E. F. PARKS & S. W. WARDWELL.

BRAIDING MACHINE.

APPLICATION FILED JAN. 3, 1907.

Patented Jan. 17, 1911.

981,938.

6 SHEETS—SHEET 1.

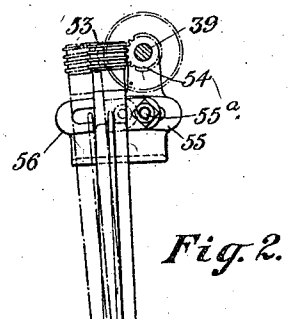

Fig. 2.

Fig. 1.

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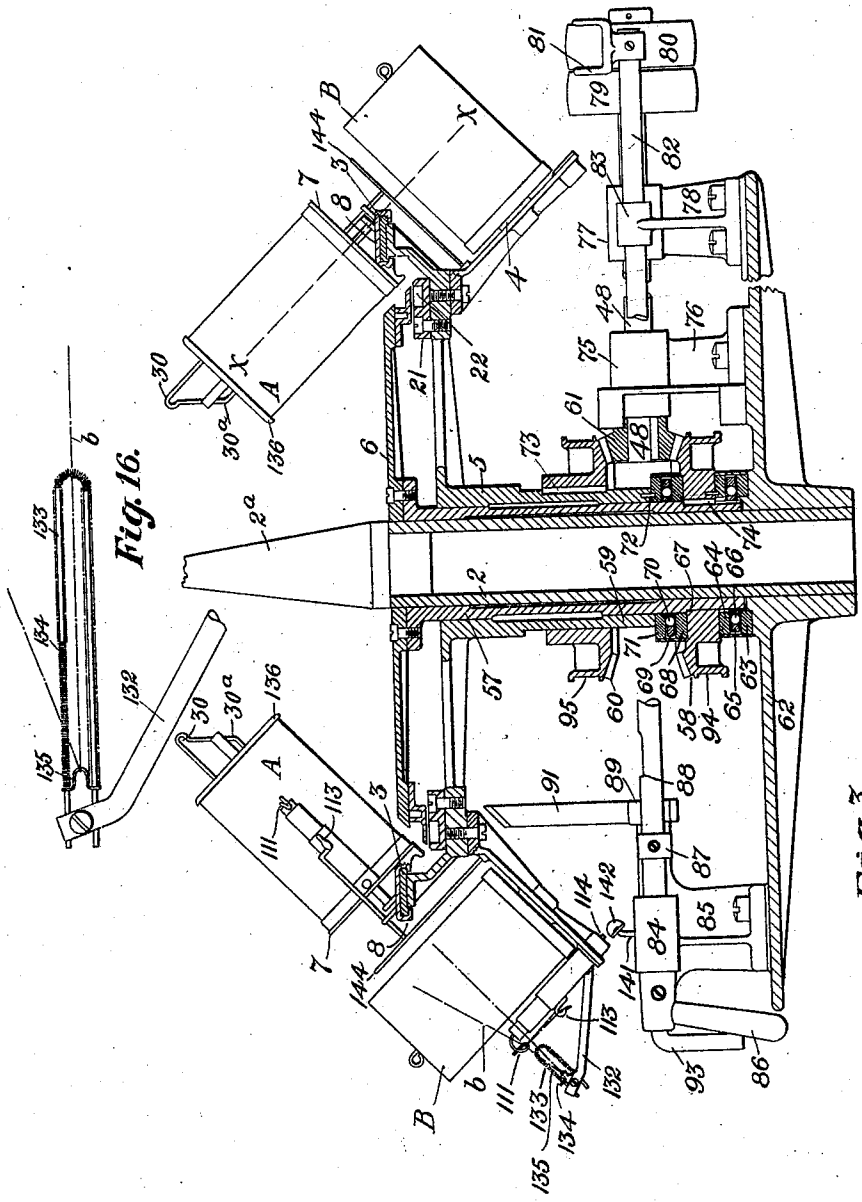

Fig. 16.

Fig. 3.

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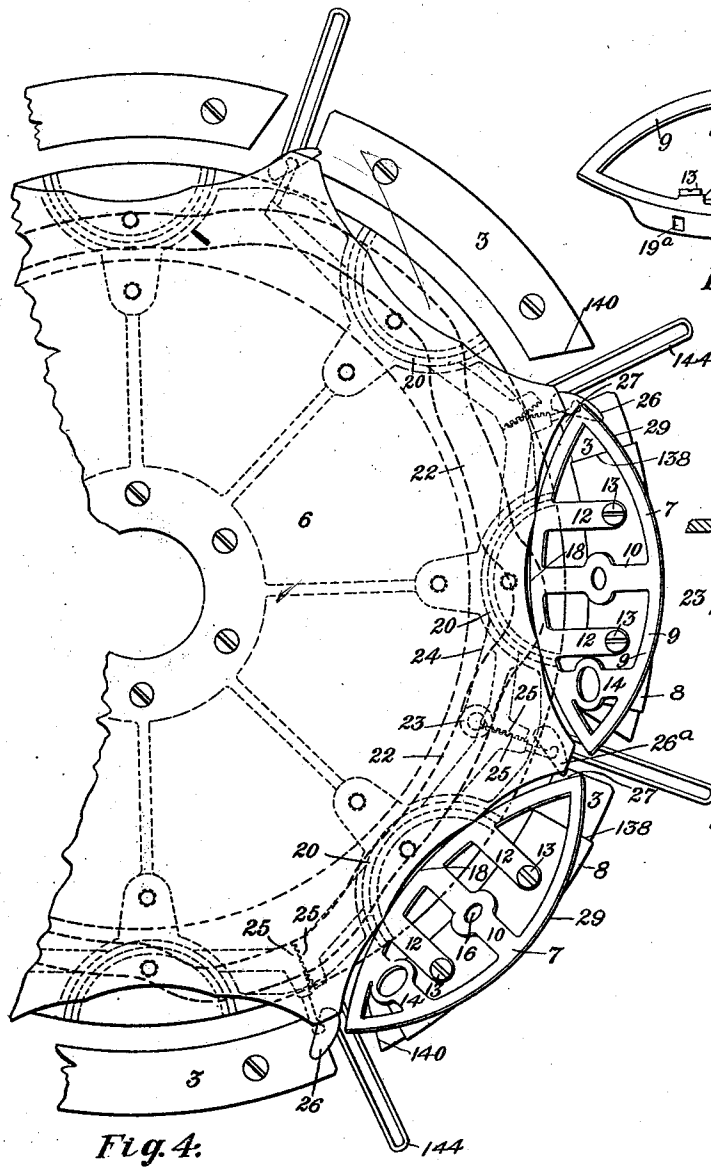

Fig. 4.

