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APPARATUS FOR WEAVING PILE FABRICS

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Fig. 1.

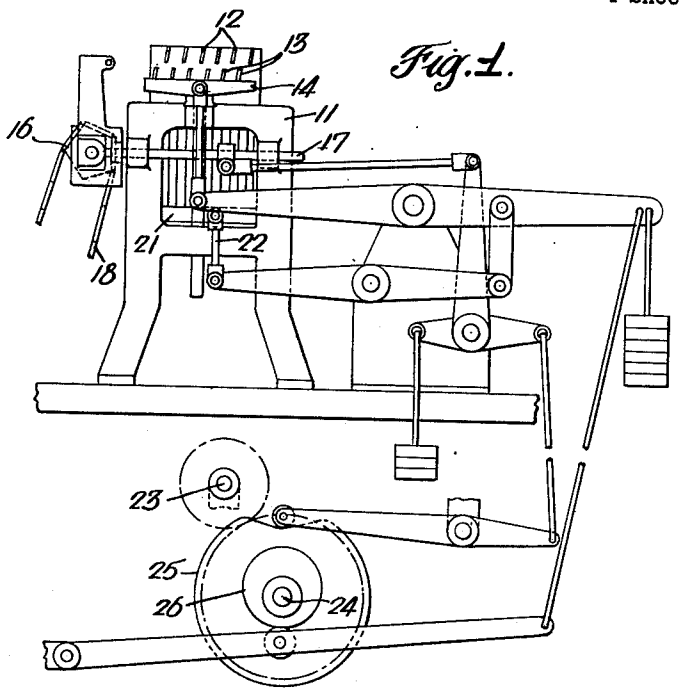


Fig. 2.

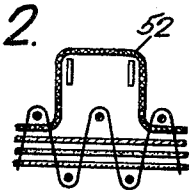


Fig. 3.

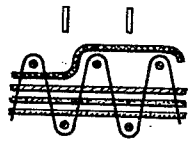


Fig. 4.

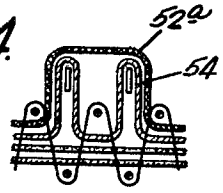


Fig. 5

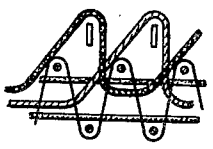
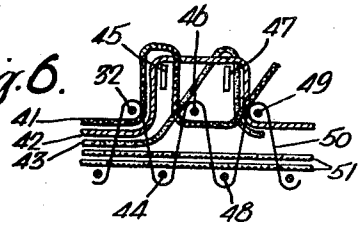


Fig. 6.



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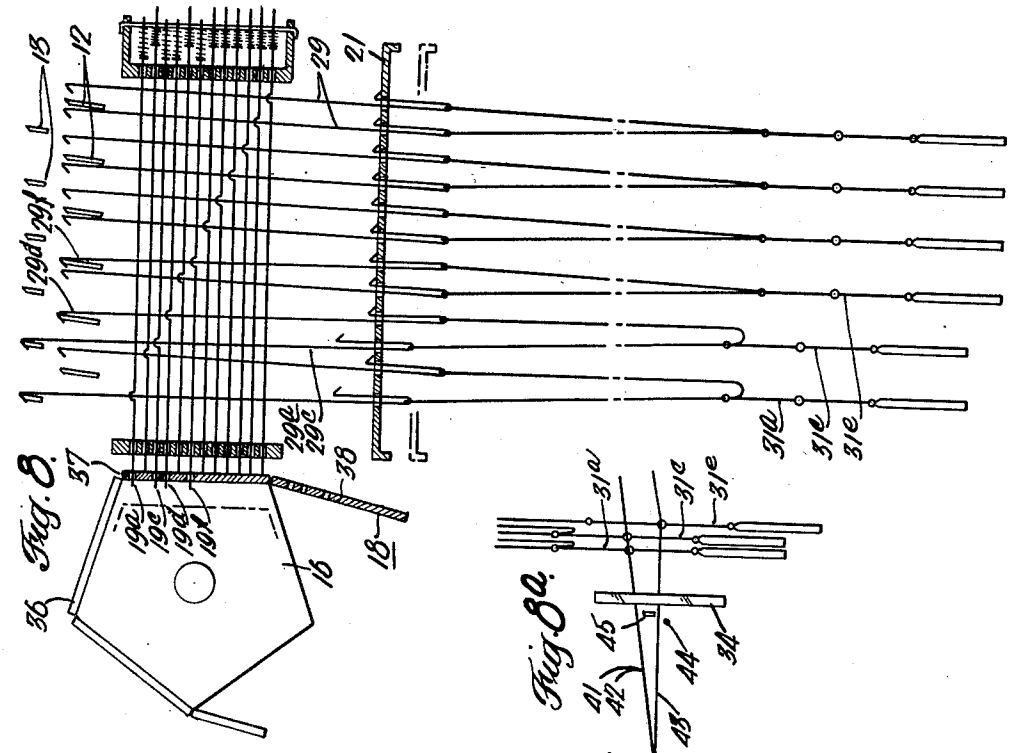


