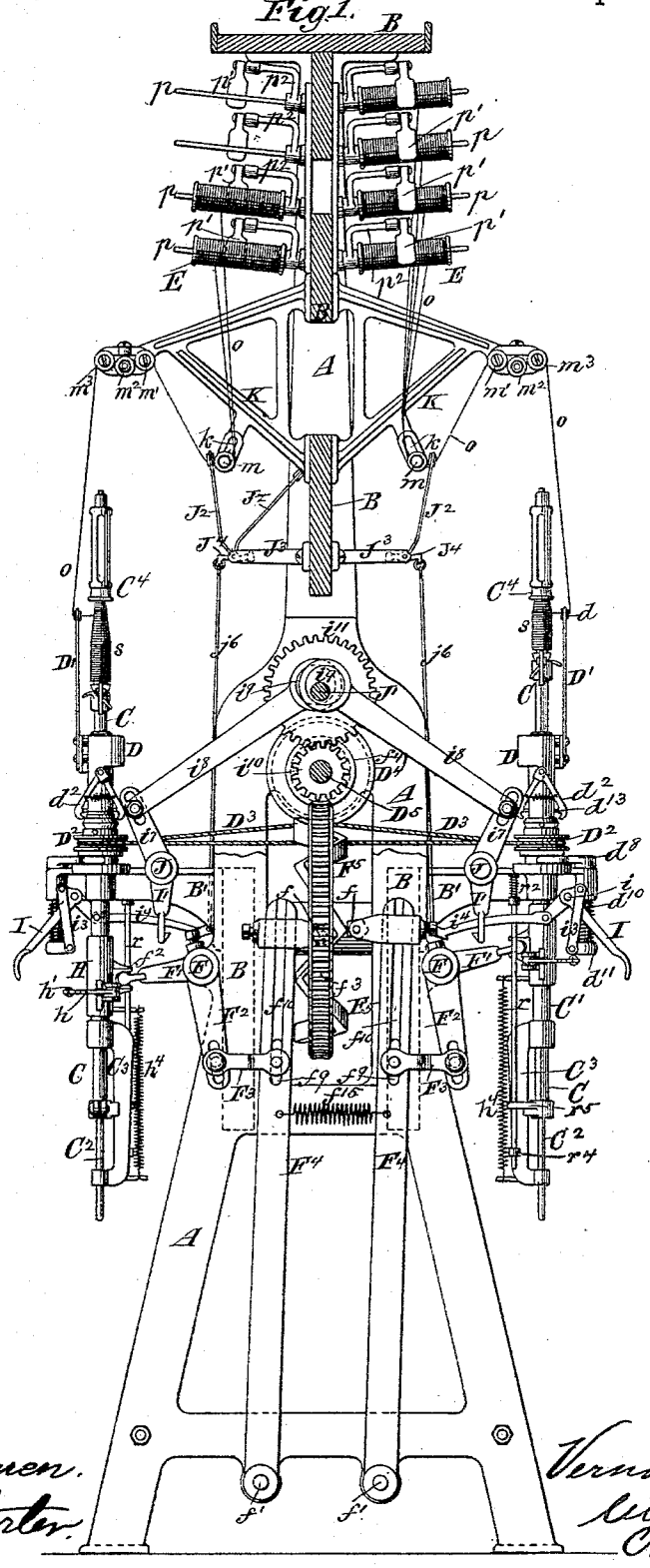
(No Model.) 3 Sheets—Sheet 1.

V. ROYLE.

MACHINE FOR WINDING SHUTTLE QUILLS, &c.

No. 389,013. Patented Sept. 4, 1888.

Fig. 1.



Witnesses:
C. L. Sundgren.
Emil J. Porter.

Inventor.
Vernon Royle.
by his Attys
Brown & Seal.

N. PETERS. Photo-Lithographer. Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

V. ROYLE.

MACHINE FOR WINDING SHUTTLE QUILLS, &c.

No. 389,013. Patented Sept. 4, 1888.

Fig. 2.

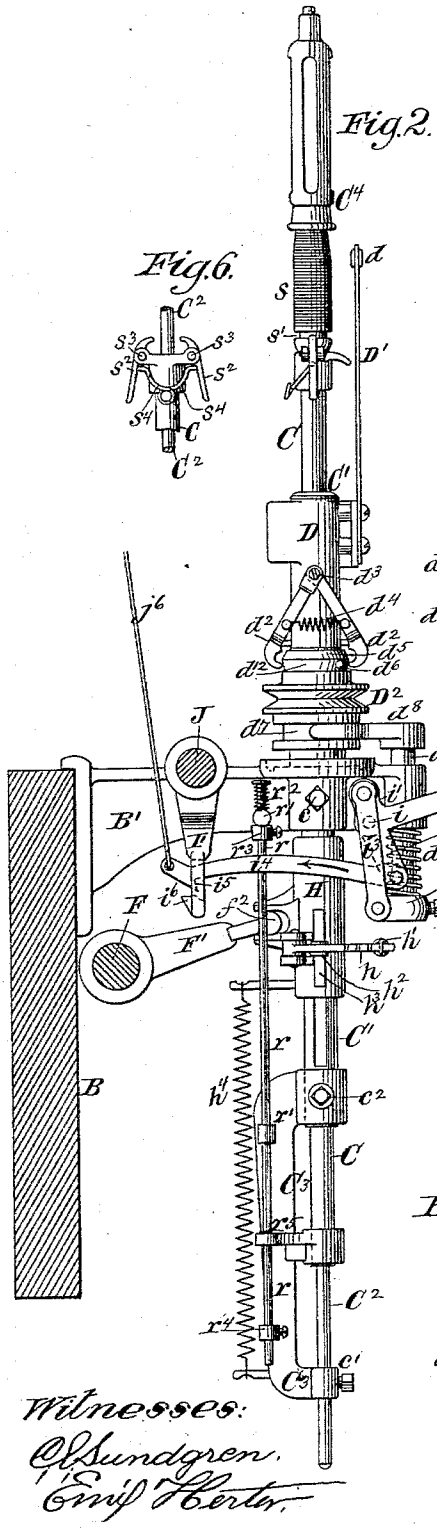


Fig. 6.

Fig. 5.

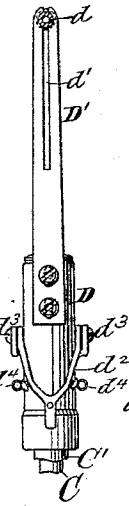


Fig. 4.

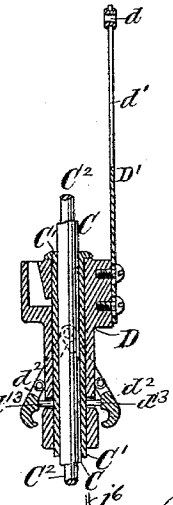


Fig. 3.