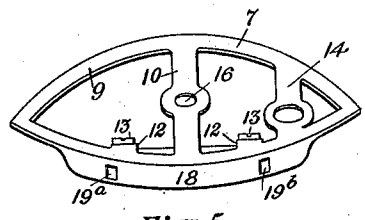

Fig. 5.

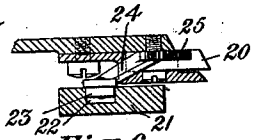

Fig. 6.

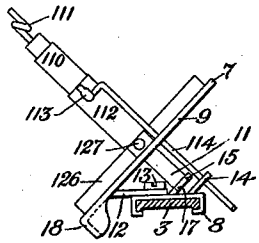

Fig. 7.

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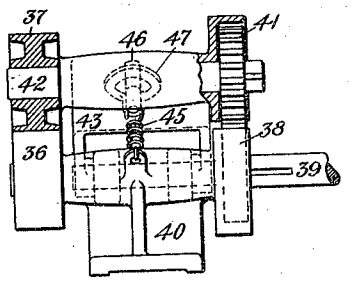

Fig. 11.

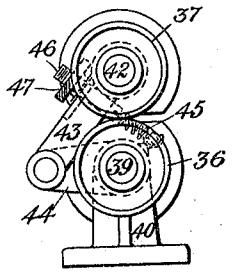

Fig. 12.

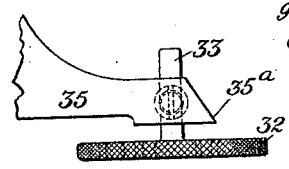

Fig. 9.

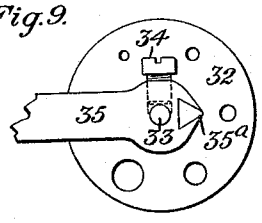

Fig. 10.

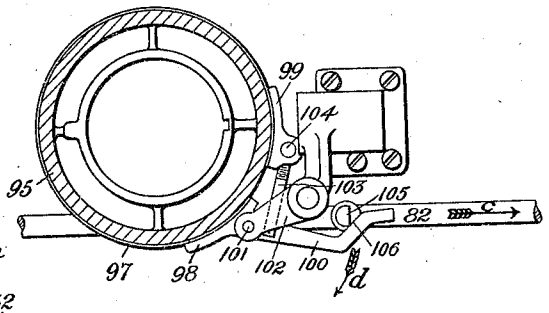

Fig. 8.

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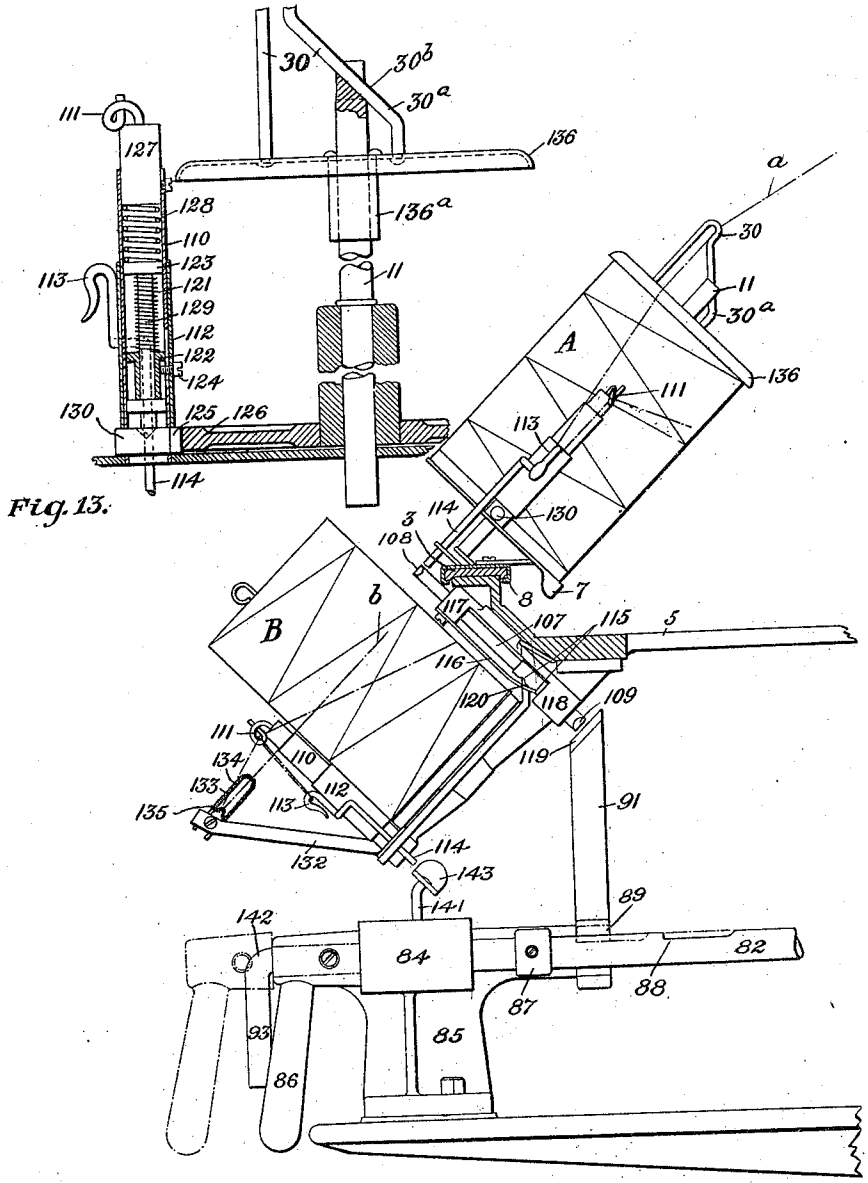

Fig. 13.