Fig. 8.

Fig. 8a.

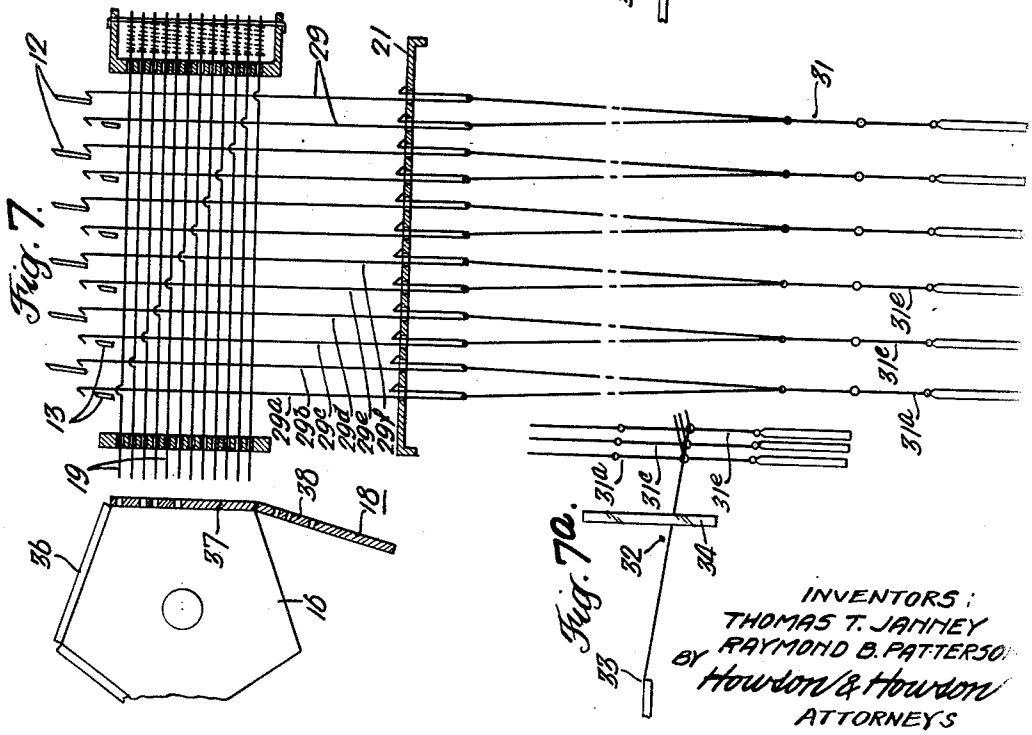


Fig. 7.

Fig. 7a.

