No. 640,716. Patented Jan. 2, 1900.

DING CIE SUI.

SPINNING MACHINE.

(Application filed Dec. 17, 1897. Renewed June 8, 1899.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 2.

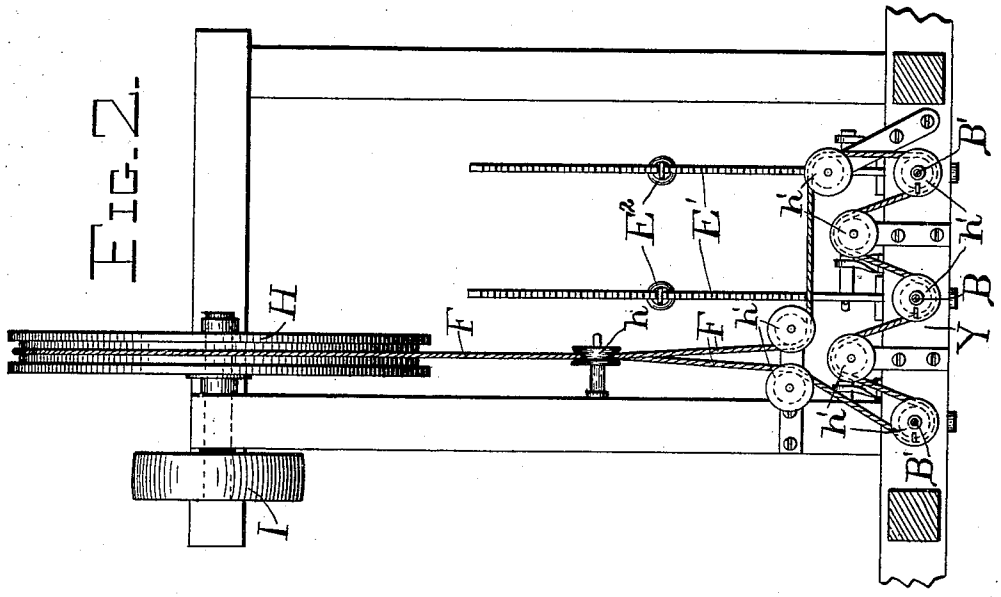
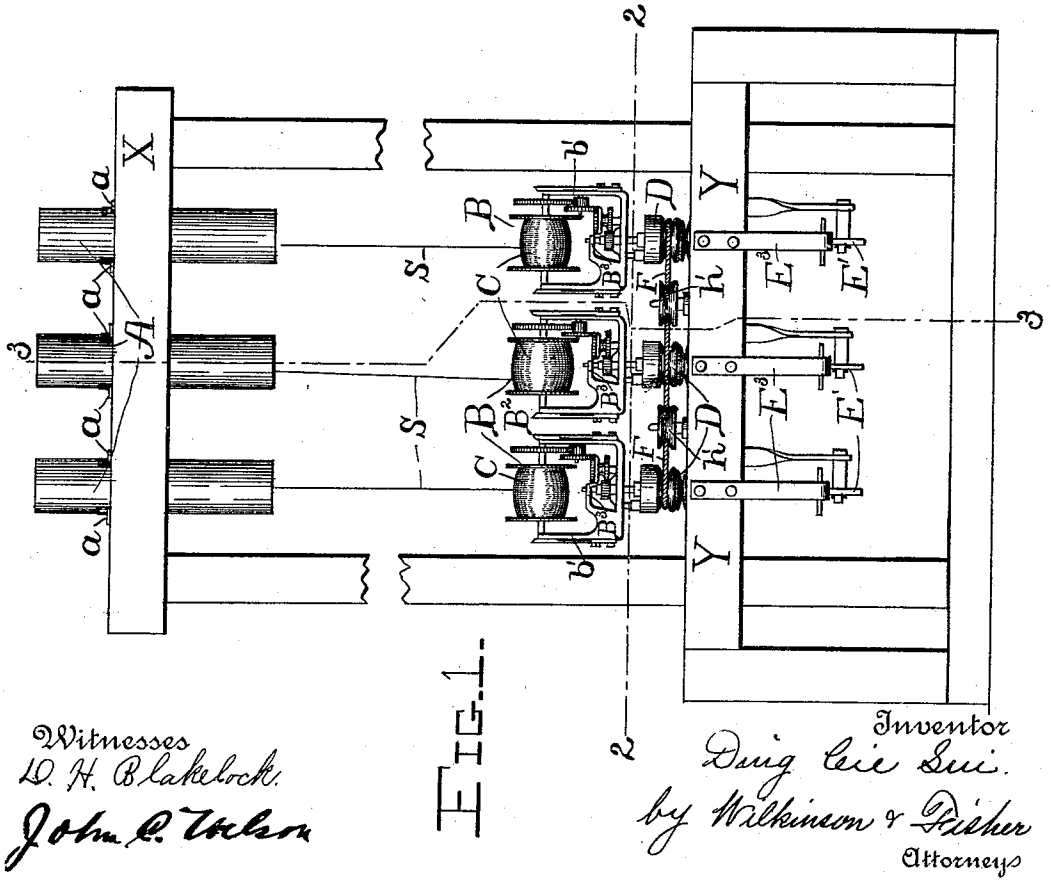


