May 17, 1927. 1,629,366

E. STUBBS

RING SPINNING FRAME

Filed Feb. 2, 1922 5 Sheets-Sheet 1

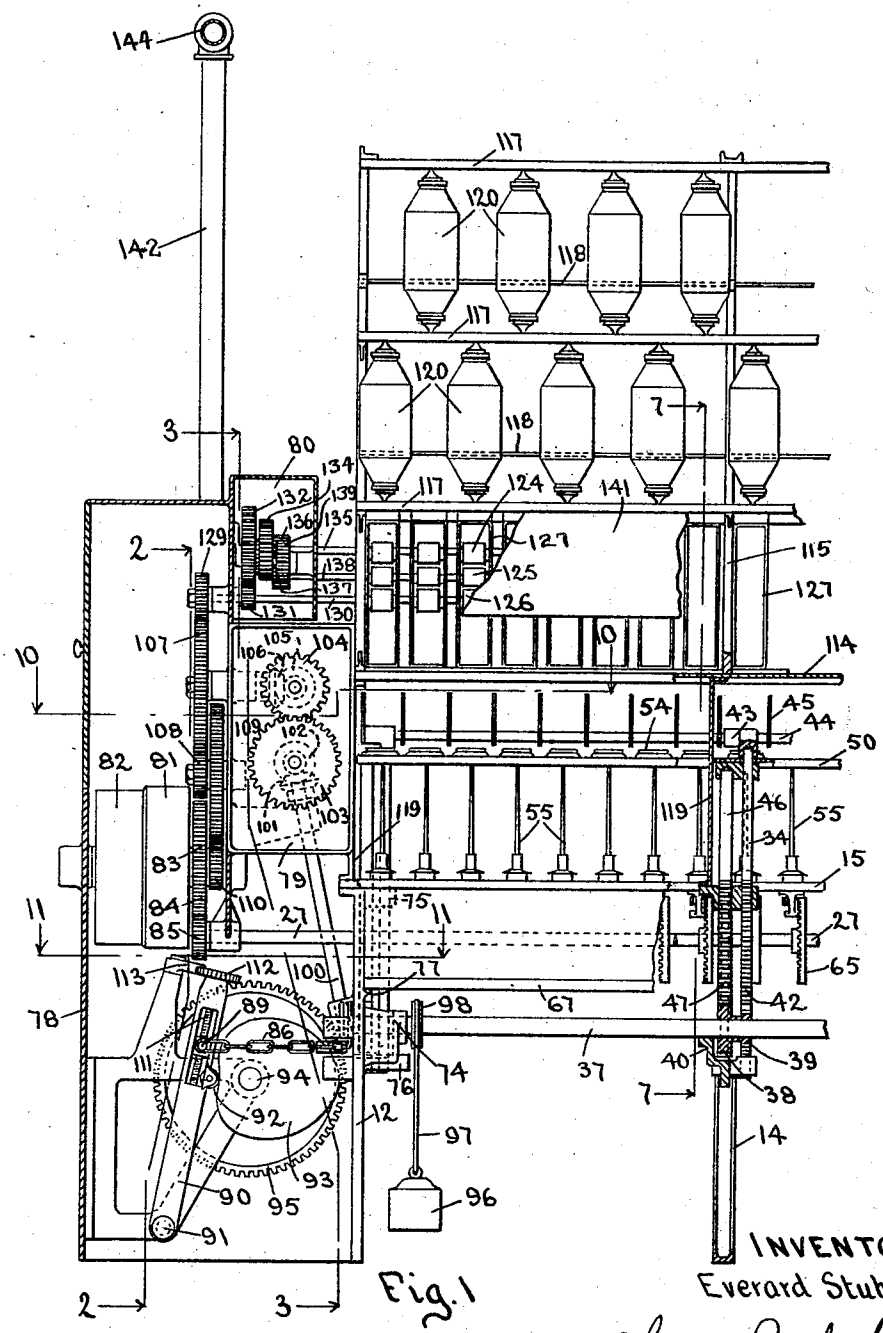

Fig. 1

May 17, 1927. 1,629,366

E. STUBBS

RING SPINNING FRAME

Filed Feb. 2, 1922 5 Sheets-Sheet 2

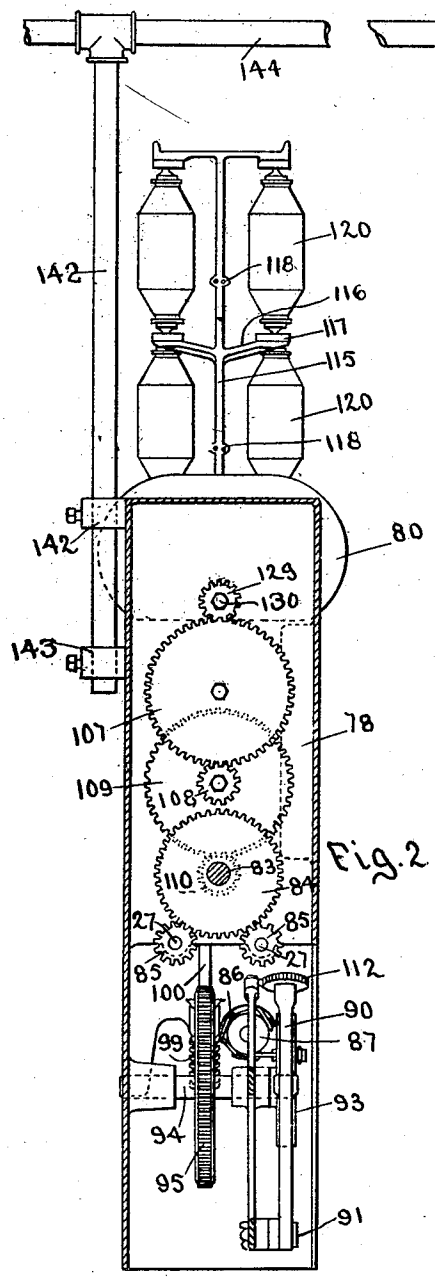

Fig.2

