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Steiner

[11] **3,848,642**

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[54] **SHED FORMING DEVICE**

[75] Inventor: **Alois Steiner,** Rieden/SG, Switzerland

[73] Assignee: **Ruti Machinery Works Ltd., formerly Casper Honegger,** Ruti, Switzerland

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Apr. 14, 1972 Switzerland 5654/72

[52] **U.S. Cl.** **139/28,** 139/48

[51] **Int. Cl.** **D03c 13/00**

[58] **Field of Search** 139/11, 28, 116, 35, 48

[56] **References Cited**

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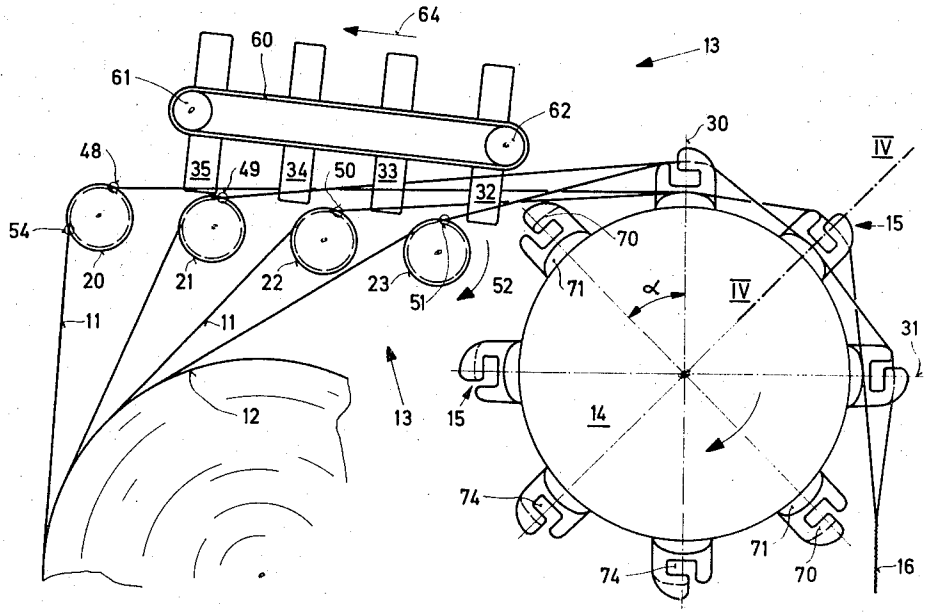
Primary Examiner—Henry S. Jaudon

Attorney, Agent, or Firm—Donald D. Denton

[57] **ABSTRACT**

The present invention covers a device for forming textile weaves on a loom having a plurality of sheds following each other in the longitudinal direction of the warp threads, wherein there are provided rows, extending transversely of the warp threads, of shedding elements alternatingly establishing the upper and lower shed and travelling along the warp threads, so that they retain the latter in their upper or lower shed position over a predetermined travel path.

