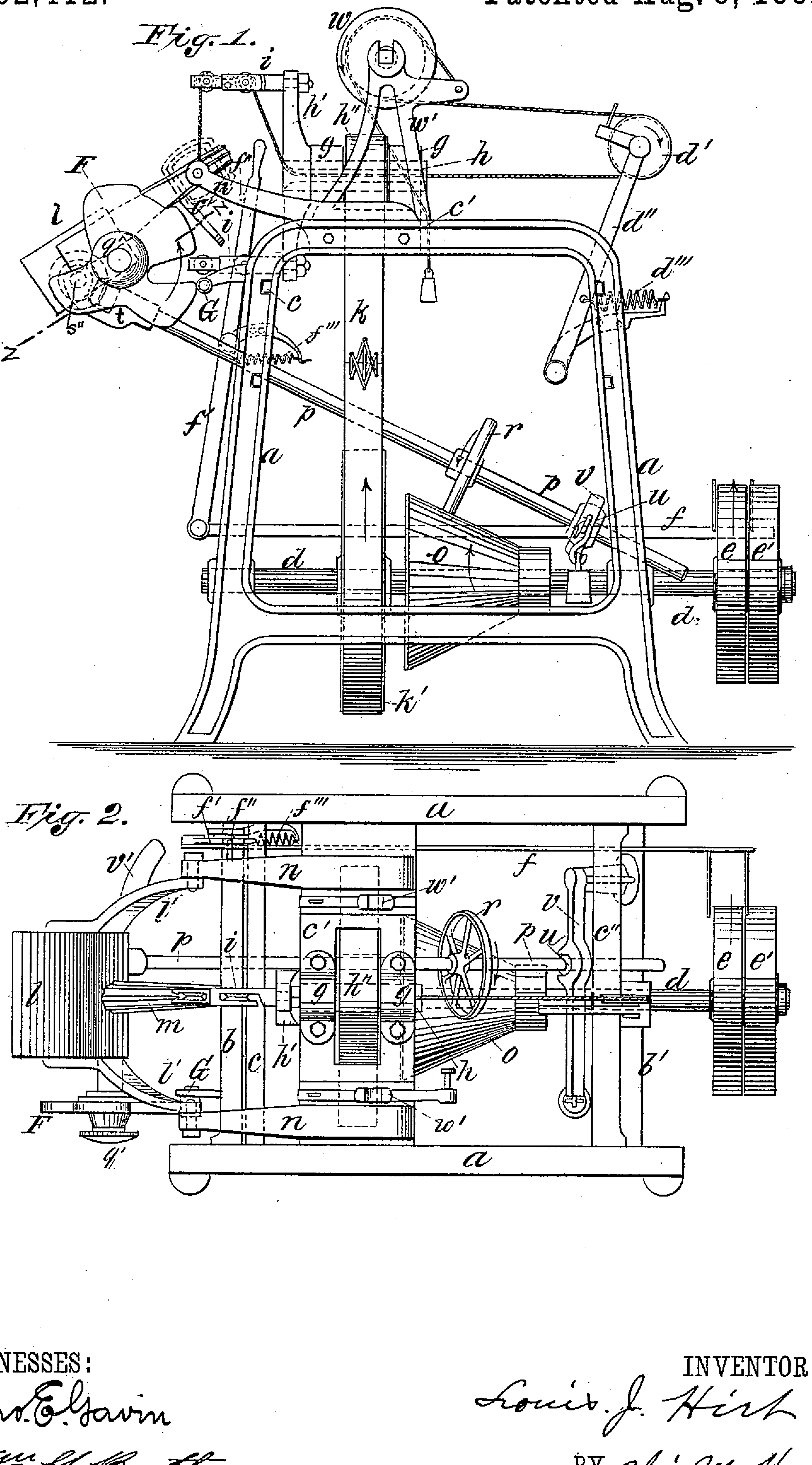
(No Model.) 2 Sheets—Sheet 1.

L. J. HIRT.

TWINE BALLING MACHINE.

No. 262,412. Patented Aug. 8, 1882.



WITNESSES:

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Fig. 3.

