No. 617,677. Patented Jan. 10, 1899.

A. D. EMERY.

SPINNING AND TWISTING MACHINERY.

(Application filed Feb. 3, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1

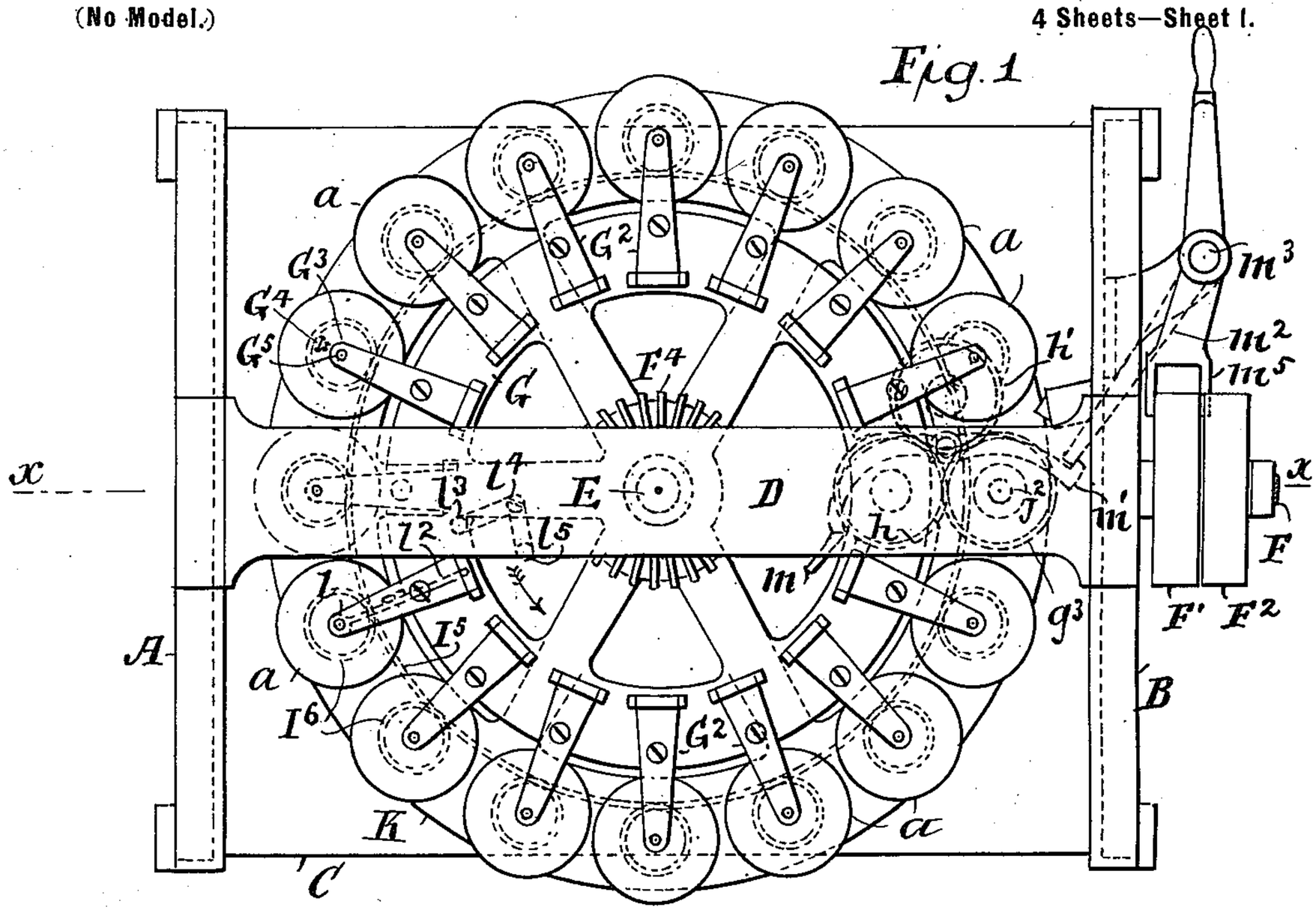
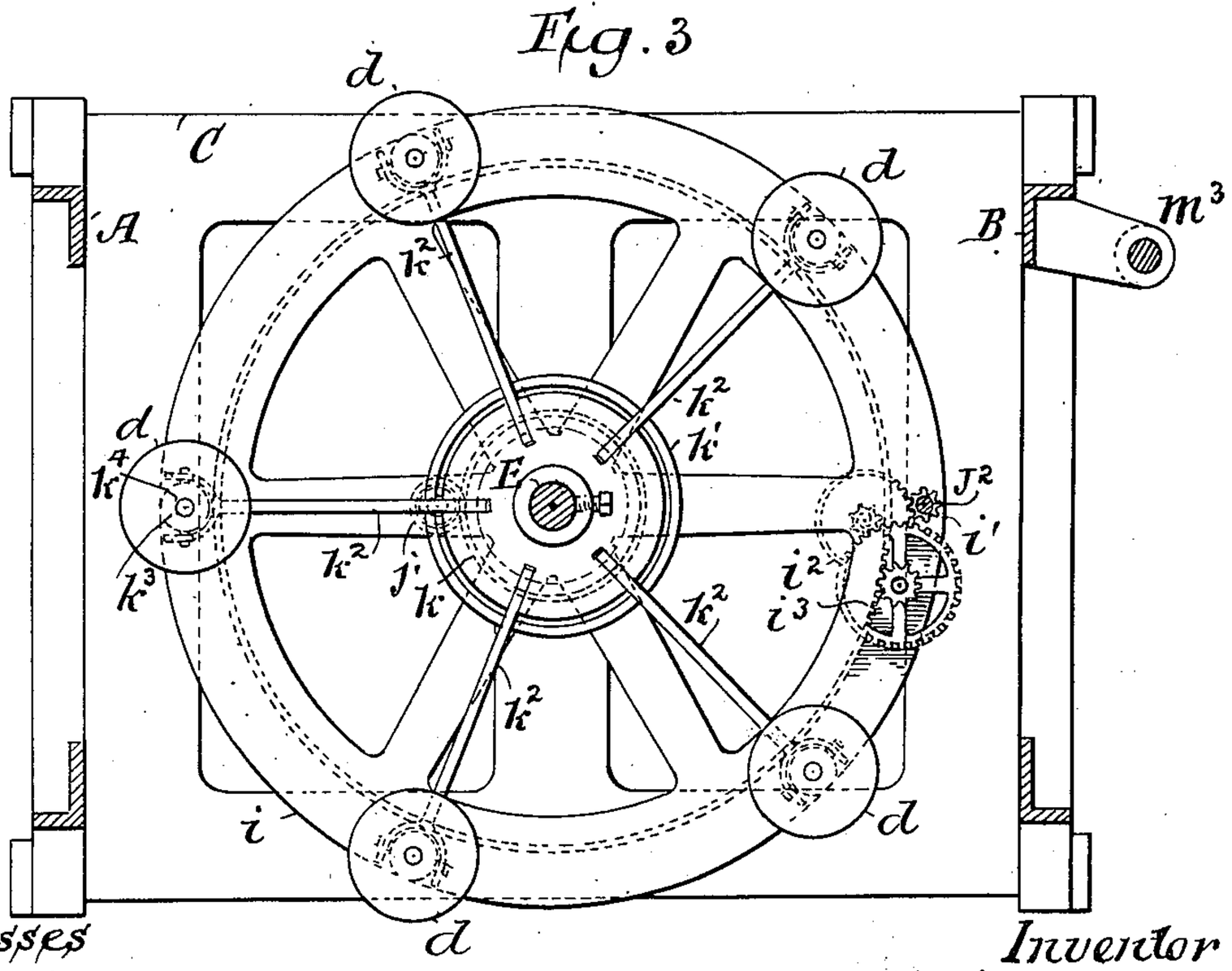