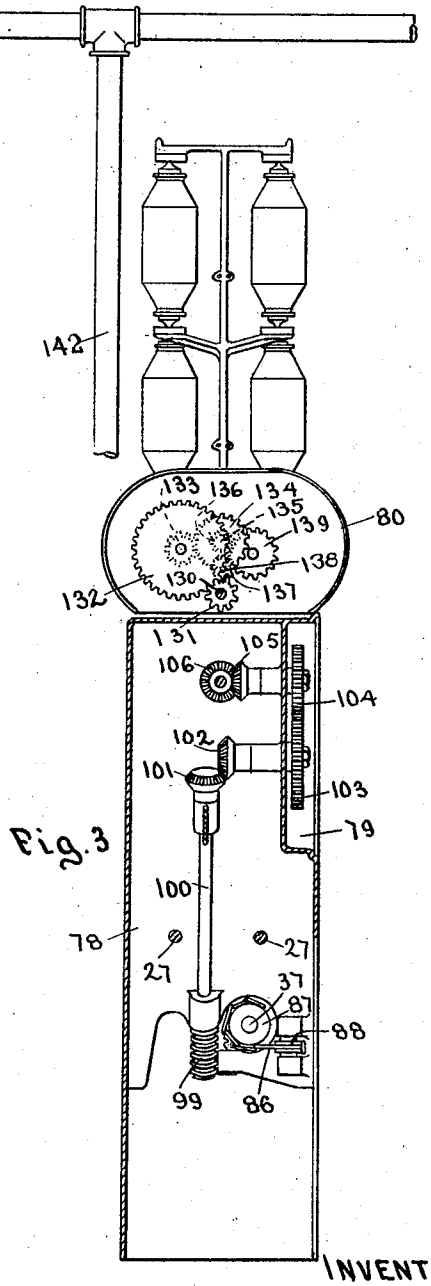

Fig.3

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E. STUBBS

RING SPINNING FRAME

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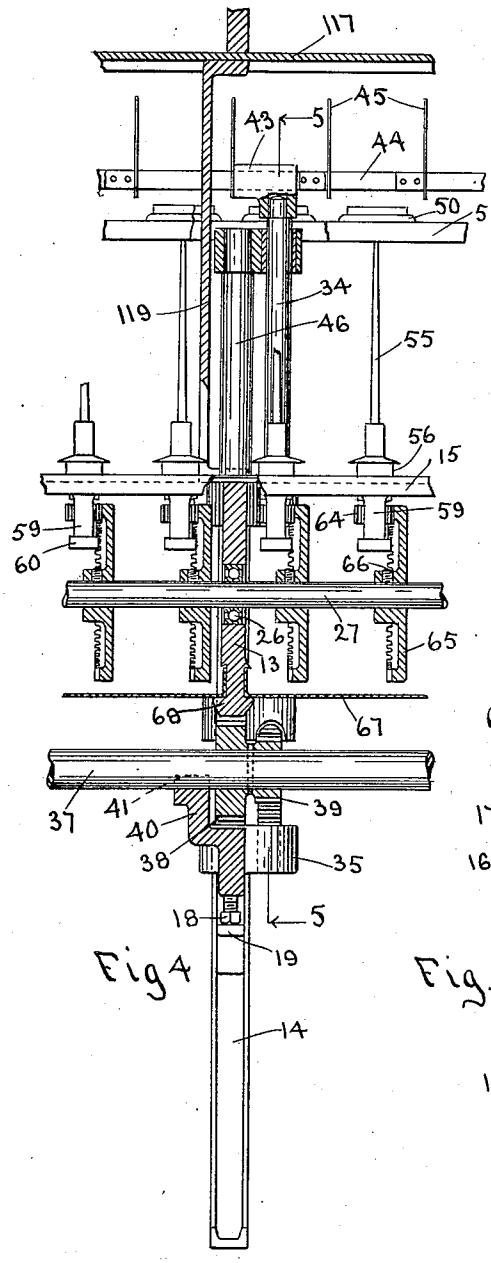

Fig 4

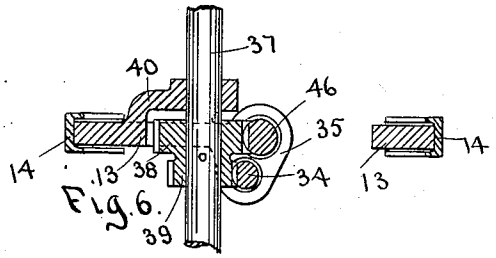

Fig. 6.

