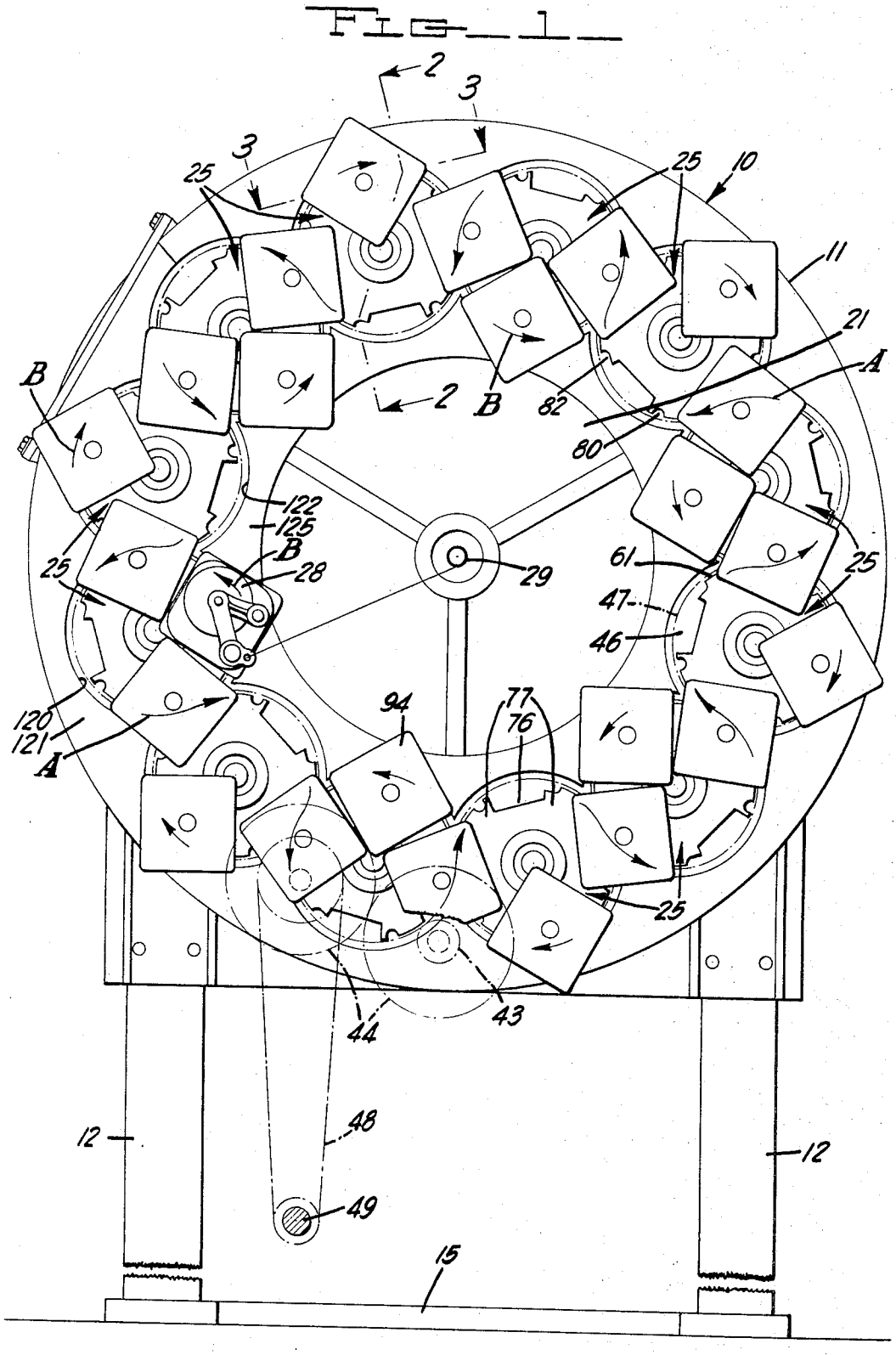
Jan. 16, 1968 M. R. FLORENTINE ET AL 3,363,502