Fig. 3



Witnesses
Geo. Wadman
E. Gatterer.

Inventor
Abram D. Emery,
Per Edw. E. Linnby,
Atty.

No. 617,677. Patented Jan. 10, 1899.

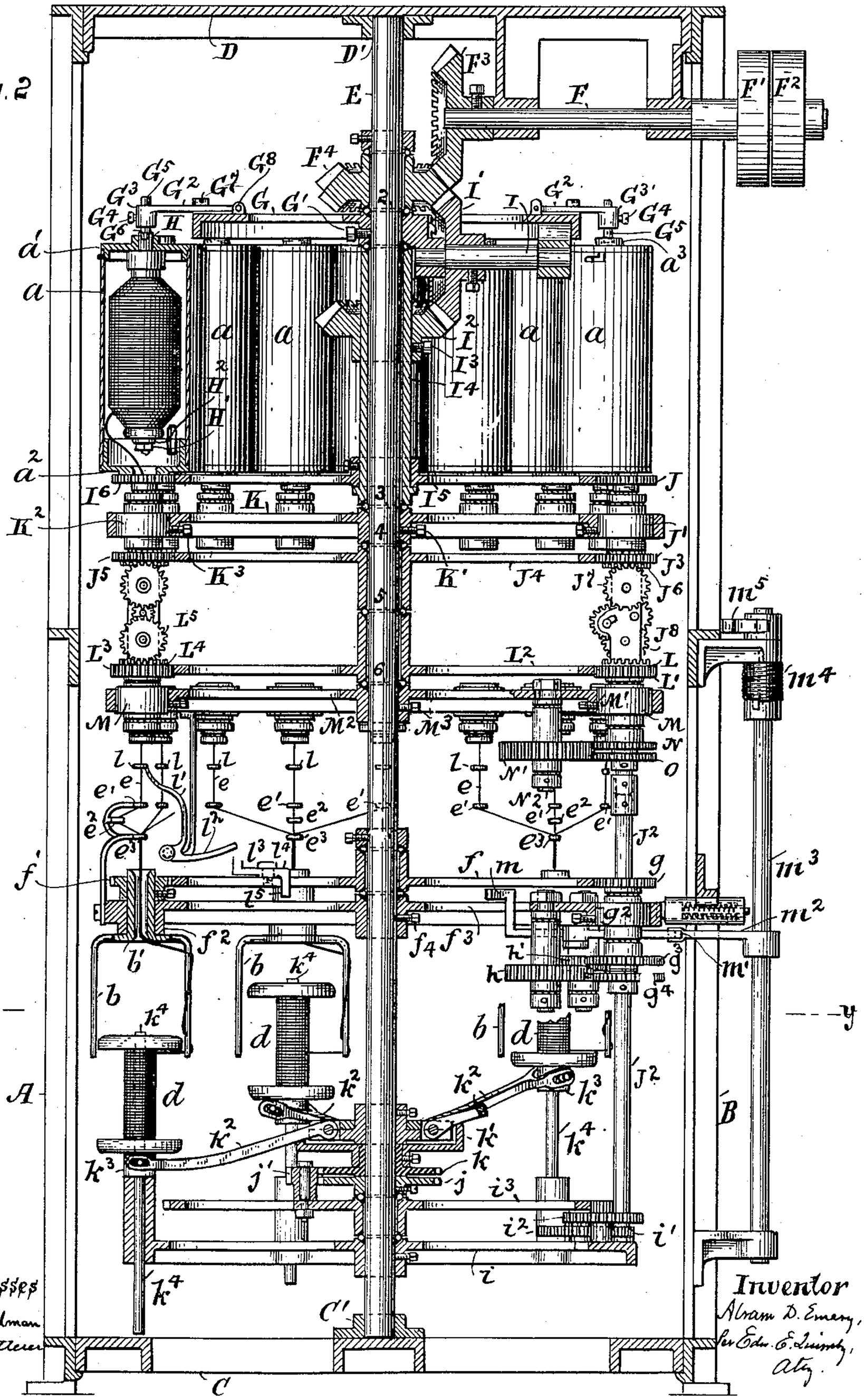
A. D. EMERY.

SPINNING AND TWISTING MACHINERY.

(Application filed Feb. 3, 1897.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2



Witnesses
Geo. Wadman
E. Gatterer

Inventor
Abram D. Emery,
per Edw. E. Linney,
Atty.

No. 617,677. Patented Jan. 10, 1899.

A. D. EMERY.

SPINNING AND TWISTING MACHINERY.

(Application filed Feb. 3, 1897.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 5

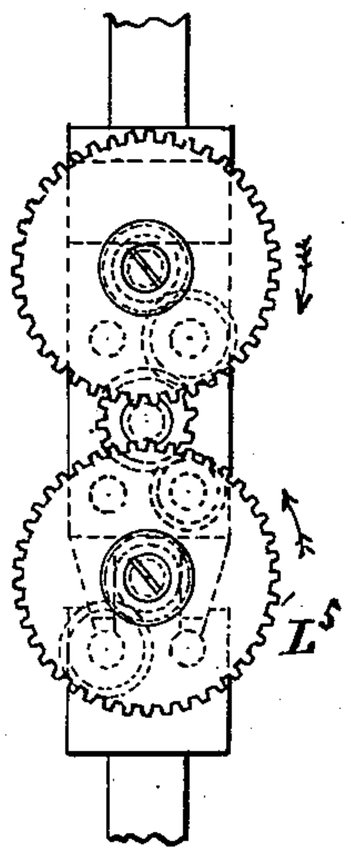
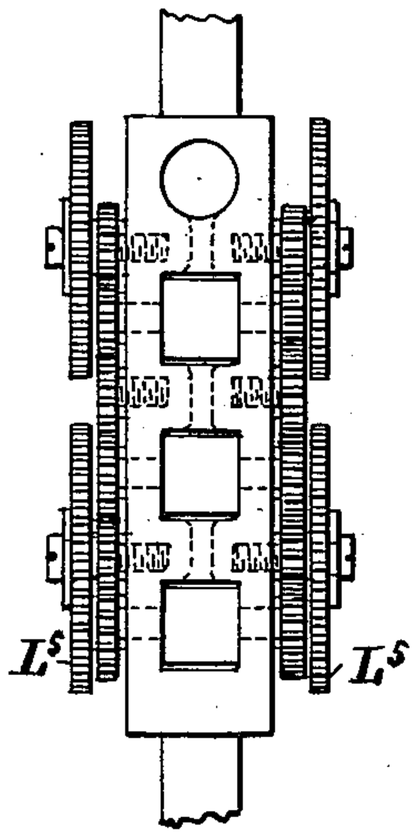


