

[54] **BRAIDING MACHINE WIRE CONTROL**

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[51] Int. Cl. **D04c 3/12; D04c 3/40; D04c 3/24**

[58] Field of Search **87/28-30, 44-48**

[56]

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[57]

ABSTRACT

A machine for braiding wire, yarn or other filaments around a common axis, comprising a first plurality of wire bobbins in an annular array which dispense yarn to the central axis and which array moves in one direction about the axis and a second plurality of wire bobbins in a radially more inward annular array, and each of which dispenses wire to a wire guide that delivers wire to the central axis; the second bobbins and the wire guides move together in the opposite direction around the first bobbins; each wire guide selectively shifts between a position radially outwardly of the first wire bobbins and radially inwardly of the first wire bobbins; the radial shifting motion of the guide means is between alternate first wire bobbins; means for radially shifting the wire guides to coordinate their radial movement with the relative movements of the first wire bobbins.

15 Claims, 7 Drawing Figures

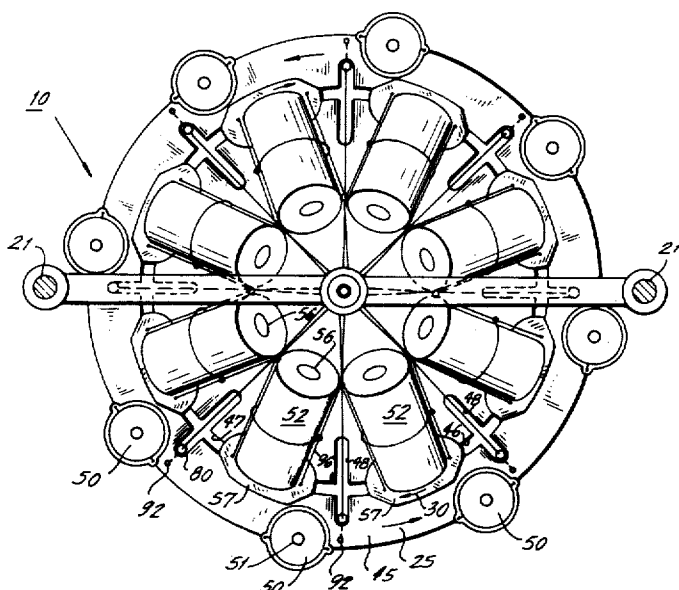


FIG. 1

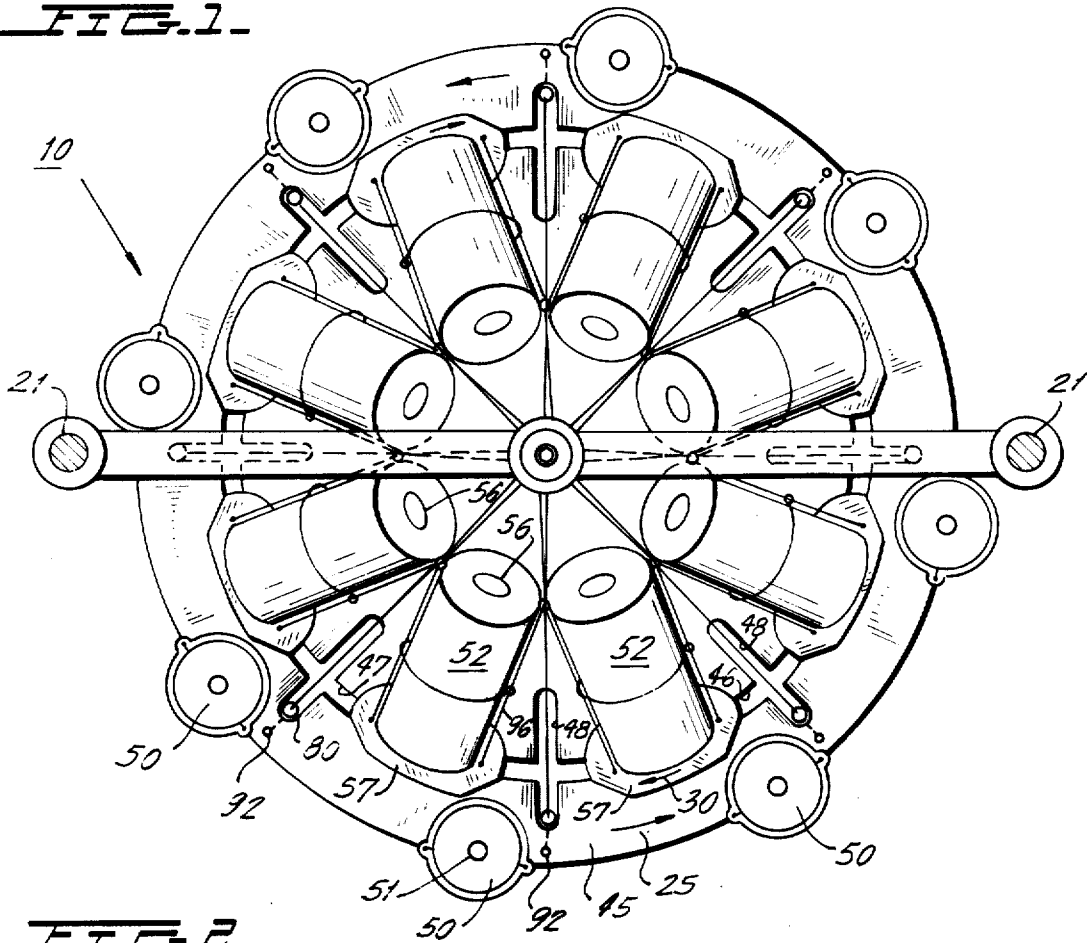


FIG. 2

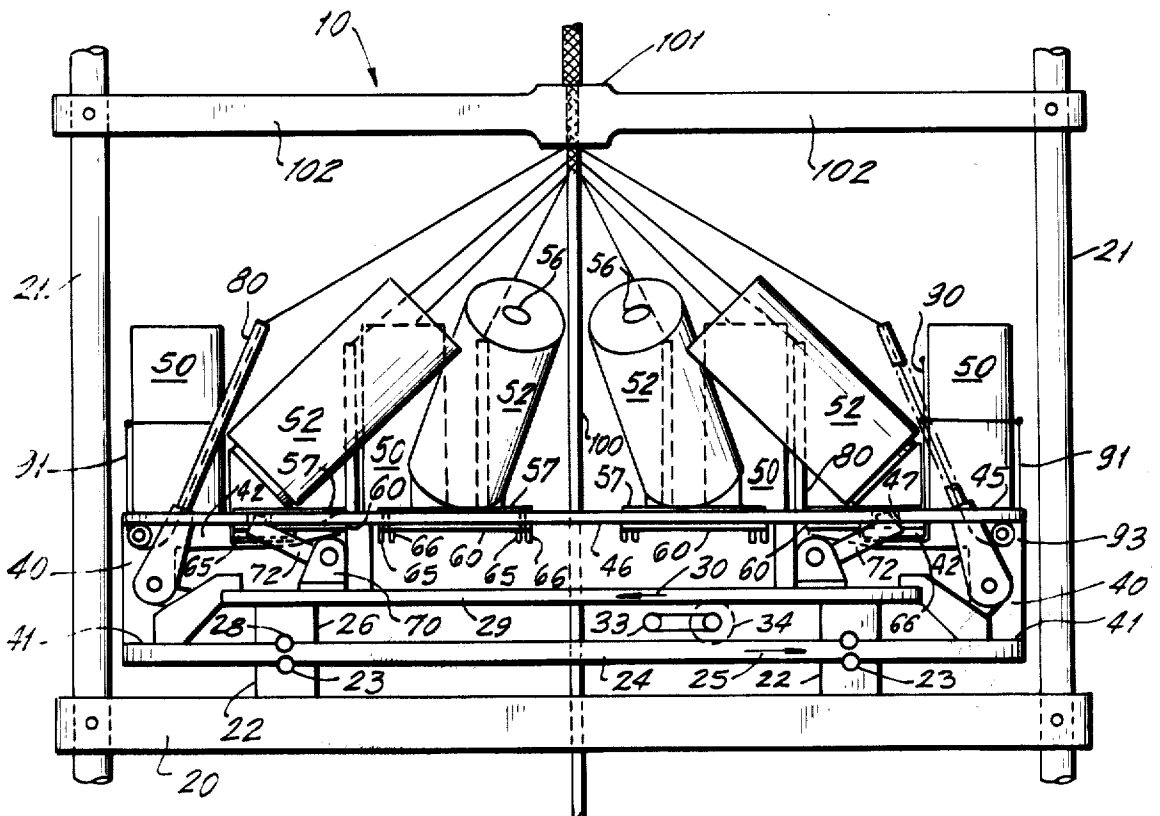


FIG. 3.

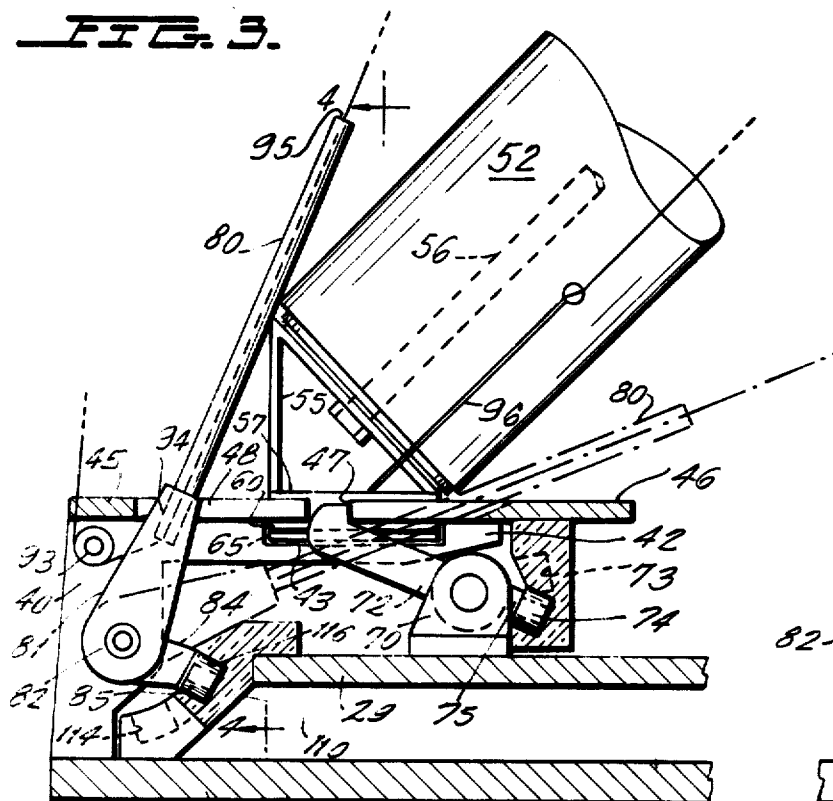


FIG. 4.