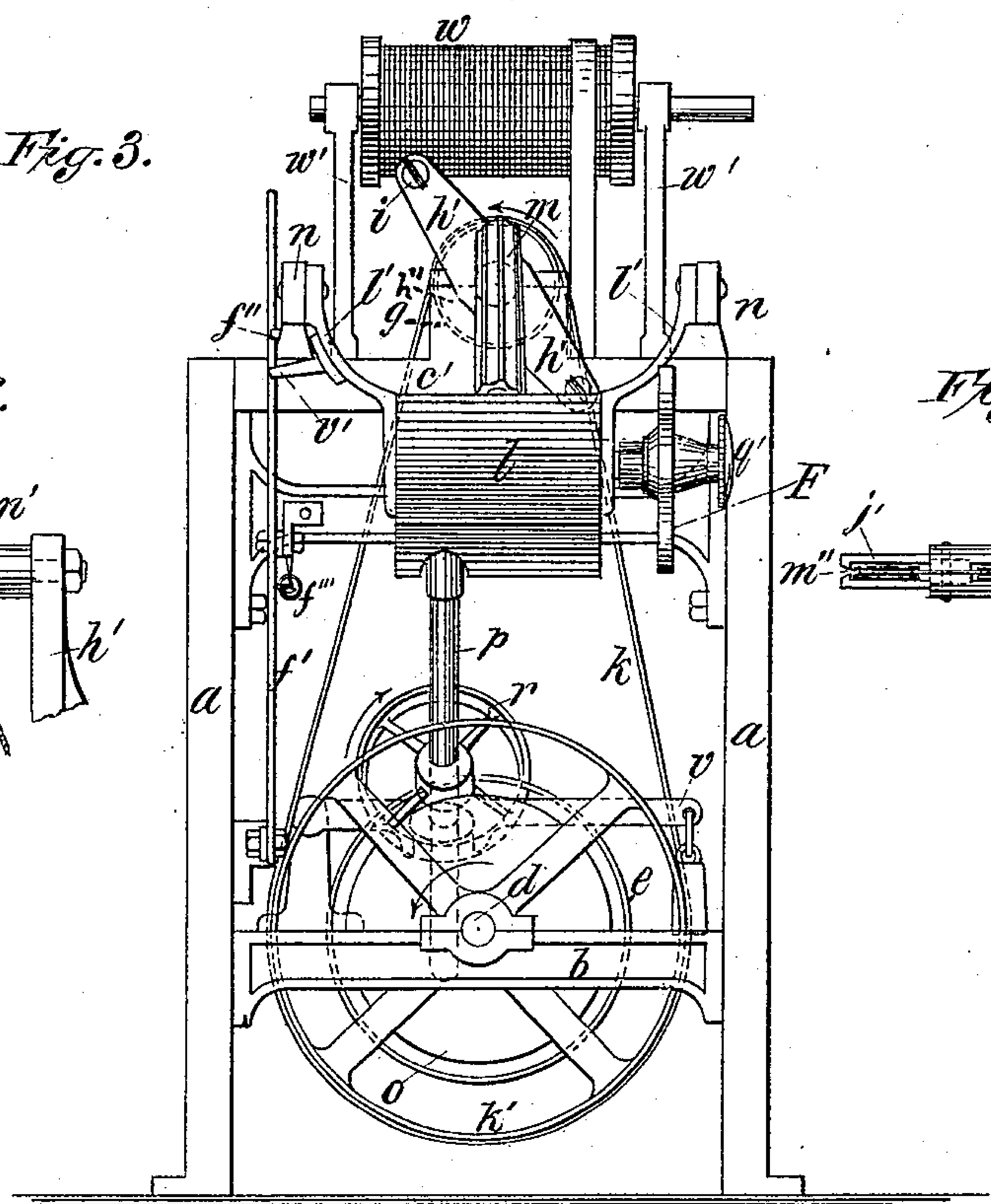


Fig. 6.

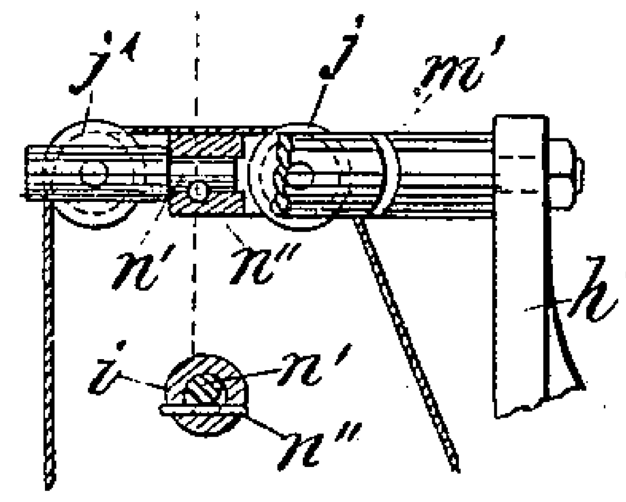


Fig. 7.