BRAIDING APPARATUS WITH MEANS FOR GUIDING AND PROPELLING STRAND CARRIERS

Filed April 14, 1967

4 Sheets-Sheet 1

Fig. 1

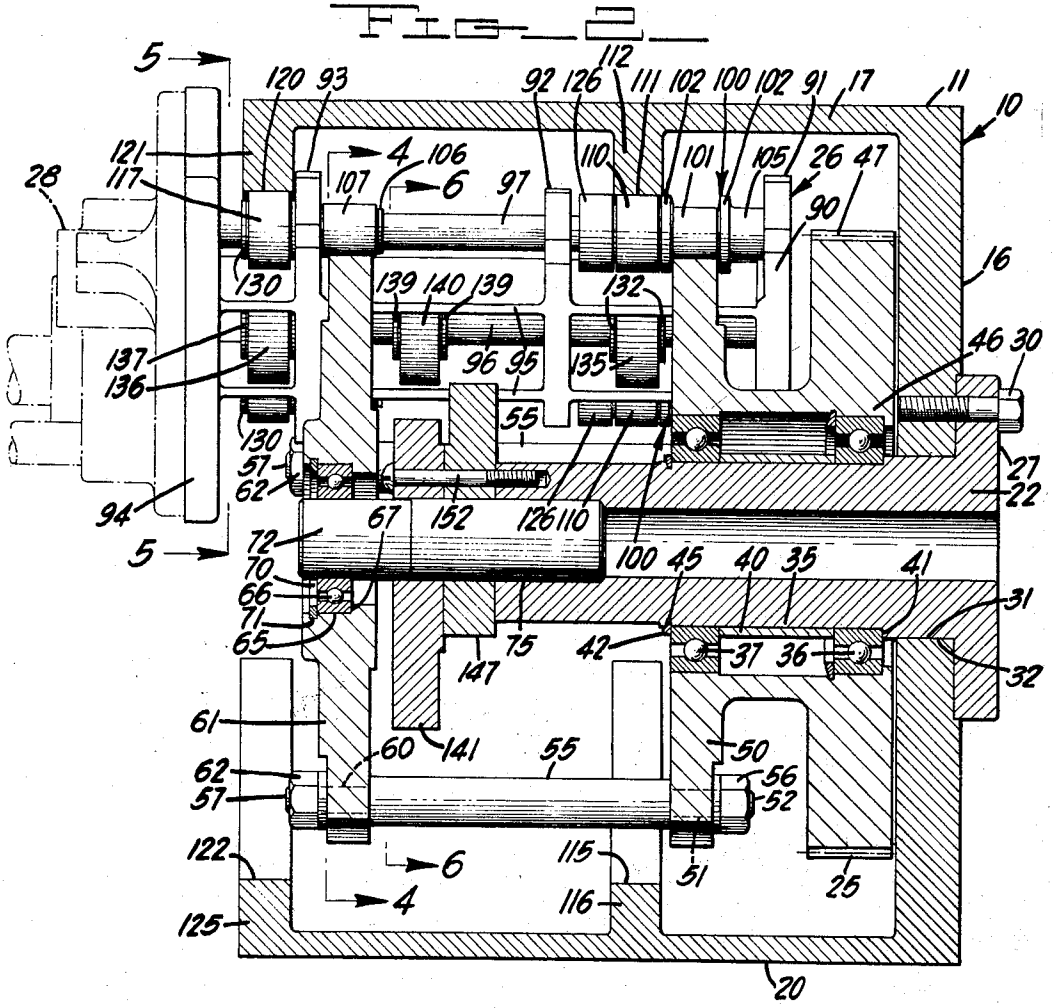


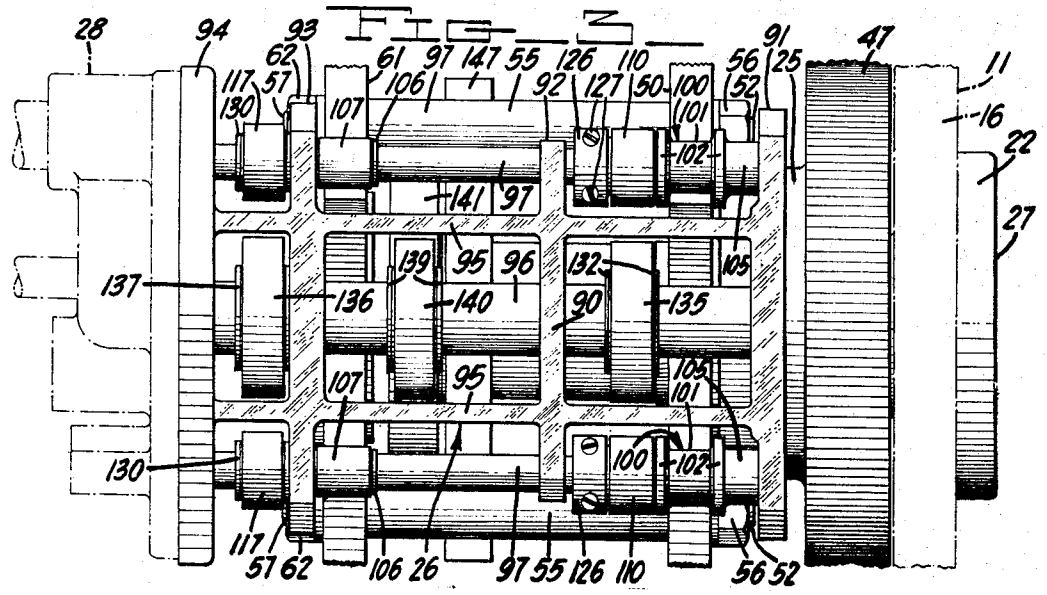
Jan. 16, 1968 M. R. FLORENTINE ET AL 3,363,502

