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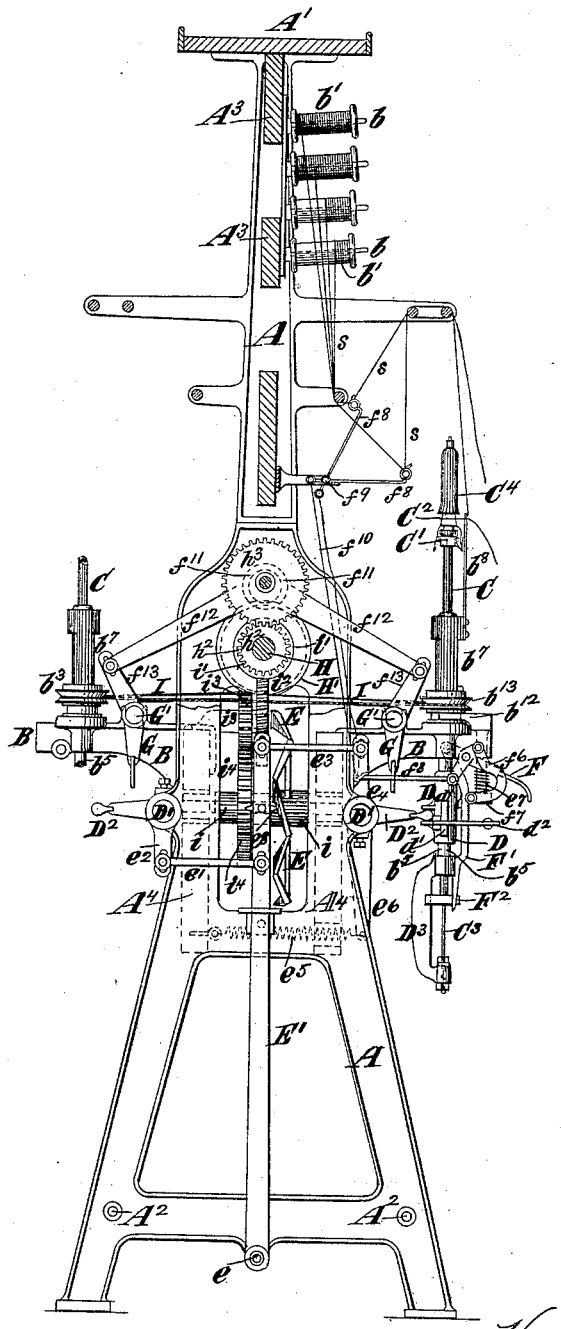
V. ROYLE.

MACHINE FOR WINDING QUILLS AND BOBBINS.

No. 385,480. Patented July 3, 1888.

Fig. 1.



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Emil Carter.

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Brown & Hale.

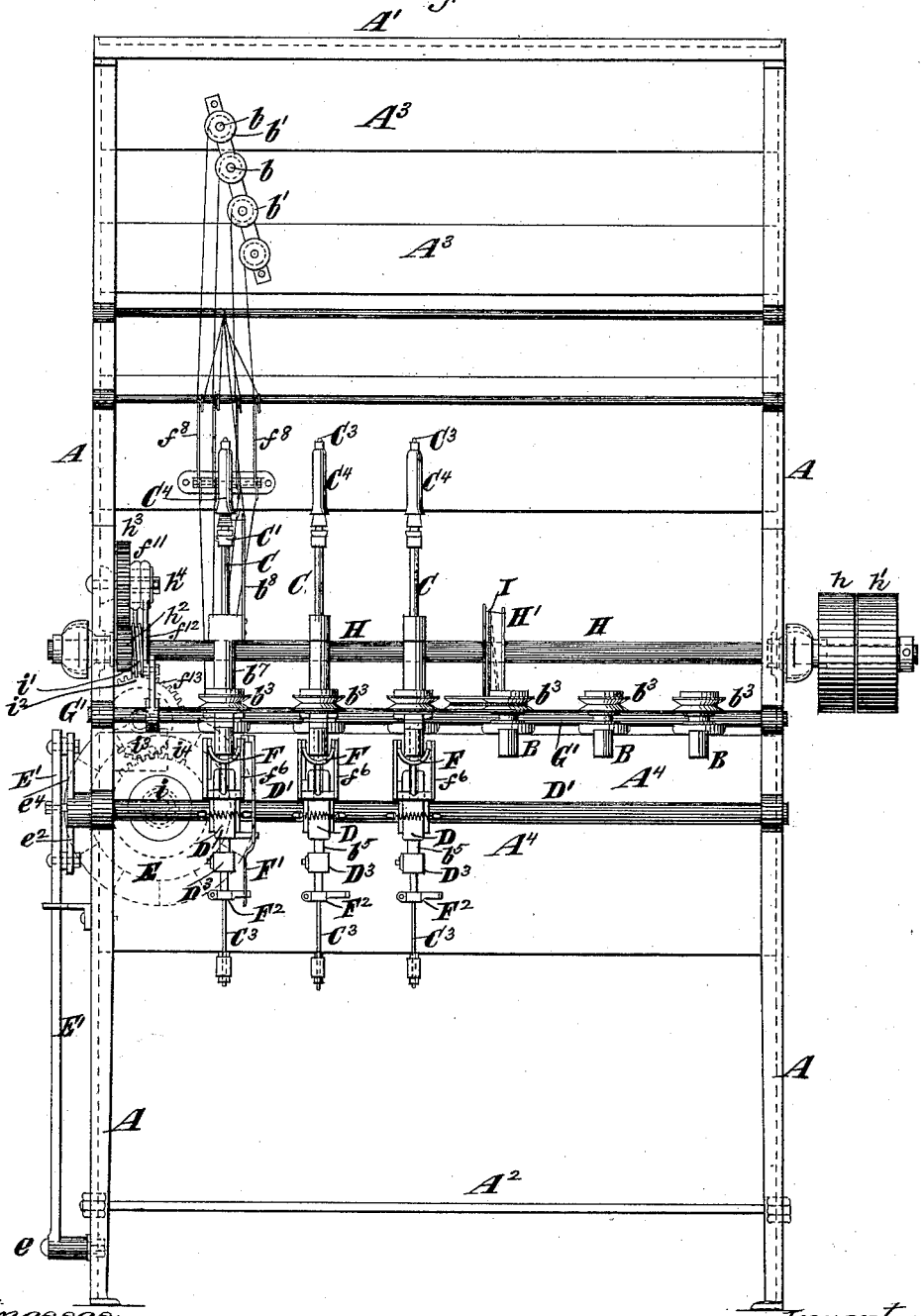
(No Model.) 6 Sheets—Sheet 2.

V. ROYLE.

MACHINE FOR WINDING QUILLS AND BOBBINS.

No. 385,480. Patented July 3, 1888.

Fig 2.



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(No Model.) 6 Sheets—Sheet 3.

V. ROYLE.

MACHINE FOR WINDING QUILLS AND BOBBINS.

No. 385,480. Patented July 3, 1888.

