June 29, 1937. N. E. RICHARDS 2,085,334

BRAIDING MACHINE

Filed Jan. 22, 1935 5 Sheets-Sheet 1

Fig. 1.

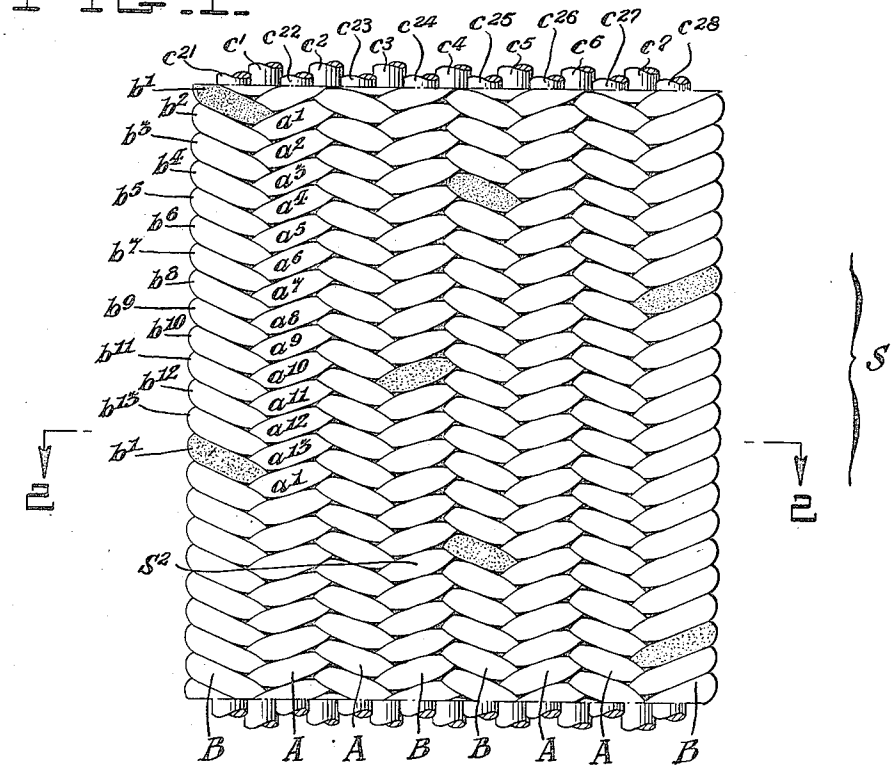
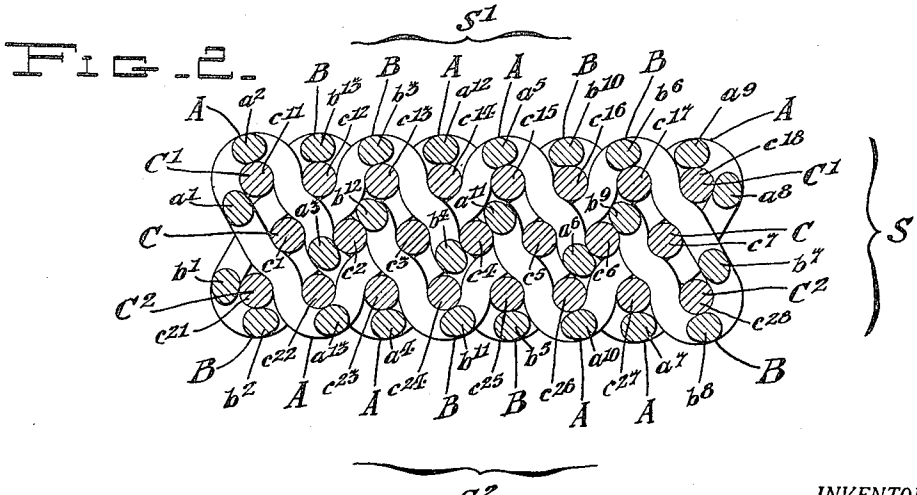


Fig. 2.



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BRAIDING MACHINE

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FIG. 3.

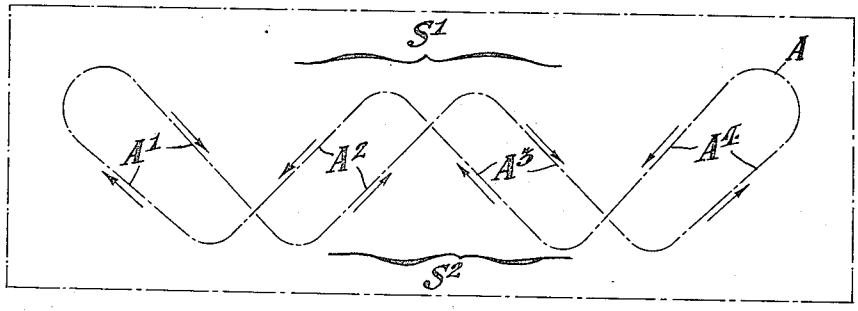


FIG. 4.

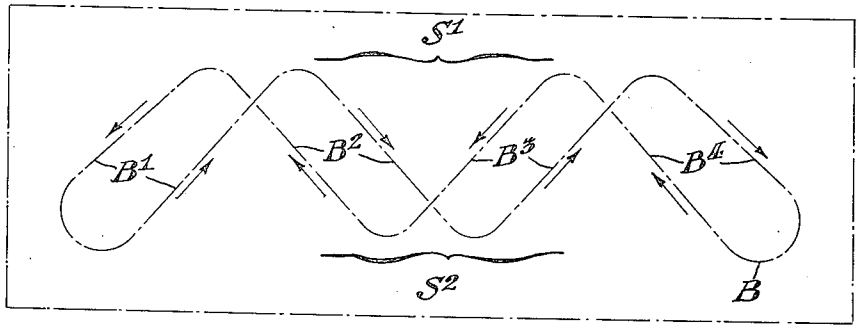
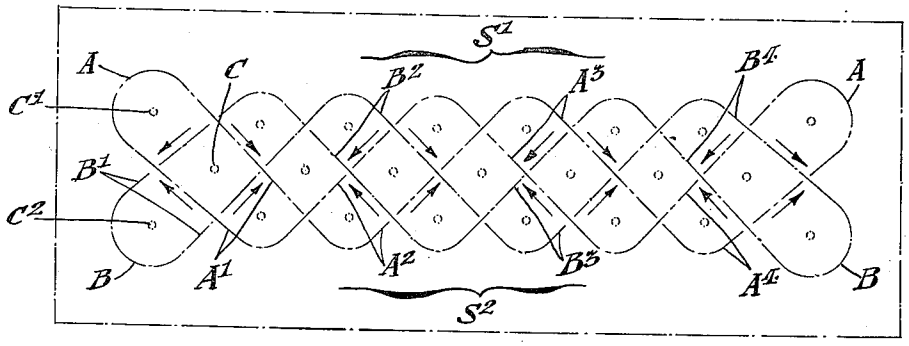


FIG. 5.



