Feb. 20, 1934. W. A. DICKIE ET AL 1,947,976

TEXTILE MACHINERY

Filed Aug. 4, 1932 2 Sheets-Sheet 1

FIG_1_

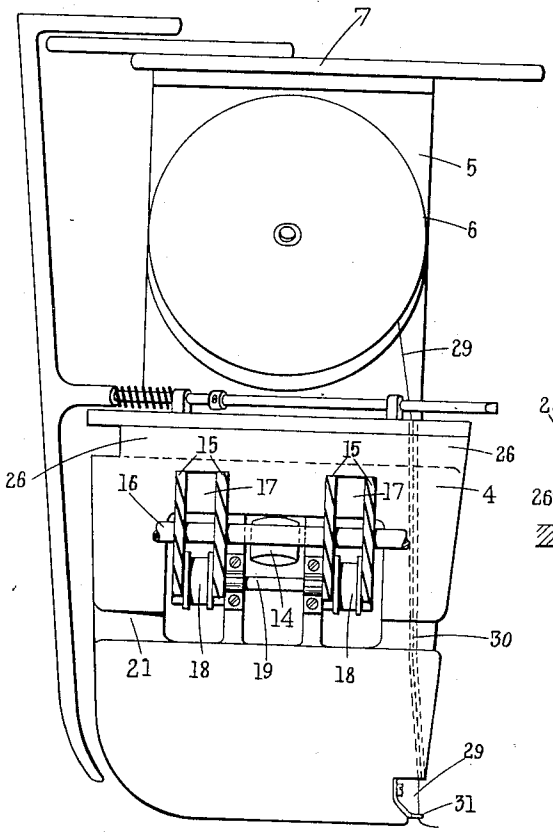

FIG_2_

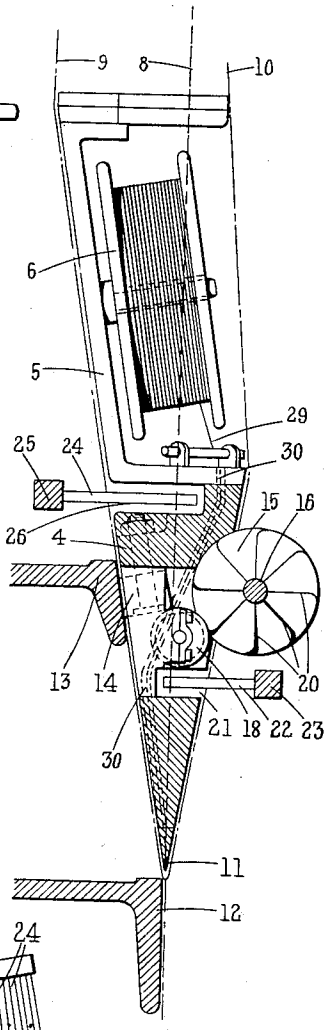

FIG_3_

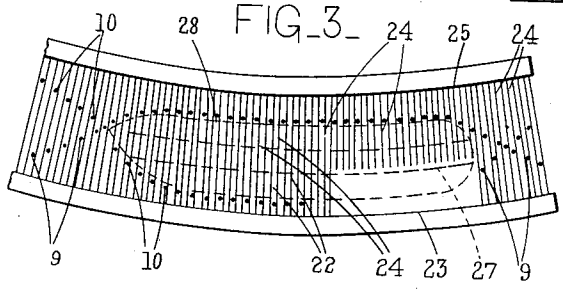

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FIG 4.