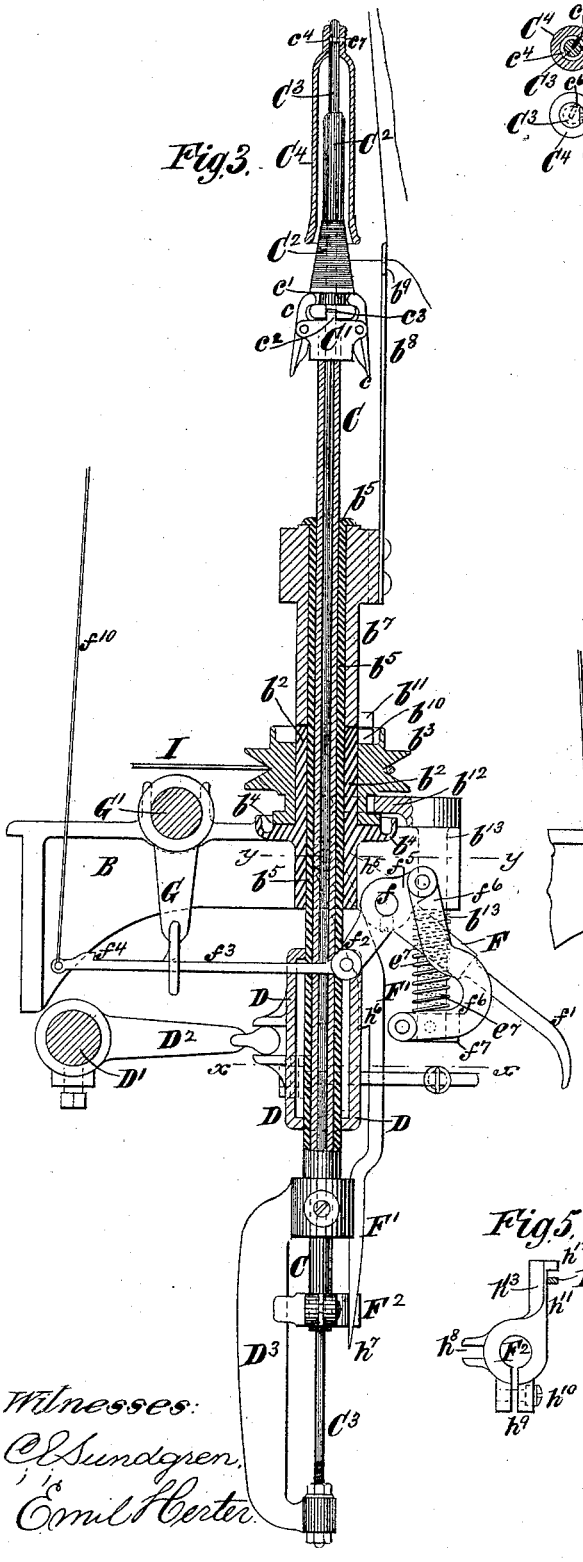

Fig. 3.

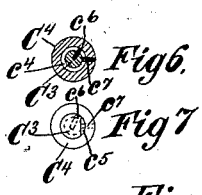

Fig. 6.

Fig. 7

Fig. 4.

Fig. 8.

Fig. 5.

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V. ROYLE.

MACHINE FOR WINDING QUILLS AND BOBBINS.

No. 385,480. Patented July 3, 1888.

Fig 8a

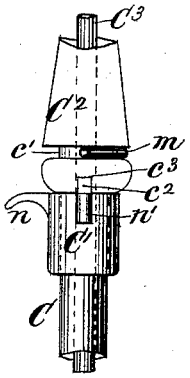


Fig 8b

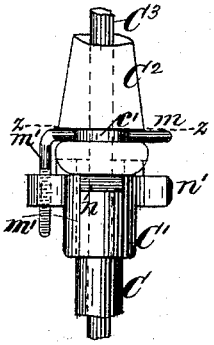


Fig 8c

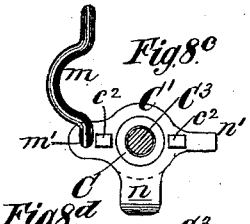


Fig 8d

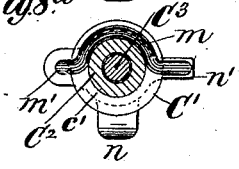


Fig. 10.

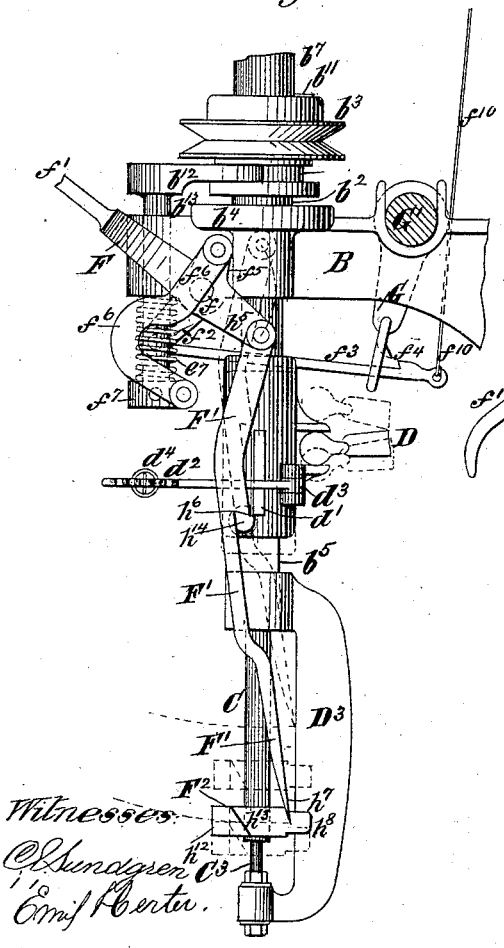
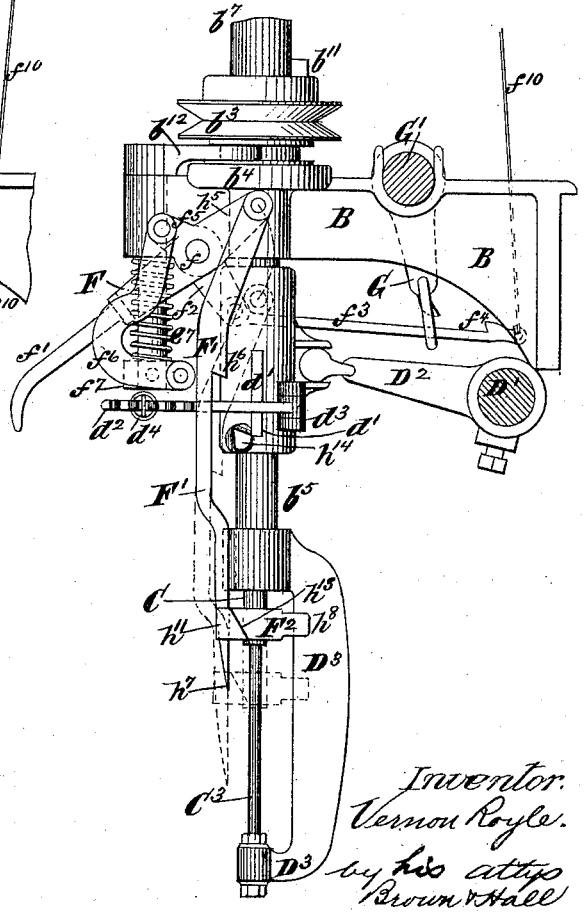


Fig. 9.



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V. ROYLE.

MACHINE FOR WINDING QUILLS AND BOBBINS.

No. 385,480. Patented July 3, 1888.

Fig. 11.

