Sheet 1, 3 Sheets

I. B. Hartwell.

Spinning Mach.

No. 1,166. Patented Jun. 7, 1839.

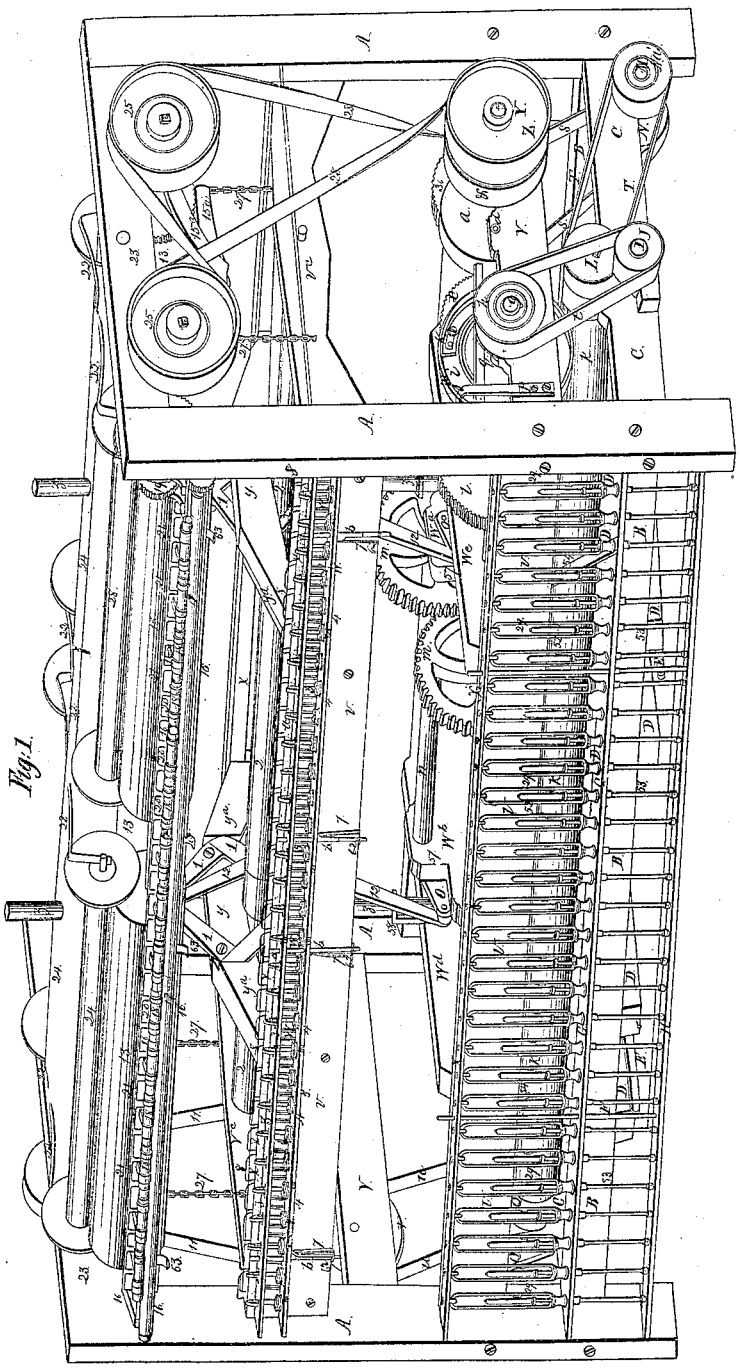


Fig. 1.

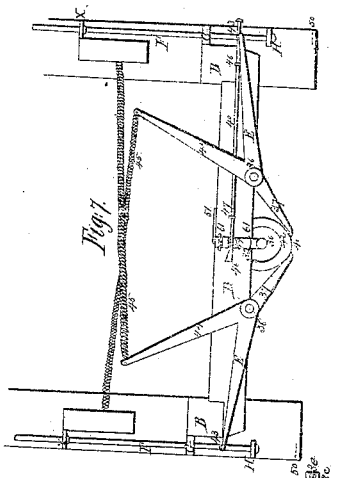


Fig. 7.

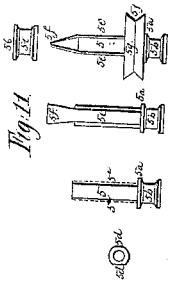


Fig. 11.

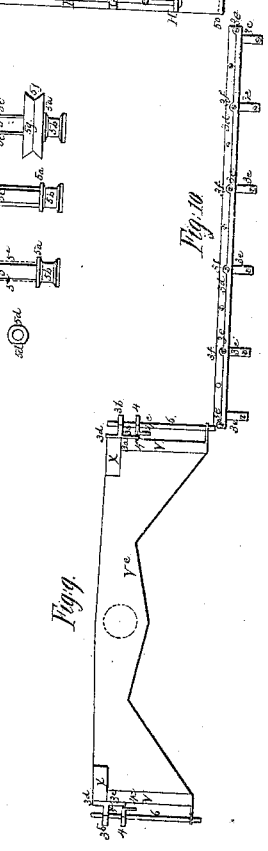


Fig. 10.

Fig. 12.

Fig. 9.

Sheet 2, 3 Sheets

I. B. Hartwell.

Spinning Mach.

No. 1,106. Patented Jun. 7, 1839.

Fig. 2.

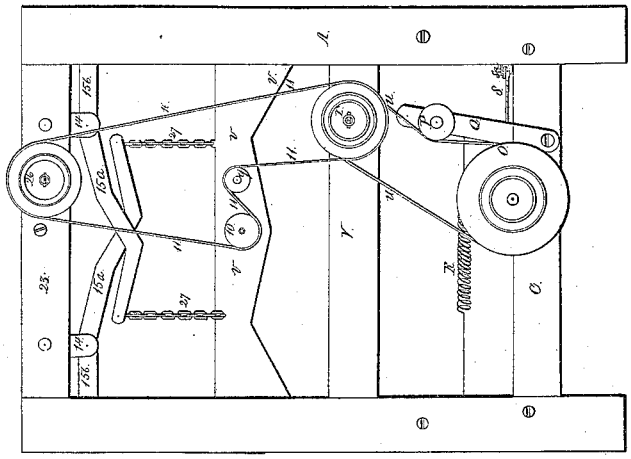


Fig. 4.

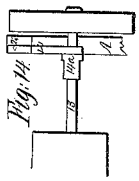


Fig. 5.

