No. 814,711. PATENTED MAR. 13, 1906.

H. W. LARSSON.

BRAIDING MACHINE.

APPLICATION FILED SEPT. 10, 1903.

3 SHEETS—SHEET 1.

Fig. 1.

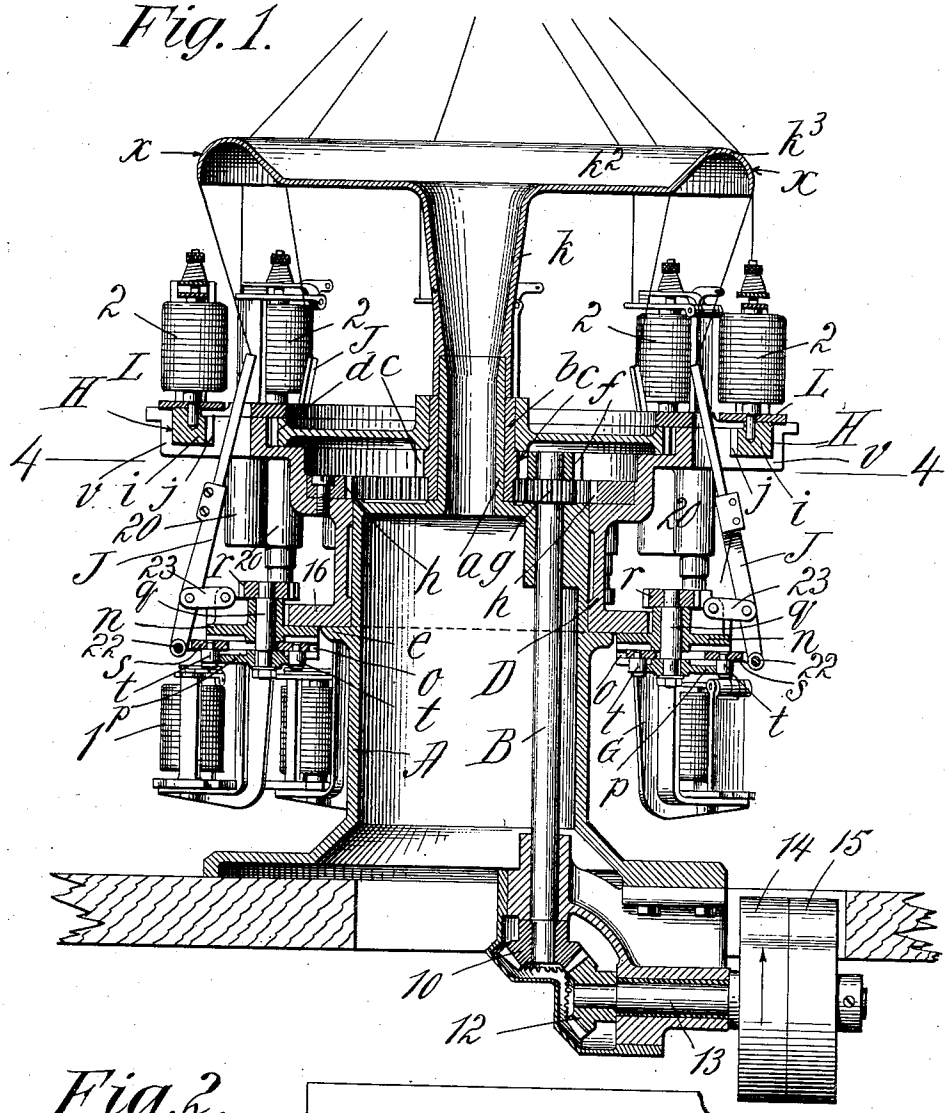
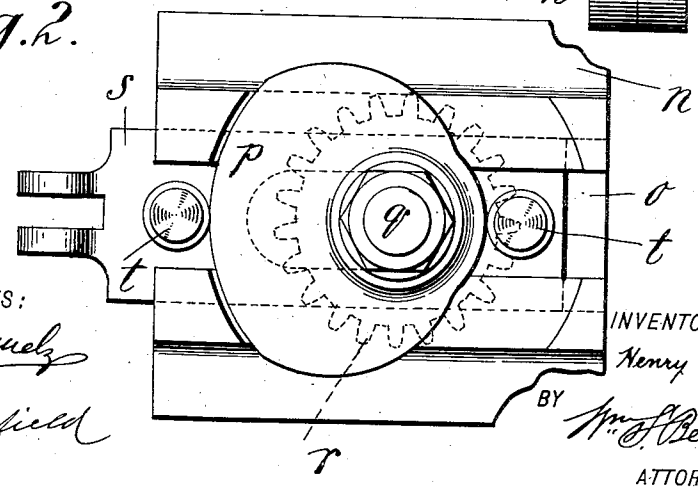


