United States Patent

Jud

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[54] **METHOD AND APPARATUS FOR PRODUCING A TERRY FABRIC ON A LOOM**

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[52] **U.S. Cl.** **139/27**

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[58] **Field of Search** 139/26, 27, 25, 189, 191, 188

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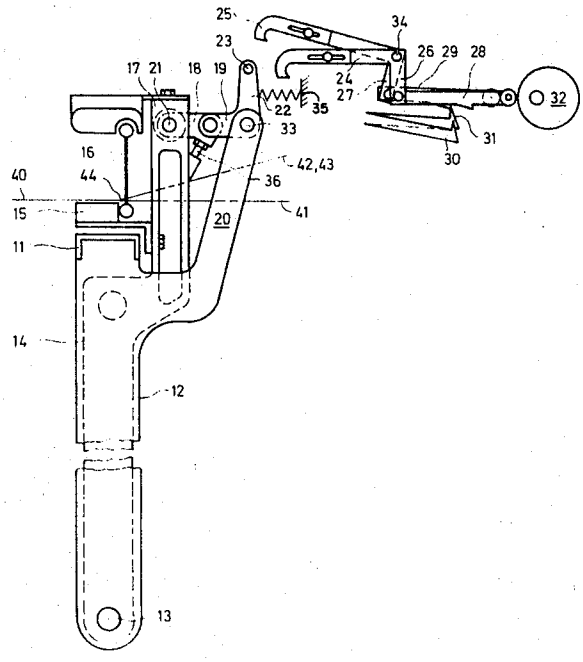
[57] **ABSTRACT**

A method of producing a terry towelling on a loom wherein weft threads are beaten up in a repeating sequence at various distances from a reference fabric beat-up which comprises beating up the first weft thread of a sequence at a predetermined distance from the fabric beat-up, beating up the second weft thread of the sequence at a distance somewhat less than said predetermined distance from the fabric beat-up, beating up the last weft thread of the sequence at a distance from the fabric beat-up that corresponds to the distance of a beat-up in the case of plain weaving, and looping terry warp threads round the second weft thread. Also, apparatus for carrying out this method is disclosed.