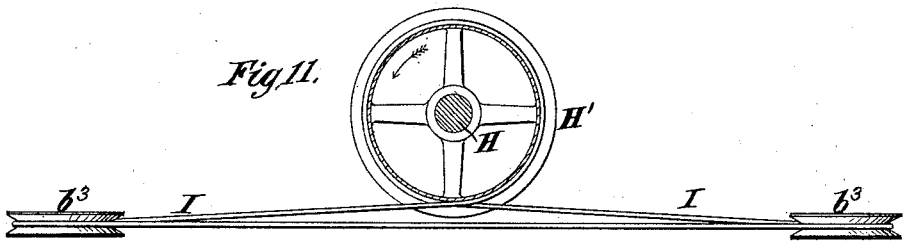


Fig. 12.

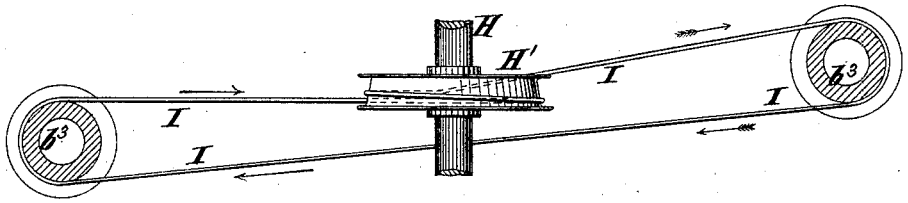


Fig. 13.

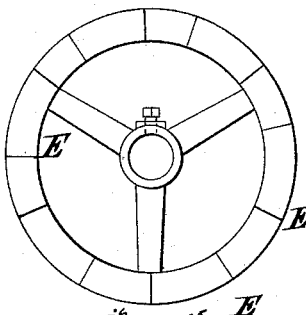


Fig. 14.

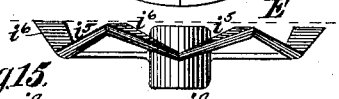


Fig. 15.

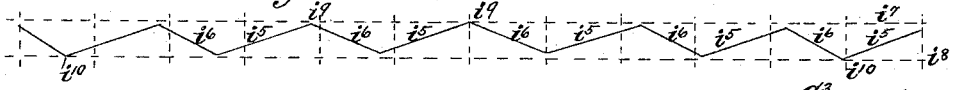


Fig. 16.

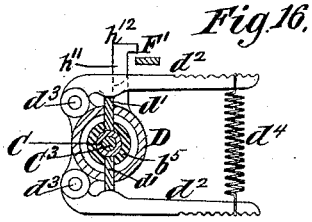


Fig. 17.

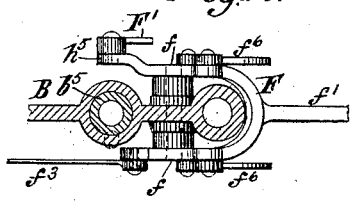
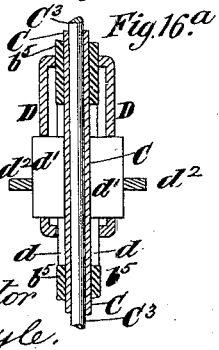


Fig. 16.a



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(No Model.) 6 Sheets—Sheet 6.

V. ROYLE.

MACHINE FOR WINDING QUILLS AND BOBBINS.

No. 385,480. Patented July 3, 1888.

Fig 22.

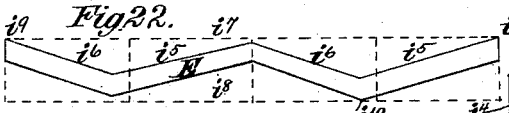


Fig 20.

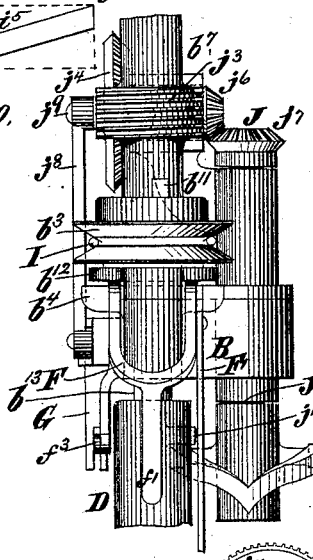


Fig 18.

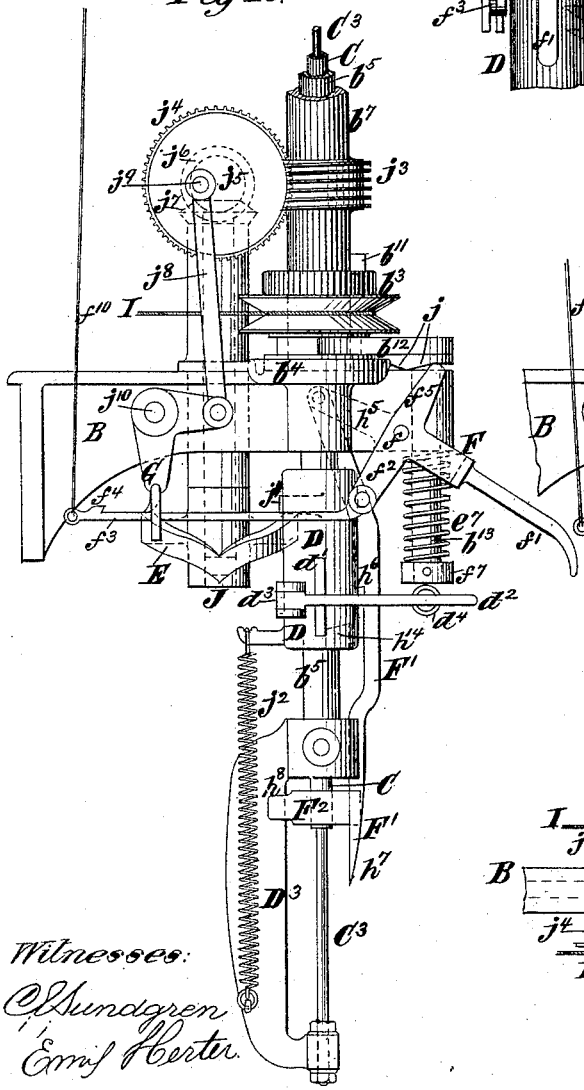


Fig 19.

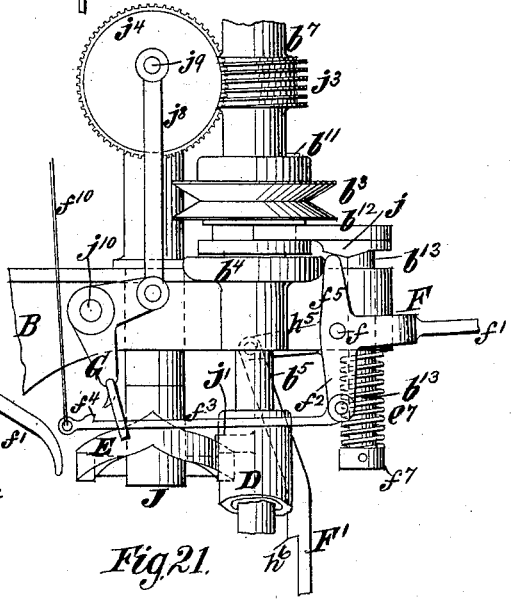
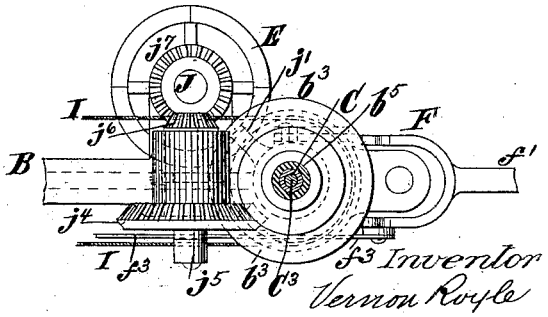


Fig 21.