Fig. 6



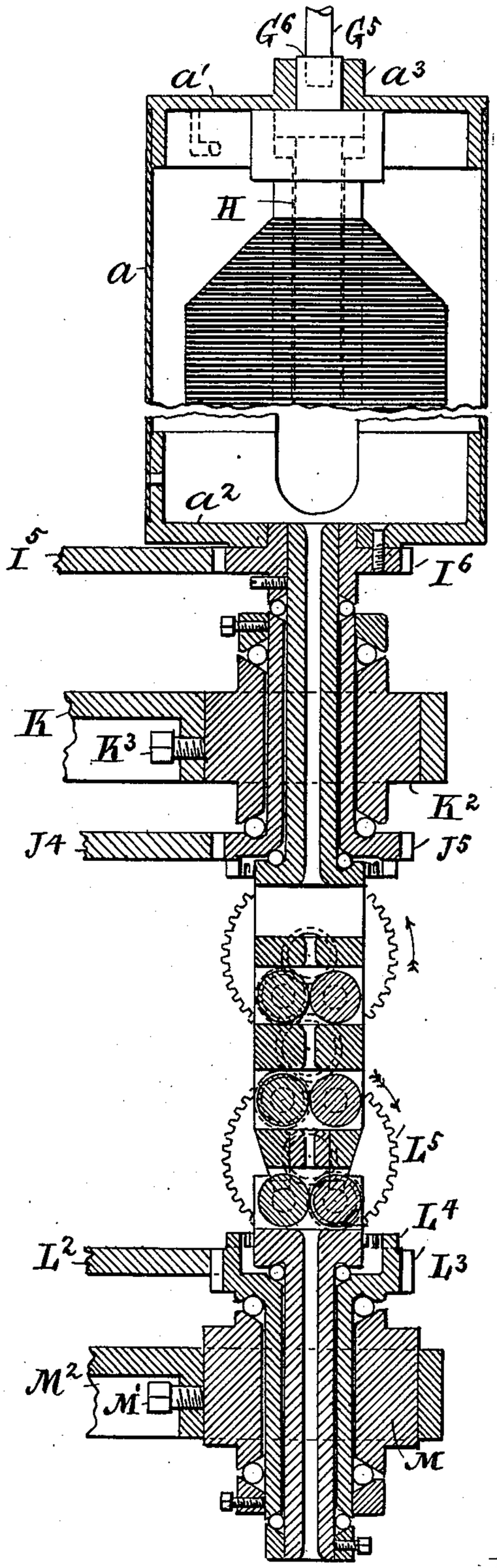


Fig. 4

Witnesses
Geo. Wadman
C. Gatterer

Inventor
Abram D. Emery,
Per Edw. E. Lemmby,
Atty.

No. 617,677. Patented Jan. 10, 1899.

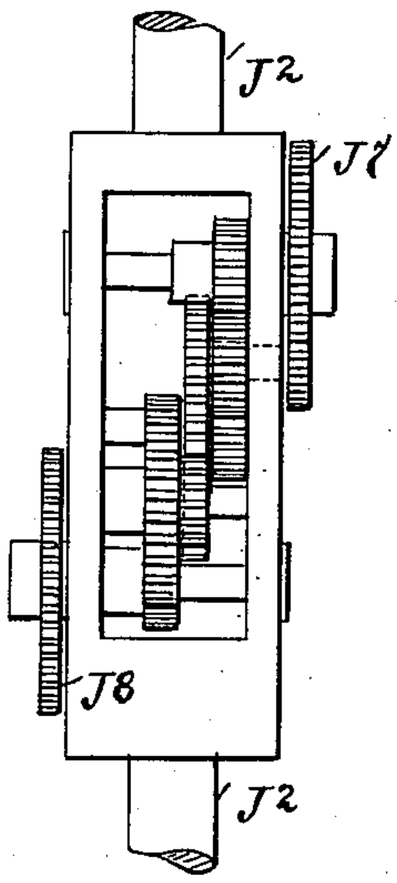
A. D. EMERY.

