

April 5, 1960

H. KLEIN ET AL
WINDING MACHINERY

2,931,162

Filed Jan. 17, 1956

5 Sheets-Sheet 1

FIG. 1

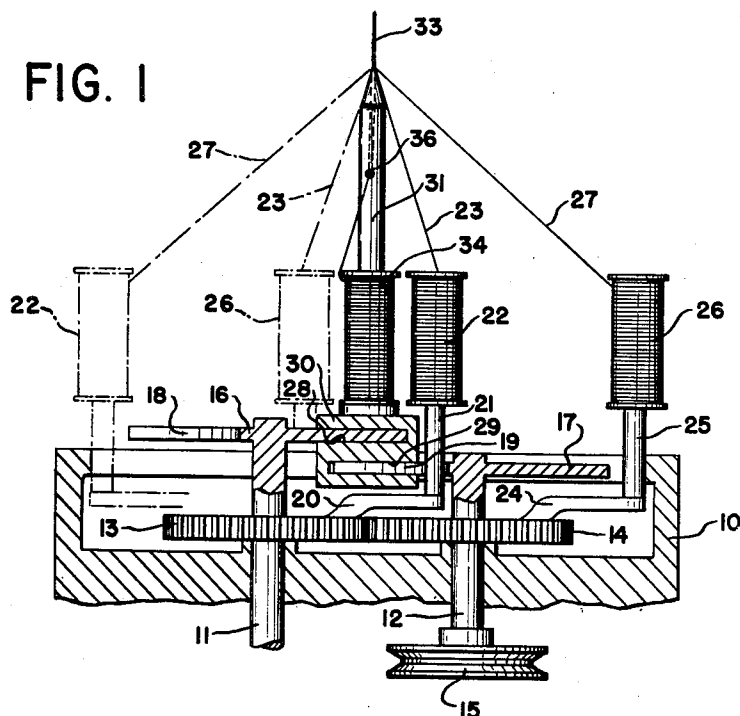
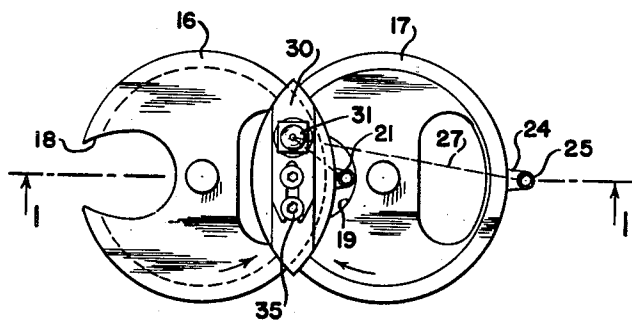


FIG. 2



INVENTOR
HEINRICH KLEIN
ARTHUR STEINRÜGNER
BY HERBERT GROSSCHOPF
Armand E. Lachmuth
ATTORNEY

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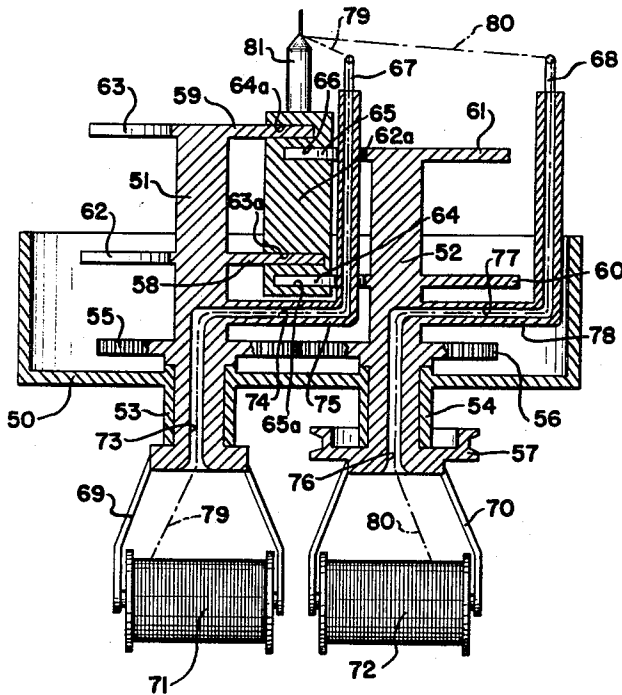


FIG. 3

FIG. 4

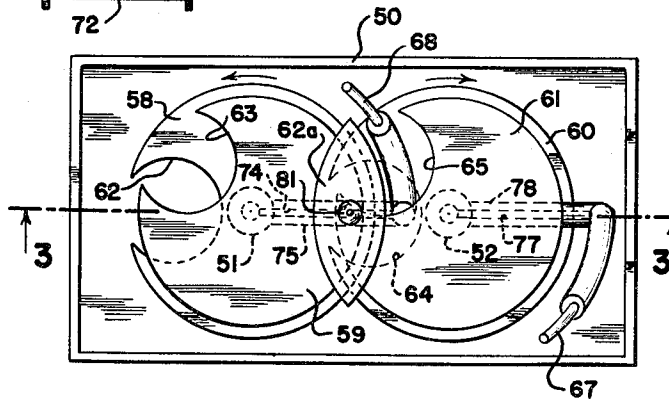
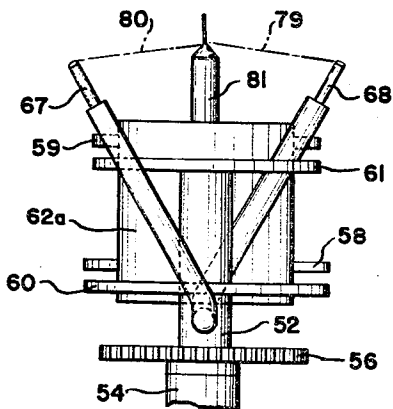