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BRAIDING MACHINE

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Fig. 6.

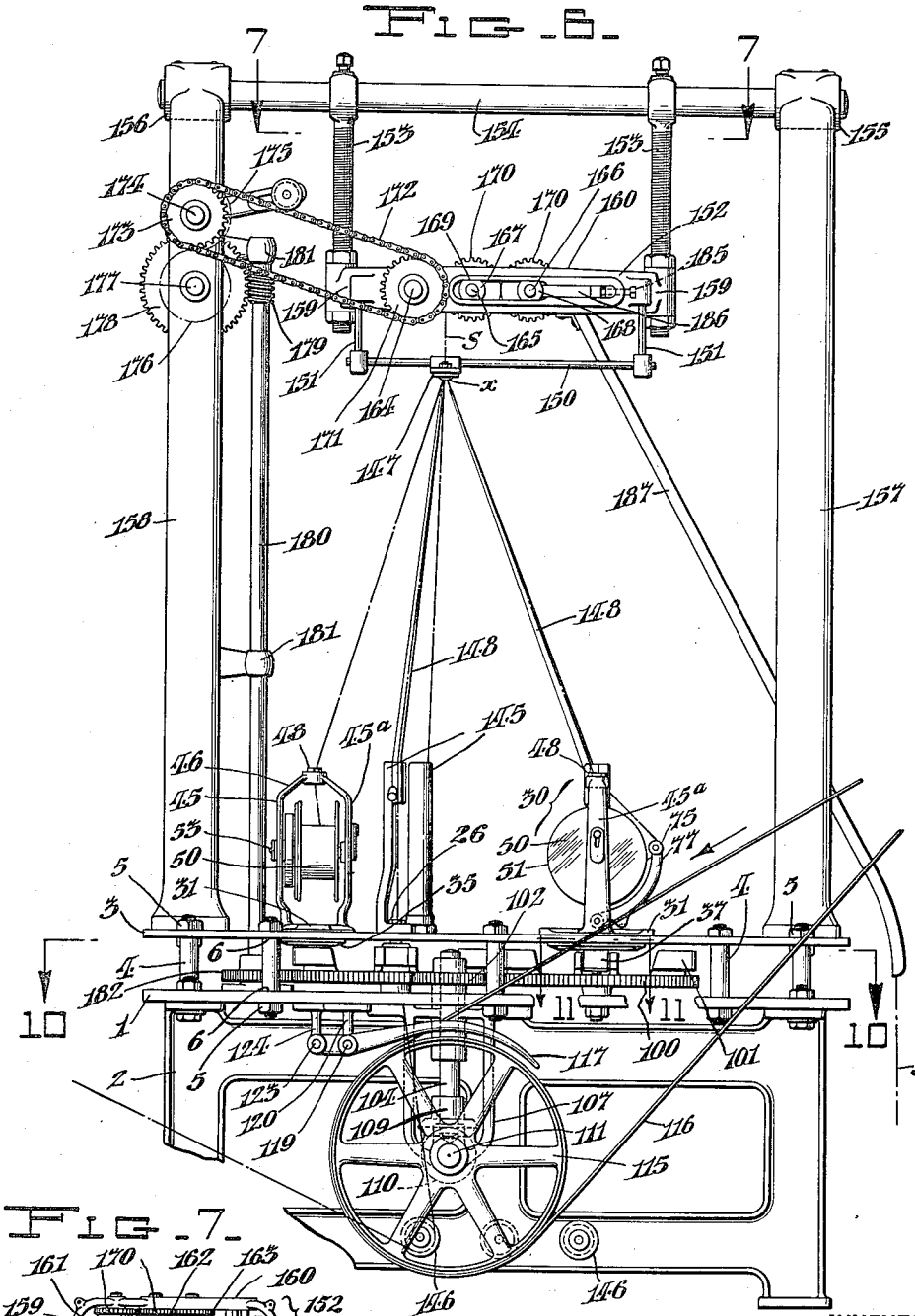
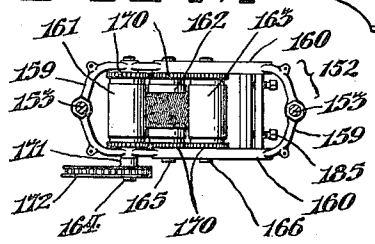


Fig. 7.



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BRAIDING MACHINE

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FIG. 9.

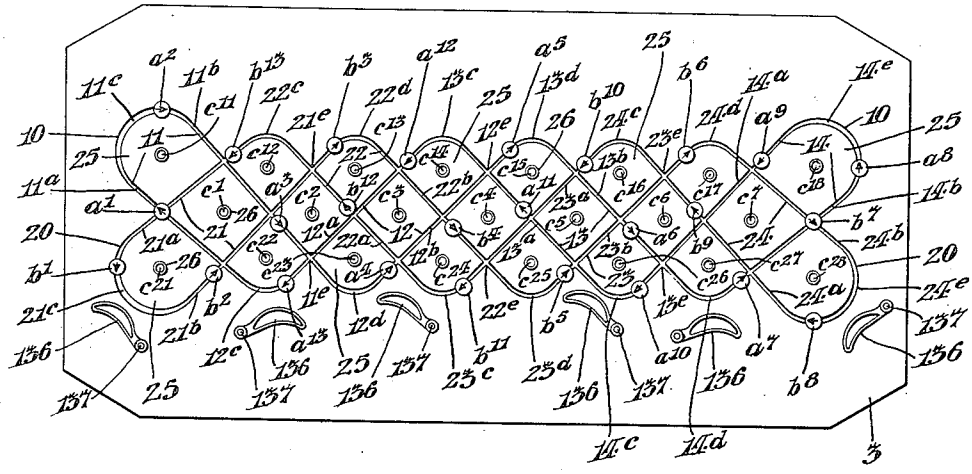


FIG. 11.

