Sheet 1. 3 Sheets

J. J. J. Pierrard.

Spindle and Flyer.

No. 94,640. Patented Sept. 7, 1869.

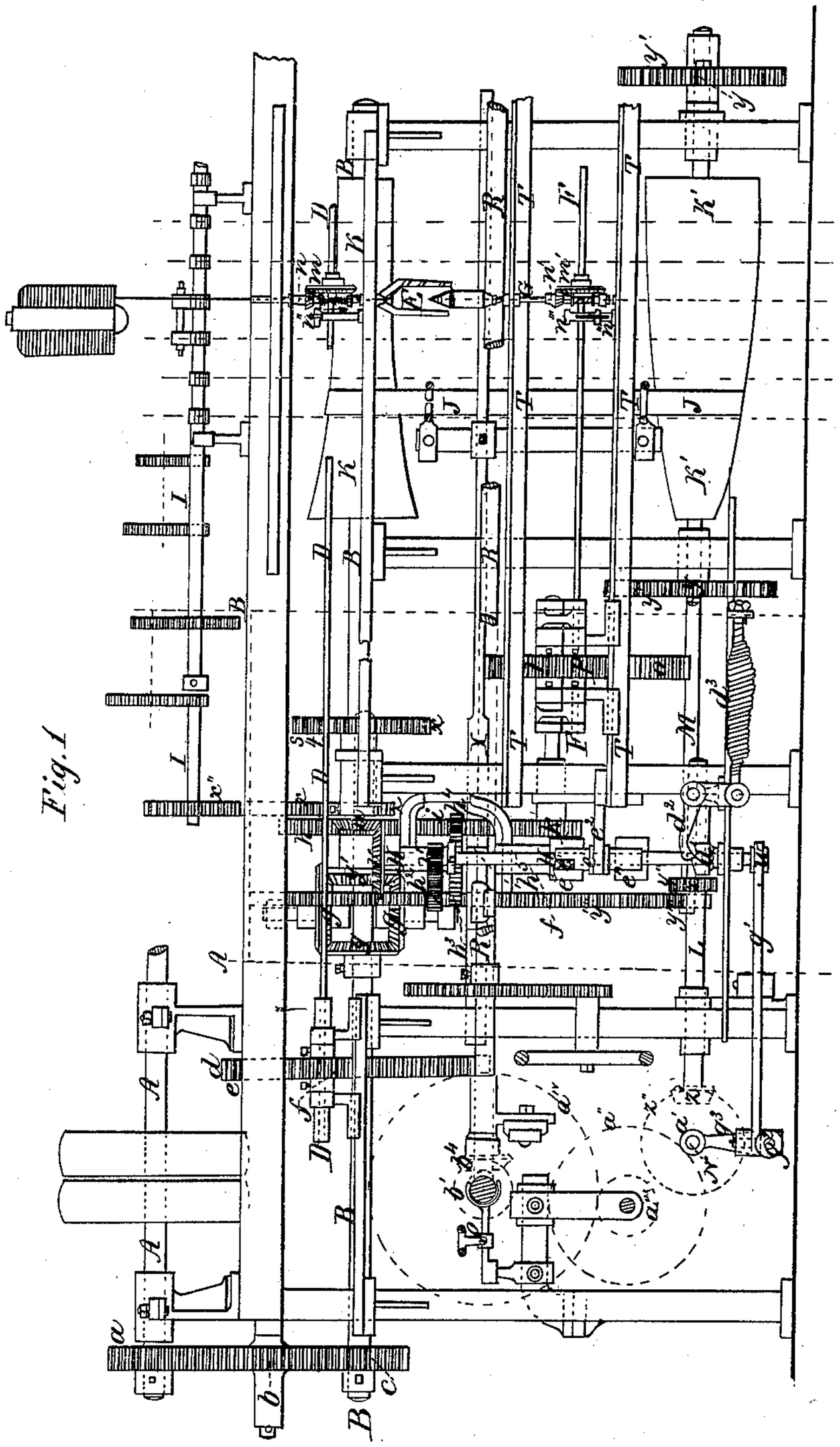

Fig. 1