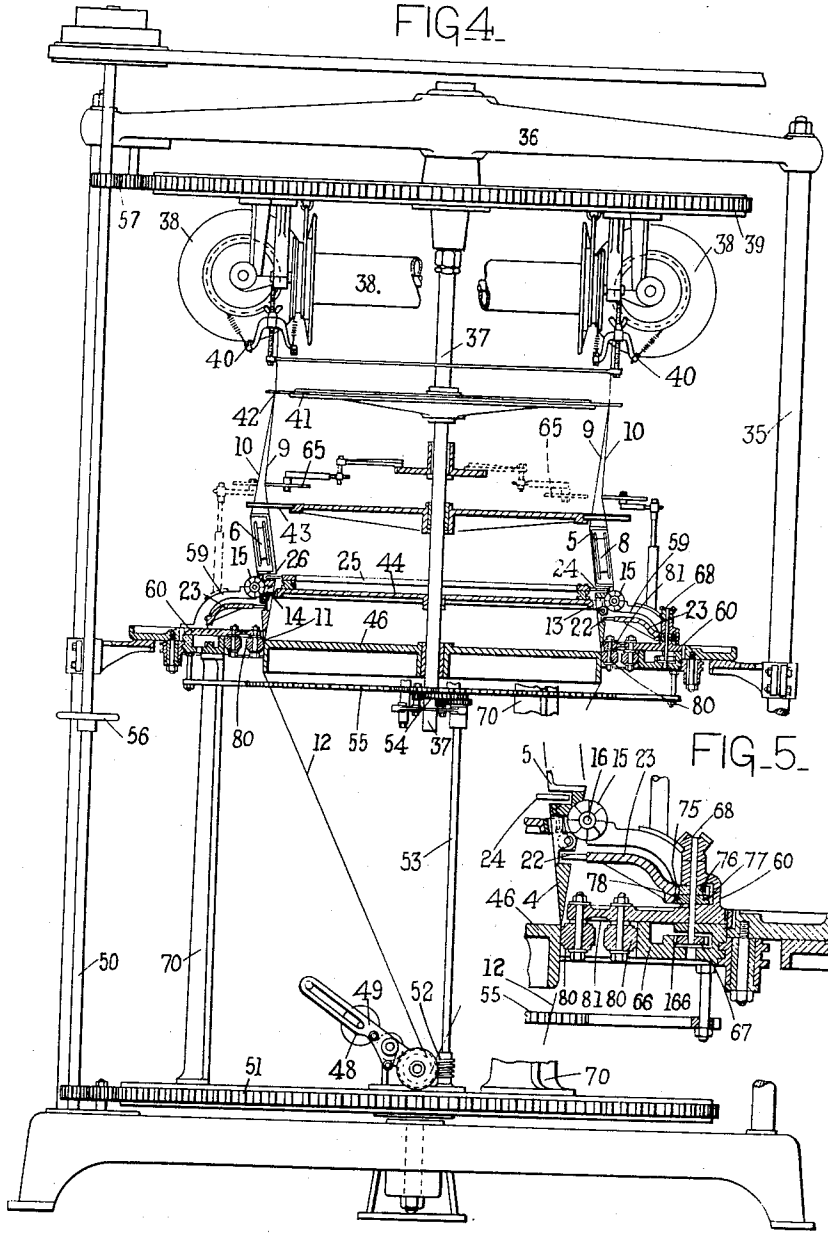

FIG 5.

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1,947,976

TEXTILE MACHINERY

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Application August 4, 1932, Serial No. 627,406, and in Great Britain August 11, 1931

5 Claims. (Cl. 139—13)

This invention relates to improvements in textile machinery, and more particularly to looms for weaving.

The object of the invention is to improve looms of the circular type for the purpose of securing equi-distant spacing of the warps in fabrics produced on such looms.

In looms of the above character it is not practically convenient to provide a reed which moves up to the fell of the cloth after the insertion of the weft in order to simulate the beat-up of the weft and the even warp spacing achieved in ordinary looms, and in consequence difficulty is experienced in obtaining even spacing of the warps. This is particularly the case where sheets of warps are frictionally engaged by the sides of the shuttle in the space between the usual fixed reed and the fell of the fabric, since the even spacing of the warps imposed by the reed is apt to be upset by such engagement. Such frictional engagement arises to a large degree in looms in which the weight of the shuttle is employed to effect a firm beat-up of the weft, since in this case it becomes necessary to allow the two sheets of warps themselves to support and guide the shuttle in some measure.

Further, in circular looms where the shuttle is located in position within the shed by means of vaned, wheel-like members which pass through a sheet of warps and enter recesses in the shuttles, the "cutting" of the warps by the vanes tends to break up the even spacing of the warps, particularly as the warps usually pass between the vanes in bunches.

According to the present invention any tendency for the warps to lose their even spacing is nullified or rectified by the provision of an open reed or comb which is arranged fairly near to the fell of the cloth and is so disposed that the warps enter the dents thereof and are so maintained equi-distant over that part of their lengths which extends from the reed or comb to the fell.

The teeth of the comb are sufficiently long to extend beyond the normal line of the warp, i. e. the line of the unshedded warp, as it passes from the supply to the fabric, so that as the warps are deflected by the shedding mechanism one sheet of warps in the shed is pressed further into the comb to maintain the equal spacing of those warps. At the same time, the projection of the teeth through the normal line of the warps enables the other sheet of the warp shed to pass clear of the teeth so as to provide a passage for the weft within the shed to the fell of the fabric. On reversal of the shed for plain weaving the other sheet of warps is brought into re-engagement with the teeth, so that the warps of that sheet are in turn spaced by the teeth. The sheet which has previously been depressed deeper into engagement with the teeth is in the second shed brought out of engagement with the teeth again to provide a passage for the weft beyond the teeth to the fell of the cloth. With other than plain weaving, all the warps may not pass into and out of engagement with the teeth of the comb in simple alternation, but whenever a warp thread moves out of the comb, it is sooner or later re-engaged therewith and so maintained in correct position relative to the other warp threads.