8 Claims, 5 Drawing Figures



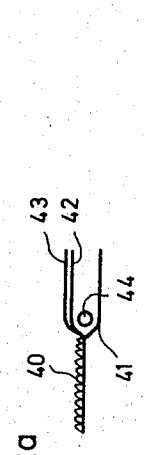


FIG. 2a

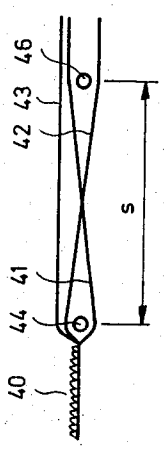


FIG. 2b

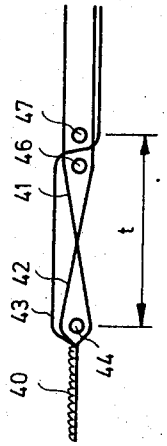


FIG. 2c

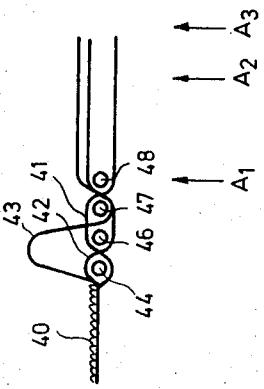


FIG. 2d

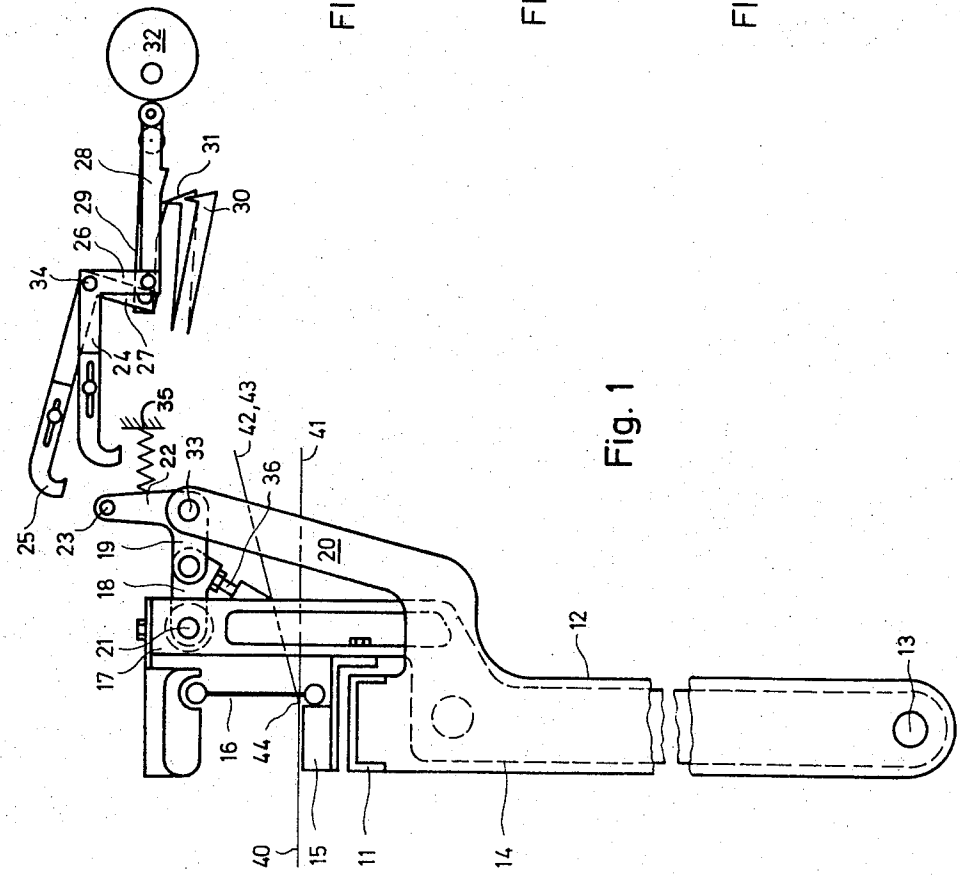


Fig. 1

METHOD AND APPARATUS FOR PRODUCING A TERRY FABRIC ON A LOOM

This invention relates to a method and apparatus for producing a terry fabric, and more particularly to a method of producing a terry towelling, in which weft threads are beaten up in a repeating sequence at various distances from the fabric beat-up and to the apparatus or arrangement for carrying out this method on a loom or weaving machine.

In producing terry fabrics it is known to operate with sequences of weft thread insertions in such a way that the weft threads are inserted at a distance from the fabric beat-up, one of these weft threads being looped by the terry thread, i.e., by the thread forming the nap of the resulting fabric. During the subsequent displacement of this weft thread towards the fabric beat-up point, the warp threads, which form the basic fabric, are held. The warp threads forming the nap are, however, released over a distance equivalent to the amount of displacement of the weft threads towards the fabric beat-up. The looped form of the terry threads is thus obtained.

The present invention is intended to increase the uniformity in the depth of the nap of the individual terry loops.

Thus, this invention contemplates a method for producing a terry fabric which is characterized in that the first weft thread of the sequence is beaten up at a predetermined distance from the beat-up of the fabric; the second weft thread of the sequence is beaten up at a distance somewhat less than this predetermined distance from the fabric beat-up; the last weft thread of the sequence is beaten up at a distance from the fabric beat-up corresponding to beat-up in plain weaving; and the terry warp threads are looped round the second weft thread.

This invention is also concerned with an apparatus or an arrangement for use on a terry loom for beating up the weft threads, which comprises control means for varying the beat-up movement of the reed in order to obtain, in a repeating sequence, weft thread beat-up positions at various distances from the fabric beat-up. This apparatus is further characterized in that the control means sets the beat-up positions of the reed, the first of which is at a predetermined distance from the fabric beat-up, the second of which is at a distance somewhat less than this predetermined distance from the fabric beat-up, and the third of which is at a distance from the fabric beat-up corresponding to beat-up in the case of plain weaving, provision being made for the shed to be changed before and after the second beat-up for the terry threads.

The invention will now be described in more detail by reference to one of its embodiments and to the accompanying drawings in which:

FIG. 1 is a side view of the apparatus of this invention for forming the terry towelling on a loom; and

FIGS. 2*a* through 2*d* are schematic views, on a larger scale, of the warp and weft threads during the weaving operation, serving to illustrate the mode of operation of the apparatus of the invention.

