No. 617,679. Patented Jan. 10, 1899.

A. D. EMERY.

SPINNING MACHINERY.

(Application filed Oct. 1, 1896. Renewed May 21, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1

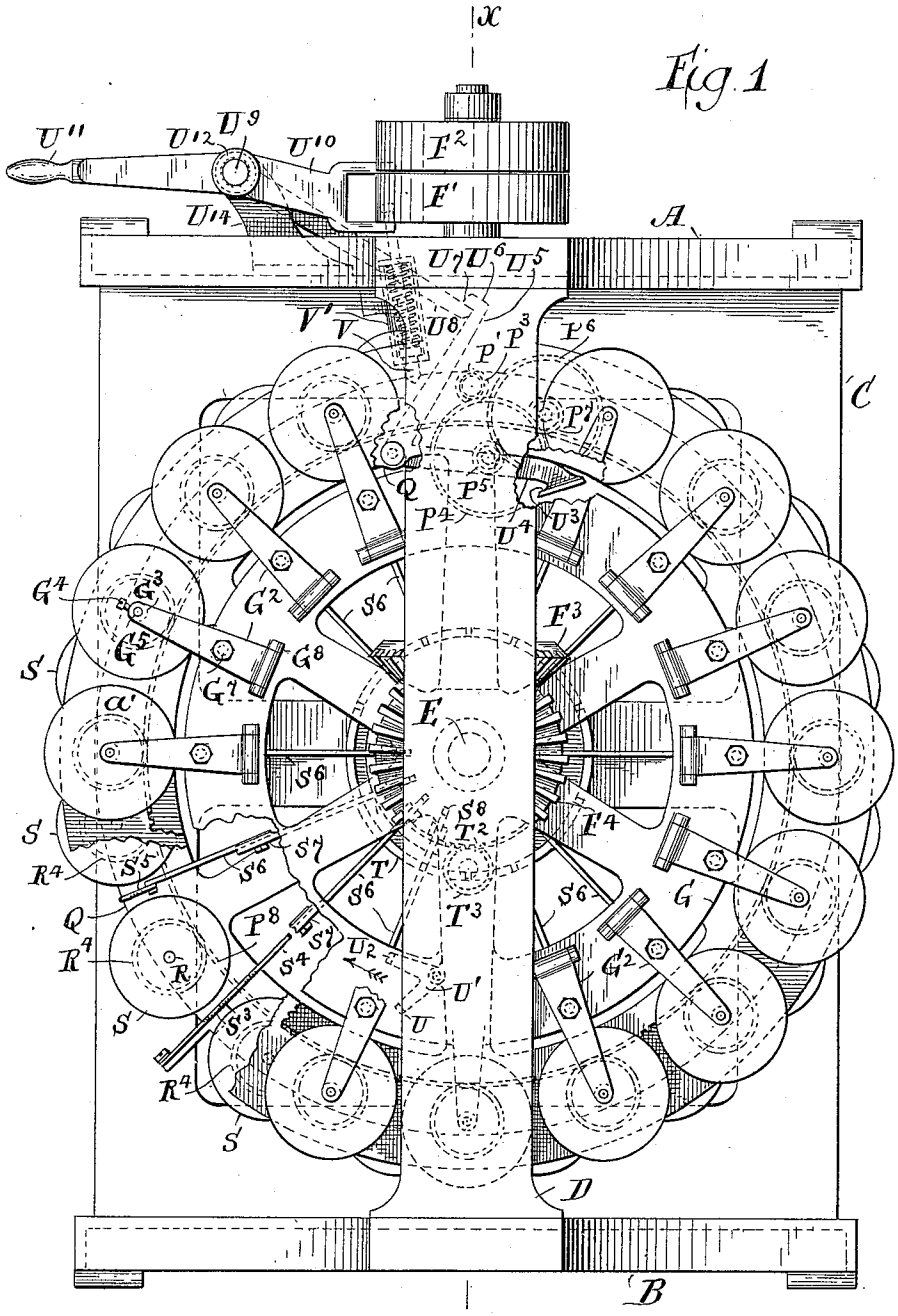

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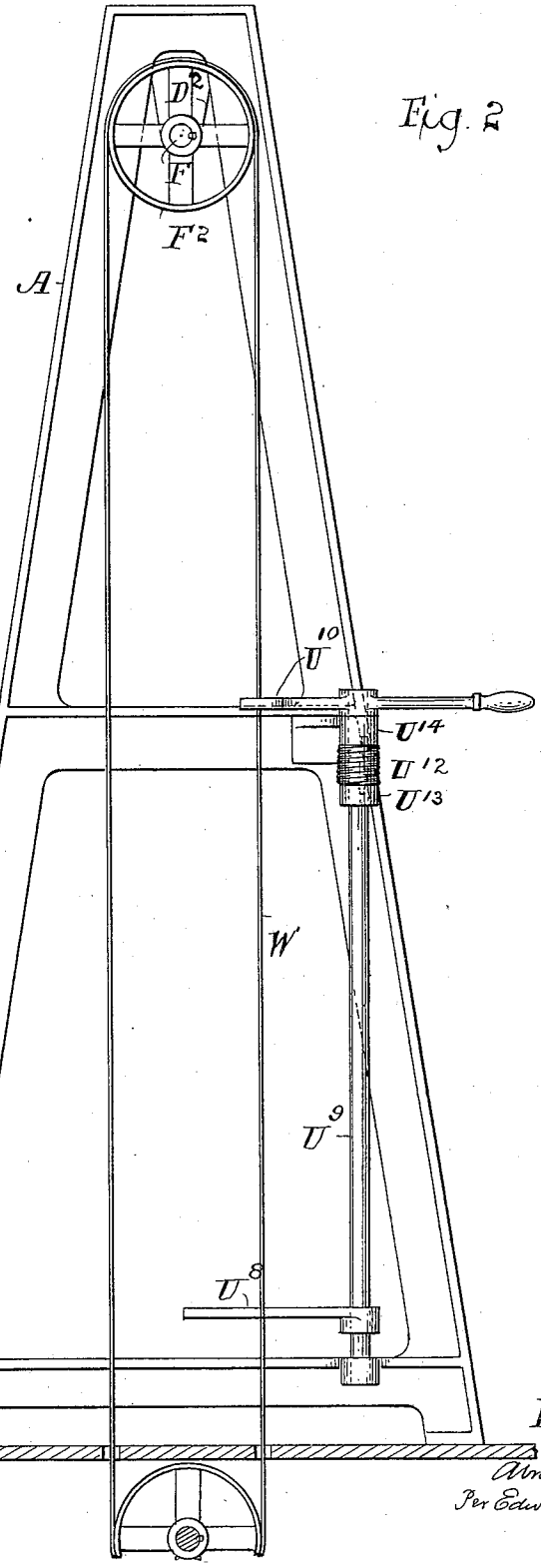
Fig. 2



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(No Model.) 4 Sheets—Sheet 3.