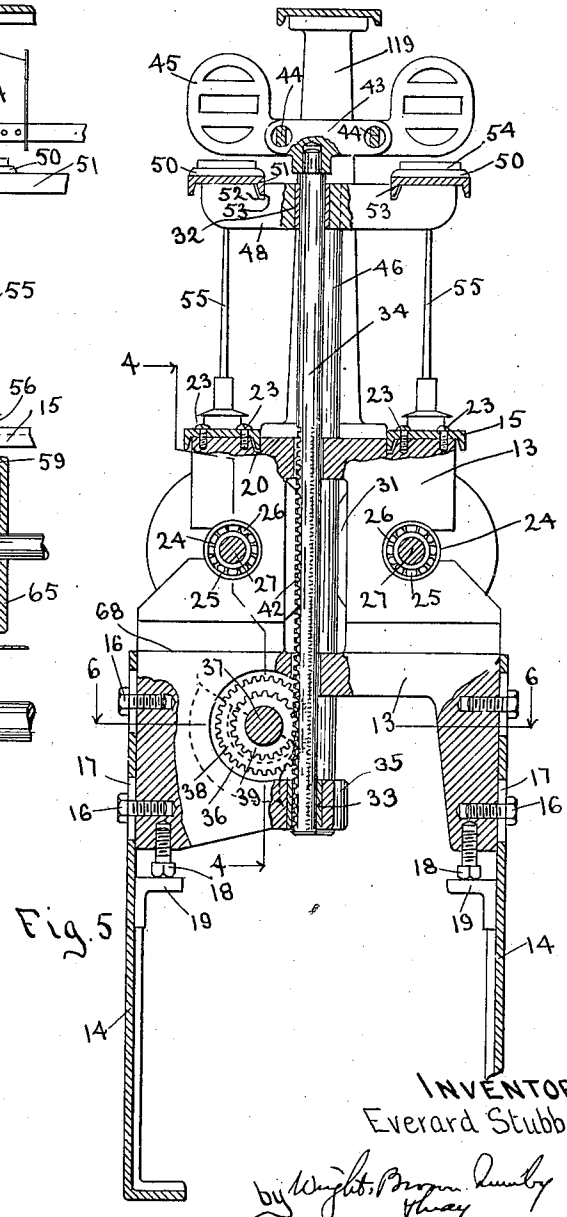

Fig. 5

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RING SPINNING FRAME

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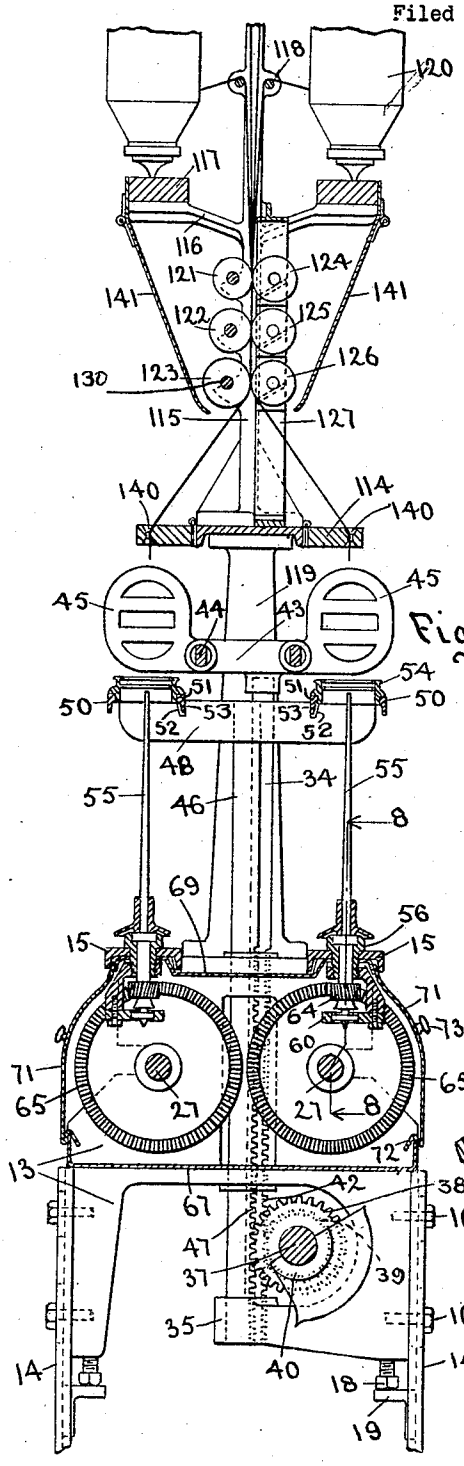

Fig. 7.