Fig. 14.

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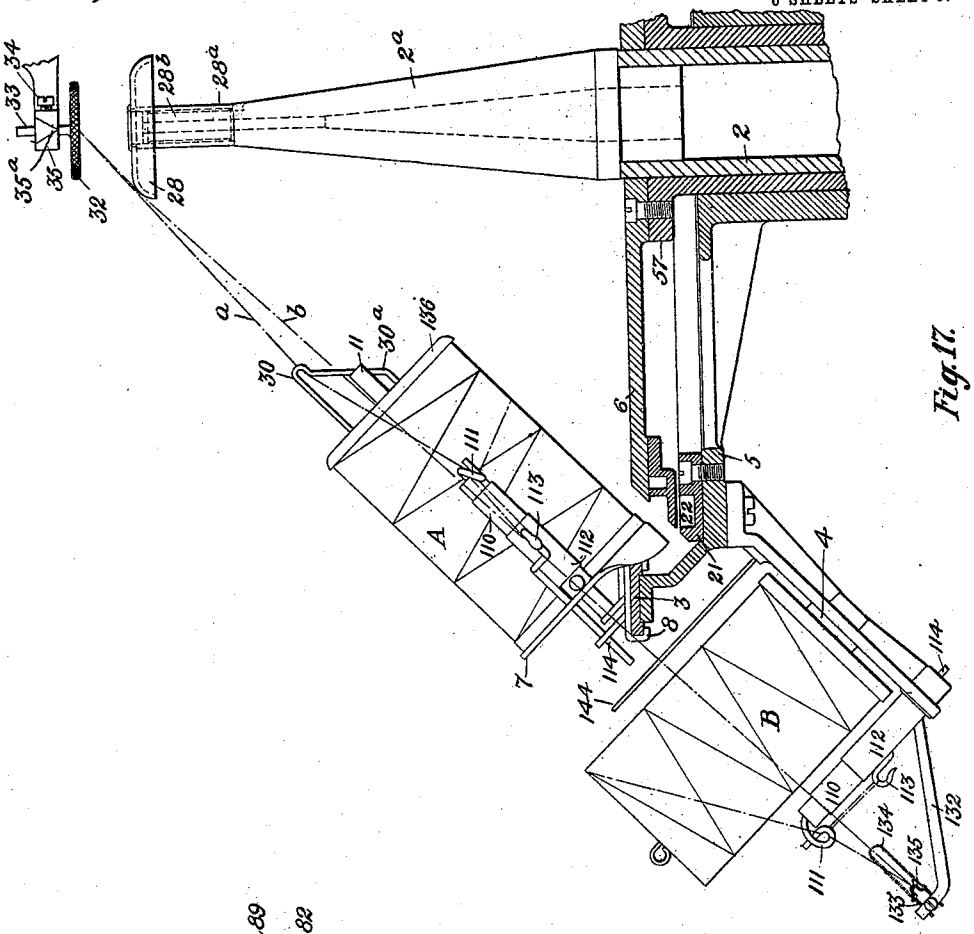

Fig. 17.

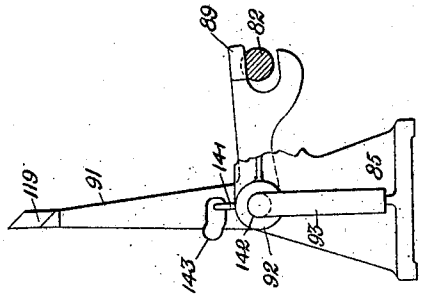

Fig. 15.

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UNITED STATES PATENT OFFICE.

EDWARD F. PARKS AND SIMON W. WARDWELL, OF PROVIDENCE, RHODE ISLAND.

BRAIDING-MACHINE.

981,938. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed January 3, 1907. Serial No. 350,641.

To all whom it may concern:

Be it known that we, EDWARD F. PARKS and SIMON W. WARDWELL, citizens of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Braiding-Machines, of which the following is a specification.

Our invention relates to braiding machines and consists of improvements in or relating to the invention set forth in our Patent No. 851,204, dated April 23, 1907.

Our invention lies in novel constructions and arrangements which effect a superior product at a higher rate than is attainable by any device known to us, and that, with fewer parts, more durable, and arrangements less susceptible to wear than any of which we know.

The nature of our invention is fully set forth in the following specification and accompanying drawings which form a part of same, which drawings respectively show:

Figure 1, a part elevation of the machine; Fig. 2, a detail of the same; Fig. 3, a section of the main portion of the machine, taken through its axis in a plane parallel with the sheet, in Fig. 1; Fig. 4, a plan view of a portion of the carrier plate showing some of the carriers and their method of connection and relation; Figs. 5, 6 and 7 are details of the carriers and of their driving mechanism; Fig. 8 is a detail of the brake mechanism; Fig. 9 and Fig. 10 are details of the gatherer; Fig. 11 and Fig. 12 are details of the take-up mechanism; Figs. 13, 14, 15 and 16 are details of the tension device and stop mechanism; Fig. 17, a vertical cross section of a portion of the machine, showing the relative positions of the yarns.

In general aspect the machine resembles that of our pending application, Serial 274,136, above referred to, having a central post which constitutes the tangible axis of the machine, about which are revolved, in opposite directions, two sets of yarn supplies. These yarn supplies have no other motion than that of revolution about the axial post and that of individual rotation to deliver the yarn.

The most apparent change from our prior construction is the inclination of the yarn supplies toward the axis of the machine, so that the yarns are delivered directly from the supplies to the braiding point, without intervention of guides and deflectors. The advantage, as it effects a most direct path of travel for the yarn, is obvious; and further, as the supplies revolve at high speed, and are therefore subject to material centrifugal action, the said centrifugal action is balanced and neutralized by gravity. This results in more uniform pressure on the track and a reduction of side strain, and, therefore, uniform, evenly distributed wear of the parts. The principle involved is that which dictates the elevation of the outer rail on a railroad curve, and requires no discussion.

