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METHOD AND APPARATUS FOR PRODUCING BRAID

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This invention relates to braiding machines, particularly braiding machines of the type generally referred to as bi-circle or radium braiders, and to an improved method of braiding.

In connection with the widespread use of narrow elastic fabrics having special selvedge edge structure, thereby to facilitate attachment thereof to hose and the like, certain production problems arise. Thus when narrow elastic fabric is to be impaled upon the needles of a knitting machine and the garment subsequently knitted thereto, it has been found desirable to space the selvedge of the elastic fabric from the main body thereof by a structure embodying a series of regularly spaced openings. Although fabrics embodying the aforesaid desired characteristics have been hereunto produced on other types of braiding machines, it has not been possible to produce braided material of this type on radium or bi-circle braiding machines. To adapt a braiding machine of this class for producing fabric embodying the aforesaid desired characteristics, it is necessary among other things, to provide for selective variation of the extent of travel of the various carriers.

It is therefore an object of the invention to provide a bi-circle or radium braider capable of producing elastic fabrics of the type referred to.

Another object is to provide an improved method of producing braided fabrics of the mentioned type.

Still another object is to provide novel means for producing braided fabric having a selvedge spaced from the main body of the fabric and anchored thereto by a series of regularly spaced transverse braiding yarns.

A further object is to provide, in connection with a braiding machine of the type disclosed, means whereby the travel of selected carriers may be reversed at a point spaced from an end of the raceway.

With these and other objects in view, which will more readily become apparent from the following detailed description of the illustrative embodiment of the invention shown in the accompanying drawings, my invention resides in the novel elements, features of construction and arrangement of parts, as hereinafter more particularly pointed out in the claims.

In the drawings:

Fig. 1 is a plan view of a bi-circle braiding machine table illustrating concentric communicating raceways and the associated carrier control mechanism;

Fig. 2 is an enlarged view of a portion of the structure shown in Fig. 1;

Fig. 3 is a plan view of the understructure of the mechanism illustrated in Fig. 2;

Fig. 4 is a sectional view taken substantially on the line 4—4, Fig. 2;

Fig. 5 is a plan view of a strip of braided fabric produced in accordance with the invention; and

Fig. 6 is an enlarged diagrammatic view of the fabric structure shown in Fig. 5.

Braiding machines of the bi-circle or radium type include a duplex run or raceway which is constructed of a pair of communicating sinuous raceways of open-circle construction which are concentrically arranged to permit the carriers to move from one raceway to the other and back again in predetermined order controlled by pattern mechanisms. In machines of this general nature a deck or top plate 10 is supported by a lower plate 12 through means of intermediate supporting studs 13, Fig. 1. Two series of quots or tellers 14 and 15 are arranged in concentric parallel relationship by means of gear bolts 16 and 17, respectively which are secured to the bottom plate 12 in manner best illustrated in Fig. 4. It will be noted that the edges of the tellers, although paralleling the inner edge of the cut-out portion of the deck 10, are however sufficiently removed therefrom to effect two runs or raceways respectively indicated at 18 and 19. The raceways 18 and 19 are arranged to effect a duplex communicating structure in which the carriers 20 move from one raceway to the other in sequence controlled by pattern mechanisms generally indicated at 22 and 23. Two sets of switches 24 and 25, pairs of which are pivoted to common supporting axles 26, are respectively controlled by the pattern mechanisms 22 and 23 through means of intermediate linkages including rods 30 and 32 respectively. These switches, in addition to intermediate switches 33 which are normally held in the positions illustrated in Fig. 1 by resilient means, operate to guide the carriers from one raceway to another in accordance with the desired pattern.

Movement of the carriers around sinuous raceways is effected through means of horn gears 27 which rotate about the gear bolts 16 and 17. The gear portions 27 of the gears 26 intermesh with each other in manner effecting a continuous gear train, all members of which train rotate simultaneously with the operation of the drive gear. The upper portions of the members 28 have horn portions 28 which coact with the usual pin or lug elements extending from the lower portion of the
carrier by means of which operation of the carriers is effected. A series of stop actuator levers 34 are pivotally positioned on the top plate 10 at spaced intervals about the raceways 18 and 19. These levers 24 cooperate with suitably shaped members supported by the carriers to stop operation of the machine in the usual manner. This operation is effected under various conditions as for instance, when the yarn is ruptured or tensioned beyond a predetermined degree. Attached to one of these stop actuators 34 is a loop or ring 35 for the purpose of facilitating manual operation of the stop actuator mechanism.

Provision is made for manually operating the machine through means of hand levers 36 which are operatively supported on the deck 10, see Fig. 1.