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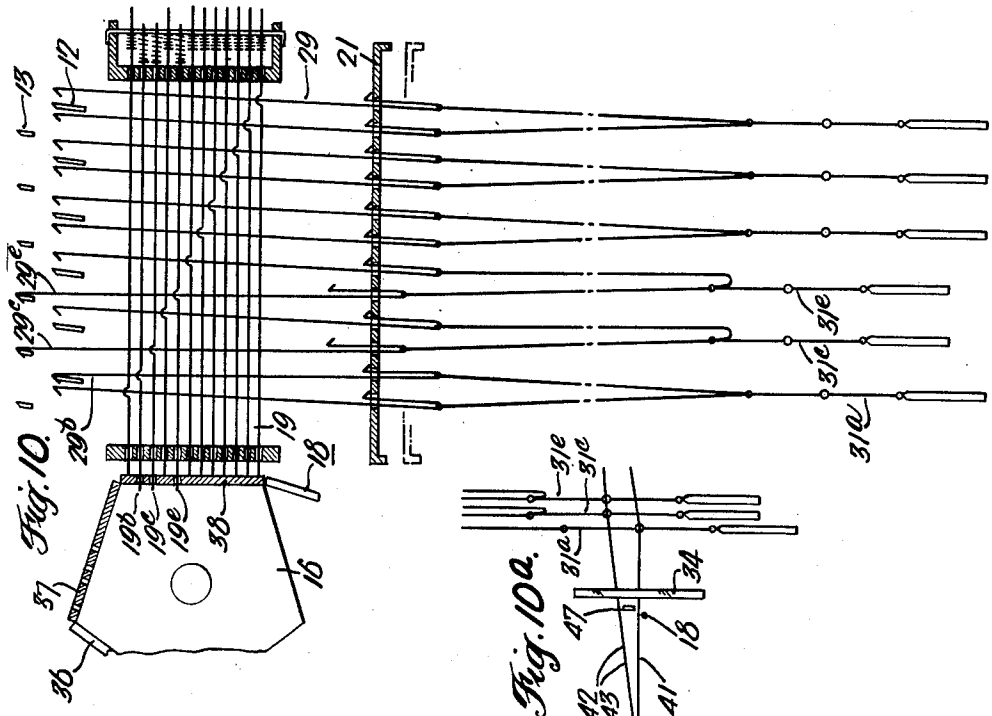


Fig. 10.

Fig. 10a.