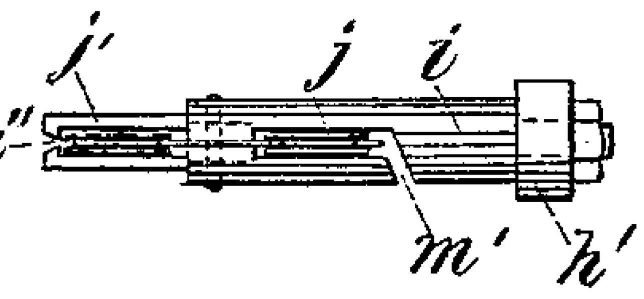


Fig. 4.

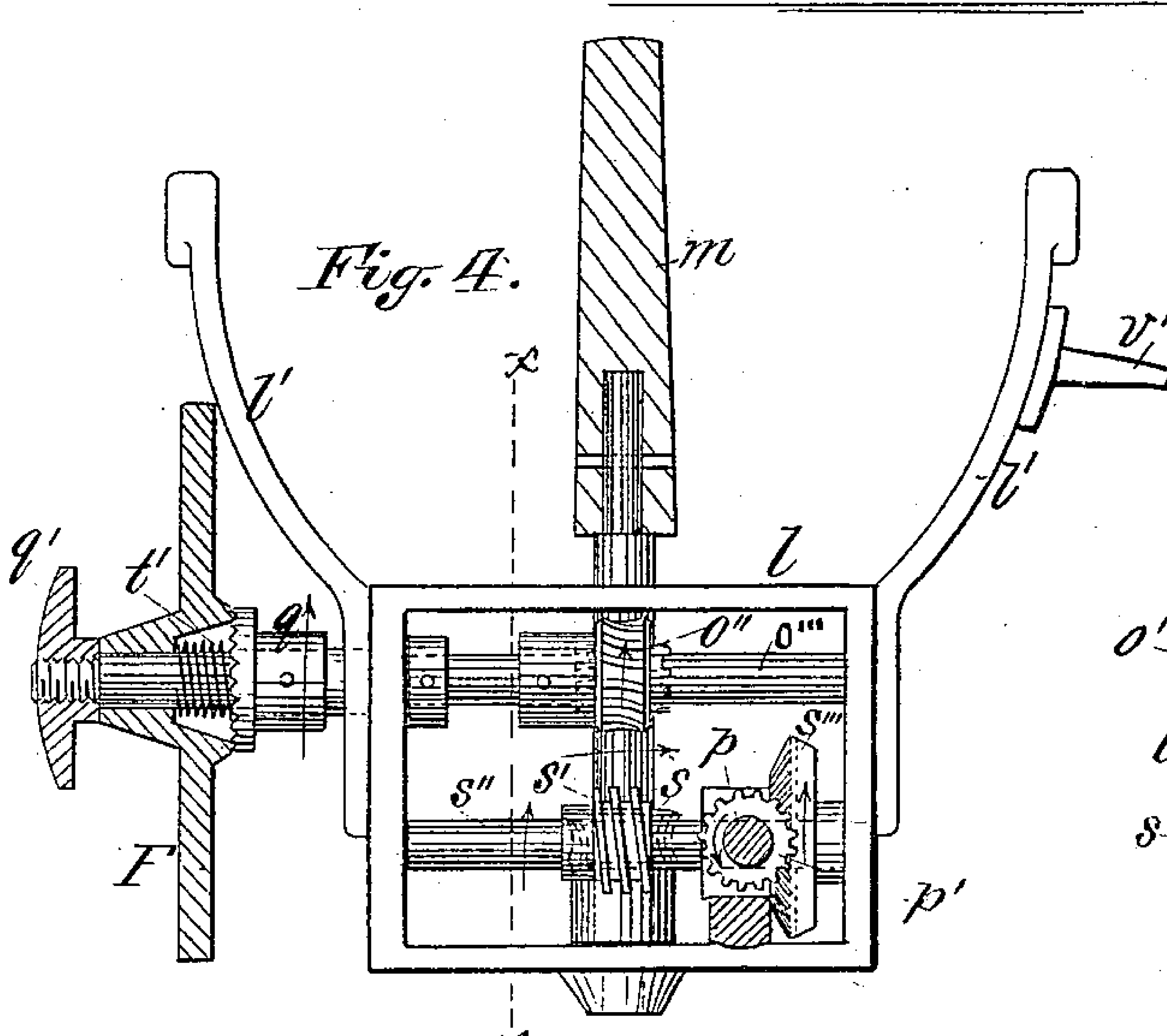
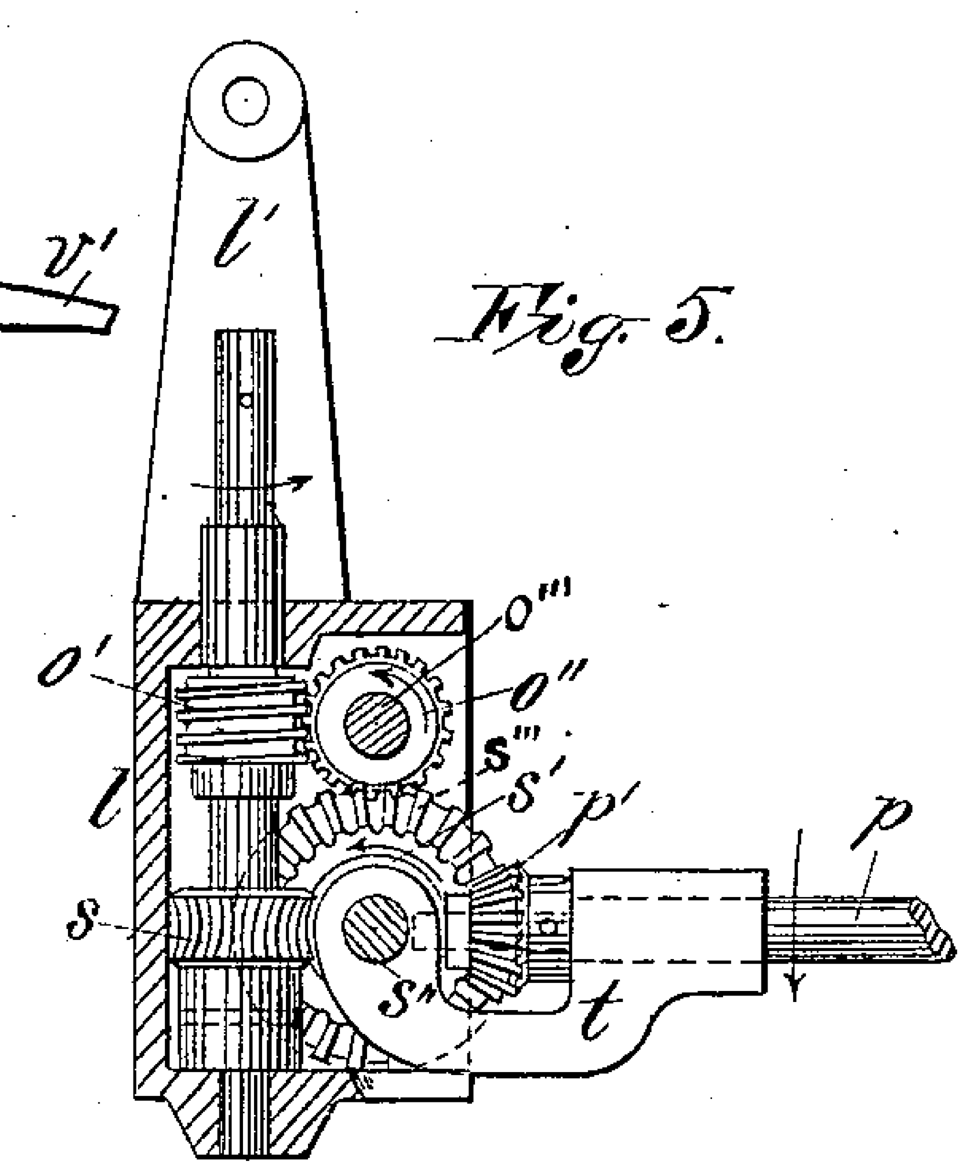