The spacing comb is preferably employed at the side of the shuttle into which warp-penetrating shuttle-holding means enter, where such means are employed, so that the comb not only combats any tendency for warp displacement by friction with the side of the shuttle, but also that due to the action of the shuttle-holding means.

In order to lead the weft from the supply beyond the teeth of the comb to the fell suitable guide means are provided in or on the shuttle. In the case where the shuttle itself extends to the fell of the cloth so that the weight of the shuttle or pressure applied thereto serves to beat-up the weft, a slot of appropriate shape in the shuttle forms a convenient means for guiding the weft to the fell of the cloth. With such a shuttle a slot is provided at the level of the comb into which the teeth of the comb enter so as to permit relative movement between the shuttle and the comb, the comb, of course, remaining stationary where stationary, i. e. non-rotating, warps are employed, and moving with the warps in the case where the warps are caused to move.

If desired two combs may be employed which extend through the normal line of the warps from both sides of the warps. Thus two combs may be provided at different levels, their teeth being of such a length that the warps normally are engaged by both combs, so that on shedding one sheet of warps is freed from one comb to provide a passage for the weft past the teeth of that comb and depressed further into the teeth of the other comb, while the other sheet of warps is freed from the other comb to complete the passage for the weft to the fell of the fabric and depressed further into the teeth of the first comb. On changing of the shed both sheets of warps are maintained equally spaced so that each thread enters the correct dent as it passes from comb to comb.

Where only one comb is used it is arranged as near as is practicable to the fell of the cloth, while preserving a sufficiently wide passage for the weft within the shed outside the teeth of the comb penetrating one sheet of the warps. Where two combs are employed one comb must be arranged at a somewhat greater distance from the fell of the cloth than the other.

Where shuttle-engaging means penetrating a sheet of the warps are employed with two warp spacing combs, it is preferred to arrange the comb on the side of the shuttle which the shuttle-engaging means enter near to the fell of the fabric, while the other comb is arranged on the other side of the shuttle at a somewhat higher level. The second comb may conveniently be arranged somewhat above the level of the recess which the shuttle-holding means enter on the other side of the shuttle, and enters a slot in the shuttle similar to that provided for the lower comb.

The warp spacing means according to the invention may be used with any type of circular loom, but will now be described with the aid of the accompanying drawings more particularly with reference to circular looms in which the weight of the shuttle or pressure applied thereto is utilized to effect beat-up.

In the drawings, Figs. 1 and 2 show in side elevation and part sectional front elevation respectively a shuttle arranged for operation with spacing combs according to the invention.

Fig. 3 is a diagrammatic plan view showing the operation of the spacing combs;

Fig. 4 is a part sectional elevation of the loom; and

Fig. 5 is an enlarged view of part of Fig. 4.

The shuttle consists of a substantially solid body member 4 (Figs. 1 and 2) of triangular vertical section carrying a frame 5 on which is rotatably mounted a weft spool 6. The horizontal section of the body 4 is substantially boat-shaped as shown in dotted lines in Fig. 3. The upper end of the frame 5 carries plates 7 of similar shape.

The warp threads, whose normal, (i. e. unshedded) line is indicated at the dotted line 8 in Fig. 2, are shedded by any suitable means operating above the level of the shuttle into two sheets 9, 10 (Figs. 2 and 4) which pass over the inner and outer faces of the shuttle. The shedding may be effected by means of any convenient form of mechanism, as will be described later.

As shown in Figs. 2 and 4, the general cross-section of the whole shuttle is such that the shuttle occupies the whole space between the sheets of warp threads below the level of the plates 7, thus providing space for the spool 6 of considerable weft-holding capacity.

