

*A. Woodworth 3rd,  
Spinning Machine,  
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## IMPROVEMENT IN MACHINERY FOR SPINNING.

Specification forming part of Letters Patent No. 12,889, dated May 15, 1855.

*To all whom it may concern:*

Be it known that I, ARAD WOODWORTH, 3d, of Boston, in the county of Suffolk, and State of Massachusetts, have invented certain new and useful Improvements in Spinning Apparatus; and I do hereby declare that the following description, taken in connection with the accompanying drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements, by which my invention may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by Letters Patent.

The figures of the accompanying plate of drawings represent my improved spinning machinery.

Figure 1 is a plan or top view, and Fig. 2 is a longitudinal vertical section of the same, taken in the plane of the line A B, Fig. 1. Figs. 3 and 4 are detail transverse sectional views taken, respectively, in the planes of the lines C D and E F, Fig. 1.

In the process of spinning all the various fibrous materials, next to the quality of the yarn, the great points to be secured are to put the twist into the yarn in the shortest possible time with the least expenditure of power, and when the spinning and drawing down are combined, as in the "jack" or mule spinning, to arrange the machinery to effect these operations in the smallest possible space. It is also very desirable in this kind of machinery to be able by simple means to regulate or adjust the number of twists in a given measure of yarn to suit the various purposes for which it is to be used and the different fabrics into which it is to be woven.

The aim or object of the improvements which I have devised, and which are hereinafter described, is to secure the several advantages above enumerated; and the essential features of these improvements consist, first, in the use of one, two, or more inner fliers arranged within the outer flier in succession, one within the other, and so as to be revolved either at the same or different rates of speed and in the same or different directions with the said outer flier, for the purpose of producing any desired degree of twist

in the yarns and twisting and spinning more yarn at the same rate of revolution than any other spinning apparatus.

By the simple use of the fliers, as above suggested, and running them in opposite directions and at equal speeds three times the amount of twist can be secured at the same rate of speeding the machinery as can be obtained by the ordinary spinning apparatus, as one twist is given by the revolution of the outer flier between the first set of drawing-rollers and the neck of the said outer flier, and the two twists between the first extra set of drawing-rollers and the neck of the inner flier. Any proportional higher rate of speed of the inner flier over the outer one gives the same proportional increased twist to the yarn, and by the use of a third flier arranged and operated within the second precisely as that is within the first or outer flier, and as shown in the drawings, a much greater variety of twists may be produced.

In ordinary spinning the twist is regulated altogether by the speeding of the delivering-rollers—that is, so much twist is given to such length of the roving as is at any time between the delivering-rolls and the neck of the flier. Machines have been contrived, however, for giving a second twist to the yarn at the end of the flier opposite the neck after it has received its first twist; but such machines must always give the two twists, no more no less.

I have before suggested that by the use of the two fliers, as I have above specified, I can secure a treble or quadruple twist; but by the same means there may be also secured any intermediate twist between a single and a double twist, or between the double and triple twist, and by the use of a third flier a still greater variety of twist may be produced. In using two fliers, for instance, by revolving the inner flier in the same direction with the outer flier and at one-half the speed there will be produced a twist and a half in the yarns, and if the first inner flier be revolved in the same direction and at a greater rate than the outer one a portion of the twist which has been given to the yarns between the drawing-rollers and the neck of the outer flier will be taken out, so that it will be apparent that any degree of twist can be secured by the use of the



two fliers and running them as specified, it being only necessary to change the gearing by which the said fliers are revolved.

By the use of a third flier, as before suggested, the varieties of twist may be increased in a manner which will be readily understood from what has above been stated. By combining additional drawing-rollers with the inner fliers, as hereinabove specified, I think my improved spinning apparatus can perform the same work as the jack or mule spinner, as it can draw and spin at the same time, with a great saving of space and cost and dispensing entirely with the traversing carriage.

