distance slightly greater than the distance between the abutment 18 and the said lower ends of the needles. The bar 19 moves in unison with bar 16 and in the upward movement of the said bar 16, the bar 19 will engage and raise the needles to the upper position 13'. As seen in Figure 1, at the lower position of bar 19, the same is spaced from the ends of the needles. At the raised position of the bar 16 the shoulder 17 will likewise be spaced from the lug or abutment 18. This provides for a lag or rest period for the needles at both ends of the reciprocating stroke of the said bars 16 and 19.

The needle bed 10 according to the invention is made in two parts 22 and 23. The part 22 is attached to the supports 11 by means of bolts 24 to be held stationary, and the part 23 which carries the needles is slidably mounted on the part 22. The part 23 is connected to a cam motion (not shown) by means of a link 25 which is pivotally attached to the said part 23 as at 26. The cam motion (not shown) which may be of any suitable

3

approved design may be actuated by some rotating element of the machine, as by way of example, the main drive shaft indicated 27. The relative position of the needle bed parts 22 and 23 during the manipulation of the warp and weft threads in and about the needles is substantially as shown in Figure 1.

The warp threads designated T to be hereinafter referred to as warp, which form the wales of the fabric, are guided to the needles 13 by thread guide fingers 28, there being a guide finger 28 for each warp thread. These guide fingers are mounted on a guide bar 29 which extends in a horizontal direction at a position above the needle bed 10 to position the lower end of fingers 28 near the upper end of the path of the needles. The bar 29 oscillates about a pivot 30 and is also mounted for axial movement in a horizontal direction, whereby the guide fingers 28 may be oscillated toward and from the needles and also moved laterally thereof so as to guide the warp in and about the needles during the knitting.

In the present instance the machine disclosed is particularly adapted for making carpet and like heavy fabric and accordingly an upper and a lower set of guides or fingers 31 and 32 are provided. There is an upper guide finger 31 for each needle 13 and also a lower guide finger 32 for each needle 13. These guide fingers are reciprocated in the space between needles to carry the weft to the back of the needles and are moved laterally of the needles to lay the weft across the warp. The guide fingers 31 are carried on a guide bar 33 which extends laterally across the machine in a general horizontal direction. The bar 33 is provided with a plurality of grooves 34 one for each finger 31 which is received therein and secured in position by means of a clamp fastening 35.

A guide bar support or bracket 36 has a horizontal bar 37 which extends laterally across the machine. The bar 37 has a longitudinal recess 38 in which is received the guide bar 33 which is secured in said recess by fastening 39. The ends of bar 37 are provided with an arm 40 which is adjustably supported on a rod 41. The arm extends rearwardly from the rod 41 and is adjustably secured as at 42 to a strap 43 which is mounted on rod 41 and a second rod 44 which extends parallel to rod 41, both of which rods form part of the guide bar 33 actuating mechanism (not shown). These bars are moved toward and from the needles 13 and laterally thereof.

The guide fingers 32 in the present instance are tubular in cross section, and these are carried in a horizontally extending guide bar 45, the front end portion of which is provided with a plurality of openings 46, there being an opening to receive each guide finger. These fingers 32 are frictionally or otherwise secured in said opening and project therefrom towards the needles 13. The guide bar 45 is supported and attached to a guide bar support 47 which is of substantially the same construction as the guide bar support 40, and like elements are indicated with like but prime numerals. The strap 43' is likewise attached to parallel extending rods 41' and 44' which form part of the guide bar 45 actuating mechanism. These rods are likewise movable toward and from the needles 13 and laterally thereof. The fingers 31 are threaded with the face weft F, and the guide fingers 32 are threaded with the ground weft G.

The face wefts are laid across a loop former 50 so as to produce loops in the face weft which appear as pile on the surface of the fabric. When the pile is to be a cut pile, the leading end portion of the former is provided with a knife edge 51 over which the loops are moved and severed. The former 50 has a longitudinal slot 52 therethrough at the forward end portion thereof, a recess 53 extending inwardly from the upper edge thereof and a recess 54 extending inwardly from the bottom edge thereof. There is a former 50 in each space between needles, and the formers are supported in stationary position on a support 55 which is provided with a plurality of grooves 56 (see Figure 3) in which the said formers

4

are received with the recess 54 receiving a bar 57 (see Figure 1) which extends laterally across the support 55 to intersect the said grooves in the support. The formers 50 are held in position on the support 55 by means of a plate 58 which is positioned to engage the upper edge of the formers and is provided with a lug 59 which extends into the recess 53 and is adapted to engage the forward end of the recess. A screw threaded element 60 engages against the rear edge of plate 58 to move the same forwardly to engage the lug 59 against forward end of recess 53 so as to move the formers for the rear end of recess 54 to engage against the bar 57. A cap screw or the like 61 extends through the plate 58 and is screw threaded into the support 55 to assist in securely holding the formers 50 in position.

