H. W. HERBST.

SPINNING OR TWISTING AND BALLING MACHINE.

APPLICATION FILED APR. 15, 1910.

997,128. Patented July 4, 1911.

5 SHEETS—SHEET 1.

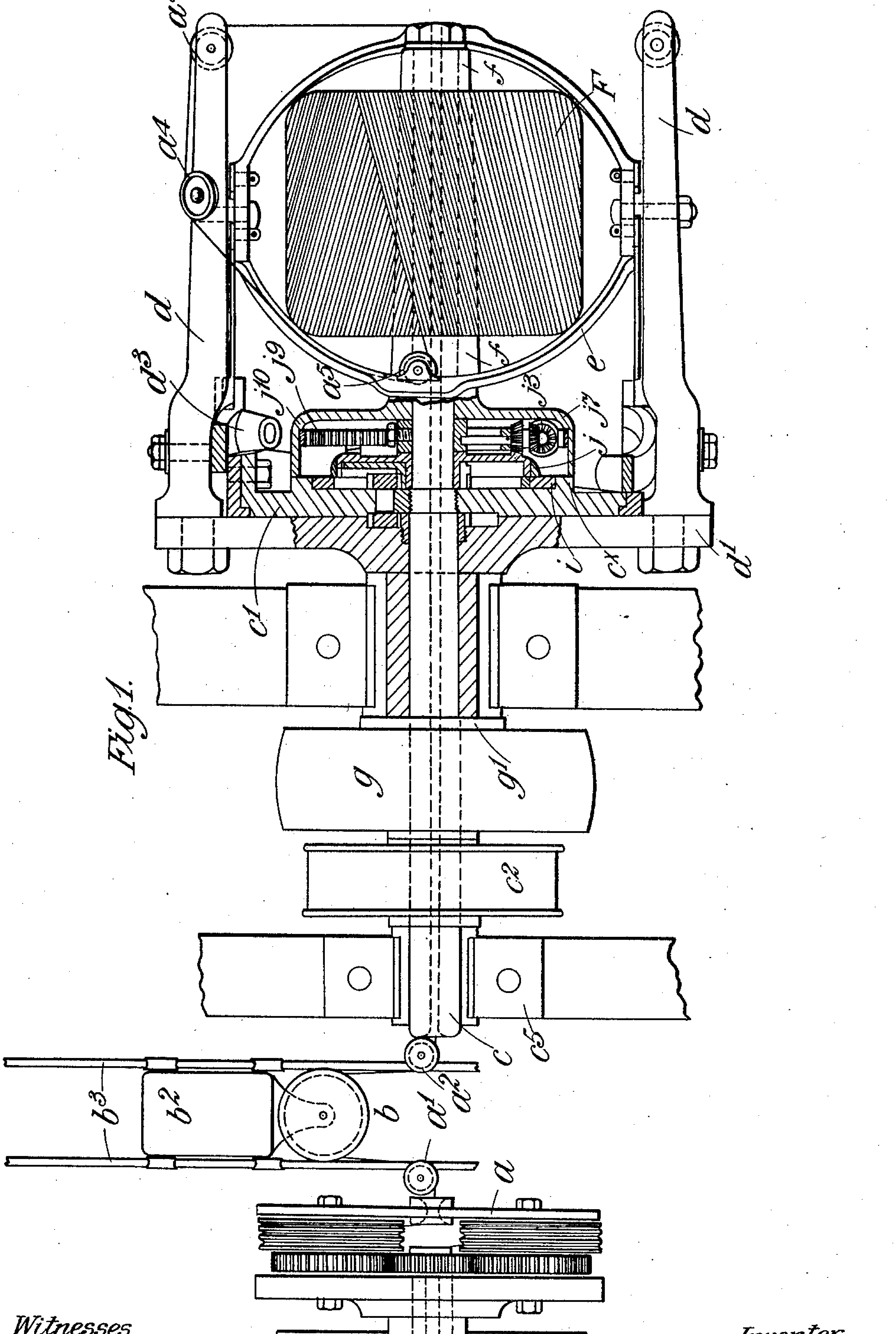

Fig. 1.