In spinning for the woolen manufacturers I think the roving can be passed to my improved spinning apparatus directly from the carding-engine, all the necessary drawing and spinning being done by my machinery, and I am of the opinion, also, that in spinning for cotton fabrics the use of the drawing-frame and speeding may be altogether dispensed with.

It is sometimes necessary in woolen spinning to put in a certain degree of twist at the same time that the roving is drawn down and then give the yarn a finishing twist afterward, and this is effected in the spinning-jack by keeping the traversing carriage stationary after it is drawn out, while the finishing twist is put in; but in my machine I think it can be done by the inner fliers after the extra sets of drawing-rollers have drawn the yarn down sufficiently without any suspension of progress in the yarn.

I shall now proceed to describe the construction and operation of my improved spinning-machine in detail.

*a a a a* represent in the several drawings the frame-work of the machine, which should be made of such shape and material as to enable it to sustain the operative parts of the apparatus.

*b b b b* is the "main" or "outer" flier, as I have before termed it, which is of common rectangular form, the neck *c* and journal *d* of which rest and revolve in suitable bearings in the cross-stanchions *e e*, said flier being revolved by power applied directly to its journal *d*. The neck *c* of this flier is hollow or tubular, as usual, so that the roving may be passed through it from the series of drawing-rollers *f f g g*, arranged in the usual way in two sets, the lower one of each set being fluted and the upper one covered with cloth or other suitable material, and the inner set being revolved at a higher speed than the outer one, so as to draw the roving down by the connecting-gear. (Shown at *a<sup>3</sup> b<sup>3</sup> c<sup>3</sup>*, Fig. 1.) These drawing-rollers are revolved through the medium of the spur gear-wheel *h* on the neck of the flier, the teeth of which engage with those of a similar wheel *i* on one end of a short connecting-shaft *d<sup>3</sup>*, properly sustained in the barrel-bearing *e<sup>3</sup>*, connected to the main frame-work, and having on its other end a beveled pinion

*f<sup>3</sup>*, which engages with a bevel gear-wheel *g<sup>3</sup>* on one journal of the inner lower roller *g*.

The "first inner flier," as I have before called it, is shown at *j j j j*, and is of a similar rectangular shape to the outer one *b b b b*, the neck *k* and journal *l* of the said first inner flier having proper bearings in the cross-bars *m m* and *n n* of the main flier. The neck *k* of this inner flier is at the opposite end of the machine to that where the neck *c* of the outer flier is placed. The third flier, or "second inner flier," as I shall term it, is shown at *h<sup>3</sup> h<sup>3</sup> h<sup>3</sup> h<sup>3</sup>*, and is generally similar in construction to the other flier, its neck *l<sup>3</sup>* and journal *k<sup>3</sup>* having proper bearings in the cross-bars *l<sup>3</sup> l<sup>3</sup>* and *m<sup>3</sup> m<sup>3</sup>* of the first inner flier.

The spool-shaft is shown at *o o* in the sectional drawings, Fig. 2, one end being of a socket form and resting and revolving on the conical end of the adjustable screw-shaft *n<sup>3</sup>*, which is arranged so as to be moved forward and back (but not to be revolved) by the nut *o<sup>3</sup>* in the tubular bearing *q<sup>3</sup>* in the cross-bar *p p* of the second inner flier. The other end of the spool-shaft is formed in a hollow clutch shape, so as to embrace and turn with the short friction-shaft *q q*, as shown at *r* in Fig. 2, said friction-shaft having proper bearings in the neck and tubular bearing *r<sup>3</sup>* in the cross-bar *m<sup>3</sup> m<sup>3</sup>* of the first inner flier. The spool *s s*, on which the yarn is to be wound, is connected to its shaft *o o* by the arm *t t*, having a proper dog upon it, which arm is cast with or fastened on said shaft, and the dog of which engages with a proper slot in one of the spool-heads, as shown by dotted lines in Fig. 1. By turning the nut *o<sup>3</sup>* so as to make it press against the face of the tubular bearing *q<sup>3</sup>* of the cross-bar *p p* of the second inner flier the end of the screw-shaft *n<sup>3</sup>* will be moved inward and make the clutch end of the spool-shaft engage with the end of the friction-shaft *q q*, and when these two shafts are so connected they are in proper position for operating the machine; but by turning the said nut *o<sup>3</sup>* in the opposite direction the screw-shaft *n<sup>3</sup>* may be run through its bearing in the cross-head, so that the clutch end of the spool-shaft can be disengaged from the said friction-shaft and the spool-shaft, with the spool, be taken out of the machine for the purpose of removing a full spool and replacing it with an empty one.