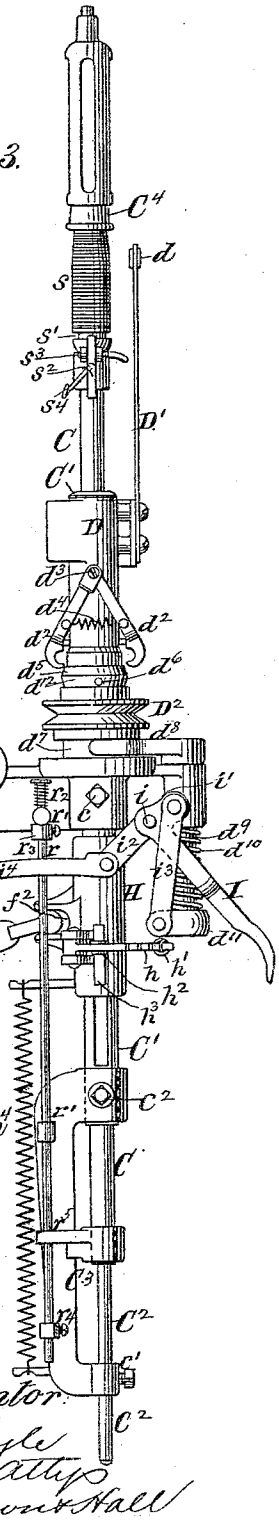
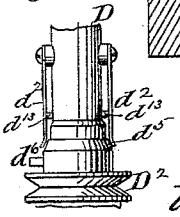


Fig. 7.



Witnesses:
C. L. Sundgren.
Emil Herter.

Inventor:
Vernon Royle
by his Attys
Brown & Hall

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 3.

V. ROYLE.

MACHINE FOR WINDING SHUTTLE QUILLS, &c.

No. 389,013. Patented Sept. 4, 1888.

Fig 8.

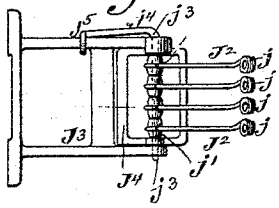


Fig. 8*

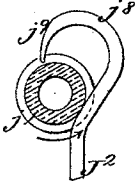


Fig 11.

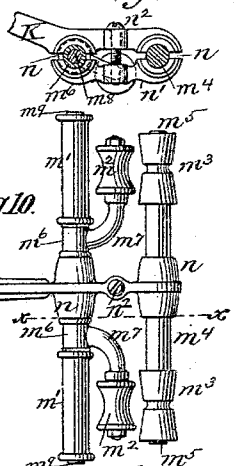


Fig 9.

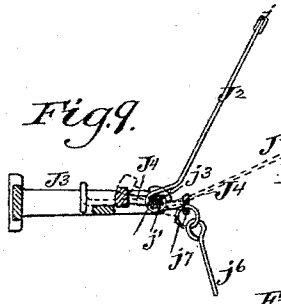


Fig 10.

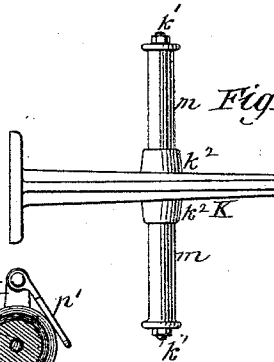


Fig 13*

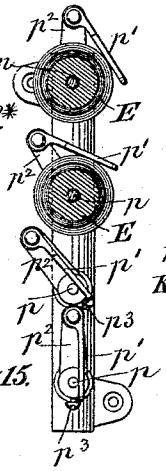


Fig 12.

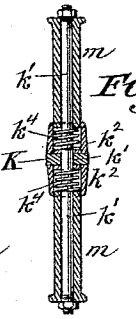


Fig 13.

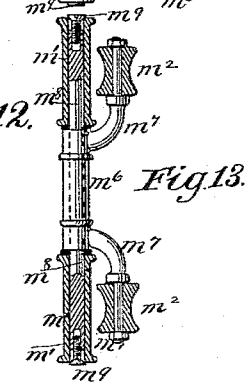


Fig 14.

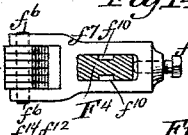


Fig 15.

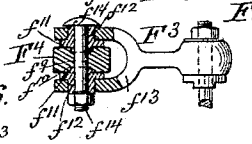


Fig 16.

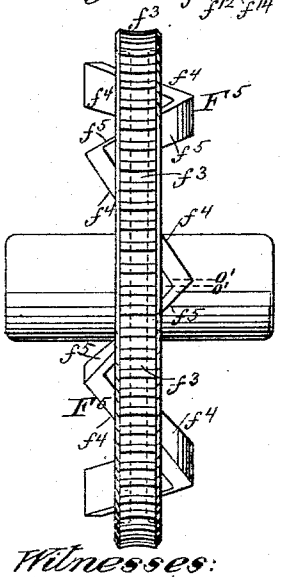
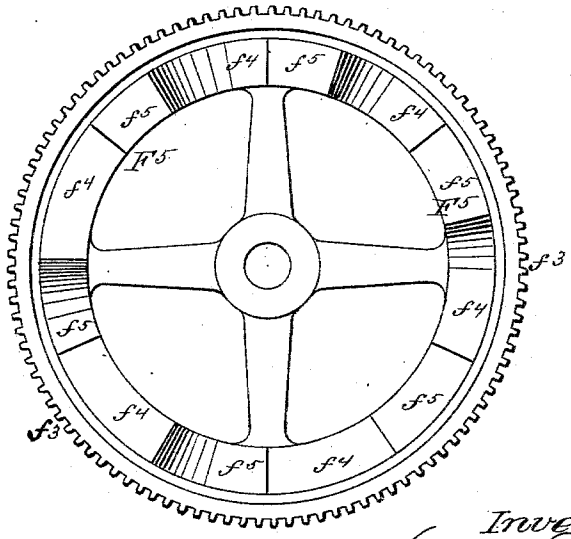


Fig 17.



Witnesses:

C. L. Sundgren.

Emil Carter

Inventor:

Vernon Royle

by his atty

Brown & Hall.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

VERNON ROYLE, OF PATERSON, NEW JERSEY.

MACHINE FOR WINDING SHUTTLE-QUILLS, &c.

SPECIFICATION forming part of Letters Patent No. 389,013, dated September 4, 1888.

Application filed May 6, 1887. Serial No. 237,311. (No model.)

To all whom it may concern:

Be it known that I, VERNON ROYLE, of Paterson, in the county of Passaic and State of New Jersey, have invented a new and useful Improvement in Machines for Winding Shuttle-Quills, &c., of which the following is a specification.

My invention relates more particularly to machines for winding shuttle-quills with silk or other material; but certain features thereof may be employed in machines for winding other spools or bobbins.

The machine which I have illustrated in the accompanying drawings is somewhat similar in its general character to the machine which forms the subject of my application for Letters Patent, Serial No. 206,194, filed June 25, 1886, and my present invention may be said, in a general way, to consist in improvements on that machine.