FIG. 1.



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(No Model.) 3 Sheets—Sheet 2.

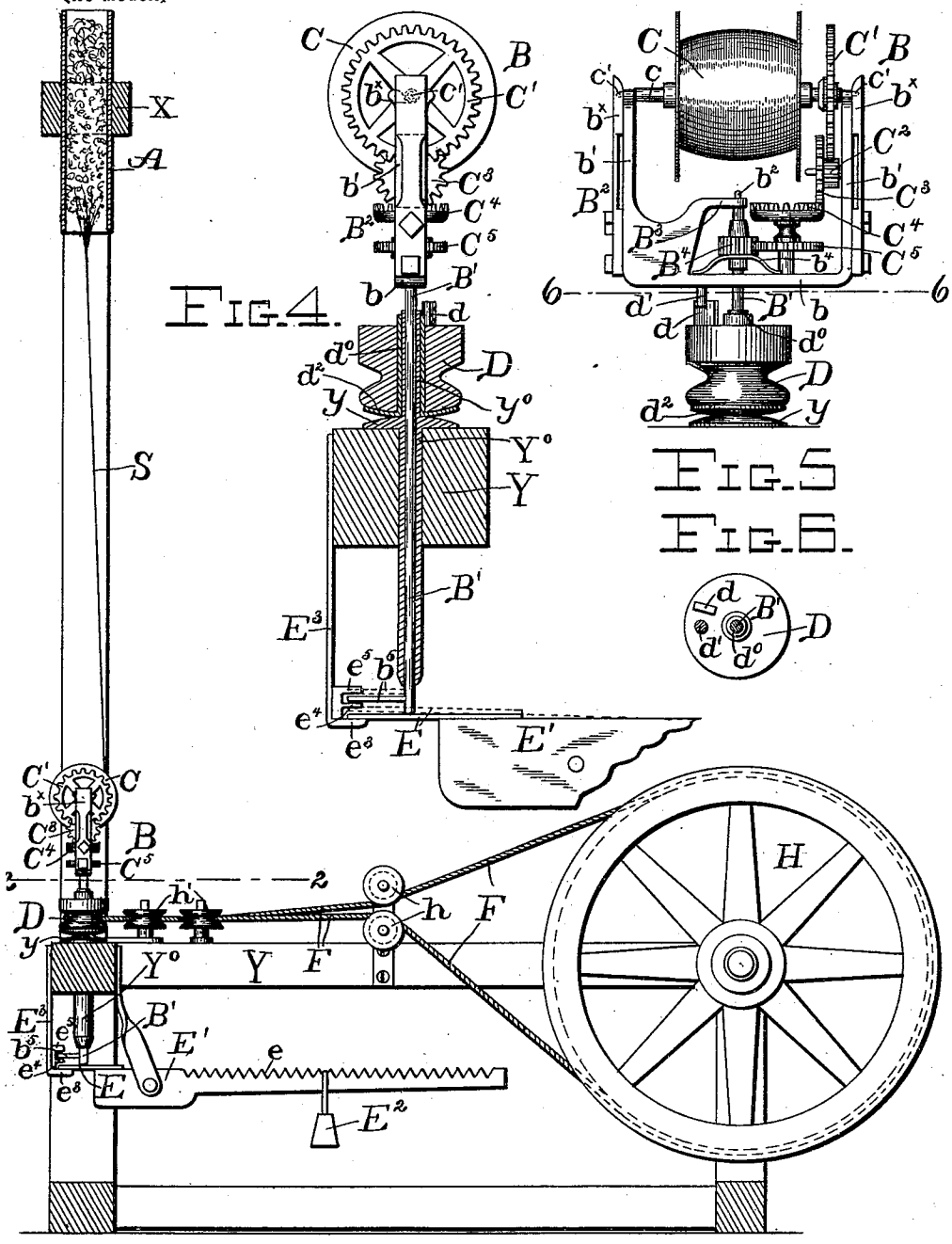

FIG. 4.