Referring to FIG. 1, a plate **11**, disposed at right-angles to the plane of the drawing, is carried by a support or drive member **12** at each of its two ends. The supports **12** execute swinging movements of a constant angle or uniform sweep about the shaft **13**. In the case of a loom with shuttles, the shuttle boxes of the loom are also carried on supports **12**. Two swinging arms or sley supports **14** are likewise swingable about the shaft **13**. Where these are masked by the drive member **12**, they are drawn in broken lines. At its upper end each of the sley supports or swinging arms **14** carry a sley **15** and a reed **16**. The sley **15** and the reed **16** extend at right-angles, i.e., perpendicular, to the plane of the drawing. The sley and reed are supported at each end by a swinging arm **14**. Also, each of these arms has a carrier **17** at its upper end. Rotatably mounted on each of these carriers is a toggle link comprising arms **18** and **19**. The other end of each of the toggle links can swing about a shaft **33**, each such shaft being carried by an extension **20**. Each of the extensions forms part of one of the drive members **12**. The arm **18**, swingable about the axis designated by reference numeral **21**, is biassed by a coiled spring **35**. This bias urges the arm **18** of the toggle link **18**, **19** in the clockwise direction. The end position of this rotary movement is determined by the adjustable stop **36**. The arm **19** is rigidly connected to the arm **22**. At its free end arm **22** carries a rod **23**, with which the hooks of the retaining members or means **24**, **25** can engage in their lowered position. The retaining members **24**, **25** are of different lengths. It will be appreciated that the lengths of the retaining members may be adjustable. Together with the arms **26** and **27**, respectively, these members constitute double-armed levers that can be swung about the shaft **34**. Two retaining members **24**, **25** are associated with each of the toggle links **18**, **19** at the ends of the extensions **20**.

The mechanism for actuating the retaining members **24**, **25** is illustrated diagrammatically in FIG. **1**. The eccentric disc **32** executes one revolution for each insertion of the weft thread in a shed of the loom. If it is required to move one of the retaining members **24**, **25** into its lowered or retaining position, the corresponding hook **30** or **31** is programmed, appropriately in accordance with the loom operation, to be lowered so that the rod **28** or **29**, respectively, remains on the curved guide surface of the eccentric **32**. While the rod **28** or rod **29** bears against the small diameter of the disc **32**, the hook of retaining member **24** or **25** is located in its lower position, i.e. in a position in which it retains the rod **23** and thus the arm **22**. In the raised position the hooks **30**, **31** prevent their associated rods **28** and **29**, respectively, from moving to the right, so that the corresponding retaining members **24** and **25**, respectively, remain in their raised positions.

The terry towelling is indicated by the reference numeral **40** and the warp threads by the reference numerals **41**, **42** and **43** in FIGS. **2***a* through **2***d*. The method of producing the fabric **40** in accordance with the invention is also schematically illustrated in detail in these figures. The basic fabric is formed by means of the warp threads **41** and **42** and the nap by the towelling warp threads **43**. The fabric beat-up or fell providing the reference point for the repeating sequence of weft thread insertions is assumed to be constituted or formed by the last inserted weft thread **44** in FIG. **2***a*. This thread extends perpendicular to the plane or the drawing and like the other weft threads is shown on a larger scale to facilitate understanding of the drawings. After a shed-change of the warp threads

41 and 42 for the basic fabric, the next weft thread 46 is inserted and, as shown in FIG. 2*b*, is beaten up at a distance *s* from the fabric beat-up or fell formed by thread 44. The next weft thread 47 is inserted in the same shed of the warp threads 41 and 42, but with nap or terry threads 43 the shed position of which has been changed. The weft thread 47, as shown in FIG. 2c, is beaten up at a distance *t* from the fabric beat-up point at thread 44, which distance is equal to or somewhat less than the distance *s*. The weft thread 46 is thus moved somewhat towards the fabric beat-up at thread 44, and threads 46 and 47 are positioned close to each other. After a shed-change of the threads 41 and 42 and of the terry thread 43, the next weft thread 48 is inserted. The following thread beat-up occurs up to a distance from the fabric beat-up of thread 44 such that the weft threads 46 to 48 are spaced in a way corresponding to a normal fabric or to plain weaving. The sequence of weft insertions is then repeated, i.e., the next weft thread is again inserted and beaten up at a distance *s* from the new fabric beat-up at thread 48, and so on. It will be appreciated that the fabric beat-up or fell formed by weft thread 44 may also be considered as the reference beat-up or fell for the described repeating sequence.