9 Claims, 6 Drawing Figures



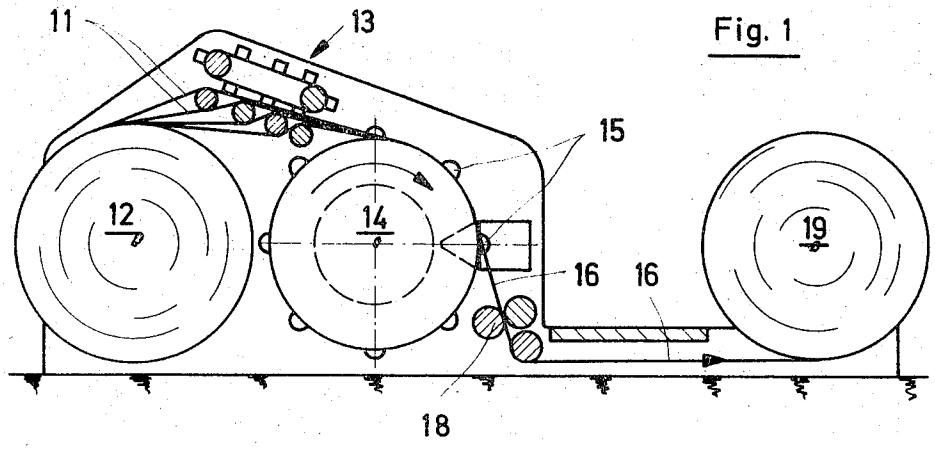


Fig. 1

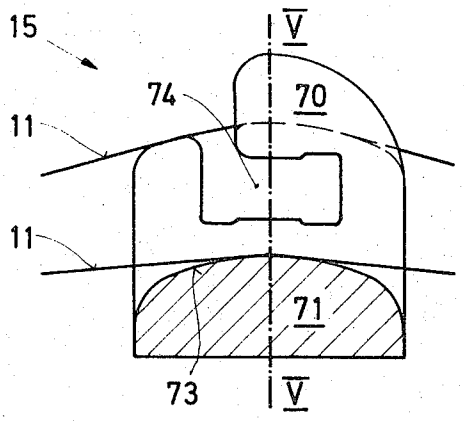


Fig. 4

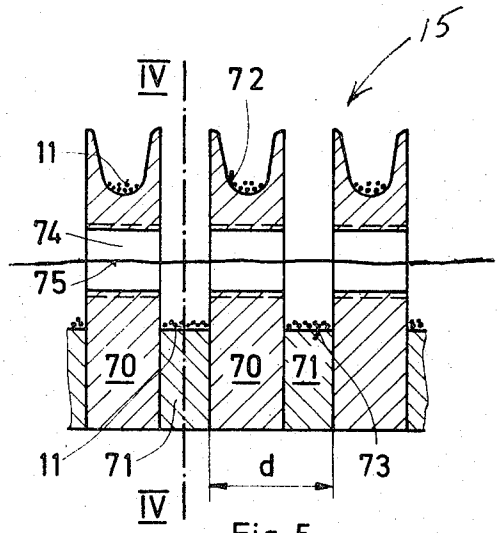


Fig. 5