In machines of this character there are usually arranged on opposite sides of the main frame of the machine two series or rows of spindles, each spindle being combined with a flier, and one of said parts being rotated relatively to the other. In the example of the invention illustrated in the accompanying drawings the flier is rotated relatively to the spindle and is driven through a clutch from a wheel or pulley. When the clutch is constructed with projections or members which positively interlock and allow no opportunity for the yielding of one member relatively to the other, the sudden starting of the flier at full speed sometimes breaks the thread, especially in winding fine silk; and one feature of my present invention consists in novel combinations of parts which include a combined friction-clutch and positive clutch for driving the rotary part, or, in other words, a clutch which first engages by friction, and when fully shifted or thrown on engages by positively interlocking portions. This clutch may be formed by a pair of laterally-yielding spring-supported jaws on one part—as, for example, the hub of the flier—and a conical spreader constituting the other part or member of the clutch. The conical spreader is preferably upon a whirl, and at the base of the conical or taper surface is a pin or projection which when the spreader is advanced sufficiently far between the laterally-yielding jaws engages with one of said jaws and so forms a positive interlocking of the two parts of the clutch. By this construction the flier is started gradually, and in first starting an opportunity for slip between the two members of the clutch is afforded, and even delicate thread will not be broken. I preferably construct the conical spreader with a reversed taper or conical surface at the base of the one which is active in engaging the clutch, so that the spreader will not produce a continued upward pressure upon the other member of the clutch and the hub of the flier. I also combine with the laterally-yielding member of the clutch a brake for arresting or retarding the rotation of the flier when the clutch is thrown off, and the brake may consist of a pin or pins projecting laterally inward from the two jaws, which form one member of the clutch, through openings in the flier-hub, and which bear at the inner end upon a fixed tube which surrounds the spindle and on which the flier-hub rotates.

The invention also consists in other novel combinations of parts hereinafter described, and pointed out in the claims, and which include a flier comprising an arm which is split or slotted lengthwise from one end inward, and a guiding eye flanged at opposite ends and held between the fingers formed by the slot in the flier-arms, which enter a circumferential groove between the flanges. This eye may be placed in position by laterally displacing one of the fingers formed by slotting the flier-arm away from the plane of the other finger, as will be hereinafter described.

The novel combinations of parts also include hinged clutch-levers which are upon the upper end of the spindle, and which engage a groove in the quill for holding it upon the spindle, and a bow-spring of semicircular form, the ends of which are engaged with or enter indentations in the said clutch-levers and cause them to spring into engagement with the groove in the base of the quill.

The novel combinations of parts also include novel features in a stop-motion, whereby the mechanism for throwing off or disengaging the clutch in order to stop the operation is automatically rendered operative on the breaking of a thread. These novel combinations of parts also include, in connection with a cam and a cam-lever operated thereby, and suita-

ble connections through which a traverse motion in one direction is imparted to the spindles in a row or series, springs applied one to each spindle for producing a traverse motion in the reverse direction, and which serve to take up all lost motion in the connections through which the spindle is traversed.

The novel combinations of parts also include, in connection with spindles and fliers and means for driving one relatively to the other, tension-brackets having short guides of novel construction projecting from opposite sides thereof, as distinguished from guides consisting of long rods extending lengthwise of the machine. The short guides on opposite sides of the tension-brackets are much more advantageous than the long guide-rods, because in preparing the machine for operation, and in replacing the thread in proper position after breakage, the thread may be passed endwise over the guides instead of being threaded through or over the guides, as is necessary when they consist of long rods. The thread-guides consist of porcelain, glass, or analogous smooth material which will not be readily worn, and the novel combinations of parts above referred to also include novel features in the way of securing these guides or guiding-sleeves to the tension-brackets.

The above novel combinations also include, in connection with a spindle to receive a spool or bobbin and a brake for acting on the spool or bobbin, said brake preferably bearing directly upon the material wound on the spool or bobbin, a support to which the brake is pivoted, and which is adjustable around the spindle to vary the action produced by gravity of the brake upon the spool or bobbin. This support may be journaled directly upon the spindle and provided with a set-screw, whereby it may be secured in place after being adjusted around the spindle.

The novel combinations of parts also include, in connection with spindles and fliers on opposite sides of a machine, two cams having a common axis and having the projections or points of greatest projection of one arranged opposite the depressions or points of greatest depression in the other, and mechanism, substantially as hereinafter described, whereby the two spindles are traversed in opposite directions simultaneously. Where the spindles are upright, as is usual, the weight of parts assists the downward traverse and increases the resistance to upward traverse of the spindle, and where one series is moved upward and the other series downward simultaneously the resistance to the traverse is rendered more uniform than it is where both series are moved simultaneously upward or downward. These two cams may be formed by circular cam-surfaces on opposite sides of the cam-wheel, and in machines of this class I prefer to form the cams of a series of long and short inclines arranged alternately, so as to produce a slow traverse of the thread on the quill in one direction and a quicker traverse of the thread in the other direction, the advantages of such difference in traverse being well understood in the art. To render still more uniform the resistance offered to the traversing movement of the spindle, I prefer to construct the cam-wheel so that the inclines upon one side or face, which constitutes one cam, overlap the inclines upon the opposite side or face, constituting the other cam, so that the inclines of one cam always commence their action before the termination of the action of the inclines of the other cam, and there will then be no time in the operation of the machine when there will be no resistance to the movement, as would be the case if both cams acted exactly simultaneously.

In order to drive the cam-wheel, a worm or spur gear has been employed, and to secure simplicity and economy in construction and compactness of the machine I employ a combined spur or worm wheel, which consists of a circular series of worm or spur teeth and a zigzag web portion within such circular series of teeth, and having on opposite sides long and short inclines arranged alternately. The levers on which the cams operate are tangential to the circle in which the inclines are arranged, and in some cases the bearers on which the cams act consist of polygonal blocks mounted on levers.

It is obvious that points in the circle near the outer circumference of the cam move faster than points in the circle near the inner circumference of the cam, and where a solid block is employed it has not, during the entire operation of the cam, a bearing throughout its entire face upon the inclines. To enable this result to be secured, and therefore to reduce wear and prevent lost motion in the parts of the machine, I construct the bearing-blocks for the levers, and on which the cams act, of a number of thin and freely-turning plates placed side by side, and which readily adapt themselves to the faces of the inclines, and I also provide a novel and simple construction whereby a forked link, through which the cam-actuated lever transmits motion, may be connected with the lever.