The inclination of braider supplies is old, *per se*, and therefore admittedly not, *per se*, of the invention, but so far as we know, such inclination has involved additional mechanism and a complication of devices which we avoid.

Specifically, there are two sets of supplies A and B which rotate about a central post 2. These sets of supplies are both mounted on the carrier frame 5, the supplies A, slidably, on a sectional circular track 3; the supplies B, fixedly (with relation to the carrier frame) on spindles 4, secured to said carrier frame.

Adjacent the supplies A is the driving head or plate 6 which rotates in a direction opposite to the carrier frame or driving head 5, and by devices to be described engages the carriers 7 on which the supplies A are mounted, and revolves them in a direction opposite to the direction of revolution of the supplies B. The arrangement of the driving plate and carrier frame, their mode of mounting and connections will be later described.

Note that the relation of the two sets of supplies is such that when one of the supplies A registers with a supply B, their individual axes are substantially perpendicular, and the longitudinal dimension of the supply is substantially bisected by the intersection of the axis of the supply A imaginarily extended downward, as indicated by the broken line x—x in Fig. 3.

The track 3 on which the carrier 7 travels is of a flat, circular plane, not of a conical or cylindrical surface; the engaging part or runner of the carrier is similarly of circular, arcal form adapted to engage and hold to the said track. This runner portion 8, as we prefer to term it, is made preferably of sheet metal, to conform to the track 3, extending

across the top, down the edges and beneath, sufficiently to prevent said runner from lifting, as shown in Fig. 3, but more clearly in Fig. 7.

The deck portion 9 which supports the bases of the supply is made separate and secured to the runner 8. It is of lenticular contour, so that the yarns from the lower supplies B shall easily ride over or under said deck portion. This further brings the supply in close proximity to the track with its base crossing and extending below the track, thereby lowering the center of gravity and diminishing its distance from the track.

It will be seen that by the arrangement of the two sets of supplies axially perpendicular to each other in respect to the thin flat circular track, the supplies and the intermediate track are brought into very close proximity, the track being practically about 45° to the axes of each set, and thereby the apparatus is rendered more compact and the center of gravity of the supplies lowered. Further this construction and arrangement is one which can readily be produced with great accuracy; resulting in economy of manufacture and perfection of operation. The turning moment due to centrifugal action is also reduced to a minimum, thus minimizing wear and strain.

By the arrangement of the flat track and a flat driving disk with drivers which directly engage the carriers on the track there is secured a positive coupling of the driving plate with the carriers, and the drivers can be located in grooves in the plate so as to move radially from the axis when driven by the cam in the same plane. This not only involves simplicity of mechanism and direct application of the force developed by the rotation of the cam, but also insures a firm engagement of the drivers with the carriers, preventing the play and backlash which would be detrimental to the proper control of the carriers. Whether the said yarns pass over or under the carriers is determined by devices which will later be described.

In behalf of lightness, to avoid inertia and minimize momentum, the deck is of skeleton structure, consisting of a rim having the lenticular contour aforesaid, and a cross tie 10, enlarged at its middle to receive the supply spindle 11. For securing the deck to the runner, two ears 12—12 are formed where the interior metal is cut out, and these are formed at the requisite angle to secure said deck and runner at the correct relative inclination. The mode of securing may be of any usual form, though we prefer to employ screws 13—13 for the purpose. A second cross tie 14 is formed near one end of the carrier for the purposes to be later described.

In the runner an ear 15 is turned up opposite the middle cross tie of the deck and in said cross tie and ear are alining holes 16 and 17 to receive and secure the supply spindle 11.

The edge 18 of the deck which is radially inward toward the axial post 2 of the machine is turned or formed downward, and is further pierced with two apertures 19^a and 19^b, (Fig. 5), which provide engagement means whereby the carriers 7 are driven. Preferably the surface of the down turned portion or edge 18 is inclined to both the plane of the deck and of the track, it being parallel with the path of travel of the under supply yarn *b*, as it leads to the carrier, or, in other words, parallel with the surface that would be described by a line extending from or past the carrier deck to the slack controlling guide to which reference will be later made. Owing to the varying angles at which the yarn *b* draws by the carrier, the downturn is made of varying depth or extent.

To engage the carriers there are drivers 20 mounted on the driving plate 6, each of circular arcal form, mounted in a track or groove of similar form. The engaging ends of these drivers are beveled (see Fig. 6) or conformed to the surface of the down-turned deck portion aforesaid, so that the least possible movement shall be required to engage the drivers with the carriers. These are operated from a cam 21, see Figs. 3, 4 and 6, secured to the carrier frame 5. Engaging the groove 22 of this cam is a roll 23, carried on an arm 24 which is secured in turn to one of the drivers 20. A series of these drivers is so coupled together that the whole series is controlled by one roll 23, as, for example, by the segmental racks 25, 25. The action of this mechanism is to cause the drivers to alternately engage the carriers by one or the other of the apertures 19^a and 19^b aforesaid, so that a yarn may pass the drivers without obstruction or interference.

The mode of coupling, as well as the mode of action of the drivers in engaging the carriers and passing the lower yarns, has all been fully disclosed in our prior pending application, and should require no further explanation.

Carried by each driver is the switch 26 which, in Fig. 4, is shown in two positions. 26 and 26^a. When in position 26 the switch is thrown outward and closes or obstructs the slit 27, so that the yarn is engaged by the inclined edge of the switch, rides over it onto the outer edge 29 of the carrier deck and travels outward around the yarn supply carried by said carrier.

26^a shows the position of the switch withdrawn, leaving the slit 27 open so the yarn can travel into it and inwardly around the yarn supply on the carrier.

In brief résumé, then, we have two sets of supplies posed axially perpendicular to each other (considered when the two sets register), each delivering yarns to a substan-

tially common point of convergence, and working conjointly are drivers operating substantially in a common horizontal plane, switches or yarn deflectors likewise operating in a horizontal plane; and, further, it should be noted that the carrier track is a flat track, albeit sectional.