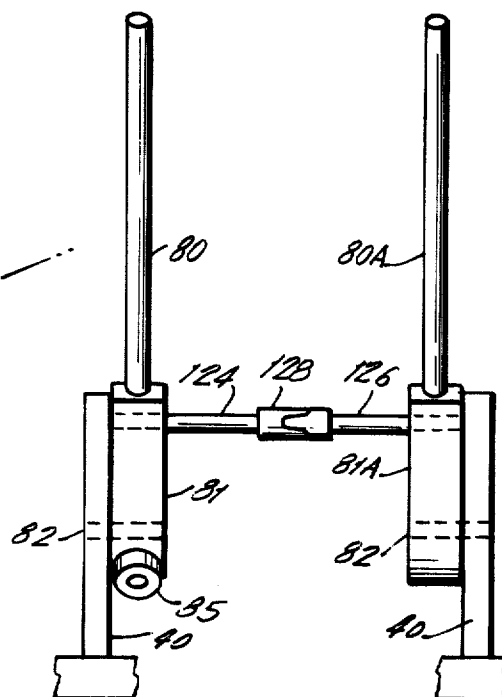


FIG. 5.

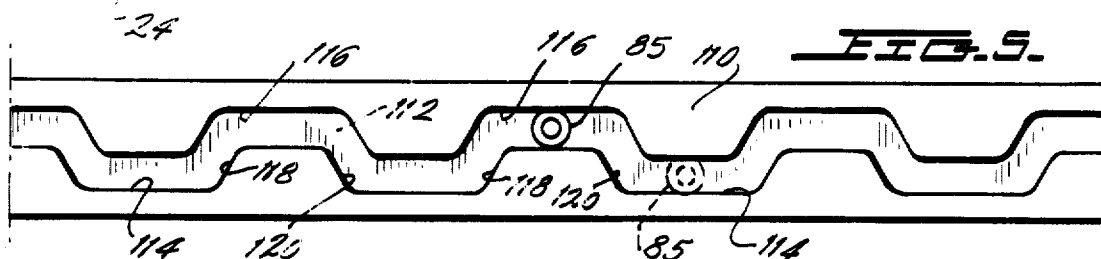


FIG. 6.

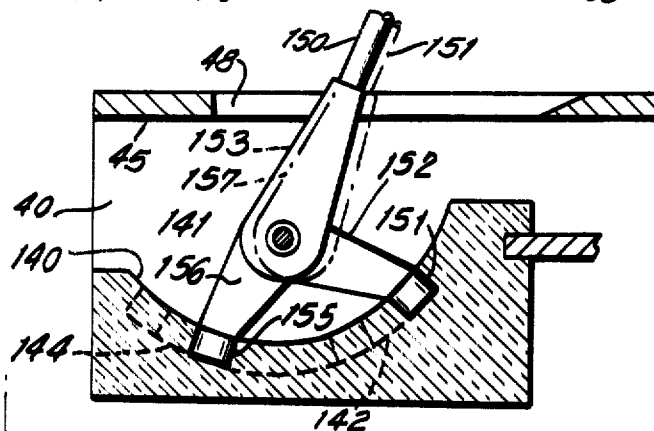
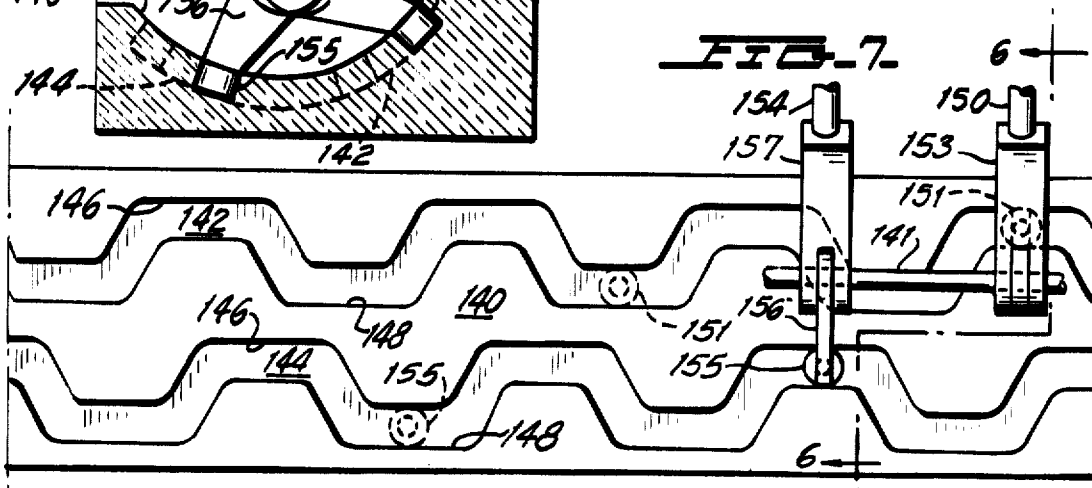


FIG. 7.



BRAIDING MACHINE WIRE CONTROL

BACKGROUND OF THE INVENTION

This invention relates to braiding machines and particularly to braiding machines of this type in which two sets of bobbins or other wire or filament dispensers revolve in opposite directions about a common axis with the wire from each of the bobbins being wrapped about the axis of rotation and being braided together as the bobbins revolve about the axis. This invention is an improvement upon the wire braiding invention described in my prior U.S. Pat. No. 2,464,899, issued Mar. 22, 1949. My earlier patent is incorporated herein by reference.