FIG. 5

FIG. 6.

FIG. 3.

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(No Model.) 3 Sheets—Sheet 3.

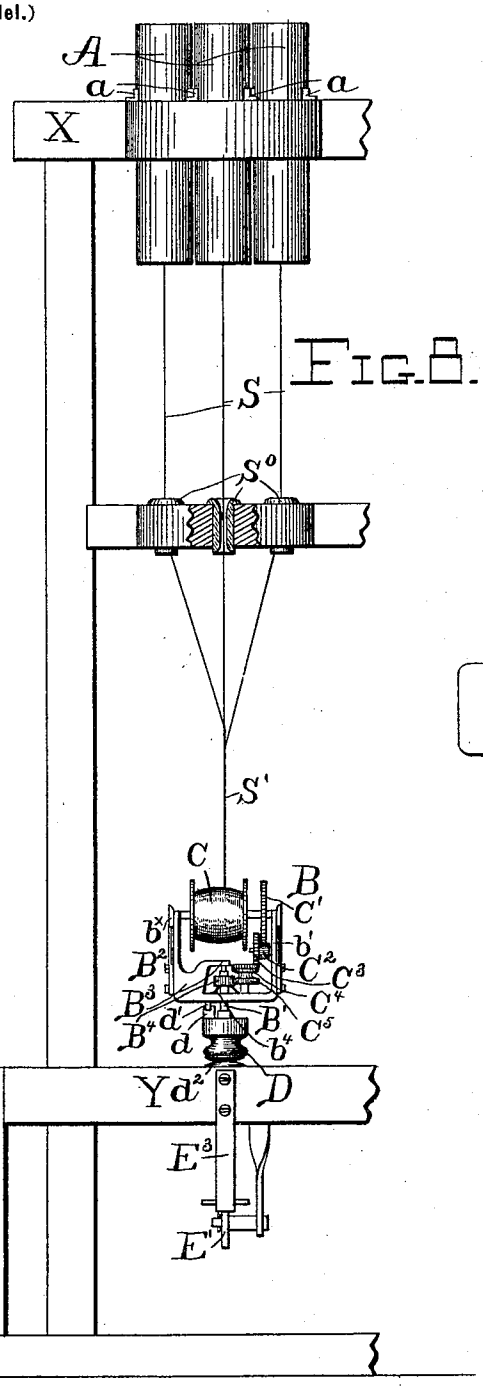
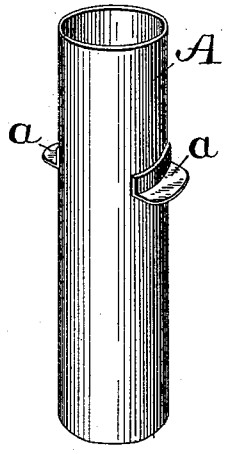


FIG. 8.

FIG. 7



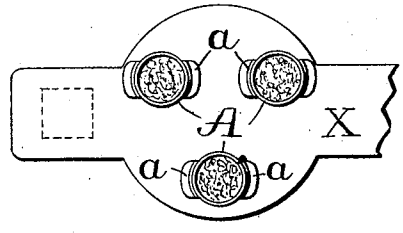


FIG. 9.

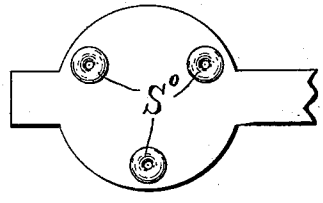


FIG. 10.

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UNITED STATES PATENT OFFICE.

DING CIE SUI, OF FOOCHOW, CHINA, ASSIGNOR TO GEORGE S. MINER AND WILLIAM N. BREWSTER, OF SAME PLACE.

SPINNING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 640,716, dated January 2, 1900.

Application filed December 17, 1897. Renewed June 8, 1899. Serial No. 719,823. (No model.)