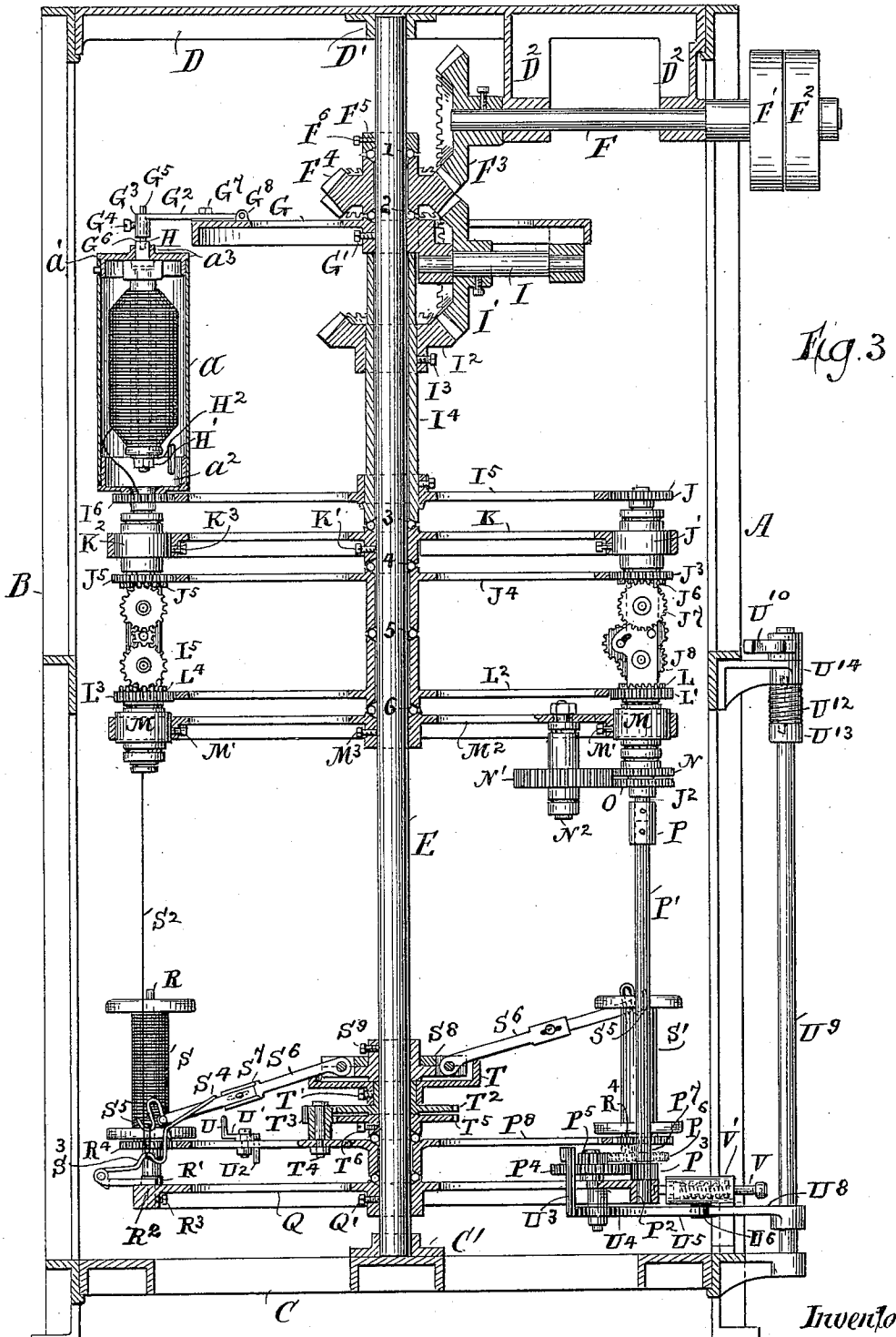

Fig. 3

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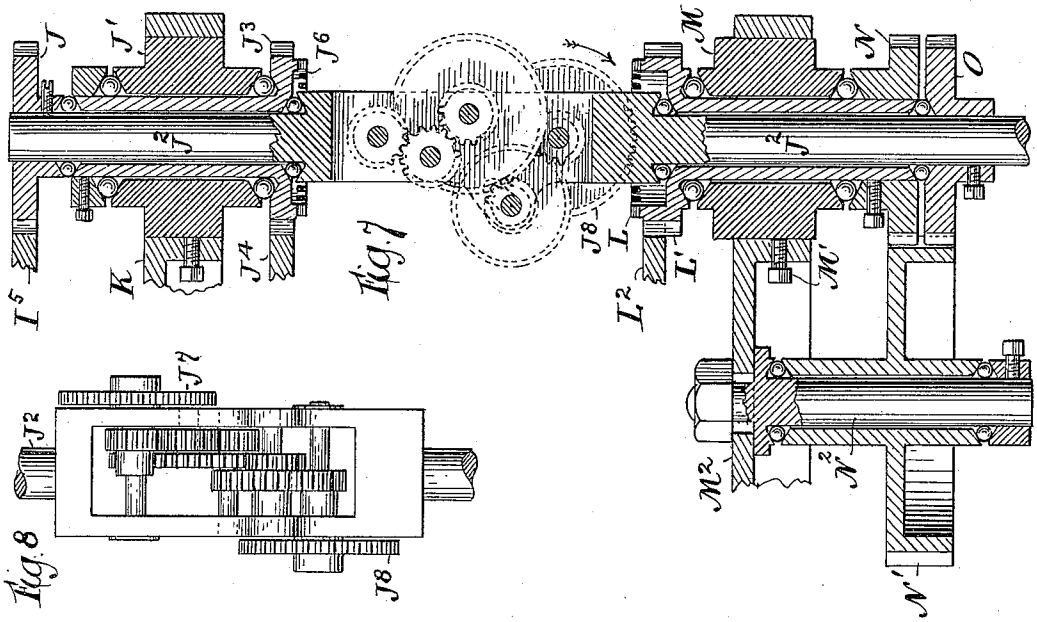