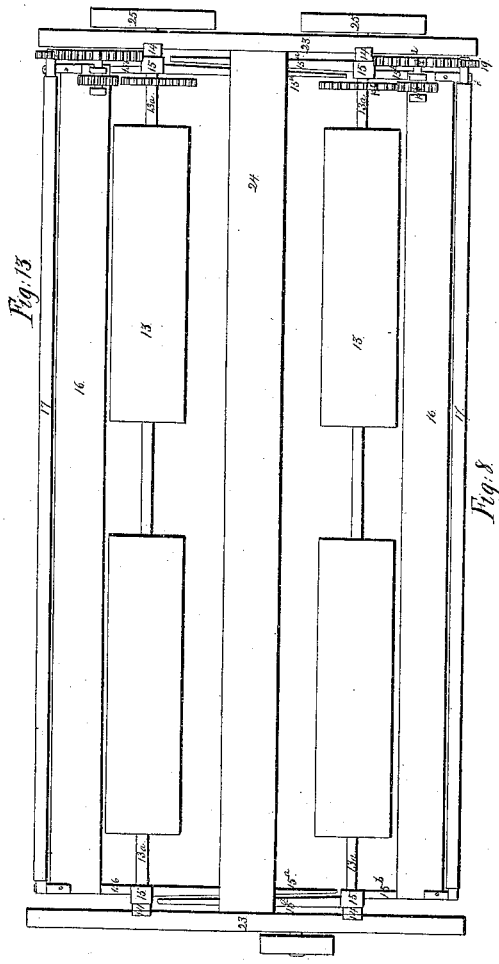


Fig. 8.

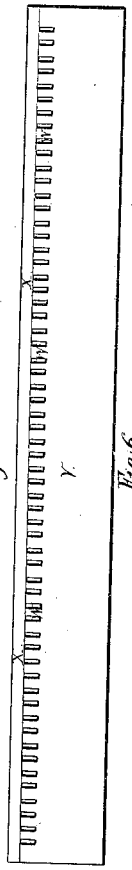
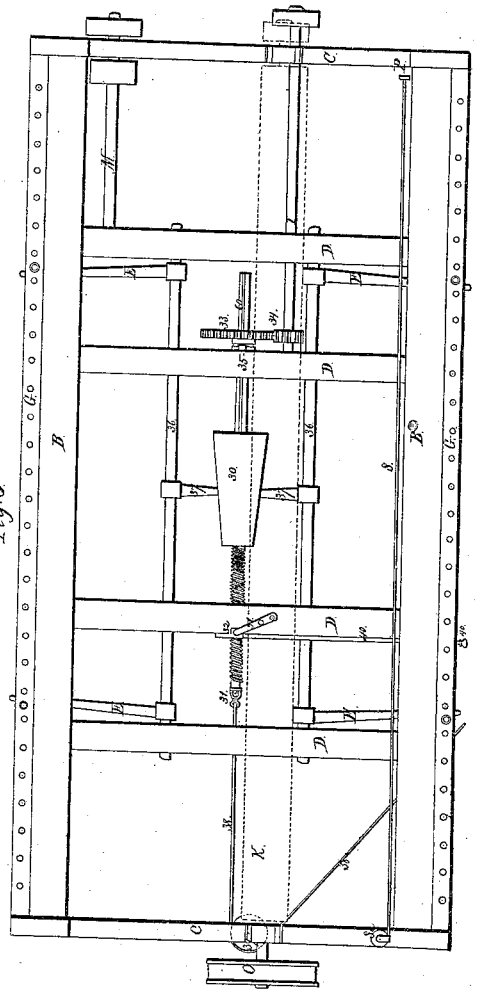


Fig. 6.



Sheets 3, 3 Sheets.

I. B. Hartwell.

Spinning Mach.

No. 1,166.

Patented Jun. 7, 1839.

Fig. 15.

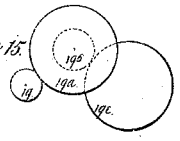


Fig. 5.

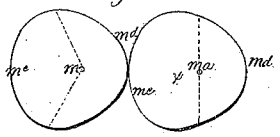


Fig. 4.

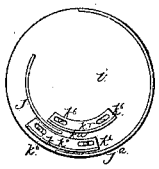
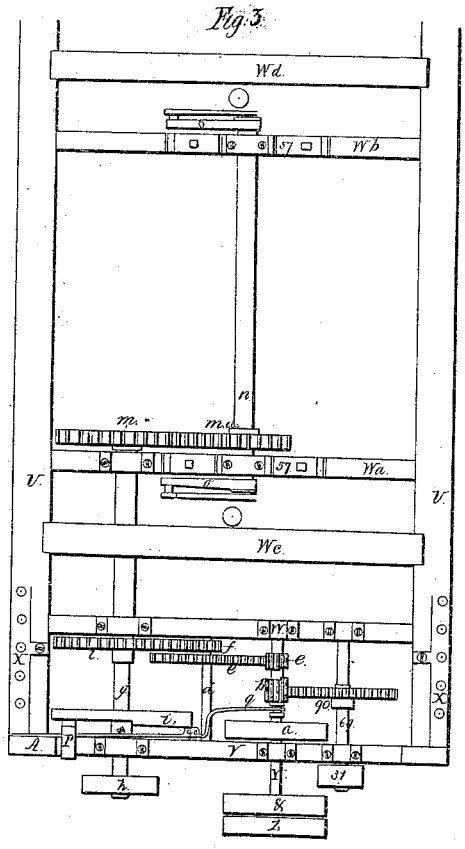


Fig. 3.



UNITED STATES PATENT OFFICE.

ISAAC B. HARTWELL, OF NORTHFIELD, VERMONT.

MACHINERY FOR SPINNING WOOL.

Specification of Letters Patent No. 1,166, dated June 7, 1839; Antedated February 22, 1839.

To all whom it may concern:

Be it known that I, ISAAC B. HARTWELL, of Northfield, in the county of Washington and State of Vermont, have invented a new and useful Improvement in Machinery for Spinning Wool, called "Hartwell's Wool-Spinner," of which the following is a full and exact description.

For a spinner of sixty spindles, let there be constructed of wood a frame of the following dimensions, viz seven feet eleven and a half inches long, five feet five inches high, and three feet and eleven inches wide.

Figure 1 presents a perspective view of the machine, in the drawings annexed to this description.