BRAIDING APPARATUS WITH MEANS FOR GUIDING AND PROPELLING STRAND CARRIERS

Filed April 14, 1967 4 Sheets-Sheet 2

FIG. 2





Jan. 16, 1968 M. R. FLORENTINE ET AL 3,363,502

BRAIDING APPARATUS WITH MEANS FOR GUIDING AND PROPELLING STRAND CARRIERS

Filed April 14, 1967 4 Sheets-Sheet 3

Fig. 4

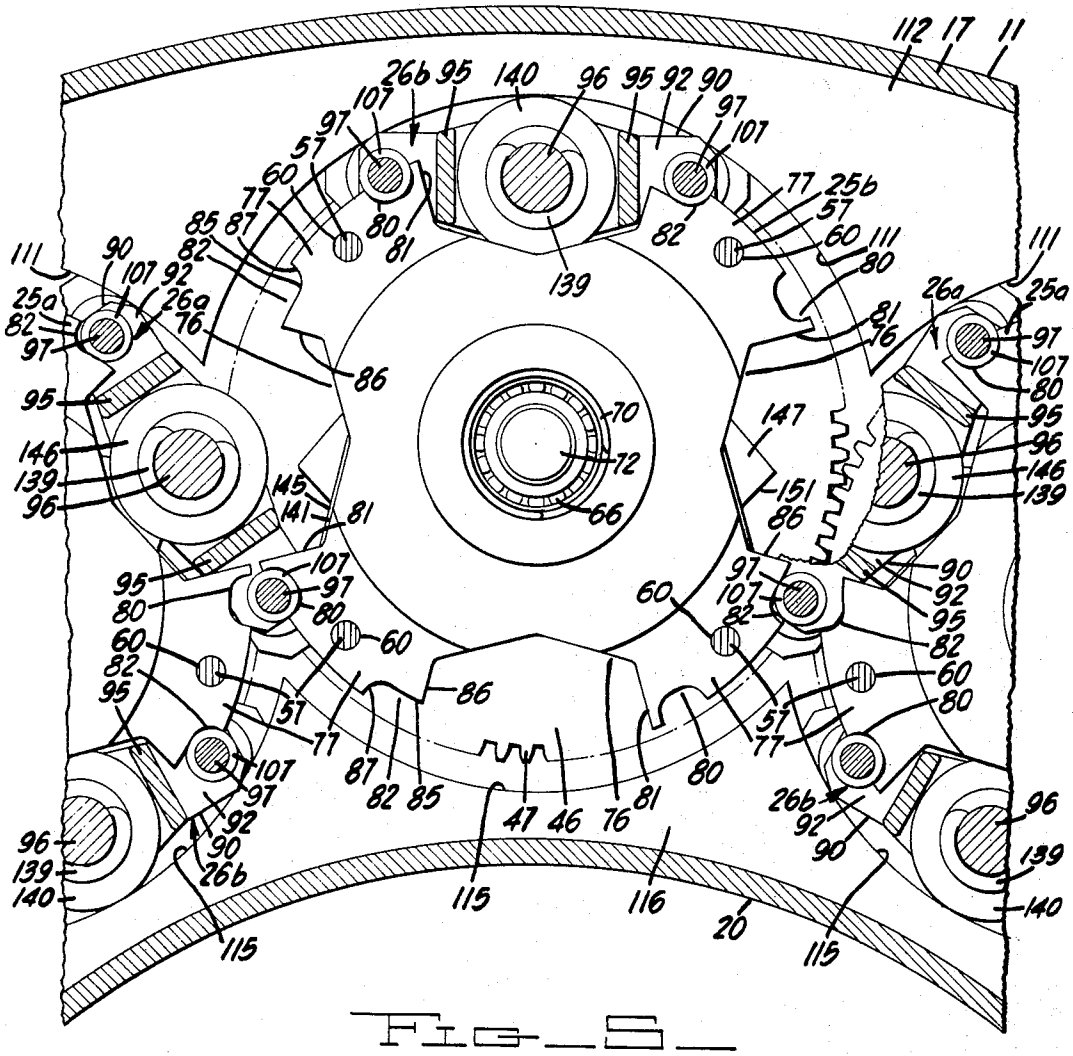
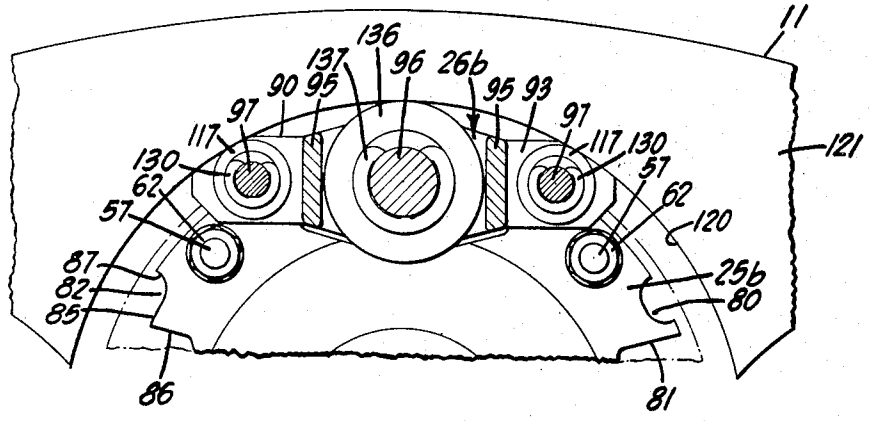