The common point of convergence for the yarns is most clearly shown in Fig. 17, and is practically the braiding point. We say practically, because the position of the latter is liable to a slight fluctuation, depending on the rate of braiding, rate of take-up or winding of the material braided and variation of thickness of yarn entering into the braid. Because of this, we employ an abutment 28, the same being a mushroom or substantially umbrella-shaped member, supported axially of the machine and on an extension 2^a of the post 2, and also positioned so as to limit the downward deflection of the yarns due to any downward tendency of the braiding point.

The axes of the supplies A are so inclined that the axial lines pass substantially tangent to the surface of the abutment 28. At the top of each of the supplies A is a guide 30 which is positioned enough eccentric to the axis of the supply to raise its yarn from the abutment. This permits the yarn *b* from the supplies B to pass between the yarn *a* of the supply A and the abutment without drag and abrasion of the two yarns. In order that the yarn *b* shall not drag on the abutment, the latter is rotatable, its bearing being formed by a sleeve 28^a turning on the stud 28^b, the latter turned down or chambered between the ends. The abutment 28 will be inductively rotated by the contact of the revolving yarns in their travel. By this rotative engagement the frictional resistance to travel of the yarns is minimized, thereby reducing liability to abrasion and breakage, and tending to a better braided product.

The tendency of the braiding point to rise, as well as of the braided product to vibrate, is overcome by the gatherer, so-called, 32. We have made this in novel fashion as a circular plate, rotatable about the axis of the stem 33 and adjustable in varying positions, both rotatively and vertically, by the set screw 34, Figs. 9 and 10. The plate is pierced with a circular sequence of holes of different size, to accommodate different sizes of braid.

The bearing 35 for the stem 33 in the main frame is so located, eccentric to the line of braiding, that each and every hole can be rotated into the braiding line to receive and gather the braid as formed. The triangular projection 35^a of the bearing 35 serves as a pointer or marker to set the holes by.

From the gatherer 32 the braid passes to the take-up rolls 36 and 37, which have a novel arrangement. Referring to Figs. 11 and 12, observe that the rolls aforesaid are "over-hanging"—*i. e.* not between but entirely outside of and beyond their bearings, as shown particularly in Fig. 11. The lower roll 36 with its gear 38, is on the driving shaft 39 of the take-up, which shaft has bearing in a fixed pedestal 40.

The upper roll 37 and its gear 41 are on a short connecting shaft 42 which, bearing in the yoke 43, swings from the horizontal arms 44 of the pedestal 40. A spring 45 holds the rolls 36 and 37 together under elastic tension, which tension is adjustably variable by the screw 46 and thumb nut 47. This arrangement is distinctly advantageous as braid can, at any distance from its end, be introduced into these open side rolls, whereas with housed rolls (*i. e.* rolls having bearings on both sides) the end itself must first be introduced between the rolls and then the requisite amount or length rolled through to connect with the take-up or whatever is desired. Further, this construction maintains the rolls and their shafts parallel at all times, variation in depth of mesh of gears admitting variation of distance between the rolls.

The take-up is of a known variety and therefore not subject for detailed description, but the mode of driving and controlling the take-up devices is novel.

48 is the main shaft of the machine (see Figs. 1 and 2), mounted on which is the bevel gear 49. Concentric with the shaft 48 is mounted the arm 50 which carries a shaft 51, at the lower end of which is a bevel gear 52 meshing with the bevel gear 49. At the upper end of the shaft 51 is a worm 53 that meshes with a worm gear 54 on the shaft 39. The arm 50 has at its upper end a bearing 55 bearing on the bracket 56 in which the shaft 39 has a bearing. By the bolt 55^a extending through a hole in the bearing 55, and a slot in the bracket 56, the arm 50 can be locked in any desired position to adjust the worm 53 to different diameters of worm gears to vary the rate of take-up. The arm 50 is preferably mounted on the bearing of the shaft 48, so said arm shall not be subjected to wear due to the rotation of said shaft.

The main driving devices are in some degree similar to those of the machine of our pending application, but possess novel features of merit. The carrier frame 5 and the driving plate 6 are oppositely rotated about the post 2. The driving plate 6 is secured to a sleeve 57 which carries at its bottom end a bevel gear 58.

The carrier plate 5 has a long sleeve hub 59 which has its rotative bearing on the sleeve 57, and similar to the latter has a bevel gear 60 attached, and in such position and relation to the gear 58 that both are con-

currently rotated in opposite directions by the gear 61 on the main shaft 48. To take the thrust of the carrier plate 5 and the driving plate 6, ball bearings are introduced as shown in Fig. 3.

Secured to the main frame 62 of the machine is the ball race 63 and attached to the gear 58 is a corresponding race 64. Interposed between the two races is the ball cage 65 holding balls 66.

The gear 58, in addition to being rotatively secured to the sleeve 57, abuts a shoulder 67 which prevents the sleeve 57 slipping through the gear 58 impelled by the weight of the driving plate and the parts which it carries. Superimposed upon the body of the gear 58 is a third ball race 68 on which is a ball cage 69 with balls 70, and engaging said balls is a fourth ball race 71 on which rests the hub 59 of the carrier frame 5. This fourth ball race is secured to said hub 59 by the pin 72.

The gear 60 is preferably secured to the hub 59 by a key 73, and the gear 58 to the sleeve 57 by a key 74.

The main shaft 48 is mounted preferably in a bearing 75 of the pedestal 76 and a bearing 77 of a pedestal 78, and at its outer end has tight and loose pulleys 79 and 80, by which the action of the machine is effected or is discontinued. This control is effected through the belt shipper fork 81, secured to the shipper rod 82, Figs. 3, 14 and 15, which in turn has a bearing 83 on the pedestal 78 and a bearing 84 on the pedestal 85. Secured to the end of the shipper rod is the handle 86, at one end of the bearing 84, and on said shipper rod at the opposite side of the bearing 84 is the stop collar 87 to limit the extent of movement of said shipper rod.

Adjacent the stop collar 87 is a lock notch or shoulder 88 on the shipper rod 82 Figs. 13, 14 and 15. This shoulder 88 is engaged by a rocking detent 89 which; by such engagement, resists the tendency of the spring 90 (see Fig. 1) to throw, by the shipper fork 81, the driving belt onto the loose pulley 80.