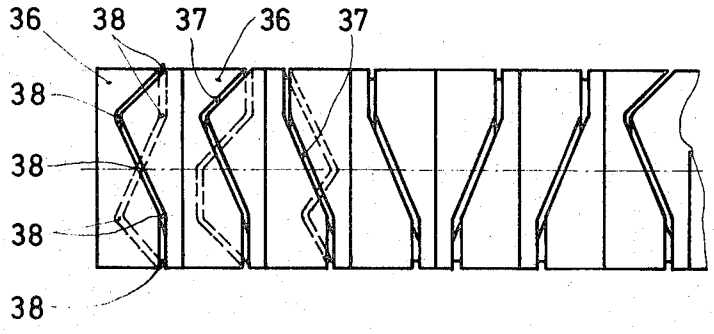


Fig. 6

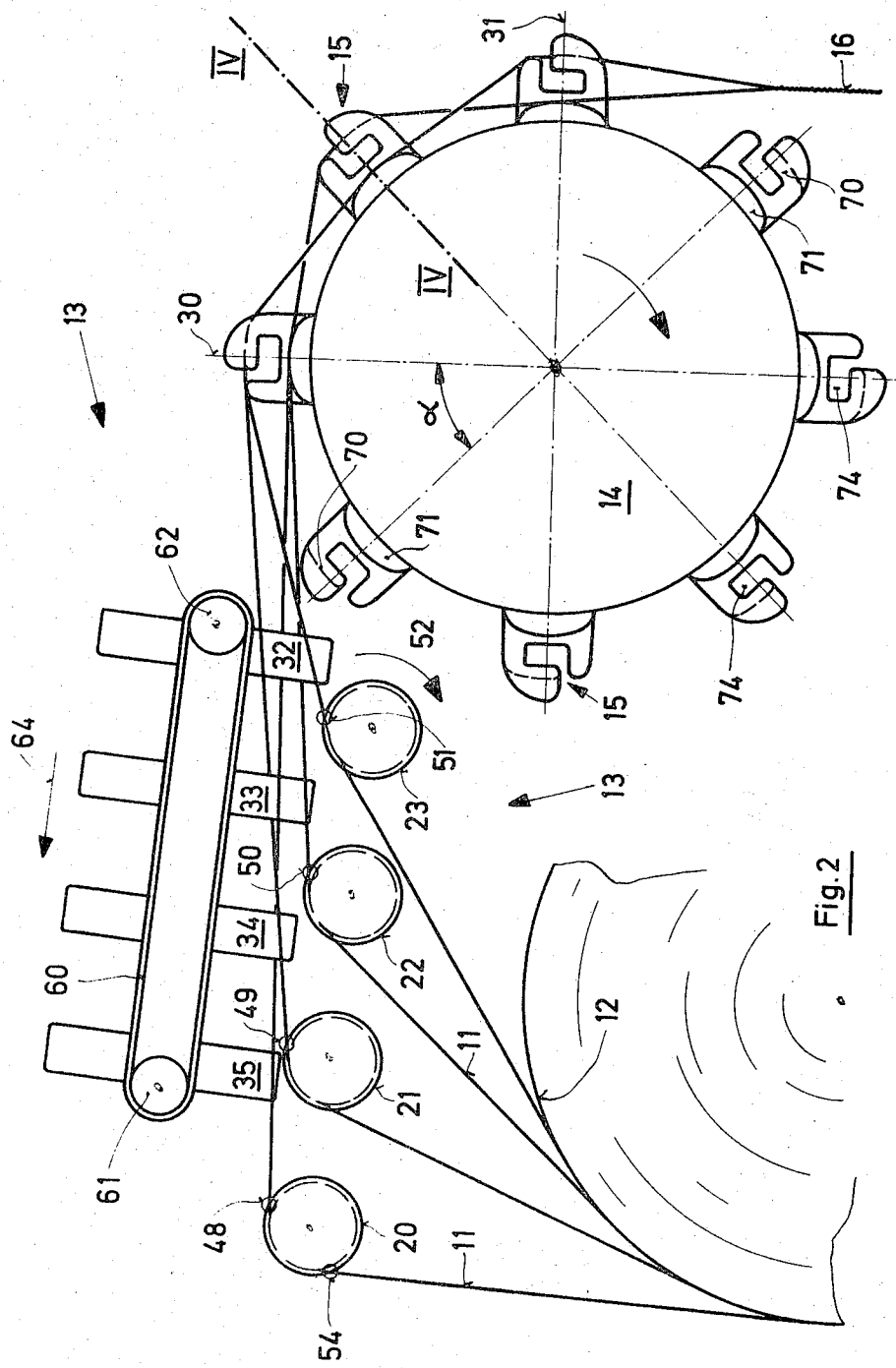

IV
15
31
16
70
71
IV
13
30
α
14
74
62
52
32
64
51
23
13
33
50
34
22
60
49
12
11
35
21
61
48
20
11
54