Fig. 5



Jan. 16, 1968 M. R. FLORENTINE ET AL 3,363,502

BRAIDING APPARATUS WITH MEANS FOR GUIDING AND PROPELLING STRAND CARRIERS

Filed April 14, 1967 4 Sheets-Sheet 4

Fig. 6

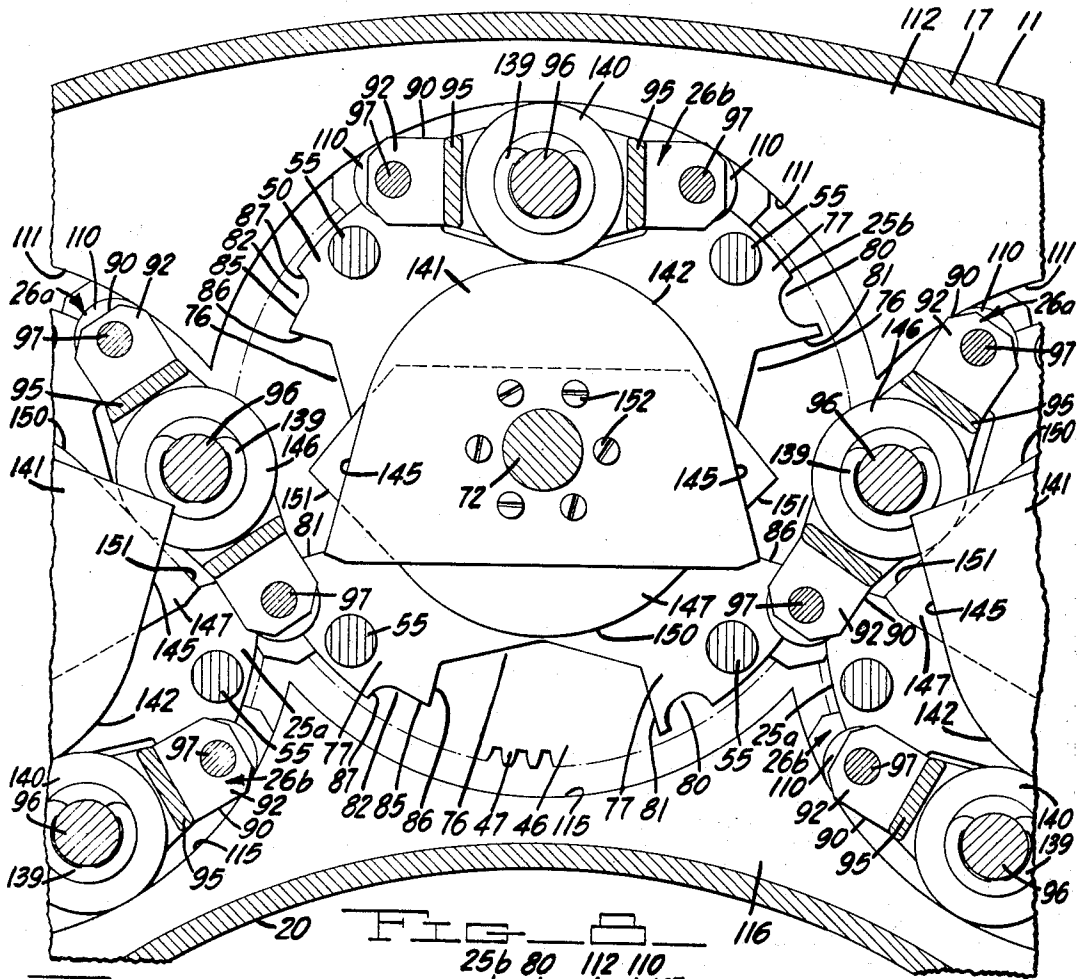


Fig. 7

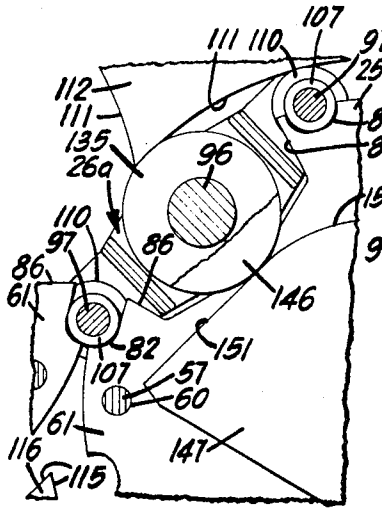


Fig. 8

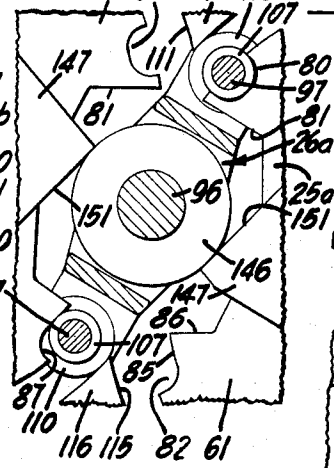
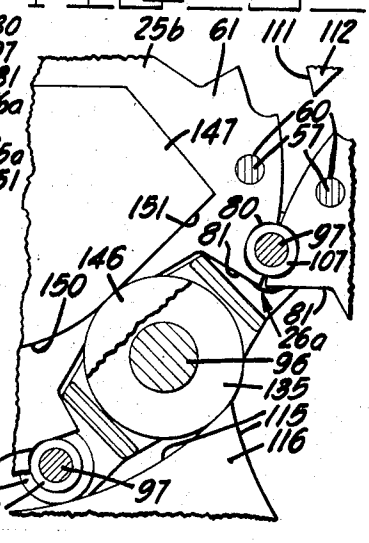


Fig. 9



United States Patent Office 3,363,502 Patented Jan. 16, 1968

3,363,502

BRAIDING APPARATUS WITH MEANS FOR GUIDING AND PROPELLING STRAND CARRIERS

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Filed Apr. 14, 1967, Ser. No. 630,916
10 Claims. (Cl. 87—38)

ABSTRACT OF THE DISCLOSURE

The invention disclosed herein relates to braiding machines and more particularly to means for propelling and guiding the strand supply carriers of such machines along sinuous paths in opposite directions about a braiding point.