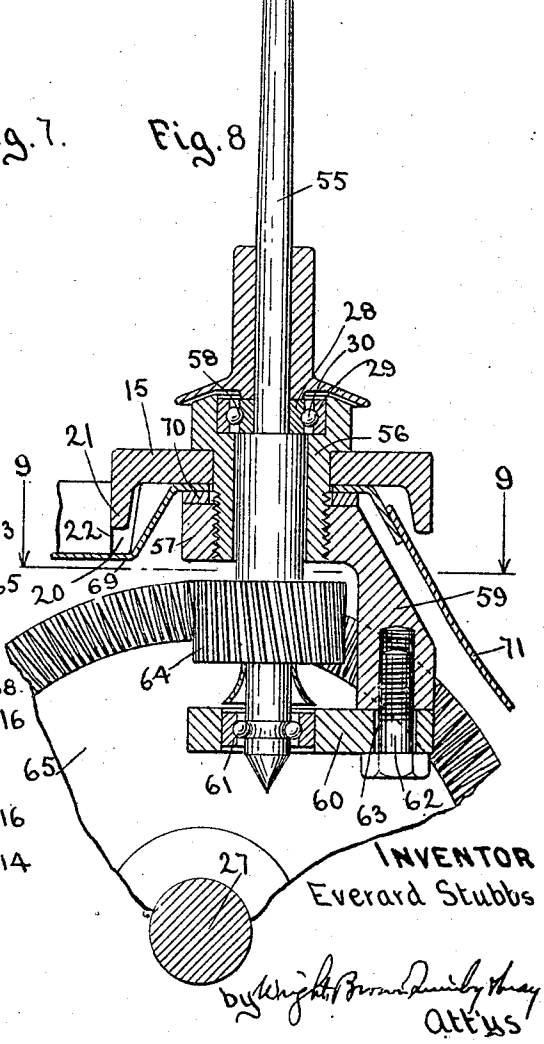

Fig. 8

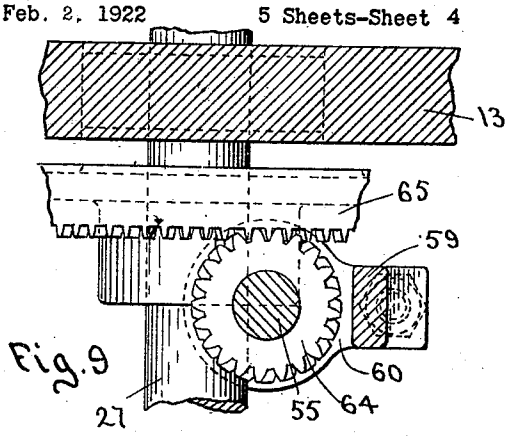

Fig. 9

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RING SPINNING FRAME

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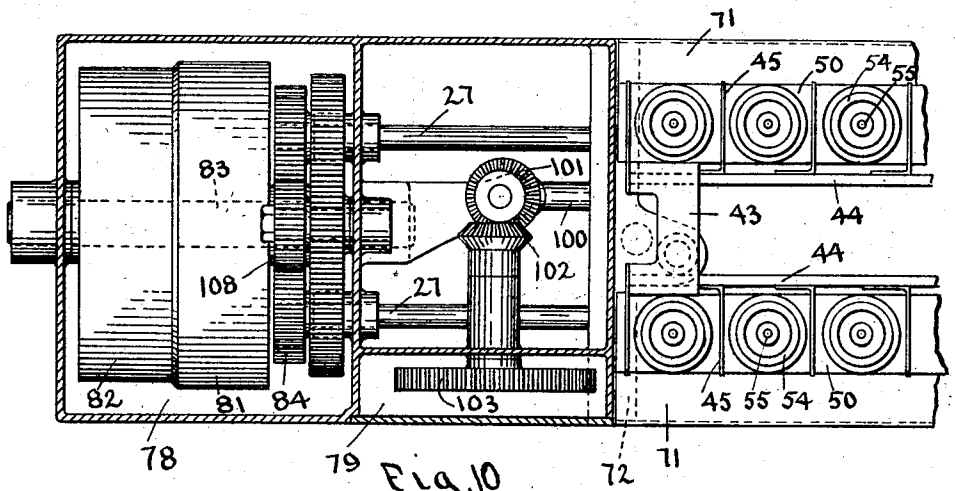

Fig. 10

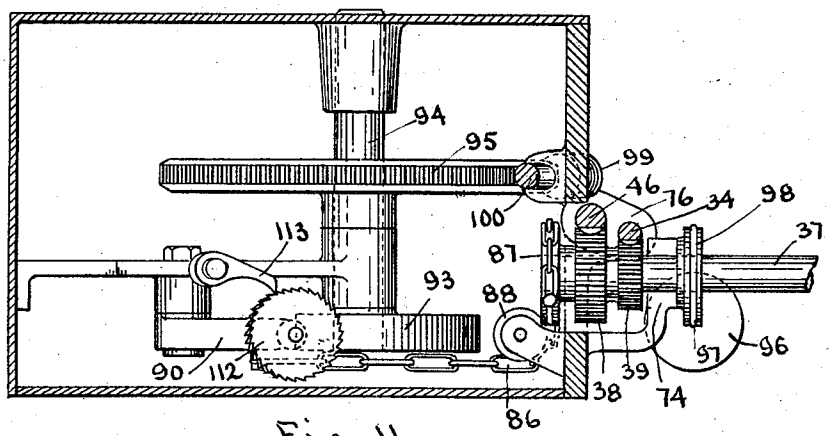

Fig. 11.

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Patented May 17, 1927. 1,629,366

UNITED STATES PATENT OFFICE.

EVERARD STUBBS, OF SPRINGFIELD, VERMONT.

RING-SPINNING FRAME.

Application filed February 2, 1922. Serial No. 533,507.

The present invention relates to spinning machines of the type in which the yarn being spun passes to the rotating spindle through a traveler which runs on a ring surrounding the spindle, such machines being commonly termed "ring spinning frames." It is adapted for machines of this type running at any of the speeds known to be practicable, and the embodiment illustrated in the drawings and described in the specification has been particularly designed with reference to machines for spinning the finest yarns in which the spindles are run at the highest speeds, up to ten thousand revolutions per minute, or more.

The objects of the invention are 1st to provide a spinning frame which is much more compact than those heretofore employed to produce the same amount of yarn, whereby a substantial saving of space in the spinning mill may be effected; 2d, to provide a gear drive for the spindles capable of running without objectionable noise or vibration at the highest spinning speeds, thereby avoiding the troubles incident to machines wherein the spindles are driven by bands or tapes, such troubles including variation of spindle speed, wear and stretching of tapes, etc.; 3d, to simplify the construction and reduce the weight of the machine in proportion to its output capacity and to enable it to be assembled and disassembled, with sufficient accuracy and correct aligning of those parts which have to be aligned, more easily and quickly than is possible with machines heretofore produced; 4th, to provide a new and simple mode of mounting the spindles with means for adjusting individual spindles to center them; 5th, to protect the builder motion of the machine from dirt and lint and render the adjustable parts of such mechanism more convenient to the operator; and 6th, to arrange drawing rolls in association with the machine in such arrangement and location that one collection of rolls is adapted to furnish material to two spindles or sets of spindles and that the rolls may be readily reached for cleaning.

These and subsidiary objects are accomplished in the spinning machine or frame described in the following specification and illustrated in the accompanying drawings; and the invention consists in the means herein shown and described for accomplishing such results, and all equivalents thereof, as set forth in the appended claims with reference to the specification.

In the drawings:—

Figure 1 is an elevation, with parts broken away and shown in section, of one end of a spinning frame embodying the invention.