Witnesses

[signature]

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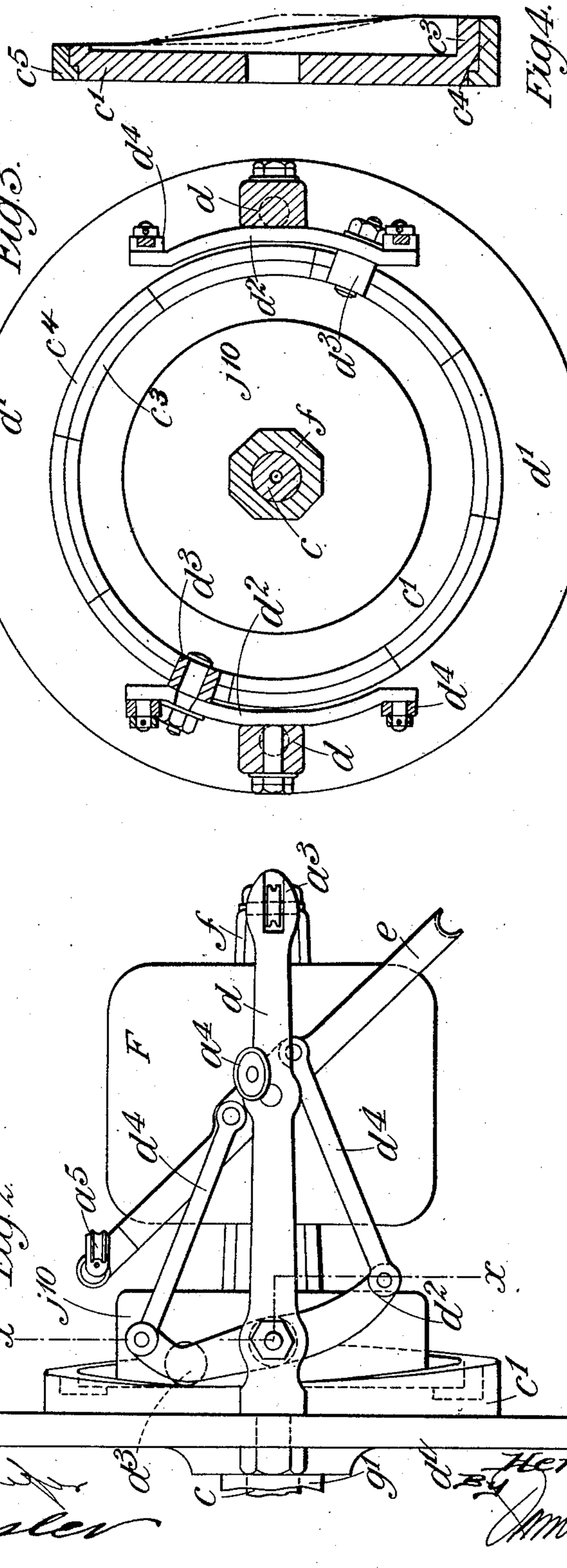

Fig. 3.

Fig. 2.

Fig. 5.

Fig. 4.