It will be noted that certain of the gear bolts 16 of the outer raceway are of a hollow structure, Fig. 3, thereby providing means for introducing longitudinal warp threads to the braiding point. These longitudinal warp threads are interlaced with the transverse threads, supplied to the carriers 28, in a manner necessary to produce fabric of the type illustrated in Figs. 5 and 6, which in the present instance is generally indicated by the reference numeral 31.

In machines of the type disclosed the carriers move from the single switches 33 to the pattern controlled switches 24 and 25 thereby providing means for selectively guiding carriers from one raceway to the other each time they pass the switches. With the switches positioned as shown in Figs. 1 and 2 the carriers in the inner raceway moving in a clockwise direction will not safely continue in this raceway until their direction of travel is reversed at the end of the raceway, while the carriers which are shown as moving in a counterclockwise direction in the inner raceway will be directed into the outer raceway 18 upon their next engagement with the pattern controlled switches. Furthermore, with the switches positioned as shown, the carriers in the outer raceway 18 which are shown as moving in a clockwise direction will pass over to the inner raceway as soon as they contact a switch, whereas those carriers moving in a counterclockwise direction will continue in the outer raceway until after they have reached the terminus of the raceway and reversed their directional movement. Of course this routine may be reversed upon shifting of all of the pattern controlled switches; or the routine of selected carriers may be changed by shifting the desired switches.

It will thus be appreciated that as much as there are no warp threads fed through the gear bolts 17, movement of the carriers around one or more tellers of the inner raceway will successively float the thread over a corresponding number of longitudinal warp. It is by means of this floating of selected threads on one face of the fabric over a distance covering a plurality of warp threads that a design effect is embodied in the fabric as for example is illustrated in Figs. 5 and 6.

In braiding machines of the type disclosed the carriers 20 ordinarily travel from one end of the raceway structure to the opposite end along a course controlled by the switches. When it is desired to produce fabric in which the transverse threads selectively traverse longitudinal warp, it is necessary to reverse the travel of selected carriers before these carriers reach the end of the raceway.

In accordance with the invention a cut-out member 37 has been provided to reverse the travel of the carriers engaging therewith, whereas switch elements 24 and 25 have been provided to direct selected carriers into engagement with the cut-out member in predetermined order while the unselected carriers traverse the entire length of the outer raceway. By means of the cut-off member 37, the alternate transverse threads 11, 1 Fig. 6, are in the present instance deflected before they reach the out-run portion of the raceway and 4 is this prevented from interlacing with the longitudinal selvedge warp 9 which is spaced from the main body of the fabric in manner shown. Certain of the remaining carriers are driven through an out-run 21 of the raceway 18 thereby feeding the yarns 8 around the selvedge warp 9 and binding the latter to the main body of the fabric which is composed of the main body warps 7 and the transverse yarns 8 and 11. The individual weft yarns of series 8 and 11 are fed around the right selvedge warp in the order named by means of the respective carriers 28 which are successively moved to the right terminus of both raceways 18 and 19. Fig. 35, these carriers are operated through the out-run or left terminus 21 of the outer raceway 18 only during alternate traverses, consequently the yarns fed therefrom are successively laid around the spaced selvedge warp 9 and then around the next adjacent warp 7 during successive cyclic movements thereof to produce the fabric 31 shown in Figs. 5 and 6. In order to permit a horn gear 38, which cooperates with cut-off 37, to function properly as a terminal member the structure of this raceway until their direction of travel is reversed at the end of the raceway, while the carriers which are shown as moving in a counterclockwise direction in the inner raceway will be directed into the outer raceway 18 upon their next engagement with the pattern controlled switches. Furthermore, with the switches positioned as shown, the carriers in the outer raceway 18 which are shown as moving in a clockwise direction will pass over to the inner raceway as soon as they contact a switch, whereas those carriers moving in a counterclockwise direction will continue in the outer raceway until after they have reached the terminus of the raceway and reversed their directional movement. Of course this routine may be reversed upon shifting of all of the pattern controlled switches; or the routine of selected carriers may be changed by shifting the desired switches.

It will thus be appreciated that as much as there are no warp threads fed through the gear bolts 17, movement of the carriers around one or more tellers of the inner raceway will successively float the thread over a corresponding number of longitudinal warps. It is by means of this floating of selected threads on one face of the fabric over a distance covering a plurality of warp threads that a design effect is embodied in the fabric as for example is illustrated in Figs. 5 and 6.