FIG. 5

INVENTOR
HEINRICH KLEIN
ARTHUR STEINGRÜBNER
BY HERBERT GROSSCHOPF
Armand E. Sackeubach
ATTORNEY

April 5, 1960

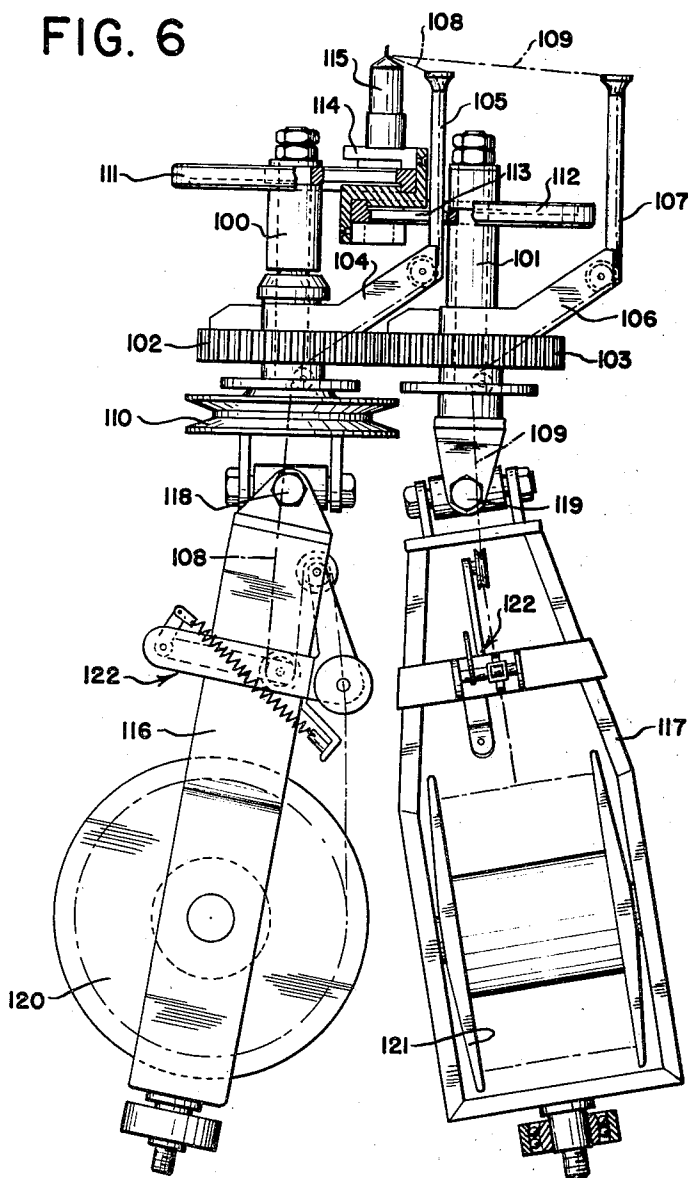
H. KLEIN ET AL
WINDING MACHINERY

2,931,162

Filed Jan. 17, 1956

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FIG. 6



INVENTOR
HEINRICH KLEIN
ARTHUR STEINGRUBNER
BY HERBERT GROSSCHOFF
Armand E. Lachnabach
ATTORNEY

April 5, 1960

H. KLEIN ET AL
WINDING MACHINERY

2,931,162

Filed Jan. 17, 1956

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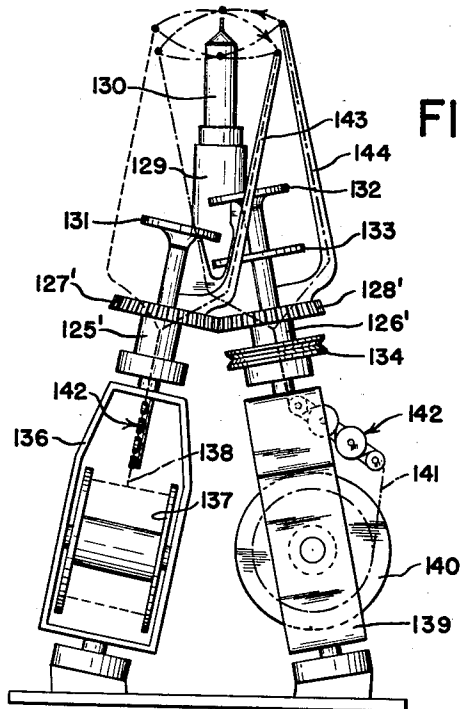