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Sheet 2 - 3 Sheets

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Fig. 6

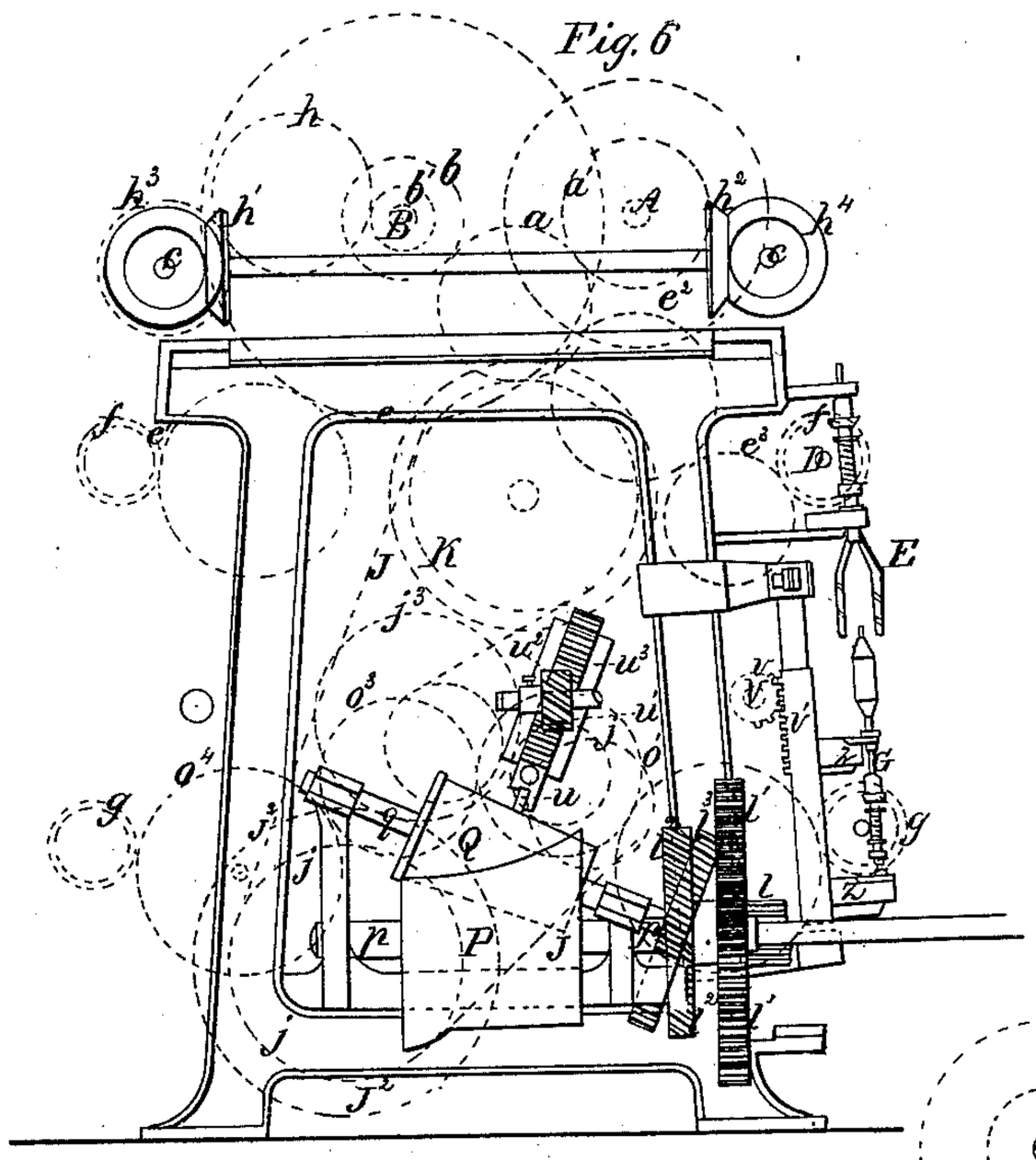