In the accompanying drawings, Figure 1 is a sectional elevation in a plane transverse to its length of a machine embodying my invention. Fig. 2 is a sectional elevation upon a larger scale, showing one spindle and flier, together with the frame or bracket which supports them and the parts employed in connection with them, the clutch being shown as shifted and held in a position to drive the flier. Fig. 3 is a sectional elevation corresponding to Fig. 2, but showing the clutch as thrown off or shifted to a position to stop the flier. Figs. 4 and 5 are respectively a sectional elevation and an external elevation showing a flier, one of the clutch portions, and particularly showing the construction of the flier-arm, whereby the guiding-eye for the thread is readily secured therein. Fig. 6 is an elevation at right angles to the plane of view of Fig. 1, showing the clutch whereby a quill may be secured on the

spindle. Fig. 7 is an elevation showing a modified form of clutch, through which the whirl may transmit motion to the flier-hub, and which is also included in my invention. Figs. 8 and 9 are respectively a plan and vertical section of fallers and a faller-frame embodying my invention. Fig. 8* is a detail view, hereinafter described. Fig. 10 is a plan of a tension-bracket and the guides with which it is provided. Fig. 11 is a sectional view upon about the plane indicated by the dotted line *x x*, Fig. 10. Figs. 12 and 13 are respectively a sectional and partly sectional view of tension-guides, showing the means of securing them in place and to the tension-bracket. Fig. 13* is an elevation of spool supports and brakes which embody my invention, also including a transverse section of the spools. Fig. 14 is a transverse section of one of the cam-actuated levers, the block or piece on which the cam bears including a holder for this block or piece adjustably secured upon the lever. Fig. 15 is a transverse section of said lever and a forked link, also partly in section and connected therewith; and Figs. 16 and 17 are edge and side views of the combined spur or worm wheel and cam-wheel.

All the figures except Fig. 1 are upon a larger scale than said figure, and similar letters of reference designate corresponding parts in all the figures.

The main frame of the machine comprises end standards, A, and longitudinal stretchers B, extending between them and supporting the several parts of the machine. It will be understood that the series or row of spindles C is to be arranged on each side of the machine, as is represented in my aforesaid application, Serial No. 206,194, and I have thought it unnecessary to here show a side elevation of the machine. Ten, twenty, or any other number of spindles may be arranged on each side of the machine.

I will first describe the construction of a spindle and flier, together with its appurtenances, it being understood that the description applies equally to each spindle in the machine.

To the longitudinal stretcher or rail B is secured a spindle-bracket, B′, and in this bracket is secured in fixed position a tube, C′, as in my aforesaid application. This tube may be secured in the bracket by a set-screw, *c*, or otherwise, and is of such size as to receive the spindle C freely and yet snugly through it. The spindle is tubular, and through it extends a fixed rod, C^2, which is here shown as secured in fixed position at *c′* in a bracket, C^3, secured at c^2 to the lower end of the fixed tube C′. The rod C^2 extends upward through and above the spindle C, and supports at its upper end a hollow abutment, C^4, which is concentric with the spindle, and the function of which will be hereinafter described. The quill *s* is mounted on the top of the spindle C, and, as here represented, has at its base a circumferential groove, *s′*, with which engage the ends of clutch-levers s^2, which are fulcrumed at s^3. By means of a bow-spring, s^4, of semicircular form with a coil, and which has its ends engaged with the levers s^2, the upper ends of the levers are automatically held in engagement with the groove *s′* in the base of the quill.

D designates a flier-hub, which, as best shown in Fig. 4, is journaled on the fixed tube C′, and has an upwardly-projecting arm, D′, provided with a thread eye or guide, *d*. In machines of this character the spindle and flier are rotated one relatively to the other, and in this example of the invention the spindle is non-rotary and the flier is rotated rapidly upon the fixed tube C′ by power transmitted from a whirl or pulley, D^2. As here represented, the flier-arm D′ is slotted or divided lengthwise from one end inward, as shown at *d′*, thereby forming flexible fingers for grasping between them the guiding eye *d*, which at opposite ends or sides is flanged, as shown in Fig. 4. One of the fingers formed by the slot *d′* may be bent in the direction of its thickness out of the plane of the other finger, so as to separate them sufficiently to insert the eye *d* between them, and the fingers, by their resilience, return into the same plane and thus hold the eye securely against displacement.

As shown in Fig. 1, the whirls D^2 of two spindles on opposite sides of the machine may be driven by a single band, D^3, from a pulley or drum, D^4, upon the main shaft D^5, and motion is transmitted from each whirl D^2 to the flier-hub D by a clutch, which may be thrown off or on at will, in order to stop or start each spindle independently of the others, as may be necessary, by the running out of the spool E, from which the thread *o* is taken by the breaking of the thread or by the quill *s* upon the spindle becoming full. When the clutch is of such character that its two members engage independently by a positive interlocking of projections, one member of the clutch is moved lengthwise and the flier is instantly started at full speed, thereby not only bringing an increased resistance suddenly upon the driving-band D^3, but producing a sudden draft upon the thread, which, if it is thin, is liable to be broken. To obviate this difficulty, I employ a combined friction-clutch and positive clutch, the two members of which are constructed to engage first by friction on the first movement of the sliding member of the clutch, and subsequently, on the completion of such movement, by the positive interlocking of parts, and in this way I secure a gradual starting of the flier and an opportunity for the slipping of one part of the clutch upon the other part or member, which prevents any sudden jerk upon the thread and avoids breakage thereof.

As here represented, one member of the clutch consists of forked or bifurcated jaws d^2, which are pivoted at d^3 on opposite sides of the flier-hub and are connected by a spring, d^4. The other member of the clutch, which is formed upon the whirl D^2, comprises a cen-

tral spreader having a conical or taper surface, d^5, and at the base of such cone or taper one or more pins or projections, d^6. As here represented, the whirl D^2 has an annular groove, d^7, which receives a fork, d^8, on the upper end of the pin or stem d^9, arranged to slide in a suitable socket in the bracket B′ and having a spring, d^{10}, applied below the bracket and above a collar, d^{11}, on its lower end.

In the position of parts shown in Fig. 3 the clutch is thrown off or rendered inoperative, and the flier D is supposed to be stationary. When the whirl D^2 is raised by the action of the fork d^8, the conical surface d^5 of the spreader enters between the laterally-yielding and spring-supported jaws d^2 and by its frictional engagement with the points of said jaws tends to rotate the flier D. Such rotation, however, is not positively effected, and there is ample opportunity for slip between the conical surface d^5 and the jaws d^2 until the whirl has been raised, so that the pin or projection d^6 is in the same horizontal plane with the jaws d^2, whereupon such pin engages positively with the side of one of the jaws, and motion is thereafter transmitted to the flier positively and without any slipping.

It will be observed that the action of the conical or tapered surface d^5 on the yielding jaws d^2 not only spreads them, but has a tendency to produce an upward pressure on them and on the flier-hub D, with which they are connected. In order to relieve such upward pressure and avoid unnecessary wear of the flier-hub D and the fixed tube C′, on which it is journaled after the parts of the clutch are in positive engagement, I have shown the spreader on the whirl D^2 as having below the conical or tapered surface d^5 a reversely-tapered or downwardly-tapering surface, and as soon as the pin or projection d^6 is lifted into engagement with the jaws d^2 said jaws are in contact with the downward or reverse taper d^{12}, and the flier-hub is relieved of upward pressure.