The invention in my earlier patent comprises a wire or filament braiding machine for braiding filaments about a common central axis. The machine comprises a radially more inward array of bobbins, or reel type filament carriers or other dispensers rotatable together around the axis in one direction and a radially more outward array of similar bobbins, carriers or dispensers rotatable together around the common axis in the opposite direction. Respective guide means associated with each outward bobbin directs the filament therefrom alternately radially inwardly of and outwardly of the annular path of the inner bobbin array. Each guide means comprises a respective dipable and raisable dispensing tube having an inlet for the filament from its bobbin and a filament outlet, which outlet moves radially inwardly and outwardly of the inward array of bobbins.

Means coordinate the radial shifting of the annularly rotating guide means with the opposite annular motion of the inward bobbin array to avoid contact between these relatively moving elements.

In my earlier patent, the radial shifting of the guide means or tubes associated with one array of bobbins is controlled by a cam connected to and annularly movable with the other array of bobbins. This coordinates the radial shifting of the radially shiftable guide means with the opposite annular movement of the radially non-shiftable inward bobbin array. However, the cam arrangement as described in my prior patent was not as effective and efficient as that described herein. It is the new cam arrangement for controlling the motion of the radially shiftable guide means or tubes toward which the present invention is directed.

After a guide means moves inwardly, it passes inwardly of a first array bobbin. Then it moves out between the first array bobbin it just passed and the next first array bobbin and passes outwardly of that next bobbin. Then it moves inwardly between that first array bobbin it just passed and the next one. Each first array bobbin is eventually passed on all sides by one or another guide means. To avoid engagement between the guide means passing each first array bobbin and the bobbin itself, a system of two spaced operators or fingers for controlling and moving each first array bobbin is provided. Except at the time of transfer from the operative position between the two operators or fingers, only one of the operators or fingers is operatively connected to the bobbin at any one time. All first array bobbins are positively engaged by at least one finger or operator at all times so that they rotate at a continuous rate. Means selectively move the operators or fingers for each first array bobbin out of and into contact with the bobbin in coordination with the movement of the

guide means or tubes so as to have the fingers or operators out of the way of every radially shifting guide means or tube as it moves past a radially fixedly positioned first array bobbin either radially outwardly of that bobbin or radially inwardly thereof.

SUMMARY OF THE INVENTION

The present invention is adapted to braid filaments of any material. It is particularly useful for braiding wire, although it can braid yarn or other filaments. The motion of the shifting elements of the invention never applies large momentary stresses that might break the wire.

In accordance with the desired braiding operation with which the invention is associated, each radially shiftable guide means or tube, which is guiding the wire from a second array bobbin, shifts radially outwardly and remains there as it passes one radially non-shiftable first array bobbin and then shifts radially inwardly and remains there as it passes radially inwardly of the next or alternate radially non-shiftable first array bobbin, and then shifts radially outwardly of the next radially non-shiftable first array bobbin, etc.

In the usual situation, there are the same number of radially non-shiftable first array bobbins and of radially shiftable guide means for the wire of the second array bobbins. When each radially shiftable guide means passes under one radially non-shiftable bobbin and over the next, during one 360° circuit of the radially shiftable guide means, they will have moved radially inwardly a number of times that is half the number of radially non-shiftable bobbins and will have moved outwardly the same number of times. In a typical arrangement with eight bobbins in each array, during one complete 360° circuit of the guide means, each individual radially shiftable guide means dips radially inwardly four times and passes under four of the eight radially non-shiftable first array bobbins and moves radially outwardly four times and passes over the other four first array bobbins. As all eight guide means move in this manner in unison, during one 360° circuit, each first array bobbin is passed radially outwardly by four guide means and radially inwardly by the other four.

The radially non-shiftable first array bobbins are connected to and move annularly with the guide cam for guiding the radial shifting of the guide means. These radially shiftable guide means or tubes move with the second array bobbins in the opposite direction around the common axis. The guide cam is shaped to shift the guide means radially inwardly and outwardly the required number of times. For example, in the typical eight bobbin array, the guide means dip radially inwardly four times and rise outwardly four times.

Because there are eight guide means and each only dips inwardly four times, and because all of the guide means must dip inwardly and rise outwardly together, either the guide means must be connected to one another to facilitate the simultaneous dipping and rising, or a particular type of camming means associated with the various guide means must be provided for this purpose. A conventional camming means positively connected to each of the guide means for raising and lowering each one four times during a complete annular circuit of the guide means would not also have the capacity to cause all eight of the spaced apart guide means to rise and dip simultaneously.

In accordance with a preferred embodiment of the invention, only alternate guide means communicate with the cam means. The intermediate guide means between two cam controlled guide means is connected, not to the cam means, but to one of the neighboring, cam controlled guide means, such that as the cam controlled guide means dips and rises, the connected guide means does the same. Thus, every two guide means are connected. An appropriate connection or joint, e.g., a universal joint, intermediate the means connecting two guide means may be needed because the guide means are each shifting radially with respect to the common central axis.

More generally expressing the foregoing arrangement, the number of guide means that are positively communicating with the cam means can be equal to the total number of guide means divided by every exponential power (except 0) of the number 2, so long as the result is a whole number. For eight guide means, for example, the number of guide means which may be positively driven by cam means is four, two or one. In every arrangement, those guide means that are in engagement with and are positively driven by the cam are evenly spaced annularly around the device and each such guide means is connected to drive the same number of those guide means that are not positively connected to the cam means.