Fig. 4

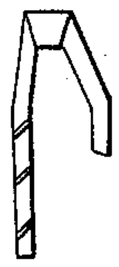


Fig. 3

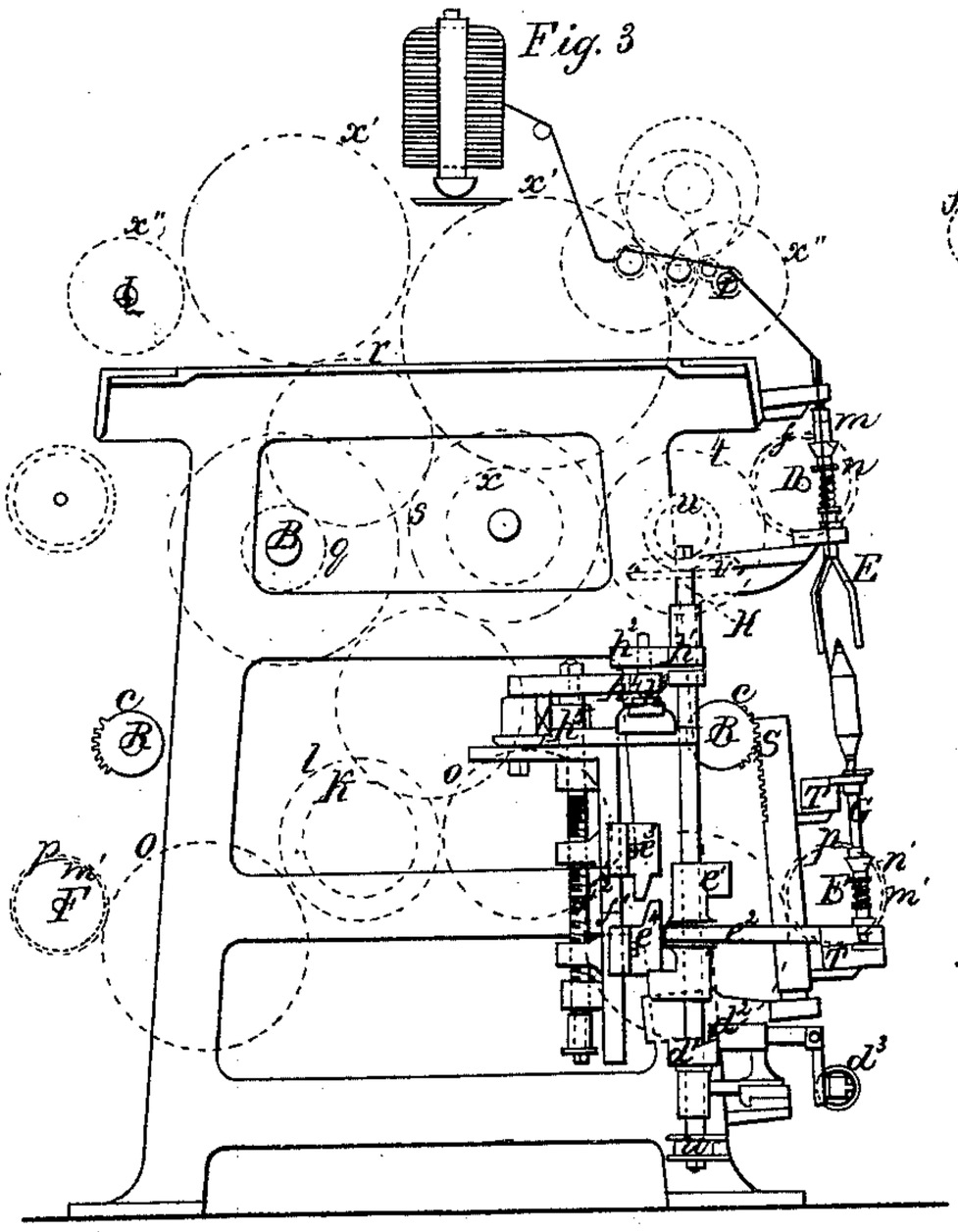
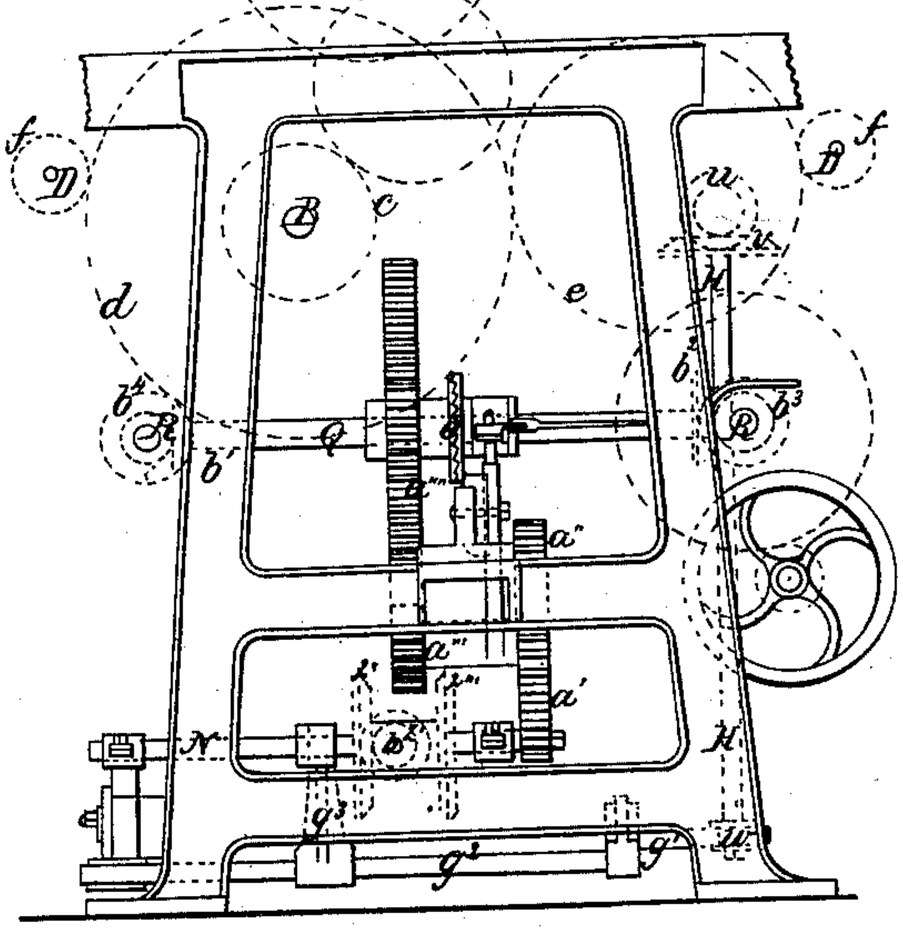