To all whom it may concern:

Be it known that I, DING CIE SUI, a subject of the Emperor of China, residing at Foochow, in the Empire of China, have invented certain new and useful Improvements in Spinning-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in the art of spinning; and it consists in the improved machine for spinning cotton and similar fibrous material, hereinafter described and claimed.

My invention will be understood by reference to the accompanying drawings, wherein the same parts are indicated by the same letters throughout the several views.

Figure 1 represents a front elevation of my improved spinning-machine. Fig. 2 is a sectional plan view of the machine, the section being taken on the line 2 2 in Figs. 1 and 3. Fig. 3 is a sectional view taken on the line 3 3 in Fig. 1. Fig. 4 is an enlarged detail sectional view of the twisting and drawing mechanism. Fig. 5 is an elevation of the twisting frame and its driving-pulley as seen from the left in Fig. 4. Fig. 6 is a sectional plan view taken on the line 6 6 in Fig. 5. Fig. 7 is an enlarged perspective view of one of the cotton-tubes. Fig. 8 represents an elevation, partly in section, of a modification of my machine, wherein the same is adapted for twisting together several strands drawn from a corresponding number of cotton-tubes. Fig. 9 represents a plan view of the cluster of cotton-tubes shown in Fig. 8; and Fig. 10 represents a plan view of the guides for the several strands, also shown in Fig. 8.

My machine comprises a suitable framework of any convenient arrangement or construction, having an elevated horizontal support X for a cluster of tubes A for holding cotton or other fibrous material in a mass, as seen in Figs. 1 and 3. A corresponding number of spinning devices B are mounted upon a suitable support Y beneath the tubes A, as also seen in Figs. 1 and 3. Each cotton-tube A is of a cylindrical form and open at both ends and is preferably provided with suitable flanges, such as *a*, thereon, as shown in Fig. 7, by means of which the tube is held stationary in an opening in its support X.

Referring now to Figs. 4 and 5, which show most clearly the construction and operation of each spinning device B, B^2 represents a horizontally-rotatable frame composed of a base member *b* and two upright members *b'* *b'* and is mounted upon a spindle B', which passes centrally through the base member *b* and has its upper end b^2 reduced and journaled in a horizontal arm or bracket B^3 in the frame B^2. A pinion B^4 is mounted fast upon the spindle B' between the base member *b* and the arm or bracket B^3. A half-elliptical spring b^4 is interposed between the base member *b* and the pinion B^4 and by friction with the said pinion may cause the latter, together with the spindle B', to rotate as the frame B^2 rotates, as will be hereinafter more fully described, the frame B^2, however, being free to rotate on the spindle B'.

C represents a spool fixed upon a shaft *c*, the ends of which rest upon bearings on the uprights *b'* *b'* of the frame B^2 and are held by spring-arms $b^\times$ $b^\times$, having sockets in their inner faces which engage the ends *c'* *c'* of the said shaft, as seen most clearly in Fig. 5. These spring holding-arms allow of the ready removal or replacement of the spool and shaft in the frame B^2 and yet hold the said spool securely against accidental displacement. A gear-wheel C' is mounted fast upon this shaft *c* and connects through a train of gears C^2, C^3, C^4, and C^5 with the pinion B^4, the rotation of which causes the rotation of the gear-wheel C' and the spool and shaft.

By the arrangement described in the foregoing paragraph it will be seen that when the frame B^2 and the spindle B' are rotated together with an equal speed the spool C will not be rotated upon its axis and will simply turn with the frame, but that whenever the said frame is caused to rotate independently of the said spindle the spool C will be rotated through the train of gears above described at a speed varying accordingly as the speed of rotation of the said frame is greater or less than the speed of rotation of the said spindle.

The spindle B′ passes through a hollow sleeve Y^0, which is fitted through a vertical opening in the support Y and extends some distance above and below said support, as seen in Fig. 4. This hollow sleeve has an annular flange y thereon, which rests upon the support Y. The upper face of this flange y is preferably rounded or convex, as seen in Figs. 4 and 5.