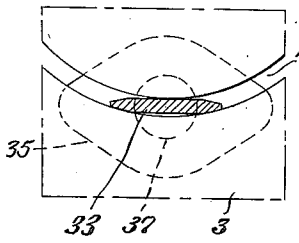


FIG. 8

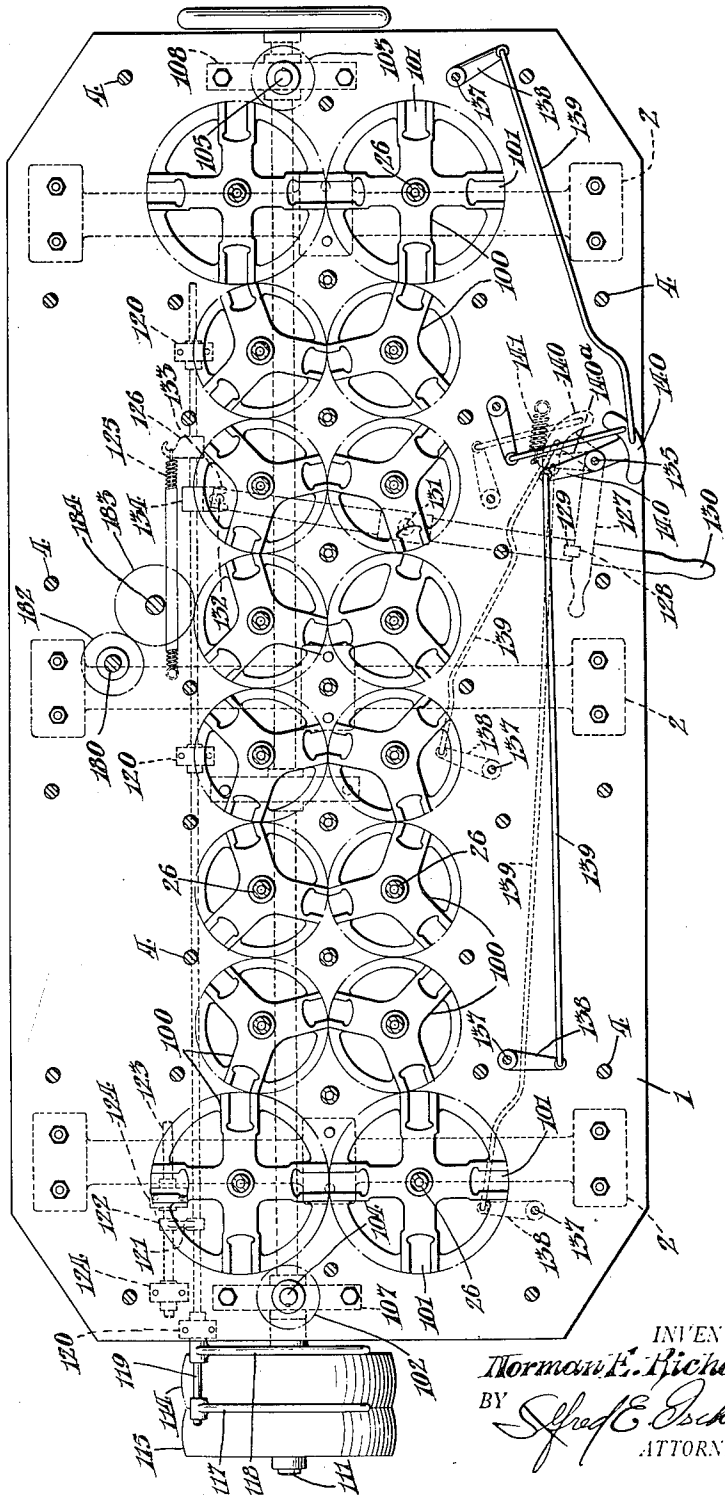
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BRAIDING MACHINE

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Fig. 10.



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Patented June 29, 1937

2,085,334

UNITED STATES PATENT OFFICE

2,085,334

BRAIDING MACHINE

Norman E. Richards, Wyomissing, Pa., assignor to Textile Machine Works, Wyomissing, Pa., a corporation of Pennsylvania

Application January 22, 1935, Serial No. 2,855

14 Claims. (Cl. 96—12)

This invention relates to a braiding machine for producing a flat selvedged-edge strip of textile fabric, substantially rectangular in cross-section and suitable when completed for use as a brake lining or in the fabrication of brake linings and/or correspondingly and similarly used and fabricated articles. It relates more particularly to a novel and useful means for making an article which in its ultimate form would be subjected to a rubbing or frictional action on at least one of its flat faces, which friction would cause a wearing away of the exposed surface of the strip.

In order to increase the wearing resistance of such a strip of brake lining to a maximum and in order to simultaneously make a strip having maximum frictional gripping qualities at all times during its useful life, the present invention contemplates the provision of a simple yet highly efficient machine which is adapted to lay the various wear-resisting threads of which the strip is composed in a predetermined order and pattern-weave with respect to each other and to arrange these threads and intertwist them in such a manner as to cause the frictional rubbing action to take place in a direction transverse to the wear-resisting threads, i. e., across the ends of the fibers of the interbraided threads of the strip, to the greatest possible extent.

In order to produce a strip having a firm body with a minimum degree of longitudinal extensibility and at the same time to accentuate the presentation of the fiber ends to the wearing action of the drum or other member against which it frictionally rubs, the machine is adapted to insert longitudinally extending core threads within the strip during the interbraiding of the wear-resisting threads. The interbraiding of the wear-resisting threads may thus take place about or around these core threads and thus the core threads become firmly bound into the body of the strip.

One object of my invention is to produce a novel machine adapted to braid strands or threads of any desirable cross-section or quality whereby a friction or brake lining of any thickness may be made in a single braiding operation.

It is also an object of this invention to provide a machine capable of making a braided fabric in which the interbraided threads are completely interlocked and intergripped within the fabric, thereby producing an article far superior to, and more cheaply and easily made than any similar article heretofore manufactured.

A further object of this invention is to provide a machine for producing an article that is integrally interbraided and does not embody the objectionable features of super-positioned layers of fabric.