Witnesses:
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Emil Hester.

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UNITED STATES PATENT OFFICE.

VERNON ROYLE, OF PATERSON, NEW JERSEY.

MACHINE FOR WINDING QUILLS AND BOBBINS.

SPECIFICATION forming part of Letters Patent No. 385,480, dated July 3, 1888.

Application filed June 25, 1886. Serial No. 206,194. (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 Quills and Bobbins, of which the following is a specification.

Although my invention, or certain features thereof, may be employed in winding quills, spools, and bobbins for various purposes, the invention as a whole is more particularly intended for winding shuttle-quills with silk, and the invention will be described as embodied in a machine for that purpose.

Shuttle-quills for silk-weaving are commonly wound in taper or conical layers with a quick traverse in one direction and a slower return traverse to bind and securely hold the silk thread in place; and as the quills are built up layer by layer it becomes necessary to change the relation of the spindle and traverse mechanism or to produce the feed of the spindle.

My invention consists in novel combinations of parts, hereinafter described, and pointed out in the claims, whereby the feed of the spindle is produced as the winding of the quill progresses, and which comprise a spindle held by frictional engagement of smooth and toothless surfaces in a clutch which has a regular and predetermined reciprocating movement and a fixed abutment at the end of the spindle, against which the body of thread on the quill or bobbin will strike at the termination of the traverse movement in one direction. As each layer is wound, the increased size or height of the body of thread on the quill or bobbin causes it to strike against the abutment, and the spindle is pushed or fed through the friction-clutch a distance corresponding to the thickness of the layer. By this means the feed automatically proportions itself to the uneven size and varying diameter of the silk thread—a result which, I believe, has not before been accomplished.

The invention also consists in novel combinations of parts, also hereinafter described, and pointed out in the claims, whereby the spindle and friction-clutch are properly guided in their reciprocating movements, and the flier, whirl, and abutment for the quill or bobbin supported in proper relative position, such combinations including a fixed tube, concentric with and outside of which are arranged the flier, whirl, and clutch, and within which is fitted the spindle; and the spindle, being tubular, receives within it a fixed central rod supporting at its end and beyond the end of the spindle a cup-shaped abutment, into which the quill or bobbin is carried by the traverse.

The invention also consists in novel combinations of parts, hereinafter described, and pointed out in the claims, whereby I provide a simple and effective stop-motion, through which the whirl will be automatically thrown off to stop the flier on the breaking of a thread or when a quill or bobbin is full, or, if desired, by hand.

In winding a quill the length of the traverse or number of turns of thread should vary both in the layers wound with quick traverse and in the layers wound with slow traverse, and the traverse should terminate at different points to give a roundness of profile alternately at the ends of the traverse. This is accomplished by necessity in winding by hand, because of the impossibility of terminating the traverse with uniform regularity in the different layers; but in automatic quilling-machines the result has not heretofore been accomplished.

The invention also consists in other novel combinations of parts including a single cam, preferably of a simple and novel construction, hereinafter described, and pointed out in the claims, whereby the quills on opposite sides of a machine are traversed in a manner to produce the results above described.

The invention also consists in novel combinations, also hereinafter described, and pointed out in the claims, in a machine which has spindles on opposite sides of the frame driven by a single band which in passing between the spindles in one direction encircles a pulley, whereby the band on the opposite spindles in the machine may, on stopping work, be slackened by simply turning the band-driving shaft a portion of a turn in a backward direction; also including a chuck of novel construction, whereby the quill may be held fast on the end of the spindle.

In the accompanying drawings, Figure 1 rep-

resents an elevation, partly in end view and partly in transverse section, of a quilling-machine embodying my invention. Fig. 2 is a side view thereof, all the spindle and other parts which are many times duplicated not being shown. Fig. 3 is a view, partly in vertical section, of one spindle and its appurtenances for traversing the spindle and stopping the whirl through a single system of stop mechanism either by hand or when the thread breaks or the quill is full, the whirl being shown as thrown off the flier. Fig. 4 is an elevation of the same parts, the whirl being in position to drive the flier, the whirl, its shipper, and a traverse rock-shaft only being in section. Fig. 5 is a plan of an adjustable stop-gage, hereinafter described. Fig. 6 is a horizontal section, and Fig. 7 is a plan, of the quill-abutment and its supporting-rod. Fig. 8 is an elevation of the upper end of the flier. Fig. 8^a is an elevation of a part of a spindle and a quill-head, showing a chuck for holding the quill to the spindle, and which is included in my invention. Fig. 8^b is an elevation in a plane at right angles to Fig. 8^a. Fig. 8^c is a plan of the chuck and spindle, showing the parts adjusted for placing a quill in place on the spindle and including a transverse section of the rod within the spindle. Fig. 8^d is a horizontal section on the plane of the dotted line $z\,z$, Fig. 8^b. Figs. 9 and 10 are partly sectional elevations of a spindle and appurtenances for traversing it and the stop-motion, showing the opposite sides of these parts from that shown in Figs. 3 and 4, but showing the parts in positions corresponding, respectively, to Figs. 3 and 4. Fig. 11 is an elevation of two whirls and a driving-pulley and band. Fig. 12 is a plan and horizontal section of the same parts. Fig. 13 is a face-view, and Fig. 14 an edge view, of the traverse-cam. Fig. 15 represents a development of the edge of said cam as it would appear if spread out in a straight plane. Fig. 16 is a horizontal section on the plane of the dotted line $x\,x$, Fig. 3. Fig. 16^a is a vertical section of a part of the spindle and its friction traversing clutch in a plane at right angles to the plane of Fig. 3. Fig. 17 is a horizontal section on the plane of the dotted line $y\,y$, Fig. 3. Fig. 18 is an elevation, somewhat similar to Fig. 4, illustrating a slight modification of my invention as to the stop-motion and traverse mechanism. Fig. 19 is an elevation of some of the parts which are shown in Fig. 18, illustrating the stop-motion in a different position. Fig. 20 is an elevation at right angles to Fig. 18 of parts shown therein. Fig. 21 is a plan of parts shown in Figs. 18, 19, and 20; and Fig. 22 illustrates the development of a traverse-cam shown in the last said figures.

Similar letters of reference designate corresponding parts in all the figures.

A designates the two upright end frames of the machine, which are united by suitable cross bars or rails, $A'\,A^2$, and by cross stretchers A^3 and A^4, which may be of wood. The cross rails or stretchers A^3 support the pins or fixed spindles b for the spools or bobbins b', from which the thread is taken for winding the quills, and the cross-rails or stretchers A^4, which are or may be of wood, support brackets B, by which the several spindles and their appurtenances are supported.

Along opposite sides of the machine are arranged two series of brackets, B, supporting two rows or tiers of spindles, and a description of one spindle and its appurtenances applies to all of them. The construction and relative arrangement of the spindle and its appurtenances are best shown in Figs. 3 to 10, inclusive, to which I shall now refer.