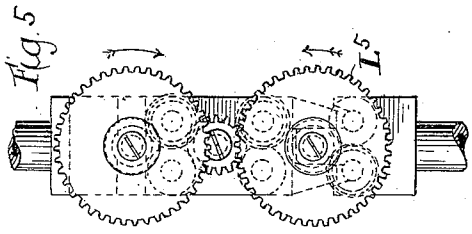
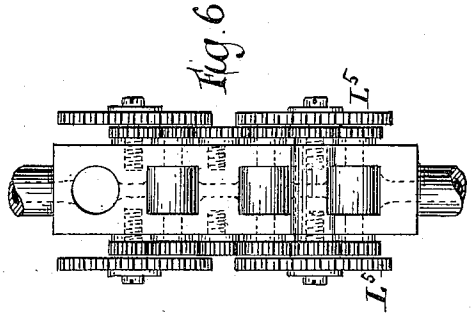
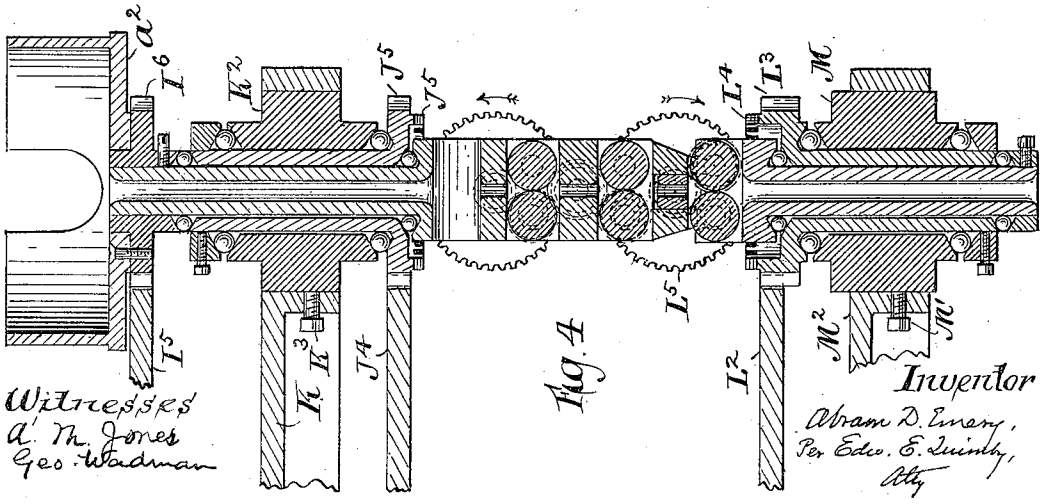
(No Model.) 4 Sheets—Sheet 4.