Let there be four corner posts A A A A, six inches wide and two inches thick; and at each end of the frame, three girts, C, V, 23, across its shorter diameter, five inches wide, and two inches thick. The lower edge of the lower end girts C, C, Figs. 1 and 2, should be seven inches above the bottom of the posts. The lower edge of the middle end girt V at the right end of the machine as presented in Fig. 1, should be seventeen and three fourths inches above the bottom of the posts; while the middle end girt V, Fig. 2, at the left end of the machine, should have its lower edge twenty-six and a half inches above the bottom of the posts.

The long girts running from end to end of the machine are made as follows: The lower long girts B, Fig. 1, should be four, by three and a half inches and should be placed, one on each side of the frame, having their greatest width in a horizontal position, their interior surface even with the inner edge of the posts, and their upper surface even with the upper edge of the lower end girts C, C. The second long girts V should be seven and a half inches wide and two inches thick, and are also placed one on each side of the frame, nearly in the center of the posts, or so far from the outer edge of the posts, as to give room for the fliers, (marked 29). These girts have their greatest width in a perpendicular position, and their upper edges at such a distance from the upper surface of lower long girts B, as to accommodate the length of the fliers, 29, 29.

The crown beam 24, is six inches by four, having its greatest width in a horizontal position. It is extended directly over the center of the machine and is framed to the two upper end girts 23, 23, having its upper surface even with the upper edges of the girts and tops of the posts, and with them, forms the highest part of the frame. Let four pieces of timber, D, D, D, D, in dimensions four by three inches, be locked and bolted on to the lower long girts B, across the shorter diameter of the frame, so as to bring their upper surfaces two inches below the upper surfaces of the long girts. The girts D D D D are called suspended girts, and have their greatest width in a perpendicular position. The two outside ones are placed eighteen inches from the inside of the posts at each end of the frame and the other two are placed thirty and a half inches from the inside of the posts.

Fig. 6 in the drawings annexed presents a plan of the lower section of the machine. The purpose of the four suspended girts D D D D, is to sustain the conic heart 30, and machinery immediately connected with it; which heart and machinery regulate the winding of the bobbin as hereafter described. The conic heart 30, has the bearings of its shaft on the under side of the two middle suspended girts D D. On that portion of its shaft extending from the heart 30, to near the swivel 31 is cut a screw or thread; and a half nut, or semicircular female screw 32, fitted to that portion of the shaft, and resting upon it, is secured to the suspended girt D. Consequently a rotary motion of the conic heart 30, will cause it, the heart, to traverse endwise the whole extent of the thread on its shaft. Motion is communicated to the conic heart 30, by the leading shaft I and gearing 33, 34. The gear wheel 33 has a loose fit on the heart shaft, and is secured in place, by a fork attached to the girt D and fitted to a groove in the hub 35, of the gear wheel 33, thus permitting the heart shaft to traverse through it. Through the whole extent of this portion of the heart shaft, fitted to slide through the gear 33, is a longitudinal groove or slot 60, fitted to receive a pin or projection in the orifice of the hub 35; thus connecting the gear to the shaft, so far as a rotary motion is concerned. The leading shaft I has its bearings supported by the lower end girt C and suspended girt D at the end of the shaft, and passes through an orifice in one of the suspended girts at I. The lever shafts 36 36 have their bearings supported on the under side of the four sus-

pended girts D D D D. On the longitudinal centers of these two lever shafts 36 36, and firmly secured thereto, are two friction levers 37 37, extending from opposite sides; and nearly meeting under the center of the conic heart 30. These levers have their extremities so formed as to rest constantly on the surface of the conic heart. Near the ends of the lever shafts 36 36, are secured the spindle levers E E E E. These spindle levers are extended outward under the lower long girts B B and upper spindle rails G G. Thus when the smallest diameter of the conic heart 30 is presented to the friction levers 37 37, the exterior ends of the spindle levers E E E E will be at their lowest depression, and when the largest diameter of the heart is thus presented, they will be at their greatest elevation.

Let a swivel 31 be attached to the end of the heart shaft, and a leather strap 38 be attached to the swivel, and extended therefrom around the carrying pulley 39 on the underside of the lower end girt C, and thence under the lower long girt B, to a convenient point for the operator at the outside of the machine. Let the nut 32 be raised from the heart shaft, by means of the rod 40 as hereafter described, and the conic heart 30 be slipped endwise, by pulling the leather strap 38, so as to bring the largest diameter of the heart over the friction levers 37 37, and this will bring the exterior ends of the spindle levers E E to their greatest elevation as represented in Fig. 7. In Fig. 7 41 represents the greatest diameter of the conic heart and 42 the smallest diameter. The nut 32 being permitted to rest on the shaft of the heart, a rotary motion of the heart will cause a vibration of the friction levers 37 37, equal to the difference of the radii of the heart at that portion of the cone pressing the friction levers, the traverse motion of the heart, caused by the thread and nut, will gradually present a smaller diameter to the friction levers 37 37, and consequently cause them both to vibrate through a short distance, and at the same time slowly approach nearer the axis of conic heart. Thus a short vibratory motion and gradual depression will be communicated to the spindle levers E E, by means of the lever shafts 36 36. The spindle guide rods F F slide loosely through the upper spindle rails G G and flier nose plates X X. The lower spindle rails H H are made fast to the guide rods F F, and are suspended on them.

From the spindle guide rods F F a small pin 43, projects over the upper edge of the spindle levers E E so as to permit the lower spindle rails H H to be suspended on the ends of the spindle levers E E, and to move with them. To counter balance the weight of the spindle rails H H, and to assist the conic heart in raising them, branches 44 44 are extended from the spindle levers E E, having spiral springs 45 45 attached to their upper extremities and extended to opposite sides of the frame.

A small rod 40 extends from the outside of the machine through a loop or eye 46 attached to the lower long girt B and another loop 47 attached to the girt D, having its end 48 widened so as to form a cam or inclined plane. A space 49 is cut from the side of the nut 32 to receive the widened end of the rod. The nut 32 is kept in place by two staples 61 61 driven into the girt D.

When the conic heart has traversed its whole length, so as to present its smallest diameter to the friction levers 37, 37, the lower spindle rails H H are at a point marked 50 and are restored to the situation represented in Fig. 7, by sliding the small rod 40 outward, which by the inclined plane 48 will raise the nut 32 from the heart shaft, and by pulling the strap 38 Fig. 6, so as to slide the heart to such position as to bring its largest diameter in contact with the friction levers 37 37. The small rod 40 should then be slipped in which will permit the nut 32 to rest on the heart shaft and a small spring 51 will hold it in place.