The formers 50 project in the space between the path of the needles with the leading end of the former a substantial distance beyond the back of needles 13. It will be observed that a substantial portion of the formers necessarily projects unsupported a substantial distance beyond the forward edge of the support 55. It will also be observed that the lower edge of the formers 50 are necessarily spaced from the lowered normal position of the needle bed 10 a distance to permit the fingers 32 to be moved to the back of the needles in laying the weft G across the back of the needles or warp to be bound thereby. The face weft F is laid across the formers 50 and is bound at each side of a former 50 by the traverse of the warps T of adjacent needles. The term "traverse" of the warp is herein used to designate that portion or stretch of warp across which the weft extends and which stretch of warp extends from the last formed knit stitch to the hook of the needles. The tightening of this traverse of warp in the knitting draws the face weft into a tight loop about the formers 50. The fabric is advanced by the fabric take-up mechanism and pulls the loops along the former. The tightness of the loops on the formers places an undesirable strain on the fabric and has a tendency to stretch the loops as well as placing considerable strain on the unsupported projecting portions of the former 50.

According to the present invention a reed-like element 65 (see Figures 1, 2, and 3) is provided which functions to supplement the pull of the fabric on the loops to advance the same along the former. The reed 65 comprises a flat bar 66 which extends through the slot 52 in the formers 50. The ends of the reed bar 66 are connected to a link 67 (see Figures 2 and 3), the front end of which has a hook formation 68 which is received in an opening 69 in the reed bar 66. The link 67 is slidably received in a groove 70 (see Figure 3) which is at a position between the grooves 56. The other end of link 67 is pivotally connected to a second link 71 (see Figure 1) which is in turn pivoted to a rod 72. There may be a plurality of such linkage 67 and 71 connected at intervals along the reed 65 and rod 72. A lever 73 which is rockable about a stationary stud 74 is pivotally connected on one side of pivot 74 to the rod 72. Upon rocking of the lever 73 in a counter-clockwise direction as seen in Figure 1, the reed bar 65 will be moved forwardly in the slots 52.

The rocking of lever 73 may be cam actuated and controlled by means of a cam 77 mounted for rotation on drive shaft 27 (see Figure 1). The cam 77 has a suitable cam groove 78 engaged with a cam follower 79 which is fixed to the end of a yoke 80 which is slidably mounted on a bearing block 81 rotatable about shaft 27. The yoke 80 has an arm 82 which is pivotally attached to the lever 73 as at 82. It will be observed that for each rotation of shaft 27, the yoke 80 will be reciprocated along bearing 81 and rock lever 73 which in turn will move reed bar 66 forwardly and rearwardly in the slots 52 of the formers 50.

In the operation of the machine at the start of a knitting course, the needles are at their lowest position. The guides 28 are at their front position to lead the warp T from the needles 13 toward the left as seen in Figure 1