The retarding friction on the spool is produced and regulated through the medium of the washer *t<sup>3</sup>*, pressed against the friction-pulley *u<sup>3</sup>*, fixed on the friction-shaft *q q* by means of the regulating-screw *v<sup>3</sup>*, working through a proper nut *w<sup>3</sup>*, secured to the cross-head of the first inner flier, as shown in Fig. 1. The connection hereinabove explained between the friction-shaft and the spool-shaft, it will readily be seen, gives the proper retarding motion to the spool.

The proper proportional motion for the guide which controls the winding of the yarn upon the



spool is communicated from the friction shaft  $q\ q$  by means of the pulley  $a'$  on said shaft, a band  $b' b'$  from which passes to and around a similar pulley on the revolving right and left threaded screw-shaft  $c' c'$ . The journals of the said shaft have proper bearings in one cross-head of the inner flier and a short cross-head  $d'$ , secured to and making a part of one side of the said flier. This screw-shaft has a right and left threaded screw cut upon it, in which the foot of the traversing guide-nut  $c'$  travels forward and back, the guiding-hole for the thread being formed in the upper part of said nut, which is also provided with a proper barrel  $f'$  to slide along upon the guiding-rail  $g' g'$ , forming a part of one side of the flier.

The outer flier, as hereinbefore stated, is revolved directly from the driving machinery, and the first inner flier  $j j j j$  is revolved by means of a stationary gear-wheel  $h'$  around the journal of the outer flier, and a gear-pinion  $i$  on the neck of the said first inner flier, and a loose shaft  $k'$ , turning in bearings in the cross-bar  $n\ n$  and cross-head of the outer flier and having gear-wheels  $l' m'$  fixed on each of its ends. The teeth of the wheel  $m'$  engage with and roll round those of the stationary gear-wheel  $h'$  as the outer flier is revolved, and thereby turn the loose shaft  $k'$ , and through the medium of the gear-wheel  $l'$  and pinion  $i$  the proper motion is imparted to the first inner flier.

The second inner flier is connected with the revolution of the first inner flier and revolved by being so connected by a precisely-similar combination of gear-wheels and loose shafts as that just above explained as connecting the motions of the outer flier and first inner flier—viz., a gear-wheel  $a^4$  on the journal of the first inner flier and a gear-pinion  $b^4$  on the neck of the second inner flier, and the loose shaft  $c^4$ , with its gear-wheels  $d^4 e^4$ , all arranged and operating as shown in Fig. 1.

The first extra pair of drawing-rollers  $x' x'$  are arranged so as to revolve in proper bearings in the small bearing-frame  $o' o'$ , secured to the inside of the cross-head of the outer flier farthest from the neck of the same. They are geared together by the small gear-wheels  $p' q'$  and are revolved by extending one journal of the lower roller  $x'$  through the cross-head of the outer flier and fixing thereon a gear-pinion  $r'$ , which, as said flier is revolved, engages with and travels around the stationary gear-wheel  $h'$ , before referred to, (see Fig. 3,) and thus gives the requisite motion to the said drawing-rollers. Springs  $s' s'$  are arranged, as shown in Fig. 1, to press the upper of said drawing-rollers upon the lower one with any pressure which may be desirable. A second extra set of drawing-rollers, and precisely similar to those just above described, are similarly arranged at  $f^4 f^4$  in a bearing-frame  $g^4$ , secured to the inside of the cross-head of the first inner flier. They are geared

together by the gear-pinions  $h^4 h^4$  and are revolved by a gear-wheel  $i^4$ , which travels round a gear-pinion  $k^4$ , fixed on the inside of said cross-head.