The conic heart and machinery immediately connected with it, as described regulates the winding of the yarn upon the bobbins 52 as follows—viz: The bobbins 52 Fig. 1 rest upon the spindles 53; and the spindles 53, pass loosely through the fliers 29 and the upper spindle rails G, and are supported by the lower spindle rail H. Consequently the motion of the lower rail H will be communicated to the bobbins 52, Fig. 1.

At the commencement of the winding of the bobbins, they are at their highest elevation, and when filled with yarn, they are at their lowest depression. The hooks 54 on the fliers guide the winding of the yarn, and the operation of the conic heart presents every portion of the bobbins, successively and accurately, for being wound.

The conic heart, spindle rails, flier nose plates, fliers, spindles and bobbins, are of the same construction and operation in this machine as in cotton spinning frames, which are well known and in common use. The upper spindle rails G, one on each side of this machine, are attached to the lower long girts B, and the two flier nose plates X, also one on each side, are attached to the upper long girts U, Fig. 1.

Motion is communicated to the leading shaft I, which communicates with the heart in the manner described on the fourth page of this description, and as drawn in Fig. 6, by a belt passing over a pulley *h* on the cam shaft *g*, Fig. 1, hereafter to be described, and a corresponding pulley J on the leading

shaft I at its exterior end. These pulleys are made of such diameters as will accommodate the motion of the heart to the size of the yarn.

The multiplying shaft M (see Fig. 6,) has its bearings on the lower end girt C, and one of the suspended girts D. The multiplying shaft M, (see Fig. 1) is bolted to the driving shaft Y, hereafter described, by a pulley N, five inches in diameter, and two and a half thick, placed between its bearings, and a corresponding pulley *a* on the driving shaft Y; and is designed to give the requisite speed to the larger cylinder K, by means of corresponding pulleys N and L on the larger cylinder K, and multiplying shaft M, at their exterior ends, greater or less, as may be required in the different kinds and sizes of yarn; which pulleys are connected by a belt T. The larger cylinder K is five inches in diameter and runs through the whole length of the machine having its bearings on the two lower end girts C C, three and a half inches from their longitudinal centers toward the observer, to permit the descent of the guide rods of the movable frame hereafter described.

Thus far the description has been principally confined to the lower or first section of the machine. The second section of the machine includes the second long girts U, and the middle end girts V and all attached thereto. Ten inches from the middle end girt V, at the right end of the machine, is a cross girt W, of the same dimensions and in the same plane as the end girt; as seen in Fig. 3, which is a plan of the second section, in part. Twenty-eight inches from the girt V, Fig. 3, is another cross girt W^a, and at an equal distance from the opposite end of the frame, is still another cross girt W^b, all of the same dimensions and in the same plane. Three cross girts are attached to the second long girts U U. On the end girt V, and first described cross girt W, place the main or driving shaft Y, five and three-fourths inches from their longitudinal centers, to the right. This driving shaft Y has on its exterior end a loose and tight driving pulley Z, &c., each eleven inches in diameter and two and a half thick, then between its bearings a pulley *a* eleven inches in diameter and two and a half thick, designed to carry the multiplying shaft, described on page 7, then a loose dog gear *b* two and three fourths inches in diameter, meshing into the intermitting gear 90 then a pinion gear *c* mashing into the diminishing gear *e*. On the right side of the driving shaft Y and on the same girts, is the intermitting shaft 69, having between its bearings the intermitting gear 90 eleven and a half inches in diameter. To the left of the driving shaft Y, on the same girts, is placed the diminishing shaft *d* having on it the diminishing gear *e* eleven and a half inches in diameter, meshing into the pinion *c* and having five times as many cogs as the pinion. The diminishing shaft *d* has also upon it a pinion *f* meshing into a gear *l* on the cam shaft *g*, seventeen and a half inches in diameter, and having five times the number of cogs, contained in the pinion *f*. This arrangement of gears will reduce the motion of the cam shaft *g* to one twenty-fifth part of the speed of the driving shaft Y.

The cam shaft *g* extends from the end of the machine, over the girt W, under the girt W^e and over, and two inches beyond the girt W^a. This cam shaft has on its exterior end a pulley *h*, corresponding with the pulley on the leading shaft, as described on page 7. Between the end girt V and cross girt W are first the cam wheel *i* hereafter described, and near the girt W, the gear *l* before described. Beyond and near the cross girt W^a is an eccentric gear *m*, meshing into another eccentric gear, *ma*, of the same form and construction. The cam shaft *y* has its bearings on the three girts V, W, and W^a.

Fig. 5 presents a diagram of the eccentric gears, *m* and *ma*.—*m ma*, the axes of the eccentric wheels.—*me md*, the mesh line of the cogs. *mc*, the longest radii, *md* the shortest radii of the eccentric wheels. Let the cogs or teeth on the shortest radii—*md* of the eccentric wheel *m*, be united with the cogs or teeth on the longest radii *me*, of the eccentric wheel *ma*. A rotary motion of equal velocity being given to the eccentric wheel *m*, will cause the eccentric wheel *ma*, to revolve during one half of each revolution, in about one half the time required for the performance of the other half of its revolution. When the shortest radii of the eccentric wheel *m*, are united with the longest radii of the eccentric wheel *ma* the wheel *ma* will be at its slowest speed; and when the longest radii of the wheel *m* are brought around, the shortest radii of the wheel *ma* will also be presented and united with the longest radii of the wheel *m*— consequently the wheel *ma* will then be at its greatest speed. Lest the unequal rotary motion of the wheel *ma* be converted to a reciprocating motion by means of the common crank, and it will be evident that the reciprocating motion will also be unequal; the application of which will hereafter be described. (See Fig. 3.)

On the cross girts W^a and W^b, one inch to the right of their longitudinal centers, is supported the crank shaft *n*. This shaft is raised by means of blocks or stands 57 57 Fig. 1 and Fig. 3, four and one-fourth inches above the upper edge of the girts W^a and W^b, Fig. 3. Between the girts W^a and W^b and near the girt W^a on the crank shaft *n* is placed the eccentric gear wheel *ma*,

mashing into and being driven by the eccentric wheel *m*. On the ends of the crank shaft are two cranks *o o* eight inches in length, causing a reciprocating motion of sixteen inches perpendicularly, to the movable frame hereafter described. Lest the cranks *o o* be so adjusted on the shaft *n*, that during their descent the shorter radii of the eccentric wheel *m* shall be united with the longer radii of the eccentric wheel *ma* and consequently during their ascent, the longer radii of the eccentric wheel *m* will be united with the shorter radii of the eccentric wheel *ma*. Twenty-five inches from each end of the frame are two other cross girts, W^c, W^d, three inches wide and four inches deep, attached to the second long girts V V, and having their upper surfaces one and a half inches above the upper surfaces of the long girts, U, U. These last described girts sustain the guides 58 58 through which pass the guide rods *z z* Fig. 1, of the movable frame *v*, *v*, Fig. 1.