Fig. 5.



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UNITED STATES PATENT OFFICE.

LOUIS J. HIRT, OF BROOKLYN, ASSIGNOR TO McLAUGHLIN & LOYD, OF NEW YORK, N. Y.

TWINE-BALLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 262,412, dated August 8, 1882.

Application filed August 2, 1881. (No model.)

To all whom it may concern:

Be it known that I, LOUIS J. HIRT, of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Twine-Balling Machines, of which the following is a specification.

Twines and cords of various sizes, as is well known, are commonly wound in balls of a definite size and weight and of a proximately cylindrical shape, with flat or crowning ends, the windings being laid in the well-known diagonal and concentric courses around the circumference. Lately the extensive employment of automatic binding devices in connection with harvesting-machines, in the great agricultural sections, which now use a strong rough twine to bind the sheaf in lieu of the wire heretofore employed, has called for a large supply of binding-twine. This binding-twine, to suit the automatic machinery, requires to be wound in unusually large balls, and in a very compact and regular manner, providing as nearly as possible a continuous cord without knots or irregularities, and it is this requirement which has chiefly stimulated the invention of my present improved machine, by which a much more perfect and firm ball is produced, and in a more rapid and economical manner, being at the same time equally adapted for balling all kinds of twine or cords.

The ordinary balling-machine employs, as is well known, a hollow rotating spindle, through which the cord is drawn from the reel, and, being threaded through projecting arms on the spindle, termed the "fly," is thence wound on a corrugated spindle by the rotation of the fly thereabout. The corrugated spindle forms of course the temporary axis of the ball, and it is so inclined to the wind of the thread from the fly, and at the same time slowly revolved before the fly, that the windings lie diagonally or in a steep spiral around the same in the well-known manner. As the winding continues and the ball increases in size the inclination of the ball-spindle is changed or decreased at certain stages by hand, so as to have the windings lie approximately in the proper manner, and of course as the ball increases in size the rotary motion of the ball-spindle decreases correspondingly, so as to have the strands lie as close in the outer layer as in the inner layers of the ball, or nearly so. Hence in the ordinary balling-machine the ball-spindle is mounted in a swinging head or frame hinged to the main frame in front of the flies, and inclosing gearing which meshes with the ball-spindle and is driven by a sliding shaft projecting from the swinging head, and carrying at its end a friction-wheel, which, according as the swinging head inclines in or out, moves radially to or from the center of a driving friction-disk, so as to correspondingly reduce the rotary speed of the ball-spindle as its inclination decreases and the size of the ball increases. In my improved machine I employ a similar hollow rotating spindle and fly-arms, and an inclining rotating ball-spindle mounted in a swinging head; but this swinging head is inclined in an accurate automatic manner and at the proper periods and speeds by a cam, and the sliding gear-shaft, which drives the ball-spindle and carries the friction-wheel, rides to or fro upon a friction-cone, whereby a much more perfect motion of the ball-spindle and a more compact and perfect ball is produced.

My improvement consists partly in the devices here outlined and partly in certain other details of construction, as hereinafter fully set forth.

Figure 1 of the annexed drawings gives a side elevation of my improved machine; Fig. 2, a plan view, and Fig. 3 a front elevation, thereof. Fig. 4 is a partly-sectional elevation, on line *z z*, Fig. 1, on a larger scale, of the swinging head carrying the ball-spindle, shown detached from the machine and viewed from the rear or inside. Fig. 5 is a vertical section of the same on line *x x* of Fig. 4, the corrugated ball-spindle being removed. Figs. 6 and 7 represent respectively a side and top view of one of the fly-arms through which the twine is threaded, illustrating my construction thereof.

The frame of the machine consists of two side frames, *a a*, made in a light open shape, similar to a wide capital A, and joined by suitable cross-braces, *b b′* and *c c′ c″*. The lower cross-braces, *b b′*, are provided midway with journal-boxes, in which the main driving-shaft *d* is mounted, and on the projecting end thereof, at the rear side of the machine, are attached the fast and loose pulleys *e e′*, on which the driving-belt is applied, while the belt-shipper *f*, operated by the lever *f′*, enables the belt to be shifted from one to the other to start or stop the machine in the ordinary manner. On the middle of the upper cross-bar, c′, bearings g g are formed, in which the hollow winding-spindle h is free to revolve, and on the front end of this spindle is fixed the fly-head h′, from which the fly-arms i project. On the middle of the spindle, between the bearings g g, is fixed the small pulley h″, which is driven by a straight flat belt, k, from a large driving-wheel, k′, on the driving-shaft d, as best seen in Figs. 1 and 3. It may therefore be now noted that the arrangement of the main parts of the machine is central and symmetrical, the driving-shaft and winding-spindle being in the center of the machine and in line with each other, and connected by a straight direct belt, while the driving-belts are at the remote rear of the machine, whereas in the old machines the winding-spindle and driving-shaft are out of line and connected by a twist-belt, which is never a desirable arrangement, while the driving-belt is at the side of the machine.