BACKGROUND OF THE INVENTION

Field of the invention

The invention is specifically directed to means for controlling the high speed movement of the strand supply carriers of braiding machines along oppositely directed sinuous intersecting paths around a braiding point including shuttle members on which the strand supply carriers are mounted, a circle of rotors adjacent pairs of which are driven in opposite directions, cooperating means on the shuttle members and rotors by means of which the shuttle members are connected to and driven by the rotors, and a series of rollers on the shuttle members cooperating with inner and outer guiding or camming surfaces associated with each rotor for maintaining the driving connection between the shuttle members and the individual rotors and for transferring the driving connections for the shuttle members between adjacent rotors to move the shuttle members along their sinuous paths.

Description of the prior art

Heretofore in the most common form of braiding machines for forming tubular braids, or a tubular braided covering for cores, the machines were provided with a deck plate having sinuous intersecting guideways for directing strand carriers in opposite directions around the braiding point, the strand carriers having driving lugs for engagement in slots in oppositely rotating horn gears, upper and lower foot plates for engaging opposite faces of the deck plate and elongated heart pieces connecting the foot plates and interfitting in the guideways. The guideways were arranged to coact with the heart pieces to maintain the carriers in predetermined relationship to the braiding point and cause transfer of the driving lugs from a slot in one horn gear to a slot in the adjacent horn gear generally as disclosed in U.S. Patent No. 1,801,104, issued Apr. 14, 1931.

In another form of machine, as shown in German Patent No. 344,745, the strand carriers were provided with a pair of driving pins for engagement in semicircular notches in flanges of the horn gears with the carriers driven in one direction having a roller intermediate the driving pins for engaging alternate inner and outer arcuate surfaces associated with adjacent pairs of the horn gears. The ends of the adjacent arcuate surfaces extended parallel to each other to confine the roller during transfer of the driving pins from the notches in one horn gear to the notches in the adjacent horn gear. The carriers driven in the opposite direction were also provided with pairs of driving pins for engaging the notches in the horn gears and opposed rollers one of which coacted with an outer arcuate cam surface associated with one horn gear and the other of which coacted with an inner arcuate cam surface associated with the adjacent horn gear. While it appears that coaction between the rollers and arcuate cam surfaces maintained the driving pins in engagement with the notches of the individual horn gears engagement of the rollers between the extensions of the arcuate surfaces did not prevent rotation of the carrier about the roller at the transfer points which resulted in partial disengagement of both the leading and trailing driving pins from the notches in the adjacent horn gears. Furthermore, such disengagement of the driving pins was actually necessary to compensate for the increase in the center-to-center distance between the trailing notch of one gear and the leading notch of the adjacent gear over the center-to-center distance between the driving pins.

Hence, in machines having carriers with the heart piece and lug type guiding and driving means or carriers with roller and pin type guiding and driving means momentary lose of control of the carriers at the crossing or transfer points which coupled with the centrifugal forces developed in the carriers caused the carriers to wobble and resulted in the development of excessive wear between the coacting surfaces of the carriers and the guiding and driving means of the machine thereby greatly limiting the speed of operation of the machine.

Summary of the invention

Briefly summarized the invention resides in the provision of means in a braiding machine for moving strand supply carriers in oppositely directed intersecting sinuous paths including rotors, shuttle members on which the strand supply carriers are mounted and cooperating means on the rotors for driving the shuttle members, means for maintaining the cooperating means on the shuttle members and the individual rotors in driving engagement and for guiding the shuttle members through the intersecting portions of their paths in a manner to transfer the shuttle members between adjacent rotors while maintaining the cooperating means on the shuttle members and adjacent rotors in driving engagement.

Description of the drawings

FIG. 1 is a plan view of a braiding deck of a horizontal braiding machine having mechanism according to the invention incorporated therein;

FIG. 2 is a sectional view on an enlarged scale taken substantially along the line and in the direction of the arrows **2—2** of FIG. 1;

FIG. 3 is a view on an enlarged scale of the strand carrier supporting means and driving means therefor taken in the direction of the arrows **3—3** of FIG. 1;

FIG. 4 is a sectional view taken substantially along the line and in the direction of the arrows **4—4** of FIG. 2;

FIG. 5 is a sectional view taken along the line and in the direction of the arrows **5—5** of FIG. 2;

FIG. 6 is a sectional view taken along the line and in the direction of the arrows **6—6** of FIG. 2; and

FIGS. 7, 8 and 9 are views similar to a portion of FIG. 4 but with the parts shown in different positions relative to each other.

Description of the preferred embodiment

Referring to the drawings there is shown a braiding head or deck **10** of a horizontal type braiding machine for forming braided coverings on high pressure tubular hose and the like including an annular housing **11** secured to and supported by legs **12** on a base member **15** (FIG. 1). The housing **11** has a rear wall **16**, an outer wall **17** and an inner wall **20** (FIG. 2) defining an inner circular opening **21** through which the hose passes from other similar braiding heads or other heads or stations at which other operations are performed in forming the hose.

Mounted in the rear wall **16** on a circular center line concentric with the axial center of the housing is a series of like bearing members **22** for rotatably supporting rotors **25** for driving shuttle members **26**, each of which supports a strand supply carrier, diagrammatically shown at **28** in FIGS. 1, 2 and 3, along intersecting sinuous paths in opposite directions around a braiding point **29**, in a manner to be hereinafter described. Each of the bearing members **22** has a flange **27** adapted to be secured to the outer face of wall **16** by bolts **30**, a bearing portion **31** interfitting a bore **32** in the wall **16** and a bearing portion **35** of reduced diameter for mounting inner races of ball bearings **36** and **37**. The inner races of bearings **36** and **37**, which are separated by a spacer sleeve **40**, are retained in position on the portion **35** between a shoulder **41** formed between bearing portions **31** and **35** of the member **22** and a C-ring **42** or the like carried in a groove **45** in the portion **35**.