Fig. 2



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Sheet 3 - 3 Sheets

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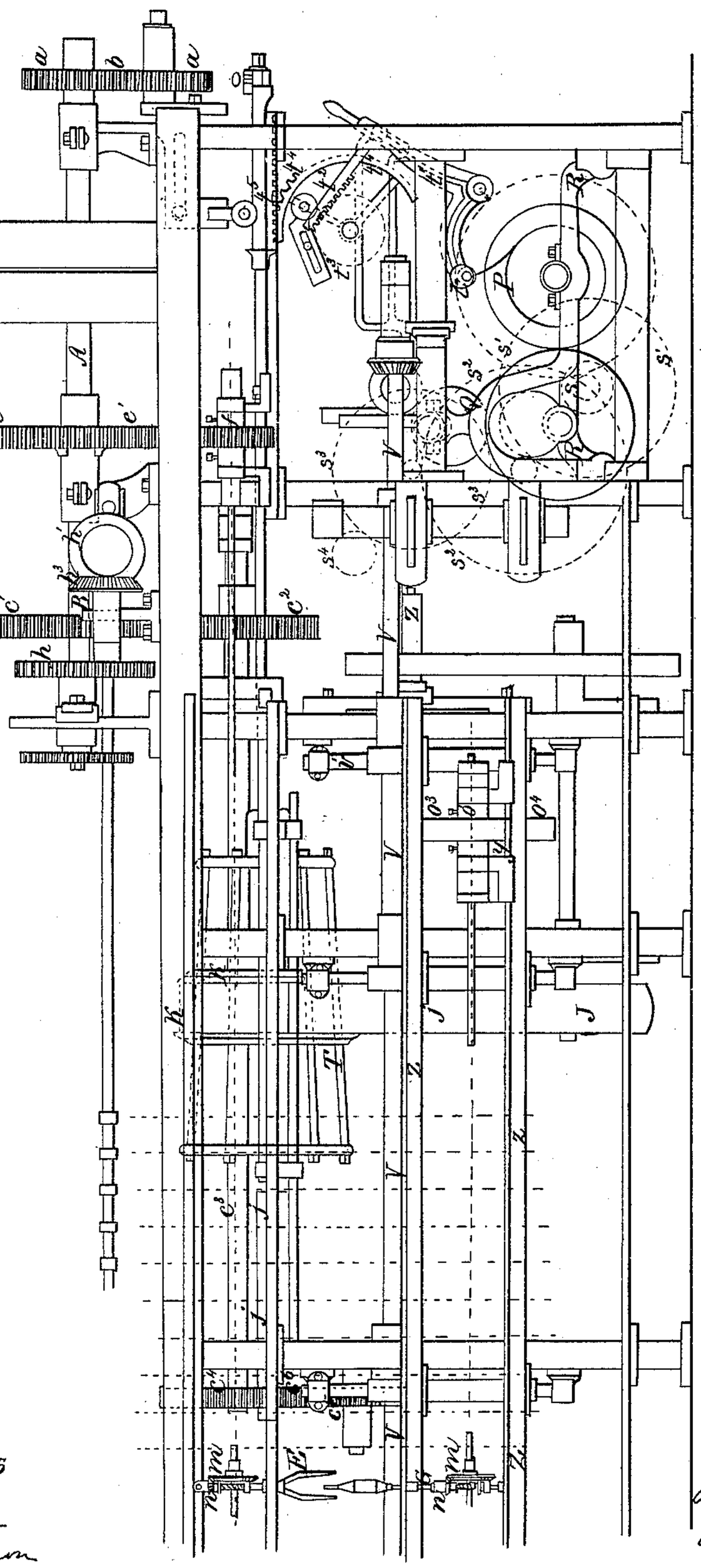
Spindle and Flyer.

No. 94,640. Patented Sept. 7, 1869.

Fig. 5



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JEAN JOSEPH JULES PIERRARD, OF REIMS, FRANCE.

Letters Patent No. 94,640, *dated September* 7, 1869.

IMPROVEMENT IN SPINDLES AND FLIERS.

The Schedule referred to in these Letters Patent and making part of the same

To whom it may concern:

Be it known that I, JEAN JOSEPH JULES PIERRARD, of Reims, in the Empire of France, have invented certain new and useful Improvements in Spinning-Machines; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings.

The object of my invention is to produce a new kind of throstle-frame, which I call a "self-acting throstle-frame."

The two results I have proposed to accomplish by the system which I have devised are the following:

First. To direct the thread, when it comes out from the drawing-cylinders, in such manner as to cause it to diverge gradually, but constantly, from the axis of its course, and to thus withdraw it from and neutralize the injurious effects of the centrifugal force.

Second. To impart to the thread the requisite amount of twist, and to distribute the windings upon cylindrical or conical cops, of pasteboard or paper, effecting, simultaneously and continuously, the operations of twisting and distributing, thereby giving the thread a steady tension, and distributing it uniformly and regularly upon the bobbin.