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3

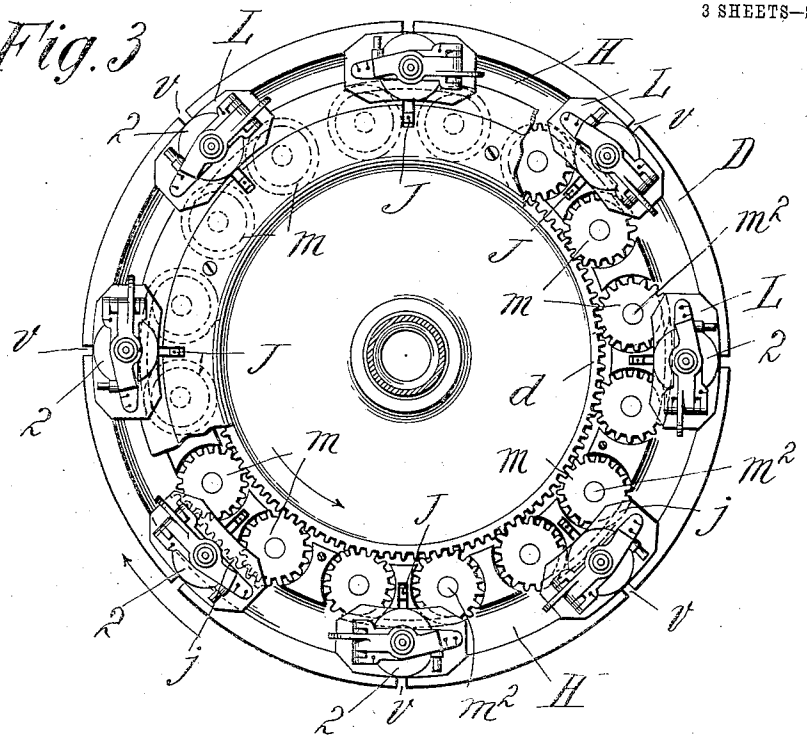
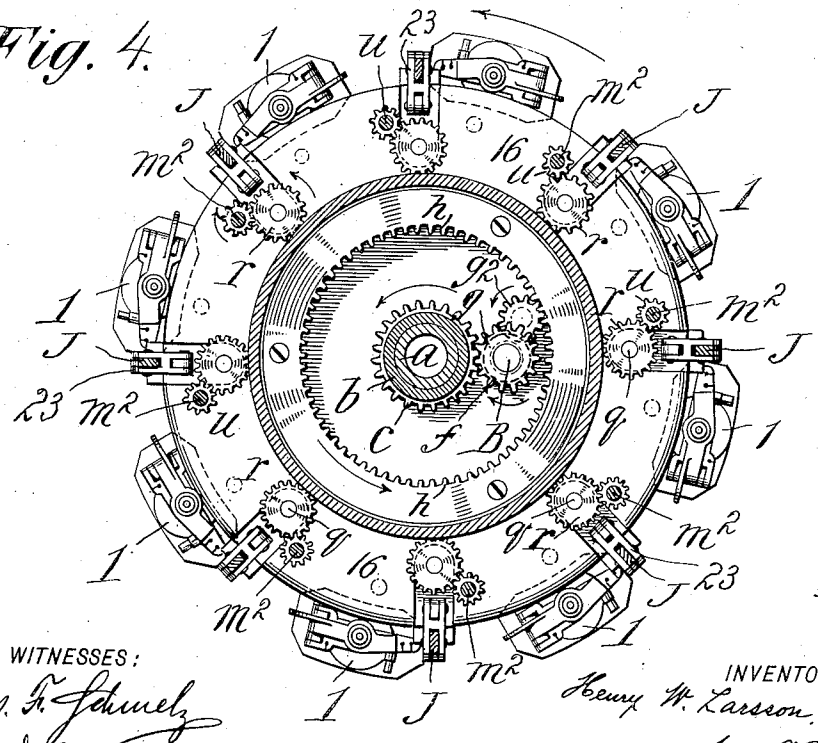


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 6.