FIG. 8

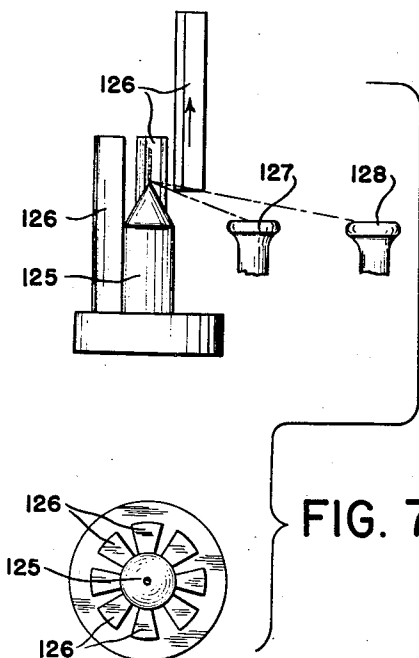


FIG. 7

INVENTOR
HEINRICH KLEIN
ARTHUR STINGRUBNER
BY HERBERT GROSSCHOPF
Armand E. Lockenbach
ATTORNEY

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2,931,162

WINDING MACHINERY

Heinrich Klein and Arthur Steingrübner, Bonn, and Herbert Grosschopf, Grevenbroich, Germany, assignors to Wahl Brothers, a partnership

Application January 17, 1956, Serial No. 559,754

21 Claims. (Cl. 57—13)

This invention relates to winding machinery; and the general object is to provide novel apparatus for winding together—simultaneously and in opposite directions—two filaments, or two strands comprising a plurality of filaments each.

The invention contemplates apparatus for winding two filaments, or strands, in the manner set forth above, about either a stationary mandrel or an axially progressing core.

The apparatus is particularly well suited for making interlocking helicoid slide fastener stringers of the class shown in United States Patent No. 2,300,442, issued November 3, 1942, to Nicolas Wahl. Such stringers are formed of filaments of plastic or other suitable material of special cross-section, and are simultaneously formed by winding two filaments, under tension, and in opposite directions, about a tapered mandrel, which itself is of special cross-section. Such stringers are formed by oppositely winding tensioned filaments around the base, or the thickest portion, of a tapered mandrel which rises rigidly from the center of a much thicker support, the top of which is conical, to provide forming means as shown and described in application, Ser. No. 418,491, filed March 25, 1954, of Wahl. The conical top of the mandrel support is slidably engaged by the filaments during the winding operation, and, of course, the conical top providing a stationary shoulder, causes newly formed turns of the tensioned filaments to pry previously formed turns away from the mandrel support and, progressively, off the thinner end of the mandrel. Means have been devised for preventing disengagement of the two interlocking helicoid stringers as they leave the mandrel, and for setting the material of the filaments (e.g. by heat-treatment in the case of a thermoplastic material) beyond the mandrel to preserve their interlocked helicoid characteristics in the absence of applied stresses. However, the present invention is concerned only with the winding operation, and provides much simpler and more efficient apparatus for this function than has been known heretofore.

The apparatus is also equally well suited to operate, in connection with an axially progressing core, as a novel and extremely simple core-covering or braiding machine. Attention is invited to United States Patent Number 1,805,494, issued May 19, 1931, to McCahey. By substituting a core, as defined above, for a stationary mandrel, the apparatus may form upon the core a tubular reticulate comprising two oppositely directed coils of filaments, or strands, the reticulate being more or less open in accordance with the combined factors of the speed of progress of the core and of the speed of the winding operation. Employed as a core-covering or braiding machine, the apparatus provides means for winding two filaments, or strands, in opposite directions alternately over and under each other about a core with the filaments, or strands, crossing at regular angular intervals.

Winding machinery which, in effect, braids—that is, simultaneously winds together one filament; or strand, in

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a clockwise direction and another filament, or strand, in a counterclockwise—invariably includes a solution, more or less complex, of the problem of handling sources of filaments, or strands, traveling in opposite directions in two twice-intersecting orbits. And also, of course, such machinery includes a solution of the problem of supporting a mandrel, or of feeding a core at a location within that area bounded by the overlapping orbits.

Winding machinery which simultaneously winds together two filaments in opposite directions customarily involves the idea of two interrupted ring gears, each of which represents the overlapping orbits of two traveling sources of supply of filaments.

The first difficulty that engineers encountered with a machine of this type was, of course, arranging some means for overcoming the problem of letting two supplies of filaments come through the same place without striking an obstruction. The art teaches us about the use of interrupted ring gears running in channels, which are, in effect, bearings.

A particular object of this invention is to avoid the necessity of the ring gear principle.

Another object of the invention is to avoid rotating two spools of varying mass of filaments in intersecting orbital paths which necessarily cause an eccentric load to the mechanism, unless compensating counterbalancing means are employed.

Another object of the invention is to provide a means whereby the supply of filaments may be greatly enlarged, by having the source of the filaments rotating in time with the winding operation. A still further object of the invention is to cause the supplies of filaments to rotate in opposite directions relatively close to, and substantially equidistant at all times, from the mandrel or core.