The third section of the machine includes the movable frame *v vc* Fig. 1, with all its appendages. The length of the movable frame *v vc*, should be such as to pass freely up and down within the posts of the first described or principal frame, and the width should be four and three-eighths inches less than the width of the principal frame. The extent of the motion of the movable frame is sixteen inches or twice the length of the cranks *o o*. This frame should be made of materials combining the greatest strength and lightness.

Fig. 8 presents a side elevation of this frame. Let there be two side pieces of the length above specified represented by V Fig. 4, nine inches wide and one and one-fourth inches thick. On the upper edges of these side pieces are cut notches or spaces, *w w* adapted in number and situation, to the reducing tubes, to permit bands to pass from the smaller cylinder around the whirls of the reducing tubes, which remains to be described. Directly over these spaces W W on both sides of this frame, and extending from end to end, are placed pieces of wood or caps X X four inches wide, and one and one-half inches thick, having their outer surfaces even with the outer surfaces of the side pieces V and their greatest width in a horizontal position.

Fig. 9 presents an end elevation of this frame—V V the side pieces, X X the caps. The end pieces, of which there is one at each end of this frame, are represented by *vc* Fig. 9. They are one and one-fourth inches thick and of an unequal width, and are firmly secured to the side pieces *v v* and caps X X. The caps X X Fig. 4 are secured to the side pieces *v*, by light joint bolts passing from the caps *x* into the side pieces *v* between the spaces W W at suitable distances asunder. Across the central portion of the movable frame *v*, (see Fig. 1) in a situation to correspond with the cross girts W^c W^d described on the tenth page, as supporting the guide rods *z z*, are two cross girts *y y*, two inches in horizontal width, having their ends attached to the caps *x x*. To give greater strength to their attachments, pieces of boards *ya ya*, forming braces, are extended from the sides of the girts *y y*, to the side pieces of the frame *v v*. The ends of the girts *y y* are of the same perpendicular thickness as the caps X, and swell to four inches in the middle portion. These girts are made so far crowning as to admit the smaller cylinder 2 Fig. 1, to pass directly beneath them, from end to end of the movable frame, with its shaft in a horizontal plane, three-fourths of an inch below the upper edge of the side pieces *v*. The smaller cylinder 2 Fig. 1 is three and five-eighths inches in diameter, and gives motion to the reducing tubes 5 5, hereafter described. To the cross girts *y y* in the movable frame, two large guide rods *z z* are attached. The guide rods *z z* are made as follows, viz: The whole length is five feet and four inches. From each end to the extent of two feet they are round; while the middle portion of the rods 1 1 1 1 is split in two parts and spread out into a square figure 1 1 1 1, measuring twelve inches on each of its four sides 1 1 1 1. This hollow square of the rods is so shaped that a perpendicular falling through the length of the rods, will pass through two opposite angles of the square. The two remaining angles are attached to the cross girts *y y*. The design of this hollow square figure is first, to permit the smaller cylinder 2 to pass directly through the rods, and secondly to give greater strength and security to their attachments.

Attached to the upper part of the movable frame *x*, is what is denominated the upper tube rail 3 3. This rail has its lower surface just even with the lower surface of the caps *x x* and is constructed in the following manner. It has been found convenient to have them made in lengths, of half the length of the movable frame, and placed, two on each side of the frame, bringing their ends together so as to extend them the whole length of the frame. They are made of cast iron. The main body of the rail 3 3 is two inches wide horizontally, and three-eighths of an inch thick. 3^a 3^b Fig. 9 presents an end view of the upper tube rail. It consists of two parts. The part 3^a which is directly attached to the frame, is one and one-fourth inches wide, and the other part or cap 3^b, is three-fourths of an inch wide. The two parts 3^a and 3^b are united together so that holes may be drilled through them, of a diameter sufficient to receive the collars of the reducing tubes, hereafter de-

scribed, at the line of junction of the two pieces 3^a 3^b. These holes are adapted in number and situation, to the reducing tubes as represented in Fig. 1. 5 5 5 Fig. 1 are the reducing tubes. 3 3, represents the two parts of the upper tube rails, nicely fitted together so as to appear one piece. The larger portion 3^a Fig. 9, has fingers 3^c projecting downward from its inner edge, one and three-fourth inches long, three-fourth inch wide and one-fourth of an inch thick, and has also a flanch 3^d projecting upward from the same edge.

Fig. 10 presents a side elevation or view of a section of the upper tube rail 3.—3^c 3^c 3^c &c. are the projecting fingers 3^d the projecting flanch; which flanch and fingers are designed to give strength to the rail, and admit of fastenings to the movable frame. The two pieces forming the upper tube rail 3, are secured together by cap screws 3^e 3^e 3^e. At the places of the insertion of these screws, the rail has swells or knobs 3^f 3^f, to prevent its being weakened by such insertion.

The lower tube rail 4, Fig. 9, is made in the same manner as the foregoing, except that the larger part 4^a, is only one inch wide horizontally; while it has no projecting fingers, or flanch projecting upward, but a flanch 4^c projecting downward one inch, from its inner edge, to give it strength. The lower tube rails are drilled with holes to fit the lower ends of the reducing tubes hereafter described, and are suspended directly under the upper rails on guide rods 6 6 Fig. 9, and 6 6 6 6 Fig. 1; of which there are four on each side of the machine. These small guide rods, serve to guide it in its upward and downward motion. The lower tube rail has this motion of five eighths of an inch, to and from the upper tube rail, independent of the motion of the movable frame. These small guide rods are firmly secured in the lower rail, and extend downward, through guides 62 62 Fig. 1, attached to the lower edge of the movable frame, and to such a point below, that when the movable frame has nearly reached its utmost point of descent, the guide rods shall meet the flier nose plates X—X Fig. 1, and thereby arrest the further descent of the lower rail, while the upper rail is completing its descent, thus causing the upper and lower rails to approximate each other, five eighths of an inch. The upper ends of the small guide rods extend upward through the upper rail, loosely to such a distance as to permit them to come in contact with projections 63 63 Fig. 1 from the roll beam, hereafter described, so as to arrest the upward motion of the lower rail; when the movable frame has nearly completed its upward motion, in such manner, that the full completion of the upward motion of the frame, shall cause the rails to recede from each other, five eighths of an inch.