Each bracket B is constructed with an upwardly-projecting cylindric hub, b^2, upon which rotates freely the whirl b^3, and which is constructed to form a shoulder and adjacent oil-cup, b^4, as best shown in Fig. 3. The hub b^2 is bored out, so as to form a cylindric socket, within which an upright tube, b^5, is held in fixed position by a set-screw, b^6, as shown in Fig. 4, or by other suitable means. The fixed tube b^5 projects above the whirl b^3, and upon the upwardly-projecting portion of this tube the hub b^7 of the flier b^8 rotates freely. The upper portion of the flier b^8 is provided with an oblique slot, b^9, as shown in Fig. 8, which provides for the ready introduction of thread. The whirl b^3 is capable of rising and falling slightly upon the hub b^2, and has a clutch-connection with the flier-hub b^7. As here represented, this clutch-connection is formed by a lug or projection, b^{10}, on the whirl, which, when the whirl is raised, engages a corresponding lug or projection, b^{11}, on the flier-hub, and so transmits rotary motion to the flier. When the whirl b^3 is lowered, as shown in Fig. 3, so that its lug or projection b^{10} ranges below the lug or projection b^{11} on the flier, the flier will be stopped. The position of the whirl b^3 is controlled by a shipper, which consists of a fork, b^{12}, embracing a groove in the whirl and mounted upon an upright stem, b^{13}, which slides upward and downward in the bracket B.

C designates the spindle, which is tubular and non-rotary and which is fitted to slide freely upward and downward within the fixed tube b^5. This spindle C has upon its upper end a chuck or clutch, C', which comprises spring-actuated jaws c, adapted to engage a circumferential groove, c', in the lower end or head of a quill, C^2, and which also has a tooth or projection, c^2, for engaging a notch, c^3, in the quill-head. By this means the quill C^2 is secured upon the upper end of the spindle, so that it will rise and fall with the spindle.

If the circumferential grooves c' in all the quills employed are at uniform distances from the ends of the quills, the chuck above described will well answer the purpose; but as the quills often vary in this particular I may employ a chuck of the form shown in Figs. 8^a, 8^b, 8^c, and 8^d, to which I now refer. In those figures the spindle C has a head or chuck

body, C′, which has projections or ribs c^2 for entering notches c^3 in the head of the quill C^2, and the quill is held in place by a semicircular keeper, *m*, which may be made of wire, and has a downwardly-projecting and screw-threaded stem or shank, *m′*, adjustable in the chuck-body C′ to bring said keeper to exactly the right height for engaging the groove *c′* in the quill. The cup-shaped abutment C^4, hereinafter described, is necessarily removed each time a quill is to be placed on the spindle, and if it be desired to adjust the keeper *m* to bring it to proper position a stop-gage, F^2, which is clamped on the lower end of the spindle, as hereinafter described, may be removed, and by taking hold of a finger-piece, *n*, on the chuck-body the spindle may be raised above a stationary rod, C^5, which is within it, and the keeper adjusted, as desired. The chuck-body C also has a projection, *n′*, which serves as a rest for the thumb or fingers in springing the keeper *m* into the groove *c′* of a quill.

Within and concentric with the tubular spindle C is a fixed or stationary rod, C^5, which extends entirely through the spindle C and projects above and below the same. At its upper end, and above the spindle, the rod C^5 supports an abutment, C^4, which is here shown as of inverted-cup shape and arranged concentric with the spindle C and the quill C^2. In order to remove the quill C^2 and replace it by a fresh quill it is necessary to remove the abutment C^4, and I therefore secure the abutment detachably in place on the stationary rod C^5 by means best shown in Figs. 3, 4, 6, and 7. The upper end of the stationary rod C^5 is grooved circumferentially at c^4, and is cut away or recessed above the groove and on one side of the rod to the depth of the groove, as shown at c^5. Projecting from the rod in the line of the circumferential groove c^4 is a pin, c^6, and projecting inward from the abutment C^4 is a pin, c^7. In order to place the cup-shaped abutment C^4 upon the rod C^5, the pin c^7 is brought to the recessed side c^5 of the rod, and the abutment is then slipped down until the pin c^7 reaches the plane of the groove c^4, after which the abutment is turned slightly until the pin c^7 strikes the pin or shoulder c^6. This forms a very secure lock for holding the abutment C^4 upon the rod C^5 in such manner that it may be readily detached therefrom whenever it is desired to replace a wound quill with a fresh or unwound quill.

The cup-shaped abutment, or any other equivalent abutment against which the body of thread on the quill may strike, is intended for use in connection with a spindle which is traversed upward and downward by a clutch which is in frictional engagement with it.

D designates a clutch-sleeve or bushing, which is shown in sectional view in Figs. 3, 16, and 16ª, and which is fitted to slide freely upon the exterior of the fixed tube b^5, and engages with said tube by smooth and toothless surfaces, so as to provide for a very slight movement of the clutch upon said tube. Within the portion covered by the movement of the clutch-sleeve D the fixed tube b^5 is slotted at opposite sides, as shown best at *d* in Fig. 16ª, and sliding transversely within the opposite sides of the clutch-sleeve D are clutch-jaws *d′*, which project through the slots *d* in the fixed tube b^5 and bear with frictional contact upon opposite sides of the spindle C, as best shown in Figs. 16 and 16ª. These clutch-jaws *d′* are pressed inward by levers d^2, fulcrumed at d^3 to the clutch-sleeve D, and actuated by a spring, d^4, in order to press them with the requisite force against the spindle C. As shown in Fig. 16, the arms of the levers d^2, with which the spring d^4 engages, are notched at different points in their length, so as to provide for setting the spring to exert more or less pressure of the clutch-jaws *d′* upon the spindle C.

From the above description it will be seen that normally the reciprocating or traversing movement of the friction-clutch D will impart a like traversing movement to the spindle C, which it holds by frictional engagement, and if any unusual resistance be opposed to the upward movement of the spindle the hold of the clutch upon the spindle will yield slightly, and the clutch will complete its upward movement, while the spindle will be held down and pushed slightly through the clutch. This is exactly the office performed by the cup-shaped abutment C^4, into which the conical body of thread upon the quill enters at the termination of the traversing movement of the spindle in one direction. The thread is wound in conical layers upon the quill, and as the body of the thread is increased by a double layer at each upward and downward traverse of the spindle, the body of thread will at the end of each upward traverse strike the cup-shaped abutment C^4, and will thus push or feed the spindle slightly downward through the clutch D. This combination, with a fixed abutment above the spindle, of a traversing clutch in which the spindle is held by friction, and by which the spindle is traversed, is a very desirable arrangement, because by it the feed of the spindle will be exactly proportioned to the degree of fineness of the thread being wound.

The traversing motion of the friction-clutches D, which are on opposite sides of the machine, is produced by two rock-shafts, D′, extending lengthwise of the machine and provided with arms D^2, each engaging a clutch, D, as best shown in Fig. 3. These two rock-shafts are operated from a single cam, E, which will be particularly hereinafter described, and which acts upon a lever, E′, fulcrumed at *e*, and connected by a rod, *e′*, with an arm, e^2, extending downward from the rock-shaft D′ on one side of the machine, and by a rod, e^3, with an arm, e^4, extending upward from the rock-shaft D′ on the other side of the machine. The bearing-surfaces of this cam are in planes transverse to its axis, and the lever is operated in a plane parallel with the axis. This lever E′

is held against the cam by a spring, e^5, which is connected by an arm, e^6, upon one of the rock-shafts D′, and it will be understood that by this mechanism all the spindles C on opposite sides of the machine are traversed upward and downward in unison.