5

to be clear of the lateral path of the guides 31 and 32 at the rear of the hook portion of the needles. The guides 31 and 32 are advanced forwardly or towards the left as shown in Figure 1 and then moved or jogged across the back of the needles for a distance depending on the pattern of the fabric but at least two needles and then come to rest. That is, the wefts F and G are laid across the warp T at the right thereof as seen in Figure 1. The needles 13 now rise to their upper position 13'. The guides 28 now swing toward the right to a position in front or hook side of the needles, then laterally across the needles, and then forwardly to the back of the needles. This motion places a traverse of warp in the hooks of the needles, the latches of which had been previously opened as will hereinafter appear. The ground and face wefts F and G are now held in the bight of the traverse of warp T at the left of the needles. The guides 31, 32 move toward the rear, and the needles are lowered and draw a loop of thread. In the repeat knitting motion, the guides 31 and 32 are advanced toward the left to back of the needles and are jogged laterally in the opposite direction across the warp T. The needle rises, and the guides 28 again move to lay a new traverse of warp T in the hook of the needles. During the upward movement of the needles, the previous traverses of warp looped in the hook of the needles are moved downwardly around the shank of the needles; that is, the previous traverses of warp are held against upward movement and the needles pass upwardly through the loops, and the loops passing down the said shank engage and open the latch of the needles. When the needles are moved down, the old loops move up the needle, close the latch on the new traverse of warp in the hook of the needles and slip off or are cast off the needles and the needles at the same time pull a new stretch of warp or traverse into a loop through the old one and binding the ground and face wefts in the knit stitches. The face weft F is bound at each side of a former 50 by the traverse of warp of adjacent needles as previously described. The stretch of face weft between needles is prevented from being drawn into the fabric by the formers. Thus, a loop in the face weft is made in the space between needles.

Now referring to Figure 4 for a more complete description of the various knitting motions, it will be apparent that a length of fabric has been made and a plurality of face loops are about the former 50. The bed portion 23 and the observed needle 13 are at the lower position thereof. The guide 28 is at its left position behind the needles. The guides 31 and 32 have been moved forwardly to lay their weft across the back of the needles across the right of warp length or traverse of warp T1 which extends from the last made chain stitch S1 to the hook of the needle 13 in a loop S2 and thence to the guide 28. The guide 31 is moved toward the plane of the drawing to lay a stretch F1 of face weft F across the upper edge of former 50 and across the back of the adjacent needle beyond the former 50 and comes to rest. The stretch of weft F1 now extends across the traverse T1 of warp from adjacent needles at each side of the said former 50. During this motion the guide 32 has likewise been moved laterally beneath the former toward the plane of the drawing and across the back of the needles beyond former 50 to lay a stretch G1 of weft G, the number of needles crossed in the said lateral movement of weft G depending upon the design of the fabric. The needle 13 now rises, and the old loop S2 moves down the shank of the needle 13 opening the latch 113 during its downward movement (see Figure 5). The guide 28 now moves rearwardly to the front of the needles, then laterally in the direction of the observer, across the front of the needle 13 so as to pass the traverse T1 of warp in the hook of the needle 13. The guide 28 now swings towards the left and comes to rest. The guides 31, 32 are now withdrawn toward the right to the front of the

6

needles (see Figure 6). The face weft portion F1 and the ground weft portion G1 are now held in the portion T2 of traverse T1 of warp from adjacent needles one at each side of former 50. The needles start to lower (see Figure 6), and the bed portion 23 rises to engage and clamp the fabric between the upper side of the bed 23 and the under side of the former 50. The needles continue to lower (see Figure 7) and the old loop S2 is cast off and the traverse T1 of warp is drawn through the old loop S2 into a loop S3 in the hook of the needle 13 and draws a new traverse T3 of warp. This completes a needle and guide motion.

The bed portion 23 now is lowered to provide a clearance between the formers 50 and the needle bed for the advance of the fabric by fabric take-up motion (not shown). During the advance of the fabric, the lever 73 is oscillated to move the reed 65 into engagement with the loop of face weft (see Figure 8) to push the same along the former and relieve the strain on the fabric and then returns to initial position. As the face loops are advanced along the former, they in turn come in contact with the knife edge 51 and are severed thereby into cut pile. Should it be desired that the pile be left uncut, then the knife edge is omitted.

From the foregoing description it will be observed that during the binding of the wefts F and G with the warp to produce a fabric, the fabric made is held stationary against rearward movement. This provides for drawing the new loop of warp through the old loop of warp and tightening the old loop while the same is held on the upper side of the bed 23 whereby to assure of an even line of similar length stitches across the fabric at each course. It will also be apparent that the reed 65 supplements the advancing action of the pull of the fabric on the face loops. Thus, the face loops are prevented from being stretched and are moved generally at right angles to the advance of the fabric.

It will be understood that while the operation of the machine has been given with reference to making a particular pile fabric, the various motions and order may be changed in accordance with the particular fabric design desired.

We claim:

1. A warp knitting machine including knitting needles supplied with warps, means for supplying wefts across said warps to be bound by the traverse of said warps during the knitting, loop forming means over which certain of said wefts are laid and held thereby against being drawn into the fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, and means engaging and moving said loops along said loop forming means.

