No. 617,680. Patented Jan. 10, 1899.

A. D. EMERY.

PROGRESSIVE SPINNING APPARATUS.

(Application filed Sept. 23, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

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Fig. 2

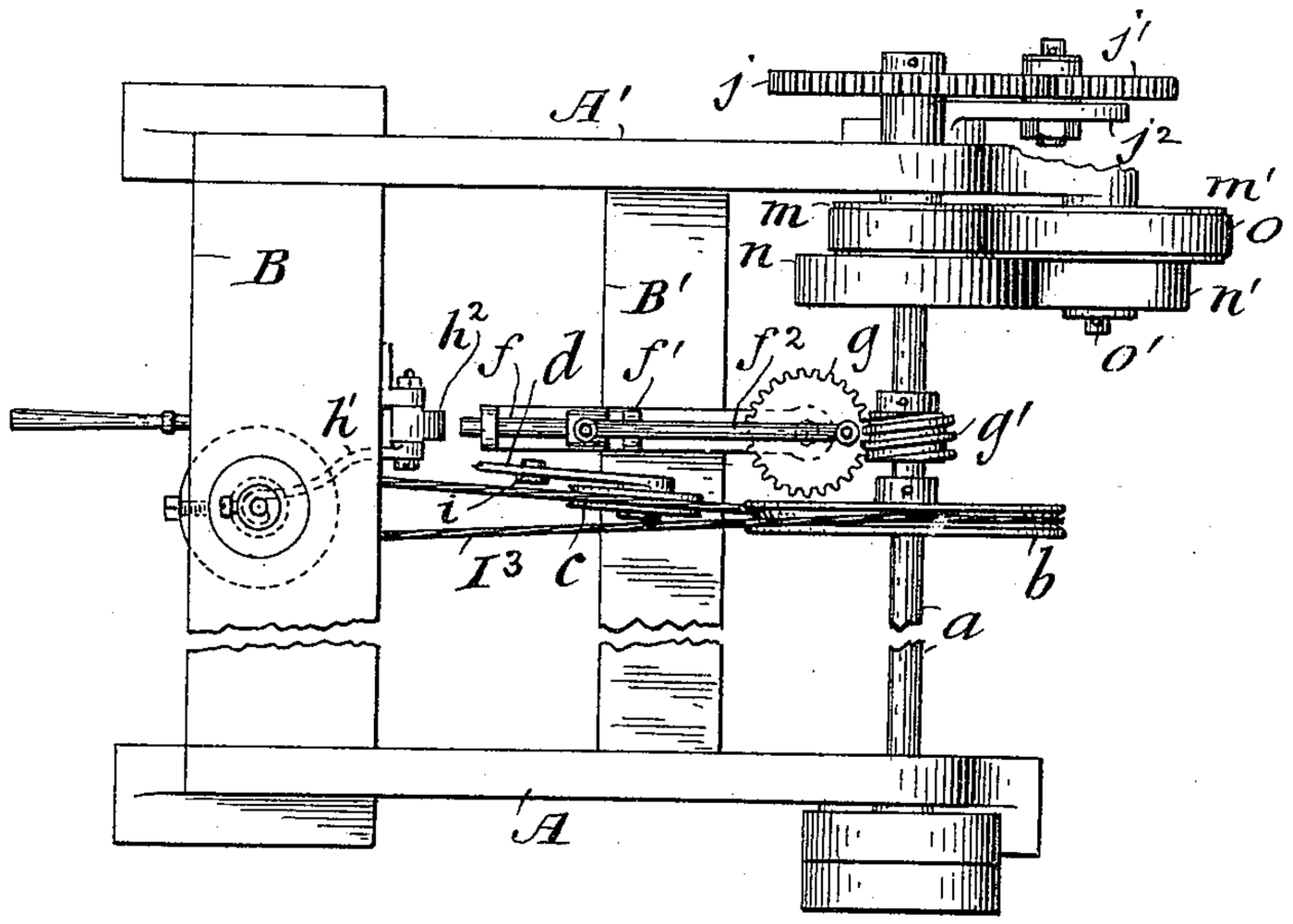

Fig. 3

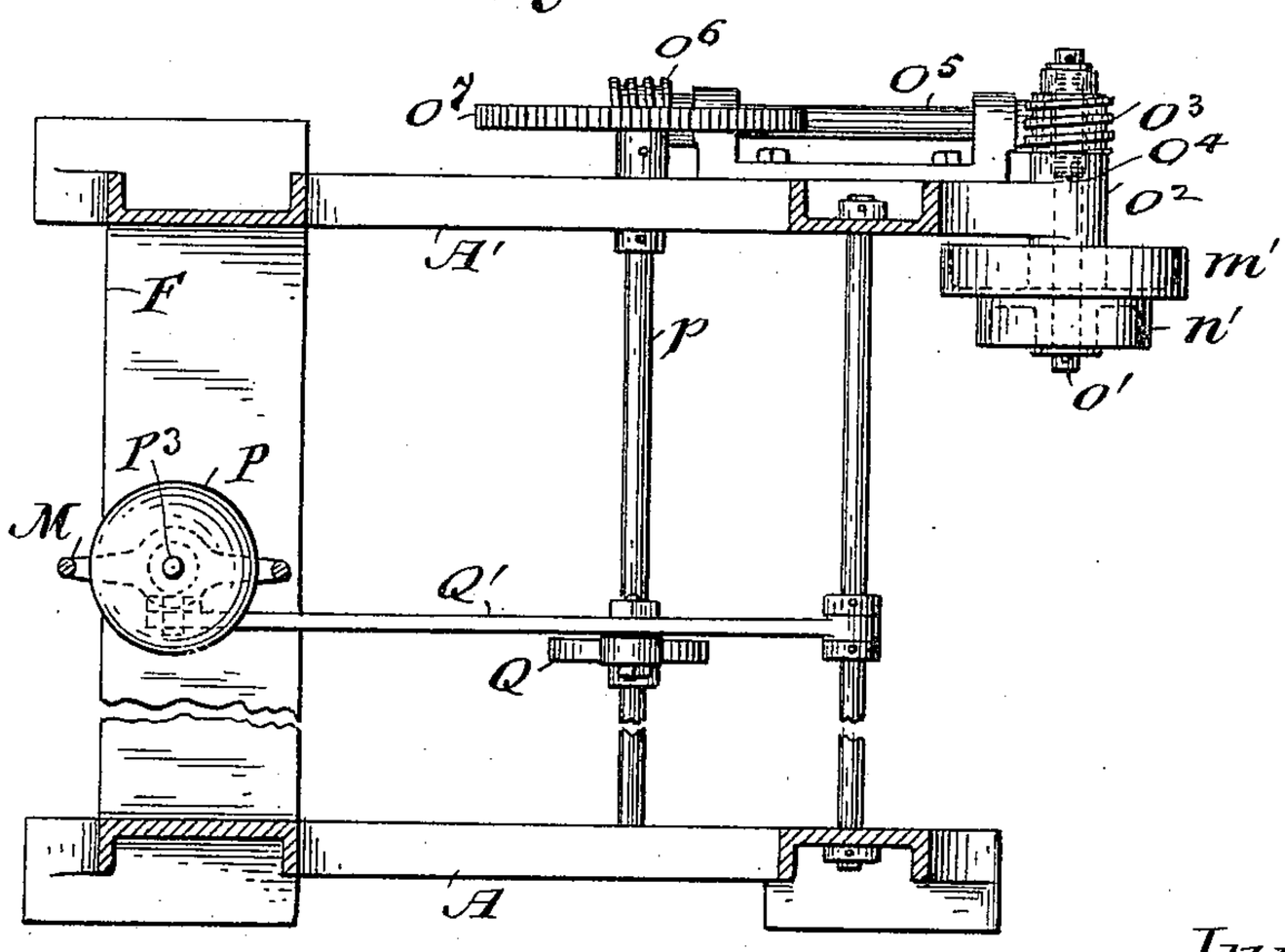

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Fig. 4

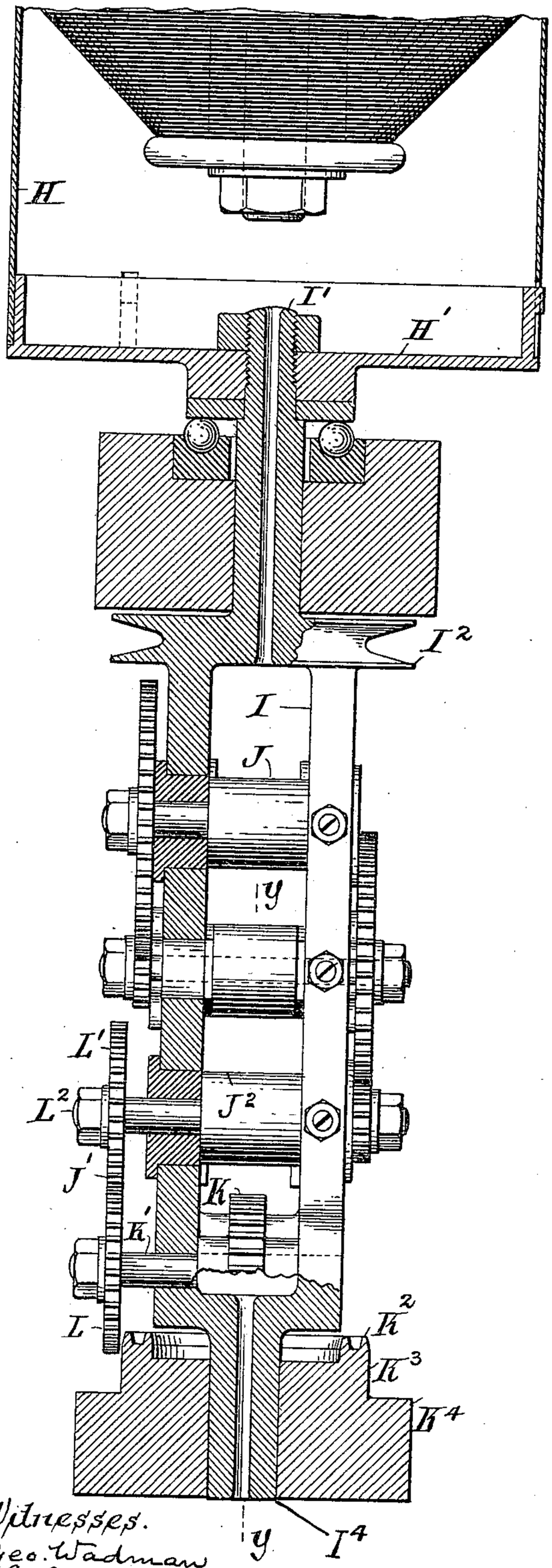


Fig. 6

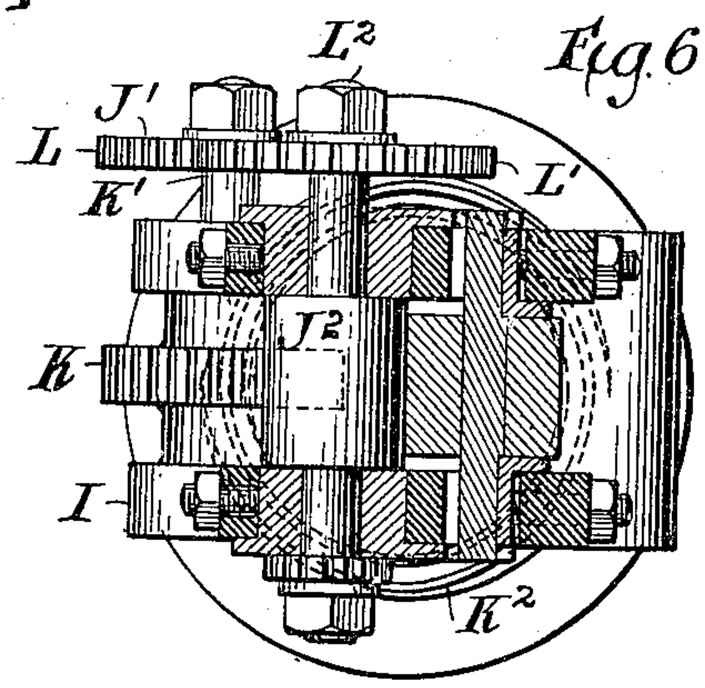
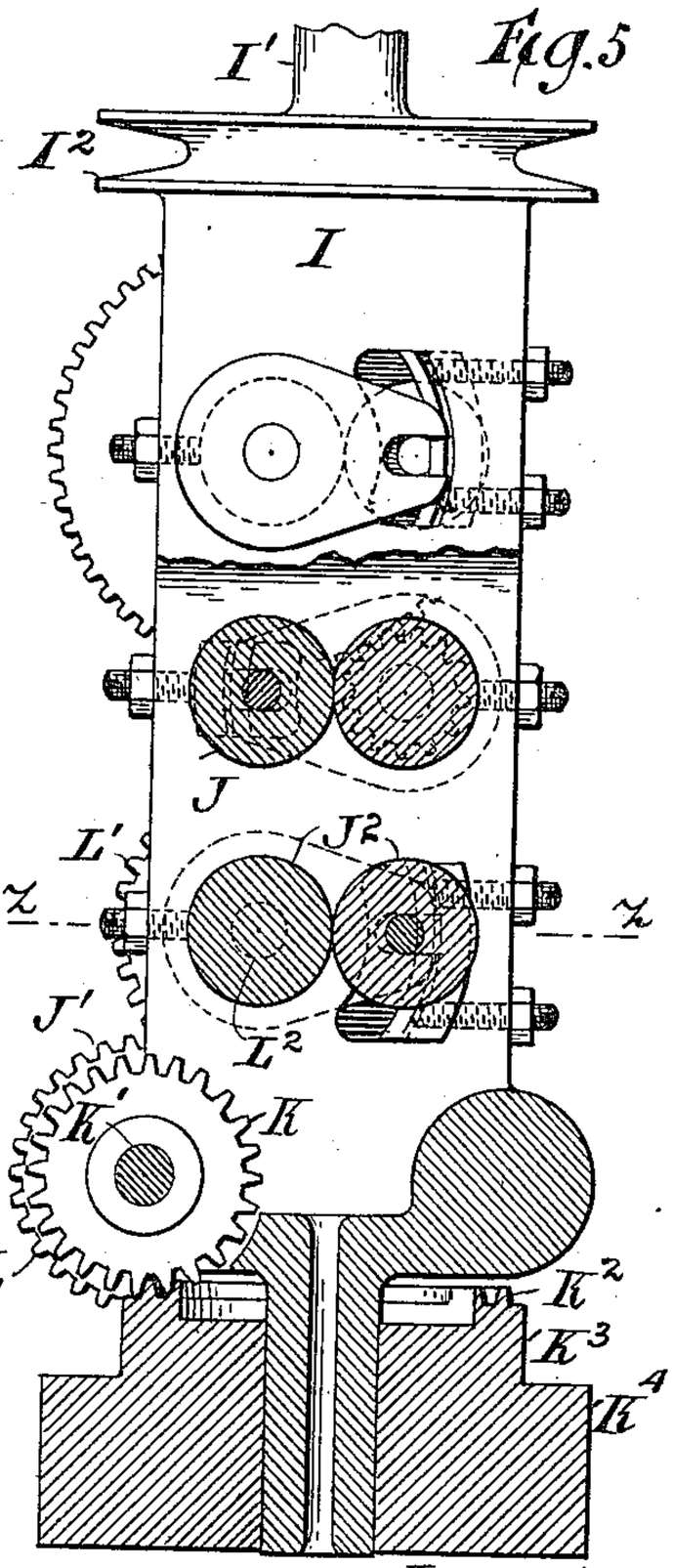


Fig. 5



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UNITED STATES PATENT OFFICE.