SPINNING AND TWISTING MACHINERY.

(Application filed Feb. 3, 1897.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 8



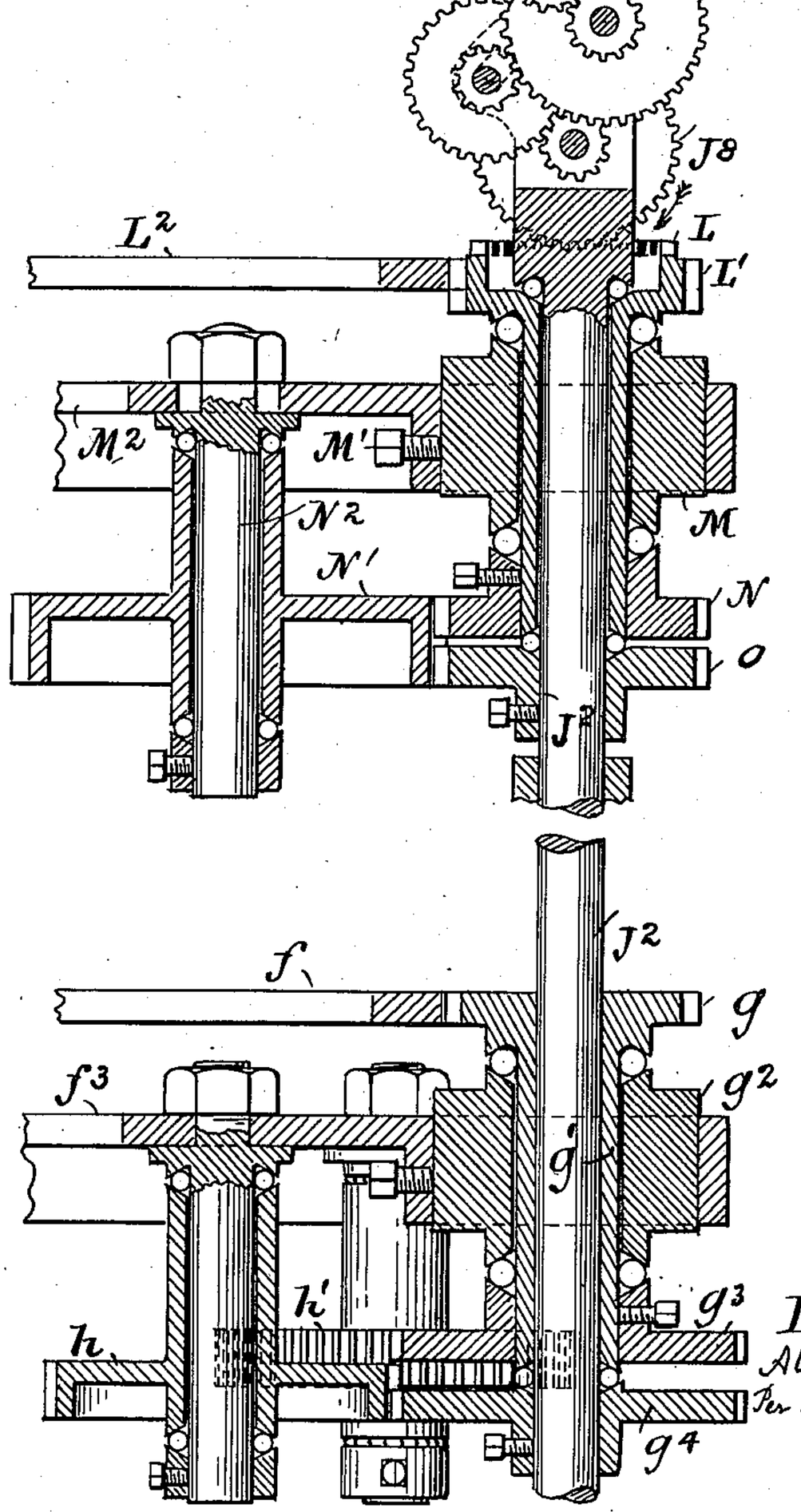


Fig. 7

Witnesses
Geo. Wadman
E. Gatterer.