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

In the drawings:

Figure 1 is a face view of a piece of flat fabric strip which is one type that may be produced on the machine illustratively forming the subject matter of the present invention;

Figure 2 is a diagrammatic transverse sectional view of the strip taken on the line **2—2** of Fig. 1;

Figure 3 diagrammatically illustrates the braiding path or course traversed by one of the series of threads of which the strip shown in Figs. 1 and 2 is composed;

Figure 4 is a view similar to Fig. 3 but showing the braiding course followed by a second series of threads while travelling through the body of the strip shown in Figs. 1 and 2;

Figure 5 is a view showing the courses of Figs. 3 and 4 combined, wherein the intersecting relation of the two courses with respect to each other is clearly illustrated;

Figure 6 is an end elevation of one embodiment of a machine constructed in accordance with the principles of the present invention;

Figure 7 is a top plan view slightly reduced however, and taken on the line **7—7** of Fig. 6;

Figure 8 is a front elevational view of the machine illustrated in Fig. 6, partially diagrammatic, with the superstructure of the machine shown in section;

Figure 9 is a diagrammatic top plan view of the thread carrier supporting race-plate of the machine;

Figure 10 is a sectional plan view taken on the line **10—10**, Fig. 6, and shows, clearly, the driving means for the thread carriers and the means for determining their movements over the carrier-supporting race-plate shown in Fig. 9; and

Fig. 11 is a sectional view taken substantially along the line **11—11**, Fig. 6.

In all of the drawings corresponding numbers

indicate the same or similar structures and where repeated, the same has been done in order to more clearly indicate the inter-relation and association of the respective parts.

As shown in Figs. 1 and 2, the strip S comprises a braiding series A consisting of individual wear-resisting threads a^1 to a^{13} inclusive and a second braiding series B consisting of individual wear-resisting threads b^1 to b^{13} inclusive. The threads of the series B are interbraided with the threads of the series A, this interbraiding of the series A and B takes place around a series C of longitudinally extending core threads disposed in a central plane substantially parallel to the opposite faces S^1 and S^2 of the strip S and consisting of individual threads c^1 to c^7 inclusive; an outer series C^1 disposed in a plane intermediate that of the series C and the plane of the face S^1 of the strip and consisting of individual core threads c^{11} to c^{18} inclusive; and a second outer series C^2 disposed in a plane intermediate the plane of the series C and the plane of the face S^2 of the strip and consisting of individual core threads c^{21} to c^{28} inclusive.

As diagrammatically illustrated in Fig. 3, the series of wear-resisting threads A follows an undulated course transversely of the strip S which takes the form of the letter W, the first arm A^1 of which starts at one corner of the strip on the face S^1 thereof and extends obliquely and at an angle to the plane of face S^1 of the strip, and through the interior of the strip to the second face S^2 thereof, then passes into a second arm A^2 extending obliquely and at an angle to the second face S^2 and to the arm A^1 and traverses from the second face S^2 of the strip to the first face S^1, then goes into a third arm A^3 extending in a direction substantially parallel to the direction of the first arm A^1, the arm A^3 extends the course from the first face S^1 to the second face S^2 of the strip and finally, a fourth arm A^4 extends in a direction substantially parallel to the direction of the second arm A^2 of the course A and goes from the second face S^2 of the strip to the first face S^1 thereof, terminating at a corner of the strip in the same plane as that in which the first arm of the course began, e. g., on the same face S^1 of the strip as the beginning of the arm A^1.

The second thread series B diagrammatically illustrated in Figs. 4 and 5, follows a course substantially the same as that of the course A but in inverted and intersecting relationship thereto. The course of the series B is inverted with respect to the course of the series A and takes the form of the letter M, wherein, the first arm B^1 of the second series B intersects the first arm A^1 of the first series A; the second arm B^2 of the course of the series B intersects the second arm A^2 of the course of the first series A; the third arm B^3 of the course of the second series B intersects the third arm A^3 of the course of the first series A; and the fourth arm B^4 of the course of the second series B intersects the fourth arm A^4 of the course of the first series A, the terminals of the arms B^1 and B^4 being in the same plane e. g., face S^2 of the strip S and directly opposite, respectively, to the terminals of the arms A^1 and A^4 of the course of the series A.

As shown in Fig. 2 the core threads of the central series C and those of the outer series C^1 and C^2 are longitudinally disposed and are separated from each other by the traversing courses of the series A and B, i. e. the intersecting of the two series of threads A and B takes place between adjacently disposed core threads.

The machine comprises a main horizontal bed-plate 1, Figs. 6 to 10, supported by a series of laterally spaced transversely extending pairs of legs 2, 2, said bed-plate being substantially rectangular in form.

Spaced above and disposed substantially parallel to the bed-plate 1 is the race-plate 3 of the machine which, like the bed-plate 1, is substantially rectangular in form. The race-plate 3 is supported in spaced relation to the bed-plate 1 by a series of shouldered bolts 4 of relatively large diameter intermediate the plates 1 and 3 and having reduced threaded ends passing through said plates respectively. Securing nuts 5 hold the plates against shoulders 6 provided by the reduction in the diameters of the opposite ends respectively of the bolts 4, the shoulders 6 functioning to maintain the plates 1 and 3 rigidly in spaced relation to each other.

As clearly shown in Fig. 9, the race-plate 3 is provided with two intersecting raceways 10 and 20 respectively which define a parallel-sided braiding zone, the raceway 10 taking the form of the letter W in accordance with the course of the series of threads A, the raceway 20 taking the form of the letter M in accordance with the course followed by the series of threads B.

The first arm 11 of the W-shaped raceway 10 comprises a pair of substantially parallel slots 11*a* and 11*b* formed in the race-plate 3 connected to form one terminal end of the raceway 10 by a substantially semicircular slot 11*c*.

The second arm 12 of the raceway 10 comprises a pair of substantially parallel slots 12*a* and 12*b* which are connected to the slots 11*a* and 11*b* of the raceway 10 by arcuate slots 12*c* and 12*d* respectively, the slot 12*a* of the second arm crossing the slot 11*b* of the first arm at 11*e*.

The third arm 13 of the raceway 10 comprises a pair of substantially parallel slots 13*a* and 13*b* which are connected to the slots 12*a* and 12*b* of the second arm 12 by arcuate slots 13*c* and 13*d* respectively, the slot 13*a* of the third arm crossing the slot 12*b* of the second arm at 12*e*.