Each spindle and flier is provided with a stop-motion, whereby the whirl may be thrown off from the flier and the rotation of the flier stopped, either when the thread breaks or when a quill becomes full, or, if desired, by hand, the stoppage of the flier being accomplished through the same set of stop mechanism in either case. As I have before stated, the shipper b^{12}, controlling each whirl b^3, is upon the stem b^{13}, which slides vertically within a suitable socket in a bracket, B, and which, when not held up, is depressed or slid downward by a spring, e^7, applied to the stem b^{13}, as shown in Fig. 3. The stop-motion for each spindle comprises a stop-lever, F, which is pivoted or fulcrumed at f, and which is preferably of U shape or forked, as best shown in Fig. 17, so as to embrace the bracket B. This lever has a tail-piece, f', which serves as a handle whereby it may be moved by hand. The stop-lever F has at one side an arm, f^2, to which is pivoted or otherwise attached a rod, f^3, having a shoulder, f^4, and it also has at opposite sides arms f^5, which are connected by rods or depending links f^6 with a collar, f^7, fast upon the lower end of the shipper-stem b^{13}, and also forming a shoulder for the spring e^7 to bear against. In Fig. 3 the whirl is shown as thrown off the flier, and the shipper b^{12} is in its lowermost position. By swinging the stop-lever F upward from the position shown in Fig. 3 to the position shown in Fig. 4, the pivotal point of attachment of the rod f^6 to the lever-arm f^5 will be carried past a straight line drawn through the fulcrum f and the point of attachment of the rod or link f^6 to the stem b^{13} of the shipper, and consequently when the stop-lever is placed or set by hand in the position shown in Fig. 4 the shipper b^{12} will remain in its elevated position and maintain the whirl operative until said lever is thrown off by the breaking of the thread by a quill becoming full or by hand.

I will first describe how the lever F and the whirl b^3 are thrown off on the breaking of the thread. I have in Fig. 1, and also in Fig. 2, shown faller-wires or fallers f^8, which are pivoted at f^9, and through which the threads s are severally conducted on their way to the fliers b^8. The tail of each faller f^8, which projects on the opposite side of the pivot f^9 from the thread-eye, is connected by a cord or wire, f^{10}, with the shouldered rod f^3, pertaining to a spindle. So long as the thread remains intact the faller will be maintained in the elevated position and the shouldered rod f^3 will remain below the reach of a reciprocating or oscillating knocker, G, having a constant to-and-fro reciprocating or oscillating motion. The faller f^8, instead of acting by its weight on a balanced bar or beam on which it falls, as is usual, serves by an upward pull on the wire or cord f^{10}, when a thread breaks, to move the shouldered rod f^3 within reach of the knocker G, and at its next movement the knocker strikes the shoulder f^4, and by pulling upon the shouldered rod and the arm f^2 of the stop-lever F swings said stop-lever from the position shown in Figs. 4 and 10 to the position shown in Figs. 3 and 9, thereby releasing the shipper-fork b^{12} and permitting the spring e^7 to throw the shipper and whirl downward out of driving connection with the hub b^7 of the flier. The knocker-arms G, which pertain to the spindles on opposite sides of the machine, extend from two rock-shafts, G′, arranged on opposite sides of the machine, and these rock-shafts have motion imparted to them in this example of my invention by a single eccentric, f^{11}, which transmits motion through two rods, f^{12}, to arms f^{13}, extending upward from the rock-shafts G′, as best shown in Fig. 1.

H designates the main driving-shaft of the machine, to which motion may be imparted by a belt running over fast and loose pulleys h h', and which, by means of a pinion, h^2, and a wheel, h^3, transmits rotary motion to the eccentric f^{11}. The wheel h^3 and the eccentric f^{11} may be formed in the same piece or connected to rotate as one, and they turn upon a stud, h^4, projecting inward from the end frame, A, of the machine, as shown in Fig. 2. The rock-shaft G′ and the knocker-arms G are reciprocated or oscillated constantly and without effect until such time as a thread breaks and one of the shouldered rods f^3 is lifted within reach of the knocker-arm G, whereupon the flier of a corresponding spindle is stopped until the break is repaired and the stop-lever F reset.

The throwing off of the whirl b^3 when a quill becomes full is effected by mechanism which I will now describe, and which acts through the same pivoted stop-lever, F. At one side the pivoted stop-lever F is prolonged to form an arm, h^5, from which depends a rod, F′, provided with a shoulder, h^6, and having, preferably, a pointed extremity, h^7. To the lower end of the fixed tube b^5 is secured a yoke or hanger, D^3, which serves to support the inner stationary rod, C^3, on which the spindle C slides, and which also serves to guide and prevent the turning of the stop-gage F^2, which is adjustably secured to the lower end of the spindle C. This stop-gage F^2 has a fork or notch, h^8, (best shown in Fig. 5,) whereby it is guided upon the yoke or hanger D^3, and it is divided or split at h^9, so that by means of a clamping or binding screw, h^{10}, it may be tightly clamped upon the lower end of the spindle C. The stop-gage F^2 has a laterally-projecting arm, h^{11}, against which the depending rod F′ rests, and at the end of that arm is a lip or shoulder, h^{12}, which prevents the rod F′ from slipping off laterally beyond the end of said arm h^{11}. The back of the arm h^{11} is beveled from its upper edge downward and rearward, as shown at h^{13} in Fig. 5, and this beveled back of said

arm combines with the pointed extremity of the depending rod F′ in a way soon to be described. The clutch-sleeve D has a lateral projection, spur, or pin, h^{14}, which is best shown in Figs. 9 and 10, and which as the clutch moves upward will strike against the shoulder h^6 of the depending rod F′, if such shoulder is within range of the path traveled by said projection or pin. The bearing which is afforded by the arm h^{11} of the stop-gage to the depending rod F′ prevents said rod from swinging inward to bring its shoulder h^6 in the path of the projection h^{14} so long as the stop-gage F^2 does not travel below the point of the rod F′. I have before described that as the winding progresses the spindle, and therefore the stop-gage F^2, are pushed downward step by step through the friction-clutch D by the action of the quill on the fixed abutment C^4, and the parts are so adjusted for operation that when a quill is full the adjustable stop-gage F^2 will at the lower termination of the traverse of the spindle just clear the point of the depending rod F′. When this occurs, the rod, being offset slightly at its upper portion, as shown best in Figs. 9 and 10, will swing inward sufficiently to carry its shoulder h^6 within range of the stop projection h^{14} on the friction-clutch D, and at the next upward movement of the friction-clutch said projection, acting upon the shoulder of the rod F′, will push the rod upward and swing the stop-lever F from the position shown in Figs. 4 and 10 to the position shown in Figs. 3 and 9, thereby permitting the spring e^7 to throw down the shipper b^{12} and to throw off the whirl b^3 from the flier. It is advantageous to have the back of the arm h^{11} formed with an incline, h^{13}, so that in case the rod F′ does not swing inward sufficiently to bring its shoulder h^6 within range of the stop projection h^{14} the inclined arm will, at the next upward movement of the spindle, act upon the extremity of the rod F′ to force it inward to bring its shoulder h^6 within range of the stop projection h^{14}.

The stop-motion which I have above described, and which operates under the three conditions named, is not likely to get out of order, is comparatively simple, and is certain in its operation.

As best shown in Fig. 3, the lower end of the rod C^5 is threaded and adjustably secured by nuts in the yoke or hanger D^3. This adjustment provides for varying the height of the abutment C^4 to suit variations in the conical portions of the different quills.