The detent 89 is part of a bell crank lever having a vertical arm 91, which bell crank is rockably mounted in the bearing 92 of the pedestal 85. The connected handle 93 serves to operate the detent 89 manually to stop the machine.

In order that the stopping of the machine shall be prompt, to prevent the in-running of broken ends, preventing further breakage and to insure rapid operation without delays in stopping, and further to prevent damage to the yarns or fabric in case of breakage or other accident, we employ the brake system now described.

The carrier frame 5 and driving plate 6 are provided with brake seats 94 and 95, Figs. 1, 3 and 8, preferably formed as portions of the gears 58 and 60. Engaging these seats are bands 96 and 97. Both bands are secured and operated in the following manner (see Fig. 8). To the ends of each band are secured blocks 98 and 99. Connected with the block 98 is a cam lever 100 which is rockable about the pin 101 in the rockable arm 102. The other block 99 is connected with the cam lever 100 by the link 103 which has at 104 provision for micrometer adjustment to regulate the degree of friction of the brakes.

Upon the shipper rod 82 is a projection or pin 105 adapted to engage the cam surface or incline 106 when moved in the direction of the arrow *c*, as it is under action of the spring 90. Such engagement causes the cam lever 100 to swing in the direction of the arrow *d* and constrict the brake band on its seat, thereby stopping the member of which the seat is a part. As the same action occurs with both bands, and concurrently, further description is not required, except to note that the relative arrangement of parts for one band with respect to that for the other is reversed to accommodate the opposite rotation of the gears 58 and 60 and their related parts.

Means have been set forth for manually controlling the starting and stopping of the machine, but more essential is the automatic control, by the yarns, of the stopping, as, for example, when any one of the yarn supplies is exhausted or when any one of the yarns is broken or unduly slack.

Mounted on the carrier frame 5 is a longitudinally slidable pin 107 (see Fig. 14) beveled at its upper end 108 and also at its lower end 109. The lower end 109 is in such position that if the pin projects downwardly a sufficient distance, it will engage the arm 91 of the bell crank lever above referred to, move it, and thereby effect the stopping of the machine, in the manner before explained. The pin 107 is operated by means about to be particularized, by each or any of the supplies of the upper bank or set. Adjacent each supply and traveling with it is the device shown in section in Fig. 13, consisting of a tube 110 having a longitudinal side slot, a guide 111 at the top of the tube and suitably secured thereto, a slidable sleeve 112, a second guide or loop 113, and a pin or projection 114, the two latter being secured to the sleeve.

The pin 114 shows more clearly in Fig. 14, where the relation of this device to the supplies is indicated. The yarn *a* draws from the supply package A through the guide 111 and thence through the loop guide 113 and thence upward to the braiding. The loop guide 113 is constituently integral with the pin 114, preferably made in one piece with it. Obviously, when the yarn *a* is intact and under tension of braiding, the

pin 114 is drawn up and withheld from engagement with the pin 107. When, however, the pin 114 is not held up by the yarn, because the latter is exhausted, broken or become unduly slack, it engages the beveled top end of the pin 107, forcing it down and causing it to engage the bell crank arm 91, to raise the detent 89 and release the belt shifter, causing the machine to stop, as described. But there is only one pin 107 and it rotates with the carrier frame 5 and as exhaustion, breakage or slack of the yarn may occur when the pin 107 is not near the arm 91, the following provision is made: In the side of the pin 107 are cut two notches 115 with either of which may engage a spring 116. This is preferably a flat spring secured to one of the bearings 117 and 118. The tension of the spring is such as to permit easy shifting of the pin 107, and the form of its end and shape of the notches 115 such as to retain the pin 107 in whatever position to which it is shifted, and also complete said shifting after having been started by other agencies. If then the pin 107 should be forced down at a point, say diametrically opposite the bell crank arm 91, the said pin 107 will stay down until said bell crank arm 91 has been engaged and operated. But the bell crank arm 91 has a limited movement, only sufficient to release the shipper rod 82. It also has a beveled extremity 119 which engages the lower beveled end of the pin 107, so that when the bell crank reaches the extent of its movement, the reaction of its resistance is communicated through the beveled extremities 109 and 119 aforesaid, and the pin 97 is thereby replaced in its neutral position out of range of engagement with the arm 91.

The movement of the pin 107 is only initiated by either the pin 114 or the arm 91. The relation of the spring 116 and the notches 115 is such that the pin 114 or the arm 91 need only move the pin 97 sufficiently to pass the high point 120 that is between the notches, past the formed end of the spring 116, and the latter, by wedging action, completes the movement.

To insure action of the pin 114, we prefer to employ a light spring 121 (Fig. 13) which is interposed between what we term the piston 122 and the plunger head 123. The piston 122 is connected with the sleeve 112, by the screw 124, which slides in a longitudinal slot in the side of the tube 110. Embodied with this device is the tension device, which is of a usual form: viz:—a brake shoe 125, engaging the periphery of the disk 126, which is a part of the supply holder. But we apply and regulate elastic pressure of this brake shoe in a novel manner and for a further purpose.

The guide 111 is secured in a solid plug, or cap 127, which in turn, is secured to the tube 110. Within said tube, and between the plug 127 and the plunger head 123 is the spring 128, which presses downward the plunger 129.

The lower end of the plunger 129 is beveled, and engages a correspondingly beveled sided, or V notch in the stem 130 of the brake shoe 125. The extremity of the plunger 129, and the brake stem 130, are therefore engaged wedgewise, so that the action of the spring 128 downward, is transmitted laterally to the brake stem 130, and forces the brake shoe 125 against the disk 126.

The spring 128 is materially heavier than the spring 121, so that the latter has practically a full range of movement without affecting the brake action; but should a resistance to delivery of the yarn occur, so great as to render breakage liable under the existing tension, this resistance, will cause the spring 121, to close entirely on itself. Then compression of the spring 128 will begin, permitting the plunger 129 to be withdrawn from the brake stem 130 by the yarn, acting through the loop guide 113, the sleeve 112 to which it is secured, and the piston 122 with which it is connected. This relieves the tension action of the brake shoe 125 on the disk 126, and permits free rotation of the supply. In other words, the spring 128 serves only to control or modify the tension, and the spring 121 serves only to control the pin 114, and insure its engagement with the pin 107 when released by the yarn.