A pulley D is loosely mounted upon the upper portion y^0 of the sleeve Y^0 and is rounded or convex upon its lower side, as seen in Figs. 4 and 5. This pulley is preferably provided with a hollow bearing-sleeve d^9, fitted within its central opening, and a concavo-convex bearing-disk d^2, integral with said bearing-sleeve and fitting over the lower convex side of the said pulley, which rests upon and rotates on the convex upper surface of the annular flange y, as also seen most clearly in Figs. 4 and 5. An upwardly-projecting axial lug d is rigidly mounted upon the upper flat side of this pulley D and is adapted to strike against a depending stud, lug, or projection d' upon the base of the frame B. The frame B^2 is rotated by the pulley D through the engagement of the lug d upon the said pulley with the stud or projection d' upon the base of the said frame, so that under some circumstances the rotation of the frame B^2 may be intermittent, while the rotation of the pulley D is constant.

The lower end of the spindle B′ rests upon a metallic plate E, rigidly mounted upon the short end of a pivoted lever arm or beam E′, the long end of which is provided with notches e for the adjustment of a weight E^2 along the long end of said arm, by which means the tension upon the thread or yarn being spun is regulated, as will hereinafter more fully appear. The short end of the lever-arm E′ is supported by a step e^3 on a depending arm or bracket E^3, upon which the end of the said plate E normally rests, as seen in Figs. 3 and 4, the weight upon said short end of the lever-arm E′ being constantly greater than the weight upon the long end of said arm, except when the tension upon the strand or yarn S is sufficiently great to lift the spool and its rotating frame slightly, more or less, as will occur when the thread or yarn is twisted or drawn too tightly. The short end of the lever-arm E is also limited in its upward movement by means of a finger or projection e^4 upon the bracket E^3. A second and preferably thicker finger or projection e^5 is provided upon this bracket a short distance from and above the finger e^4, and a radial arm b^5, rigidly mounted upon the spindle B′ near its lower end, is adapted to pass between the said fingers e^4 and e^5 as the spindle rotates when the latter is resting upon the plate E in its lowest position, but will strike against the finger e^5 and retard or arrest the rotation of said spindle when the said spindle is raised slightly by the increased tension upon the strand or yarn, as indicated by dotted lines in Fig. 4. The radial arm b^5 will strike against the lower end of the sleeve Y^0 and limit this upward movement of the said spindle, thus allowing the said radial arm to rise only far enough to strike against the side of the finger e^5 and arrest the rotation of said spindle, which spindle has been hereinbefore described as being rotated solely by the friction of the spring b^4 upon the under side of the pinion B^4 as the frame B^2 rotates. The stud or projection d' on the base of the frame B^2 will not be lifted above the end of the lug d on the pulley D by the rising of the said frame until the arm b^5 on the said spindle comes into contact with the end of the sleeve Y^0, or approximately into such contact, so that the frame B^2 may continue to rotate after the rotation of the spindle B′ has been retarded or arrested entirely by the arm b^5 coming into contact with the finger e^5. In this way, it will be seen, the strand of fiber is continuously twisted by the rotation of the frame and spindle together; but as the strand tightens and shortens the frame and spindle will be lifted slightly, causing the arm d^5 on the spindle to strike more or less positively against the finger e^5, accordingly as the said frame is raised more or less, thus arresting or retarding the rotation of the said spindle, so that as the frame continues to rotate with a greater speed than the spindle the spool C will be rotated through the train of gears in said frame, and more of the loose fiber will be drawn from the tube, which additional fiber will take up some of the twist on the strand and by thus relieving the tension thereon will cause the frame to fall and allow the spindle to rotate with less interruption until the tension on the strand again becomes great enough to lift the frame and spindle once more. It will thus be seen that the strand is twisted continuously, but is drawn from the tube intermittently just fast enough to prevent the said strand being twisted so tightly as to cause it to break; but should, however, the strand be twisted and drawn so tight as to lift the stud or projection d' on the base of the frame beyond the end of the lug d on the pulley D then the rotation of the said frame would cease until this excess of tension has been relieved.

By adjusting the weight E^2 along the arm E′ the degree of twist given to the strand may be regulated with great nicety and the said strand may be made as tight or as loose as desirable.

The pulleys D are rotated by means of a cord F, driven from a drum H, running over a pair of vertical guide-pulleys h h and over a set of horizontal guide-pulleys, such as h' h', &c., as shown in Fig. 2, which allow the said pulleys D to be driven all in the same direction. Any suitable power may be used to

rotate the drum H, such as a belt running over the driving-pulley I. (Shown in Fig. 2.)