l (see Figs. 1, 2, and 3) indicates the swinging head of the machine, which carries the corrugated spindle m, on which the twine is wound to form the ball. This head has the form of a square hollow box, open on the rear or inside, (see Figs. 4 and 5,) and from its upper part extend two curved arms or horns, l′ l′, which are pivoted to two curved overhanging arms, n n, that project forward from the upper brace-bar, c′, of the main frame, the pivot-line being of course coincident with the center of the ball-spindle and with the line in which the twine winds upon the spindle, as shown in Fig. 1. The lower end of the ball-spindle is journaled within the head or box l, as seen best in Figs. 4 and 5, and is driven by the gearing there shown, which gearing is itself propelled by the shaft p, (see Figs. 4 and 5, and thence Figs. 1 and 2,) which inclines downwardly from the swinging head toward the back of the machine, and is fitted with a friction-wheel, r—that is, a wheel having a frictional leather or equivalent rim—which rides upon a cone, o, fixed to the main driving-shaft d, between the large pulley k′ and the back bearing of the shaft, as best seen in Fig. 1. It will therefore be seen that if the swinging head l is swung out or in to increase or decrease the inclination of the ball-spindle the friction-wheel will be moved correspondingly on the friction-cone.

At the commencement of winding a ball the parts are in the position shown in Fig. 1, the ball-spindle being at its greatest inclination, and, as the ball increases in size, the swinging head is allowed to descend gradually, so as to decrease the inclination, and this descent of the head, as will be observed from Fig. 1, will move the friction-wheel toward the small end of the cone, thus decreasing the rotation of the ball-spindle as the size of the ball increases. Hence by employing a cone with the friction-wheel riding thereon, as shown, a rotation of variable speed of precisely the right nature to perfectly and compactly wind all the courses of the ball may be obtained, for the size and inclination of cone necessary for this may be readily determined and made, whereas where a flat friction-disk is used, as in the old machine, with the friction-wheel riding radially in or out thereon, the change of speed is in a too rapid and constant manner to impart the correct variable speed to the ball-spindle to form a perfectly-wound ball in all its courses.

The ball-spindle is geared with the sliding shaft p, as best shown in Figs. 4 and 5—that is, the spindle is fitted with a worm-wheel, s, near its lower end, which is driven by a worm, s′, on a short transverse shaft, s″, arranged in the bottom of the box or head l, and journaled at the ends, as shown, which shaft is fitted with a bevel-wheel, s‴, that is driven by a pinion, p′, on the upper end of the sliding shaft p. This end of the shaft turns, as shown, in a bent bearing-arm, t, having an eye at one end, which is loosely hung on the shaft s″, as seen in Figs. 1, 4, and 5, thus forming a jointed connection of the shaft with the swinging head, which allows the necessary articulation between the two, while keeping the two in constant operative connection. The lower end of the shaft p is supported in a bearing, u, having a spherical exterior, which fits in a similar sperical socket in a weighted lever, v, arranged as shown in Figs. 1, 2, and 3, whereby the friction-wheel is constantly pressed against the friction-cone, yet the shaft is free to slide back and forth through its bearing, which, by reason of its ball-and-socket construction, is capable of a swiveling movement to adapt itself to the change of inclination of the shaft, due to its movement back or forth, as will be understood.

It may now be seen from Figs. 1, 2, and 3 that the friction-wheel rests on the friction-cone a little one side of the vertical diameter or crest thereof, and on the side of the cone which revolves downward, so that hence the tendency of revolution is to let the friction-wheel fall or to draw it against the cone, thus greatly increasing its adhesion over what would occur if the rotation were in the reverse direction, or if the wheel and cone contacted on the same vertical diametrical line.

In Figs. 1 and 3, w indicates the reel from which the cord is drawn to form the ball. This reel is supported over the winding-spindle on the standards w′ w′, which rise on either side thereof from the upper brace-bar, c′, and the tops of these standards are provided with slots, as seen in Figs. 1 and 2, to admit the spindle or axle of the reel. Heretofore the reel has been usually fixed to the spindle, so that the spindle revolves in its bearings with the reel. In my case, however, I prefer to have the reel loose upon the spindle, and the ends of the spindle which enter the slots of the standards w′ are squared or flattened, so as to remain stationary in the bearings while the reel revolves thereon. This plan reduces the clatter of the reel when running, and prevents the reel from rising out of its bearings, as frequently occurs by the vibrations of the reel and spindle when the spindle revolves in the bearings. A weighted friction-strap passes around the reel, in the usual manner, to put the necessary tension or retardation thereon to prevent the reel revolving faster than is necessary and to wind the ball tightly. The cord in passing from the reel to the spindle passes around a roller, d', on the upper end of a lever-arm, d'', which is constantly drawn backward by a spring, d''', and the cord thence passes through the bore of the winding-spindle, and, being threaded through one of the fly-arms *i*, thence passes to the ball-spindle, on which it is fastened, and it is then wound thereon to form the ball as the spindle is revolved. The roller d' and its spring-lever d'' form, as it were, a yielding take-up, which always keeps the thread taut, with a regular or nearly regular tension thereon, and at the same time will yield to any sudden strain of winding, so as to prevent breakage of the thread and render the action more elastic, and the lay of the windings on the ball more regular and compact.