In order to lay the thread *o* conically upon the quill *s* in the usual manner of building up cops, the spindle C has imparted to it a longitudinal traverse. As each layer of thread is placed upon the quill, beginning at the base and progressing upward, it will be understood that the height of the quill is slightly increased, and, inasmuch as the traverse movement is through a definite range, the quill will at the termination of each upward traverse be brought in contact with the abutment C^4, which is supported concentrically with the quill.

As described in my aforesaid application, I impart a traverse motion to the spindle by a friction-clutch, and as the winding of the quill progresses, and at the termination of each upward traverse of the spindle, the quill strikes the abutment C^4, and the spindle is pushed slightly downward.

As here represented, the mechanism for producing the traverse movement of the spindle in one direction consists of a rock-shaft, F, and cams or toes F′—one for each spindle—mounted on the rock-shaft, and also applied to the rock-shaft is an arm, F^2, which by a link, F^3, is connected with the lever F^4, carrying a block or shoe, *f*, on which acts a cam-wheel, F^5, as shown in Fig. 1. The lever F^4 is, as here shown, fulcrumed at its lower end, *f′*, and the details of construction of these parts will be hereinafter referred to.

For traversing each spindle C the arm or toe F′ pertaining thereto engages by a fork or notch, f^2, a clutch body, H, which is fitted to slide upon the fixed tube C′, and has at opposite sides levers *h*, drawn toward each other by a spring, *h′*, and each carrying a shoe, h^2, which extends through a slot, h^3, in the fixed tube C′ into contact with the spindle C within said tube. This clutch may be of the same construction as is shown in my aforesaid application, and, although by the action of the spring *h′* the shoes h^2 are held with sufficient pressure upon the spindle C to prevent slip in performing the principal portion of the traverse movement, they will permit the spindle C to be slid very slightly downward through the clutch-body when the quill comes in contact with the fixed abutment C^4. The mechanism shown transmits upward traverse, or traverse in one direction to the spindle C, and for assisting and insuring traverse in a reverse direction I have represented a spring, h^4, as applied to each spindle or clutch-body H, this spring being here represented as secured at one end to a projection from the bracket C^3 and at its other end to a projection from the clutch-body. The springs h^4 applied for the several spindles have their aggregate strength sufficient to insure the downward traverse of all the spindles on that side of the machine and to hold the bearing block or shoe *f* of the cam-actuated lever F^4 against the cam-wheel F^5, thereby taking up all lost motion due to wear in the connections.

As here represented, the cam-wheel F^5 actuates two levers, F^4, which each operate all the spindles upon the side of the machine, and the opposite faces of the cam, which are at right angles to the axis thereof, may be considered as constituting two cams, which have a common axis. For rotating the cam I employ a spur or worm wheel or circle of teeth, f^3, with which engages a worm, f^{41}, upon the main shaft D^5, and I have here represented the cam-wheel F^5 as formed integral with the circle of worm-teeth or spur-teeth. In other words, I construct and combine the worm or spur wheel and cam-wheel, which comprise the circle f^3 of worm or spur teeth, and the cam portion F^5, which is formed by the web of the wheel within the circle of teeth, as is best shown in Figs. 16 and 17.

As represented, each surface of the cam-wheel F^5, which may be considered as constituting a cam, is made up of inclines $f^4 f^5$, which may be termed "long" and "short" as compared with each other, and which are arranged

alternately in the circumference. Not only may the inclines be considered as long and short, but the short inclines are of different lengths and the long inclines are also of different lengths, and the result of this construction is to produce a comparatively quick traverse in one direction and a comparatively slow traverse in the other direction, and to vary minutely the traverse in each direction, thereby imitating as closely as may be the results produced in winding quills when the traverse is produced by hand.

It will be observed that in the two cams which are formed by opposite faces of the zig-zag web or wheel F^5 the points of greatest projection in one cam or side are approximately opposite the points of greatest depression in the other cam or side, and hence the series of spindles at one side of the machine will be traversed upward simultaneously with the downward traverse of the spindles on the opposite side of the machine, and the resistance to the operation of the machine will be more uniform, because more power is required to make the upward traverse than the downward traverse. In the former case the weight of the spindles and their quills is an additional resistance, while in the latter case the weight facilitates the downward traverse.

From Fig. 16 it will be seen that the inclines f^4 f^5 at opposite sides of the cam F^5 do not terminate in the same plane axially of the cam, but overlap one another. This is best shown by the dotted lines o' in Fig. 16, from which it will be seen that the incline on the right-hand side overlaps the incline on the left-hand side to the extent of the distance between the two lines. Consequently there is no point or instant in the operation of the machine when there is no resistance, because by the action of the cam the traverse of one series of spindles in one direction commences before the traverse in the other series of spindles in one direction terminates.

It will be observed that in the cam F^5, which may be considered as a double cam, inasmuch as its two opposite faces are operative, the points which are in circles at different distances from the center move at different speeds, and as the lever F^4 is tangential to the cam the block or shoe f, if made in a single piece, would not bear with its flat faces directly and evenly throughout their whole extent on the cam. To obtain a large bearing-surface of the block or shoe f upon the cam, I construct it of a series of polygonal plates, as best shown in Fig. 14, said plates being placed side by side and of little thickness, and adapted to turn freely upon a pivot or pin, f^6, by which they are secured in the holder f^7, which is here represented as looped to slip over the lever F^4, and may be secured thereon by a set-screw, f^8. As the cam turns relatively to the block or shoe f, the faces of the thin plates or sections of which said block is composed each adjusts itself to a true bearing upon the cam, and by the increased surface thus afforded the wear is reduced and less lost motion produced in the machine.

The preferred method which I have adopted of connecting the link F^3 with the lever F^4 is shown in Fig. 15. I have shown each lever F^4 as formed with a slot, f^9, which is continued as a groove, f^{10}, in opposite sides of the lever, and applied to the opposite sides of the lever are blocks or slides f^{11}, each having a tongue or projection adapted to fit in the groove f^{10}, and each having a trunnion, f^{12}, upon its outer side. The link F^3 is forked or bifurcated at the end f^{13}, so as to embrace the lever F^4, and the slides f^{11} and the two side portions of its bearing receive the trunnions f^{12} upon the outer faces of the slides f^{11}. By means of a bolt, f^{14}, inserted through the slots f^9 in the lever and through the slides f^{11}, the latter may be clamped tightly upon the lever, and the freedom for swinging movement of the link F^3 on the trunnions f^{12} remains unimpaired.