Specific embodiments and modifications of the present invention are illustrated in the accompanying drawings, in which:

Figs. 1 and 2 are illustrative of a first embodiment of the invention;

Fig. 1 is a vertical sectional elevation according to the index line 1—1 of Fig. 2;

Fig. 2 is a diagrammatic plan view of the structure with certain parts omitted;

Figs. 3, 4, and 5 show a second embodiment;

Fig. 3 is a vertical sectional elevation according to the index line 3—3 of Fig. 4;

Fig. 4 is a diagrammatic plan view of the structure;

Fig. 5 is an elevational end view of the structure;

Fig. 6 relates to a third embodiment, and is an elevation, in part schematic;

Fig. 7—bracketed in the drawing—comprises two elements, one of which is a schematic elevation, and the other of which is a plan. This figure relates to a fourth embodiment;

Fig. 8 shows a fifth embodiment in which the shafts and block supports are inclinedly disposed; and

Figs. 9, 10, and 11 illustrate a sixth embodiment of the present invention, but with only block sustaining means, filament feeds and mandrel support shown, it being understood that as to the remaining portions of the mechanism not shown, these are the same as appear in the fourth embodiment of Fig. 8.

Figs. 1 and 2 illustrate a first embodiment of the invention. This embodiment solves the problem of supporting the mandrel, or of feeding the core, within that area bounded by the overlapping orbits without relying directly upon the main frame.

Fig. 1 is a partly erased vertical section of the apparatus according to the index line 1—1 of Fig. 2.

The main frame of the machine is designated 10, and may be, as shown, a rigid casting in the shape of a shallow

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box having a relative thick bottom. The only purpose of the sides of the illustrated main frame is to provide a guard. The main frame could well be a plate (substituted for the bottom of the illustrated box) thick enough to provide adequate bearings for relatively short shafts.

Suitably journaled in the bottom of the main frame, in the exemplary structure shown, are two parallel shafts 11 and 12. The axes of these shafts intersect the plane indicated by the index line 1—1 of Fig. 2 (that is the longitudinal centerline of the apparatus).

Two meshing similar gears 13 and 14 are respectively rigidly mounted on shafts 11 and 12 above the upper surface of the bottom of the main frame. Accordingly the shafts 11 and 12 are rotationally timed. Shaft 12 extends beneath the bottom of the main frame, and rigidly mounted on the lower portion of this shaft is a pulley 15. Obviously the pulley provides means whereby the apparatus may be belt-driven by a suitable external source of power.

Rigidly mounted on shaft 11, above gear 13, is a block support 16. Rigidly mounted on shaft 12, above gear 14 (but substantially off level with respect to, and, lower than, block support 16) is another, and like, block support 17.

Fig. 2 is a more or less diagrammatic plan view of the first embodiment, with certain parts omitted. However, an adequate top view of the block supports 16 and 17 is provided. It will be noted in this figure that a bight 18 is provided in block support 16, and a similar bight 19 is provided in block support 17. The bights 18 and 19 have a common angular relationship to their respective block supports 16 and 17 and, of course, to the shafts 11 and 12. In Fig. 2 both bights are disposed toward what amounts to direction 270° in the drawing. Plainly when the shafts 11 and 12 have turned 180° the bights will then be disposed toward what amounts to direction 90° in the drawing, and an illustration thereof would be a mirror image of Fig. 2.

Extending radially from the upper surface of gear 13 is a rigid arm 20 at the outer edge of which is a standard 21 supporting a spool 22 of filament 23. Extending radially from the upper surface of gear 14 is a similar arm 24 at the outer end of which is a standard 25 supporting a spool 26 of filament 27, which spool in the present embodiment provides "filament supply means," as that term is used in the appended claims. In Fig. 1, both arms, 20 and 24 have a common angular relationship to their respective gears 13 and 14, and, of course, to the shafts 11 and 12. With respect to shafts 11 and 12, the bights 18 and 19 have respectively angular dispositions which are diametrically opposite the dispositions of the arms 20 and 24. The arms 20 and 24, the standards 21 and 25, and the spools 22 and 26, are all to the right of the vertical centerline of the figure. In this figure standard 21 is seen to pass through the bight 19 of block support 17. Also, in this figure, standard 25 passes to the right beyond the periphery of block support 17 and is near the righthand side of the main frame 10. The relative positions of the standards, spools and filaments, when the shafts 11 and 12 have rotated 180° from the solid line positions of Fig. 1 are indicated by a phantom to the left of the vertical centerline of the figure. It will be immediately apparent in Fig. 1 that the outer end of arm 20, standard 21, and spool 22 travel in a circular path which considerably overlaps gear 14. Accordingly the two spools 22 and 26 travel in circular orbits which twice intersect each other as shown in Fig. 2.