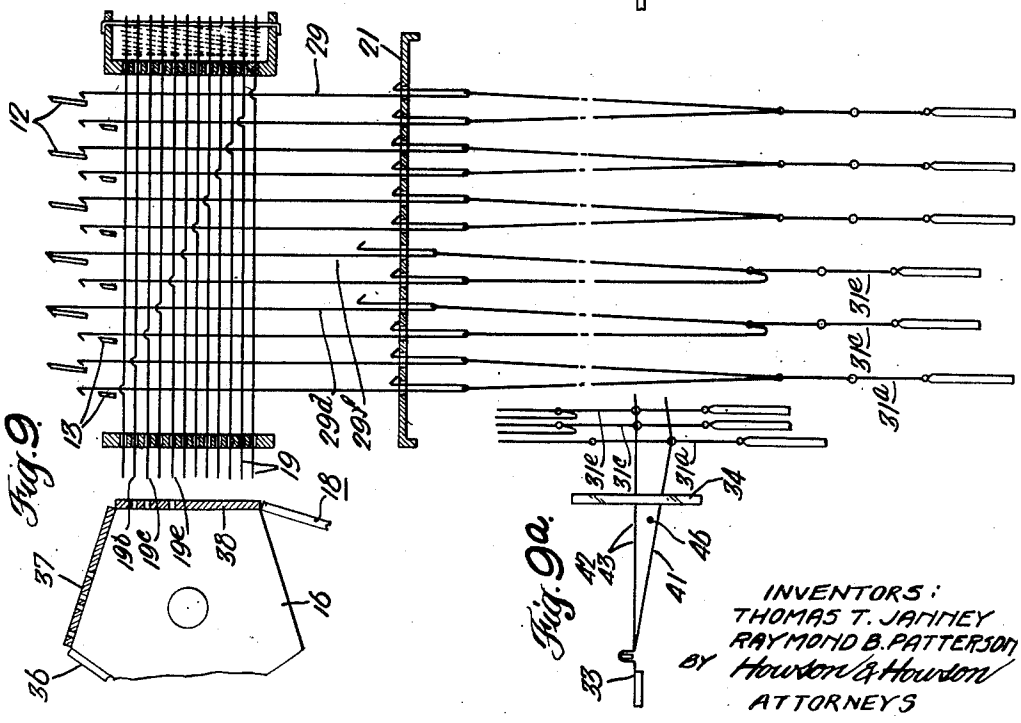


Fig. 9.

Fig. 9a.

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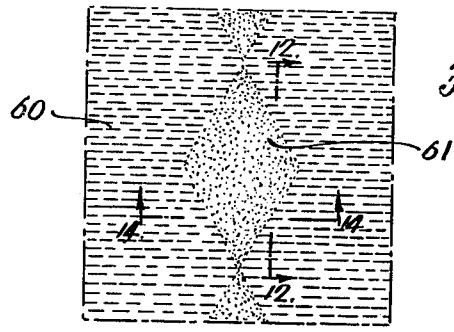


Fig. 11.

Fig. 12.





Fig. 13.

Fig. 14.



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APPARATUS FOR WEAVING PILE FABRICS

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Application March 23, 1954, Serial No. 418,010

5 Claims. (Cl. 139—59)

The present invention relates to an improved apparatus for weaving Wilton carpet fabrics and more particularly to an improved jacquard mechanism and arrangement for controlling the standard heddles of a pile wire loom.

The conventional method of weaving certain Wilton fabrics employs a jacquard having a card for controlling the positions of the pile warps during the insertion of each weft yarn. The present invention affords a substantial reduction in the number of cards required by employing only one jacquard card for each pile wire insertion in a two-shot fabric. The present invention may be applied to a standard Wilton loom without substantial modification of the warp and weft manipulating means and produces by proper selection of the cards a wide variety of pile weaves.

The construction and operation of the present invention and further advantages derived therefrom are more fully set forth hereinafter with reference to the accompanying drawings in which:

Fig. 1 is a side elevation of a jacquard mechanism made in accordance with the present invention showing the operating connections with the pile wire loom;

Figs. 2 to 6 inclusive show various pile weaves which may be obtained by the arrangement shown in Fig. 1;

Figs. 7 to 10 inclusive show the sequence of operations to weave the fabric illustrated in Fig. 6;

Figs. 7*a* to 10*a* show diagrammatically the sheds formed by the operations shown in Figs. 7 to 10 respectively;

Fig. 11 illustrates schematically an improved fabric woven by an apparatus of the present invention;

Fig. 12 is a typical warpwise sectional view of the fabric disclosed in Fig. 11;

Fig. 13 is a diagrammatic representation corresponding to Fig. 12 prior to the removal of the wires from the fabric; and,

Fig. 14 is a typical weftwise section of the fabric shown in Fig. 11.

The jacquard of the present invention is a three-position jacquard wherein two lash hooks are employed to control a single heddle. Each lash hook is controlled by a needle which in turn is controlled by the presence or absence of an aperture in the card positioned on the conventional card cylinder. One of each pair of hooks controlling a heddle is positioned to cooperate with a stationary knife mounted at a station corresponding to the middle or neutral level of the pile warps in the shed. The other hook is positioned to engage a movable knife which is actuated between an upper station corresponding to the upper level of the pile warps in the shed and a lower station below the lower level of the shed. A hook grate is positioned below the needles to engage the lower end of the lash hooks and is movable between stations corresponding to the lower and middle levels in the shed respectively.

In accordance with the invention, the movable knives and the hook grate are actuated to their lower stations during the insertion of the upper weft yarn of the carpet fabric. In accordance with the conventional practice, the weft yarns are projected across the loom at a location between the intermediate and lower levels in the shed. The movable knives and the hook grate are elevated to their upper stations and the lower weft yarn and pile wire are inserted within the shed below and above the middle level respectively.