I will now describe the cam E, premising that this cam or any other single cam capable of producing like results and comprising like elements constitutes an important feature of my invention. The cam, E, here shown, and which serves to impart traverse to all the spindles on both sides of the machine, is a face-cam operating upon a knife-edged piece or projection, e^8, upon the lever E′. This cam is upon a cross-shaft, i, which receives motion through a worm and worm-wheel, i' i^2, and pinions or toothed wheels i^3 i^4 from the main shaft H. The bearing-surface of the cam presents a succession of long and short inclines, i^5 i^6, which are arranged alternately on the circumference of the cam and which are oblique to the plane of rotation of the cam. Neither the long inclines nor the short inclines are of uniform length, but vary each among themselves or respectively to each other, as clearly seen by the dotted lines in Fig. 15, which are uniformly spaced. These inclines throughout their series or succession are arranged alternately, so as to produce alternately the quick and slow traverse required in winding quills, the short inclines corresponding to the quick traverse and the longer inclines corresponding to the slow traverse. Because of its peculiarity of construction the cam E not only produces alternately a quick and a slow traverse, but the number of turns of thread in the several layers wound with quick traverse will vary, as will also the number of turns in the layers wound with slow traverse. The cam also is constructed so as to terminate the traverse at different points at the top and bottom of the layers of thread upon the quill, and so acts to produce a convex profile at the lower termination of the conical winding, thereby tightening the thread of one layer upon another and holding the thread securely, with its long and short traverse preserved. This latter effect is produced by terminating the inclines i^5 i^6 of the cam in different planes or paths, as is best understood from the diagram Fig. 15. These inclines i^5 i^6, although they terminate their throw in different planes or paths, have a substantially uniform extent of throw. In Fig. 15 the two dotted lines i^7 i^8 indicate the extreme points of travel reached by any of the inclines. It will here be seen that while certain of the inclines terminate upon the dotted line i^7, as shown at i^9, such inclines at their opposite ends fall considerably short of the dotted line i^8, and in like manner those inclines which terminate at the dotted line i^8, as at i^{10}, fall considerably short at opposite ends of the line i^7. This drunkenness of the cam serves to terminate the traverse in the different layers of the quill at different points, and accomplishes in a very simple way what has before required much more complicated mechanism.

I will now describe how the whirls b^3 in the two rows at opposite sides of the machine are driven, the arrangement of a driving-band relatively to a driving-pulley and two whirls at opposite sides of the machine being best shown in Figs. 11 and 12. Upon the main driving-shaft H are flanged driving-pulleys H′, corresponding in number to the whirls on one side of the machine, and each band I is of a length to encircle two whirls, b^3, on opposite sides of the machine, and to also encircle in its travel between the whirls in one direction the driving-pulley H′. The whirls b^3, which are driven by the band I, are offset in opposite directions laterally from the plane of

the driving-pulley H', as shown in Fig. 12, in order to prevent the portion of band running onto the driving-pulley from interfering with the portion of band running off from or leaving the driving-pulley. In order to prevent these portions of the band from interfering with that portion running directly between the whirls b^3, the driving-pulley H' is raised slightly above the level of the whirls. To still further prevent the portion of band running onto the driving-pulley H' from interfering with the portion of band leaving said pulley, the face of the pulley is slightly conical, as shown in Fig. 12, and by turning the driving-shaft H a portion of a turn backward the band will be run down onto the smaller side of the driving-pulley H' and thereby slackened. In the use of quilling-machines the bands are often thrown off when stopping the machine in order that they shall not be strained by being left under tension; but when conical driving-pulleys H' are employed the same result of slackening the bands is secured by turning the shaft H and driving-pulleys backward a trifle and without throwing off the bands from their pulleys.

In Figs. 18 to 22 I have shown a modification of my invention in which an independent traverse-cam is employed for each spindle and in which each spindle has an independently-operated reciprocating or oscillating knocker-arm, G. In these figures, also, I have illustrated a very slight modification of the stop-motion, which consists, simply, in dispensing with the rods or links f^6, before described, and providing on the shipper b^{12} a reverse incline, j, upon which the arm f^5 of the stop-lever F acts to lift the shipper in order to throw in the whirl b^3. In Fig. 18 the stop-motion is shown in the position which it occupies when the whirl is thrown off the flier, and in Fig. 19 the parts are shown in the position which they occupy when the whirl is raised and is operative to drive the flier. In order to set the whirl for work, the lever F is raised into the position shown in Fig. 19, and as its arm passes the apex of the double inclines j said lever will be held against accidental falling and will hold the shipper and whirl in their elevated position. A pull upon the shouldered rod f^3 will, however, swing the lever F into the position shown in Fig. 18 and permit the spring e^7 to throw off the whirl. In this modification of my invention the traverse-cam E is upon an upright shaft, J, which has a suitable bearing provided on the bracket B, and this cam engages a lateral projection, j', on the friction-clutch D, which reciprocates or traverses the spindle C. This cam therefore acts only to give the traverse movement in one direction, and the friction-clutch D and spindle are returned or pulled downward by a spring, j^2, as shown in Fig. 18. In this example of the invention the hub b^7 of the flier is provided with a worm or screw, j^3, which engages a bevel-wheel, j^4, upon a cross-shaft, j^5, and this cross-shaft, by bevel-wheels j^6 j^7, transmits motion to the upright shaft J, on which is the traverse-cam E. The cross-shaft j^5 here serves to reciprocate or oscillate the knocker-arm G through a rod, j^8, worked from a crank-pin, j^9, in the bevel-wheel j^4, and in this case the rocker-arm G is formed by a bell-crank lever pivoted at j^{10}.

From the diagram, Fig. 22, it will be seen that the cam E is constructed like that before described, which is employed to operate all the spindles, in that it has the long and short inclines i^5 i^6, and in that the inclines terminate in different paths or planes of rotation.

The dotted lines i^7 i^8 represent the extremes of throw of the inclines i^5 i^6 in opposite directions, and where the inclines terminate nearest the dotted line i^7 they fall farthest short of the dotted line i^8, and vice versa.

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

1. The combination, with a non-rotary spindle to receive a quill or bobbin and a rotary flier for laying the thread upon the quill or bobbin, of a clutch wherein the spindle is held by frictional contact of substantially smooth and toothless surfaces, mechanism, substantially as described, for imparting to the clutch a definite length of traverse motion, and a stationary abutment supported independently of and concentric with the spindle, and against which the body of thread on the quill or bobbin will strike at the termination of each traverse movement in one direction, and by which the spindle and quill or bobbin will be fed lengthwise, substantially as herein set forth.

2. The combination, with a tubular spindle to receive a quill or bobbin, of a clutch wherein the spindle is held by friction, mechanism, substantially as described, for traversing the clutch, a stationary rod within and projecting beyond the spindle, and an abutment supported by said rod and against which the body of thread on the quill or bobbin will strike at the termination of the traversing movement of the spindle in one direction, substantially as and for the purpose herein set forth.

3. The combination, with a bracket or frame portion constructed with a cylindric socket, of a slotted tube fixed therein, a spindle to receive a quill or bobbin arranged within the fixed tube, a rotary flier and its driving-whirl external to and concentric with the fixed tube, and a friction-clutch sliding on the exterior of the fixed tube and having jaws grasping the spindle through the slots in said tube, and mechanism, substantially as described, for traversing the clutch, substantially as herein set forth.

4. The combination, with a bracket or frame portion, B, constructed with a cylindric socket or hub, of a tube, b^5, fixed therein, a spindle to receive a quill or bobbin arranged within the fixed tube, the flier b^7, journaled on the fixed tube above the cylindric hub, and the whirl b^3, journaled on the hub and having a clutch-connection with the flier, and mechanism, substantially as described, for traversing

the spindle within the fixed tube, substantially as herein set forth.