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UNITED STATES PATENT OFFICE.

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SPINNING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 617,679, dated January 10, 1899.

Application filed October 1, 1896. Renewed May 21, 1897. Serial No. 637,630. (No model.)

To all whom it may concern:

Be it known that I, ABRAM D. EMERY, of Taunton, Massachusetts, have invented certain Improvements in Spinning Machinery, of which the following is a specification.

This invention relates generally to the grouping in a circle and driving from a single master-gear of a multiplicity of spinning-heads of the character of those shown and described in a pending application, Serial No. 592,306. Each of said spinning-heads consists of a roving-bobbin holder surmounting a carrier carrying a system of three superposed pairs of rotating draw-rolls. The roving-bobbin holder and its draw-roll carrier rotate together upon an axis which is perpendicular to the planes of the axes of rotation of the pairs of draw-rolls. The upper two pairs of each set of draw-rolls are rotated upon their own axes at a prescribed rate of speed for the purpose of taking the roving from the roving-bobbin, while the lower pair of each set of draw-rolls are rotated at a higher rate of speed for the purpose of stretching the roving as it issues from the next higher pair of draw-rolls. By means of appropriate winding devices similarly grouped in a circle and driven by motion derived from said master-gear the twisted yarns are taken up and wound without thereby having their twist either diminished or increased.

In the machine illustrating the invention shown in the accompanying drawings fifteen spinning-heads are mounted in vertical bearings arranged upon the periphery of a horizontal disk divided into sixteen parts, one of which is occupied by mechanism for transmitting motion to rotate the draw-rolls and the take-up devices and the others by the spinning-heads.

Figure 1 is a top view of the machine. Fig. 2 is an end elevation of the frame. Fig. 3 is a central vertical section taken through the plane indicated by the dotted line $x\,x$ on Fig. 1, showing one of the spinning-heads partly in section and partly in elevation and showing two of the take-up spools in elevation and showing the gearing for driving the various parts of the machine partly in elevation and partly in section. For the sake of clearness of illustration the other spinning-heads are omitted from Fig. 3. Fig. 4 is a central vertical section of one of the spinning-heads. Fig. 5 is an elevation of the draw-roll frame, affording face views of its gearing. Fig. 6 is an elevation of the draw-roll frame, affording edge views of its gearing. Fig. 7 is an elevation, partly in section, of the intermediate gearing for transmitting motion from the master-gear to operate the draw-rolls and winding mechanism. Fig. 8 is an elevation affording an edge view of the train of differential gears shown in Fig. 7.

The frame of the machine consists of two upwardly-tapering standards A B, connected at the bottom to the base-plate C and connected with each other at the top by the horizontal girder D. The operative parts of the machine derive their support from the central vertical post E, loosely stepped at its lower end in the bearing C′ upon the top of the base-plate and journaled at its upper end in the bearing D′, affixed to the under side of the girder D.

The post E is made rotatable in its bearings in order that it, with the mechanism supported upon it, may be turned manually for convenience of access to different parts of said mechanism. Brackets D^2 D^2 extend downward from the girder D and afford bearings for the horizontal driving-shaft F, having upon its outer end the fast and loose pulleys F′ F^2 and having affixed to its inner end the miter-gear F^3, which meshes with the double miter-gear F^4, provided with a hub turning loosely on the post E.

The upper end of the hub of the double miter-gear F^4 is countersunk to receive the system 1 of balls, which are retained in position by the countersink of the collar F^5, secured to the post E by the set-screw F^6.

The lower end of the hub of the gear F^4 is countersunk and bears upon the system 2 of balls, which are supported in the countersunk upper end of the hollow hub of the disk G, which is secured to the post E by the set-screw G′ and which has appropriately arranged upon its upper surface fifteen hinged arms, one of which, G^2, is shown in side elevation in Fig. 3. Each of these arms is pro-

vided at its free end with a hollow boss G^3, in which is adjustably secured by the set-screw G^4 the steady-pin G^5, the lower end of which serves as an axle which centralizes the upper end of the adjacent spinning-head. To this end the lower end of the steady-pin G^5 is loosely inserted in a cylindrical cavity G^6, formed in the upper end of the spindle H, upon which the roving-bobbin is loosely mounted. The roving-bobbin is contained within a hollow cylinder *a*, provided at its upper end with a removable head *a'* and attached at its lower end to the lower head a^2. The spindle H, which is tightly driven into the hub a^3 of the top cylinder-head and extends downward therefrom through the core of the roving-bobbin, has a screw-thread cut upon its projecting lower end to receive a nut H'. A washer H^2 is interposed between the nut and the lower end of the roving-bobbin.