Witnesses

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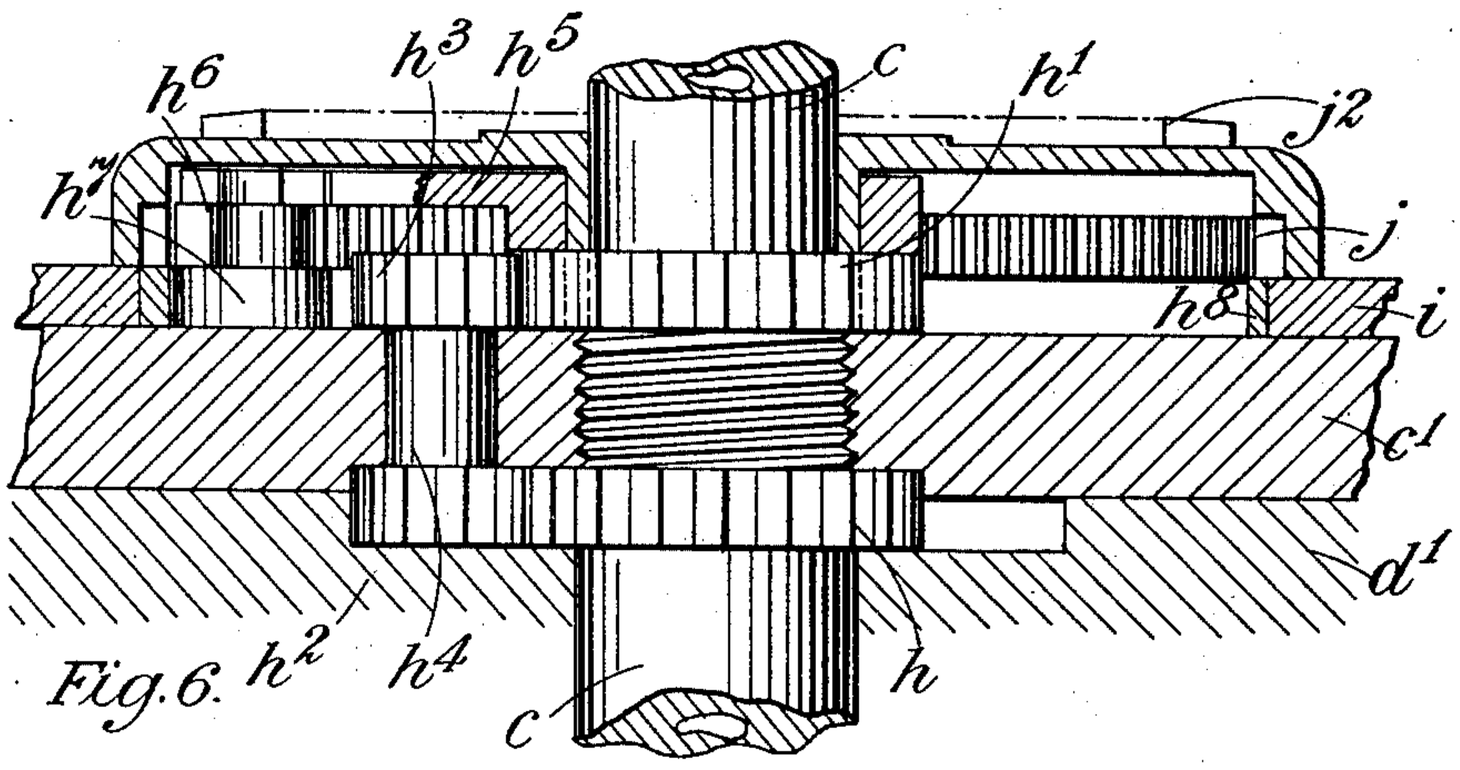
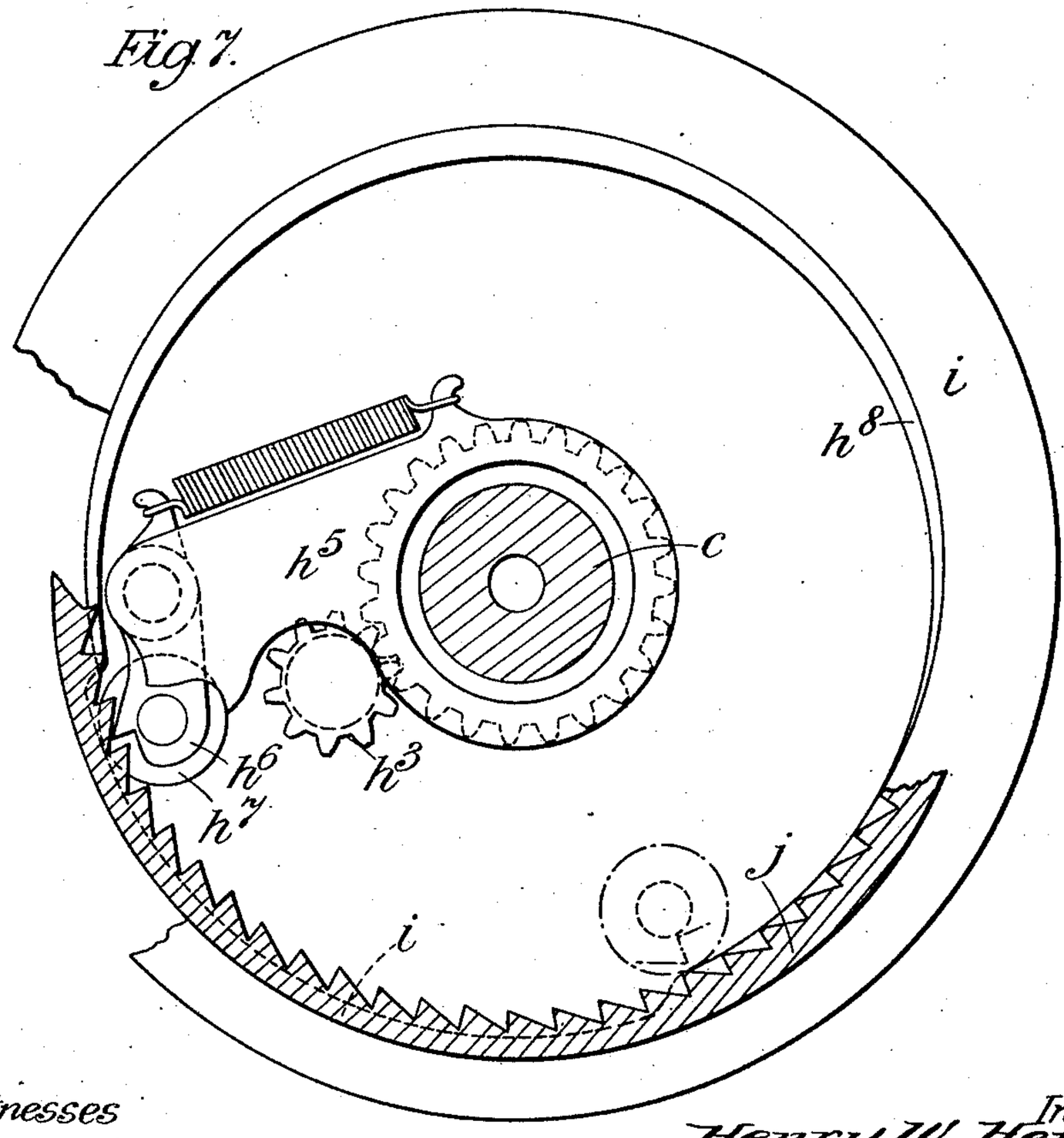