In another embodiment, two annular, concentric, but annularly angularly offset, cam means are provided. Alternate guide means are attached to the one and to the other cam means, respectively, such that each cam means controls four alternate guide means. The dip and rise control features of the two cam means are offset so as to enable all guide means to dip and rise simultaneously.

One of the benefits of the invention is that it braids wire when both bobbin arrays move in first opposite directions. But, in the event of a knot, wire separation, snag, etc., the bobbin arrays can be simply reversed in direction. This will automatically unbraids the wire so that the problem area can be repaired. Then the bobbins can be restored to proper motion.

Accordingly, it is the primary object of the present invention to provide a simple and practical braiding machine for wire, yarn, other filaments, or the like.

It is another object of the invention to provide simple and effective means for guiding the wire as it is braided.

It is a further object of the invention to control the guiding means for the wire as the wire is braided.

It is yet another object of the invention to provide such a braiding machine with properly controlled, radially shiftable wire guide means.

It is a further object of the invention to coordinate the radial shifting of the guide means with the motion of the wire dispensing bobbins.

These and other objects of the invention will become apparent from the following description of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a braiding machine in accordance with the invention;

FIG. 2 is a vertical, sectional elevational view through the braiding machine;

FIG. 3 is a sectional elevational view taken through one edge of the braiding machine, particularly showing the means for controlling the radially shiftable wire

guide means and the means for controlling the annular motion of the radially fixed bobbin array;

FIG. 4 is an elevational view, in the direction of arrows 4 in FIG. 3, of a pair of radially shiftable guide means whose motion is coordinated in accordance with a first embodiment of the invention;

FIG. 5 is a developed, flattened elevation view of one complete circuit about the surface of the annular guide cam which guides the guide means of FIG. 4;

FIG. 6 is a fragmentary sectional elevational view through the edge of the braiding machine showing an alternate arrangement for controlling the shifting of the radially shiftable wire guide means; and

FIG. 7 is the same type of view as in FIG. 5 showing the guide cam means used in connection with the second embodiment of FIG. 6.

The drawings incorporate by reference the teachings of my prior U.S. Pat. No. 2,464,899. A number of elements and structures are shown schematically in the drawings herein. Further particulars and details as to these elements and structures can be found in my prior patent. Insofar as it is possible, the reference numerals used in the drawings herein correspond to the reference numerals used in my prior patent.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 and 2, braiding machine 10 according to the invention is supported on circular frame 20, which is in turn supported by vertical posts 21 connected on a fixed support (not shown). Located on circular frame 20 is annular support frame 22 which provides the main support for the braiding machine. Annular ball bearing or the like bearing means 23 supports lower annular plate 24, which is rotatable in the direction of arrow 25 as described below. Above the upper surface of plate 24 is annular ball bearing or bearing means 26 which communicates with plate 24 through annular ball bearing 28. Bearing means 26 is secured to flat plate 29. Plate 29 moves in the direction of arrow 30, counter to the direction of arrow 25.

Pulley 33 is connected by appropriate means (not shown) to any suitable source of power (not shown) which rotates the pulley. Pulley 33 is connected to gear 34, which engages a cooperating gear track in plate 24 below and in plate 29 above. Rotation of gear 34 moves plate 24 counterclockwise in FIG. 1 in the direction of arrow 25 and correspondingly moves plate 29 clockwise in FIG. 1 in the direction of arrow 30. Both of plates 24 and 29 move at the same rate in opposite directions and both make one complete circuit simultaneously.

On the upper surface of annular plate 26 are mounted a plurality of vertically disposed supporting blocks 40. There is a respective block 40 for each below described bobbin 50 of the radially outward array. Base 41 of each block 40 is secured to and movable with the upper surface of plate 24. Each block 40 has a laterally, radially inwardly projecting portion 42. To the upper surfaces of blocks 40 is secured another upper, annular plate that is comprised of radially outer annular section 45, radially more inward annular section 46 and narrow annular slot 47 therebetween for guiding the motion of each below described bobbin 52 of the radially more inward array. Section 46 of the upper plate is secured on the upper surface of block projection 42. Plate sections 45, 46 and slot 47 are additionally intersected by a plurality of radially extend-

ing slots 48 which permit the radial shifting movement of the below described wire guiding tubes 80.

Adjacent the periphery of plate section 45 are secured a first annular array of a plurality of bobbins, reels or other wire or filament dispensers 50 on which are wound or carried the wire, yarn, other filament or other material (hereinafter wire) to be braided. Each bobbin 50 is carried on a respective mounting post 41 secured to plate section 45. Bobbins 50, 51 rotate annularly with their supporting plate section 45, blocks 40 and plate 24.

A second, radially more inward, annular array of bobbins 52 is mounted to be guided for sliding annular movement through slot 47 and over supporting plate 45, 46.

Each bobbin 52 is carried on spindle 56, which is secured to and supported at the obliquely tilted orientation shown in FIGS. 2 and 3 upon triangular bracket 55. Each bracket 55 is in turn secured to a respective slide plate 57 which slides over the surfaces of plate sections 45, 46. Appropriate connecting means (not shown) extend through slot 47 to a lower plate 60, which matches plate 57 in shape. Plates 57, 60 sandwich plate sections 45, 46 between them and thereby guide and support the motion of bobbins 52 and the means (not shown) which pass through slot 47 guide the annular motion of the spindles.