The top head *a'* is detachably secured to the upper end of the bobbin-cylinder *a* by a bayonet-catch or by any other convenient device. The object of this construction is to facilitate the removal of an empty bobbin from the cylinder *a* and the supply of a full bobbin in its place. To effect this object, the set-screw G^4 is loosened and the steady-pin G^5 is detached from its bearing in the cavity G^6. The holding-nut G^7 is unscrewed to release the arm G^2, which is then swung out of the way by being turned on its hinge G^8. The top cylinder-head *a'* and the spindle H, thereto connected, are then detached from the cylinder *a*. The empty bobbin can then be easily removed from the spindle H and a full bobbin substituted therefor. The head *a'* is then replaced in the upper end of the cylinder *a*, the arm G^2 swung outward, the steady-pin G^5 lowered into the cavity G^6 in the end of the spindle, the set-screw G^4 tightened, and the holding-nut G^7 set down upon the top of the arm G^2, thus restoring the parts to their operative positions, in which they are represented in Fig. 3.

The disk G is provided upon its under side with brackets, in which are formed the bearings for the counter-shaft I, to which is affixed the miter-wheel I', which extends upward through an opening in the disk G and meshes with the double miter-wheel F^4, from which it transmits motion to the miter-wheel I^2, which is fastened by the set-screw I^3 or otherwise to the hollow shaft I^4, loosely mounted upon the post E.

The hollow shaft I^4 may be regarded as the prime or master shaft of the machine. Near its lower end it has affixed to it the master-gear I^5, which engages and drives the pinions I^6, securely affixed to the spinning-heads, and also the pinion J, from which motion is transmitted to operate the draw-rolls and winding mechanism. The lower end of the shaft I^4 is countersunk and bears upon the system 3 of balls, which are supported upon the countersunk upper end of the hub of the disk K, which by means of the set-screw K' or otherwise is fastened to the post E and which is provided upon its outer edge with sixteen vertical apertures, fifteen of which are for containing the boxes in which the spinning-heads have their intermediate bearings. One of these boxes K^2 is shown in Fig. 4, in which it is represented as secured to the disk K by means of the set-screw K^3. The sixteenth aperture is for containing the box J', which affords the upper bearing for the vertical counter-shaft J^2, to the upper extremity of which the pinion J is secured. A pinion J^3 is loosely mounted upon the shaft J^2 and meshes with the large gear J^4, which is loosely mounted on the post E immediately beneath the disk K, the system 4 of balls being introduced between the countersunk upper end of the hub of the gear J^4 and the countersunk lower end of the hub of the disk K.

The gear J^4 meshes with the several pinions J^5, which are loosely mounted on the spinning-heads and which are provided on their under sides with crown-teeth for engaging the gears by which motion is transmitted to the upper pairs of draw-rolls.

The pinion J^3 is provided upon its under side with crown-teeth J^6, which are engaged by the teeth of the upper member J^7 of the train of change-gears mounted in a suitable frame affixed to the shaft J^2. The lower member J^8 of the train of change-gears engages the crown-teeth L on the upper side of the pinion L', which is provided with an elongated hub and which is loosely mounted on the shaft J^2. The pinion L' meshes with the horizontal gear L^2, mounted on the post E. The gear L^2 engages the pinions L^3, loosely mounted upon the lower parts of the spinning-heads and provided upon their upper sides with the crown-teeth L^4, by which motion is given to the gears L^5, which drive the lower pairs of draw-rolls.

The system 5 of balls is interposed between the countersunk lower end of the hub of the gear J^4 and the countersunk upper end of the hub of the gear L^2.

The intermediate bearing for the counter-shaft J^2 and the lowermost bearings for the spinning-heads are afforded by the boxes M, secured, by means of set-screws M', in vertical apertures formed in the perimeter of the disk M^2, which is affixed to the post E by the set-screw M^3.

The system 6 of balls is interposed between the countersunk upper end of the hub of the disk M^2 and the countersunk lower end of the hub of the gear L^2.

The spinning-heads and the vertical counter-shaft J^2 are rotated at like speed. In order to effect the rotation of the draw-rolls, the pinions provided with the crown-teeth, by means of which motion is transmitted to the draw-roll gears, must be rotated either at a higher or a lower speed than that at which the spinning-heads are rotated. The required

differentiation in the speed of the pinions referred to is effected in the following described manner:

A pinion N is affixed to the lower end of the elongated hollow hub of the pinion L', which turns loosely on the shaft J^2. The pinion N is driven by its engagement with the teeth of the intermediate gear N', loosely mounted on the stud N^2, adjustably secured to and projecting downward from the disk M^2. Motion is given to the intermediate gear N' by the pinion O, affixed to the shaft J^2.