In assembling the parts the trunnions f^{12} of the slides f^{11} may be placed in position in the fork f^{13}, and the slides may then be slipped downward over the upper end of the lever F^4 until the slot f^9 is reached, when the bolt f^{14} is inserted through the slides f^{11}, and they are clamped solidly against opposite sides of the lever. I have here shown the levers F^4 as connected by a spring, f^{15}, which may be used, if desired, although it is not essential, inasmuch as the aggregate strength of the springs h^4 applied one for each spindle will be sufficient to produce the downward traverse of the spindles and to hold the lever F^4 against the cam F^5.

I will now proceed to describe the stop-motion and also the guides over which the threads are passed in unwinding from the spools E and the brakes which are employed to prevent such spools from racing ahead. As here represented, the shipper d^8, before described, is supported by a shipper lever or trigger, I, fulcrumed at i, and having upwardly and downwardly extending arms i' i^2. The arms i' are connected by links i^3 with the collar d^{11} on the lower end of the rod or stem d^9, and it will be readily understood that when the lever or trigger I is swung to the position shown in Fig. 2 the draft upon the links i^3 is directly in line with the fulcrum i of the lever, and consequently the shipper d^8 and the whirl D^2 are held in an elevated position with the clutch operative. When, however, the lever or trigger I is swung downward on its pivot i to the position shown in Fig. 3, the clutch is rendered inoperative and the whirl D^2 is moved downward by the action of the spring d^{10}. Connected with the downwardly-projecting arm i^2 of the lever is a stop-finger, i^4, which is shouldered at i^5, and, as here represented, passes through a slot in an oscillating knocker mounted upon the rock-shaft J. As shown in Figs. 2 and 3, the position of the slot through which the stop-finger i^4 passes is indicated by dotted lines, and the oscillating knocker I' has a shoulder or projection, i^6, which when it en-

gages the shoulder i^5 on the stop-finger i^4 produces a draft thereon in the direction of the arrow shown in Fig. 2, and thereby throws off the lever or trigger I and stops the flier. There is a rock-shaft, J, on each side of the machine, each rock-shaft carrying a suitable number of oscillating knockers, I', corresponding to the number of spindles on that side of the machine, and each shaft has an arm, i^7, with which is connected a rod, i^8, operated by an eccentric, i^9, on the shaft J', as shown in Fig. 1. The shaft J' receives motion, as here represented, by a pinion, i^{10}, and wheel i^{11} from the main shaft D^5.

From the above description it will be understood that as long as the stop-finger i^4 is maintained with its shoulder i^5 lifted above or out of the path of the tooth or shoulder i^6 of the oscillating knocker I' the parts will remain in the position shown in Fig. 2, and the flier will continue its operation.

As usual in machines of this class, the arrangement of devices through which the clutch is shifted to stop the spindle is controlled by faller J^2, and I have in Figs. 8 and 9 shown the arrangement of fallers which is well adapted for the purpose.

The machine may be employed for doubling silk from two or more spools, E, and winding it upon a single quill, and in Fig. 8 I have shown four fallers, J^2, as mounted in a fixed frame, J^3, one such frame being employed for each spindle. Each faller J^2 consists of a wire having a thread-eye, j, at one end, and at its opposite end secured to a hub, j'. The several hubs are journaled upon the pin or pivot j^3. The construction of the fallers, however, constitutes no part of the present invention, but is the subject of a separate application for United States Letters Patent, Serial No. 282,179, filed August 7, 1888. As here represented, the pin j^3, which consists of a wire, has its end portion, j^4, bent laterally and forked, as at j^5, to engage one side portion of the frame J^3 and to thereby hold the pin j^3 in place. Upon the same pin, j^3, is journaled or pivoted a balanced frame, J^4, the back portion of which is made of greater weight, as shown in Figs. 8 and 9, so that it normally maintains the position shown in Fig. 9, and, being connected by a wire, j^6, with the stop-finger i^4, holds the latter lifted out of the path of the oscillating knocker I'. When any thread breaks, the faller through which it is passed drops downward upon the frame J^4 to the position shown by dotted lines in Fig. 9, and by its weight tilts the balanced frame J^4 downward and permits the stop-finger i^4 to fall into the path of the oscillating knocker I', so that at the next movement of the knocker the shoulder i^5 will be caught by the knocker and a pull upon the finger i^4 in the direction of the arrow (shown in Fig. 2) produced. To secure the most advantageous operation of these parts, I give the wire or rod j^6 a very loose connection with the balanced frame J^4, such as may be obtained by ring or loop j^7, interposed between the two. This ring or loop j^7 gives the rod j^6 more freedom of movement when the faller drops upon the balanced frame, and this precludes the danger of the said rod failing to let down the shouldered finger i^4.

I have represented by the balance or balanced frame J^4 how the flier of a spindle is stopped when a thread breaks or runs out from the spool E, and I will now describe how the flier is stopped when a quill is full. Extending parallel with the spindle C is a stop-rod, r, which is represented as fitted to slide in a bearing, r', applied to the spindle-bracket B' and in a corresponding bearing, r', on the bracket C^3. This stop-rod r is held in a normally-elevated position by a spring, r^2, as shown in Figs. 2 and 3, and it has near the top a shoulder or lateral projection, r^3, which is above the stop-finger i^4, and near the bottom a corresponding shoulder or lateral projection, r^4, which is in the path of an arm, r^5, which is on the spindle C and which moves along the rod r. As the spindle C is lowered very slightly at each upward traverse by the quill striking the abutment C^4, it follows that the arm r^5 will at last come to such a point at the lower end of the spindle-traverse that it will strike the shoulder or lateral projection r^4 on the stop-rod r, and when this occurs the stop-rod will be drawn down against the action of the spring r^2, and the shoulder or lateral projection r^3 will, by striking the top of the stop-finger i^4, pull the same down, so as to bring its shoulder i^5 into the path of the oscillating knocker I'. This arrangement of devices for stopping the flier when a quill is full is very desirable, inasmuch as on the first commencement of the upward traverse of the spindle the stop-rod r is relieved of pressure which tends to hold it downward, and its spring r^2 will at once raise it off the stop-finger i^4. The thread from the spools E passes downward over guides m, and thence is carried over and under guides m', m^2, and m^3 in a well-understood manner. As here represented, the several guides m, &c., are projected from opposite sides of a tension-bracket, K, whereby they are supported, one tension-bracket serving to support the guides for two spindles. Short guides projecting from opposite sides of a tension-bracket, as shown in Fig. 10, are very much more desirable than long guide-rods, such as are more commonly employed, because the thread may be passed endwise over the guides, and the necessity of threading the thread over and under the guides in succession, as must be done where the guides consist of long rods, is avoided. I desire to make the guides of porcelain, glass, or like smooth and hard material, which will not be cut by the continued passage of thread over them, and the means of securing such guides to and in the tension-brackets is best shown in Figs. 10, 11, 12, and 13. The guides m are arranged in such position that when the fallers J^2 are raised their thread-eyes j come at about the level of said guides, and by fitting the guides, so that they are adjustable upward and downward

in the tension-brackets K, I provide for raising the guides to permit any one or more of the fallers J^2 being placed behind them, as shown at the left hand of Fig. 1, and for then lowering the guides, so as to hold the faller in such elevated position and keep it off the balanced frame J^1 while it is idle. To this end each tension-bracket has a slot, k, through which passes a bolt, k', as shown in Fig. 12, and to opposite sides of the bracket are applied cup shaped slides k^2, through which the bolt k' passes.