To sustain the lower rail in its approximate or nearest position to the upper rail, small springs 7 7 Fig. 1, are made to press against the guide rods, into a notch, so arranged as to sustain the rail, and yet so gently as to be overcome by the resistance applied to the top of the rods.

The reducing tube 5 Fig. 11 is made in the following manner,—Its length is two and three eighths inches, and it is perforated through its center longitudinally so as to form a caliber one fourth of an inch in diameter. It is turned to two sizes so as to form a shoulder, having its lower or larger portion 5^a, three fourths of an inch in diameter, and five eighths of an inch long and its upper or smaller portion 5, one and three fourths of an inch long, and half an inch in diameter. A groove or bearing 5^b is turned in the lower portion, fitting it to the lower tube rail, 4 Fig. 1. From two opposite sides of the upper or smaller portion, are cut away two segments, represented by the dotted lines 5^c 5^c. 5^d 5^d, Fig. 11, is a plan of the upper or smaller end of the tube, with the segments removed. In place of these segments removed, two pieces of elastic metal or springs 5^e 5^e, are adjusted, so as to restore the upper portion of the tube 5, to the form of a cylinder. These springs 5^e 5^e, extend above the tube three fourths of an inch, increasing in width after leaving the tube so as to be one half of an inch in width at their upper extremities, 5^f. The springs 5^e 5^e, are secured in place by driving the whur 5^g over them, down to the shoulder 5^a formed by the lower or larger portion of the tube. The portions of the springs 5^f, above the tube, are made so as to come together in the form of tweezers immediately over the center of the tube. The springs are so adjusted, that the tweezers 5^f will remain constantly open unless compressed together. The tube is now prepared to receive the movable collar 5^h, which is seven eighths of an inch in diameter, and five eighths of an inch long, perforated so as to slide loosely over the tube and springs 5 5^e. The collar 5^h has a sliding motion, five eighths of an inch in extent, so arranged that when the collar is slipped down to the whur 5^g, the tweezers 5^f are open, and when slipped up to the top of the tube, the springs are compressed, and the tweezers closed. The collar 5^h, has a groove or bearing 5^i, fitting it to the upper tube rail 3 Fig. 1. Thus the bearing below the whur, and the bearing on the collar, constitute the two bearings of the tube and appendages, and are adapted to its rotary motion when placed in the rails 3 and 4 Fig. 1.

The whurs 5^g Fig. 11 is one and three-fourth inches in diameter, and half of an inch

thick, having a groove 5^{j}, fitted to receive a band from the smaller cylinder which gives it a rotary motion.

2, Fig. 12 is a section of the smaller cylinder—2^{a} the band driving the tube 5—3 the upper tube rail—4 the lower tube rail. The number of the reducing tubes 5 5, are equal to the number of spindles 53 53 Fig. 1, and are placed directly over them.

The upward and downward motion of the movable frame v, v^{c}, v v^{c} Fig. 1, may be likened to the upward and downward motion of the hand, in the act of spinning flax on the common foot wheel; the tweezers on the reducing tubes 5, 5, do the office of the thumb and finger, in seizing the thread at their highest point of elevation, and releasing it at their lowest point of depression. When the tweezers have seized the thread, and the requisite quantity of roping is delivered, the tweezers continuing to recede from that part of the roping apparatus which delivers the roping, both attenuate the thread, and at the same time, by their rotary motion give it the necessary twist, to improve and strengthen it, while in the process of being reduced.

The thread at all times, passes through the reducing tube, on its way from the roping apparatus to the fliers and spindles. The spinning process is accomplished in the same manner on both sides of the machine, there being thirty spindles on each side.

The movable frame v, v^{c} v^{c} Fig. 1, is so adjusted within the first described or principal frame A A A A, that the guide rods Z, Z, shall be in the guides 58, 58, and its lower edge one inch above the flier nose plates X X, when at its lowest point of descent. The upper ends of the guide rods Z Z, pass through the crown beam 24 24 at the top of the frame.

Motion is communicated to the movable frame v, v^{c}, by the two cranks o o described on the 10th page of this specification. These cranks o o are connected to the guide rods Z, Z, at the upper angles of their squares 1, 1, 1, 1, by means of two sweeps 12, 12, made so curving as to pass around the smaller cylinder 2 2, and not conflict with it in their lateral motion.

To give motion to the smaller cylinder 2 2, a flanch pulley O Fig. 2 and O Fig. 6, is attached to the larger cylinder K Fig. 6—at the left end of the machine. For spinning filling this pulley should be 11 inches in diameter, and for warp, four inches in diameter.

On the middle end girt V, Fig. 2, seven inches from the post A, is a double loose pulley r, nine inches in diameter. Over the exterior portion of this double pulley r passes a belt u u, connecting it with the flanch pulley O on the cylinder. On the upper end girt 23, is a loose pulley 26—nine inches in diameter, at a distance of one foot from the post A. On the exterior end of the smaller cylinder, is a tight pulley 10, of such diameter as will give the requisite speed to the smaller cylinder and reducing tubes. Six inches from the pulley 10, toward the post A, and horizontal with it, is a small loose pulley 9, attached to the movable frame v. Pass the race belt 11 11 Fig. 2, around the interior portion of the double pulley r, and over the loose pulley 26, on the upper end girt, thence down to the pulley 10, on the smaller cylinder, thence up and over the small loose pulley 9, thence down to the double pulley r, first mentioned. This disposition of pulleys and belts, will cause a constant rotation of the smaller cylinder 2 Fig. 1, and reducing tubes 5, 5, at all points of their vibration, unless interrupted as hereafter described.