Fig. 6.

Fig 7.



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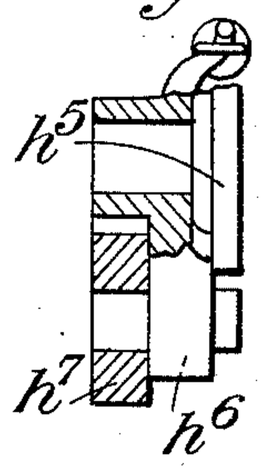
5 SHEETS—SHEET 4.

Fig. 8.



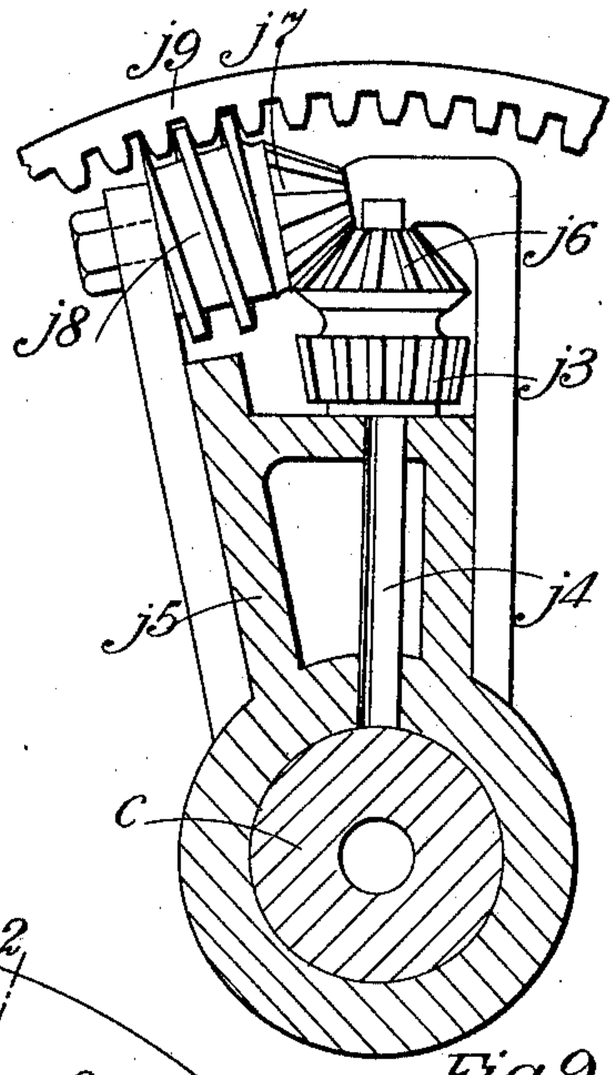
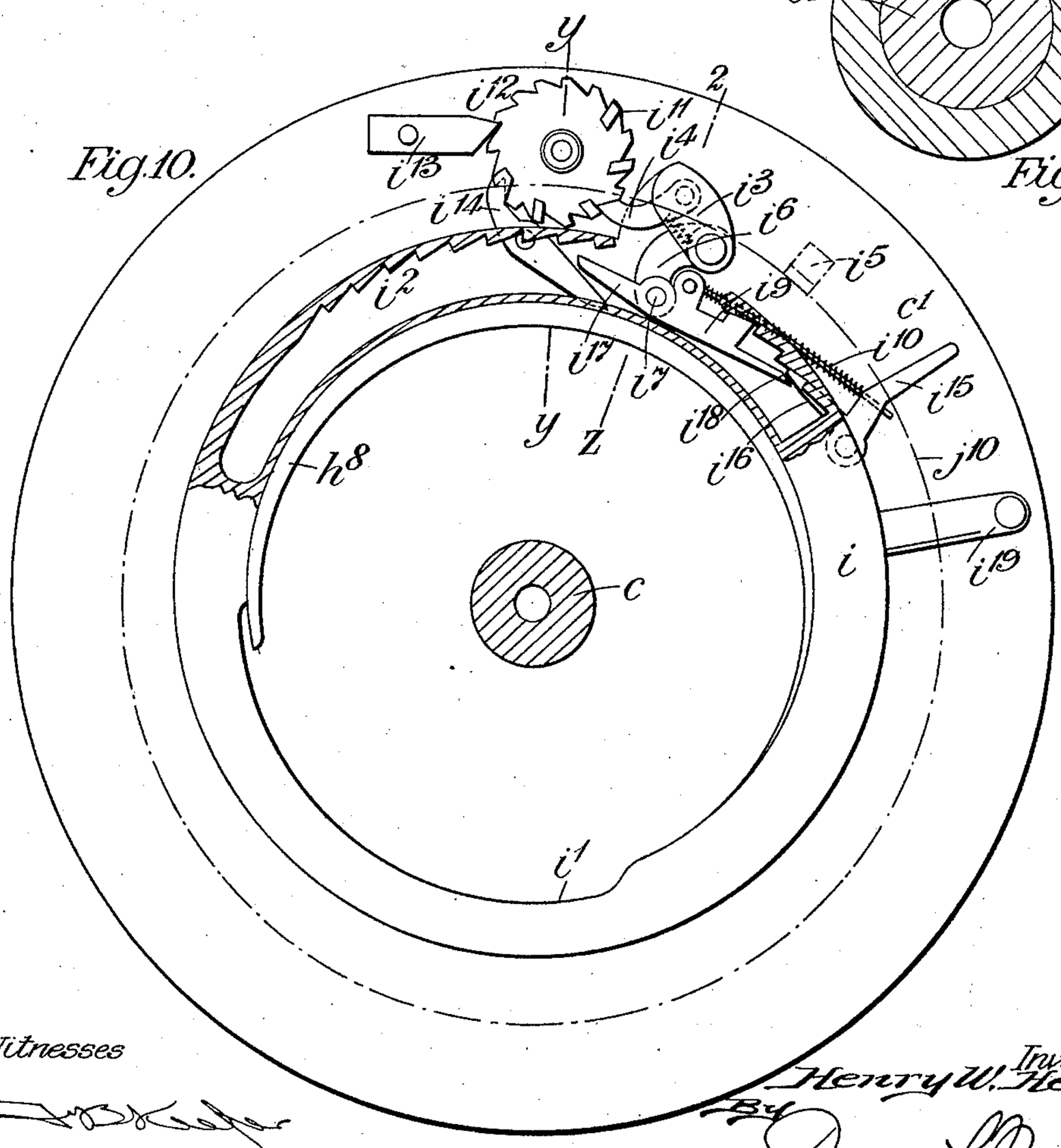