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PROGRESSIVE SPINNING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 617,680, dated January 10, 1899.

Application filed September 23, 1897. Serial No. 652,688. (No model.)

To all whom it may concern:

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

This invention relates to mechanism embracing a primary spinning-head for progressively imparting a prescribed number of twists to roving detached by centrifugal force from a roving-bobbin mounted in and having its geometrical axis coincident with the axis of rotation of said primary spinning-head, a supplemental spinning device for imparting a prescribed further number of twists to the partially-spun roving delivered from said primary spinning-head, and any suitable winding devices for spooling the resulting yarn.

In the apparatus represented in the drawings embodying an illustration of the invention the primary spinning-head, which is of the type of that shown and described in my pending application Serial No. 624,112, embraces, first, an upright cylinder adapted to rotate upon its geometrical axis and to contain a bobbin of roving; secondly, a draw-roll frame, which is surmounted by and connected to said cylinder and is provided with a whirl for engaging a band, by which said draw-roll frame and cylinder are rotated upon a common vertical axis; thirdly, a system of pairs of superposed draw-rolls mounted in said frame and rotated upon their parallel horizontal axes by motion transmitted through a train of change-gears, including as its prime member a worm-wheel mounted upon the lower end of the draw-roll frame and engaging a spiral worm formed upon a horizontal bed supported upon the top of the box, in which a hollow trunnion at the lower end of the draw-roll frame has its bearing.