Each of the rotors **25** includes a member **46** mounted on outer races of the bearings **36** and **37**, the member **46** having a gear portion **47** adapted for meshing engagement with the gear portions of next adjacent rotors whereby alternate rotors of the series will be caused to rotate in a direction opposite to intermediate rotors for purposes hereinafter set forth. The rotors are rotated by a gear **43** meshing with the gear portion **47** of one of the rotors, the gear **43** being driven by gears **44** and a chain or belt **48** from a drive shaft **49** as diagrammatically shown in FIG. 1. Each member **46** is provided with a flange **50** having spaced openings **51** for receiving reduced portions **52** at one end of posts **55**, the posts being secured in the flange by nuts **56** threadably carried on the ends of portions **52**. The other ends of posts **55** are similarly provided with reduced portions **57** inserted through openings **60** in a second flange **61** secured to the posts by nuts **62** threadably carried on portions **57**. The flange **61** is provided with a bore **65** adapted to receive an outer race of a ball bearing **66**, the outer race being retained in the bore between a shoulder **67** formed at one end of the bore and a C-ring **70** carried in an annular groove **71** in the bore **65**. The inner race of the ball bearing **66** is mounted on a stub shaft **72** carried in a bore **75** in the end of the member **22** remote from the flange **27** (FIG. 2).

The flanges **50** and **61** of the rotors **25** are provided with recesses **76** alternating with portions **77**. The corresponding portions **77** in each of the flanges of alternate rotors have aligned notches **80** formed in the outer periphery thereof adjacent a wall **81** defining one end of each recess **76** (FIGS. 4 and 6). The flange portions **77** of alternate rotors are also provided with aligned elongated notches **82** each having a surface **85** concentric to the axial center of the rotor and extending inwardly from a wall **86** defining the other end of each recess **76**, the inner end of the surface **85** being connected to the outer periphery of the portion **77** by an end surface **87**. In the intervening rotors **25** the portions **77** on the flanges **50** and **61** are provided with notches **80** and **82** which are reversed in order as compared to the alternate rotors (FIG. 1) so that like notches meet in next adjacent rotors during rotation thereof in opposite directions.

The shuttle members **26** each include a frame **90** (FIGS. 2, 3 and 4) having flanges **91**, **92**, and **93** and a support flange **94**, on which a strand supply carrier **28** is mounted, which are joined to each other by transversely extending ribs **95**, a center shaft **96** mounted in the flanges intermediate the ribs, and end shafts **97** also mounted in the flanges but equidistant from the center of shaft **96** and at opposite sides thereof. Each of the shafts **97** rotatably carries a spool-like roller **100** having a portion **101** for engagement with the notches **80** and **82** in the flanges **50** of the rotors **25**, flanges **102**, flanking the portion **101**, for engagement with opposite side faces of the flange **50** and a hub **105**. Also rotatably mounted on each of the shafts **97** between the flange **93** and a C-ring **106** carried in a groove in the shaft, is a roller **107** for engagement with the notches **80** and **82** in the flange **61**.

A roller **110** rotatably mounted on each of the shafts **97** adjacent the roller **100** is adapted to engage outer guide surfaces **111** concentric to the center of each rotor **25** and defined by a flange **112** extending inwardly of the wall **17** of the housing **11**, and similar inner guide surfaces **115**, having the same radius as surfaces **111**, defined by a flange **116** extending inwardly of the inner wall of the housing. A roller **117** of the same diameter as roller **110** is rotatably mounted on each shaft **97** for engagement with outer guide surfaces **120**, aligned with and having the same radius as surfaces **111**, defined by a flange **121** extending inwardly of the wall **17** of housing **11** and guide surfaces **122**, aligned with and having the same radius as surfaces **115**, defined by a flange **125** extending inwardly of the wall **20** of the housing. The rollers **100** and **110** are retained against axial movement on the shafts **97** by the flange **91** of the shuttle frame **90** and a split collar **126** clamped to the shafts as by screws **127** (FIG. 3) and the rollers **117** are retained against axial movement on the shafts by C-rings **130** (FIGS. 2 and 5) carried in grooves in the shafts at opposite sides of the rollers.

Rotatably mounted on the shaft **96** of each shuttle member between C-rings **132**, carried in grooves in the shaft, is a roller **135** adapted to engage the surfaces **111** and **115** defined by the flanges **112** and **116**, respectively, and a roller **136** also rotatably mounted on the shaft between the flanges **93** and a C-ring **137** is adapted to engage the surfaces **120** and **122** defined by the flanges **121** and **125**, respectively. Also rotatably mounted between C-rings **139** on the shaft **96** of each of the shuttle members **25** adapted to follow a clockwise path, indicated by the arrow B in FIG. 1, is a roller **140** adapted to engage a cam **141** associated with each of the rotors **25**, the cam **141** having a portion **142** parallel to the guide surfaces **111**, **120** or **115**, **122**, and diverging portions **145**. As will be seen in FIG. 6 the positions of the cams **141** associated with adjacent rotors is reversed so that the surface **142** of one cam is parallel to surfaces **111** and **120** while the surface **142** of the next adjacent cam is parallel to the surfaces **115** and **122**. Also as shown in FIG. 6 the portions **145** of adjacent cams **141** are in facing relationship to each other.