During the actuation of the movable knives and the hook grate, the card cylinder is engaged against the needles to select the lash hooks which are to be engaged upon the movable and stationary knives. The hooks selected for engagement with the movable knives are elevated to the upper level and the remaining hooks are elevated to the intermediate level. The movable knives and the hook grate are then dropped to their lower stations and the hooks selected for engagement with the stationary knives are retained in the middle level upon descent of the hook grate, the remaining hooks descending to the lower level. During this movement, the card cylinder is retracted and a new card is positioned in confronting relation to the needles.

Referring now to the drawings, the jacquard mechanism illustrated in Fig. 1 comprises a frame **11** having a first set of knives **12** fixedly mounted on the frame and a second set of knives **13** mounted for vertical reciprocation on lifting arms **14** positioned at the opposite sides of the jacquard frame **11**.

A card cylinder **16** is mounted in the usual manner for horizontal reciprocation as indicated at **17**, each reciprocation effecting rotary movement of the cylinder so as to advance the card chain **18** and position a new card in confronting relation to the needles **19**. A hook grate **21** is mounted below the bank of needles **19** for vertical reciprocation, for example by means indicated at **22**.

The cylinder **16**, the movable knives **13**, and the hook grate **21** are actuated by driving connections from the main shaft **23** of the loom. To this end, the shaft **23** is geared to a cam shaft **24** which carries a cam **25** for reciprocating the cylinder **16** between the back position shown in Fig. 1 and a forward position in which it engages the needles. Mounted on the same shaft **24** is a cam **26** for actuating both the movable knives **14** and the hook grate **21**. The connections are such that the movable knives **13** are actuated between stations corresponding to the upper and lower levels in the warp shed. As shown in Fig. 1, the hook grate **21** and the knives **13** are in their lower stations at the same time as the cylinder **16** is in its back position. The knives **13** and the hook grate **21** are actuated to the upper stations simultaneously with the actuation of the cylinder **16** to its forward or needle-engaging position. Thus, for each revolution of the cam shaft **24**, the cylinder **16** is actuated to its forward position and then to its back position, and the hook grate and movable knives are actuated to their upper stations and then back to their lower stations. In accordance with the invention, an upper weft shot is inserted in the shed when the elements are at the lower

stations shown in Fig. 1. When the elements are at the upper stations, a lower weft shot and a wire are inserted respectively in the lower and upper portions of the shed formed by the warps.

Fig. 7 illustrates the position of the needles **19** at a point in the operation corresponding to the position shown in Fig. 1, after a blank card **36** (one with no holes punched in it) has been shifted out of confronting relation to the needles. As shown in Fig. 7, each needle of the bank **19** controls a single lash hook of the series of lash hooks **29**; for example, the needle **19***a* controls the lash hook **29***a*; the needle **19***b* controls the hook **29***b*, etc. Two adjacent lash hooks control a single heddle of the set **31**, for example, the lash hooks **29***a* and **29***b* control the heddle **31***a*, the hooks **29***c* and **29***d* control the heddle **31***c* and the hooks **29***e* and **29***f* control the heddle **31***e*.

Since the card **36** is blank, all of the needles were displaced to disengage the complete set of hooks **29** from the knives **12** and **13**. Thus, all the heddles **31** are at their lower level as determined by the hook grate **21**. All of the warps controlled by the heddles **31** will therefore be in the lower level, as shown schematically in Fig. **7***a*. When the heddles are in this position, an upper weft shot **32** is inserted in the shed which is subsequently beat up into the fell **33** of the fabric by a reed **34** in accordance with the conventional weaving practice. During the beat-up, the cam shaft **24** rotates 180 degrees to advance the cylinder **16** into engagement with the bank of needles **19**.