The pinion O has nineteen teeth and the pinion N twenty teeth. It follows that while the pinion O, which is affixed to the counter-shaft J^2, is making twenty revolutions the pinion N and the crown-wheel L, to the lower end of the hub of which the pinion N is affixed, makes only nineteen revolutions, and consequently the crown-wheels L^4, which drive the lower pairs of draw-rolls in the spinning-heads, also make only nineteen revolutions while the spinning-heads, which are driven at the same rate as the shaft J^2, are making twenty revolutions. It hence results that the gears L^5, which drive the lower pairs of draw-rolls, are each made to make one revolution on their axes by the lag of the crown-wheels L^4 while each spinning-head is making twenty revolutions.

Assuming the gears to be so proportioned that a single rotation of the driving-gears L^5 of the spinning-heads will effect the delivery by the draw-rolls of two inches of roving, it results that the two inches of roving thus delivered will be twisted at the rate of ten turns to the inch.

By means of the train of differential gears between the crown-wheel L and the crown-wheel J^6 a slightly more rapid speed of rotation is given to the crown-wheel J^6, and hence by means of the pinion J^3 and the gear J^4 to the crown-wheels J^5, by which the upper pairs of draw-rolls in the various spinning-heads are driven, or, perhaps, more properly speaking, are governed in their speed of rotation. It follows that there is less difference between the speed of rotation of the spinning-heads and the speed of rotation of the crown-wheels J^5, and consequently the upper pairs of draw-rolls are rotated with slightly less rapidity than the lower pairs.

Any desired difference between the speeds of rotation of the upper pairs of draw-rolls, which may be called the "feed-rolls," and the lower pairs of rolls, which are herein called the "draw-rolls," is established by the introduction of appropriately-proportioned wheels into the chain of gearing between the crown-wheel L and the crown-wheel J^6. If it be desired to otherwise proportion the relative speeds of rotation of the spinning-heads and the several pairs of draw-rolls, the pinion N or the pinion O, or both of them, may be removed and replaced by other pinions having other numbers of teeth, respectively, and the intermediate gear N' can be removed, and a larger or smaller gear, as may be required, may be introduced in its place, the stud N^2, upon which the intermediate gear N' is mounted, being for this purpose made radially adjustable upon the disk M^2.

The spinning-heads herein shown and described as respects their principal features of construction are the same as those described and claimed in pending application, Serial No. 592,306. They are herein described for the purpose of showing their relation to the described system of intermediate and differential gearing, by means of which a group of such spinning-heads are driven from a single main shaft rotating upon an axis parallel with the axes of rotation of the spinning-heads.

Motion to operate the winding devices is derived from the counter-shaft J^2, for which purpose the lower end of the counter-shaft J^2 is connected by a sleeve P to the shaft P', extending downward in alinement with the shaft J^2 and having its lower end stepped in the bearing P^2, formed in the disk Q, secured by the set-screw Q' to the lower part of the post E. Just above its seat in the bearing P^2 the shaft P' has affixed to it the pinion P^3, which engages the gear P^4, loosely mounted upon a stud affixed to the disk Q and having connected with it the small pinion P^5, which engages the gear P^6, loosely mounted upon another stud projecting upward from the disk Q. A pinion P^7, connected with the gear P^6, meshes with the large gear P^8, which is loosely mounted upon the post E and is the driving-gear for all the winding devices.

The winding devices may be of any of the well-known types. The drawings represent the machine as provided with fifteen spools equidistantly arranged in proper relation to the spinning-heads. In Fig. 3 of the drawings two of these spools are shown in elevation, the others being omitted for the sake of clearness of illustration. Each spool is loosely mounted upon a vertical stud R, having near its lower end the fixed collar R', which bears upon the top of the stationary disk Q. The lower part R^2 of the stud R is inserted in a vertical aperture in the disk Q, in which it is secured by the set-screw R^3. The portion of the stud R immediately above the collar R' affords the bearing for the elongated hub of the pinion R^4, which meshes with and is driven by the driving-gear P^8. The spool S is rotated by the frictional hold upon its lower head of the face of the pinion R^4, upon which it is supported. This frictional hold, caused by the weight of the spool, is sufficient to effect the winding upon the core S' of the yarn S^2. The yarn S^2 extends vertically downward from its point of delivery to and around the bight of a suitable bend S^3 in the gravity stop-finger S^4. From the bend S^3 the yarn extends upward to and over the hook S^5 on the extremity of the vertically-reciprocat-

ing traverse-arm S^6, by means of which the thread is guided from end to end of the spool-core during the winding operation. Preferably the traverse-arm S^6 is composed of two members united by the telescopic joint S^7, so that the total length of the arm can be varied for the purpose of increasing or decreasing the range of traverse motion, as may be desired. A similar traverse-arm is provided for each spool, and the traverse-arms are all pivoted to a hub S^8, secured by a set-screw S^9 to the post E of the machine. The traverse-arms tend to drop downward by their own gravity. They are elevated by their bearing upon the top of the annular cam T, the hollow hub of which is secured by the set-screw T′ to the hollow hub of the gear T^2, which meshes with and is driven by the wide-faced pinion T^3, loosely mounted upon the vertical stud T^4, affixed to the driving-gear P^8.