Inventor
Abram D. Emery,
Per Edw. E. Linney
atty.

UNITED STATES PATENT OFFICE.

ABRAM D. EMERY, OF TAUNTON, MASSACHUSETTS.

SPINNING AND TWISTING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 617,677, dated January 10, 1899.

Application filed February 3, 1897. Serial No. 621,769. (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 and Twisting Machinery, of which the following is a specification.

This invention relates generally to the combination, in an organized machine, of a circularly-arranged group of spinning-heads of the character of those shown and described in pending application Serial No. 607,528, with a smaller group of twisters and systems of guides for guiding to each twister the yarns from a multiplicity of such spinning-heads. The operative parts of the machine are supported on a central vertical post, upon which is loosely mounted a horizontal master-gear, which meshes with and rotates pinions severally affixed to the spinning-heads and also meshes with and rotates a pinion affixed to a vertical shaft, from which by means of systems of suitable intermediate gearing, including other horizontal gears loosely mounted upon said central vertical post, motions are imparted at appropriate speeds to the draw-rolls of the spinning-heads in the manner shown and described in said pending application Serial No. 607,528. In the present case by means of other systems of gearing motions are also transmitted from said vertical shaft to a group of throstles arranged at an appropriate distance below the group of spinning-heads and to a cam loosely mounted on said central vertical post, by means of which vibratory motions are imparted to traverse-arms for raising and lowering the several spools upon which the threads twisted by the throstles are wound.

The peculiarity in the mode of spinning yarn inherent in the operation of a spinning-head of the character of those shown is that all parts of the yarn are successively given precisely the same amount of twist and are never given any greater twist than that which they ultimately retain. This is due to the fact that the twist is initially imparted to the part of the yarn immediately adjacent its point of delivery from the lowest pair of draw-rolls. The yarns thus produced are of superior evenness and by reason of their uniformity of twist are especially adapted for being associated and twisted together to form threads.

It is of material advantage to have the spinning-heads rotate upon vertical axes and to have the spun yarn delivered downwardly, so that the roving, which is unwound from each roving-bobbin by centrifugal force, will be assisted by gravity in its passage to the draw-rolls, because this permits the spinning of soft roving having little tensile strength. Hence the most favorable position for the throstles is in a horizontal plane immediately below the spinning-heads, because it thereby follows that the paths of the yarns from the draw-rolls to the throstles are comparatively short and direct and the organization as a whole is rendered especially compact.

In the machine illustrating the invention shown in the accompanying drawings fifteen spinning-heads are mounted in vertical bearings arranged around the edge of a horizontal disk divided into sixteen equal parts, one of which is occupied by the upper bearing of the vertical counter-shaft employed for transmitting motion to actuate the draw-rolls, the group of throstles arranged beneath the spinning-heads, and the traverse-arms for raising and lowering the spools upon which the threads are wound.

The drawings are as follows: Figure 1 is a top view of the machine. Fig. 2 is a central vertical section on the plane indicated by the dotted line $x\,x$ in Fig. 1, in which some of the parts are shown in elevation and some of the parts are omitted for the sake of more clearly exhibiting others which are shown. Fig. 3 is a horizontal section on the plane indicated by the dotted line $y\,y$ on Fig. 2. Fig. 4 shows in central vertical section one of the spinning-heads, with a portion of the roving-bobbin and its cylinder represented as broken away. Figs. 5 and 6 are elevations of the draw-roll frame, respectively affording face and edge views of its gearing. Fig. 7 is an elevation of the upper portion of the vertical counter-shaft by which motion is transmitted from the master-gear, showing in section the train of differential gears for operating the draw-rolls and also the train of differential gears for driving the throstles. Fig. 8 is an elevation affording an edge view of the gears for differentiating the speeds of rotation of the upper and lower pairs of draw-rolls.

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. The horizontal driving-shaft F, having upon its outer end the fast and loose pulleys F′ F², has affixed to its inner end the miter-gear F³, which meshes with the double miter-gear F⁴, loosely mounted on the post E.

The lower end of the hub of the gear F⁴ 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, G², is shown in side elevation in Fig. 3. Each of these arms is provided at its free end with a hollow boss G⁸, in which is adjustably secured by the set-screw G⁴ the steady-pin G⁵, 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 G⁵ is loosely inserted in a cylindrical cavity G⁶ 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 *a²*. The spindle H, which is tightly driven into the hub *a³* 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 H² 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 G⁴ is loosened and the steady-pin G⁵ is detached from its bearing in the cavity G⁶. The holding-nut G⁷ is unscrewed to release the arm G², which is then swung out of the way by being turned on its hinge G⁸. 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 G² swung outward, the steady-pin G⁵ lowered into the cavity G⁶ in the end of the spindle, the set-screw G⁴ tightened, and the holding-nut G⁷ set down upon the top of the arm G², thus restoring the parts to their operative positions, in which they are represented in Fig. 5.