The block supports 16 and 17 are slidably received within concave arcuate notches or recesses 28 and 29 respectively provided in a block 30. See Fig. 2. As a refinement, not shown in the drawings, the block supports 16 and 17 may be provided with several concentric keyways and lands near their peripheries, and, of course,

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the related notches 28 and 29 may be provided with segmental concentric lands and keyways adapted to mate with the patterns provided on the block supports. Plainly such patterns on block supports 16 and 17 will be interrupted by the related bights 18 and 19. Obviously block 30 cannot move because of the oppositely disposed grooves 28 and 29; and the block is accordingly supported by the two block supports 16 and 17, which rotate in opposite directions. It will be noted that the block 30 depends directly upon these block supports for its support. As is well known, it is common in the art to support the filament, or strand, carriers, which necessarily travel in twice-intersecting orbits, near the periphery of at least one interrupted ring gear. Or two interrupted ring gears may be used, the gears themselves representing the overlapping orbits. Rigidly mounted on block 30, and slightly eccentrically, as shown in Figs. 1 and 2 is a mandrel support 31 which has a conically shaped upper end which provides forming means out of the center of which rises the mandrel proper which is designated 33. (It will be shown subsequently that for the mandrel 33 an axially progressing core may be substituted.)

To this point this first embodiment of the apparatus is adequately suited for making interlocking helicoid slide fastener stringers of the class referred to above. If this embodiment is to be employed as a core covering or braiding machine a spool 34 of suitable core material may be rotatably placed on a stub shaft 35 (see Fig. 2) which is rigidly mounted eccentrically on block 30. Where the operation desired is to cover a core the support 31 may be centrally supported on block 30. A passage way 36 in support 31, indicated in dotted lines in Fig. 1, may receive the core material from spool 34 so that by any suitable means it may be pulled out of the center of the top of the support 31. Of course under these conditions the mandrel 33 will have been removed. It is unnecessary here to illustrate or describe means for pulling the core upwardly through the passage way 36; but it will be readily understood that tension exerted on the core will cause spool 34 to rotate.

While no counter weights are shown in Fig. 1 to compensate for the eccentrically positioned spools 22 and 26, it will be understood, that to prevent the apparatus from loping whether working to make interlocking helicoid slide fastener stringers or to cover a core with braided filaments, or strands, a system of compensating for the aggregate eccentric loads of arm 20, standard 21, spool 22, and its filament 23 and for arm 24, standard 25, a spool 26, and filament 27, should be provided. To counterbalance these loads accurately when filament is being unwound from both spools 22 and 26 is extremely difficult. So, in practice, the counterweights used are usually of sufficient mass exactly to counterbalance the two eccentric loads when one-half the filament from both spools has been withdrawn. But it will be plain that when both spools are fully loaded with filament the counterweights are not heavy enough to prevent some slight lobe in the apparatus and that this condition continues, although it decreases in magnitude, until precisely one-half of the filament has been withdrawn. As soon as more than one-half of the filament of the spools has been withdrawn the eccentric load sought to be counterbalanced progressively gets lighter than the counterweights. In the absence of means for varying mass of counterbalances to compensate for the variation of mass of the eccentric loads some lobe is almost impossible to avoid; and for this reason it is not ideal to employ eccentric supplies of filament which must necessarily vary in mass as the apparatus operates.

However, this first embodiment of the invention, while not ideal, accomplishes the novel result of avoiding rigidly anchoring the mandrel support and spool of core material directly to the main frame of the apparatus; and, thereby, of course, avoids the well known interrupted ring gear system.

Figs. 3, 4, and 5 illustrate a second embodiment of the invention. This embodiment solves both the problem of supporting the mandrel, or of feeding the core, within the area bounded by the overlapping orbits without relying directly upon the main frame (and thereby avoids interrupted ring gears) and the problem of overcoming two eccentric loads of filament supply, which constantly change in mass. In short, in the second embodiment of the invention, there is no need for a continuously varying system of counterbalancing the steadily decreasing supplies of filament, and, in consequence, the apparatus involves no varying eccentric loads. Fig. 3 is a vertical section of the embodiment according to the index line 3—3 of Fig. 4.

The main frame of the second embodiment may be much like that of the first embodiment, and is designated 50. The main frame is preferably a casting. Its primary requirement is that its construction is such that ample bearings may be provided for two vertical shafts.

Suitably journaled in the main frame are two parallel shafts 51 and 52. The shafts are vertically disposed and are prevented from moving axially by means of their respective bearings 53 and 54. The axes of shafts 51 and 52 intersect the plane indicated by the index line 3—3 of Fig. 4 (that is, the longitudinal centerline of the apparatus).

Two meshing similar gears 55 and 56 are respectively rigidly mounted on shafts 51 and 52 above the upper surface of the main frame. Accordingly the shafts 51 and 52 are rotationally timed. Both shafts extend beneath their bearings in the main frame; and rigidly mounted on the lower portion of shaft 52 is a pulley 57. Obviously the pulley provides means whereby the apparatus may be belt-driven by a suitable external source of power.

Rigidly mounted on shaft 51, above gear 55, are two block supports, the lower one being designated 58 and the upper one 59. Rigidly mounted on shaft 52, above gear 56, are two other block supports, staggered with respect to block supports 58 and 59, the lower one being designated 60 and the upper one 61. See Fig. 3. The four block supports are of substantially equal thickness, but block supports 58 and 60 are larger in diameter than block supports 59 and 61. It will be noted in Fig. 4, which is a more or less diagrammatic plan view of this embodiment, that bights 62 and 63 are provided respectively, in block supports 58 and 59, and that bights 64 and 65 are provided respectively in block supports 60 and 61; and it will further be noted that bights 62 and 64 have the same angular dispositions, and that these bights are slightly staggered with respect to bights 63 and 65, which also have the same angular dispositions.