Instead of having each strand or yarn drawn from its tube and wound upon a separate spool I may draw a plurality of strands from a corresponding number of tubes at one time by means of a single spinning-frame, which twists these strands together as they are drawn from their several tubes into a single thread, which is wound upon a single spool carried in the said spinning-frame. In Fig. 8 I have shown a machine for accomplishing this purpose. In this figure the tubes are grouped together in a cluster. The strands S are passed through guides S^0, preferably of porcelain or other hard smooth substance, and are twisted together into a single thread S', which is wound upon the spool C. The rotation of the frame B^2 twists each strand as it is drawn from its tube by the rotation of the spool C and also twists the several strands together into a single thread S', which is finally wound upon the said spool and the latter rotates, as will be readily understood from an inspection of Fig. 8.

The spinning-frame and its operating connections (shown in Fig. 8) are precisely similar in construction and arrangement to the spinning-frames shown in Figs. 1, 3, 4, and 5, and any further description or explanation thereof is deemed unnecessary.

The fiber is first compressed somewhat and then placed into the tubes A, the mass being held in the tube by the force of its own expansion merely. To start a strand, a small portion of the fiber is pulled from the lower end of the tube and then connected to a thread or strand previously connected to the spool. The rotation of the frame B^2 creates the necessary tension upon the fiber, which is intermittently drawn from the tube as the tension becomes sufficient to lift the frame B^2, until the mass of fiber in the tube is exhausted, when it is renewed and the operation proceeds as before.

The operation of the machine will be clearly understood by any one skilled in the art from the foregoing description, and any more specific reference thereto is not thought to be necessary.

It will be obvious that many modifications in the details of the hereinbefore-described machine might be made which could be used without departing from the spirit of my invention, and I therefore do not wish to limit myself to the precise details of construction herein shown and described; but

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. In a machine for spinning fibrous material, the combination of means for directly forming a thread or yarn from a mass of such material by continuously twisting, means for intermittently drawing said thread or yarn, and means for regulating said drawing action by the tension upon the thread or yarn by the twisting action, substantially as described.

2. In a machine for spinning fibrous material, the combination with a receptacle for the said material, of a rotatable frame; a spool carried in said frame; means for rotating said frame; means for causing the intermittent rotation of said spool and a separable connection between said means, whereby the drawing action of the spool is regulated by the tension on the thread caused by the twisting action of the frame, substantially as described.

3. In a machine for spinning fibrous material, the combination with a receptacle for the said material, of a spindle rotatably mounted in a vertical bearing; a frame rotatably mounted upon said spindle; a spool rotatably mounted in said frame; means for rotating said frame; means for causing the intermittent rotation of the spool therein and a separable connection between said means, whereby the drawing action of the spool is regulated by the tension on the thread caused by the twisting action of the frame, substantially as described.

4. In a machine for spinning fibrous material, the combination with a receptacle for the said material, of a spindle rotatably mounted in a vertical bearing; a frame rotatably mounted upon said spindle; a spool carried in said frame; means for rotating said frame; a separable friction device between said frame and said spindle for causing the rotation of the latter; and gearing between said spindle and said spool for causing the rotation of said spool.

5. In a machine for spinning fibrous material, the combination with a receptacle for the said material, of a spindle rotatably mounted in a vertical bearing; a frame rotatably mounted upon said spindle; a spool carried in said frame; means for rotating said frame; a separable friction device between said frame and said spindle for causing the rotation of the latter; gearing between said spindle and said spool for causing the rotation of said spool; and means for retarding the rotation of said spindle.

6. In a machine for spinning fibrous material, the combination with a receptacle for said material; of a vertical spindle and bearings therefor; a frame rotatably mounted on said spindle; a spool rotatably mounted in said frame; a pinion fast on said spindle; means for rotating said frame; means for causing the rotation of said spindle; a separable connection between said means and gearing between said pinion and said spool for causing the rotation of the latter in said frame, substantially as described.

7. In a machine for spinning fibrous material, the combination with a receptacle for said material; of a vertical spindle and bear-

ings therefor; a frame rotatably mounted on said spindle; a spool rotatably mounted in said frame; a pinion fast on said spindle; means for rotating said frame; a separable friction device between said pinion and said frame for causing the rotation of said spindle; and gearing between said pinion and said spool carried in said frame for causing the rotation of said spool in said frame, substantially as described.