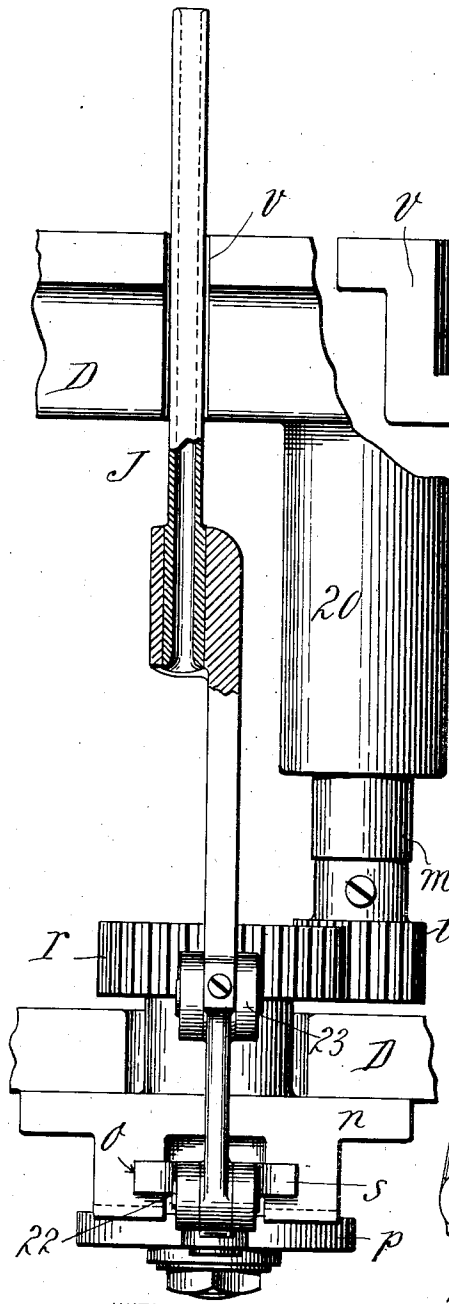
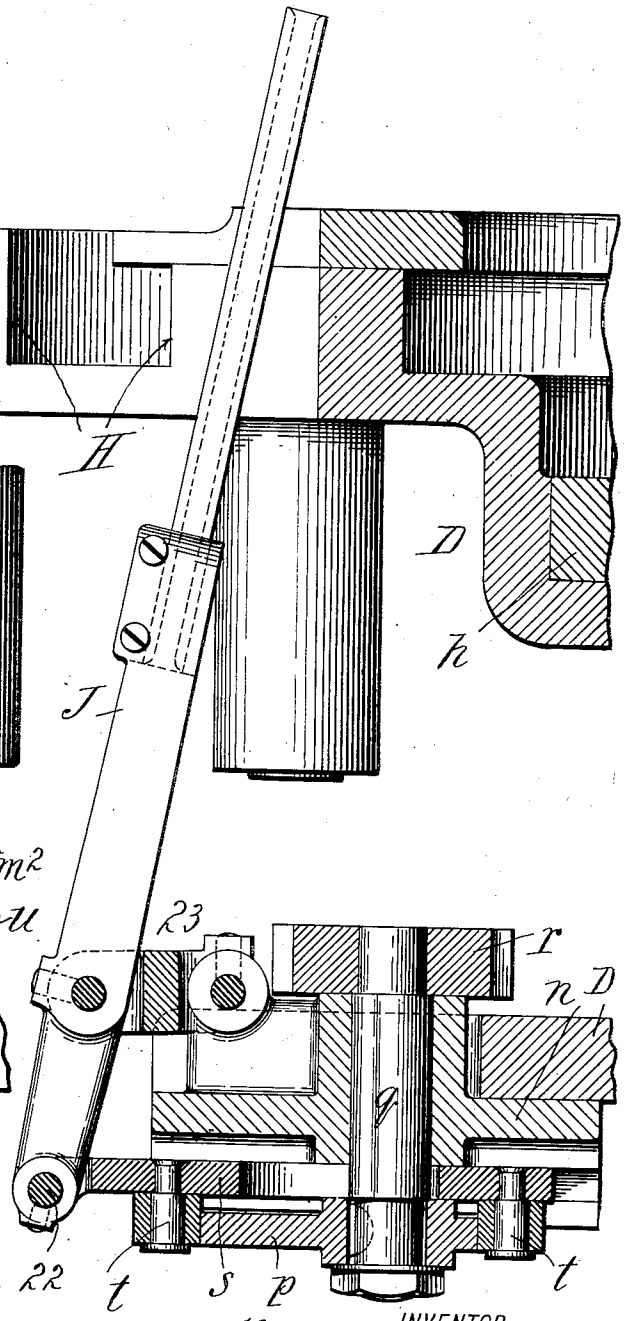


Fig. 5.