The relatively sharp lower edge 11 of the shuttle body rests on the fell of the fabric 12 being formed towards the lower end of the loom, and the shuttle is supported in operative position within the warp shed by means of a tapered race 13 inside the circle of warps and engaged by a freely mounted roller 14 carried by the shuttle, the inner sheet of the warps 9 passing freely between the race 13 and roller 14. The shuttle is also held by means of a number of discs 15 mounted on a driven shaft 16, carried on bearings 59 mounted on a rotatable ring 60 outside the warp circle. These discs 15 enter recesses 17 in the shuttle body 4 and engage freely-mounted flanged rollers 18 carried on a spindle 19 on the shuttle body. The discs 15 are divided by a number of slots into helical vanes 20, so that the sheet of warps 10 passing over the outside of the shuttle body passes between the vanes, the discs thus maintaining contact with the shuttle body while not interfering with the relative movement between the warps and the shuttle. By holding the shuttles stationary, the difficulty occasioned by centrifugal force when using rotating shuttles is avoided.

Since the number of vanes 20 in the discs 15 must necessarily be relatively few, the threads of the outer sheet of warps cannot pass individually between the vanes, but are divided into bunches each containing a number of threads. In order to prevent this division of the threads into bunches from being maintained after the threads have passed the discs and to avoid any tendency to unequal spacing arising by friction between the warps and the face of the shuttle, a slot 21 is formed across the outer face of the shuttle body 4 at a level just below the discs 15, and into this slot the teeth 22 of an open-ended annular comb secured in and carried by a ring 23 to be described later, project slightly beyond the normal warp line 8. As the warps are shedded from this line they pass deeply into the spaces of this comb and are therefore maintained equidistant from each other, notwithstanding any dividing effect of the discs 15. On the threads of that sheet of warps being moved by the shedding mechanism to the other side of the line 8, the threads leave the comb and later re-enter it still in their correctly spaced positions on returning to the normal line 8. The ring 23 may be made in one piece or in two or more sections suitably connected together. As the ring rotates with the warps, its teeth pass freely along the length of the slot 21 in the shuttle and do not interfere with the holding of the shuttle stationary in the shed.

In order to ensure that the thread spacing is maintained correct notwithstanding the side of the line 8 to which the threads are moved, a second open-ended comb having teeth 24 outwardly extending from a ring 25 can be arranged at a different level in the loom, a further slot 26 being formed in the shuttle body to receive the teeth of this comb. The threads of one sheet of warps enter the spaces of one comb before leaving the spaces of the other in passing from one side of the shed to the other. This will readily be seen from Fig. 3, which shows the teeth 22, 24 of the two combs arranged in line with each other so as to form an unbroken space for the threads between the rings 23, 25. A few of the teeth 22 are omitted to show the corresponding teeth 24 passing almost to the dotted line 27 which represents the depth of the slot 26. Similarly the teeth 22 extend almost to the dotted line 28 which represents the depth of the slot 21.

The weft 29 on leaving the spool 6 is led by a passage 30 through the shuttle body 4 to a guide eye 31 on the rear end of the base of the shuttle from which it passes to the fell of the cloth. The passage 30 directs the weft round the end of the slot 26 and then round the end of the slot 21, so that notwithstanding the interposition of the combs 22 and 24 across the warp, the weft can pass freely to the fell of the cloth. The slots 21, 26 follow the curved horizontal section of the shuttle, as is shown in Fig. 3, being struck from the centre of the loom.

The shuttle described above is particularly suitable for use in the type of loom shown in Fig. 4. The loom comprises a vertical frame 35 carrying at its upper end a spider 36 or like support for a downwardly depending control shaft 37. Four warp beams 38 are carried by a rotatable frame 39 mounted at the upper end of the shaft 37, the beams being geared together and provided with suitable braking means 40 to regulate the let-off of the warps. Below the warp beams 38 is a horizontal ring 41 provided with a series of guide holes 42 through which the

warp threads pass. Still further down the shaft 37 is a circular reed 43 below which is mounted a circle 44 carrying a comb 25 having teeth 24. Towards the lower extremity of the central shaft 37 a further circle 46 is mounted so that its upper edge is at the level at which the weft is beaten-up into the fabric 12. The fabric 12 proceeds from the ring 46 in double form to a take-up device 48 which is mounted in a frame 49 rotatable about a vertical shaft 50 perpendicular to the base of the loom. The take-up device 48 is driven by a worm 52 on the lower extremity of a vertical shaft 53 which in turn is driven through a train of wheels 54. One of the wheels of the train 54 is in constant mesh with a circular rack 55, and by rotation of the loom base plate 51, which carries the shaft 53 around the periphery of the rack 55, the drive is transmitted to the fabric take-up device 48. The rate of take-up may be adjusted by varying the ratio of the train wheels 54. The shaft 50 is equipped with a hand wheel 56 by means of which the shaft 50 may be rotated when effecting adjustments. This shaft 50 is connected by gearing 57 to the support 39 carrying the warp beams 38, a motor (not shown) being provided to effect rotation of these members.