The shaft **96** of each of the shuttle members **25** adapted to follow the counterclockwise path, indicated by the arrow A in FIG. 1, rotatably carries a first transfer means comprising a roller **146** (FIG. 6) for engagement with a second transfer means comprising a cam **147** associated with each rotor **25**, the cam having a surface **150**, parallel to the surfaces **111**, **120** or **115**, **122**, and diverging portions **151**. The function of the first and second transfer means is hereinafter set forth in detail. As will also be noted in FIG. 6 the positions of the cams **147** associated with adjacent rotors is reversed so that the surface **150** of one cam **147** is parallel to surfaces **115** and **122** while the surface **150** of the next adjacent cam is parallel to the surfaces **111** and **120**. Also the portions **151** of adjacent cams **147** are in facing relationship to each other. The cams **141** and **147** associated with each rotor are mounted on the stub shaft **72** and secured to the end of the bearing member **22** for the rotor as by screws **152** (FIGS. 2 and 6) and the rollers **140** and **146** are positioned on the shafts **96** at the level of the cams they engage.

In operation one group of shuttle members identified as **26*a*** are driven in the counterclockwise direction A and a second group of shuttle members identified as **26*b*** are driven in the clockwise direction B. The notches **80** and **82** in the flanges **50** and **61** of the rotors **25** are arranged so that the trailing rollers **100** and **107** of the shuttle members are engaged in the notches **80** adjacent one side of recesses **76** and the leading rollers **100** and **107** are engaged in the notches **82** adjacent the other side of the recesses. During movement of the shuttle members **26*a*** and **26*b*** with the individual rotors, rollers **110**, **135**, and

117, 136 alternately engage the outer and inner surfaces 111, 120, and 115, 122 respectively, to maintain the rollers 100 and 107 in engagement with the notches 80 and 82 in the rotors. Also at this time the roller 146 on each of the shuttle members 26*a* moving in the counterclockwise direction A alternately engages the cams 147 of the adjacent rotors, and the rollers 140 on each of the shuttle members 26*b* moving in the clockwise direction B alternately engage the cams 141 of the adjacent rotors.

As shown in FIGS. 4 and 6 to 9, during movement of a shuttle member 26*a*, in the counterclockwise direction A between adjacent rotors, after the rollers 110 and 117 at the leading end of the shuttle member pass the ends of the outer surfaces 111 and 120 respectively, associated with a rotor indicated at 25*a*, engagement of the rollers 110 and 117 at the trailing end of the shuttle member, and engagement of the rollers 135 and 136 on the shuttle member, with the surfaces 111 and 120 maintain the leading rollers 110 and 117 in engagement with the notches 82 in the rotor 25*a*. As the rotors continue to rotate the notches 82 in the rotor 25*a* and the adjacent rotor indicated at 25*b* converge and meet with the leading rollers 100 and 107 of the shuttle member 26*a* in engagement with the ends 87 of the notches as shown in FIG. 7. At this time the rollers 110 and 117 at the trailing end of the shuttle member 26*a* and the rollers 135 and 136 on the shuttle member continue to engage the surfaces 111 and 120 associated with the rotor 25*a* and the roller 146 on the shuttle member is still in engagement with the surface 150 of the cam 147 associated with the rotor 25*a*.

During continued rotation of the rotors the rollers 135 and 136 of the shuttle member 26*a* move out of engagement with the surfaces 111 and 120, respectively, associated with the rotor 25*a* and the roller 146 passes from surface 150 to a portion 151 of cam 147 to transfer the rollers 100 and 107 at the leading end of the shuttle member to the notches 82 in the adjacent rotor 25*b* as the paths of the notches diverge as shown in FIG. 4. Also it will be noted in FIG. 4 that the distance between the notches 80 in the rotor 25*a* and the ends 87 of the notches 82 in the adjacent rotor 25*b* has increased slightly so that at this time the leading rollers 100 and 107 in the shuttle are momentarily out of engagement with the end surfaces 87 of the notches 82. As the rotors continue to rotate the leading rollers 110 and 117 on the shuttle member 26*a* engage the surfaces 115 and 122 associated with the rotor 25*b* to hold the leading rollers 100 and 107 in the notches 82 in the rotor 25*b*. Also at this time the roller 146 is held between the portions 151 of the cams associated with both rotors 25*a* and 25*b* and the trailing rollers 110 and 117 are in engagement with the surfaces 111 and 120 respectively, associated with the rotor 25*a* to hold the trailing rollers 100 and 107 in the notches 80 of the rotor 25*a*, as shown in FIG. 8.

As the rotors continue to rotate the trailing rollers 110 and 117 on the shuttle 26*a* move out of engagement with the surfaces 111 and 120 associated with the rotor 25*a* and at this time engagement of the roller 146 with the cam 147 associated with the rotor 25*b* maintains the trailing rollers 100 and 107 in driving engagement in the notches 80 of the rotor 25*a* until the corresponding notches 80 in the rotors 25*a* and 25*b* converge and meet and the rollers 135 and 136 engage the surfaces 115 and 122, respectively, associated with the rotor 25*b*, as shown in FIG. 9. At this time since both leading and trailing rollers 100 and 107 are in engagement with the notches 80 and 82 in the rotor 25*b* the leading rollers 100 and 107 are again in engagement with the end surfaces of the notches 82. Thereafter as the rotors continue to rotate engagement of the leading rollers 110 and 117 and the rollers 135 and 136 with the surfaces 115 and 122 associated with the rotor 25*b* maintains the trailing rollers

100 and 107 in driving engagement with the notches 80 in the rotor 25*b* until the trailing rollers 110 and 117 also engage the surfaces 115 and 122 associated with the rotor 25*b* to hold the trailing rollers 100 and 107 in the notches 80 therein.