Upon the bolt are also placed guiding-sleeves or tubular guides m, the ends of which enter the cup-shaped slides k^2, and are supported therein by springs k^4, and by tightening the nut or nuts at opposite ends of the bolt k' the springs may be compressed, so as to hold the cup-shaped slides k^2 with some considerable pressure against opposite sides of the tension-bracket K. This construction permits of sliding the guides m, which are at opposite sides of the tension-bracket, upward and downward within the limits of the slot k, and after the guide has been raised and the faller or fallers J^2 placed in position behind it, as shown at the left hand of Fig. 1, the guide or guides may be lowered in the slot k, so that they are obtruded in the way of the fallers, and the latter will be held in their upright and inoperative position. As shown best in Fig. 11, the tension-bracket K has divided bearings n, formed by a cap or clamp, n', secured by a screw, n^2. In one of these divided bearings n is clamped a rod, m^4, to the opposite ends of which the guides m^3 are secured each by a screw, m^5. In the other divided bearing, n, is clamped a tubular sleeve or casting, m^6, having lateral projections or branches m^7, on which are the guides m^2. Through the sleeve m^6 extends a bolt, m^8. On opposite ends of the bolt or rod are the tubular guides m', secured in place each by a screw, m^9. If the screw n^2 be slightly slackened, the tubular sleeve m^6 may turn in its bearing, thereby lowering the lateral branches m^7 and the guides m^2 and producing a greater deflection of the thread as between the guides m' and m^3.

The spools E are or may be placed upon fixed spindles or jacks p at the upper part of the machine, and I have represented brakes p' as arranged to bear one upon each spool. The term "spool," as applied to the parts E, may be considered as including both the core or center, the body and the thread wound thereon; but I prefer that the brakes p' shall bear upon the material wound on the spool, because then as this material becomes reduced and the weight of the spool is decreased the action of the brake p' becomes less powerful, inasmuch as it is exerted at a point nearer the center of the spool. The brake p' is, as here represented, pivoted at one end to a support, p^2, which consists of a bracket adjustable circumferentially about the spindle p. As here represented, the bracket is journaled directly upon the spindle, and may be turned thereon and secured in any desired position by means of a set-screw, p^3, or other suitable device. I have in Fig. 13* shown several positions into which the brake-supports or brackets p^2 may be adjusted and by which the action of the brake p' upon the spool may be varied. If the brake-supports p^2 be brought to such position that the brake p' will bear only on the top of the spool, it will have the most powerful effect; but if it be adjusted to such position that the brake bears upon the side of the spool and exerts its pressure thereon in nearly a horizontal line it will have much less effect, inasmuch as the gravity will not cause it to press so strongly upon the spool.

I have heretofore neglected to describe the action of the brake, whereby the flier-hub is stopped when the clutch is thrown off, and which is best shown in Fig. 4. On one or both of the yielding jaws d^2, which compose one of the clutch members, are inwardly-projecting pins d^{13}, which project through lateral openings in the flier-hub D, and the inner ends of which are in close proximity to the fixed tube C', on which the flier-hub turns. When the fork d^3 is lowered and the whirl D^2 is drawn down, thereby lowering the conical spreader d^5 and permitting the jaws d^2 to move toward each other under the action of the spring d^4, the pins d^{13} are pressed against the surface of the fixed tube C' and constitute a brake for arresting the movement of the flier.

In Fig. 7 I have described a modification of the clutch, in which two spring-arms are secured at one end to the flier-hub D and at their other ends are formed to bear against a conical surface, d^5, on the whirl D^2, and at the base of which conical surface is a pin or lateral projection, d^6. When this whirl is raised, the clutch will act similarly to that shown in Fig. 2, motion being imparted to the flier D through friction, and subsequently through the positive interlocking of the projection d^6 with one of the springs d^2.

The slots f^9, or a corresponding series of holes, provide for varying the length of traverse motion received from the cam F^5.

I have before neglected to describe the manner of securing the eyes in the fallers J^2. These eyes may be of porcelain, and the end of the wire may be bent to form a hook, j^8, as shown in Fig. 8*, which at its beak j^9 is made to constitute a slight spring. When the eye j is placed as shown in Fig. 8*, a turning motion in the direction of the arrow thereon will force the eye into the hook and it will be there retained. This is particularly useful, because after the eye is in place in the hook j^8 it will be free to play or move therein, but cannot escape therefrom.

In connection with my eighth claim I am aware of French Patent to Tardy, No. 8,783, of June 4, 1842, and I do not seek to include in my invention anything shown in that patent. That patent shows, among other things, a thread-guide formed of wires twisted together and separated at the upper portions, so as to produce a fork which grasps the porcelain or other guide-eye, through which the thread is

directly conducted. My flier-arm D′ is a strip of thin metal slotted from one end inward at d' to form the two elastic fingers, which embrace between them the guide-eye, and may either of them be deflected from its normal plane to facilitate the insertion of this guide-eye thereinto and its removal therefrom.

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

1. The combination, with a spindle and flier, one of which is mounted to rotate relatively to the other, and a whirl, of a combined clutch having portions engaging by friction and also having projections engaging positively for driving the rotary part from the whirl, whereby the first rotation of said part on starting will be produced by frictional engaging-surfaces and the subsequent rotation produced through positively-engaging projections, substantially as herein described.

2. The combination, with a spindle and a flier, one of which is mounted to rotate relatively to the other, and a whirl, of a clutch for driving the rotary part from the whirl, and which has two parts, one of which slides relatively to the other, and which are constructed with frictional engaging portions and with projections engaging positively, whereby the two members of the clutch are made to engage by friction during the first portion of such sliding movement and by projections positively during the continued sliding movement, and a shipper for operating the sliding part of the clutch, substantially as herein described.

3. The combination, with a spindle and flier, one of which is mounted to rotate relatively to the other, and a whirl, of a clutch for driving the rotary part from the whirl and having two members, one arranged to slide relatively to the other and one of which consists of laterally-yielding and spring-supported jaws, and the other of which consists of a tapering or conical spreader having a shoulder or projection at the base of the taper or conical portion, and a shipper for sliding the part which is capable of such movement, substantially as herein described.

4. The combination, with a spindle and a flier mounted to rotate one relatively to the other, and a whirl, of a clutch for driving the rotary part from the whirl and consisting of two members, one of which is laterally yielding and spring-supported and the other of which is arranged to slide, said members being constructed, substantially as described, to engage, first by friction and then positively, a brake connected with the laterally-yielding member for stopping the said rotary part when the clutch is thrown off, and a shipper for operating the sliding-clutch member, substantially as herein described.