The shuttles are carried below the reed 43 with their lower edges 11 at the level of the upper edge of the ring 46 carried at the lower end of the central shaft 37.

The form of shedding mechanism which is employed is similar to that described in detail with reference to Figs. 15 and 16 in the U. S. Patent to Jabouley No. 1,626,411, and briefly consists in the reed 43 being adapted to offer free passage for certain of the warps to one side of the normal line of the warps while restricting the movement of the remaining warps. This restriction is effected by reducing the space between selected teeth of the reed to little more than a guide eye or by forming selected teeth with such an eye. By pressing the warps with cams, or as shown in Fig. 4, by rotatable discs 65 alternately inwardly and outwardly at successive shuttles those warps which are allowed free passage can be given a greater movement than those which are restricted by passage through the eyes of the reed, thereby initiating a shedding movement which can be completed by the shuttle entering between the separated warps and pressing them apart, the warps then sliding along each face of the shuttle to its rear.

The ring 23 is of curved cross-section and bears at its outer extremity an annular rack 75 adapted to engage spur wheels 76 fixed on vertical spindles 68. The spindles 68 transmit the drive from a rotatable ring 66 to the shafts 16 upon which the vane wheels 15 are mounted. The ring 23 is maintained in position by grooved pulleys 77 mounted on the spindles 68 directly beneath the spur wheels 76. These grooved pulleys engage a tongue 78 which extends round the periphery of the ring 23 immediately below the annular rack 75. The vertical spindles 68 have further spur wheels 67 at their lower extremities adapted to engage a circular rack 166 borne by the rotatable ring 66. This ring 66 is connected to the base plate 51 of the loom by standards 70 by which the ring 66 is rotated at the same rate as the rotation of the warps. Vertical guide rollers 80, 80 suspended from an arm 81 inwardly projecting from the ring 60 are mounted between the ring 66 and the ring 46 and serve to maintain the course of the rings substantially concentric with the axis of the loom.

A high rate of weaving can be effected by the use of several shuttles, the separate sheds being caused to follow each other with close frequency round the periphery of the warps.

What we claim and desire to secure by Letters Patent is:—

1. A circular loom comprising a spool-holding shuttle extending to the fell of the fabric, means for supporting said shuttle so that it presses against the fell of the fabric and beats-up weft laid within the warp shed, and a comb having teeth adapted to penetrate and control the spacing of one sheet of the warp shed, said shuttle being provided with means to guide weft from the spool round the projecting teeth of the comb to the fell of the fabric.

2. A circular loom comprising a spool-holding shuttle extending to the fell of the fabric so as to press against the fell of the fabric in order to beat-up weft laid within the shed, shuttle-holding means adapted to engage the shuttle through one sheet of warps, and a comb having teeth adapted to penetrate and control the spacing of the same sheet of warps, said shuttle being provided with means to guide weft from the spool round the projecting teeth of the comb to the fell of the fabric.

3. A circular loom comprising a spool-holding shuttle extending to the fell of the fabric so as to press against the fell of the fabric in order to beat-up weft laid within the shed, a rotatable vaned member adapted to penetrate one sheet of the warps in order to enter a recess in the shuttle body so as to hold the shuttle while allowing of relative motion between the warps and the shuttle, and a comb disposed between the fell of the fabric and the vaned member adapted to penetrate the warps so as to prevent irregular spacing of the warps in the fabric due to the action of the vanes on the warps, said shuttle being provided with means to guide weft from the spool round the projecting teeth of the comb to the fell of the fabric.

4. A circular loom comprising a spool-holding shuttle extending to the fell of the fabric, means for supporting said shuttle so that it presses against the fell of the fabric and beats-up weft laid within the warp shed, and a pair of combs disposed on opposite sides of the warps having teeth adapted to penetrate beyond the normal line of the unshedded warp threads in order that the threads are always in engagement with at least one comb and are thereby maintained in correct spaced relation, said shuttle being provided with means to guide weft from the spool round the projecting teeth of the combs to the fell of the fabric.

5. A circular loom comprising means for rotating the warps about the axis of the loom, a spool holding shuttle extending to the fell of the fabric, means for supporting said shuttle so that it presses against the fell of the fabric and beats-up weft laid within the warp shed, a comb having teeth adapted to penetrate and control the spacing of one sheet of the warp shed, and means for rotating the comb with the warps, said shuttle being provided with means to guide weft from the spool round the projecting teeth of the comb to the fell of the fabric.

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