Fig.2

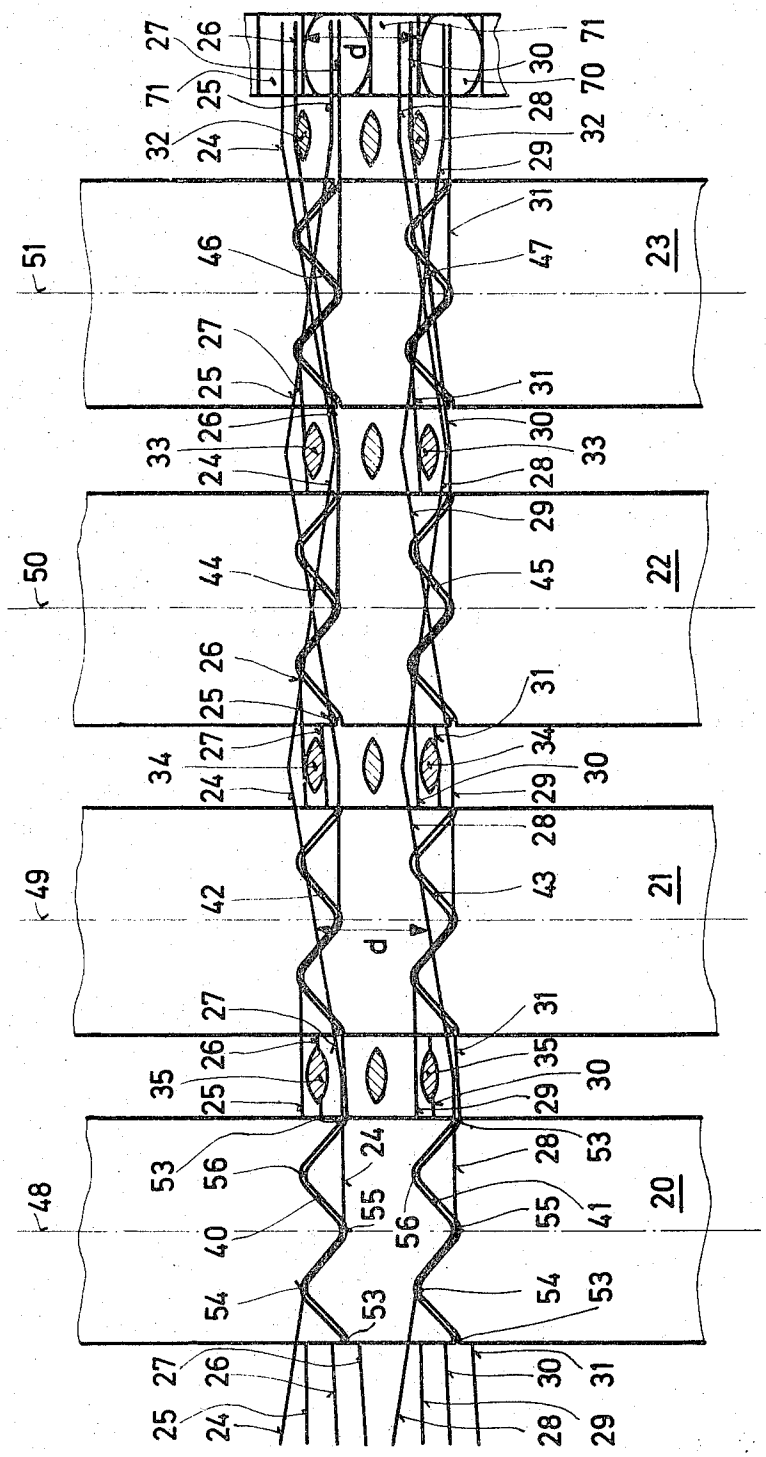


Fig.3

SHED FORMING DEVICE

BACKGROUND

In the endeavor to increase the weaving velocity, it is possible to adopt a procedure whereby one shed is formed after the other in the direction of the warp threads, in such manner that a plurality of such sheds is continuously available. In this way, it becomes possible to effect a plurality of picks simultaneously. In such a weaving system, the weft insertion procedure has progressed to the greatest extent (or is terminated) in that shed of those sheds which are open at a given instant, which was first formed, whereas in the shed last formed the picking procedure is still in the initial phase and in the intermediate sheds it is in corresponding intermediate states. With this arrangement, the sheds are distributed over a laminar zone, so that it is possible to speak of a "laminar" loom or, since the sheds extend in aligned, juxtaposed arrangement, of an "aligned shed" loom. The closest prior art known to the applicant in connection with the subject application is German Pat. No. 1,008,215 and Swiss Pat. No. 164,808.

SUMMARY

It is the object of the present invention, in such an aligned shed loom, to make possible the production of various weaves. The invention is characterized in that there is arranged before the zone of the sheds control means for laterally deflecting each warp thread in accordance with a programme, thereby associating the shed-forming elements determining the establishment of an upper or lower shed with one of the said warp threads.