Figures 2 and 3 are vertical sectional views taken on the lines 2—2 and 3—3, respectively, of Figure 1.

Figure 4 is a fragmentary view in longitudinal section of the machine illustrating particularly an intermediate supporting member of the frame and the means for respectively driving the spindles and moving the ring rail and separators. The plane of section on which this figure is taken is indicated by the line 4—4 in Figure 5.

Figure 5 is a cross section of the machine taken on line 5—5 of Figure 4.

Figure 6 is a fragmentary horizontal section taken on line 6—6 of Figure 5.

Figure 7 is a cross section of the entire machine taken on line 7—7 of Figure 1.

Figure 8 is a fragmentary sectional view on an enlarged scale of one of the spindles taken on line 8—8 of Figure 7.

Figure 9 is a horizontal cross section taken on line 9—9 of Figure 8.

Figures 10 and 11 are horizontal sections taken on lines 10—10 and 11—11, respectively, of Figure 1.

The view points from which the sectional views are seen are indicated by the arrows adjacent to the several specified lines of section.

Like reference characters designate the same and duplicate parts wherever they occur in all the figures.

The frame of this machine is constructed to support two rows or sets of spindles, and the spindles are driven by gear wheels, which makes it possible to place the different rows of spindles close together, and likewise to arrange the sets of cooperating rings close together, whereby a single lifter mechanism is applicable for raising and lowering the ring rails to build up the accumulation of yarn on the spindle bobbins, and a single set of drawing rolls may be arranged to deliver yarn to the spindles of both sets.

The base of the machine is a framework constructed of a head end casting 12, a foot end casting (not shown but which may be like the casting 12), intermediate castings 13 of which the number may be varied ac-

cording to the length of any particular machine, legs 14 supporting the intermediate castings, and longitudinal members 15, 15. The latter are preferably rolled steel bars of channel section. The parts herein designated as castings are preferably so made because their more or less complicated forms can be made most cheaply by founding, but equivalent members may, if desired, be otherwise constructed, and the term "casting", as herein used, is intended to include all structural equivalents of such parts. Provision is made for adjusting the legs 14 in respect to the intermediate castings 13 in order that the latter may be raised or lowered to place them in proper alinement with each other and with the end castings, and to support them firmly on an uneven floor. Such legs are connected to the opposite outer edges of the associated casting by means of bolts 16 passing through slots 17 in the legs, and a screw 18 threaded into the under side of the casting bears on a bracket 19 secured to the leg. Thus evidently a very accurate vertical adjustment of the intermediate casting may be made while the frame of the machine is being set up. These legs also may be made out of rolled steel channel bars.

An important feature of the invention consists in the fact that the longitudinal members or bars 15 serve to locate or aline the intermediate castings. These bars are secured at their ends to the head and foot castings and they are adapted to extend over the upper edges of the intermediate castings. The latter have notches 20 (Figures 5 and 8) to receive the inner flanges 21 of the channel bars 15, and one side of each notch 20 provides a shoulder 22 which is designed to bear against the outer surface of the flange which occupies it. The distance between the shoulders which thus bear against two bars 15, respectively, is equal to the distance from the inner side of one bar to the nearer side of the other, wherefore when the castings are assembled with the bars 15 as thus indicated they are necessarily placed in correct lateral alinement. Vertical adjustment of the castings on the legs 14 to bring their upper sides into contact with the under sides of the bars, and to bring the bars level, determines the correct vertical alinement of the castings. Attachment of these castings and bars is made by screws 23, as shown in Figure 5.

The intermediate castings have notches 24 in their opposite side edges opening into recesses 25 adapted to receive ball bearings 26 which support the spindle driving shafts 27. These recesses in the several castings are so related to the shoulders 22 that when the castings are thus assembled with the side bars and placed at the proper elevation by adjustment of the legs 14, all the bearings for the said drive shafts are correctly alined throughout the whole length of the machine. The notches 24 are larger than the shafts 27, whereby the shafts may be passed laterally through them; and the bearings are preferably of the well known self-contained type adapted to be slipped endwise upon and along the shafts. The preferred type of bearing is indicated in Figure 4, and is shown on a larger scale and in another relation in Figure 8. It consists of an inner ring-shaped race 28 having an encircling groove in its outer surface, a surrounding ring-shaped outer race 29 having a groove in its inner surface, and an interposed series of balls 30 occupying both grooves. When the outer race is sprung over the balls, the entire bearing becomes a unit and can be applied and shifted as such without falling apart. Thus it is possible to mount and dismount the shafts without removing the gears carried thereby, by placing the bearings on the shafts at one side of the castings, passing the shafts through the notches of the castings and then slipping the bearings along the shafts into the recesses 25.

An upright sliding rod 34 is arranged in the open central part 31 of each casting 13. Said rod slides in a guideway 32 in a bracket 48 (later described) and in a lower guideway 33 provided in a part of the casting formed by a lug or bracket 35 separated from the adjacent part of the casting by an opening 36 large enough to receive a shaft 37 carrying a connected pair of spur gears 38 and 39. A web 40, formed as part of the casting, is offset to one side of the recess 36 and is formed in its upper part with a bearing cavity 41 to receive and support the shaft 37, such web being so formed and arranged that the shaft may be placed in said bearing and removed from it through the open space previously described and without need of removing or displacing the connected gears 38 and 39.

The rod 34 is provided in its lower part, on one side, with a series of rack teeth 42 meshing with the gear 39, whereby said rod may be raised and lowered by oscillation of the shaft 37. This rod and the rods like it mounted similarly in other castings of the frame carry on their upper ends brackets 43 holding rods 44 to which are attached separator blades 45 arranged in the spaces between adjacent spindles for the purpose of preventing interference between the yarns being spun on adjacent spindles, in accordance with common practice in this art.