In order to weave the terry pattern illustrated in FIGS. 2*a* through 2*d*, the hook 31 (shown in FIG. 1) is raised upon insertion of the weft thread 46, in accordance with a program which is determined by a system including a punched card associated with the shed-forming mechanism of the loom. When the eccentric 32 moves the rod 29 to the left, the rod is held by the hook 31 which latches into it. The retaining member 25 thus remains in its upper position. Since the hook 30 is not however moved upwards by the programming system, the rod 28 can move to the right and can remain in contact with the eccentric 32. If, for beating up the thread 46, the drive members 12 now swing in the anti-clockwise direction about the shaft 13, the swinging arms 14 are carried around since the arms 14 are linked with the drive members 12 on each side of the loom by way of the extended toggle links 18, 19. When the reed 16 approaches the fabric beat-up at thread 44, the rod 23 of each arm 22 is seized by a retaining member 24 on each side of the loom. The arms 22, 19 therefore rotate about the shaft 33 and the arm 18 is rotated, thereby overcoming the tension of the coiled spring fitted on the shaft 21. Because of this buckling of the toggle link 18, 19, the distance between the shafts 21 and 33 becomes smaller. Since the swinging movements of the swinging members 12 always remain the same, the reed 16 will not move so close to the fabric beat-up at thread 44 as it would if both retaining members 24, 25 were raised. The retaining member 24 is then so adjusted, that the thread 46 is moved only up to a distance *s* from the fabric beat-up at thread 44.

During insertion of the weft thread 47, the hook 30 is raised and the hook 31 of the control means is lowered by a mechanism (not shown) which is actuated, e.g., by signals, advantageously electrical signals from the heald mechanism or shed forming mechanism of the loom including the heretofore-described punch card. The retaining member 25 thus moves into its active position, and the retaining member 24 is held in its non-operative position. The retaining member 25 is somewhat longer than the retaining member 24, so that when the weft thread 47 is beaten up, the rod 23 is seized a little later than in the case when the weft thread 46 is beaten up. Thus the swinging arm 14 is retracted to a somewhat less extent, and the beat-up action of the reed takes place closer to the edge adjacent to thread 44 of the fabric, and at a distance *t* therefrom.

When the next weft thread 48 is inserted, both hooks 30 and 31 are raised in accordance with the predetermined program. As a result of this, both retaining members 24 and 25 remain in their raised non-active positions. When the thread 48 is beaten up, the toggle link 18, 19 therefore remains extended and the reed 16 executes a complete beat-up movement. Whereas during the preceding beat-up of thread 47, thread 46 was also moved a short distance towards the fabric beat-up at thread 44, upon beat-up of thread 48, both the thread 48 and the threads 46 and 47 are now pushed fully to the fabric beat-up at thread 44 (as can be seen from FIG. 2*d*). If the fabric beat-up of thread 44 is not taken as a reference point, it can be said that when the retaining members 24 and 25 are raised, beat-up of the thread occurs at location A_1, when the retaining member 25 is lowered, the thread beat-up occurs at location A_2, and when the retaining member 24 is lowered, it occurs at location A_3. In the case of the weaving process described, it has to be borne in mind that advance of the fabric, corresponding to that of normal or plain weaving, always takes place.

An important feature of the present invention is that when the weft thread 47 is beaten up, the thread presses against the weft thread 46 and thus the thread 46 is likewise pushed a little towards the beat-up at thread 44 of the fabric. Thus the terry thread 43 is already firmly held between the weft threads 46 and 47 in the phase of operation illustrated in FIG. 2*c*. This retention is further increased during the full beat-up illustrated in FIG. 2d, since the towelling thread 43 is looped round the warp thread 47 and is pressed against it on both sides. As a result of this retaining action, a considerable improvement is obtained as compared with the known terry fabrics in the sense that the loops 43 are of appreciably more uniform size.