Experience has shown that the roping is best reduced, by having only a small amount of twist in it at the commencement of its reduction. This reduction or attenuation does not commence, till the requisite quantity of roping is delivered; it thence becomes necessary to arrest the rotary motion of the reducing tubes after they have completed their descent, so that their rotary motion shall have ceased, before the tweezers grasp the roping or thread. The rotary motion is again communicated, in the manner hereafter described, at such points, and with such speed, as shall be best adapted to the different qualities of roping and yarn. This intermitting motion is secured in the following manner, viz: The belt u, u, Fig. 2 passing from the flanch pulley O to the double pulley r, is so loose, that unless tightened, it will not turn the double pulley r, but when the belt u u is tightened, it will carry the double pulley r, and with it the pulley 10, connected with the smaller cylinder and reducing tubes. To tighten this belt, a tightening pulley P is attached to the movable stud Q, in such manner, that a spring R, acting against it, will, unless prevented, press the tightening pulley P against the belt u u, and thus secure a rotary motion to the smaller cylinder and reducing tubes. By withdrawing the tightening pulley P, from the belt u u, the motion of the reducing tubes is suspended. To do this a cord S, or other connecting substance is attached to the movable stud Q and passing around a pulley S^{a} extends to the opposite end of the machine. In the plan Fig. 6, is seen the cord S which is attached to a perpendicular lever of which P Fig. 6 is a section. In Fig. 1 is seen the perpendicular lever P. It is attached to the end girt V, and passing up by the lever g, is bent around the lever g, and passes downward between the lever g, and cam wheel i. The perpendicular lever P, Fig. 1 has a lateral motion to the right and left, the

spring R Fig. 2, by means of the connection before described, inclines the lever to the left, and the intervention of a cam on the cam wheel *i*, Fig. 1, forces the lever to the right.

The cam wheel *i* Fig. 1 is made as follows viz. The wheel is sixteen inches in diameter and half of an inch thick, and being connected with the crank shaft *n* Fig. 3, by means of the gearing *m m a*, and cam shaft *g*, consequently performs one revolution to each upward and downward motion of the movable frame. Fig. 4 presents a diagram of the cam wheel *i*. From the plane or surface of the wheel *i* Fig. 4, projects a flanch or cam *j a*, of the same curve, and even with the periphery of the wheel, three eighths of an inch thick, and one inch in a projection perpendicular to the plane of the wheel.

The flanch or cam *j a*, extends 200° around the wheel and may be extended to any length desired from 200° to 270°, by the supplemental flanch, or movable segment *k*. This supplemental flanch *k* is a segment of a circle so much smaller than the principal flanch *j a*, as to permit it to slide within the principal flanch *j a*. The flanch *j a*, and segment *k* have one and the same office, and project equally from the plane of the wheel *i*. The segment *k* has a wing *k o*, by which it is attached to the plane of the wheel *i*, and may be moved at pleasure to any desired position, and secured in place, by the screws *k b k b*. Six inches from the center of the wheel *i*, projects a second cam or flanch *j* having in connection likewise a supplemental flanch *k a*, which flanch and suplement are in all respects similar to the first, except in circumference and extent. This last may be extended from 100° to 190°. The flanch *j*, with its supplement *k a*, have the same office and constitute a cam, susceptible of variation, as to its length; which cam operates on the perpendicular lever P Fig. 1, before described, as an antagonist to the spring R, Fig. 2. By shortening the cam, motion is communicated earlier, and by lengthening it later, to the reducing tubes.

The flanch *j a* and supplement *k* Fig. 1, constitute a cam, susceptible of variation as to length, which cam operates on the horizontal lever *q* Fig. 1, to regulate the quantity of roping delivered. This is effected by the crooked, horizontal lever *q*, Fig. 3, being attached to the dog gear *b*, Fig. 3 by means of a fork at the end of the lever fitting a groove in the dog gear. The lever *q*, Fig. 3, extends from the dog gear *b*, horizontally over the diminishing shaft *d*, and cam-shaft *g*, and is attached to the post A. The lever *g* has a lateral motion from *a* to *c*. The elasticity of the lever inclines it to *c*, and the intervention of the cam operating at *q a* forces it toward *a*. The cam or flanch is so adjusted on the cam wheel *i*, that when the movable frame *v v c* Fig. 1, has reached its utmost point of ascent, the cam is removed from the lever, while that part of the cam wheel which has no flanch is presented, giving liberty to the lever *q* Fig. 3 to incline toward *c*, and carry with it the dog gear *b*. When the dog gear *b*, which is loose on the shaft Y, is slipped to the left, or to *c*, it becomes attached to the tight pinion *c*, by means of projections on the pinion *c*, and dog gear *b*, and is thus put in motion. The teeth on the dog gear *b*, are of sufficient breadth to keep it always connected with the intermitting gear 90. The intermitting shaft 69 is connected with the roping apparatus in the manner hereafter described, and consequently when the dog gear *b* is attached to the pinion *c* and put in motion, roping is delivered, and when detached by the intervention of the cam, operating at *q a* and forcing the lever and dog gear *b* toward *a*, roping ceases to be delivered. Thus by shortening the cam, by means of its sliding supplemental flanch, or segment, a greater quantity of roping is delivered, and by lengthening it, a less quantity is delivered; thus accommodating the machine to the various sizes of roping and yarn.

Motion is communicated to the roping apparatus by means of a belt passing over a pulley 31 Fig. 3, on the exterior end of the intermitting shaft 69, and two pulleys 25, 25, Fig. 1 thirteen and a half inches in diameter, the belt is marked 28 28 Fig. 1. The motion of the apparatus delivering the roping is always made to correspond with the receding motion of the reducing tubes, during the first half of their recession from the rolls 17 18 17 18 Fig. 1. Fig. 13 is a plan of the top of the machine.

The fourth section of the machine includes the roping apparatus. The roping apparatus consists of two drums 13, 13, Fig. 13 adapted to receive two roping spools on each. They are eight inches in diameter, and are placed one on each side of the machine. It has also, on both sides of the machine a roller beam 16 16—two sets of rolls, distinguished by long rolls and top rolls. In Fig. 1, 17 17 represents the long rolls and 18 18 the top rolls.—Thus forming a double apparatus, or an apparatus of similar construction on both sides of the machine.

A particular description of all the parts of this apparatus is not included in this specification, as they are, in construction and operation, similar to such as are in spinning jacks in common use, except in such particulars as are specified in the following paragraphs.

The roping spools 28 28 Fig. 1—are filled with roping at the cords—placed upon the drums 13, 13, Fig. 1, and the drums 13 13,

and rolls 17 18, 17 18, are made to deliver roping in the same manner as in jack spinning.

The roping spool guides 22, 22, 22, &c. are small pieces of iron attached to the upper surface of the crown beam 24—and extending outward six inches from the beam are bent downward at right angles, so as to present a perpendicular stand or guide to support the roping spools, 28—28. The roping spools 28 28, are placed so far beyond the summit of the drums that their gravity will incline their ends to rest gently against the spool guides 22, 22. The bearings of the drums 13 13, Fig. 13, are placed one foot from the outside of the machine inward, and two inches below the lower edge of the upper end girts 23, 23, Fig. 13, and are supported by means of four iron hangers 14, 14, 14, 14,—attached to the end girts 23, 23. In Fig. 2, two of the hangers are seen, marked 14, 14.