This invention will now be described hereinbelow with reference to examples of the following embodiments and to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a cross-section through an "aligned shed" loom of the invention;

FIG. 2 shows a detailed elevation of the said cross-section in the zone of the control means and of the shedding elements for forming the woven cloth;

FIG. 3 shows a plan view of the control means according to FIG. 2;

FIG. 4 shows a cross-sectional view of the shedding elements forming the upper and lower sheds shown in FIG. 2;

FIG. 5 shows a view taken on the line V—V of FIG. 4 of the said elements in longitudinal section; and

FIG. 6 is a view of a further embodiment of a portion of the control means.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the figures, like elements have been given the same reference numerals.

As shown in FIG. 1, the warp threads 11 travel from a warp beam 12 to control means 13 with the aid of which the warp threads are associated with an upper or lower shed position in accordance with a predetermined cloth pattern. From the control means 13, the warp threads 11 travel to the weaving rotor 14. Arranged over the periphery of weaving rotor 14 are rows of shedding elements 15. The weaving process takes place on the rotating weaving rotor 14, in that zone in which open sheds are available. The woven cloth 16 travels over the cloth draw-off roller 18 to the cloth beam 19.

The control device 13 for associating the warp threads 11 with an upper and lower shed position is shown again, to an enlarged scale, as a lateral view in FIG. 2 and as a plan view in FIG. 3. The warp threads 11 are, after beng drawn off from the warp beam 12, guided over control rollers 20, 21, 22, and 23. FIG. 3 shows the surface of each roller 20 to 23 as a development located in the plane of the drawing. Each roller is formed with a plurality of guide grooves whereof the grooves 40, 41 formed in the roller 20, the grooves 42, 43 in the roller 21, the grooves 44, 45 in the roller 22 and the grooves 46, 47 in the roller 23 are shown. The grooves formed in each roller are separate from each other and each groove extends about the generated surface of the roller and is continuous. For the sake of simplicity, four control rollers 2o to 23 are shown; however, as a rule there will be more than four such rollers. Again for the sake of simplicity, that pattern or configuration of the rollers 40 to 47 is provided which will produce a linen weave.

In order to show clearly the travel path of the warp threads 11, referring to FIG. 3 eight individual threads or yarns have been designed by numerals 24, 25, 26, 27, 28, 29, 30, and 31. Associated with each warp thread 24 to 31 is one of the grooves 40 to 47 and each warp thread is permanently disposed in the groove associated with it, for example the warp thread 24 in the groove 40 and the warp thread 25 in the groove 42. The warp threads 11 or 24 to 31 respectively are so guided, with reference to the rollers 20 to 23, that at one of the generatrices 48 to 51 they are lifted off from the associated rollers of the rollers 20 to 23. They take up their position in those grooves of the grooves 40 to 47 which are associated with them at locations located, with reference to the direction of rotation indicated by the arrow 52 of the rollers 20 to 23, upstream of the generatrices 40 to 51. In the case of the threads or yarns 24 and 28, these are the locations designated 54. The rollers 20 to 23 rotate in the direction of the arrow 52 at a velocity such that, per pick, they rotate by a value such that each warp thread control location travels to the site of the next warp thread control location. The said warp thread control locations have been given reference numerals (i.e., numerals 53 to 56) only at the roller 20. With each pick, the control locations 53 travel to the site of the control locations 54 and the latter to the site of the control locations 55, etc. If, as in this example, four such locations 53 to 56 are provided over the periphery of the rollers 20 to 23, then each roller 20 to 23 effects, for one pick, a rotation through 90°.

Provided above the rollers 20 to 23 is an endless band, belt or tape 60 rotating about the rollers 61, 62. The band 60 has separating elements whereof the lower ones have been designated 32 to 35. The said separating elements are plate-shaped and serve for maintaining the sorting of the warp threads 24 to 31. The direction of rotation of the band 60 is indicated by the arrow 64. The velocity of rotation is so calculated that each of the elements 32 to 35 travels, in that working phase in which the rollers 20 to 23 perform a rotation from one warp thread control location 53 to 56 to the next one, from its position into the position of the elements immediately preceding it, for example the element 34 passes into the position of the element 33 shown.