At each arcuate end of each lower plate 60 is disposed a respective depending set of a pair of lugs 65, 66, which is to be engaged by an annular drive 70, 72 (described below) for the respective bobbin 52. Notch 43 in each block extension 42 provides clearance for the passage thereby of depending lugs 65, 66.

The radially more inward bobbin array is rotated in the direction of arrow 30 in the following manner. For each bobbin 52, there are secured upon the upper surface of plate 29 a pair of angularly spaced fingers 72 which are supported by and pivotable with respect to respective space support brackets 70. The outward end of each finger 72 is adapted, when in its upper or operative position, to be positioned between one set of lugs 65, 66. As bracket 70 and finger 72 are carried by plate 29, they rotate therewith in the direction of arrow 30. When the fingers are in their upper, operative positions, they cause their respective bobbin 52 to move in the direction of arrow 30.

Pivoting motion of each finger 72 between the illustrated operative position of FIG. 3 and the inoperative position where finger 72 is away from and below lugs 65, 66 is positively controlled by means of annular cam 73 that is secured beneath section 46 of the uppermost plate. As shown in my prior patent, cam 73 comprises a confining slot in which roller 74 at the end of arm 75 of finger 72 is carried. Cam 73 is designed so that when one finger 72 for a bobbin 52 is in the inoperative position, the other finger 72 for that bobbin is disposed in the operative position between a pair of lugs 65, 66. At the time of transfer of the fingers, both are momentarily in the operative position. Thus, there is continuous annular motion of the array of bobbins 52. The reason for providing two fingers for each bobbin 52 and for pivoting these fingers into and out of the operative position is so as to prevent the fingers 72 from interfering with the feed of wire from the bobbins 50 of the outer array, as described below.

Bobbins 52 of the radially more inward array are each provided with a respective wire guide 96 through

the eye of which the wire from bobbin 52 is led to central core 100 located at the common central axis.

In order to form a braid of wire, the strands of wire from bobbins 50 of the outer array are guided to alternately pass inside of and then outside of the wire from bobbins 52 of the inner array. Such radial shifting of the wire from the outer bobbin array is accomplished by means of guiding means or tubes 80. A respective tube 80 is provided for each bobbin 50. The lower end of each tube 80 carries tube supporting bracket 81, which bracket is pivotally supported at 82 to the respective block 40 for that bobbin 50.

Rigidly attached to the bracket 81 of at least some of the tubes 80 is bracket extension 84, which carries cam follower guide roller 85 at the free end thereof. Each cam follower roller 85 rides in cam 110 which, as described below, pivots tube 80 between the radially outward solid line position of FIG. 3, which causes the wire from that tube to be radially outside of the respective stationary bobbin 52, and to the radially inward position illustrated in broken lines in FIG. 3, causing the wire from that tube to be radially inward of bobbin 52. Tube 80 slides through and is guided for its reciprocating radial pivoting through the respective slot 48. Tube 80 remains in its radially outward solid line position of FIG. 3 as it passes one bobbin 52 and then shifts between the bobbin it has just passed and the next bobbin 52 to its radially inward broken line position. It passes radially inward of that next bobbin. It then moves radially outward again between that bobbin it has just passed and the next bobbin, and so forth.

As is illustrated by the radially inward position of tube 80 in FIG. 3, because the direction of annular movement of tubes 80 is counter to that of the bobbin moving fingers 72, the radially inwardly positioned tubes 80 and the fingers 72 in operative position would collide. Thus, the cam controlled operation of fingers 72 is coordinated with the annular motion of tubes 80 when they are radially inward in order that the fingers 72 can be out of the way of the tubes 80 as they pass.

The passage of wire from outer array bobbins 50 to their respective tubes 80 is schematically illustrated in FIGS. 2 and 3. A particular arrangement for accomplishing this purpose is described in detail in my prior patent and is shown schematically in FIGS. 2 and 3 herein. Each outer array bobbin is surrounded by a frame comprised of upright guide members 90, 91, with member 91 having an eye through which wire from bobbin 50 is led. Wire from the eye of guide member 91 passes through opening 92 in plate 45, around guide roller 93, which is appropriately tensioned to tension the wire, into base 94 of tube 80, and then out of tube outlet 95 to central core 100 located at the common central axis.

The common central core 100 may comprise a wire or tube or any other element on which it is desired to braid wire. Core 100 passes through guiding die 101, which is centrally supported upright by arms 102 extending inwardly from posts 21.

The significant feature of the present invention relates to the means which guides and coordinates the radially pivoting motion of guide tubes 80.

FIG. 5 shows a first embodiment for guiding tubes 80. Cam 110 includes positive guide passage 112 in which cam follower rollers 85 on tubes 80 of FIGS. 3 and 4 continuously ride and by which they are continuously controlled and driven.

Placing roller 85 in enclosed pathway 112 provides positive guidance for pivoting of tube 80. Because of the rapidity of the pivoting motion of tube 80 that is required during operation of the braiding machine, this positive guidance for both of tube 80 rising and descending is an improvement over the spring controlled pivoting taught in my earlier patent.

As shown in FIG. 1, there are eight bobbins in each of the inner and outer arrays. As shown in FIG. 5, on a 360° circuit around cam 110, there are four depressions 114 in cam pathway 112. When a roller 85 is in a depression, its tube 80 is in the radially inward, broken line position of FIG. 3. There are four elevated sections 116. When a roller 85 is at each elevated section 116, as shown in FIG. 3, the respective tube 80 is at its radially outward, solid line position. The number of lower 114 and upper 116 path sections in a 360° circuit around cam 110 is coordinated with the number of radially more inward, stationary bobbins 52. Because a tube moves under one bobbin 52 and over the next, the number of each of path sections 114, 116 is one-half the number of non-shifting bobbins 52.