These results have been attained by the employment of spindles and fliers of peculiar construction, as hereinafter described, and of mechanism adapted to impart the necessary movements to the same.

The attainment of these results is conducive of several advantages, which I will enumerate:

First. The machine to which my invention is applied performs double work, for it is capable of running twice as fast as ordinary machines—the spindles turning at the rate of five thousand five hundred to six thousand revolutions per minute, while in ordinary throstle-frames they make but from two thousand five hundred to three thousand revolutions; and, moreover, the general action of the machine is unsubjected to the stoppages and interruptions which constantly occur in mule-jennys and winders, the operations of twisting and of distributing not being accomplished simultaneously in the latter, but successively.

Second. A more perfect thread, and one endowed with a more regular tension, is produced than can be formed in ordinary machines.

Third. It is not subject to the oscillations and jars arising from the action of the carriage in mule-jennys and winders.

Fourth. It admits of the spinning of warp at the least possible torsion, without cutting the thread, and also of spinning at the highest degrees of torsion, so that a weft of extremely fine numbers is made, such as could not, up to this time, be produced by machinery.

Fifth. It is productive of considerable economy in labor, as the employment of a spinner may be dispensed with, one attendant sufficing to direct its movement, even if there be two hundred bobbins; and this attendant, if it be necessary, can oversee, at the same time, another frame.

Sixth. Finally, it may be applied to the spinning of all known textile substances, animal or vegetable, wood, silk, cotton, flax, &c., whatever may be their degree of fineness, and the use for which the thread is intended.

I will indicate in this description the two particular arrangements which I give to my new kind of spinning-machine, intended, especially, the one to spin thread for the warp on cylindrical cops or pasteboard tubes—that is to say, a machine for spinning the warp; the other to spin thread for the woof or conical cop-tubes—*i. e.*, a machine for spinning weft.

The bobbins obtained in the two cases have the trunco-conical shape required for the weaving.

The nature of my invention will be readily understood by reference to the accompanying drawings, in which are represented the spindles and fliers invented by me, and the mechanisms required to operate the same properly.

The machine for spinning the warp is represented in Sheets I and II; that for spinning the weft in Sheet III.

These two machines have, in common, the spindles and fliers devised by me; but they are distinguished from each other by the mechanisms employed to act with the said spindles and fliers, according as the thread is intended for the warp or for the woof, and according to whether the cop upon which the thread is wound is cylindrical or conical.

In the warp-machine, the mechanism is analogous to that of ordinary bobbin and fly-frames, the variable speed being effected by means of the double cone, which is adapted to this machine by means of new mechanical combinations. With respect, however, to the machine for spinning weft, the mechanism is new, consisting in the employment of two cylindrical cams—that is to say, cams presenting several successive curves situated in parallel planes.

The characteristics which distinguish this machine are the following:

First. The application of a system of spindles and fliers, independent of each other, actuated by gearing in which the rotation of the spindles and fliers, which is constant and common to both, produces the twisting, while the difference in speed between the bobbin and the flier produces the winding.

Second. The employment of the double cone combined with a differential movement.

Third. The application of an escapement-movement to regulate the change of direction of the frames.

Fourth. The particular modes of regulating the fliers, the spindles, the cones, the escapement-movement of the drawing-cylinders, the differential wheel, and the bobbin and fly-frames.

The machine is symmetrical in the direction of its length. The head of the loom carries the driving-pulley and all the gear-mechanism which communicates to the bobbin and fly-frames, and other parts, the varied movements necessary to accomplish the work.

Figure 1, Sheet I, is a front elevation of the machine.

Figure 2, Sheet II, is an end view of the machine as far as the red line A, fig. 1, showing, also, the vertical escapement-arbor H.

Figure 3, Sheet II, is a view of the mechanism from the line A to the line B, fig. 1, together with a section of the cylinders and the gearing-machinery, the organs of the differential movement being removed, so as to avoid complication.

The thread, on leaving the last of the drawing-cylinders, is conducted to the spindle G (see figs. 1 and 3) by the flier E.

This flier is formed of two branches, having a helical slot or groove formed in one of them. One only of these branches is performing the work. The other is used only to balance the first, and may, therefore, be shortened, as shown in Figure 4, giving it, at the same time, more thickness, in order to maintain the equilibrium.

The flier is mounted on a tube, through which the thread passes, and follows thence the helicoidal path or groove in the branch of the flier, which it leaves, in order to be wound upon the spindle.

The flier is actuated by a pinion, *n*, resting on a conical ring.

This pinion is pressed by a cap, actuated by a spiral spring, which produces the necessary friction between the pinion and the conical ring, in order to effect the revolution of the flier.

When a thread breaks, and it is desired to stop, so as to reunite the thread, motion is arrested by means of the brake *n″*.

This brake is moved, so as to bear against the cap interposed between the spiral spring and pinion, and compress the spring, in such manner that the pinion becomes free or loose, and, consequently, the flier ceases to revolve.