5. The combination, with the spindle C, the fixed tube C′, surrounding the same, and the flier-hub D and its arm, of the clutch member, consisting of the laterally-yielding and spring-supported arms or jaws d^2 on the flier-hub, the whirl D^2, carrying the conical spreader d^5, provided at the base of the conical surface with a projection, d^6, and a shipper for sliding the whirl on the said fixed tube, substantially as herein described.

6. The combination, with the spindle C, the fixed tube C′, and the flier-hub D and its arm, of the laterally-yielding and spring actuated jaws d^2, the whirl carrying the spreader constructed with the conical or taper surface d^5, and with the reversed taper d^{12} and projection d^6, and a shipper for sliding the whirl and spreader, substantially as herein described.

7. The combination, with the spindle C and surrounding fixed tube C′, of the flier-hub D and its arm, the yielding and spring-actuated jaws or arms d^2 on the flier-hub and having brake pins d^{13} projecting through lateral openings in the flier-hub to make contact with the fixed tube, the conical spreader d^5, and a shipper for sliding the same between the jaws on the flier-hub, substantially as herein described.

8. The combination, in a flier, of a guide-eye, d, flanged at opposite ends, and an arm, D, consisting of a strip of thin metal slotted from one end inward, as at d', thereby forming two elastic fingers which embrace the said eye in the circumferential groove between its flanges, and which may either of them be deflected out of its normal plane to facilitate the removal or replacement of the eye, substantially as herein described.

9. The combination with the spindle C for receiving a quill or bobbin and having at opposite sides the hinged clutch-levers s^3, of the semi circular bow-spring s^4, having its ends engaged with said levers, substantially as herein described.

10. The combination, with a spindle and flier, and mechanism, substantially as described, and including a clutch for rotating one relatively to the other, of a cam and connections, substantially as described, for transmitting from the cam a traverse motion to the spindle, an oscillating knocker and a shouldered stop-finger for the spindle, and connections, substantially as described, between it and the clutch, a faller and connections, substantially as described, for holding the stop-finger away from the knocker, an arm on the spindle and a stop-rod parallel with the spindle, along which the arm works, and having shoulders or lateral projections, one serving to receive the impact of the arm on the spindle at one end of the traverse motion and when a quill or bobbin is full and the other serving to move the stop-finger into the path of the knocker, substantially as herein described.

11. The combination, with a spindle and flier, and means, substantially as described, for rotating one relatively to the other, of a cam having alternately-reversed inclines, a lever acted upon by the cam, and connections, substantially as described, whereby a traverse motion in one direction is imparted to the spindle, and a spring applied to the spindle for producing the traverse motion in the other direction and for taking up lost motion in the

said connections, substantially as herein described.

12. The combination, with a spindle and flier, and mechanism, substantially as described, and including a clutch for rotating one relatively to the other, of a cam and connections, substantially as described, for transmitting a traverse motion to the spindle, a shouldered stop-finger and connections, substantially as described, between it and the clutch, and an oscillating knocker and mechanism for operating the knocker, the fixed faller-frame J^3, the fallers J^2, pivoted therein, and the balanced frame J^4, connected with said stop-finger, substantially as herein described.

13. The combination, with the fixed faller-frame J^3 and the fallers J^2, of the pivot j^3, on which the fallers swing, and which has a laterally-projecting arm, j^4, forked at the end to embrace one side of said frame, substantially as herein described.

14. The combination, with the fixed faller-frame J^3, the balanced frame J^4, and the fallers J^2, of the wire j^6, through which motion is transmitted from the balanced frame and connected with the balanced frame by a ring or loop, substantially as herein described.

15. The combination, with the tension-bracket slotted at k, of the bolt k', passing through the slot, the cup-shaped slides k^2 on the bolt and fitted to opposite sides of the bracket, the sleeves m, surrounding the bolt and entering the cup-shaped slides, and springs on which the ends of the sleeves are seated, substantially as herein described.

16. The combination, with the tension-bracket K, having the divided bearings n, of the sleeve m^6, clamped therein and provided on opposite sides of the bracket with the laterally-extending arms m^7, provided with guides, and sleeve-guides m' at opposite ends of the sleeve m^6, and a central rod, m^8, substantially as herein described.

17. The combination, with the fixed faller-frame J^3, the balanced frame J^4, and the fallers J^2, of the tension-brackets K, slotted at k, and the guides m, and transverse bolts supporting the guides and adjustable in said slots to bring the guides above or below the free ends of the fallers, substantially as herein described.

18. The combination, with a spindle for a spool or bobbin and a brake for acting on the spool or bobbin, of a support to which the brake is pivoted, and which is adjustable around the spindle to vary the action of the brake, and a device, as screw p^3, for securing the brake-support in different positions on the spindle, substantially as herein described.

19. The combination of the spindle p, the brake-supporting bracket p^2, journaled on the spindle and secured in desired position thereon by a set-screw, and the brake p', pivoted to the bracket, substantially as herein described.

20. The combination, with spindles and fliers on opposite sides of a machine, and means, substantially as described, for rotating the spindles or fliers one relatively to the other, of two cams having a common axis and having the projections of one opposite the depressions of the other, two levers acted upon by the cams, and mechanism, substantially as described, whereby the two spindles are traversed in opposite directions simultaneously, substantially as herein specified.

21. The combination, with two spindles and fliers on opposite sides of a machine, and means, substantially as described, for rotating the fliers, of two cams, each having long and short alternating inclines and arranged on a common axis, with the inclines of one cam overlapping the inclines of the other cam, two levers, and mechanism, substantially as described, whereby the two spindles are traversed in opposite directions simultaneously, substantially as herein specified.

22. The combined worm or spur wheel and cam-wheel herein described, consisting of the circular series of worm or spur teeth f^3, and the zigzag web portion within such circular series of teeth, having on opposite sides the long inclines f^4 and short inclines f^5, arranged alternately, substantially as herein specified.

23. The combination, with a spindle and flier, and means, substantially as herein described, for rotating one relatively to the other, of a cam having upon its side a circular series of alternating long and short inclines, a lever, a polygonal bearer or block on the lever on which the cam acts, and which is composed of thin and freely-turning plates, and connections, substantially as described, for imparting a traverse motion to the spindle from said lever, substantially as herein described.

24. The combination, with a spindle and flier, and means, substantially as described, for rotating one relatively to the other, of a cam, the lever F^4, having a longitudinal slot, f^9, the slides f^{11}, having trunnions on their outer sides and fitting against opposite sides of the lever, the bolt f^{12} for clamping said slides against the lever, the forked link F^3, embracing the lever and fitting the trunnions on the slides, and other connections, substantially as described, through which and said link a traverse motion is imparted from said lever to the spindle, substantially as herein specified.

VERNON ROYLE.

Witnesses:
C. HALL,
FREDK. HAYNES.