Other guideways are provided in the castings beside those previously described to receive upright sliding rack bars 46 having teeth 47 (Figures 1 and 7) which mesh with the gears 38. The rack bars or rods 46 support brackets 48 on which the ring rails 50 are mounted. Such ring rails are preferably rolled steel channel bars similar to the frame members 15, and, like the latter,

they are alined with the several brackets 48 of the machine by their inner flanges 51 entering notches 52 in the brackets and bearing against the shoulders 53 which bound said notches. Openings are formed at suitable intervals in the ring rails 50 and in or over these openings are set the spinning rings 54 which may be of usual or any other suitable form and made fast in any suitable way. The spindles 55 are mounted upon the frame members 15 in alinement with the axes of the spinning rings; adjacent spindles and rings having the proper spacing from one another for spinning the sizes of yarn for which any particular machine is designed.

The preferred mount for the spindle is shown in detail in Figure 8 and consists of a tubular socket or bushing 56 which is passed through a hole in the bar 15 and is held by a nut 57. The upper end of the socket 56 has a shoulder which rests on the member 15 and contains a ball bearing 58, preferably of the type previously described in detail, through which the spindle blade passes and by which its position is determined. A bracket 59, either made as a part of the nut 57, or secured by it, hangs down below the socket and supports an arm 60 which carries a ball bearing 61 for the foot of the spindle blade. The arm 60 is separate from the bracket 59 and is clamped thereto by a screw 62 which passes through a hole 63 larger than itself in the arm. Thus the lower ball bearing may be shifted horizontally in any direction far enough to center the spindle blade accurately, by placing its upper end exactly in the center of the contiguous ring.

On the spindle between the ball bearings is arranged a pinion 64 in mesh with a driving gear 65 on the shaft 27. Preferably the pinion is integral with the spindle blade, but it may be made of a separate piece and attached to the blade. Each spindle in the entire machine is equipped with such a pinion and the two shafts 27 carry driving gears properly spaced and mounted to mesh severally with each of the spindle pinions. These gears are secured on their respective shafts by set screws 66, as shown in Figure 4, and may be adjusted to bring them into correct mesh with the pinions.

The elimination of tapes or bands for driving the spindles, permitted by substitution of the gearing last described, makes possible the compact construction of the machine; and the gearing employed for this purpose in high speed spinning frames, where the speed of the spindles may be as high as ten thousand revolutions per minute or even higher, preferably has the following characteristics. The spindles are out of line with their respective driving shafts, or, in other words, are non-radial to the shaft and gears by which, respectively, they are driven. This is clearly shown in Figures 7 and 8, where the axis of each spindle there represented is shown as outside of the vertical axial plane of its associated shaft. Further, the teeth of the pinions are helically arranged and the driving gears are crown gears having skew teeth which are fashioned accurately conjugate to the helical pinion teeth so as to mesh with the latter without greater backlash than is required by the best gearing practice. Thus the gears run quietly and without objectionable vibration even at the exceedingly high spindle speeds required for spinning the finest yarns. For the purposes of this description, the crown gear thus formed to mesh with the helical pinion whose axis does not intersect that of the crown gear, may be called a "skew helical crown gear." This gearing embodies the principles and characteristics of the gearing disclosed by the patent of Edwin R. Fellows and myself No. 1,461,230, July 10, 1923.

Lubrication of the gearing and spindles is obtained by oil confined in closed compartments between the castings or transverse members of the frames. Referring to Figures 4 and 7, oil pans 67 are supported underneath the driving gears by shoulders or ledges 68 on the sides of the transverse castings. Fixed splash covers 69 are secured to the frame members 15 by the nuts 57 which hold the spindles fast (such covers having holes through which the spindle sockets pass and which are closed by washers 70, as shown in Figure 8). Removable side covers 71 overlie the vertical spaces between the splash pans and the fixed covers. These side covers are preferably of sheet metal, the lower edges of which are folded to form a lug 72 which rests on the edge of the pan and the upper edges of which are adapted to slide beneath the outer flange of the adjacent frame bar 15 and to overlap the turned down outer edge of the fixed top cover 69. The side covers are equipped with knobs or handles 73, by which they can be removed when it is necessary to have access to the encased mechanism. Both the pans and top covers, as well as the side covers, may be of sheet metal, or any other suitable material or construction. Oil is kept in the pans to a depth great enough for the under sides of the driving gears to dip into it. The rotation of these gears churns the oil into a spray or mist which fills the enclosed chambers and passes into the ball bearings 61 and 58, thus lubricating said bearings as well as the contacting gear teeth. Efficient lubrication is afforded by the oily mist so produced.

The head casting 12, and likewise the foot casting, is provided with a bearing 74, similar to the bearings 40 of the intermediate castings, in which the shaft 37 is supported, with other bearings through which the

shafts 27 pass, with lugs 75 and 76 providing guideways for duplicates of the rods 34 and 46 previously described, and with a ledge 77 supporting the adjacent oil pan 67. On the outer side of the head casting are gear casings 78, 79 and 80 and such other brackets and supporting means as may be necessary to mount and enclose the pulleys and gears which receive and transmit power to drive the machine.