In the foregoing I have stated the objects aimed at in my new spinning-machine and have described all the several parts thereof and the means by which they are moved and made to perform their various functions. I shall now proceed to describe the operation of the machine.

The roving and yarn formed from the same are represented in the several drawings by red lines. The roving is passed into the machine through the series of drawing-rollers  $f\ g\ g$  and the tubular neck  $c$  of the outer flier and receives its first twist between the said rollers and the guiding-roller  $l^5$ , set in the said neck, as shown in Fig. 1. From thence it passes on the exterior of the outer flier around proper guiding-pulleys  $u' v'$ , set in the same, and nearly the whole length of said flier. From the latter of these pulleys  $v'$  it is passed through the side of the said outer flier at its end opposite its neck and then between the first extra set of drawing-rollers  $x' x'$  to and through the tubular neck of the first inner flier. From the neck of the first inner flier the yarn passes round a proper guiding-roller  $l^4$ , set in said neck and on the outside of said inner flier, round proper pulleys  $m^4 n^4$  set in the same, and nearly the whole length of said flier, and through the side of the same and between the second extra set of drawing-rollers  $f^4 f^4$  to and through the neck of the second inner flier. From the neck of the second inner flier the yarn passes round a guiding-pulley  $w'$  through the eye or hole in the end of the guiding-nut  $e'$  to the spool. Between the first extra set of drawing-rollers and the neck of the second inner flier, as hereinbefore explained, any remaining twist desired to be given to the yarn is produced by the three fliers operating as hereinabove specified.

It will not be necessary for me to repeat the description of the manner of producing the various degrees of twist in the yarn, as that is sufficiently set forth in the former part of the specification in describing the essential features of my invention.

It should be stated that when the several extra sets of drawing-rollers are revolved at the same rate as the first series of rollers they merely guide the yarn along without drawing it down any, but they grip it for the succeeding twists, and, what is very essential, as hereinbefore stated, they prevent the draft or tension on the yarn occasioned by the retarding-friction on the spool from being felt beyond said rollers, behind which the yarn in such case, being only partially twisted, is weak and liable to be broken when no such provision is made. When the roving is sufficiently strong and it is desired to draw the yarn down after it is partially spun, and



then put in a finishing twist by speeding the extra sets of drawing-rollers at a greater rate than the first series are turned, this result can be secured to any extent that may be desirable.

The mode of producing friction on the spool-shaft, and through the same of giving a proper draft and tension to the yarn, is believed by me to be as good as any now known; but any other of the numerous modes heretofore devised for securing the same results may be substituted therefor.

From the foregoing specification it will be apparent to any one skilled in the art of spinning fibrous materials by machinery that the distinguishing characteristic or feature of my improvements may be still further developed by the use of further extra fliers and sets of drawing-rollers similarly arranged one within another, as hereinabove explained, so that the process of combined drawing down and spinning which results from the use of such

machinery may be continued to any desired extent.

Having thus described my improvements, what I claim as my invention, and desire to have secured to me by Letters Patent, is—

The use of one or more inner fliers arranged in a sequence one within the other, to revolve in the same or different directions or at the same or different speeds with the outer flier, all the fliers acting continuously upon the roving yarns or material first received by the outer flier until the spinning or twist is completed and the yarn or yarns are wound upon the spool or bobbin, thereby twisting and spinning more rapidly and attaining any desired degree of twist in yarns, as hereinbefore more fully described.

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