The card **37** now positioned in confronting relation to the needles, has holes punched to register with the needles **19***a*, **19***c*, **19***d*, and **19***f*. The presence of the hole in registry with the needle effects selection of the corresponding lash hook for engagement with one of the knives **12** and **13**. In this respect, it is noted that alternate hooks are positioned to engage the movable knives **13** whereas the intermediate hooks are positioned to engage the fixed knives **12**. As shown in Fig. 8, the hooks **29***a* and **29***c* are engaged upon the knives **13** and the hooks **29***d* and **29***f* are engaged upon the knives **12**. The heddles **31***a* and **31***c* are therefore at their upper level as determined by the position of the knives **13**, and the heddle **31***e* is at the intermediate level as determined by the position of the hook grate **21**. Thus, a shed is formed wherein the warps **41** and **42** in the heddles **31***a* and **31***c* respectively, are at the upper level and the warp **43** in the heddles **31***e* is at the intermediate level (see Fig. **8***a*). The lower weft shot **44** and the wire **45** are then inserted in the shed respectively below and above the warp **43**. The reed **34** then beats up these elements into the fell **33** of the cloth as the cam shaft **24** is rotated another 180 degrees.

Rotation of the cam shaft retracts the cylinder **16** which rotates to advance the card chain **18** to present a new card **38** to the bank of needles **19**. At the same time, the knives **13** and hook grate **21** are dropped to their lower stations, carrying all the hooks except the hooks **29***d* and **29***f* with them. The latter hooks are retained at the intermediate level by their engagement with the fixed knives **12**. This arrangement is shown in Fig. 9. Thus, a shed is formed in which the warps **42** and **43** are at the intermediate level and the warp **41** is at the lower level. An upper weft shot **46** is then inserted, and in a succeeding operation, is beat up into the fell **33** of the fabric.

During this operation, the cam shaft **24** is rotated to advance the cylinder **16** into engagement with the bank of needles **19**. The card **38** has apertures registering with the needles **19***b*, **19***c* and **19***e* so that the upwardly moving knives **13** engage the hooks **29***c* and **29***e* to elevate the warps **42** and **43** to the upper level in the shed. The warp **41** is elevated to the intermediate level and a wire **47** and lower weft shot **48** are inserted and beat up in the usual manner. It is noted that the hook **29***b* is engaged with the knife **12** so that in the succeeding operation, the warp **41** is retained at the intermediate level while the remaining warps are dropped to the lower level. Thus, when the upper weft shot **49** is inserted, the warp **41** will be above it.

The fabric woven by this series of operations is clearly shown in Fig. 6. The chain warp **50** is manipulated independently of the pile warps **41**, **42**, and **43**. The stuffer warps **51** are controlled independently of the jacquard.

Fig. 2 illustrates a pile weave made by apparatus of the invention wherein the pile yarn **52** is controlled in the same manner as the pile yarn **42** of the previously described embodiment. Thus, for a sequence of three cards, the hole controlling the needle which actuates the hook engageable with the fixed knife, is blanked in the first and third card and open in the second card. The hole for controlling the needle actuating the hook engageable with the movable knife is open in the second and third cards.

The weave illustrated in Fig. 3 shows a pile yarn **53** floated over the second and third upper wefts and under the wires. In the three cards for producing this weave, the hole for controlling the needle actuating the hook engageable with the fixed knife, is blanked in the first card and open in the second and third. The hole for controlling the needle actuating the hook engageable with the movable knife is blanked in the second and third cards.

In Fig. 4, the weave is illustrated in having a pile yarn **52***a* controlled similarly to the pile yarn **52** of Fig. 2 and a pile yarn **54** which passes under every upper weft and over every wire. In the set in three cards for producing this weave, of the holes controlling the yarn **54**, the holes controlling the needle actuating the hook engageable with the fixed knife are blanked, and the holes for actuating the needle controlling the hook engageable with the movable knife, are open.