Pulleys 81 and 82 on a shaft 83 receive a driving belt which is driven by any suitable means, and shaft 83 carries a gear 84 which meshes with pinions 85 on the two shafts 27, respectively, (Figures 1 and 2), whereby these shafts are driven. A builder motion, by which the shaft 37 is oscillated so as to raise and lower the ring rails and the separator blades, is constructed and operated in the following manner, reference being directed to Figures 1, 2, 3 and 11. A chain 86 is wrapped around and secured to a sprocket disk 87 on the shaft 37 and passes around a guide roll 88 to a connection with a pin 89 on a lever 90 which oscillates upon a fixed pivot pin 91. Said lever carries a roll 92 bearing against the edge of a cam 93 which is fast to a shaft 94, on which also a worm wheel 95 is made fast. Said lever 90 is constantly held against the cam 93 by a weight 96 suspended by a cord 97 which is wrapped around and made fast to a pulley 98 on the shaft 37. Meshing with the worm wheel 95 is a worm 99 on a shaft 100 which receives motion through bevel gears 101, 102, spur gears 103, 104, bevel gears 105, 106, and spur gears 107, 108, 109 and 110 from the shaft 83. The gear 110 is fast on shaft 83; gears 108 and 109 are connected together; and so are gears 107 and 106, 105 and 104, and 103 and 102, as is clearly evident from the drawings. While the receding surface of the cam 93 passes the trundle roll of the oscillating lever 90 it permits the weight 96 to rotate the shaft 37 in the direction which will raise the rods 46 and 34 by means of the gears 38 and 39, respectively, while the advancing surface of the cam causes the shaft 37 to be rotated in the opposite direction through the lever 90, chain 86 and sprocket 87, whereby the rods are lowered. This up and down motion of the rods 46 raises and lowers the spinning rings and so causes the yarn being spun to be wound evenly on the spindle bobbins. The gears 39, being smaller than the gears 38, cause the separator blades to travel in the same direction but in a shorter path than the spinning rings, whereby these blades are always approximately midway between the rings and the eyes through which the yarn passes to the rings, the condition which best safeguards the yarns passing to adjacent spindles from interfering with each other. Shaft 37, gears 38 and 39, and the upright rods 46 and 34 constitute the lifting mechanism, operated by the builder motion, for moving the ring rails and separator blades up and down.

The pin 89 which connects the chain 86 to the oscillating lever 90 is carried by a block through which a screw 111 is threaded. Said screw is carried by the lever 90 and is provided with a ratchet wheel 112 which swings past an adjacent stationary pawl 113 with oscillations of the lever. The arrangement of the pawl, ratchet and screw is such that the connection 89 is moved gradually toward the pivot of the lever, whereby successive traverses of the ring rails are made shorter and shorter. The accumulation of yarn on the spindles is thus built up with tapered ends.

The facts that a single lifting mechanism operated by the builder motion is provided for controlling both sets of spindles, that the oscillating lever of the builder motion is in an upright position, and that the entire builder motion is enclosed in a gear case are features novel to this invention for which I claim protection. The encasement of the builder motion protects it from accumulation of lint and dirt; the upright arrangement of the oscillating lever gives the attendant more convenient access to the ratchet gearing, and the operation of both sets of ring rails by one lifting mechanism eliminates the lever mechanisms heretofore generally used for lifting ring rails, thus conducing to the object of simplicity and economy in construction.

Over the base frame there is mounted a framework carrying drawing rolls and supply bobbins or cops of yarn or roving to be spun. This framework comprises a base plate 114, uprights 115 having brackets 116, longitudinal bars 117 and longitudinal rods 118. Posts 119 mounted on the members of the lower frame support the upper framework. The bars 117 hold the bobbins or spools 120 of yarn or roving prepared for spinning and the rods 118 are guides over which the yarns pass from the bobbins to the drawing rolls. The gear driven drawing rolls 121, 122 and 123, of progressively increasing diameter, are mounted on shafts, which rest in bearings on the sides of the uprights 15, and run in conjunction, respectively, with the complemental rolls 124, 125 and 126, which latter are mounted in sub frames 127 attached to the base plate 114 and uprights 115. Said rolls, cooperating as described, constitute what I call for the purposes of this specification a "set" of drawing rolls. Generically a "set" of rolls comprises any number of pairs of rolls arranged to draw yarn. There is one such set of drawing rolls for each pair of spindles; and for present purposes the term "pair of spindles" is intended to include two spindles

arranged in any transverse plane of the machine as represented in Figure 7.

The corresponding gear driven rolls of the several sets cooperating with the several pairs of spindles are mounted on the same shafts and driven in unison. The gear-train for driving them is shown in Figures 1 and 3. The gear 107 drives the pinion 128 on the shaft 130 of the rolls 123, and this shaft carries a pinion 131 driving a gear 132, to which is connected a pinion 133 in mesh with a gear 134 on the shaft 135 of the rolls 121; and a pinion 136 on the latter shaft drives a pinion 137 on the shaft 138 of the roll 122 through an idler gear 139.

Yarns passing from the drawing rolls are led to eyes in thread boards 140 hinged to opposite edges of the base plate 114, one of which eyes is directly over each spindle, and thence to the nearest spindle. One set of drawing rolls thus supplies yarn to two spindles, as distinguished from the previous practice where a set of rolls was provided for each spindle. Or, if it be considered that all the rolls of the machine form a "collection" and that there are two sets or series of spindles in the machine, then it may be said that the entire collection of drawing rolls is assembled over the middle of the machine and supplies yarn to both sets or series of spindles.

The narrow width of the machine makes the result just described possible, and also makes it possible to arrange the drawing rolls in vertical series, whereby the gear driven rolls are placed beside the complemental rolls instead of under the latter as in the prior practice, making it easily possible to clean the gear driven rolls. These rolls are encased by guard plates 141 which protect them from dirt and may be moved aside when necessary to get at the rolls for cleaning them.

I have indicated in Figures 1, 2 and 3 means for supporting or steadying the frames constructed as thus described. Owing to their relatively great height and narrow width, such frames are not very stably supported on their own bases and for giving them additional support I mount an upright rod or tube 142 in lugs 143 projecting from the side of some part of the frame, preferably the gear casing on the head frame casting, and connect such upright bar with an overhead transverse bar 144. A row of spinning frames may thus be connected so as amply to support one another, and the cross rod may be fastened to some part of the mill building.