The roving receives its initial twist at its point of delivery from the draw-rolls—that is to say, at what may be called the "unfinished" end of the yarn—while the required additional twist is given by a supplemental spinning device in comparatively close proximity to the draw-rolls, so that the yarn receives and permanently retains one part of its twist at its unfinished end, while having the other part of its twist imparted at its finished end.

The supplemental spinning device, which may be of any known kind, is rotated in a direction opposite to the direction of rotation of the primary spinning-head and at such prescribed greater speed as may be desired—as, for example, at twice the speed of the spinning-head.

The system of change-gears for transmitting motion to operate the draw-rolls affords opportunity for varying the speed of rotation of the draw-rolls upon their own axes relatively to the speed of rotation of the spinning-head. Thus the draw-rolls may be made to deliver the roving at a prescribed rate proportioned as may be desired with reference to the whole number of twists which are given to the roving by the spinning-head and supplemental spinning device combined. Reducing the said relative speed of rotation of the draw-rolls increases the number of twists to the inch given to the roving delivered, and, on the other hand, increasing the said relative speed of rotation of the draw-rolls diminishes the number of twists to the inch given to the roving delivered. The number of twists to the inch in the finished yarn may also be varied by merely changing the relative speeds of rotation of the spinning-head and supplemental spinning device.

An important function performed by the spinning-head is the giving of a permanent initial twist to the roving at its point of delivery from the draw-rolls, whereby it results that the roving is immediately so strengthened as to enable it to go through the complete spinning operation without breaking, for the roving is unwound from the roving-bobbin by centrifugal force and is assisted by gravity in its passage down to and through the pairs of draw-rolls. If the twist should be permitted to run up the roving above its point of delivery, it would be necessary to greatly increase the energy of the grip of the draw-rolls. To avoid this, the partially-twisted roving is subjected to moderate friction by being given one or two turns around a smooth helically-curved wire or "pigtail" arranged a short distance below the spinning-head, whereby it results that the whole or substantially the whole of the twist above the pigtail is that which has been given to the roving by the spinning-head, the remainder

of the twist being that given by the supplemental spinning device to the part of the yarn between the pigtail and the supplemental device.

While spinning-heads of the character described produce yarn of superior quality in respect of evenness and smoothness of finish, their rate of production is comparatively small, because they cannot be run at the high speeds of ordinary spindles; but by the combination of the described spinning-head with a supplemental spinner—such, for example, as a throstle or flier—the rate of production is increased without impairment of quality. For example, if the spinning-head be rotated in one direction at a speed of three thousand revolutions a minute and the supplemental spinning device be rotated in the opposite direction at a speed of six thousand revolutions a minute the yarn will receive nine thousand twists a minute, and allowing twenty twists to the inch four hundred and fifty inches of finished yarn will be produced per minute.

The accompanying drawings, embodying an illustration of the progressive spinner, are as follows: Figure 1 is an elevation, partly in vertical section, conventionally representing an upright frame supporting a spinning-head, flier, and spooling device with appropriate driving-gear. Fig. 2 is a top view with the horizontal members of the structure represented as broken apart for the purpose of indicating that a multiplicity of progressive spinners may be mounted side by side upon a frame of suitable length. Fig. 3 is a horizontal section taken through the plane indicated by the dotted line *x x* on Fig. 1. Fig. 4 is an elevation, partly in vertical section, showing the lower part of the roving-bobbin cylinder and affording a side view of the draw-roll frame. Fig. 5 is an elevation of the draw-roll frame, partly in section, taken through the plane indicated by the dotted line *y y* on Fig. 4. Fig. 6 is a transverse section taken through the horizontal plane indicated by the dotted line *z z* on Fig. 5.

The drawings represent a frame in which there is mounted one progressive spinner. It will be understood that in practice a multiplicity of such spinners will be mounted side by side in the same frame.