The stop and tension devices for the lower supplies B are similar in construction and arrangement to those for the supplies A, save in that there is no rod 107 or its equivalent. The rod 114 engages directly with a projection 141, or a part carried thereby, Figs. 14 and 15, from the rod 142 on which the detent 89 is mounted. This projection is preferably in the form of a wire extending through an opening in the bearing 92 of the pedestal 85 and mounted at the top of the wire is a flat spring 143 which is sufficiently rigid to cause the tilting of the rod 142 to release the detent 89, when engaged by the rod 114, but resilient enough to yield to allow the rod 114 to pass by without hindrance.

The supplies B have a spring take-up, or slack controller, embodied in an arm 132, Figs. 16 and 17, to which is secured a staple 133, on which is a light coiled spring 134, which extends around the loop of the staple and along both legs thereof—see Fig. 16. Sliding on the staple is a guide 135 which tends, under action of the spring 134 aforesaid, toward the arm 132. The function of the slack controller is to yield when the yarn *b* passes over or under the carrier deck of the supply A, to compensate for the extra yarn taken up by the deflection; or, in other

words, yield the requisite yarn to pass said carrier deck without withdrawing an excess from the supply.

The position of the take-up device is such that the yarn *b* passes from it to the braiding point in a line of direction which is substantially coincident with the path of travel of the axis of the supplies A, but depressed a slight amount, so that the line of draft of the yarn *b* is such that, if not diverted by the switch above referred to, the said yarn would always travel below, or radially within the supplies A—viz: through the slits 27.

The yarns *b* from the lower supplies B pass therefrom to the guides 111, thence to the loop guides 113, thence to the take-up 135, and from there, by the supplies A, to the abutment 28, where they enter the braid.

To insure free passage over the supplies A, the latter have at their upper ends caps or heads 136 with highly polished edges, over which the yarns *b* pass with the least possible resistance. Further, the cap protects the supplies A from abrasion and also insures a constant angle of convergence of the yarns *b*. Without this provision, the said angle would vary as the supply A diminishes in diameter. The caps, while removable from the supply spindles, are non-rotatable, being rotatively fixed by means of the guide 30 which, by the portion 30^a, engages the recess or slot 30^b, Fig. 13, in the supply spindle. This not only guarantees the position of the guide 30, but also sustains the cap 136, preventing it from riding on the yarn supply and causing frictional resistance to the yarn delivery. The sleeve 136^a centralizes the cap so that the wedging coaction of the spindle and guide portion 30^a cannot displace the cap laterally.

The yarns *a* pass directly from the loop guides 113, through the guide 30, previously mentioned, to the braiding. This guide is a wire loop secured to the cap 136, and in such position that the yarn *a* is led to the braiding therefrom in a line slightly above the path of travel of the axis of the supplies A, as previously indicated. Attention is also directed to the relation of the yarn guiding system for the yarns *a*, to those of the yarns *b*. The latter, as they travel over or under the supplies A, travel in a substantially lenticularly conical path, and the guiding devices for the yarns *a* are entirely within this path, so there is no interference of the yarns *a* with the yarns *b*.

Because of the eccentric position of the guides 30, under normal conditions, with uniform yarns and correct correlation of rate of take-up to rate of braiding, the yarns *b* pass above and below the yarns *a* without touching the latter. If conditions are abnormal, this relation of the parts relieves the effects of the abnormality.

For the protection of the machine and insurance of rapid working, unique provision is made to prevent wedging and jamming of the carriers on their track, due to loose ends of yarn being forced between the carriers and their track. To consummate this, the leading end 138 of the carrier runner is finished with a beveled edge, and the ends 140 of the track sections, which meet the carriers as they revolve, are formed with a shearing edge, so that, should an end of yarn break, slacken or otherwise become liable to be forced between the carrier runner and its track, it will instead be cut off.

Guides for the yarns *b* are provided in the staple or hair-pin shaped pieces 144 Fig. 17 which serve to restrict the yarns' movement in the direction of movement of the carriers 7, whose decks 9 engage said yarns to deflect them. The guides 144 are, in effect, abutments which hold the yarns *b* up to the wedging or deflecting action of said carrier decks. The said guides 144 are inclined to the axis of the machine so that when registering with the decks 9, they are parallel to them. There is great merit in this relation, because it insures that, whether the yarns *b* are deflected inwardly or outwardly around the supplies A, their deflection in the direction of movement of the carriers is uniform.

We do not here claim the construction of carrier herein set forth as the same is the subject-matter of a separate application about to be filed.

Having now fully described our invention, we claim:

1. In a braiding machine, the combination with two oppositely rotating heads, and a track of separate, segmental sections of flat circular plane attached to one of the heads, of one set of yarn supplies axially inclined toward a common point of convergence, carriers for said supplies, movably supported on the track and driven by the other head and having lenticularly formed decks inclined to the plane of the track, a second set of supplies downwardly beyond and closely adjacent the supplies of the first set, and switches movable to shift the yarn of the second set of supplies in position to be caught and deflected by the carrier decks.

2. In a braiding machine, the combination with means for interlacing yarns to form a braid, of a member 28 rotatable by contact with engaging yarns passing over it, for the purpose specified.

3. In a braiding machine, the combination with carriers having their leading ends formed to cut, of a sectional track for said carriers whose individual sections are adapted to engage said carriers for the purpose specified.

4. In a braiding machine, the combination with carriers, of track sections therefor, each

having a shear formed end to coact with said carriers for the purpose specified.

5. In a braiding machine, the combination with two sets of supplies revoluble in opposite directions, of means to revolve the supplies, stopping devices and individual brakes for the driving head of each set of supplies.

6. In a braiding machine, the combination with a flat circular track, of carriers having runners formed to embrace the track and deck portions which extend across and below the plane of the track, and means for driving said carriers.

7. In a braiding machine, the combination with a flat circular track, of carriers having runners formed to embrace the track, and deck portions inclined to and crossing and extending below the plane of the track, and means to drive the carriers at two alternate points in the downward extending portions of their decks for the purpose specified.