The fourth arm 14 of the raceway 10 comprises a pair of substantially parallel slots 14*a* and 14*b* which are respectively connected to the slots 13*a* and 13*b* of the third arm by arcuate slots 14*c* and 14*d* respectively, the slot 14*a* of the fourth arm crossing the slot 13*b* of the third arm at 13*e*. The ends of the slots 14*a* and 14*b* of the fourth arm 14 are connected by a substantially semi-circular slot 14*e* forming the second terminal end of the raceway 10.

The raceway 20 in a like manner comprises four relatively angularly disposed arms each consisting of a pair of substantially parallel slots respectively extending substantially at right angles to the slots of the corresponding legs of the raceway 10, the raceway 20 being substantially of the same form as the raceway 10 but in an inverted position with respect thereto as the letter M is to the letter W.

The first arm 21 of the M-shaped raceway 20 comprises a pair of substantially parallel slots 21*a* and 21*b* connected at the first terminal end of the raceway 20 by a substantially semi-circular slot 21*c*.

The second arm 22 comprises a pair of substantially parallel slots 22*a* and 22*b* which are connected to the slots 21*a* and 21*b* of the first arm 21 by arcuate slots 22*c* and 22*d*, with the slot 22*a*

of the second arm 22 crossing the slot 21*b* of the first arm 21 at 21*e*.

The third arm 23 of the raceway 20 comprises a pair of substantially parallel slots 23*a* and 23*b*, which are respectively connected to the slots 22*a* and 22*b* of the arm 22 by arcuate slots 23*c* and 23*d*, with the slot 23*a* of the arm 23 crossing the slot 22*b* of the second arm 22 at 22*e*.

The fourth arm 24 of the raceway 20 comprises a pair of substantially parallel slots 24*a* and 24*b* which are respectively connected to the slots 23*a* and 23*b* of the arm 23 of the raceway 20 by arcuate slots 24*c* and 24*d*, the slot 24*a* of the fourth arm 24 crossing the slot 23*b* of the third arm 23 at 23*e*.

The terminal ends of the slots 24*a* and 24*b* are connected by a substantially semi-circular slot 24*e* forming the second terminal end of the raceway 20.

Due to the intersecting relation of the various slots constituting the various arms of the two raceways 10 and 20, intervening portions of the race-plate 3 are completely separated from the outer or marginal portions of the race-plate and from each other, forming what are commonly referred to as "tellers" or "quoits" which in Fig. 9 are indicated at 25.

The tellers 25, 25 are individually supported from the underlying bed-plate 1 by studs 26, 26, Fig. 10, respectively. In the present instance the studs 26 are of a tubular form and are rigidly connected at their upper ends to the tellers 25, 25 and at their lower ends to the bed-plate 1, whereby the tellers are maintained in rigidly fixed laterally spaced relation to each other and to the marginal portions of the race-plate 3 to form and maintain the continuity of the slots constituting the intersecting raceways 10 and 20 respectively.

Arranged to travel over the upper face of the race-plate 3 along the raceways 10 and 20 respectively are two independent series of thread or bobbin carriers 30, 30, Fig. 6, there being provided one carrier for each of the threads a^1 to a^{13} inclusive in the series A thereof and one carrier for each of the threads b^1 to b^{13} inclusive in the series of B thereof.

The bobbin carriers for this specific machine may be of any of the well-known type familiar to those versed in the related art. However, in this particular case, the carriers are provided with a pair of spaced plates 31 and 35, Fig. 6, which are connected by an elongated fin or heart piece 33 of well known and suitable construction, see Fig. 11. The fin 33 extends through and rides in the raceway slots 10, 20, Fig. 9, formed or cut in the race-plate 3. Each bobbin carrier at its lower extremity is provided with a lug or stud 37 which is adapted to be engaged by and travel with a horn-shaped pair of projections 101 carried by the gears 100.

The usual upright arms 45, 45*a*, Fig. 6, the spindle-shaft or axle 53, and the bobbin or spool of thread 50 having lateral flanges 51, together with its attendant thread tensioner 77, and thread guide 48 are also shown. The thread is led upwards, as shown to the braiding point X, Fig. 6.

The braiding movements of the carriers 30 for effecting interbraiding of the series of threads A with the series of threads B are effected through mechanism shown particularly in Fig. 10.

Rotatably mounted on each of those of the teller or quoit-supporting studs 26 which correspond in position to the outer series of core threads C^1, C^2, intermediate the base plate 1 and the race-plate 3, is an ordinary horn bearing gear or horn-gear 100. Those horn-gears which are located at the terminal ends of the raceways 10 and 20 are provided with four horns, illustrated at 101, while those intermediate the terminals of said race-ways are provided with but three horns each.

Each horn gear intermeshes with each of its immediately adjacent neighbors and the horns on the several gears are so arranged that a horn on one gear is brought into alignment with a horn on the next gear at predetermined times during the rotation of the several gears at uniform peripheral speed.

The horns 101 engage the studs 37 of the carriers 30 and as the several gears are rotated in unison the carriers are moved over the surface of the race-plate 3 and are guided by the tongues or fins 33 running in the slots constituting the raceways 10 and 20 respectively. The slots guide the carriers through the above noted intersecting courses of the threads indicated as series A and B to effect intertwining and interbraiding of the two series of threads in the manner above noted. These slots also function to guide the stud 37 of each carrier out of the horn of one gear into the horn of the next gear when the horns are aligned one with the other in the manner above noted.

The train of horn gears is driven at the opposite ends thereof by horizontally disposed pinions 102 and 103, Fig. 10, respectively. These pinions are secured or journalled on vertically disposed shafts 104 and 105 respectively, the lower ends of which are mounted in bearings 106, Fig. 8, carried by brackets 107 and 108 respectively secured to the under side of the base plate 1 adjacent the opposite ends thereof.

The upper ends of the shafts 104 and 105 have bearing in the base plate 1 and extend above said base plate a sufficient distance to permit of the pinions 102 and 103 being secured thereto in the plane of the teeth of the horn gears 100.

Adjacent the lower bearing 106 in each instance the shafts 104 and 105 are provided with beveled gears 109. The beveled gears 109 intermesh respectively with beveled gears 110 which are secured to a main drive shaft 111.