5. The combination, with a bracket or frame portion constructed with a cylindric socket and hub, of a tube fixed therein, a spindle concentric within the fixed tube and to receive a quill or bobbin, a flier journaled on the fixed tube beyond the cylindric hub, a whirl journaled on the hub and having a clutch-connection with the flier, a clutch wherein the spindle is held by friction, mechanism, substantially as described, for traversing the clutch, and an abutment against which the body of thread on the quill or bobbin will strike at the termination of the traverse movement in one direction, substantially as and for the purpose herein set forth.

6. The combination, with the clutch body or sleeve D, the jaws d', sliding transversely therein, the pivoted levers d^2, bearing on said jaws, and a spring connecting the levers, of a spindle held in the body or sleeve by the frictional contact of the said jaws with the spindle, substantially as herein described.

7. The combination, with the clutch body or sleeve D and its sliding jaws d', the levers d^2, provided each with a series of notches and bearing on said jaws, and a spring, d^4, connecting the levers and adjustable along their notched edges to vary the pressure of the jaws, of a spindle held in the body or sleeve by the frictional contact of said jaws with the spindle, substantially as herein described.

8. The combination, with a spindle and rotary flier and a whirl having a clutch-connection with the flier, of a movable shipper controlling the whirl, a pivoted lever, and a rod or link whereby the shipper will be sustained in position to make the whirl operative when the lever is set, a reciprocating knocker, and mechanism, substantially as described, for operating it, a shouldered rod connected with said lever, and a faller and faller-connection, through which said shouldered rod will be moved into the path of said reciprocating knocker on the breaking of a thread, substantially as and for the purpose herein set forth.

9. The combination, with a spindle and rotary flier, a whirl having a clutch-connection with the flier, and a movable shipper for controlling the whirl, of a pivoted stop-lever having an arm-and-rod connection, through which the shipper and whirl are held up when the point of connection of said arm and rod is made to pass the pivotal point of the lever by setting the lever, a reciprocating knocker, and mechanism, substantially as described, for operating it, a faller and faller-connection, and a shouldered rod connected with said stop-lever, and which, by the movement of the faller consequent on the breaking of a thread, will be moved into the path of said reciprocating knocker, substantially as herein set forth.

10. The combination, with a spindle, a rotary flier, a whirl having a clutch-connection with the flier, a shipper controlling the whirl, and a spring for moving the shipper to throw off the whirl, of the stop-lever F, fulcrumed at f and provided with the arms f^5 f^2, the rod f^6, connecting the arm f^5 and the shipper, the shouldered rod f^3, connected with the arm f^2, a faller and faller-connection for moving said rod f^3, and the reciprocating knocker G and mechanism, substantially as described, for operating it, substantially as and for the purpose herein set forth.

11. The combination, with a spindle and mechanism, substantially as described, for traversing it lengthwise and for imparting a feed thereto, and having a stop projection or shoulder, as h^{11}, of a rotary flier, a whirl having a clutch-connection with the flier, stop mechanism, substantially as described, for throwing off the whirl on the breaking of a thread, and having a stop-lever, as F, the shouldered rod F', depending from said stop-lever, and a stop-gage moving with the spindle and by which said rod is held out of the path of the stop projection or shoulder h^{11} until allowed to escape by the stop-gage clearing its lower end, substantially as herein set forth.

12. The combination, with a spindle to receive a quill or bobbin, a clutch wherein the spindle is held by friction, and which has a projection, h^{14}, mechanism, substantially as described, for traversing the clutch, and an abutment at the top of the spindle against which the body of thread on the quill or bobbin may strike to produce downward feed of the spindle, of a rotary flier and a whirl having a clutch-connection therewith, a shipper for controlling the whirl, and stop mechanism, substantially as described, for throwing off the whirl on the breaking of a thread, and having a pivoted stop-lever, as F, a shouldered rod depending from said lever F, and an adjustable stop-gage carried by the spindle and by which the said shouldered rod is held out of the path of the projection h^{14} until the gage clears the lower end of said shouldered rod, substantially as and for the purpose herein set forth.

13. The combination, with the bracket B and the tube b^5, fixed therein and carrying at its lower end the yoke and stop gage guide D^5, the spindle C, sliding within said tube b^5, the rod C^3, concentric with the spindle and supported by said yoke D^3, the friction-clutch D, provided with the stop projection h^{14}, mechanism, substantially as described, for reciprocating said clutch, and an abutment for a quill or bobbin above the spindle, of a rotary flier and a whirl having a clutch-connection therewith, a shipper for controlling the whirl, and stop mechanism, substantially as described, for throwing off the whirl on the breaking of a thread, and having a pivoted stop-lever, as F, the shouldered rod F', depending from the stop-lever F, and the stop-gage F^2, carried by the spindle, substantially as and for the purpose herein set forth.

14. The combination, with a spindle and flier and mechanism, substantially as described, and including a clutch for rotating

one relatively to the other and for reciprocating the spindle, of a shipper for the clutch, a lever, F, and rod-connections between it and the shipper, the shouldered stop-rod F′, and the stop-gage F^2, having an arm, h^{11}, beveled at the back from its top downward, substantially as and for the purpose herein set forth.

15. The combination, with a spindle, its flier, and a flier-driving whirl, of stop mechanism, substantially as described, whereby the whirl is thrown off to stop the flier, and a faller pivoted between its ends and having on one side of its pivot a thread-eye and on the other side a faller-connection, f^{10}, through which the stop-motion is made operative to throw off the whirl, substantially as herein set forth.

16. The combination, with a spindle to receive a quill or bobbin, of a traverse-cam having a succession of long inclines and short inclines arranged alternately for producing slow and quick traverse, said long inclines being of different lengths relatively to each other, and said short inclines also being of different lengths relatively to each other, and traverse mechanism, substantially as described, through which said cam traverses the spindle, substantially as and for the purpose herein set forth.

17. The combination, with a spindle to receive a quill or bobbin, of a traverse-cam having a succession of long inclines and short inclines arranged alternately for producing slow and quick traverse, the said inclines having substantially uniform throw or projection, but terminating in different paths, and traversing mechanism, substantially as described, through which said cam traverses the spindle, substantially as and for the purpose herein described.

18. The combination, with a spindle to receive a quill or bobbin, of a rotary face-cam having a succession of long inclines and short inclines arranged alternately for producing slow and quick traverse, said long inclines being of different lengths relatively to each other, and said short inclines also being of different lengths relatively to each other, and traversing mechanism, substantially as described, through which said cam traverses the spindle, substantially as and for the purpose herein set forth.

19. The combination, with the two rows of spindles G on opposite sides of the machine and friction-clutches receiving the spindles through them, of the rock-shafts D′, provided, respectively, with arms e^2 e^4, which extend in opposite directions, and with other arms, D^2, engaging said clutches, a single traverse-cam, E, and a lever, E′, connected with the rock-shaft arms e^2 e^4, and on which said cam acts, substantially as herein described.

20. The combination, with spindles and whirls on opposite sides of a machine, of a conical driving-pulley, H′, and a single driving-band, I, for both whirls, substantially as and for the purpose herein described.

21. The combination, with a spindle, of a chuck-body thereon for receiving a quill, and a keeper, m, for engaging the groove in a quill, and having a screw-threaded shank or stem, m', whereby it is adjustably connected with the chuck-body, substantially as herein described.

VERNON ROYLE.

Witnesses:
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