8. In a controlling device for braiding machines, the combination with braiding devices, tension devices and stopping devices, of a spring actuated stop projection to control the stopping devices, a spring actuated plunger to control the tension devices, and a yarn controlled member to actuate the stopping devices and tension devices.

9. In a controlling device for braiding machines, the combination with stopping devices, a detent therefor, and yarn controlled means to effect action of said stopping devices, of an instrumentality movable by the yarn controlled means to engage said detent for the purpose specified and after such engagement acted upon by said detent to withdraw to its normal position.

10. In a controlling device for braiding machines, the combination with a plurality of carriers with their yarn supplies, a stop pin on each carrier controlled in position by the yarn from its supply, stop devices controlling the action of the carriers and a detent therefor, of a pin movable from one of two alternative positions by the stop pin aforesaid, and from the other by the detent aforesaid and a spring to complete the movement initiated by said stop pin or detent, from one of said positions to the other.

11. In a controlling device for braiding machines, the combination with a yarn supply and a stop pin 114 controlled in position by the yarn from said supply, stop devices for controlling the machine and a detent for controlling said stop devices, of the member 107 intermediate said pin and detent for the purpose specified.

12. In a braiding machine, the combination of carriers, driving devices to operate the carriers and controlling means therefor, including a detent, with a yarn controlled stop pin 114 and a member 107 intermediate the stop pin 114 and said detent, in the manner and for the purpose specified:

13. In a controlling device for braiding machines, the combination with a yarn supply, stop devices and tension device, of a slidable member whose position is determined by a yarn, having a projection to actuate the stop devices, a spring to insure actuation of the stop devices by said projection; and a member controlling the tension device and moved by the slidable member aforesaid to vary the tension, all in the manner and for the purpose specified.

14. In a controlling device for braiding machines, the combination with a yarn supply, stop devices and tension devices, of a slidable member whose position is determined by a yarn, having a projection to actuate the stop devices, a relatively light spring to overcome the friction of the slidable member when the latter is released by its yarn and insure actuation of the stopping devices by said projection, a member controlling the tension device and moved by the sliding member aforesaid to vary the tension, and a spring of sufficient strength to resist the elastic action of the light spring aforesaid, but having its effect only varied by the positive action of the slidable member, in the manner and for the purpose described.

15. In a controlling device for braiding machines, the combination with a yarn supply, stop devices and tension devices, of the tube 110 and head 127, the headed plunger 129 to control the tension devices, and a relatively heavy spring 128 interposed between the tube head and plunger head, the piston 122 within the tube, an exterior sleeve 112 connected therewith having a projection 114 to actuate the stop devices, and the light spring 121 between the plunger and piston, all in the manner and for the purpose specified.

16. In a braiding machine, the combination with oppositely revolving sets of yarn supplies, a carrier frame 5 supporting both sets and revolving the lower, a driving plate 6 revolving the upper set of supplies on the carrier frame, and having a sleeve 57, a bevel gear 59 on the carrier frame and a bevel gear 58 on the sleeve 57 of the driving plate, each formed with brake seats, brakes 96 and 97 engaging said seats, levers 100 to tighten the brakes, means to revolve the gears and means to discontinue said revolution and concurrently engage the levers 100 to set the brakes, in the manner and for the purpose specified.

17. In a controlling device for braiding machines, the combination with the tube 110 and guide 111 secured thereto, of a slidable headed plunger operative within said tube and a spring within the tube acting

upon the head of said plunger, a piston slidable within the tube independently of the plunger, a spring acting between the plunger head and the piston, an exterior sleeve slidable on the tube and a loop guide and stop pin on said sleeve, all in the manner and for the purpose specified.

18. In a braiding machine, the combination with the oppositely rotating carrier frame 5 and the driving plate 6 having brake seats, means for rotating the members 5 and 6 and means for discontinuing such rotation, of adjustable brakes engaging said brake seats, cam levers to actuate the brakes, and means connected with the discontinuing means aforesaid to engage the cam levers in the manner and for the purpose specified.

19. In a braiding machine, the combination with yarn supplies, braiding means and a take-up, of a main driving shaft 48, a gear on said shaft and an arm 50 movable about said shaft, a second shaft 51 carried by said arm, a gear 52 engaging the gear 49 and at the opposite end of the shaft 51, a worm 53, a take-up shaft 39 having a worm gear 54 to engage the worm 53 and means to secure the arm 50 in alternative positions to accommodate an interchange of the worm gear 54, as specified.

20. In a yarn directing means for a braiding machine, the combination with yarn supplies delivering yarns to a braiding point, of a member 28 adjacent the braiding point, and removable supply caps each having a guide extending upward from its top surface, within the confines of that surface but eccentric thereto, to direct the yarn passing through said guide just clear of the member 28.

21. In a braiding machine, the combination with two sets of yarn supplies with one set of supplies arranged with their axes inclined to a common point of convergence, of two oppositely rotating heads for carrying said supplies, a flat, circular, segmental track secured to one of the heads, carriers with lenticularly formed decks and runners adapted to travel on the track and supporting one set of supplies, guides to maintain the yarns of the other set of supplies radially within the points of the carrier decks, and switches operated to move radially from the axis of the machine to act in connection with the carrier decks to shift the yarns of the second set of supplies into position to be caught and deflected by said decks.

22. In a braiding machine, the combination with carriers of means for automatically severing yarns for the purpose specified.

23. In a braiding machine, the combination with carriers revoluble about a given axis and carrying yarn supplies that are inclined to that axis, of a flat, circular track for the carriers disposed in a plane perpendicular to the axis aforesaid, and arcal drivers moved in a plane substantially perpendicular to the axis of revolution aforesaid.

24. In a braiding machine, the combination with carriers, of track sections therefor, each provided with means for severing the free yarn.

25. In a braiding machine, the combination with yarn carriers, decks therefor having downturned portions which parallel the path of travel of the yarn passing by them and drivers for the carriers having ends conforming to the downturned portion aforesaid.

In testimony whereof we affix our signatures in presence of two witnesses.

EDWARD F. PARKS.
SIMON W. WARDWELL.

Witnesses:
ARTHUR I. HARVEY,
ROBERT G. ROWLEY.