At each incline 118 in cam pathway 112, tube 80, whose roller 85 moves through that incline, is pivoted radially outwardly to the solid line position of FIG. 3. At each decline 120 in cam pathway 112, the same tube 80, whose roller 85 moves through that decline, is pivoted radially inwardly to its broken line position of FIG. 3. The inclines 118 and decline 120 are as sharp as is practicable because the shifting of tubes 80 must be accomplished in the short period that there is open space between the rapidly moving bobbins 52. Similarly, the sections 114, 116 of pathway 112 are elongated to correspond to the arcuate lengths of bobbins 52 which the tubes 80 must pass radially inwardly and radially outwardly.

In the machine of FIG. 1, there are eight radially stationary bobbins 52 and eight pivoting guide tubes 80. However, as shown in FIG. 5, there are only four low path sections 114 and four high path sections 116. If all eight tubes 80 carried a cam follower roller 85, one tube roller 85 would be on the low path 114 while its neighboring tube roller would be on the high path 116, and the motion of tubes 80 would not be coordinated. However, as described above, not all tubes 80 carry a roller 85. There is a roller 85 only on alternate tubes 80. Some means is required to coordinate the motion of the tubes 80 so that all shift in the same direction together.

Turning to FIG. 4, coordination between tube 80 and its neighboring tube 80A, is accomplished by providing a guiding cam follower roller 85 only on tube 80 and by not providing any similar means that is in direct engagement with the cam 110 for tube 80A. Therefore, as shown in FIG. 4, there is no cam follower roller 85 on tube 80A. To coordinate tubes 80, 80A, fixedly attached to bracket 81 of tube 80 is connecting arm 124 and to bracket 81A of tube 80A is connecting arm 126. As tube 80 pivots radially inward, arms 124, 126 transmit this pivoting motion to tube 80A, so that tube 80A pivots identically to and simultaneously with tube 80. Because each of tubes 80, 80A pivots radially, the linear distance between them changes as they pivot. To absorb this change, an appropriate universal joint 128 or other relative motion absorbing means joins arms 124, 126 and absorbs the changes in length and orientation of these arms. Of the eight tubes 80 in the em-

bodiment of FIG. 1, only four are positively driven by their respective cam followers 85. The pathway 112 of cam 110 provides four evenly spaced high 116 and low 114 pathways. As a result of the arrangement shown in FIG. 4, all of the eight arcuately evenly spaced tubes 80 pivot radially inwardly and outwardly together.

An alternate arrangement for accomplishing the same result as was accomplished with the embodiment of FIGS. 4 and 5 is illustrated in FIGS. 6 and 7. Cam 140 differs from cam 110. Cam 140 in vertical elevational cross-section in FIG. 6 is circularly arcuate around the common annular axis 141. Cam 140 includes two separate cam follower guiding pathways 142, 144. Pathways 142, 144 have substantially identical characteristics. Each is located completely on an arc around axis 141. Both curve around the axis 141 in the height dimension shown in FIG. 6 and both have the same height dimension, as shown in FIG. 7. Each pathway includes four respective high pathways 146 and low pathways 148 in a 360° circuit. As is apparent from FIG. 7, however, the pathways 142, 144 are offset from each other by one-eighth of a circuit, or 45°. This offset takes account of and is proportional to the number of and spacing of the eight tubes 150, 154. The eight tubes 150 (the visible one), 142 (observed behind 150) of FIG. 6 are evenly spaced from each other annularly at 45° intervals. Like tube 80 and its roller 85, tube 150 is guided by cam follower roller 151, attached to extension 152 on bracket 153. Bracket 153 and tube 150 pivot around axis 141. Similarly, tube 154 is guided by cam follower roller 155 attached to extension 156 on bracket 157. As cam pathways 142, 144 are arcuately offset, as in FIG. 6, extensions 152, 156 point in different directions toward their respective pathways 142, 144. Because brackets 153, 157 are on the common axis 141 of cam pathways 142, 144, both extension 152, 156 are the same length. Thus tubes 150, 154 pivot radially around axis 141 through the same length arcs.

Tubes 150, 154 are functionally and structurally equivalent to tube 80, except as just described. Roller 151 of tube 150 rides in upper cam pathway 142 of FIG. 7. The roller 155 of neighboring, alternate tube 154, rides in lower cam pathway 144. Because of the 45° angular offset of pathways 142, 144 and of adjacent tubes 150, 154 (FIG. 7) and because the adjacent tubes 150, 154 are respectively connected to pathways 142, 144, the tubes 150, 154 pivot radially simultaneously and in coordination.

It is apparent that other arrangements may be provided for coordinating the motion of the guide tubes so that they pivot inwardly and outwardly during a 360° circuit of the braiding machine a number of times that is equal to one-half the number of the pivotally stationary bobbins of the relatively stationary array. More generally, the apparatus of the invention is particularly directed to means for enabling the pivoting guide means for the wire being fed from one set of bobbins to pass radially inwardly of one bobbin of a second array of bobbins and to pass radially outwardly of the next bobbin of that second array of bobbins and to again pass radially inwardly of the next bobbin of that second array of bobbins, and so forth.