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HENRY W. LARSSON, OF SPRINGFIELD, MASSACHUSETTS.

BRAIDING-MACHINE.

No. 814,711. Specification of Letters Patent. Patented March 13, 1906.

Application filed September 10, 1903. Serial No. 172,685.

To all whom it may concern:

Be it known that I, HENRY W. LARSSON, a citizen of the United States of America, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Braiding-Machines, of which the following is a full, clear, and exact description.

This invention relates to improvements in braiding-machines of a type in which there are two sets of bobbins and carriers therefor revolved in opposite directions and a thread-guide for alternately moving the thread from one set of bobbins to opposite sides of the threads running from the other set of bobbins, whereby the proper disposition of the threads for laying them in for plaiting or braiding is accomplished.

The objects of this invention are to produce a braiding-machine of a simplified character susceptible of being constructed on approved mechanical principles, one in which there is necessary but a minimum of parts, and which in operation is almost noiseless, because of the easy motions produced therein, and one in which a maximum number of bobbins and correspondingly-increased amount of thread may be carried at an unusually high speed, whereby the productiveness of the machine is unusually large.

The invention consists in constructions and organizations of parts, all substantially as hereinafter fully described, and set forth in the claims.

The improved braiding-machine is illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical sectional view of the complete machine. Fig. 2 is a plan view of the under side of one of the individual devices comprised in the machine, hereinafter more particularly referred to. Fig. 3 is a plan view of the machine as seen below the annular cap, certain parts being broken away to disclose positively certain of the details of construction. Fig. 4 is a horizontal sectional view as taken on the line 4 4, Fig. 1, showing, mostly in plan view, the parts below such plane of section. Fig. 5 is a vertical sectional view, on a very much enlarged scale, of the operating mechanism for one of the duplicated thread-carriers, Fig. 6 being a front elevation of the same as seen at right angles thereto.

Similar characters of reference indicate corresponding parts in all of the views.

In the drawings, A represents a standard of circular form constructed hollow having concentrically at its upper end a tubular extension *a*, fitted on which is a sleeve or bushing *b*, which constitutes the hub for a spur gear-wheel *c* and having formed on or attached to it a large spur gear-wheel *d*.

B may be termed the "power-shaft," the same being vertically journaled within the standard A, having at its upper end a spur-pinion *f*, which meshes into the aforementioned spur gear-wheel *c*, and having fixed thereon next thereunder a slightly-smaller spur-pinion *g*, which through an intermediate spur-pinion g^2 has a driving engagement with an internal gear-wheel *h*, located within a cup-shaped portion of an annular body D, which is fitted and supported for rotation about and upon the cylindrical standard A, the latter having the supporting-flange *e* for said annular body. At the lower end of the power-shaft it is provided with a bevel-gear 10, meshing into which is a bevel-gear 12, carried on the driving-shaft 13, provided with fixed and loose pulleys 14 and 15.

The aforementioned annular body D has at its lower portion an outwardly-extending flange 16, which constitutes a support for the holders or carriers G for one set of bobbins 1 and for movable guides or carriers J for the threads of such bobbins 1 and also for the mechanisms which respectively impart the successive inward and outward radial movements to said carriers J.

In the outer portion of the upper extremity of the annular body D, which, as shown, is of a double-step form, is an upwardly-opening annular channel or raceway H, in which are closely fitted for sliding movements the blocks *i i*, which constitute the bases of the carriers L for the second set of bobbins 2, this latter set therefore, as seen, being arranged for revoluble motions at an upper part of the machine, while the aforementioned set of bobbins 1, carried by the rotatable annular body D, are disposed in a considerably lower plane.

Each of the blocks or bases *i* of the bobbin-carriers L, which is of arc shape to conform to the annular raceway H therefor, is provided with inwardly-disposed rack-teeth *j*, inwardly and concentrically disposed within which and rotatable in a common horizontal

plane are a series of spur-pinions *m m*, the axis shafts or studs therefor and on which they are affixed having vertical journal-bearings through the upper and outwardly-flanged portion of the annular body D, next within the rack-toothed bobbin-carrier bases, and all of the said pinions *m* are in constant mesh with the aforementioned comparatively large spur gear-wheel *d*, which, as shown and may be discerned from its driving connections heretofore pointed out, is rotatable in a direction the same as that of the annular body, so that through the intermediary of said pinions *m m* the rack-toothed bobbin-carriers will be caused to move, following each other around in a horizontal circular path in a reversed direction to that of the movement of said annular body—that is to say, when the machine is running the lower set of bobbins 1 will have their revoluble movements in a circular path in the direction of the arrow, Fig. 4, while the upper set of bobbins 2 will have their revoluble movements in the circular path in the direction of the outer arrow shown on Fig. 3.