In braiding machines of the type disclosed the carriers 20 ordinarily travel from one end of the raceway structure to the opposite end along a course controlled by the switches. When it is desired to produce fabric in which the transverse threads selectively traverse longitudinal warp, it is necessary to reverse the travel of selected carriers before these carriers reach the end of the raceway.
form the main body of the fabric; whereas movement of a carrier into the inner raceway will successively effect the floating of the thread on one side of a plurality of adjacent longitudinal threads before passing over to the outer raceway and around the opposite side of the longitudinal threads. Thus whenever a carrier is operated in the inner raceway, the thread therefrom is floated across the face of the fabric in manner indicated in Fig. 6, thereby producing a pattern effect of the kind illustrated in Fig. 5. It will be understood, however, that the design of the fabric being braided may readily be changed by varying the pattern lay-out on the mechanisms 22 and 23.

So that the carriers moving in opposite directions will not collide with each other at the various cross-overs, it is customary to provide terminal gears having an odd number of horns as compared with the intermediate gears which have an even number of horns. Thus in the present instance, the terminal gears are so constructed as to be the equivalent of single horn construction; whereas the intermediate gears are of four-horn structure. It will be understood that the terminal gears at the right hand end, Fig. 1, of both raceways are of five-horn structure, whereas a three and a two-horn gear operate as a single unit at the left hand end of the outer raceway to effect a five-horn structure; while the cutout portions of gear 32 render this latter gear effective as a five-horn gear. By means of this structure the direction of travel of the carriers is reversed either upon engagement of the carriers with the cutout member 31 or coincident with their movement through the cutout section, and since this change in direction is effected by terminal gear structure having an odd number of horn portions, the travel of the carriers will continue uninterrupted through the various crossovers.

In the present instance warp threads are fed through the hollow gear bolts 16 of the outer raceway while the bolts 16c are empty. By means of this arrangement the end warp 9 is spaced from the main body of the fabric, while the transverse braiding threads or yarns 8 and 11 which are positioned in definite regular order effect an interstitial structure of the type particularly adapted for use in conjunction with hosiery tops, and more especially with stockings which are held in position on the leg of the wearer by self-contained means such, for instance, as is effected by the elastic tops of knee length hosiery. In a structure of the type described the warp threads are preferably composed of elastic material, thereby imparting lengthwise elasticity to the fabric.

Braided fabric produced in accordance with the invention in which a selvedge portion is separated from the main body of the fabric by means of an intermediate structure comprising regularly spaced interstices, see Figs. 5 and 6, is particularly adapted for use in conjunction with hosiery and the like, in which preformed elastic tops are topped onto the needles of a knitting machine on which the main body of the garment is to be produced, in this manner interlinking the first row of loops of the garment with the preformed garter member to effect a unitary structure.

Although a specific design has been shown in conjunction with the fabric illustrated, it will be understood that various designs may be produced by changing the setting of the pattern control mechanisms 22 and 23.

Form the illustrations included it will be observed that the number of cross-overs made by the transverse yarns with respect to the selvedge warp 9 is appreciably less than the number of cross-overs made by the transverse threads with respect to the main body warps 1; it being by means of this structure, in conjunction with the spacing of the warp 9 from the main body of the fabric, that the intermediate interstitial structure 32 is effected. This structure is particularly adapted for topping on to the needles of a knitting machine following which the braided fabric is united with the main body of the subsequently knitted fabric during a usual operative cycle of the machine. It will also be appreciated that whereas fabric embodying structure in accordance with the present invention is particularly adapted for topping on to the needles of a knitting machine for subsequent attachment to hosiery and the like, it is similarly well adapted to be attached to articles of wearing apparel and the like, by sewing, seaming, looping or similar operations.

From the foregoing it will be appreciated that operation of flat braiding machines, in accordance with the method disclosed, will produce a new article of manufacture in which an ornamental pattern effect is combined with a selvedge spaced from the main body of the fabric by an interstitial structure comprising regularly spaced openings in turn defined by adjacent cross-overs of the transverse braiding yarns.

Accordingly, the improvements herein specifically shown and described, by which the above results are obtained, can be changed and modified in various ways without departing from the invention herein disclosed and hereinafter claimed.