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 F⁴, from which it transmits motion to the miter-wheel I², which is fastened by the set-screw I³ or otherwise to the hollow shaft I⁴, loosely mounted upon the post E.

The hollow shaft I⁴ may be regarded as the prime or master shaft of the machine. Near its lower end it has affixed to it the master-gear I⁵, which engages and drives the pinions I⁶, 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 I⁴ 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 K² is shown in Fig. 4, in which it is represented as secured to the disk K by means of the set-screw K³. The sixteenth aperture is for containing the box J′, which affords the upper bearing for the vertical counter-shaft J², to the upper extremity of which the pinion J is secured. A pinion J³ is loosely mounted upon the shaft J² and meshes with the large gear J⁴, 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 J⁴ and the countersunk lower end of the hub of the disk K.

The gear J⁴ meshes with the several pinions J⁵, 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 J³ is provided upon its under side with crown-teeth J⁶, which are engaged by the teeth of the upper member J⁷ of the train of change-gears, mounted in a suitable frame affixed to the shaft J². The lower member J⁸ 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 J². The pinion L′ meshes with the horizontal gear L², mounted on the post E. The gear L² engages the pinions L³, 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, make 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 are the same as regards their principal features of construction and mode of operation as those described and claimed in pending application Serial No. 592,306. They are herein described for the purpose of showing their mode of combination with a group of twisters and systems of guides for guiding to each twister the yarns from a multiplicity of spinning-heads.

In the apparatus illustrating the invention shown in the drawings the fifteen spinning-heads are combined with a circularly-arranged group of five twisting appliances, each of which embraces a rotating throstle *b*, having the usual tubular neck *b′*. The yarns *e* from two or more of the spinning-heads are led through suitably-arranged systems of guides *e′* to each throstle, by the rotation of which they are twisted together and the resulting thread wound upon a spool *d*, to which endwise reciprocating motion is given at the rate required to keep the successive convolutions of thread close together as the throstle winds them first around the core of the spool and subsequently around the body of the thread collected thereon.

The throstles are rotated in a direction opposite to the direction of rotation of the spinning-heads by the large gear *f*, which engages the pinions *f′*, secured to the part of the tubular neck *b′* of the throstle which extends upward above the box f^2, in which the neck of the throstle is journaled, the box f^2 being formed near the periphery of the stationary disk f^3, the hub of which is provided with a

set-screw f^4, by means of which it is secured to the central vertical part E. The gear f is driven by the pinion g, affixed to the upper end of the hollow shaft g', loosely mounted upon the vertical counter-shaft J^2 and journaled in the box g^2, secured to the disk f^3.

The pinion g rests on ball-bearings supported upon the upper end of the box g^2, and the lower part of the hollow shaft g' has affixed to it the pinion g^3. Beneath the pinion g^3 and separated therefrom by ball-bearings is the pinion g^4, which is secured to the vertical counter-shaft J^2. The pinion g^4 engages and rotates the gear h, loosely mounted upon a stud affixed to and projecting downward from the disk f^3. The gear h rotates an intermediate gear h', also loosely mounted upon a stud projecting downward from the disk f^3, and the gear h' engages the pinion g^3 and thereby rotates the hollow shaft g' and the pinion g, affixed to the upper end thereof, in the same direction as that of the spinning-heads. The lower end of the vertical counter-shaft J^2 is stepped in a suitable bearing in the top of the lowermost disk i and has affixed to it a pinion i', which, acting through train of gearing i^2, as shown in Fig. 3, effects the rotation of the gear i^3, loosely mounted upon the vertical post E. Immediately above the gear i^3 is a smaller gear j which is affixed to the central post E, and hence imparts rotation to a wide pinion j', loosely mounted upon a stud affixed to and projecting upwardly from the gear i^3. The thus-rotated pinion j' meshes with and rotates the small gear k, loosely turning on the central post E and having affixed to it the crown-cam k', which serves to alternately elevate and present the face of the radial traverse-arms k^2, each of which is loosely connected at its free end with the hub k^3 of one of the hollow stems k^4, upon which the spools k^5 are mounted with the usual moderate tightness of fit. Provision is made for introducing change-gears into the train of gearing i^2, by which motion is imparted to the disk i^3 for the purpose of accurately timing the up and down movements of the spools, as may be required with relation to the speed of rotation of the throstles, in order that the threads shall be wound symmetrically and closely.