The sets of equally-spaced pinions *m m* are in such proximity and the relative lengths of the racks *j* on the bobbin-carriers are such that such racks will never be out of engagement with some pair of the pinions *m*.

The orbits or paths of movements of the upper and lower sets of bobbins are, in the machines as I have designed it and as it is here shown, of about equal diameter.

Supported as an extension of the upstanding tubular portion *a* of the cylindrical standard is a tubular neck *k*, having an annular flange k^2 marginally upwardly rounded, as indicated at k^8, over which all of the threads from both sets of bobbins 1 and 2 pass and are convergently inwardly continued to the axial center of the machine, where they constitute the plaiting or braiding, such threads under the operation of the machine alternately crossing each other at the outer smooth surface of this part $k\,k^2\,k^3$, which may be termed the "cap." As shown, the periphery of the thread-supporting cap is in substantial vertical alinement with the path of movement of the upper set of bobbins. By this construction all of the threads have a common support concentric to the point where the braid is formed. Hence that portion of the thread which lies between the edge or periphery of the cap and the braiding-point remains in the same plane, regardless of the movement of the thread-carriers, thus insuring an even braiding. Furthermore, the thread between the cap and the bobbins extends substantially vertically, that from the thread-carriers varying but slightly from this position, so that but a minimum quantity of the thread is maintained unsupported, especially as the cap lies in proximity to the bobbins, thereby forming a sharp angle between the threads when the thread-carriers are in their extremes of movement to prevent any liability of a tangle forming.

Fixtures or brackets *n* are secured at regularly-spaced intervals on the under side of the base-flange 16 of the rotatable body D to have revoluble movements in unison with the said body D, each said fixture having in the under portion thereof a radially-alined slideway *o*, movable in which is a slide block or bar *s*, having at opposite portions in the length thereof the roller-studs *t t*, between which is located and against which operates the cam *p*, which is affixed at the lower end of a short shaft *q*, which is vertically journaled through the central portion of the bracket or fixture *n* and has affixed at its upper end a spur-pinion *r*.

The axis-shaft m^2 of every other one of the regularly-spaced pinions *m* at the upper part of the machine, driven by the large spur-gear *d* and which drive around the rack-toothed bobbin-carriers L, is downwardly extended through a journal-boss 20 therefor and is provided at its lower end with a small pinion *u*, which meshes into the pinion *r* on the cam-carrying shaft *q*, so that the travel-imparting means for the upper set of bobbins is utilized as the means for rotating the series of thread-carrier-actuating cams *p*, which are revolubly carried in conjunction with the set of bobbins 1, and the rotation of each cam imparting inward and outward radial movements to the slide *s* secures, therefore, first an outward and then an inward swinging movement to the thread-carrier J, which is seen to be pivoted at 22 at its lower end to the slide *s*, and by link 23 pivotally connected a short distance above the pivot 22 to an ear of the bracket or fixture *n*, the considerable length of the straight upwardly-extended portion of the thread-carrier being tubular, as shown in Figs. 5 and 6, and has free play of movement in slots *v* in the upper outwardly-flanged portion of the annular body D, in which the annular raceway H for the upper set of bobbin-carriers is formed, said slots transversely intersecting said raceway at regularly-spaced intervals, as clearly shown.

The braiding-machine will be usually equipped with a number of bobbins 2 and bobbin-carriers therefor (arranged for revolution in the upper plane) equal to the number of bobbins 1, bobbin-carriers therefor revoluble with the annular carrier in the reverse direction to the circular line of motion of the bobbins 2 and equal in number to the thread-carriers J, which respectively pertain to the bobbins 1, revolve in unison therewith, and have independent radial reciprocatory swinging movements, the upper ends of their tubular thread-guiding portions being, as shown, extended somewhat above the top of the annular body D. In the drawings of the machine which I have constructed, here

shown, there are eight bobbins 2 and as many of the rack-toothed bobbin-carriers therefor and eight of the lower bobbins 1 and as many of the thread-carriers J therefor.