The frame is composed of two uprights A A′, united by horizontal members B, B′, C, D, E, F, and G. The spinning-head embraces, first, an upright cylinder H, adapted to rotate upon its geometrical axis and to contain a bobbin of roving and provided at its lower end with the centrally-perforated head H′; secondly, a draw-roll frame I, provided at its upper end with the hollow trunnion I′, which is inserted in and secured to the lower cylinder-head H′; (a whirl I^2 engages a driving-band I^3, by which the said draw-roll frame and cylinder or roving-bobbin holder are rotated upon their common vertical axis;) thirdly, a system J of three pairs of superposed draw-rolls mounted in said draw-roll frame and rotated upon their parallel horizontal axis by motion derived from a worm-wheel K, affixed to the horizontal shaft K′, mounted upon the lower end of the draw-roll frame. The teeth of the wheel K engage a spiral worm or scroll K^2, formed upon a horizontal bed K^3, supported upon the top of the box K^4, in which the hollow trunnion I^4 at the lower end of the draw-roll frame has its bearing.

The plane of the wheel K is radial with relation to the axis of rotation of the draw-roll frame. In the organization of gearing illustrated in the drawings the spiral worm in one revolution gains in radius a distance equal to the width of two of the teeth of the wheel K. Hence the wheel K, which has twenty-four teeth, makes one complete revolution upon its horizontal axis during every twelve revolutions of the draw-roll frame. By means of suitably-arranged gearing J′ (represented in detail in Figs. 4, 5, and 6) motion is transmitted for the rotation of the draw-rolls. The lowest pair of rolls J^2 are so proportioned in diameter as to draw off and deliver two inches of the roving at one revolution.

Assuming that the spinning-head is rotated at the rate of three thousand revolutions per minute, the wheel K would make in the same time two hundred and fifty revolutions. Assuming that the supplemental spinning device rotates at the rate of six thousand revolutions per minute, the yarn receives nine thousand twists per minute, and if it is to have twenty twists per inch then four hundred and fifty inches must be delivered by the draw-rolls J^2. The wheel K rotates at the rate of two hundred and fifty revolutions per minute. Hence the shaft K′ is provided with a pinion L, of thirty teeth, which engages a pinion L′, of thirty-three teeth, affixed to the shaft L^2 of one of the pair of draw-rolls J^2, whereby the draw-rolls J^2 are made to rotate at one-tenth less speed than the wheel K—*i. e.*, two hundred and twenty-five revolutions—and assuming the circumference of the draw-rolls to be two inches each they will thus deliver the required four hundred and fifty inches per minute.

It will of course be understood that the gearing may be changed as required for adjusting the apparatus to spin yarns of a greater or less number of twists to the inch and also for the purpose of varying the relative proportions of the twists given by the spinning-head to the unfinished end and by the supplemental spinning device to the finished end of the yarn and that the timing of the organization is herein shown and described merely for the purposes of illustration.

The supplemental spinning device (shown by way of illustration in the drawings) consists of the quadrangular flier M, which is provided at the top and bottom with the hollow trunnions N and O and is arranged to rotate in axial alinement with the described spinning-head. The trunnion N has its bearing in the box N′, which is fastened by the

set-screw N^2 in the horizontal member E of the frame. The upper end of the hollow trunnion N projects above the box N′ and has affixed to it the whirl N^3, which is engaged by the driving-band N^4. The hollow trunnion O has its bearing in the box O′, secured by the set-screw O^2 in the horizontal member F of the frame. The partially-spun roving delivered from the draw-rolls is led through the hollow trunnion N, thence spirally around the pigtail O^3, thence spirally around the upper half of one of the side members of the flier, and through the transverse aperture therein M′ to the spool P. The spool rests at its lower end upon the disk P′, affixed to the endwise-sliding vertical stem P^2, and is centralized by the extension through its core of the upper part P^3 of said vertical stem. The lower part P^4 of said stem slides in the box P^5, secured by the set-screw P^6 in the horizontal member G of the frame.

The symmetrical laying of the yarn upon the spool is effected by appropriate up and down feeding motions of the spool-carrying disk P′. These motions are derived from the rotating feed-cam Q, which acts upon the lever Q′, pivoted at one end to the frame and having its opposite end connected by the link Q^2 with the collar Q^3, secured to the lower part P^4 of the vertical stem P^2.