The pinion T^3, while carried bodily around by the rotation of the wheel P^8, is forced to rotate upon its own axis by its engagement with the stationary gear T^5, the hollow hub of which is secured to the post E by the set-screw T^6. The rotation of the cam T is effected by differentiating the number of teeth in the gears T^5 and T^2. Thus the gear T^5 may have sixty-four teeth and the gear T^2 sixty-two teeth, whereby it will result that during each revolution of the gear P^8 the gear T^2 and the cam connected therewith will make one thirty-second of a revolution, and thus in thirty-two revolutions of the wheel P^8 the cam T will make one complete rotation and each traverse-arm will be made to complete its traverse from one flange of the spool to the other and back again to the starting-point. If one of the yarns S^2 should break, its gravity-finger S^4 will drop from the position in which it is represented in Fig. 3 to a lower position, in which its free end will intersect the path of orbital motion of what for convenience may be termed the "crank-pin" U, extending upwardly from the extremity of one of the arms of the bell-crank lever U′, pivoted to the wheel P^8. By collision with the thus-dropped gravity-finger the bell-crank lever U′ will be made to swing around upon its axis until the free end of the gravity-finger rides clear of the crank-pin U. The downwardly-projecting crank-pin U^2 at the extremity of the other arm of the bell-crank lever U′ is thus swung into a position which as it is carried bodily around by the wheel P^8 ultimately causes it to strike against the face of the standard U^3, projecting upwardly from the extremity of one arm of the bell-crank trip-lever U^4, which is pivoted to the disk Q. The extremity of the other arm U^5 of the bell-crank lever U^4 is provided with a lateral bend U^6, which presents a shoulder U^7 for catching the free end of the radius-bar U^8, secured to the lower part of the belt-shifter U^9. The belt-shifter lever U^{10}, affixed to the upper end of the shaft U^9, is bifurcated at one end to embrace the edges of the belt and provided at the other end with a handle U^{11}, by means of which it may, if desired, be manually operated. The torsion-spring U^{12}, having its lower end fastened to the collar U^{13}, affixed to the shaft U^9, and its upper end secured to the bracket U^{14}, in which the shaft U^9 has its upper bearing, exerts its stress in such wise as to always tend to make the belt-shifter shift the belt from the driving-pulley F′ to the loose pulley F^2.

It will be seen that if occasion arises the operative mechanism of the machine may be manually turned upon the vertical axis afforded for it by the post E. It may be desired to securely retain the machine in the position in which the bell-crank trip-lever U^4 engages the radius-arm U^8 of the belt-shifter shaft U^9. To this end there is provided a spring brake-pin V, carried in a suitable box V′, affixed to one of the standards of the machine and having its inner extremity pointed or chamfered, as shown in dotted lines in Fig. 1, and adapted to engage a V-shaped notch in the periphery of the disk Q, which, it will be remembered, is affixed to the central post E.

It is to be remarked that the omission of the use of the steady-pins g^5 for the upper ends of the roving-bobbin holders would permit of the omission of the double miter-gear F^4, the disk G, and the miter-gear I′, mounted thereon, because in that case the master hollow shaft I^4 might be so elongated as to permit the miter-gear I^2 to be secured to it in suitable position for engagement by the miter-gear F^3 on the inner end of the driving-shaft F′. It will of course be understood that, if desired, beveled gearing may be employed instead of the miter-gearing shown. It will be seen that in either case, whether the miter-gear I^2 is driven through the intermediate miter-gears I′ and F^4, as shown, or whether it be driven directly from the miter-gear F^3, as suggested, the entire group of spinning-heads and winding devices can be manually rotated upon the vertical axis afforded by the central vertical post E, so that the operator can obtain easy access to either one of the spinning and winding devices while standing in one position.

When the structure is rotated by hand, the brake-pin V simply rides out of its notched bearing in the face of the disk Q, and when the disk Q is completely rotated springs back again into its seat and by its frictional pressure thereon holds the post E and the parts affixed thereto stationary during the operation of the machine.

The employment of the horizontal driving-shaft F permits the arrangement of the fixed and loose pulleys F′ and F^2 in suitable position to facilitate the use of the belt-shifter.

As will be seen on reference to Fig. 2, power to drive the machine is supplied by a line-shaft beneath the floor on which the machine

rests, so that one side W of the driving-belt is carried through the bifurcated end of the belt-shifter lever U^{10}.