In Fig. 5, a weave is illustrated in which the pile yarn passes over alternate pile wires and is tied under alternate upper wefts, passing under the intermediate wires and over the intermediate upper wefts. In the set of cards for producing this weave, the holes for controlling the needles actuating the hooks engageable with the fixed knives, are alternately blanked and open in successive cards and the holes for controlling the needles actuating the hooks engageable with the movable knives are alternately blanked and open in the successive cards.

Fig. 11 illustrates a fabric embodying the weave shown in Fig. 5. As seen in Fig. 11, the fabric comprises both looped and cut pile indicated respectively at **60** and **61**. This fabric may be woven on a loom wherein the wires are arranged in a sequence alternating cutting and looping wires, i. e., wires with and without a knife on the trailing end. The fabric has a full complement of pile projections tied under each weft so that there is substantially no chance of "grinning" in the finished fabric. As seen in Fig. 13, the looped portion is formed by raising both the pile warps **62** and **63** over only the non-cutting wires **64** and floating them under the cutting wires **65**. To weave the cut portion, both pile yarns are raised over the cutting wires **65** and are floated under non-cutting wires **64**. To accomplish this, the card layout operator needs only to modify the sequence of holes for controlling the needle actuating the hook engageable with the movable knife for each pile warp, i. e., for the looped portion he must blank the alternate cards and punch the intermediate cards; for the tufted portion, he must punch the alternate cards and blank the intermediate cards.

The present invention therefore affords a simple expedient for producing many varied pile effects in a Wilton carpet fabric using a minimum number of cards for controlling the jacquard movement.

While a particular construction and a certain number of arrangements have been illustrated and described herein, it is not intended to limit the invention to such disclosures and changes and modifications may be made

therein and thereto within the scope of the following claims.

We claim:

1. For weaving a pile fabric comprising pile warps, chain warps, and weft shots, a pile wire loom having a plurality of heddles each carrying a warp and movable between lower, intermediate and upper levels to form a succession of sheds, a first lash hook mounted for vertical longitudinal movement and displaceable laterally from a normal position, means connecting one heddle to said lash hook for actuation by the latter, a first knife operable to engage said hook when the latter is in its normal position, means to move said knife between upper and lower stations concurrent with the formation of intermediate and alternate sheds respectively of said succession of sheds, said hook engageable with said knife during the upward movement of the latter to elevate the heddle and support it at its upper level, the lower station of said knife affording return of the heddle to its lower level, a second lash hook mounted for vertical longitudinal movement and displaceable laterally from a normal position, means connecting said one heddle to the second lash hook for actuation by the latter, a second knife fixed in position and operable to engage the second hook when the latter is in its normal position to support said heddle at its intermediate level, a hook grate movable between upper and lower stations and engageable with the first and second lash hooks in both their normal and their laterally displaced positions, means for moving said hook grate between said upper and lower stations in synchronism with the movement of said first knife between its upper and lower stations to afford movement of the heddle between its intermediate and lower levels respectively, and needle means operatively engaged with said first and second lash hooks and operable to selectively displace the same laterally from their normal position and preclude engagement thereof with their associated knives, said heddle being controlled only by said hook grate when both lash hooks are displaced from their normal position.

2. For weaving a pile fabric comprising pile warps, chain warps, and weft shots, a pile wire loom having a plurality of heddles each carrying a warp and movable between lower, intermediate and upper levels to form a succession of sheds, a first lash hook mounted for vertical longitudinal movement and displaceable laterally from a normal position, flexible means connecting one heddle to said lash hook for actuation by the latter, a first knife operable to engage said hook when the later is in its normal position, means to move said knife between upper and lower stations concurrent with the formation of intermediate and alternate sheds respectively of said succession of sheds, said hook engageable with said knife during the upward movement of the latter to elevate the heddle and support it at its upper level, the lower station of said knife affording return of the heddle to its lower level, a second lash hook mounted for vertical longitudinal movement and displaceable laterally from a normal position, flexible means connecting said one heddle to the second lash hook for actuation by the latter, a second knife fixed in position and operable to engage the second hook when the latter is in its normal position to support said heddle at its intermediate level, a hook grate movable between upper and lower stations and engageable with the first and second lash hooks in both their normal and their laterally displaced positions, means for moving said hook grate between said upper and lower stations in synchronism with the movement of said first knife between its upper and lower stations to afford movement of said first knife between its upper and lower stations to afford movement of the heddle between its intermediate and lower levels respectively, and needle means operatively engaged with said first and second lash hooks and operable to selectively displace the same laterally from their normal positions and preclude engagement thereof with their associated knives, said heddle being controlled only by said hook grate when both lash hooks are displaced from their normal position.