The block supports 58—61 support, approximately in the manner of the block supports 16 and 17 a block 62a, which, like block 30, is provided with concave arcuate notches; but, in this case there are four block supports, and, accordingly, four slots; to accommodate block supports 58—61, the slots are respectively indexed 63a, 64a, 65a, and 66. Of course the outer areas of the block supports may be provided with concentric keyways and lands to mate, in reverse order, with such patterns provided in the notches of block 62a. The principal purpose of the employment of four sustaining block supports for the block 62a is to minimize any rattle of the block which may be effected by the bights and this practice has been found to be highly successful. In order to compensate for the staggering of the bights of the block supports, the filament feeds 67 and 68 as indicated in Figs. 4 and 5 are slanted.

It will be noted in Fig. 3 that yokes 69 and 70, suspended from the lower ends of shafts 51 and 52, support spools 71 and 72 which may revolve on axes normal to the respective axes of the shafts to which they relate. The filament of spool 71 is led through a coaxial bore

73 in shaft 51, and through a bore 74 in a radial arm 75 to the stock of the feed 67; and the filament of spool 72 is led through a coaxial bore 76 in shaft 52, and through a bore 77 in a similar radial arm 78 to the stock of the feed 68. See in Fig. 3. The filament of spool 71 is indexed 79, and the filament of spool 72 is indexed 80. For purposes of claiming the present invention, feeds 67 and 68 in arms 75 and 78 respectively will be understood to be embraced within the term "filament supply means," which term has been heretofore used in connection with the first embodiment shown, and the same will be understood to apply to equivalent portions of subsequent embodiments.

It is obvious that the radial arms 75 and 78 must be counterbalanced to avoid any lope in the apparatus. Of course, no counterweights are shown; but it will be perfectly clear that if each counterweight substantially offsets the eccentric load of its related radial arm, feed stock, and filament, that the weight differential is negligible, being only that of the filament itself beyond the feeds, as best illustrated in Fig. 3.

Manifestly this embodiment of the invention not only avoids the difficulty of anchoring the mandrel or core support, here indexed 81, to the main frame, but also avoids the varying eccentric loads of two unwinding spools of filament by causing the spools to unwind normally to the shafts which support them.

Fig. 6 shows another embodiment of the invention which incorporates the features of the second embodiment (Figs. 3, 4, and 5), but makes it possible to supply the apparatus, at the outset, with an extremely large amount of filament.

The figure is largely schematic, and obviously required main frame portions are omitted.

Two vertical shafts 100 and 101 are connected together by equal gears 102 and 103. Mounted above each gear is an eccentric radial arm carrying at its outer end an upright filament feed. With respect to shaft 100, the arm is 104, and the feed is 105; and, with respect to shaft 101, the arm is 106, and the feed is 107. The filaments are delivered from beneath, as in the second embodiment; the filament relating to feed 105 is designated 108, that related to feed 107 is designated 109.

Below the timing gears 102 and 103, a pulley 110 is mounted on shaft 100 whereby the apparatus may be belt driven.

Above the timing gears and the eccentric radial arms each shaft is provided with a block support, each with the usual bight. The block support mounted on shaft 100 is indexed 111; that on shaft 101 is indexed 112, and the upright filament feed 105 is shown passing through the bight 113 of block support 112. A block 114, substantially like those previously described, receives the outer portions of, and is supported by, the block supports 111 and 112. Mounted on the block 114 is a mandrel or core support 115.

In order that the spools or reels of filament may be extraordinarily large shafts 100 and 101 are respectively coupled to yokes 116 and 117 by means of universal joints 118 and 119. The two yokes diverge from each other beneath the universal joints, as shown in the figure; and the bottom portion of each yoke is provided with a stub shaft mounted in a suitable bearing. Journaled in each yoke is an exceptionally large reel for filament. The reel relating to yoke 116 is indexed 120, that relating to yoke 117 is indexed 121. It will be noted that the yokes and their reels are 90° out of phase.

Filament is indicated in the figure as a phantom in the upper portion, but is not shown loaded on the reels. Provided on each yoke, above the reel, is a filament tensioning device 122.

An essential principle of this invention is to support the mandrel without anchoring the same to the main frame of the apparatus. Fig. 7, which is bracketed in the drawing, shows, diagrammatically an elevational view and

a plan view of a mandrel support 125 which is suspended from a circular arrangement of permanent magnets 126. To the right in the elevational view fragmentary filament feeds 127 and 128 are indicated. As the filament feeds rotate about their respective intersecting orbital paths one or more of the permanent magnets is raised momentarily to clear one or another of the filaments. A suitable means of selectively raising and lowering the magnets should, of course, be timed with the winding devices.

Fig. 8 shows a form of the invention which is substantially like that illustrated in Figs. 3, 4, and 5 except that the timed shafts slant toward each other and the universal joints are eliminated. The advantage gained here is that the filament feeds revolve about the mandrel support at approximately the same distance, and the problem of eccentricity is almost wholly avoided.