It will now be appreciated that the characteristics thus described and illustrated accomplish the objects recited in the introductory part of this specification. By the use of this invention an equal number of spindles may be mounted in a frame having approximately one-third the width of the spinning frames heretofore commonly used; whereby a greater number of frames may be mounted in a given mill, or a mill to provide for a given number of spindles may be built smaller than is required by former practice. The smaller transverse dimension and more compact construction of the frame results in simplicity and lower cost of construction, as well because the structural elements of the frame contain less material, as because the ability to use one lifting mechanism for two sets of rings and separators, and one series of drawing rolls for two series of spindles, eliminates a great number of duplicate parts heretofore necessary.

Setting up of the machine with substantially perfect alinement is made easy by reason of the longitudinal frame members of rolled structural steel and the alining shoulders complemental thereto of the frame castings and the ring rail brackets. The distances and positions of the bearing centers with respect to these alining shoulders in the several shaft supporting members or castings 13 can be accurately duplicated, so that assembling of these members with the longitudinal bars alines the shaft bearings without the use of loose brackets or other adjustable parts. Irregularities in the floor are taken care of by adjustment of the legs 14, and the same adjustment brings corresponding points of all the members 13 to the same height.

The employment of toothed gearing for driving the spindles ensures uniformity of rotational speed of all the spindles and eliminates the troubles incidental to the use of bands and tapes, of stretching, wearing out or breaking, and stopping of the machine to take up stretch or to replace worn out or broken bands, besides enabling the space formerly required for the band driving drums and the guide or take-up rolls to be economically utilized for additional spindles:

The provision of an accessible readily adjustable lower bearing for the spindle makes it possible to adjust and center the spindle accurately.

Finally the new arrangement of the builder motion and drawing rolls permits these parts to be covered and protected and to be easily reached for cleaning and adjusting. As to the builder motion particularly, the upright arrangement of the lever 90 enables the attendant to reach and reset the ratchet wheel 112 after first removing a detachable cover in the enclosing case.

What I claim and desire to secure by Letters Patent is:

1. A ring spinning frame comprising two substantially parallel series or rows of spindles, a driving shaft for each row of spindles, gears mounted on each of said shafts

and pinions mounted on the respective spindles, each pinion being in mesh with one of said gears, the shafts being below and parallel to the rows of spindles separated from one another a distance less than that between the rows of spindles, while the distance between the rows of spindles is less than twice the diameter of the gears, two series of spinning rings cooperating with the several spindles, a single rigid structure supporting both series of rings and mechanism operatively connected to raise and lower said structure and both series of said rings as a unit.

2. A ring spinning frame comprising two substantially parallel rows of spindles, a driving shaft for each row of spindles, intermeshing gears on said shafts and pinions on said spindles, ring rails and spinning rings cooperating with said spindles in the spinning of yarn, and means for raising and lowering said ring rails arranged between the vertical planes in which the said shafts are located.

3. A ring spinning frame comprising a supporting structure, spindles arranged in two substantially parallel rows on said structure, two substantially parallel shafts each beneath one of the rows of spindles, driving gears on each shaft for the spindles of the row above the shaft, a driven pinion connected to each spindle and each pinion being in mesh with one of said driving gears, said rows of spindles and shafts being laterally separated from each other by a distance less than twice the diameter of the gears, spinning rings complemental to the several spindles, rails on which said rings are mounted, brackets supporting said rails, upright bars supporting said brackets and extending between said shafts, and means below said shafts for reciprocating said bars to raise and lower the ring rails.

4. A ring spinning frame comprising a supporting structure, spindles arranged in two substantially parallel rows on said structure, two substantially parallel shafts each beneath one of the rows of spindles, driving gears on each shaft for the spindles of the row above the shaft, a driven pinion connected to each spindle and each pinion being in mesh with one of said driving gears, said rows of spindles and shafts being laterally separated from each other by a distance less than twice the diameter of the gears, spinning rings complemental to the several spindles, rails on which said rings are mounted, brackets supporting said rails, upright bars supporting said brackets and extending between said shafts, said bars having teeth on one side, a drive shaft for raising and lowering said bars located beneath one of the before named shafts, driving gears on the last named shaft meshing with the teeth on said bars, and means for rotating said last named shaft alternately in opposite directions.

5. In a spinning frame, the combination with spindles, ring rails and spinning rings cooperative with said spindles, and separators, of rack bars connected with the ring rails and separators, respectively, a single shaft for raising and lowering said ring rails and separators, gears on said shaft meshing with the rack bars of the ring rails and the rack bars of the separators, respectively, and means for causing and controlling rotation of said shaft alternately in opposite directions.

6. In a spinning frame the combination with spindles, a ring rail and spinning rings cooperative with said spindles, and separators, of rack bars connected with the ring rail and separators, respectively, a single shaft for raising and lowering said ring rail and separators, gears on said shaft meshing with the rack bars of the ring rail and the rack bars of the separators, respectively, and means for causing and controlling rotation of said shaft alternately in opposite directions, the gears so cooperating with the rack bars of the separator being smaller than those which operate the ring rail, whereby the separators are given a slower motion in a shorter path than the ring rail.

7. In a spinning frame having spindles, a complemental ring rail and a series of separators, a single shaft for operating the ring rail and separators, means for rotating said shaft alternately in opposite directions, gears on said shaft, and racks operatively meshing with said gears and connected with the ring rail and with the separator carriers respectively for causing reciprocative movement thereof.

In testimony whereof I have affixed my signature.

EVERARD STUBBS.