8. In a machine for spinning fibrous material, the combination with a receptacle for said material; of a vertical spindle and bearings therefor; a frame rotatably mounted on said spindle; a spool rotatably mounted in said frame; a pinion fast on said spindle; means for rotating said frame; a separable friction device between said pinion and said frame for causing the rotation of said spindle; gearing between said pinion and said spool carried in said frame for causing the rotation of said spool in said frame; and means for retarding the rotation of said spindle, substantially as described.

9. In a machine for spinning fibrous material, the combination with a vertical hollow sleeve mounted in a rigid support; a spindle extending loosely through said sleeve; a support for the lower end of said spindle; a frame rotatably mounted upon the upper end of said spindle; and a spool rotatably mounted in said frame; of means for rotating said frame, a separable connection between said frame and said spindle, and connections between said spindle and said spool, substantially as described.

10. In a machine for spinning fibrous material, the combination with a vertical hollow sleeve mounted in a rigid support; a spindle extending loosely through said sleeve; a support for the lower end of said spindle; and a spool rotatably mounted in said frame; of means for rotating said frame; a separable friction device between said frame and said spindle for causing the rotation of the latter; means for retarding the rotation of said spindle; and means for causing the rotation of said spool by the rotation of said spindle, substantially as described.

11. In a machine for spinning fibrous material, the combination with a vertical hollow sleeve mounted in a rigid support; a spindle extending loosely through said sleeve; a support for the lower end of said spindle; a frame rotatably mounted upon the upper end of said spindle; and a spool rotatably mounted in said frame; of means for rotating said frame, a separable friction device for causing the rotation of said spindle by the rotation of said frame; a pinion fast on said spindle, and gearing between said pinion and said spool carried in said frame for causing the rotation of said spool, substantially as described.

12. In a machine for spinning fibrous material, the combination with an elongated vertical hollow sleeve mounted in a rigid support; a spindle extending through said sleeve; a support for the lower end of said spindle; a frame rotatably mounted upon the upper end of said spindle; and a spool rotatably mounted in said frame; of means for rotating said frame; a pinion fast on said spindle; a separable friction device between said pinion and said frame for causing the rotation of said spindle; means for retarding the rotation of said spindle; and gearing carried in said frame between said pinion and said spool for causing the rotation of the latter, substantially as described.

13. In a machine for spinning fibrous material, the combination with a vertical spindle, and a support therefor; a frame rotatably mounted upon said spindle; a spool carried in said frame; of means for rotating said frame upon said spindle; a pinion on said spindle; gearing between said pinion and said spool for rotating the latter; and means for stopping the rotation of said frame by the tension upon the thread or yarn when it becomes too tightly twisted, substantially as described.

14. In a machine for spinning fibrous material, the combination with a vertical spindle, and a support therefor; a frame rotatably mounted upon said spindle; a spool carried in said frame; of means for rotating said frame upon said spindle; a pinion on said spindle; gearing between said pinion and said spool for rotating the latter; friction devices between said frame and said spindle for rotating the latter; means for stopping the rotation of said spindle during the rotation of said frame, and means for stopping the rotation of said frame by the tension upon the thread or yarn when it becomes too tightly twisted, substantially as described.

15. In a machine for spinning fibrous material, the combination with a vertical spindle, and a rigid hollow sleeve partially inclosing said spindle and allowing of a rotary and longitudinal movement of said spindle; a frame rotatably mounted upon said spindle; and a spool carried in said frame; of means for rotating said frame; friction devices between said frame and said spindle for causing the rotation of the latter; a radial arm on said spindle; a fixed stop adapted to be struck by said radial arm when said spindle is moved longitudinally; means for limiting this longitudinal movement of said spindle; and gearing between said spindle and said spool for rotating the latter, substantially as described.

16. In a machine for spinning fibrous material, the combination with a rigid vertical hollow sleeve; a spindle extending loosely through said sleeve and having a slight longitudinal movement therein; a frame rotatably mounted upon the upper end of said spindle; a spool carried in said frame; of a pulley loosely mounted upon said sleeve be-

neath said frame and having a lug or projection thereon adapted to strike against a projection on said frame, for rotating said frame; a pinion mounted fast upon said spindle in said frame; gearing between said pinion and said spool for rotating the latter; friction devices between said frame and said spindle for rotating said spindle; means for stopping the rotation of said spindle during the rotation of said frame; and means for regulating the tension upon the thread or yarn being spun, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

DING CIE SUI.

Witnesses:
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LAU KIENG HWO.