It is believed to be obvious from the foregoing that cooperation of the leading and trailing rollers 110 and 117 and the rollers 135 and 136 on the shuttle members 26*a* with the concentric surfaces of the housing 11 and the cooperation of the rollers 146 with the cams 147 maintain the shuttle members in positive driving engagement with the rotors 25 and control the shuttle members to effect the smooth transfer of the shuttle members 26*a* between the adjacent rotors. Also it is believed to be obvious that cooperation between the various rollers on the shuttle members 26*b* which are driven in the direction B with the concentric surfaces of the housing 11 and cooperation of the rollers 140 with the cams 141 maintains these shuttle members in driving engagement with the rotors and effect the transfer of these shuttles between adjacent rotors in the same manner as shuttle members 26*a*.

It will be understood that the improvement specifically shown and described by which the above results are obtained can be changed and modified in various ways without departing from the invention herein disclosed and hereinafter claimed.

We claim:

1. In a braiding machine having strand supply carriers adapted to be moved along intersecting sinuous paths in opposite directions around a braiding point, a housing, a circular series of rotors mounted in said housing, intermeshing gear means on said rotors whereby adjacent ones of said rotors are adapted to be rotated in opposite directions, shuttle members on which said strand supply carriers are mounted, and means for moving said shuttle members to move said strand supply carriers thereon along said intersecting sinuous paths in said opposite directions, the improvement wherein said means includes spaced pairs of notches in said rotors, first rollers on each of said shuttle members for engagement in said pairs of notches in said rotors, second rollers on each of said shuttle members, a third roller on each of said shuttle members, outer and inner concentric surfaces on said housing associated with each of said rotors, a first transfer means on each of said shuttle members, and a second transfer means associated with each of said rotors, said second and third rollers on said shuttle members cooperating with said outer and inner concentric surfaces to maintain said first rollers in engagement with said pairs of notches in said rotors associated therewith, and said second and third rollers cooperating with said outer and inner concentric surfaces and said first transfer means on said shuttle members cooperating with said second transfer means associated with adjacent rotors to transfer said first rollers from said pairs of notches in one of said adjacent rotors to the pairs of notches in the other of said adjacent rotors.

2. A machine according to claim 1 in which said spaced pairs of notches are formed in first and second flanges on each of said rotors, and there is a first pair of said first rollers on each of said shuttle members for engaging the pairs of notches in said first flange and a second pair of said first rollers one each of said shuttle members for engaging the pairs of notches in said second flange.

3. In a machine according to claim 2 in which there is a pair of said second rollers associated with each of said first and second pairs of said first rollers on each of said shuttle members, and a third roller associated with each pair of said second rollers, and there are outer and inner concentric surfaces on said housing associated with each of said rotors for engagement with each pair of said second rollers and said third roller associated therewith.

4. In a machine according to claim 3 in which each of said first and second pair of said first rollers and a pair of said second rollers associated therewith are rotatably mounted on first and second shafts in said shuttle member and said third rollers associated with said pairs of said second rollers are rotatably mounted on a third shaft in said shuttle member.

5. In a machine according to claim 4 in which said first transfer means on each of said shuttle members comprises a fourth roller rotatably mounted on said third shaft, and said second transfer means associated with each of said rotors comprises cam means for cooperation with said fourth roller, said third shaft being positioned in said shuttle member intermediate said first and second shafts.

6. A machine according to claim 5 in which there are bearing members in said housing on which said rotors are rotatably mounted, and said cam means associated with said rotors is fixed on said bearing members.

7. A machine according to claim 6 in which said fourth rollers on said shuttle members for moving said strand supply carriers in one of said opposite directions and the fixed cam means associated therewith are at one level and said fourth rollers on said shuttle members for moving said strand supply carriers in the other of said opposite direction and the fixed cam means associated therewith are at another level.

8. A machine according to claim 7 in which one of said notches of said pairs in each of said flanges closely interfit one of said first rollers of each of said first and second pairs and the other of said notches of said pairs in each of said flanges is elongated, said elongated notches having end surfaces for engagement with the other of said first rollers of each of said first and second pairs when said rollers are in engagement with said pairs of notches in said rotors, and said elongated notches of said pairs permitting disengagement of said other of said first rollers of said first and second pairs from said end surfaces during transfer of said first rollers from said pairs of notches in one of said rotors to said pairs of notches in an adjacent rotor.

9. A machine according to claim 8 in which said first rollers of said first and second pairs in trailing positions in said shuttle members during movement in opposite directions engage in said closely interfitting notches of said pairs and said other of said first rollers of said first and second pairs in leading positions on said shuttle members engage in said elongated notches.

10. A machine according to claim 9 in which one of said pairs of said first rollers on each of said shuttle members is provided with flanges for engaging opposite side faces of one of said flanges on each of said rotors.

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JOHN PETRAKES, *Primary Examiner.*