The spindle G not only should be arranged so that its motion can be arrested at pleasure, but it is also necessary, that after being disconnected from the driving-power, it should be capable of being turned by other suitable means, in order that the thread may be rapidly unwound. The spiral spring, in that case, is compressed at its two extremities, in order to release both the spindle and the pinion or wheel *n′*, which puts it in motion.

This compression is effected by means similar to that employed with the flier-spring, only there are two brakes, *n‴*, which serve to arrest the movement when it becomes necessary to unite the ends of a broken thread.

The prime mover communicates movement to a horizontal arbor, A, which carries, at one end, a wheel, *a*, serving to transmit its movement to the principal arbor B, through the medium of gears *b* and C.

This main shaft actuates—

First, the fliers, on one side, by a wheel, *d;* on the other, by a wheel, *e*. These wheels *d* and *e* engage with pinions *f* and f^1, fixed on longitudinal shafts D D, which actuate the fliers E, through the intermediation of the bevel-gear *n m*.

Second, the spindles, by means of the bevel-gear *g g g*, for producing the differential movement, the last of which, g^1, is mounted on a wheel, *h*, actuating, through the pinion *i*, a pinion, *k*, fixed on the shaft, for regulating the intermittent movement produced by the wheels *o o o*. On the axis of the pinion *k* is mounted a wheel, *l*, which, through the carriers *o o o*, transmits the movement to the pinions *p p*, fixed on the longitudinal arbors F F, and from these arbors to the spindles G, by means of the bevel-gear *n′ m′*.

Third, the upper cone, by means of a pinion, *q*, which varies the movement, according to the twist it is desired to give the thread, actuating, by means of an intermediate wheel, *r*, a wheel, *s*, fixed on the shaft of the said cone.

This cone transmits motion—

First, to the escapement-movement;

Second, to the cylinders;

Third, to the differential wheel;

Fourth, and, consequently, to the bobbin and fly-frames.

1. *To the Escapement-Movement.*

The wheel *s* gears with the wheel *t*, fixed on one end of a shaft, which carries, on its other end, a bevelled gear, *u*, engaging with a like gear, *v*, fixed on a vertical arbor, H.

This arbor has an intermittent motion, as will be seen further on. It makes a half revolution for each layer of thread.

The wheel *v*, at two points diametrically opposite each other, has a space left without teeth, to admit of the movement being intermittent.

The functions of this vertical arbor will be described hereafter.

2. *To the Cylinders.*

On the arbor of the upper cone is mounted a wheel, *x*, which, through the carriers *x′ x′*, actuates the wheels *x″ x″*, fixed on the drawing-cylinders I, located on each side of the machine.

3. *To the Differential Wheel.*

An endless belt, J, transmits the movement of the upper cone, K, to the lower cone, K′.

The outline of the cones is an equilateral hyperbola, transmitting a movement varied proportionately to the diameter of the point of the bobbin on which the thread is being wound.

The lower cone, K′, carries pinions *y y*, engaging with wheels *y′ y′*, fixed on the arbor M, which carries, on its other end, gears *y″ y‴*.

The latter wheel transmits, through the intermediary y^{iv}, the movement to the differential wheel, as hereinafter described.

4. *To the Bobbin and Fly-Frames.*

The gear *y″* actuates the toothed wheel *z*, fixed on the end of an arbor, L, which carries, on its other end, a bevel-pinion, *z′*, actuating, alternately, the wheels *z″ z‴*.

On the end of the arbor N, which carries the wheels *z″ z‴*, is fixed a pinion, *a′*, actuating a wheel, *a″*.

On the axis of the latter is mounted a pinion, *a‴*, actuating a wheel, a^{iv}, fixed, by means of the coupling O, on the transverse arbor of the frame Q.

On each end of this arbor are screwed the bevelled wheels b^1 b^2, gearing with the wheels b^3 b^4, fixed on the longitudinal arbors R R′, which cause the up-and-down motion of the frames T T.

These longitudinal arbors carry, besides, at intervals apart, pinions *c* c^1, engaging with the racks S S, on which are mounted the frames T, supporting the spindles G.

Toward the base of the vertical arbor H, hereinbefore mentioned, is fixed a ring, d^1, which supports the said arbor, and which, at the upper part, is provided with two teeth, the faces of which are cut in an elongated spiral, forming an inclined plane.

The pawl d^2, actuated by a spiral spring, d^3, being

in contact with this inclined plane, tends to cause it to turn by pushing it, and, consequently, to communicate its movement to the arbor H; but this latter is maintained in its movement by one of the two catches e e^1, which participate in its rotation, and are, besides, capable of moving up and down upon it, following the movement of one of the frames, by means of a forked support, e^2.

Two angular stops, e^3 e^4, mounted on a slide, f^1, are regulated by a right and left-hand screw, f^2, which brings them together, when it is desired to contract the bobbins, so as to form the conical ends.

The principal function of these two stops is to arrest one of the catches e^1 e^1, alternately, in such position that the bevel-wheel v, on the upper end of the shaft H, may present to the pinion u that part which is unprovided with teeth.