The apparatus or arrangement shown in FIG. 1 for beating up of the weft threads can also be used in the production of fabrics having different depths of nap. For this purpose, a third retaining member, in addition to the retaining members 24 and 25, is provided. This third member is longer than the retaining members 24 and 25 and determines the position of the fabric beat-up at thread 44 in the case of smaller depths of nap. When weaving to give a big depth of nap, this third retaining member is moved into the non-active position. As shown in FIG. 1, in another apparatus serving the same purpose, only two retaining members 24 and 25 are provided. In this case, as in terry weaving systems employed at the present time, a first partial displacement, as was described for the threads 46 and 47, is not used. The threads 46 and 47 are beaten up with the member 24 in the active position. The small depth of nap is obtained by beating up by means of the member 25 and the large depth of nap by cutting out the member 25.

It is also possible, instead of beating up three warp threads **46**, **47** and **48** each time, to beat up four threads jointly as a group. In such a procedure, the weft thread **48** shown in FIGS. **2***a* through **2***d* would also be only partially beaten up. The full beat-up up to the fabric beat-up at thread **44** occurs in this arrangement after the insertion of the weft thread following the thread **48**.

If the fabric to be produced is to have a nap on both sides, further terry threads are used in addition to the terry threads **43**. Their arrangement and movements are symmetrical with regard to the warp threads **43** and with reference to the plane of the fabric **40**.

When the apparatus described is used on a loom which does not employ shuttles for inserting the wefts, and thus does not have shuttle boxes, the supports **12**, as mentioned in connection with the above-described apparatus, are not necessary. In this case, instead of the supports **12**, other drive members or means can be provided which execute movements of constant length. In such a case the toggle links **18** and **19** connect these other drive members to the reed supports or arms **14**.

What is claimed is:

1. A method or producing a terry towelling on a loom wherein weft threads are beaten up in a repeating sequence, for each row of terry loops, at various distances from a reference fabric beat-up which comprises beating up the first weft thread of a sequence at a predetermined distance from the fabric beat-up, looping terry warp threads around a second weft thread of the sequence, beating up the second weft thread of the sequence at a distance somewhat less than said predetermined distance from the fabric beat-up, and beating up the last weft thread of the sequence at a distance from the fabric beat-up as in the case of plain weaving.

2. The method of claim **1** in which at least a third weft thread of the sequence is beaten up at a distance from the fabric beat-up that is somewhat less than the predetermined distance.

3. An apparatus for use on a terry loom for beating up the weft threads, which comprises control means for varying the beat-up movement of the reed in order to achieve a repeating sequence of weft-thread beat-up positions, for each row of terry loops, at various distances from a reference fabric beat-up, said control means determining beat-up positions of the reed so that the first beat-up position is at a predetermined distance from the reference fabric beat-up, the second beat-up position is at a distance somewhat less than said predetermined distance from the reference fabric beat-up and the third beat-up position is at a distance from the reference fabric beat-up that corresponds to a beat-up in the case of plain weaving; provision being made for a shed-change for the terry threads before and after the second beat-up position.

4. The apparatus of claim **3** further comprising a pair of swinging arms, said reed being supported at each of its two ends by one of said swinging arms, a common shaft about which the swinging arms are swung, drive members capable of executing reciprocating swinging movements of a constant distance, said swinging arms being secured to the drive members by connecting means at a distance which can be varied by the control means acting on said connecting means.

5. The apparatus of claim **4** in which the drive members constitute supports for shuttle boxes carrying shuttles which insert the weft threads into the sheds formed during the weaving operation, said drive means also being swung about the said common shaft.

6. The apparatus of claim **4** in which each swinging arm has a connecting means that comprises a toggle link, said toggle links each being capable of being collapsed to various extents by the control means, and each of the toggle links being rotatably attached by one end to one of the swinging arms and by the other end to one of the drive members.

7. The apparatus of claim **6** in which each of the toggle links forms a toggle lever continuously biased by a biasing means towards an end position, and the control means comprises lever arms, each of which is firmly connected to an arm of each toggle link, respectively, and a plurality of controllable retaining members arranged to be moved at various positions, in accordance with a program, into the path of movement of the lever arms, respectively, in order to actuate the lever arms, thereby overcoming the bias of the toggle lever.

8. The apparatus of claim **7** in which the retaining members are actuated by signals supplied by the shed-forming mechanism of the loom.

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