The main drive shaft 111 is horizontally disposed beneath the base plate 1 and rotatably supported in the bearings 106 of the brackets 107 and 108 and in a bearing 112 carried by an intermediate bracket 113 which, like the brackets 107 and 108, is secured to the underside of the base plate 1.

The main shaft 111 is provided with tight and loose pulleys 114 and 115 respectively, about which is adapted to pass a drive belt 116, the belt running between the forks or arms 117 and 118 of a belt-shifting mechanism, whereby the belt may be shifted from the tight to the loose pulley, and vice versa.

The belt-shifting arms 117 and 118 are secured to a horizontally disposed shift rod 119 which is slidably mounted in bearings 120 secured to the underside of the base plate 1. Rotation of the shift rod 119 is prevented by an arm 121 secured to the said shift rod and provided with a bearing 122 which is in turn secured to a second rod 123. The rod 123 is disposed parallel to the rod 119 and is slidably mounted in bearings 124, 124 secured to the underside of the base plate 1.

The shift rod 119 is at all times urged to move in a direction to shift the belt 116 from the tight pulley 114 on to the loose pulley 115 by a spring

125, Fig. 10, one end of which is secured to a fixed part of the machine while the other end is secured to a collar 126 fixed on the shift rod 119.

Normally, the movement of the rod 119 in the direction above noted is prevented by a latch lever 127 forming part of the stop motion of the machine, said latch lever having a notch 128 into which extends a lug 129 which is carried by the shifter lever 130.

The shifter lever 130 is pivotally mounted at 131 to the underside of the base plate 1 and is provided at its one end with a pin 132 which is engaged by and between the parallel forked ends of a lug 133 which projects laterally from a collar 134 secured to the shift rod 119.

The latch lever 127 is secured to the lower end of a vertically disposed shaft 135 fixed to the base plate 1 and the race-way guide plate 3, respectively.

At predetermined points along the intertwining straight serpentine race-ways 10 and 20 are provided a series of trip arms 136, Fig. 9, each of which is secured to the upper end of a trip shaft 137, Fig. 10, said trip shafts being vertically disposed and having bearing in the parallel plates 1 and 3.

To each of the trip shafts 137 is secured a lever 138. The several trip levers 138 are connected by rods 139 to levers 140 secured to the main trip shaft 135 and on which the latch lever 127 is secured. The latch lever 127 is held in its operative or shift retaining position by spring 141, and each of the trip shoes or levers 136 is likewise held in its inoperative position by the same spring 141 having one end secured to a lever 140a on the trip shaft 135 and its opposite end secured to a fixed part of the machine.

Means may be provided on the bobbin carrier such that when the thread breaks or becomes unusually slack, the lever 77, Fig. 6, used for tensioning the thread may operate a tripping device which in turn actuates the stop mechanism by causing a tripping device to fall in the plane of the several trip shoes 136. Consequently as the carrier on which the lowered drop or tripping device is mounted is moved along the course of either the series of threads A or B, as the case may be, then one of the drop levers or tripping devices would engage one of the trip shoes 136, thereby effecting a rocking of the shoe and a corresponding rocking of the main trip shaft 135 whereby the latch lever 127 would be moved to a position releasing the shifter lever 130, whereupon the spring 125 would slide the trip rod 119 longitudinally to effect movement of the belt 116 from the tight pulley 114 to the loose pulley 115, causing the machine to stop.

During the interbraiding movements of the several carriers in the manner above noted, the core threads of the series C, C^1 and C^2 are fed upwardly into the field of movement or braiding point of the binder or wear-resisting threads as the interbraiding operation takes place. For this purpose each of the hollow-teller-supporting studs 26 is provided with an extension 145, Fig. 6, which projects above the race-plate 3 to a plane substantially level with or above the plane of the eyes 48 of the several carriers 30.

The core threads preferably pass from any suitable source of supply located at the rear of the machine and passing under the base plate 1 and around suitable guides 146, Fig. 8, from which the threads pass to the lower ends of the hollow teller-supporting tubes 26, passing through them and the vertical extensions 145, uninterruptedly.

The guide tubes 145 for the core threads c^{11} and c^{18} of the series C^1, and c^{21} and c^{28} of the series C^2 are preferably provided with guide needles 148, around which the carriers 30, of the A braiding series travel on the S^1 face, and the B series travel on the S^2 face of the fabric, the needles keeping the fabric stretched to a width conforming with the size of the former 147 in a manner well known in the art.

From the upper ends of the guide tubes 145 and from the upper ends of the eyes 48 the core threads and binder threads respectively converge toward the braiding point x of the machine. The braiding point is located some distance above the plane of the race-plate 3 as clearly illustrated in Figs. 6 and 8. The braiding point is normally determined by the position of a forming mechanism or a former 147 and the take-up mechanism of the machine with respect to the longitudinal and transversely extending center lines of the intertwining race-ways 10 and 20. In the present instance the braiding point is disposed somewhat to the rear of the longitudinal center line of the combined race-ways and on the transverse center line thereof. The former 147 is supported between a pair of horizontally disposed transversely extending parallel rods 150, Fig. 6.

The rods 150 are supported by vertically depending rods 151 which have their upper ends secured in a frame 152. The frame 152 in turn is supported by depending rods 153, the upper ends of which are mounted on a transversely extending bar 154. The opposite ends of the bar 154 are fixed in bearings 155 and 156 respectively which are formed at the upper ends of suitable standards or brackets 157 and 158 respectively. The brackets 157 and 158 are mounted on and secured to the race-plate 3.

The frame 152, see Fig. 7, is of a substantially rectangular construction composed of end members 159, 159 and side members 160, 160. Disposed in the open center of the frame 152 is a series of take-up and/or take-off rolls 161, 162 and 163 which are secured to horizontally disposed shafts 164, 165 and 166 respectively.

The shaft 164 is rotatably mounted in fixed bearings formed in the side members 160 of the frame 152 while the shafts 165 and 166 are rotatably mounted in bearings 167 and 168, Fig. 6, which are slidably mounted in slots 169 formed in the side members 160 of the frame 152.

Secured to each of the shafts 164, 165 and 166 is a pair of gears 170 which intermesh one with the other and effect a relative rotation of the take-up rolls 161, 162 and 163.