There may be employed any suitable mechanism for rotating the spinning-head and for stopping the rotation of the same if the roving runs out or if the roving or yarn breaks. The devices for these purposes (shown by way of illustration in the drawings) are similar to those shown in my pending application, Serial No. 624,112. They consist of the horizontal driving-shaft *a*, mounted in bearings in the standards A A′. Opposite each spinning-head the driving-shaft *a* has affixed to it a pulley *b* for engaging the driving-band I^3 hereinbefore mentioned. The driving-band I^3 is held taut and made to rotate its spinning-head by means of the tightening-pulley *c*, mounted upon the inner end of the hand-lever *d*.

The hand-lever *d* is pivoted to a bracket C′, affixed to the horizontal member C of the frame, and is provided with a handle *d*′, by the depression of which the tightening-pulley is raised into its band-tightening position.

The lever *d* is provided with the downwardly-projecting shoulder d^2, which by engagement with the horizontal arm of the trigger *e* retains the tightener-pulley *c* in its band-tightening position. The trigger *e* is pivotally supported upon the bracket C′ and is provided with the weighted hand-lever *e*, by manually elevating which the trigger *e* is disengaged from the shoulder d^2 and the band-tightener pulley *c* thereupon permitted to fall, and thus slack the driving-band I^3. The trigger *e* is also provided with a downwardly-extending arm e^2, which has a slot to permit the passage of the endwise-reciprocating tripper-bar *f* when the apparatus is in normal operation.

The tripper-bar *f* slides loosely in bearings afforded by the frame *f*′, affixed to the horizontal member B′ of the main frame. A pitman f^2 connects the tripper-bar *f* with a crank-pin inserted in the upper face of the worm-wheel *g*, which is loosely mounted upon a vertical stud affixed to the frame *f*′ and which engages and is driven by a worm *g*′, affixed to the driving-shaft *a*.

The automatic dropping of the band-tightener pulley and the consequent stopping of the spinning-head when the yarn breaks or runs out is effected by means of the detector-lever *h*, the longer arm *h*′ of which is provided with an eye or hook which normally engages the partially-spun yarn between the spinning-head and the flier and is thereby retained in such position that its shorter arm h^2 is below the path of travel of the tripper-bar *f*. If the yarn breaks or the roving runs out, the longer arm of the detector under the influence of gravity falls, and its shorter arm h^2 then swings upward and over against the slotted arm e^2 of the trigger *e*. In this position it receives the impact of the tripper-bar *f* and by communicating the motion thereof to the trigger *e* releases the trigger *e* from the shoulder d^2, and thus permits the tightening-pulley *c* to fall, and thereby slack the driving-band I^3, so that it ceases to rotate the spinning-head.

The hand-lever *d* is connected by the pitman *i* with the arm *i*′, pivoted at one end to the bracket i^2, affixed to the horizontal member E of the main frame and carrying at its free end the band-tightener pulley i^3 for tightening the flier-driving band N^4.

Outside one end of the frame the driving-shaft *a* is provided with a gear *j*, which engages a gear *j*′, mounted on a stud fastened to the adjustable slotted arm j^2. The gear *j*′ also engages and serves to transmit motion to the pinion *k*, affixed to the horizontal shaft *k*′ and having its bearings in the standards A A′. The speed of rotation of the shaft *k*′ relatively to the speed of the driving-shaft *a* is determined by the relative diameters of the gear *j* and the pinion *k*. As shown in the drawings, the shaft *k*′ is made to rotate at twice the speed of the shaft *a*.

Opposite each flier is affixed to shaft *k*′ a pulley I for engaging the flier-driving band N^4.

It will be seen that by manually depressing the handle *d*′ of the lever *d* both tightener-pulleys are simultaneously raised and the belts I^3 and N^4 thus tightened. If, however, occasion arises to turn the spinning-head without turning the flier, the gear *j*′ can be disengaged from the gear *j* by properly rocking the adjustable arm j^2. Similarly if it be desired to change the relative rates of rotation of the shafts *a* and *k*′ the gear *j* and the pinion *k* may be removed from their respective shafts and others of the required differ-

ent diameters substituted in their places. The driving-shaft *a* is provided with two pulleys *m* and *n* for engaging the belt *o*, which serves to drive the pulleys *m'* or *n'*, according to which pair of pulleys it is applied to. The pulleys *m'* and *n'* are affixed to a horizontal shaft *o'*, mounted in a box o^2, projecting from the standard A'. The shaft *o'* has affixed to its outer end a worm o^3 for driving the worm-wheel o^4, affixed to one extremity of the horizontal shaft o^5, provided with bearings in a bracket affixed to the standard A'. The shaft o^5 has affixed to its inner end the worm o^6 for driving the worm-wheel o^7, secured to the feed-cam shaft *p*, which extends across the machine and at proper intervals has affixed to it the feed-cams, one of which, Q, is shown in the drawings.