The pinion u can, in this case, turn without communicating movement to the bevel-wheel v; but, as soon as the frame reaches the end of its course, the catch, which is in contact with one of the stops e^3 e^4, is released, the pawl d^2 pushes forward the tooth with which it is in contact, the toothed part of the wheel v engages with the pinion u, and the shaft H makes another half revolution.

On the lower part of the shaft H is mounted an eccentric, W, which, through the intermediary of a lever, g^1, and arm, g^3, effects the movement of the wheels z'' z''', throwing, alternately, the one and the other in gear with the pinion z', and thus causing the rising and falling of the frames.

Toward the upper end of the shaft H, a pinion, h^1, actuates a wheel, h^2, connected with a pinion, h^3.

The latter gears with a wheel, h^4, fixed on the screw f^2.

Below this wheel is a small pinion, h^5, actuating the rack X, which regulates the position of the belting on the cones.

I will conclude the description of this machine by indicating briefly, the arrangement of the mechanism for facilitating the starting of the spindles and fliers after they have been stopped in order to piece a broken thread.

This mechanism is composed, essentially, of two flat bars, which can, at any moment desired, be removed, or displaced horizontally, by the action of a pedal pressed by the foot.

The flat bars are provided with openings or slots, equal in number to the fliers and spindles, (which should be actuated by the same mechanism,) and in these openings the hooked ends of arms attached to the said spindles and fliers are arranged to slide.

The operation of the mechanism will be readily understood.

When a flier and its corresponding spindle are thrown out of gear, the hooks of the two arms, striking against the end of their respective slots, push forward the flat bars, the other slots in which move against the rigid hooks of the fliers and spindles which are in motion.

It results, therefore, that as soon as the pedal is pressed, the bars, in returning to their first position, draw back the arm of the spindle and the arm of the flier which were displaced, and their corresponding fingers, turning also, cause the flier and spindle to resume their movement.

One pedal and a single pair of bolster-plates may be employed for a dozen or more spindles or fliers.

Figures 5 and 6, Sheet III, represent the machine for spinning weft.

The features which characterize this machine are—

First, the application of a system of spindles and fliers, hereinbefore described. There is no difference, in this respect, between this machine and the one already described, except that the spindles are conical, instead of cylindrical, in order to distribute the yarn on conical cop-tubes, and to form cops to be used in the shuttles of a weaving-loom.

Second, the employment of two cylindrical cams, mounted on the same carriage, and intended; the one to give the varied rotary movement to the spindles, for producing the regular distribution of the yarn, and the other the varied and alternate rectilinear movement to the frames, in order to uniformly distribute the yarn on the bobbin.

Third, the arrangement of an expanding pulley, which is actuated by a cone operated by one of the cams, and serves, by this means, to transform the varied rectilinear motion produced by said cam into a varied circular movement, capable of being transmitted to the spindles by a system of gear-wheels, so as to produce a broken or intermittent movement.

Fourth, the particular methods of regulating the movement of the fliers, of the drawing-cylinders, and of the frames.

I will first describe the loom, and will then explain the principles which govern the construction and operation of the cams.

The loom is represented in Sheet III of the drawings—

Figure 5 being a longitudinal elevation, and

Figure 6, an end elevation.

Motion is communicated, from a suitable motor, by a belt and pulley on the horizontal shaft A, which, by means of the wheels a, a', and b, causes the revolution of the horizontal shaft B.

This principal shaft B regulates the movement—

First, of the fliers E, by means of a wheel, c, and engages on one side with the wheel c^1, and on the other with the wheels c^2 c^3, and thus effects the revolution, through the medium of the wheels f f, of the shafts D D, which actuate the fliers by means of the pinions n m.

Second, of the drawing-cylinders C C, by means of the wheel b^1 and the wheel h, which gears with the pinion h^1, mounted on the transverse shaft H. The two pinions h^1 h^2 revolve the pinions h^3 h^4, and, consequently, the cylinders.

Third, of the expanding cone T, and, consequently, of the expansible pulley K. The necessary movement is transmitted to the shaft j^1 of the expanding cone by the wheels c^1 c^2, the intermediate longitudinal shaft c^3, and the wheels c^4 c^5 c^6. The expansible pulley K is connected with the pulley j by the belting J, and by the binding-pulley j^5.

Fourth, of the two cams P and Q, which should have both a rotary movement upon their axes and a rectilinear movement.

The rotary movement is imparted by a grooved cylinder, l, which causes the revolution of a large wheel, l^1, fixed on the axis p of the cam P.

On the same axis is another wheel, l^2, with oblique teeth, which gears with the wheel l^3, mounted on the axis q of the cam Q.

The grooved cylinder l is of such dimensions that the cams, in their transit, will continue to be rotated by means of the constant engagement of the wheel l^1 with the said cylinder.

The transmission of movement to the cylinder takes place through a series of gears, not represented in the drawings.