3. For weaving a pile fabric comprising pile warps, chain warps, and weft shots, a pile wire loom having a drive shaft and a plurality of heddles each carrying a warp and movable between lower, intermediate and upper levels to form a succession of sheds, a first lash hook mounted for vertical longitudinal movement and displaceable laterally from a normal position, means connecting one heddle to said lash hook for actuation by the latter, a first knife operable to engage said hook when the latter is in its normal position, means operatively connected to said drive shaft to move said knife between upper and lower stations concurrent with the formation of intermediate and alternate sheds respectively of said succession of sheds, said hook engageable with said knife during the upward movement of the latter to elevate the heddle and support it at its upper level, the lower station of said knife affording return of the heddle frame to its lower level, a second lash hook mounted for vertical longitudinal movement and displaceable laterally from a normal position, means connecting said one heddle to the second lash hook for actuation by the latter, a second knife fixed in position and operable to engage the second hook when the latter is in its normal position to support said heddle at its intermediate level, a hook grate movable between upper and lower stations and engageable with the first and second lash hooks in both their normal and their laterally displaced positions, means operatively connected to said drive shaft for moving said hook grate between said upper and lower stations in synchronism with the movement of said first knife between its upper and lower stations to afford movement of the heddle between its intermediate and lower levels respectively, needle means operatively engaged with said first and second lash hooks and operable to selectively displace the same laterally from their normal positions and preclude engagement thereof with their associated knives, said heddle being controlled only by said hook grate when both lash hooks are displaced from their normal position, and a card and card cylinder driven by said drive shaft to selectively actuate said needle means in accordance with a predetermined pattern.

4. In a jacquard mechanism for a loom, a card cylinder, cards therefor, needles operatively engaging the cards, lash hooks operatively engaged by the needles and having upper knife hook ends and lower hook grate ends, a fixed knife engageable with the upper knife hook ends of alternate lash hooks, a movable knife engageable with the upper knife hook ends of the intermediate lash hooks, a plurality of heddles each being connected to a pair consisting of alternate and intermediate hooks, means to displace said movable knife between upper and lower stations, a hook grate engageable with the lower hook grate ends, and means to displace said hook grate between upper and lower stations concurrently with the displacement of said movable knife, the upper station of said hook grate being a lesser distance above the lower station than the upper station of said movable knife, said cards operable to select needles for engaging the lash hook knife ends with the respective knives, the lash hook selected for engagement with the movable knives raising the associated heddle to an upper level, the lash hook selected for engagement with the fixed knife holdiing the heddle at an elevated intermediate level when the movable knife and the hook grate are at their lower stations, and the remaining lash hooks affording displacement of the heddle to a lower level upon movement of the movable knife and hook grate to their lower stations.

5. In a jacquard mechanism for a loom, lash hooks having upper knife hook ends and lower hook grate ends, a fixed knife engageable with the upper knife hook ends of alternate lash hooks, a movable knife engageable with the upper knife hook ends of the intermediate lash hooks,

a plurality of heddles each being connected to a pair consisting of alternate and intermediate hooks, means to displace said movable knife between upper and lower stations, a hook grate engageable with the lower hook grate ends, means to displace said hook grate between upper and lower stations concurrently with the corresponding displacement of said movable knife, the upper station of said hook grate being a lesser distance above the lower station than the upper station of said movable knife, and means operable to select and engage lash hook knife ends with the respective knives.

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