The timed shafts are indexed 125' and 126'; their related gears 127' and 128'; and the block 129, from which the mandrel support 130 rises vertically, is supported by three block supports 131, 132, and 133, the first being mounted on shaft 125 and the last two being mounted on shaft 126, such block supports supporting block 129 substantially in the same manner as block supports 16 and 17 in the embodiment of Fig. 1, and block supports 58, 59, 60, and 61 in the embodiment of Fig. 3, except that block supports 131, 132, and 133 enter inclinedly disposed concave arcuate notches in block 129.

The reel yokes are in line with the axes of the timed shafts. Revolving with shaft 125' is yoke 136, within which reel 137 revolves, carrying filament 138; and revolving with shaft 126' is yoke 139, within which reel 140 revolves, carrying filament 141. The filaments and their paths are shown in phantom, the usual tensioning devices are indexed 142. Eccentric filament feeds above the timing gears 127 and 128 are designated 143 and 144. It will be noted in Fig. 8 that the outlets of the feeds are substantially equidistant from the top of the mandrel support. The sustaining block supports 131, 132, and 133 are presumed to have the usual bights such as block supports 16 and 17, Fig. 2.

The angularity of the shafts is for the purpose of permitting the largest possible storage reels of filament to be used.

By use of this form the necessity of using differential tensioning devices to compensate for the eccentricity of the filament feeds, resulting in a slacking of the filament, is avoided. All other advantages shown in Fig. 6 are included in Fig. 8, especially that of permitting the use of extraordinary large supplies of filament.

In the form shown in Figs. 9, 10, and 11 the result accomplished in the device of Fig. 8 is the same. The two filaments 150 and 151 are always substantially equidistant from the top of the mandrel support 152. In this form the term "block" will be understood to include block base 153, with block supports 154 and 155 moving in arcuate notches 156 and 157 in such block base 153, and block collar 158. The filament feeds 159 and 160 are like those shown in Fig. 3 except that the tops of the feeds are bent toward the top of the mandrel support. The understructure of the apparatus is substantially the same as in Fig. 8.

A cross section of the block is shown as that of a circle having two oppositely directed recesses to accommodate and slidably receive the block supports. Furthermore, the block is wedge shaped so that it is supported from the block collar and is wedged between the block supports.

All advantages of the divergent yokes in Figs. 6 and 8 for large reels of filaments are included in this embodiment although not shown in Figs. 10, 11, and 12.

We claim:

1. In a machine for winding two filaments in opposite directions about a core, a frame; two vertical shafts journaled in said frame; two like meshing gears, one thereof mounted on each shaft; two like radial arms, one thereof

mounted on and projecting beyond the periphery of each gear in common angular directions, with each arm supporting a filament carrier; two like block supports, one thereof mounted on each shaft, said block supports having bights in common angular directions and 180° removed from said arms, said carriers passing through said bights as said shafts rotate; a block having two oppositely directed concave arcuate slots at different levels and slidably receiving, and being supported by the outer portions of said block supports; and a core supported by said block.

2. In a machine for winding two filaments in opposite directions about a core, a frame; two vertical shafts journaled in said frame; two like meshing gears, one thereof mounted on each shaft; two like radial arms, one thereof mounted on and projecting beyond the periphery of each gear in common angular directions, with each arm supporting a filament carrier; two like block supports at different levels, one thereof mounted on each shaft, said block supports having bights in common angular directions and 180° removed from said arms, said carriers passing through said bights as said shafts rotate; a block having two oppositely directed concave arcuate slots at different levels and slidably receiving, and being supported by the outer portions of said block supports; and a core supported by said block.

3. In a filament winding machine having forming means and means for winding filaments about said forming means in opposite directions, a block upon which said forming means is mounted, and at least two oppositely rotatable block supports in contact with said block whereby said block is maintained in substantially non-rotatable operative position by said block supports.

4. In a filament winding machine having forming means, oppositely rotating shafts, and filament supply means rotatable with said shafts whereby filaments may be oppositely wound about said forming means, a block upon which said forming means is mounted, and block supports rotatable with said shafts in contact with said block, whereby said block is maintained in substantially non-rotatable operative position by said block supports.

5. In a filament winding machine having forming means, oppositely rotating shafts, and filament supply means rotatable with said shafts whereby filaments may be oppositely wound about said forming means, a block upon which said forming means is mounted, block supports rotatable with said shafts in contact with said block, whereby said block is maintained in substantially non-rotatable operative position by said block supports, and bights in said block supports providing means whereby said filament supply means may follow uninterrupted circular orbits including said forming means.

6. In a filament winding machine as claimed in claim 5 wherein said filament supply means have a common angular direction, and said bights have a common angular direction diametrically opposed to that of said filament supply means.