The threads from both the bobbins having been drawn off therefrom, eight carried through the tension devices provided therefor on their respective bobbin-carriers, (the tension devices here incidentally indicated on a small scale constituting the subject-matter of an application for Letters Patent of the United States filed of even date herewith, under Serial No. 172,684,) the threads from the bobbins 1 being carried through the thread-carriers J, such (in the present instance sixteen) threads are carried upwardly to the rounded edge of the cap and then carried convergently to the axial center of the machine and engaged with each other, if a braided cord is to be made, or with the surface of a whip-cable or other object if the machine is to be utilized for laying on a braided textile covering. The machine being then very speedily driven—say at eighty turns a minute to the rotatable annular body D—the lower set of eight bobbins 1 and thread-carriers will be rapidly revolved in a direction toward the right, Fig. 4, in unison with said part D, and the upper set of eight bobbins 2 and the carriers therefor will be just as rapidly revolved to the left, Fig. 3, the carriers and bobbins chasing each other around in the annular trough-like slideway H therefor in the upper step-shaped portion of said annular body D. In conjunction with the relatively reverse revolutions of the bobbins the thread-carriers J swing in proper time outwardly and inwardly in planes radial to the vertical axis of the machine, the threads from the respective bobbins 1 emerging from the upper ends of their tubular portions, the thread-carriers all crossing from points outside of the circle of arrangement of the upper set of bobbins 2 to a position inside of such circle of arrangement, the latter positions of the said thread-carriers being represented in Fig. 1, such movements being repeated in succession so long as the power-shaft continues to be rotated. Each cam p, which actuates its respective thread-carrier, as seen in Fig. 2, is formed with two concentric portions and two working portions, so there will be "dwells" in the motions of the thread-carrier while it is in its inward and its outward positions, and the abruptness of the working portions are such that the thread-carrier will be swung in the radial slot v, which intersects the raceway for the upper set of bobbin-carriers between the times when such carriers reach and are passing across the said slots, also the thread-carriers and the upper set of bobbin-carriers, with their bobbins, will dodge each other at the said slotted portions v of the annular part D. Now, for instance, when the thread-carriers J are inwardly swung, as seen in Fig. 1, right-hand portion particularly, the threads from set of bobbins 1 will be disposed and under proper tension guided within the threads of bobbins 2, both sets of threads leading over and impinging against the cap. Now the rotations of the set of bobbins 2 and the bobbins 1 and thread-carriers J in opposite directions will cause the respectively oppositely-moving threads ultimately converging to the axis of the machine at which the work is done to cross each other at the rounded edge and over the top of the cap, all the eight inwardly-disposed threads of bobbin 1 crossing first under and then over the threads of bobbins 2, the one set of threads slipping alternately over and under the other set of threads at about the level x, Fig. 1, at the rounded rim of the cap, and the threads converging to the working axis are "laid in" tangential to the surface of the part being overlaid by the braiding, or, if a braided cord is being produced, tangential to the central part thereof, and inasmuch as the arrangements of the threads and the motions which they have one relatively to another at the working center of the machine are substantially the same as heretofore produced in braiding machinery, the action or operation of the machine will be undoubtedly understood by all skilled in the art, and it is not deemed necessary to show or describe any means for slowly progressing the "work" so that the braided work will be carried endwise centrally of the machine at a rate of speed proportionate to the progress of the braiding.

Many of the constituents of this machine are interchangeable parts capable of production in large numbers at small expense. The motions of the machine are of such a character that very little detrimental wear results therefrom, and finally worn parts may be quickly replaced. The machine is almost noiseless in its working, and it has been demonstrated that it may be run at an unusually high speed for proportionately great productiveness.

Of course the machines may be constructed with any desired number of bobbins in each set, bobbin-carriers, thread-carriers, and actuating devices being correspondingly multiplied.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a braiding-machine, in combination, two circularly-arranged sets of bobbins in different planes, a rotary support or carrier for one of the sets, and means for revolubly moving the other set in the reverse direction, thread-carriers pertaining to the first set of bobbins pivotally mounted on the support therefor, and revoluble in unison therewith, cams on said support, radially-movable slides actuated by the cams, and operably connected with the thread-carriers.