I claim:
1. In a braiding machine, the combination with a plurality of carriers and a pair of communicating raceways providing definite limits of travel for said carriers, of means for reversing selected carriers at a point spaced from one limit of travel as the unselected carriers traverse to said one limit of travel.
2. In a braiding machine, the combination with a plurality of carriers and a pair of communicating raceways providing definite limits of travel for said carriers, of means comprising pattern controlled members for reversing selected carriers at a point spaced from one limit of travel as the unselected carriers traverse to said one limit of travel.
3. In a braiding machine, the combination with a plurality of carriers and a pair of concentric communicating raceways of open-circle construction traversable between the limits thereof by said carriers, of means for reversing selected carriers at a point spaced from one limit of said raceways as the unselected carriers traverse to said one limit of said raceways.
4. In a braiding machine, the combination with a plurality of carriers and a pair of concentric communicating raceways of open-circle construction traversable between the limits thereof by said carriers; of means including pattern-controlled switches for reversing selected carriers at a point spaced from one limit of said raceways as the unselected carriers traverse to said one limit of said raceways.
5. In a braiding machine, the combination with a plurality of carriers, a pair of concentric communicating raceways of open-circle construction traversable by said carriers, and switch members for controlling the travel of said carriers between
said raceways, of means for limiting the travel of selected carriers having coaction therewith in sequence controlled by said switch members as the unselected carriers travel to the limits of said raceways.

6. In a braiding machine provided with a pair of concentric communicating raceways of open-circle construction, a plurality of carriers traversable between opposite limits of said raceways, a series of thread guides spaced from each other at regular intervals in a limited portion of said raceways, a thread guide spaced from said series of guides a distance substantially greater than the extent of the other raceWay. 12. A braiding machine comprising a pair of concentric communicating raceways of open-circle construction, a series of spaced stationary guide members positioned within areas bounded by one of said raceways for incorporating longitudinally-extending yarns in the fabric, a series of carriers traversing said raceways and feeding yarns around said longitudinally extending yarns, switch members for controlling the travel of said carriers between said raceways, and means associated with one of said raceways for reversing selected carriers at a point spaced from the end longitudinal yarn and arranged for travel of the unselected carriers throughout the full extent of the other raceway.

13. A bi-circle braiding machine comprising, a pair of concentric communicating raceways of open-circle construction, a series of spaced stationary guide members positioned within areas bounded by one of said raceways for incorporating longitudinally-extending yarns in the fabric, a series of carriers traversing said raceways and feeding yarns around said longitudinally extending yarns, switch members for controlling the travel of said carriers between said raceways, and means associated with one of said raceways for reversing selected carriers at a point spaced from the end longitudinal yarn and arranged for travel of the unselected carriers throughout the full extent of the other raceway.

14. A bi-circle braiding machine comprising, a pair of concentric communicating raceways of open-circle construction, a series of spaced stationary guide members positioned within areas bounded by one of said raceways and respectively feeding yarns longitudinally of the fabric, a series of carriers traversing said raceways and interbraiding yarns fed therefrom with said longitudinal yarns, pattern controlled means for deflecting the carriers from one raceway to another, and means for limiting the travel of selected carriers to a limited zone of one of said raceways and arranged for travel of the unselected carriers throughout the full extent of the other raceway.

15. A method of braiding on a machine provided with a pair of concentric transmitting raceways of open-circle construction and a plurality of carriers traversable between limits of said raceways comprising, actuation of the carriers in said raceways, reversing selected carriers at a point spaced from one limit of one of said raceways and driving the unselected carriers to the limits of the other raceway.

16. A method of braiding on a machine provided with a pair of concentric communicating raceways of open-circle construction and a plurality of carriers traversable between limits of said raceways comprising, actuation of the carriers in said raceways, reversing selected carriers at a point spaced from one limit of one of said raceways and deflecting the unselected carriers into the other raceway to travel to the limit thereof.

17. A method of braiding, on a machine provided with a pair of concentric communicating raceways of open-circle construction and a plurality of carriers respectively feeding transverse bradding strands and traversable around said raceways, comprising, traversing a series of spaced longitudinally extending yarns, traversing selected transverse strands at a point spaced from one of the end longitudinal strands, feeding the unselected strands around both of the end longitudinal strands, and varying the number of longitudinally extending strands traversing said transverse strands between crossovers from one face of the fabric to the other.

18. A method of braiding on a machine pro-
vided with a pair of concentric communicating raceways of open-circle construction, a plurality of carriers traversable between limits of said raceways, a series of thread guides in a limited portion of said raceways and a thread guide spaced from said series of guides, comprising, actuating the carriers in said raceways, confining the travel of selected carriers to said series of thread guides and driving the unselected carriers around all of said guides.

19. In a braiding machine provided with a pair of concentric communicating raceways of open circle construction, a plurality of carriers traversable between opposite limits of said raceways, a series of thread guides spaced from each other in a limited portion of said raceways, a thread guide spaced from said series of guides a distance substantially greater than the spacing of the guides in said series, of means for confining the travel of selected carriers to said series of regularly spaced thread guides as the unselected carriers traverse all of said thread guides.

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