Secured to the shaft 164 in the present instance is a sprocket wheel 171 about which passes a sprocket chain 172. The sprocket chain 172, Fig. 6, also passes around a sprocket wheel 173 which is secured to a shaft 174 rotatably mounted in the back standard 158. Also secured to the shaft 174 is a gear 175, Fig. 8, which meshes with a corresponding gear 176 secured to a shaft 177. The shaft 177 is rotatably mounted in the back standard 158 in parallel relation to the shaft 174, Fig. 6, and is provided with a worm wheel 178. Meshing with the worm wheel 178 is a worm 179, said worm being secured to the upper end of a vertically disposed shaft 180. The shaft 180 is rotatably mounted in bearings 181, 181 carried by the back standard 158, the lower end of said shaft having bearing in the base plate 1 and race-plate 3 respectively.

Intermediate said plates the shaft 180 has

secured thereto a gear 182 which meshes with a gear 183, Fig. 10, which is rotatably mounted on a fixed stud 184. The gear 183 meshes with one of the horn gears 100 from which and through the chain of mechanism just described the take-up rolls 161 and 162 receive rotation at a definite peripheral speed to take up the braided strip S at a uniform rate of speed from the braiding point x of the machine, said strip passing into the bite formed by and between the rolls 161 and 162 and passing over the top of the roll 162 to the bite formed by and between the rolls 162 and 163, the compression of the fabric by the said rolls being governed by bite-adjusting screws 185, Fig. 6, carried by the take-up frame 152 and extending into the bearing slots 169 thereof, said screws bearing against the outer ends of the tongues 186 projecting from or bearing against the slide bearings 168 which support the shaft 166 with the take-off roll 163.

From the take-off roll 163 the finished strip S passes into the upper end of a chute 187 projecting forwardly and downwardly to the front central portion of the machine. Then the finished fabric is guided into a receptacle, together with its integrally twisted binder and core threads which were interbraided by the relative movements of the carriers 30 over the surface of the race-plate 3.

Of course, the improvements specifically shown and described, by which I obtain the above results, 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, a carrier supporting race-plate including a pair of raceways arranged to define a parallel-sided braiding zone and a series of carriers for traversing said raceways, a plurality of drive gears for said carriers, each raceway comprising a plurality of pairs of contiguous substantially parallel slots extending in straight lines between opposite sides of said zone and interconnected at the ends of the zone to form a continuous raceway, the slots of each pair being spaced apart a distance substantially equal to the diameter of one of said drive gears.

2. In a braiding machine, a carrier supporting race-plate including a pair of raceways arranged to define a parallel-sided braiding zone and a series of carriers for traversing said raceways, a plurality of drive gears for said carriers, each raceway comprising a plurality of pairs of contiguous substantially parallel slots extending in straight lines between opposite sides of said zone and interconnected at the ends of the zone to form a continuous raceway, the spacing between parallel pairs of slots of different raceways being substantially the same as the spacing between parallel slots of the same raceway and being substantially equal to the diameter of one of said drive gears.

3. In a braiding machine provided with a race-plate including a pair of sinuously disposed raceways arranged to define a parallel-sided braiding zone and a series of carriers for traversing said raceways, each raceway comprising a pair of substantially parallel slots interconnected at their ends to form a continuous raceway, a plurality of lines of drive gears for said carriers individual lines of which are positioned adjacent each side of said braiding zone, the gears of one line intermeshing with the gears of a second line and the gears of each line intermeshing with each other, said slots of each pair being spaced apart a distance substantially equal to the diameter of one of said horn gears.

4. In a braiding machine, a race-plate provided with two independent raceways arranged to define a parallel-sided braiding zone and a series of carriers for traversing said raceways, a plurality of drive gears for said carriers, each raceway including a plurality of straight arm portions alternately arranged in oppositely inclined angular relation to each other, each arm comprising only two straight and substantially parallel contiguous slots extending between opposite sides of said braiding zone and spaced apart a distance substantially equal to the diameter of one of said drive gears, one of the raceways being arranged in reversed relation to the other of said raceways and with the corresponding arms of the two raceways crossing each other.

5. A carrier supporting race-plate for a braiding machine having a plurality of substantially straight guide slots for the carriers arranged to define a parallel-sided braiding zone and a series of carriers for traversing said slots, a plurality of drive gears for said carriers, said slots being sinuously disposed in substantially parallel pairs extending and arranged between opposite sides of said braiding zone to effect a straight line movement only of the carriers crosswise of the braiding zone and comprising a first set of contiguous paired slots, a second set of contiguous paired slots substantially perpendicular to and intersecting said first set, said slots of each pair being spaced apart a distance substantially equal to the diameter of one of said drive gears, the pairs of each set being operatively interconnected for guiding a carrier only within their respective set, whereby two independent, yet intersecting raceways are formed.

6. A carrier supporting race-plate for a braiding machine having a plurality of substantially straight guide slots for the carriers arranged to define a parallel-sided braiding zone and a series of carriers for traversing said slots, a plurality of drive gears for said carriers, said slots being sinuously disposed in substantially parallel pairs extending and arranged between opposite sides of said braiding zone to effect a straight line movement only of the carriers crosswise of the braiding zone and comprising a first set of contiguous paired slots, a second set of contiguous paired slots substantially perpendicular to and intersecting said first set, said slots of each pair being spaced apart a distance substantially equal to the diameter of one of said drive gears, the pairs of each set being operatively interconnected for guiding a carrier only within their respective set, whereby two individual intersecting raceways are formed, said race-plate having openings for the passage of core threads within one or both of said raceways.

7. A carrier supporting race-plate for a braiding machine having a plurality of substantially straight guide slots for the carriers arranged to define a parallel-sided braiding zone, said slots being sinuously disposed in substantially parallel pairs extending between opposite sides of said braiding zone, and comprising a first set of contiguous paired slots, a second set of contiguous paired slots substantially perpendicular to and intersecting said first set, the pairs of each set being operatively interconnected for guiding a carrier within the set, a fin on the carriers for guiding the same in the slots of one set, a lug on each carrier below the fin thereon, gears disposed

below the race-plate, said gears having horns for engaging the lugs, the lugs being adapted to slide radially along the horns as the carriers course the straight portions of their respectively associated guide slot set.