What is claimed as the invention is—

1. The combination, as herein set forth, of a circularly-arranged group of spinning-heads supported upon disks affixed to a central vertical post loosely stepped at its upper and lower ends in a suitable frame, each of said spinning-heads consisting of a roving-bobbin holder surmounting a carrier carrying a set of superposed pairs of draw-rolls, each of said bobbin-holders and its draw-roll carrier rotating together upon an axis which is perpendicular to the planes of the axes of rotation of the said pairs of draw-rolls, a master-gear loosely mounted upon said central vertical post for rotating said spinning-heads upon their individual vertical axes; means for rotating said master-gear from an outside source of motion; intermediate gearing for transmitting motion from said master-gear to two superposed gears loosely mounted upon said central post for the purpose of appropriately driving the said sets of draw-rolls, the said intermediate gearing including a downwardly-extending vertical shaft stepped at its lower end in a bottom disk secured to said central post near the lower end thereof, and a train of gearing driven from said vertical shaft for imparting rotation to an adjacent gear-wheel loosely mounted upon said central post just above said bottom disk, in combination with a circularly-arranged group of winding devices supported upon said bottom disk and upon the lower part of said vertical post and driven by said adjacent gear-wheel, for the purpose of winding up all the yarns delivered from the lowest pairs of draw-rolls without altering the twist given to said yarns by the rotating spinning-heads.

2. In a spinning-machine comprising a multiplicity of spinning-heads and winding devices arranged in a circle around a vertical post and driven by rotating horizontal gear-wheels mounted on said post; gravity-fingers pivoted to a non-rotating part of the machine and adapted to serve as guides for, and to be supported in relatively-elevated positions by, the yarns delivered from the spinning-heads, in combination with a bell-crank lever journaled in the adjacent one of said horizontal gear-wheels and a bell-crank lever journaled in a non-rotating part of the machine and adapted to engage a radius-arm connected with a belt-shifting device and to hold said radius-arm against the strain of the spring which actuates the belt-shifter, whereby if any one of the yarns breaks or runs out its gravity-finger drops into the path of orbital movement of one of the arms of said first-mentioned bell-crank lever which by collision with said dropped gravity-finger is rocked upon its own axis into such position as to cause it, at a subsequent stage in the rotation of the gear-wheel which carries it, to trip the other bell-crank lever out of engagement with said radius-arm and hence release the belt-shifting device to the influence of the spring by which the belt is shifted from the tight to the loose pulley on the driving-shaft.

3. In spinning-machine comprising a multiplicity of spinning-heads and winding devices arranged in a circle around a vertical post and driven by rotating horizontal gear-wheels mounted on said post; gravity-fingers pivoted to a non-rotating part of the machine and adapted to serve as guides for, and to be supported in relatively-elevated positions by, the yarns delivered from the spinning-heads, in combination with a normally-disconnected lever system, one part of which includes a radius-arm connected with a belt-shifting device, and a bell-crank lever for holding said radius-arm against the strain of the spring for actuating the belt-shifter and the other part, a bell-crank lever journaled in one of said rotating horizontal gear-wheels and hence having an orbital path of movement whereby if a yarn breaks or runs out its gravity-finger, by dropping into said orbital path brings about the subsequent connection of the said two parts of said lever system and resultantly releases the belt-shifter to the influence of its actuating-spring.

4. The combination, as herein set forth, of a circularly-arranged group of spinning-heads rotating on parallel vertical axes, and a corresponding group of winding devices beneath said spinning-heads; horizontal disks supporting said spinning-heads and winding devices; a central vertical post to which said horizontal disks are affixed; a system of horizontal gears, including a master-gear, loosely mounted on said central vertical post for rotating said spinning-heads and operating said winding devices; intermediate gearing for transmitting from said master-gear motion to appropriately rotate the others of said horizontal gears; a suitable frame provided with boxes affording loose bearings for the upper and lower ends of said central vertical post; a horizontal driving-shaft mounted in said frame; miter-gearing for transmitting motion from the inner end of said horizontal shaft to said master-gear; fast and loose pulleys affixed to the outer end of said horizontal shaft in position to engage a driving-belt extending downward to a pulley upon a line-shaft beneath said horizontal driving-shaft; a spring-actuated belt-shifter lever with its bifurcated end embracing one side of the said driving-belt, and means substantially such as described, for releasing said belt-shifter to the influence of its actuating-spring if any one of the yarns delivered from the spinning-heads breaks or runs out.

5. The combination, as herein set forth, of a circularly-arranged group of spools frictionally rotated upon vertical axes; a central vertical post; a horizontal gear-wheel loosely mounted on said central post for rotating said

spools; a group of traverse-arms pivoted to a collar affixed to said central post and extending radially therefrom for guiding the yarns up and down during the operation of winding them upon said spools; a cam loosely mounted on said central post for controlling the rise and fall of said traverse-arms successively; means for rotating said horizontal gear-wheel, and suitable gearing for transmitting motion from said horizontal gear-wheel to appropriately rotate said cam.

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