It will be seen that by the described organization of the driving mechanism facility is afforded for varying the relative speeds of rotation of the spinning-head and flier, and opportunity is also afforded for varying the speed of rotation of the cam-shaft *p*.

It is desirable, especially when the filler gives a greater number of twists to the yarn than are given to it by the spinning-head, that the twists given by the flier shall be prevented from running up to the draw-rolls. To this end there is affixed to the under side of the horizontal member D of the main frame the pigtail O^3, around which the partially-spun yarn as it comes from the draw-rolls is wound spirally, as shown, prior to its delivery to the flier. The object of this device is to do away with the necessity which would otherwise exist of setting the draw-rolls close together to enable them to exert the pressure which would be required to enable them to grip the partially-twisted yarn, it being preferred that the draw-rolls shall act only on the untwisted roving and that the twist at the unfinished end of the yarn shall commence exactly at its point of delivery from the draw-rolls.

It will be seen that the number of twists per inch given to the yarn may be varied by simply changing the gearing which transmits motion from the worm-wheel K to the draw-rolls, and thereby varying the speed of rotation of the draw-rolls relatively to the speed of rotation of the spinning-head upon its vertical axis. The number of twists to the inch may also be varied without varying the speed of rotation of the draw-rolls by varying the relative speeds of rotation of the spinning-head-driving shaft *a* and the flier-driving shaft *k*, as has already been pointed out.

It will of course be understood that any well-known form of spinner may be substituted for the flier shown in the drawings without departing from the invention. The flier is selected for the purpose of illustration, because it amply answers the requirements of the case.

What is claimed as the invention is—

1. In apparatus for spinning yarn, the combination as herein set forth of two spinning appliances; a roving-bobbin mounted upon and having a common axis of rotation with one of said spinning appliances, whereby centrifugal force is utilized to initiate the unwinding of the roving from said bobbin, means for rotating said spinning appliances in relatively opposite directions, for simultaneously twisting in one direction the roving initially unwound from said bobbin by centrifugal force while twisting in the opposite direction the finished end of the length of yarn between said two spinning appliances, and means for winding up the finished yarn.

2. A progressive spinner, substantially such as herein described, the same consisting essentially of a spinning-head composed of a bobbin-holder a bobbin and a draw-roll frame rotating in one direction upon a common vertical axis; a supplemental spinning device rotating in the opposite direction and arranged beneath and preferably in axial alinement with the said spinning-head; a system of draw-rolls mounted in horizontal bearings on said draw-roll frame, and means for rotating said draw-rolls upon their own axes at prescribed speeds.

3. In a progressive spinner the combination of a spinning-head composed of a roving-bobbin holder a bobbin and a draw-roll frame adapted to rotate upon a common vertical axis; draw-rolls mounted upon horizontal axes in said frame; means for rotating said draw-rolls upon their horizontal axes by motion derived from the rotation of the spinning-head upon its vertical axis; a spinning-head-driving shaft mounted in the frame of the machine and provided with a pulley for engaging the spinning-head-driving band; a supplemental spinning device arranged beneath said spinning-head; a supplemental driving-shaft mounted in the frame of the machine and provided with a pulley for engaging the band by which the supplemental spinning device is driven; means for rotating said supplemental driving-shaft by motion derived from said spinning-head-driving shaft, and means for varying the relative speeds of rotation of the said two driving-shafts, substantially as and for the purposes set forth.

4. In a progressive spinner, the combination of a spinning-head composed of a roving-bobbin holder, a bobbin, and a draw-roll frame rotating in one direction upon a vertical axis, a supplemental spinning device rotating upon the same vertical axis in the opposite direction for imparting to the roving the remainder of the required twist, and means, as a "pigtail," for imposing moderate friction upon the partially-twisted yarn between said spinning-head and supplemental spinning device, substantially as described.

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