2. A warp knitting machine including knitting needles supplied with warps, means for supplying face and ground wefts across said warps to be bound by the traverse of said warps during the knitting, loop forming means over which the face wefts are laid and held thereby against being drawn into the fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, and means engaging and moving said loops along said loop forming means.

3. A warp knitting machine including knitting needles supplied with warps, means for supplying face and ground wefts across said warps to be bound by the traverse of said warps during the knitting, loop forming means over which the face wefts are laid and held thereby against being drawn into the fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, and a reed for engaging and moving said loops along said loop forming means.

4. A warp knitting machine including knitting needles supplied with warps, means for supplying face and ground wefts across said warps to be bound by the traverse of said warps during the knitting, a loop former held sta-

tionary in the space between needles and over which the face wefts are laid and held thereby against being drawn into the fabric during knitting so as to produce loops which appear as pile on the surface of said fabric, and means engaging and moving said loops along said loop former.

5. A warp knitting machine including knitting needles supplied with warps, means for supplying ground and face wefts across said warps to be bound by the traverse thereof during the knitting so as to produce a fabric, loop formers held stationary in the space between needles and over which said face wefts are laid to be held thereby against being drawn into said fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, and a reed slidably related to said formers for slidable movement along said formers for engaging and moving said loops along said formers.

6. A warp knitting machine including knitting needles supplied with warps, means for supplying ground and face wefts across said warps to be bound by the traverse of said warps during the knitting so as to produce a fabric, loop formers held stationary in the space between needles and over which said face wefts are laid to be held thereby against being drawn into said fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, said formers each having a slot therein with the slot in one former aligned with the slots in the other formers, a flat bar extending through said slots and slidable therein for movement along said formers for engaging and moving said loops along said formers.

7. A warp knitting machine including knitting needles supplied with warps, means for supplying ground and face wefts across said warps to be bound by the traverse of said warps during the knitting so as to produce a fabric, loop formers held stationary in the space between needles and over which said face wefts are laid to be held thereby against being drawn into the fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, said formers having a knife edge thereon, and means engaging and moving said loops along said formers to engage and be severed by said knife edge into cut pile.

8. A warp knitting machine including knitting needles supplied with warps, a slidable support for said needles, means for supplying ground and face wefts across said warps to be bound by the traverse of said warps during the knitting so as to produce a fabric, loop formers held stationary in the space between needles and over which said face wefts are laid to be held thereby against being drawn into the fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, said support being normally spaced from said formers,

and means for moving said support toward said formers so as to engage and hold the made fabric against the formers so as to prevent movement of said fabric during the binding of said warps and wefts together.

9. A warp knitting machine including knitting needles supplied with warps, means for guiding said warps to said needles so as to produce single rows of chain stitches, guide means for supplying ground and face wefts across said warps to be bound by said chain stitches during the knitting so as to produce a fabric, loop formers projecting in the space between adjacent needles and over which former said face wefts are laid to be held thereby against being drawn into the said fabric during the knitting so as to produce loops which appear as pile on the surface of said fabric, means adapted to engage and move said loops along said formers, a slidable support for said needles normally spaced from said formers, and means for moving said support toward said formers so as to engage and hold the made fabric against the formers so as to prevent movement of said fabric during the binding of said warps and wefts together.

10. A warp knitting machine including knitting needles, means for leading binding warps to said needles so as to produce chain stitches, separate means for laying wefts across said warps to be bound thereby during the knitting so as to produce a fabric, means for forming loops in certain of said wefts which appear as pile on the surface of said fabric, and means engaging the made fabric for holding the same against movement during the binding of said wefts and warps together.

11. A warp knitting machine including a single set of knitting needles, a sliding support for said needles, means for leading binding warps to said needles so as to produce rows of single chain stitches, separate means for laying wefts across said warps to be bound thereby during the knitting so as to produce a fabric, loop formers held stationary and projecting in the space between needles and over which certain of said wefts are laid to be held thereby against being drawn into the said fabric during the knitting so as to produce loops which appear as pile on the surface of the fabric, means for engaging and advancing said loops along said formers, and means for moving said support to engage and hold the made fabric against said formers so as to prevent movement of said fabric during the binding of said warps and wefts together.

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