The winding-spindle, as will be seen, has two fly-arms, this being mainly for convenience and for the purpose of balance, as otherwise but one only would be necessary. These fly-arms are generally provided with smooth eyes, through which the cord is threaded in the manner of a needle. I prefer, however, that the fly-arms be provided with rollers $j\,j'$, over which the cord is passed, thus greatly reducing friction on the cord. Furthermore, both rollers are approached by slots, whereby the thread is slipped laterally therethrough and passed over the rollers, thus avoiding the endwise "needle-threading" of the cord, as is the case with the eyes heretofore used, which is more troublesome and causes delay.

The construction of the fly-arms, which, however, is not claimed in this application, is best shown in Figs. 6 and 7, where it will be observed that the slot m', approaching the first roller, is lateral on the side of the arm, while the slot m'', approaching the end roller, is diametrical toward the periphery of the roller, and this slot has a contracting throat to admit the easy insertion of the cord, yet prevent its easy escape when inserted. The outer end of the fly-arm, carrying the outer roller, j', is swiveled to the inner end of the arm by a central stem, n', which enters a central bore in the inner portion of the arm, in which it is capable of a partial rotation or swiveling motion, which, as will be understood, allows the roller to always take the same inclination as the cord winding on the ball-spindle, thus preventing all side friction on the cord and enabling the same to wind more accurately on the ball. A pin, n'', driven through the fly-arm tangentially to the stem n', and in junction with a groove around a portion of the stem, holds the swiveling roller-block in place on the fly-arm, and at the same time allows the swiveling motion thereof, as will be understood.

As before mentioned, Fig. 1 represents the position of parts when commencing the winding of a ball, in which position the inclination of the swinging head and ball-spindle is greatest. It may now be understood that this inclination should of course always be such as to bring the diagonal diameter of the ball in junction, or nearly so, with the direction in which the cord winds from the fly-arm, in order to have the strands lie in the well-known diagonal spirals about the ball. As the diagonal diameters of different-sized balls would lie in different relative positions, (see dotted lines in Fig. 1,) hence the inclination of the ball-spindle requires to be reduced as the ball increases in size to keep the diagonal diameter in junction with the winds of the cord, as will be understood from Fig. 1. In addition to this regular decrease in the inclination, it is usual to abruptly decrease the inclination at certain stages in the winding, so as to cause the winding to occur over the ends of the ball and close up to the core or ball-spindle. This is always done about the middle of the ball and at the finish, in order to cover the ends and make the ball firm. Heretofore these inclinations of the swinging head and ball-spindle have been usually made by a hand-lever at certain stages, whereas I perform these changes in a regular automatic manner by the action of the machine.