Fig. 14, is a side elevation of a section of the top of the machine. 23 a section of the upper end girt—14 a hanger—13 a drum shaft. The hanger 14 has a hub or projection —14^a— three inches long and one and a half in diameter—extending inward at right angles with the part 14 attached to the girt 23. In the center of these projections of the four hangers, which are all alike, are inserted the bearings of the drum shafts—as represented by Fig. 14—14, 14^a a hanger—13 a drum shaft. The projections of the four hangers represented by 14^a Fig. 14 are round, and on them, as centers or fulcra, are suspended the four balance levers,—15, 15, 15, 15, Fig. 13, are the balance levers—14, 14, 14, 14, the hangers. The interior portion of these balance levers 15^a 15^a 15^a 15^a, are twenty one inches long, and are so adjusted that the two opposite ones, at each end of the machine, may pass by each other in juxtaposition, to the right and left, without interfering. To the outer ends of these levers 15^b 15^b 15^b 15^b are attached the roll beams 16, 16, of common construction, except that they are narrowed in front to permit the movable frame with its reducing tubes to come near the rolls to grasp the roping.

In Fig. 1, the shape of the roll beams is correctly represented by 16, 16—at the left end of the machine as there presented.

The long rolls 17, 17, Fig. 13—have their bearings attached to the roll beams 16, 16, and a rotary motion is communicated to them from the drums 13, 13, in the following manner, viz: (Let one side only of the roping apparatus be considered in the following). A space being left between the lever 15^b and end of the roll beam 16 when it is attached, and the framework 23 forming the end of the machine, it is occupied by two spur gears, 19, 19^a—the one 19, on the end of the long roll 17, and the other 19^a, on a short shaft 19^a 19^b, having its bearings likewise attached to the roll beam 16. On the opposite end of this short shaft, and opposite side of the lever 15^b is another spur gear 19^b, meshing into the spur gear 19^c, on the drum shaft 13^a. The other side of the roping apparatus is constructed in the same manner as the foregoing.

Fig. 15, shows the relative position of the gearing last described, as they would be seen in an end elevation of the machine. The letters of reference are made to correspond with those in Fig. 13. The top rolls project over the long rolls 17, 17, Fig. 13 outward, so as to bring their point of contact with the long rolls about 45° from a perpendicular, when the exterior portion of the balance levers 15^b, 15^b, are in horizontal position. The top rolls 18 18 &c. Fig. 1, are kept in place by fingers 20, 20, 20, 20 &c. attached to the upper surface of the small roll beams 16, 16, and fitted to receive small bearings in each end of the top rolls 18 18.

The roping guides 21, 21 &c. Fig. 1 are made of small wire, and are attached to the roll beams near the rolls, to direct the roping in the proper place to be received by the reducing tubes.

The interior parts of the balance levers 15 15 Fig. 2 are curved, so as to pass under the crown beam, and thence upward, so as to bring their ends, when elevated, nearly as high as the top of the frame.

In the plan Fig. 13 24 is the crown beam, 15^a 15^a 15^a 15^a the interior of the balance levers.

To the interior extremities of the balance levers 15 15, Figs. 1 and 2, is attached the movable frame v^c v^c Fig. 1, by means of chains 27 27 27 27, of such a length, that when the movable frame is at its highest elevation, it shall be as near as possible to the roll beam 16 16 Fig. 1. Thus the downward motion of the movable frame, will cause the upward motion of the roll beam and appendages, and vice versa, causing the rolls and reducing tubes, to approximate and recede, each from the other, when the machine is in operation. The roll beams 16, 16 should be so adjusted that the rolls 17 17, which the beams support, shall at no time in their curve motion, protrude the thread beyond the grasp of the tweezers on the reducing tubes.

The benefits resulting from the connection and reciprocating motion of the rolls and reducing tubes, are first,

The weight of the movable frame is counterbalanced by the roll beams and their attachments, secondly, it admits of nearly a continuous winding of the yarn upon the spools or bobbins within the fliers, and thirdly, resulting from this last advantage—the machine may be run at a greater speed than could otherwise be secured. Should

the roll beams and appendages prove insufficient to counterbalance the movable frame, as much as is desired, additional weight should be attached to the roll beams.

In constructing these machines, the elevation of the roping apparatus, and consequently the height of the frame may be varied, as convenience may require, by adjusting the different parts accordingly. To accommodate this machine to the different qualities and varieties of yarn, it occasionally becomes necessary to exchange the pulleys, on the cam shaft, *g*, Fig. 1, and leading shaft, I, Fig. 1—the multiplying shaft M, and larger cylinder K Fig. 1—and also on the end of the smaller cylinder at 10 Fig. 2. To add to the facility of doing this, several span pulleys of diameters, from four to ten inches should be provided, fitted to the above shafts, in such a manner that they can be removed and exchanged at pleasure. The rotary motion of the fliers and reducing tubes, is in the same direction—and all the twist which is finally left in the yarn is produced by the fliers. Motion is given to the fliers 29 29 Fig. 1, by the larger cylinder K. A small round band is extended from the cylinder K, around each of the whurs 92 92 &c. of the fliers—in the same manner that the smaller cylinder 2, Fig. 12, gives motion to the reducing tubes 5 by the band 2^a.

I claim as my invention in the foregoing described machine.

1. The reducing tube, as composed of a tube, springs, forming tweezers, movable collar and whur, and the combination of the same with the tube rails and their appendages, for the purpose of opening and closing the tweezers; and also the combination of the same with a portion of the cam wheel, tightening pulley and smaller cylinder, for the purpose of producing a rotary motion in the tube, and intermitting the same, in the manner herein described.

2. The combination of the movable frame and machinery attached to it, with the roping apparatus, and their relative approaching and receding motions, as the means of securing nearly a continuous winding of the thread upon the spool or bobbin, while an intermitting rotary motion is preserved in the roping apparatus, in the manner herein described.

3. The suspension and moving of the roller beams by means of the balance levers, having the drum shafts passing through their centers or fulcra, in the manner herein described.

4. The combination of the eccentric gears and cranks with the movable frame, in the manner and for the purposes before set forth.

In testimony whereof I, the said Isaac B. Hartwell hereto subscribe my name in the presence of the witnesses whose names are hereto subscribed, on the sixteenth day of May A. D. 1839.

ISAAC B. HARTWELL.

Witnesses:
Jos. Q. Kindall,
Phineas M. Wait.