FIG. 4 shows a section of the shedding element **15**, taken along the line IV—IV of FIG. 5 and FIG. 5 shows a section along the line V—V of FIG. 4. The section V—V is taken parallel to the axis of the weaving rotor **14**. In this direction, there are arranged alternatingly the shedding elements **70** or **71** respectively forming the upper and lower sheds. In order that the warp threads **11** may be reliably retained in the upper shed, the elements **70** forming the upper shed have in their uppermost portion a trough-shaped abutment or bearing means **72**. The elements forming the lower shed have in their upper ends an abutment or bearing surface **73**. The elements **70** are formed with a recess **74** serving for guiding the picking means. FIG. 5 shows an inserted weft thread **75**.

Shown on the right-hand side of FIG. 3 are two shedding elements **70** or **71** respectively forming the lower shed. From FIG. 3 it will be perceived how the warp threads **24** to **31**, the location of which has been determined by the guide grooves **40** to **47** for upper or lower shed (i.e., which have been "sorted") and the "sorting" of which is maintained after travel through the groove associated with them by the elements **32** to **35**, travel towards the shedding elements **70** and **71** forming the upper and lower sheds.

This travel path of the warp threads **24** to **31**, travelling in the sequence shown from the warp beam **12**, can be followed with the aid of reference numerals **24** to **31** and is as follows: the thread or yarn **24** travels at a location **54** into the groove **40**, leaving the latter once again at the location of the generatrix **48**, i.e., at location **55** (see also FIG. 2). A short distance thereafter, there are already separating elements **35** laterally of the thread **24**, for deflecting the latter into the prescribed shedding element **70** or **71**. In the case of the linen weave selected for this example, the thread **24** is, as seen in the direction of travel of the separating elements **32** and **35**, to the right with respect to the left-hand separating element **35**, to the left with respect to the corresponding separating element **34**, to the right with respect to the corresponding separating element **33** and to the left with respect to the corresponding separating element **32**. Thus it travels to an element **71** forming a lower shed. The thread **25** travels approximately at the location **54** (which has not been given a reference numeral) of the groove **42** on to the latter and leaves it again approximately at location **55** or at the site of the generatrix **49** and, commencing from a short distance further on it is between the separating elements **34**. It travels on the right-hand side of the left-hand separating element **34**, to the left relative to the associated element **33** and to the right relative to the associated element **32** and travels thereupon on to an element **70** forming an upper shed. This travel pattern, and also the travel pattern of the remaining threads **26** to **31** will readily be perceived from FIG. **3**. The elements **32** to **35** travel in those planes which are defined by the separation zone of the upper shed element **70** and the lower shed element **71**. Furthermore, the average spacing *d* (see FIGS. **3** and **5**) of two adjacent grooves corresponds to the sum of the widths of an upper and a lower shed element **70, 71**. The travel pattern of the arrangement is such that for a rotation of the rollers **20** to **23** through 90°, which corresponds to the movement of one control location to the next one, for example of location **54** into the position of location **55**, the elements **32** to **35** travel into the next position, for example the element **35** travels into that position in which the element **34** is shown. During such a working phase, each row of shedding elements **15** travels from its position into the position of the row of shedding elements immediately preceding it, i.e, the weaving rotor **14** thereby rotates through the angle "α" (see FIG. **2**).

In operation of the loom, insertion of a weft thread may take place during that time interval during which a shed is open. This is the case according to FIG. **2**, while the shedding elements **15** are traveling from the angular position **30** into the angular position **31**. The weft insertion can be effected by means of picking means, for example a shuttle, co-rotating with the weaving rotor. Such picking means is, however, not shown since the invention is independent of the nature of weft insertion.