In Figs. 1, 2, 3, and 4, F indicates a plate-cam of peculiar shape, which projects from the side of the swinging head and revolves against a fixed roller, G, on a rigid bar projecting forward from the main frame *a a*, so that as this cam is slowly revolved the swinging head will be raised or lowered, according as the inclinations or changes of the cam impel it. The cam is fixed on the outer end of a shaft, o''', (see Figs. 4 and 5,) which is journaled across the box of the swinging head, and is driven by a worm, o', on the ball-spindle, which meshes with a worm-wheel, o'', on the cam-shaft o''', the gearing being of course in such proportion as to impart the right speed to the cam relatively to the ball-spindle, as will be understood. The cam is not fixed permanently on the end of its shaft, but by means of a clutch which may be thrown into or out of action—that is, a ring of teeth on the hub of the cam—is adapted to engage with similar teeth on a collar, *q*, fixed to the shaft, the teeth being thus engaged by screwing up a screw-nut, q', while if this be unscrewed slightly a spring, t', in a cavity of the cam-hub will throw the cam out of engagement with the driving-hub. At the commencement of winding a ball, as in Fig. 1, the cam is of course clutched and is revolved slowly in the direction of the arrow, the highest point of the cam resting on the roller G. As the cam revolves, however, its first descending incline allows the swinging head to slightly fall, decreasing the inclination of the ball-spindle, corresponding accurately to the increase of the size of the ball. The first abrupt gap of the cam, however, allows the head to abruptly fall, bringing the ball-spindle nearly straight, and at the same time forcing the sliding shaft and the friction-wheel r back toward the small end of the cone, so as to reduce the rotary speed of the ball-spindle. This change allows the close inward wind over the ends of the ball, as before referred to, and occurs when the ball is about one-fourth its finished size. The next step of the cam now advancing again raises the ball-spindle to present the diagonal diameter of the cylindrical ball to the wind, and the descending incline of this step allows the regular graduation in the inclination to suit the regularly-increasing size of the ball. A second gap in the cam allows the ball-spindle to again approach the vertical to produce a second close end wind on the ball, after which the third and final step of the cam comes into action and again raises the spindle to continue the diagonal winds as the ball increases in size. This step has one slight gap about midway, as shown, to give a slight end wind, and this step finally ends at a deep and final gap, which brings the spindle at its least inclination and forces the friction-wheel to the smallest part of the cone, the windings being now the finishing ones, and being laid close over the ends of the ball. At this point the nut q' is unscrewed to unclutch the cam, as otherwise the cam would of course continue to revolve and raise the ball-spindle, whereas it is required to now remain at the reduced inclination for a short interval till the ends are compactly wound to finish the ball. When the last gap of the cam arrives at the roller G, allowing the swinging head to fall to its least or lowest inclination, as just described, an inclined projection, v', on one of the arms l' of the head strikes the belt-shipping lever f' and springs or presses it laterally away from a detaining-pin, f'', on the fixed arm n, thus releasing the lever and allowing a spring, f''', to contract, and thus sway the lever, move the shipper, and thereby shift the driving-belt to the loose pulley c', thus automatically stopping the machine. At this instant therefore the operator unclutches the cam, as just described, and then moves the shipping-lever by hand, so as to again start the machine to continue the winding of a few courses on the ends of the ball to finish the same, as just mentioned, after which he moves the lever in the opposite direction and stops the machine. He then cuts the cord, removes the finished ball, and prepares to wind the next in the same manner.

It will therefore be observed that all, or nearly all, the actions of the machine are performed automatically, and are so organized as to lay the windings of the ball perfectly without attention from the operator, and in such a way as to produce a much more compact ball and in a very rapid manner, for as the action of the machine is not only automatic, but also continuous till the ball is finished, the machine may be run at much higher speed than is usual, while the frequent stoppages or hand-adjustments required by the old machines are obviated. Hence not only are the balls produced more rapidly, but are of more perfect form and much greater density, thus effecting a material economy and improvement in the product, and requiring less labor and attention on the part of the operator.

The position of the cam F might of course be reversed—that is, arranged to revolve on the fixed frame of the machine and bear against the swinging head—but the arrangement shown is much preferable. Instead, however, of employing a cam to move the swinging head, any equivalent device may of course be employed without departing from the principle of my improvement.

The slot to the roller j' may be lateral to the roller, like the slot m', if desired.

What I claim is—

1. The combination, with the swinging head l and its ball-spindle, of the gearing within said head, the sliding shaft p, the wheel r, the driving-cone o, and mechanism, substantially as described, to control the movements of the swinging head and its connections, as and for the purpose specified.

2. The combination, with the swinging head l and its ball-spindle and a supporting-frame, of the gearing within said head, the cam F, connecting with said gearing, the stop G, acting against the cam, the sliding shaft p, the wheels r, and the driving-cone o, substantially as and for the purpose specified.

3. The combination, with the swinging head l, of the gearing p' s s' s'' o' o'', and cam F, secured to and adapted to move with said head, the stop G, the sliding shaft p, the wheel r, the driving-cone o, and a supporting-frame, substantially as and for the purpose specified.

4. The combination of the swinging head l and its ball-spindle, the sliding shaft p, the intermediate gearing connecting the shaft and the ball-spindle, the wheel r, and controlling mechanism, substantially as described, with the weighted bearing-lever v and the cone o, as and for the purpose specified.

5. The combination, with the swinging head and the supporting-frame, of a shipping bar or lever, a detent or catch to hold the same, and mechanism, substantially as described, for moving the shipping-lever when released, and to swing the head, whereby the shipper is released by the terminal descending movement of the head, as set forth.

6. The combination, with the swinging head l and the supporting-frame, of the shipping-bar f, the lever f', the detaining-pin f'', the spring f''', the projection v' on the swinging head, and cam F and stops G for governing the movement of said head, substantially as and for the purpose specified.

LOUIS J. HIRT.

Witnesses:
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