Provision is made to stop the machine if either one of the yarns breaks. The yarns e as they leave the spinning-heads are subjected to like degrees of tension by appropriately-arranged guides e', and if one of the spinning-heads is immediately over one of the twisters an extra guide e^2 is employed in order to provide a zigzag path for such yarn, whereby it will be subjected to the same amount of friction in its passage from the spinning-head to the throstles as those of the yarns which are required to have a considerable distance of lateral movement in order to pass from the guides e' to the centralizing-guide e^3, in which the multiplicity of yarns are collected for the throstles, respectively. The yarns between the spinning-head and the guides e' are held under a moderate tension in vertical position. On their way to the guides e' the yarns pass through the eyes l at the upper extremities of the trip-levers l', respectively, the laterally-projecting arms l^2 of which are thereby held upward in the position in which one of them is represented in Fig. 2, above the path of motion of the crank-pin l^8, projecting upwardly from one of the arms of the bell-crank lever l^4, pivoted upon the top of the gear f. The other arm of the bell-crank lever l^4 is provided with a crank-pin l^5, projecting downwardly through an aperture in the gear f, and when the bell-crank lever l^4 is rocked by collision with the lateral arm l^2 of the trip-lever l' the crank-pin l^5 is swung into position to engage and rock the inner arm m of the trigger-lever m', and to thereby disengage the opposite end of the trigger-lever m' from the extremity of the radius-arm m^2, secured to the vertical belt-shifter shaft m^3, provided with the torsion-spring m^4. The upper end of the shaft m^3 carries the bifurcated belt-shifter arm m^5, which, when the vertical shaft m^3 is thus freed from the torsional strain of the spring m^4, shifts the belt from the tight pulley F' to the loose pulley F^2, and thus causes the machine to come to rest.

It will be understood that the power to drive the machine is assumed to be taken from a shaft beneath the floor upon which the machine rests, as indicated by the position of the belt-shifter at a distance below the tight and loose pulleys F' and F^2.

What is claimed as the invention is—

1. The combination as herein set forth of a group of twisters and appropriate winding devices arranged in a circle; a group of spinning-heads rotating on parallel vertical axes arranged in a circle above said twisters and greater in number than the number of the said twisters, each of said spinning-heads composed of a carrier for carrying a roving-bobbin, and a draw-roll frame provided with superposed pairs of draw-rolls rotating on horizontal axes; guides for guiding the yarns from a multiplicity of said spinning-heads to each twister; a central vertical post having affixed to it horizontal disks for supporting said spinning-heads, twisters and winding devices; a horizontal master-gear loosely mounted upon said central vertical post and driven from an outside source of motion for rotating said spinning-heads; horizontal gears loosely mounted on said central vertical post for operating the draw-rolls of said spinning-heads; horizontal gears loosely mounted on said central vertical post for operating said twisters and winding devices, and suitable intermediate gearing for transmitting from said horizontal master-gear the motions required for rotating the others of the said horizontal gears at their required relative speeds.

2. The combination in an organized machine, as herein set forth, of a prescribed num-

ber of throstles and suitable winding devices, with a prescribed larger number of spinning-heads, each having a carrier for a roving-bobbin, a draw-roll frame and superposed pairs of draw-rolls, arranged above said throstles; guides for guiding the yarns from a multiplicity of said spinning-heads to each of said throstles, and means for driving said spinning-heads, throstles and winding devices at appropriate speeds.

3. In combination, as herein set forth, a prescribed number of twisting and winding devices; a prescribed larger number of spinning-heads, each having a carrier for carrying a roving-bobbin, a draw-roll frame, and superposed pairs of draw-rolls arranged above said twisting and winding devices and delivering spun yarns in downward directions; guides for severally guiding a plurality of said spun yarns to each of said twisting and winding devices; a system of trip-levers severally engaging said spun yarns at points adjacent to the lower ends of said spinning-heads, and normally held by such engagement in prescribed inoperative positions; a spring-actuated belt-shifter and connections between said belt-shifter and said system of trip-levers, whereby if a single yarn breaks or runs out said belt-shifter is released to the action of its spring and is thereby made to shift the belt and thus cause the machine to come to rest, substantially as described.

ABRAM D. EMERY.

Witnesses:
FREDERICK S. HALL,
A. M. JONES.