For forming the cloth weave, the warp thread **24** is lifted at location **55**, i.e., at the site of the generatrix **48**, off from the roller **20** and takes up its position, as seen in the direction of movement of the elements **32** to **35**, to the right of the element **35** furthest to the left. During the immediately preceding sorting step, the control location **56** was at the site of the lifting-off location or generatrix **48**. The thread **24** which is lifted-off at this location **56** was to the left of that element **34** which, as seen in the said direction of movement, was furthest to the left and was therefore so sorted as to pass into position on the left-hand side of the said element **34**. During the sorting step immediately preceding this procedure, the control location **53** was at the site of the generatrix **48**. Thus, the thread **24** was deflected on to the right-hand side of the element **33** located furthest to the left, and remains during the entire passage of the said element **33** on the right-hand side thereof. Finally, during the renewed sorting process, the thread **24** was guided onto the left-hand side of the element **32** disposed furthest to the left in FIG. **3**. The thread **24** is so guided by the element **32** that it takes up its position in an element **71** forming a lower shed. During the travel of the element **33** following the element **32** past the shedding elements **70, 71**, the thread **24** takes up its position on an element **70** forming an upper shed. During the travel of the element **34** past the elements **70, 71**, the thread **24** is again fed to an element **70** forming a lower shed and, finally, on passage of the element **35**, once again to an element **70** forming an upper shed.

Analogous conditions apply also to the further warp threads **25** to **31** and the sorting procedure can quite readily be ascertained with reference to the reference numerals shown in FIG. **3**. Thus, it will be seen that it is unnecessary to provide a corresponding description thereof.

It is clear that the sorting of the warp threads, for a predetermined series or row of shedding elements, for example the series or row of the elements **70, 71** shown in FIG. **3**, does not take place simultaneously in the case of all the warp threads. If, referring to FIG. **3**, the position of the warp threads **24** to **31** at the site of the shedding elements **70, 71** is viewed, then the position of the threads **27** and **31** is defined by the control locations **55** or the roller **23** and maintained by the separating plates **32**. The position of the threads **26** and **30** had, however, been determined in the immediately preceding working phase by the control locations **56** of the roller **22** and maintained following on that location in which the plates **33** are shown in FIG. **3**. Correspondingly, the threads **25** and **29** were sorted by the control

locations 53 of the roller 21 two working phases before the working phase shown in FIG. 3, when the plate 32 was disposed between the rollers 21 and 22. Finally, in that working phase which was three phases in front of the one shown, the threads 24 and 28 were sorted by the control locations 54 of the roller 20 and guided by the separating plates 32 in the sorted position, to the shedding elements 70, 71. Expressed in other words, this situation means that the threads 24 to 31 arranged in the illustrated row of shedding elements 70, 71 in the upper and lower sheds, are associated with control locations 53 to 56 which, relative to the control locations 55 of the control roller 23 adjacent the given row of shedding elements 70, 71, are advanced from the rotational aspect on each of the further rollers 20 to 22. In this connection, what are concerned are those control locations 56 of the roller 22 which are advanced by one position, those control locations 53 of the roller 21 which are advanced by two positions, and those control locations 54 of the roller 20 which are advanced by three positions. Thus, the control locations are advanced, on a given one of the rollers 20 to 23, by as many positions as there are rollers available between the given roller and the shedding elements 70, 71.

It is clear that each warp thread 11 which has been directed into shedding element 70 or 71 remains, during the entire travel of the shedding elements 15 or 70, 71 between the angular positions 30 and 31, in its shedding element 15. Thereby, a shed formed to correspond to a desired cloth pattern in the angular position 30, is maintained unchanged until it has travelled past the angular position 31. Since the shed is open through this entire angle range, it is available for insertion of a pick during this entire movement. Insertion of the pick may be effected for example by means of a shuttle propelled by spring force. In this case, the aperture 74 serves for guiding the shuttle.

It is clear that due to a correspondingly different selection in respect of the configuration of the grooves 40 to 47 or by changing the arrangement of the control locations 53 to 56 relative to the rollers 20 to 23 of axial direction, it would be possible to produce weaves other than a linen weave.

It is equally clear that the number of rollers 20 to 23 is not limited to four. As a rule, depending on the desired density of the warp threads 11, approximately eight such rollers will be provided. In this case, in the case of a linen weave, four warp threads will take up their position in each shedding element 70, 71.