Although the present invention has been described in connection with a number of preferred embodiments thereof, many variations and modifications will now become apparent to those skilled in the art. It is preferred,

therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.

I claim:

1. A machine for braiding wire, filaments or the like, comprising:

a central core at a central axis on which said core the wire is braided;

a first array of first bobbins, each for carrying wire to be braided; first moving means for supporting and for moving said first bobbins annularly around said axis in a first direction;

a second array of second bobbins each for carrying wire to be braided; a respective wire guide means for each said second bobbin; the wire from each said second bobbin being guided by its said wire guide means; second moving means for supporting and for moving said guide means annularly around said axis in a second direction opposite said first direction;

cam means for shifting all said guide means radially of said axis; said cam means being mounted to and being rotatable with said first bobbins;

cam follower means on at least some of said guide means, said cam follower means being in engagement with said cam means for being shifted by said cam means; each said cam follower means being so connected with its said guide means that shifting of said cam follower means in a third direction shifts said guide means radially inwardly of said axis and shifting of said cam follower means in a fourth direction opposite said third direction shifts said guide means radially outwardly of said axis;

said cam means being shaped so as to cause each said cam follower means to cause its said guide means to shift radially inwardly of all said first bobbins, thereby enabling said guide means to pass by said first bobbins radially inwardly thereof and to cause each said guide means to shift radially outwardly of all said first bobbins, thereby enabling said guide means to pass by said first bobbins radially outwardly thereof;

said cam means comprising at least one cam follower guide pathway having first cam follower shift sections which shift said cam followers in said third direction, first cam follower travel sections over which said cam followers travel after they have moved in said third direction, second cam follower shift sections which shift said cam followers in said fourth direction and second cam follower travel sections over which said cam followers travel after they have moved in said fourth direction; said cam follower first and second shift sections being located on said cam means so as to radially shift said guide means through the space between neighboring said first bobbins without engagement between said first bobbins and said guide means.

2. The machine for braiding wire of claim 1, wherein there are a first plurality of first said bobbins; the number of said first cam follower shift sections and also of said second cam follower shift sections is one-half of said first plurality of said first bobbins.

3. The machine for braiding wire of claim 2, wherein there are the same number of said first and said second bobbins.

4. The machine for braiding wire of claim 2, wherein said cam follower guide pathway first travel sections

are relatively higher and said second travel sections thereof are relatively lower; said first cam followers shift sections are inclines and said second cam follower shift sections are declines.

5. The machine for braiding wire of claim 2, wherein said cam follower means are attached only to fewer than all of said guide means and said guide means without said cam follower means are between those with said cam follower means; connecting means connect each said guide means that carries a said cam follower means with a neighboring said guide means not carrying a said cam follower means, thereby to cause both those said guide means to shift radially together.

6. The machine for braiding wire of claim 5, wherein said cam follower means are attached only to alternate ones of said guide means.

7. The machine for braiding wire of claim 5, wherein said connecting means comprises a respective arm attached to each said guide means of the connected pair of said guide means and which said arm shifts with its said guide means, and comprises a universal joint joining the said arms to absorb the relative shifting thereof.

8. The braiding machine of claim 5, wherein each said guide means comprises a tube having an inlet into which wire from the respective said second bobbin is fed and having an outlet for the wire; it is said tube outlets that are shifted radially inwardly of and radially outwardly of said first bobbins.

9. The braiding machine of claim 8, wherein said support for each said guide means comprises a respective support block; said means for moving said guide means annularly comprises means for moving said guide means blocks annularly; each said tube being pivotally connected at a pivot to its said block and being pivotable between its said radially inward and said radially outward positions.

10. The braiding machine of claim 1, wherein said cam means includes two separate said cam follower guide pathways each having the same characteristics; cam follower means attached to all of said guide means; one said cam follower means on one said guide means engaging one said guide pathway, and another said cam follower means on the neighboring alternate said guide means engaging the other said guide pathway;

there are a first plurality of said first bobbins; the number of said first cam follower shift sections and also of said second cam follower shift sections of the one said guide pathway and the number of said first cam follower shift sections and also of said second cam follower shift sections of the other said guide pathway is one-half of said first plurality of said first bobbins; said first and said second shift sections of said cam guide means pathways being annularly angularly offset from each other the same angular distance as the angular space between neighboring said guide means.

11. The braiding machine of claim 10, wherein there are the same number of said first and said second bobbins.

12. The braiding machine of claim 10, wherein said cam follower guide pathway first travel sections are relatively higher and said second travel sections thereof are relatively lower; said first cam followers shift sections are inclines and said second cam follower shift sections are declines.

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13. The braiding machine of claim 10, wherein each said guide means comprises a tube having an inlet into which wire from the respective said second bobbin is fed and having an outlet for the wire, it is said tube outlets that are shifted radially inwardly of and radially outwardly of said first bobbins;
said support for each said guide means comprising a respective support block; said means for moving said guide means annularly comprises means for moving said guide means blocks annularly; each said tube being pivotally connected at a pivot to its said block and being pivotable between its said ra-

dially inward and said radially outward positions.
14. The braiding machine of claim 13, wherein said cam means extends around said machine axis; said cam means also curves around a cam axis oriented to extend annularly of said machine axis; said cam pathways being the same distance from said cam axis; each said tube pivot connection being along said cam axis.
15. The braiding machine of claim 2, wherein said first and said second cam follower travel sections are all of the same length and said first bobbins and said guide means are uniformly spaced around said axis.
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