The transit or forward movement of the cams is effected by means of the screw S, which, receiving a rotary movement through the wheels s^1 s^2 s^3 s^4, causes the carriage R and the cams P and Q, which are carried by the same, to advance very slowly.

The eccentric-cam P, whose axis p is horizontal, causes, by its rotation, the movement of the roller t, attached on the angle-lever t^1, on one of the arms of which is the rack t^2.

The latter transmits this movement to the wheel t^3, secured upon the same shaft with the sector t^4.

This sector t^4 acts upon the rack t^5, which is attached to the rod of the expanding cone T, and thus causes the latter to enter the pulley K, which is expanded, and, consequently, moves with increased circumferential speed.

The belting transmits this augmented speed to the fixed pulley j, which imparts a more rapid rotation to the wheel j^2, which rotary movement, through the intermediary of the wheels j^3 j^4, and of the wheels o^1 o^2 o^3 o^4, for causing the intermittent motion, is communicated to the pinions g g, and, through them, to the spindles G G.

The eccentric-cam Q, which, as well as its axis q, is inclined, acts on a roller, u, attached to the extremity of a rack, u^1, which, in rising and falling, causes the wheel u^2, with oblique teeth, to turn, alternately, in the one direction and the other, this movement being communicated to the shaft u^3, pinions u^4 u^5, shafts V V, and wheels v v.

The latter engage with the nearly-vertical racks v' v', imparting to the frames Z Z the desired varied movement.

The flier and spindle revolve independently of each other, being regulated separately by their respective gearing—the spindle with a variable speed, the flier with a uniform velocity, which is always a little less than that of the spindle.

The difference in the number of revolutions made by these two organs in the same space of time causes the winding. The number of revolutions common to the spindle and flier causes the twisting.

The winding is effected as follows:

At the same time that the spindles and their cops revolve, the frame that carries them has an alternate up-and-down motion, which causes a certain recoil, in proportion as the thread is wound upon the cop. The winding is thus produced by the accumulation of successive layers, which are raised upon the cop-tube.

If the cop-tube has the form of a cylinder, the layers of the winding will be cylindrical, and the rate of speed of the winding will be uniform, as well as the velocity of the reciprocating or alternate movement of the frames and spindles; but, if the cop have the form of a truncated cone, the layers of the winding will then be trunco-conical.

It is, therefore, necessary, in order not to disturb the regularity of the tension and distribution of the thread, to modify the two movements which effect the winding.

The feed of the thread in a certain space of time being invariable, in order that its tension, produced by the action of the spindle, may be constantly the same, it is necessary that the quickness of the winding should vary in inverse proportion to the different diameters of the tube upon which the thread is moved.

On the other hand, it will be seen, that if the rate of speed of the bobbin-frame continue uniform, the number of spirals formed by the thread will be augmented according as the diameter of the tube diminishes, and that, consequently, the thickness of a layer of the thread will be irregular.

In order, therefore, to distribute, evenly and equally, the thread in a layer, to increase the distance between the spirals when their number is augmented at any one point, to bring them nearer each other when the number diminishes—in a word, to regulate the action so that they shall constitute a helix with a uniform angle—it is necessary to cause the velocity of the reciprocating movement of the bobbin-frame to vary, and to cause this variance to be in proportion to the quickness of the winding—that is to say, in inverse proportion to the corresponding diameters of the cop.

These two movements—the rotary movement of the spindles, which allows the thread to be always equally stretched, and the reciprocating movement of the bobbin-frame, which distributes the thread upon the cop-tube with regularity—are obtained in the machine by means of two cams.

These cams are surfaces generated by curves whose planes are parallel.

Each curve of the one cam has a curve in the other which corresponds to it, and it is the similarity of these two curves which produces the formation of a layer of thread.

The two cams receive, at the same time that they revolve uniformly, through the medium of an endless screw, a movement which causes them to present to their respective rollers the two corresponding curves which are required to form a layer of the cop.

In brief, an endless screw actuates two cams, of which the one, operating the spindle, produces an equal tension of the thread; the other, operating the bobbin-frame, causes the equal distribution of the thread in each layer.

The tracing or laying out of the curves for each cam is determined by the laws above laid down for the varied movements which they are to transmit.

These curves first being cut out in pasteboard, for example, are placed parallel with each other, at regular intervals apart, in such manner that their centres will lie in the same line which forms the axis of rotation of the cam, and their top edges will be in the same plane. There is thus a number of guides, sufficient to determine the continuous surface of the cam.

The patterns being made, and then the moulds, the cams are cast on the arbors which carry them, so that the cams and their shafts are perfectly and securely united.

Having now described my invention, and the manner in which the same is or may be carried into effect,

What I claim, and desire to secure by Letters Patent, is—

Spindles and fliers constructed and operating substantially as shown and described.

In testimony whereof, I have signed my name to this specification, before two subscribing witnesses.

J. J. J. PIERRARD.

Witnesses:

J. ARMENGAUD,

F. F. RANDOLPH.