Finally, the number of thread deflecting locations 53 to 56 arranged over the periphery of the rollers 20 to 23 need not, as in the example illustrated, be fixed at four, i.e, the rotation of the said rollers need not be through 90° per working phase. This embodiment can be selected to correspond to particular circumstances. It is merely necessary to ensure that the rollers 20 to 23 are compelled to rotate, from one working phase to the next one, from the one control location to the next. If, for example, there are six control locations, then the rollers rotate through 60° per working phase.

In an advantageous embodiment, the rollers 20 to 23 are assembled from individual, juxtaposed discs 36, as shown in FIG. 6. This figure shows a lateral elevation of a roller. Formed in each disc 36 is a groove 37 corresponding to the grooves 40 to 47. It will be clear that each groove has eight control locations 38 corresponding to the thread control locations 53 to 56.

This disclosure of preferred embodiments and modifications of the invention is to be interpreted as illustrative of forms the invention may take and other modifications will readily occur to those skilled in the art. The invention is not to be restricted except by the scope of the appended claims wherein the novel features desired to be protected by Letters Patent are set forth.

What is claimed is:

1. Device for producing cloth weaves on a loom having a plurality of sheds following each other in the longitudinal direction of the warp threads, wherein there are provided rows, extending transversely of the warp threads, of shedding elements alternatingly determining upper and lower sheds, which said shedding elements travel along the warp threads, so that they retain the warp threads on their upper or lower shed position over a predetermined zone, a control means arranged before the said zone for laterally deflecting each of the warp threads in accordance with a program, thereby associating each warp thread with one of the shedding elements determining the upper or lower shed, wherein said control means comprises at least one rotatable control roller, the axis of which is arranged to extend perpendicular to the warp threads and which has a plurality of warp thread guide grooves which extend, separate from each other and continuously, in juxtaposition on the generated surface of the control roller, about the latter, and extend to and fro obliquely with reference to the axis of the control roller by a predetermined amount which, according to said program, is preferably equal to the spacing of adjacent upper and lower shed elements, the locations which are outermost in the axial direction of the said grooves being control locations for controlling the warp threads.

2. Device according to claim 1 in which said control means comprises a plurality of control rollers which are arranged parallel to each other and one behind the other in the direction of the warp threads, and the warp threads are associated, corresponding to their sequence, on the one hand with the control rollers in accordance with the sequence of the latter in the direction of the warp threads, and on the other hand with the guide grooves to correspond to the sequence thereof in the longitudinal direction of the control rollers.

3. Device according to claim 2 in which in each working phase for one rotation of the control rollers from one control location to the next one, there takes place a movement of the separating elements by a distance equal to the spacing between adjacent control rollers, and also a movement of the rows of shedding elements by a distance equal to the spacing between adjacent rows of shedding elements.

4. Device according to claim 3 in which the threads arranged in the upper and lower sheds in the given row of shedding elements are associated with the control locations which, with reference to the control locations of a roller adjacent the given row of shedding elements, are advanced from the rotational aspect on each of the further rollers by a number of positions equal to the number of control rollers available between the further roller and the given row of shedding elements.

5. Device according to claim 1 in which the control roller comprises a series of juxtaposed discs each of which has formed on its surface one of said guide grooves.

6. Device according to claim 1 in which the guide grooves afford, over the periphery of the control roller,

a plurality of control locations and simultaneously effective, similar control locations are located on a generatrix of the control roller.

7. Device according to claim **1** in which said control means has displaceable separating elements which, in the vicinity of said control locations at which the warp threads are lifted off from the guide grooves, "dip" in between the warp threads and remain, up to a location forwardly of the shedding elements, between the warp threads, to maintain the association of the warp threads with the shedding elements until they are "sorted" into the latter.

8. Device according to claim **7** in which in each working phase for one rotation of the control rollers from one control location to the next one, there takes place a movement of the separating elements by a distance equal to the spacing between adjacent control rollers, and also a movement of the rows of shedding elements by a distance equal to the spacing between adjacent rows of shedding elements.

9. Device according to claim **1** in which each of the shedding elements has a warp thread bearing face extending in the direction of the warp threads and located at the level of the upper and lower shed and formed with a recess for guiding picking means during the weaving operation.

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