2. In a braiding-machine, in combination, an annular body or carrier and a set of bobbins 1 mounted thereon in circular arrangement in a horizontal plane, and revoluble in unison therewith, and said body having at an upper part thereof an annular raceway, a set of bobbin-carriers, having bobbins 2 mounted thereon, movable in said raceway, said body furthermore being provided with the radial apertures *v* extending across said raceway, means for turning said annular body in a given direction, and means for reversely revolving the carriers for the set of bobbins 2, a series of reciprocatory thread-carriers pertaining to the first set of bobbins, mounted on the annular body adjacent such bobbins, and having their upper extremities playing through said radial apertures *v*, and a cam for each thread-guide rotatably mounted on and carried by the annular body, and operable on said thread-carriers, for imparting thereto, as they revolve, their inward and outward motions.

3. In a braiding-machine, the combination of the upper and lower sets of bobbins revolubly movable in different planes and in different directions, with a series of thread-carriers pertaining to the first set of bobbins, pivotally mounted for swinging movements in vertical planes radial to the axis of the machine, slides pivotally engaged to a member of each thread-carrier and movable radially to the axis of the machine, rotary cams for actuating said slides, and means for rotating the several cams in unison.

4. In a braiding-machine, the combination of upper and lower sets of bobbins revolubly movable in different planes and in different directions, a circularly-movable support for the lower set of bobbins, a series of thread-carriers pertaining to the lower set of bobbins pivotally mounted on the circularly-movable support therefor, for swinging movements in vertical planes radial to the axis of the machine, said circularly-movable support having a plurality of radially-arranged slideways therein, slides in said ways having oppositely-located studs and connected with said thread-carriers, cams rotatably mounted on said support, disposed between and operable against said studs of the respective slides, and means for imparting the rotary movements to said cams.

5. The annular body having the raceway and the radial slots *v* intersecting same, and carrying therebelow the set of bobbins 1, bobbin-carriers with bobbins 2, movable in said raceway reversely of the motion of said body, slides movable radially in ways which are formed in said body, thread-carriers pivotally connected to fixtures therefor on the body, and also pivotally linked to said slides at points removed from the pivotal connections to the body, the free extremities of said thread-carriers being tubular and extended through said radial slots *v*, cams respectively actuating the slides, and means for rotating all the cams in unison.

6. In a braiding-machine, the combination of the cylindrical standard, the annular body supported for rotation about said standard and having its upper portion formed cup-shaped, and provided therein with an internal gear-wheel affixed thereto, a driving-shaft vertically journaled within the said standard, having at an upper portion thereof a spur gear-wheel in driving connection with said internal gear-wheel, and upper and lower sets of bobbins, the latter being carried on the annular body revolubly in one direction, and the upper set being carried by the upper portion of said annular body and being revoluble in a reversed direction, relatively to said annular body, a series of thread-carriers pertaining to the first set of bobbins, and means for imparting inward and outward swinging movements thereto.

7. In a braiding-machine, the combination of the standard, the annular body having a circular raceway, the set of bobbins 1, mounted on said annular body, a set of bobbin-carriers, fitted for revoluble movements in said raceway, a spur-gear located adjacent an upper part of the annular body and journaled for rotary movements independently thereof, an internal gear affixed to an upper part of the annular body, a power-shaft B, having thereon a gear-wheel, a gear-wheel in mesh with said last-mentioned gear-wheel and connected with said spur-gear, another gear-wheel on said power-shaft and an intermediate gear in mesh therewith and with said internal gear, rack-teeth provided to the several bobbin-carriers in the raceway, and pinions journaled at an upper portion of the said annular body, in mesh with the bobbin-carrier rack-teeth, and with said spur-gear.

8. In a braiding-machine, in combination, the central supporting-standard having an axially-located upwardly-extending portion *a*, and having a spur gear-wheel *c* fitted for rotation around said part *a* and having a larger spur gear-wheel *d* also fitted for rotation thereabout, the annular body D rotatably fitted about said standard having an annular raceway therein and provided with an internal gear-wheel *h*, a set of bobbins 2 and bobbin-carriers therefor movably fitted in said raceway, and having rack-toothed portions, a set of bobbins 1 mounted on said annular body and revoluble therewith, a series of pinions revolubly carried by, and journaled in, said annular body, in mesh with and between said spur gear-wheel *d* and the said racks of the bobbin-carriers, a power-shaft B having a gear-wheel *f* thereon, in mesh with the gear-wheel *c* and through it driving said spur gear-wheel *d* and also having a gear-wheel *g* thereon meshing with which is an intermediate gear-wheel in driving connection with the internal gear-wheel *h*, a series of reciprocatory

thread-carriers carried by said annular body, pertaining to the set of bobbins 1, and means for imparting backward and forward movements thereto.