8. A carrier supporting race-plate for a braiding machine having a plurality of substantially straight guide slots for the carriers arranged to define a parallel-sided braiding zone, said slots being sinuously disposed in substantially parallel pairs extending between opposite sides of said braiding zone, and comprising a first set of contiguous paired slots, a second set of contiguous paired slots substantially perpendicular to and intersecting said first set, the pairs of each set being operatively interconnected for guiding a carrier within the set, a fin on the carriers for guiding the same in the slots of one set, a lug on each carrier below the fin thereon, gears disposed below the race-plate, said gears having horns for engaging the lugs, the lugs being adapted to slide radially along the horns as the carriers course the straight portions of their respectively associated guide slot set, and being adapted to remain at a fixed radial distance along said slots during a portion of the course interconnecting the pairs of each set.

9. A carrier supporting race-plate for a braiding machine having a plurality of substantially straight guide slots for the carriers arranged to define a parallel-sided braiding zone, said slots being sinuously disposed in substantially parallel pairs extending between opposite sides of said braiding zone, and comprising a first set of contiguous paired slots, a second set of contiguous paired slots substantially perpendicular to and intersecting said first set, the more remote pairs of each set being operatively interconnected for guiding a carrier at their extreme ends by substantially semi-circular slots and at their intervening ends being connected sequentially to the remaining pairs of their respective set by segmental arcuate slots.

10. A carrier supporting race-plate for a braiding machine having a plurality of substantially straight guide slots for the carriers arranged to define a parallel-sided braiding zone, said slots being sinuously disposed in substantially parallel pairs extending between opposite sides of said braiding zone, and comprising a first set of contiguous paired slots, a second set of contiguous paired slots substantially perpendicular to and intersecting said first set, the pairs of each set being operatively interconnected for guiding a carrier within the set, a fin on the carriers for guiding the same in the slots of one set, a lug on each carrier below the fin thereon, gears disposed below the race-plate, said gears having horns for engaging the lugs, the lug on each carrier being adapted to engage every one of the horned gears for a portion of the latter's rotation during each complete course of the carrier over its respectively assigned raceway.

11. A braiding machine comprising a race-plate provided with two independent raceways arranged to define a parallel-sided braiding zone and a series of carriers for traversing said raceways, a plurality of drive gears for said carriers, each raceway including a plurality of straight arm portions alternately arranged in oppositely inclined angular relation to each other with one of the raceways arranged in reversed relation to the other of said raceways and with the corresponding arms of the two raceways crossing each other, each arm comprising two straight and substantially parallel contiguous slots extending between opposite sides of said braiding zone and spaced apart a distance substantially equal to the diameter of one of said drive gears, each raceway comprising a pair of substantially parallel paths providing two-way traffic throughout the course of each raceway, said paths of each raceway being connected by reverse turns at the terminal ends thereof, and the corresponding paths of each arm of each raceway being connected by arcuate sections disposed outside the intersections of the arms of the two raceways for maintaining continuity of the respective raceways.

12. A braiding machine comprising a race-plate provided with two independent raceways each including a plurality of straight arm portions alternately arranged in oppositely inclined angular relation to each other with one of the raceways arranged in reversed relation to the other of said raceways and with the corresponding arms of the two raceways crossing each other, each raceway comprising a pair of substantially parallel paths providing two-way traffic throughout the course of each raceway, said paths of each raceway being connected by reverse turns at the terminal ends thereof, the corresponding paths of each arm of each raceway being connected by arcuate sections disposed outside the intersections of the arms of the two raceways for maintaining continuity of the respective raceways, and one path in each arm of each raceway crossing the opposite path of the adjacent arm thereof intermediate the arcuate sections and said intersections, these paths comprising slots formed in the race-plate and separating those portions of the plate disposed within the areas of the intersecting raceways and between the intersections thereof from each other and from the marginal portions of the race-plate, a base-plate parallel to and spaced from the race-plate, and studs rigidly securing the separated parts respectively of the race-plate to the base-plate to maintain continuity of the raceways.

13. A braiding machine comprising a race-plate provided with two independent raceways each including a plurality of straight arm portions alternately arranged in oppositely inclined angular relation to each other with one of the raceways arranged in reversed relation to the other of said raceways and with the corresponding arms of the two raceways crossing each other, each raceway comprising a pair of substantially parallel paths providing two-way traffic throughout the course of each raceway, said paths of each raceway being connected by reverse turns at the terminal ends thereof, the corresponding paths of each arm of each raceway being connected by arcuate sections disposed outside the intersections of the arms of the two raceways for maintaining continuity of the respective raceways, and one path in each arm of each raceway crossing the opposite path of the adjacent arm thereof intermediate the arcuate sections and said intersections, these paths comprising slots formed in the race-plate and separating those portions of the plate disposed within the areas of the intersecting raceways and between the intersections thereof from each other and from the marginal portions of the race-plate, a base-plate parallel to and spaced from the race-plate, studs rigidly securing said separated parts respectively of the race-plate to said base-plate to maintain alignment of the paths of the raceways, a series of

thread carriers operating in each raceway, and means rotatably mounted on predetermined ones of said studs intermediate the base-plate and the race-plate for moving the series of carriers along the raceways respectively to effect interbraiding of threads respectively carried by the carriers, the studs being of tubular form and extending from the underside of the base plate for feeding additional threads therethrough and between the threads carried by the carriers during the interbraiding.

14. A braiding machine comprising a race-plate provided with two independent allochiral raceways each defining a plurality of straight arm portions alternately arranged in oppositely inclined angular relation to each other and with the corresponding arms of the two raceways crossing each other, each raceway comprising a pair of substantially parallel paths providing for two-way travel throughout the course of each raceway, said paths of each raceway being connected by reverse turns at the terminal ends thereof, the corresponding paths of each arm of each raceway being connected by arcuate sections disposed outside the intersections of the arms of the two raceways for maintaining continuity of the respective raceways, and one path in each arm of each raceway crossing the opposite path of the adjacent arm thereof intermediate the arcuate sections and said intersections, these paths comprising slots formed in the race-plate and separating those portions of the plate disposed within the areas of the intersecting raceways and between the intersections thereof from each other and from the marginal portions of the race-plate, a base-plate parallel to and spaced from the race-plate, and studs rigidly securing the separated parts respectively of the race-plate to the base-plate to maintain continuity of the raceways.

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