7. A filament winding machine having forming means, oppositely rotatable shafts, filament feeds rotatable with said shafts for leading filaments in opposite directions about said forming means, means for driving said shafts, a block upon which said forming means is mounted, a plurality of pairs of recesses in said block, the recesses in each of said pairs being oppositely directed and at different levels within said block, a plurality of block supports mounted on each of said shafts, there being one block support on each of said shafts for each of said pairs of recesses, each of said slots slidably receiving one of said block supports, said filament feeds being slanted relative to the axes of said shafts, and each of said block supports having a bight therein, the bights in those of said block supports mounted on the same shaft being staggered, whereby said slanted filament feeds may follow uninterrupted circular orbits including said forming means.

8. In a filament winding machine having forming means, two oppositely rotating shafts, and rotatable spools of filament mounted for rotation with said shafts whereby two filaments may be oppositely wound about said forming means, a block upon which said forming means is mounted, said block having recesses therein, and block supports mounted on said shafts, said block supports being slidably received within said recesses whereby said block is maintained in substantially non-rotatable operative position by said block supports.

9. A filament winding machine comprising forming means, two oppositely rotating shafts, two standards mounted for rotation with said shafts, rotatable spools of filament supported by said standards whereby two filaments may be oppositely wound about said forming means, a block upon which said forming means is mounted, said block having recesses therein, block supports mounted on said shafts for rotation therewith, said block supports being slidably received within said recesses whereby said block is maintained in substantially non-rotatable operative position by said block supports, and bights in said block supports providing means whereby said standards may follow uninterrupted circular orbits including said forming means.

10. A filament winding machine comprising forming means, a pair of shafts, meshing gears mounted on said shafts and drive means for one of said shafts whereby said shafts may be oppositely rotated, arms mounted in common angular relationship upon said gears, standards mounted upon said arms, spools of filament rotatably supported by said standards for supplying filaments for opposite winding about said forming means, a block upon which said forming means is mounted, said block having opposed concave arcuate notches at different levels therein, block supports mounted on said shafts for rotation therewith, said block supports being slidably received within said concave arcuate notches in said block, whereby said block is maintained in substantially non-rotatable operative position by said block supports, and bights in said block supports, said bights having a common angular relationship diametrically opposed to the common angular relationship of said arms, said bights providing means whereby said standards may follow uninterrupted circular orbits including said forming means.

11. A filament winding machine including forming means, and means for oppositely winding two filaments about said forming means, a block upon which said forming means is mounted, said block comprising a block collar and a block base, said block base having recesses therein, and oppositely rotatable block supports received within said recesses and engaging said block collar whereby said block is maintained in substantially non-rotatable operative position by said block supports.

12. A filament winding machine including forming means, two filament feeds mounted for opposite rotation about said forming means, a source of filament for supplying filament to said forming means through said filament feeds, whereby two filaments may be oppositely wound about said forming means, a block upon which said forming means is mounted, said block comprising a block collar and a block base, said block base having recesses therein, oppositely rotatable block supports received within said recesses and engaging said block collar whereby said block is maintained in substantially non-rotatable operative position by said block supports, and bights within said block supports providing means whereby said filament feeds may follow uninterrupted circular orbits including said forming means.

13. In a filament winding machine having forming

means, filament feeds for leading filaments in opposite directions about said forming means, and means for driving said filament feeds, a block upon which said forming means is mounted, said block having recesses therein, oppositely rotatable shafts, a block support mounted upon each of said shafts, said block supports being slidably received within said recesses in said block whereby said block supports sustain said block in substantially non-rotatable operative position.

14. In a machine as claimed in claim 13 wherein said filament feeds follow intersecting circular paths about said forming means, said forming means being located within a symmetrical area defined by the intersection of said paths but not at the center of said area.

15. In a machine as claimed in claim 13, wherein each of said recesses in said block comprises a concave arcuate slot, said slots being oppositely directed and at different levels within said block, each of said slots slidably receiving one of said block supports.

16. In a machine as claimed in claim 13, wherein said recesses in said block comprise overlapping concave arcuate slots, said slots being oppositely directed and at different levels within said block.

17. In a machine as claimed in claim 13, continuous bores through said shafts and said filament feeds, said bores emerging at the bottom of said shafts and the tops of said filament feeds, whereby filament may be supplied from below said shafts for winding about said forming means.

18. In a machine as claimed in claim 13, continuous bores through said shafts and said filament feeds, said bores emerging at the bottom of said shafts and the tops of said filament feeds, yokes secured to the bottom of said shafts and spools of filament rotatably supported by said yokes, whereby filament may be supplied from said spools for winding about said forming means.

19. In a machine as claimed in claim 18 wherein said spools are disposed normal to the axes of said shafts, said yokes being rotatable with said shafts.

20. In a machine as claimed in claim 18 including universal joints for securing said yokes to said shafts, said yokes diverging downwardly, whereby large filament reels may be accommodated within said yokes, said yokes being rotatable with said shafts.

21. In a machine as claimed in claim 13 wherein said recesses in said block are inclinedly disposed therein and said block supports are mounted on said shafts normal to the axes of said shafts, whereby said shafts diverge downwardly from said forming means, continuous bores through said shafts and said filament feeds, said bores emerging at the bottom of said shafts and the tops of said filament feeds, yokes secured to the bottom of said shafts, and spools of filament rotatably supported by said yokes, said spools being disposed normal to the axes of said shafts, said yokes being rotatable with said shafts.

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