9. In a braiding-machine, in combination, the annular body rotatably mounted having the annular raceway and associated therewith the spur gear-wheel *d*, and provided with a set of bobbins 1 mounted thereon to be bodily revolved in unison with said annular body, a set of thread-carriers pertaining to said set of bobbins 1 mounted on the annular body for revoluble movement in unison therewith, and also capable of back and forth swinging movements radially relatively thereto, a set of bobbins 2, and bobbin-carriers therefor, movable in said annular raceway and provided with rack-teeth, spaced spur pinion-wheels concentrically journaled at an upper portion of the annular body, between and in mesh with said spur gear-wheel *d* and the rack-teeth of the said bobbin-carriers, and certain of said spur-pinions having shafts m^2 downwardly extended, rotary cams *p* for operating said thread-carriers, in driven connection with the said shafts m^2.

10. In a braiding-machine, in combination, the rotary annular body having the annular raceway in its upper portion, having a set of bobbins 2 and bobbin-carriers individual thereto, movable around in said raceway, said carriers having rack-teeth, and said annular body having mounted thereon a set of bobbins 1, and equipped with a series of slides radially movable having oppositely-located studs *t t*, a series of thread-carriers, pertaining to the set of bobbins 1, bodily carried by the annular body and jointed thereto for radially swinging movements relatively thereto, and connected with said slides, cams *p* located between said studs and having their shafts rotatably carried by said annular body and provided with gear-wheels *r*, a set of spur gear-wheels *m* journaled for rotation at an upper portion of the annular body, in mesh with the rack-teeth of said set of bobbin-carriers, and a number thereof corresponding to the number of the thread-carriers having downwardly-extended shafts, provided at their lower portions with pinion-wheels *u* in mesh with the said gear-wheels *r*, means for imparting rotary movement to the annular body, and means for imparting individual rotary movements to the series of pinions *m*, for the purposes set forth.

11. In a braiding-machine, in combination, the cylindrical standard A provided with the external supporting-flange *e* and having the shaft B vertically journaled therethrough, the annular body D fitted for rotation about the said standard and supported on said flange, having the annular raceway therein, a set of bobbins 2, and bobbin-carriers having rack-teeth at their inner edges and movable in said raceway, a spur gear-wheel *d* rotatable about and relatively to an upper portion of the cylindrical standard, a series of spur-pinions concentrically arranged and journaled at an upper portion of the annular body and between and in mesh with said spur gear-wheel *d* and the rack-teeth of the bobbin-carriers, a set of bobbins 1 circularly arranged on, and movable with, the annular body, a set of thread-carriers supported by, and jointed to, said annular body, pertaining to the set of bobbins 1, means operated by the shaft B for rotating said spur gear-wheel *d*, means operated by the shaft B for rotating the annular body, and means for imparting inward and outward radially swinging movement to said thread-carriers.

12. In a braiding-machine, the combination with the rotatable annular body, sets of bobbins carried thereby and means for revolving said sets in different directions, of thread-carriers pivotally mounted on said body, a continuously-rotating cam for each thread-carrier and a radially-movable slide to transmit motion from each cam to its thread-carrier.

13. In a braiding-machine, the combination with the rotatable annular body, sets of bobbins carried thereby and means for revolving said sets in different directions, of thread-carriers pivotally mounted on said body, a continuously-rotating cam for each thread-carrier to actuate the latter, a shaft geared to each cam and gearing connecting said shaft to the means for revolving the bobbin sets.

14. In a braiding-machine, the combination with the rotatable annular body, sets of bobbins carried thereby and means for revolving said sets in different directions, of thread-carriers pivotally mounted on said body, a continuously-rotating cam for each thread-carrier to actuate the latter, a shaft for each cam, a second shaft geared to the first-named shaft and gearing connecting the second shaft to the means for revolving the bobbin sets.

15. In a braiding-machine, the combination with the rotatable annular body, sets of bobbins carried thereby and means for revolving said sets in different directions, of thread-carriers pivotally mounted on said body, a cam for each carrier mounted on the body for rotation in a horizontal plane, a shaft for each cam, a second shaft geared to the first-named shaft, and gearing connecting the second shaft to the means for revolving the bobbin sets.

Signed by me at Springfield, Massachusetts, in presence of two subscribing witnesses.

HENRY W. LARSSON.

Witnesses:
WM. S. BELLOWS,
A. V. LEAHY.