Fig. 9.

Fig. 10.



Witnesses

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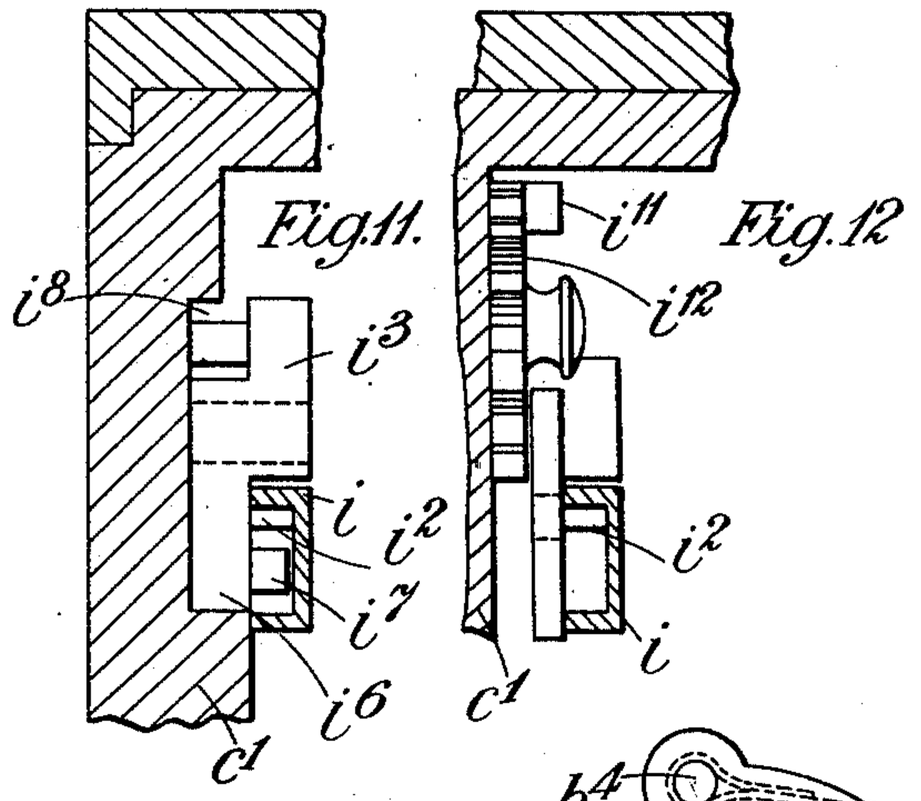
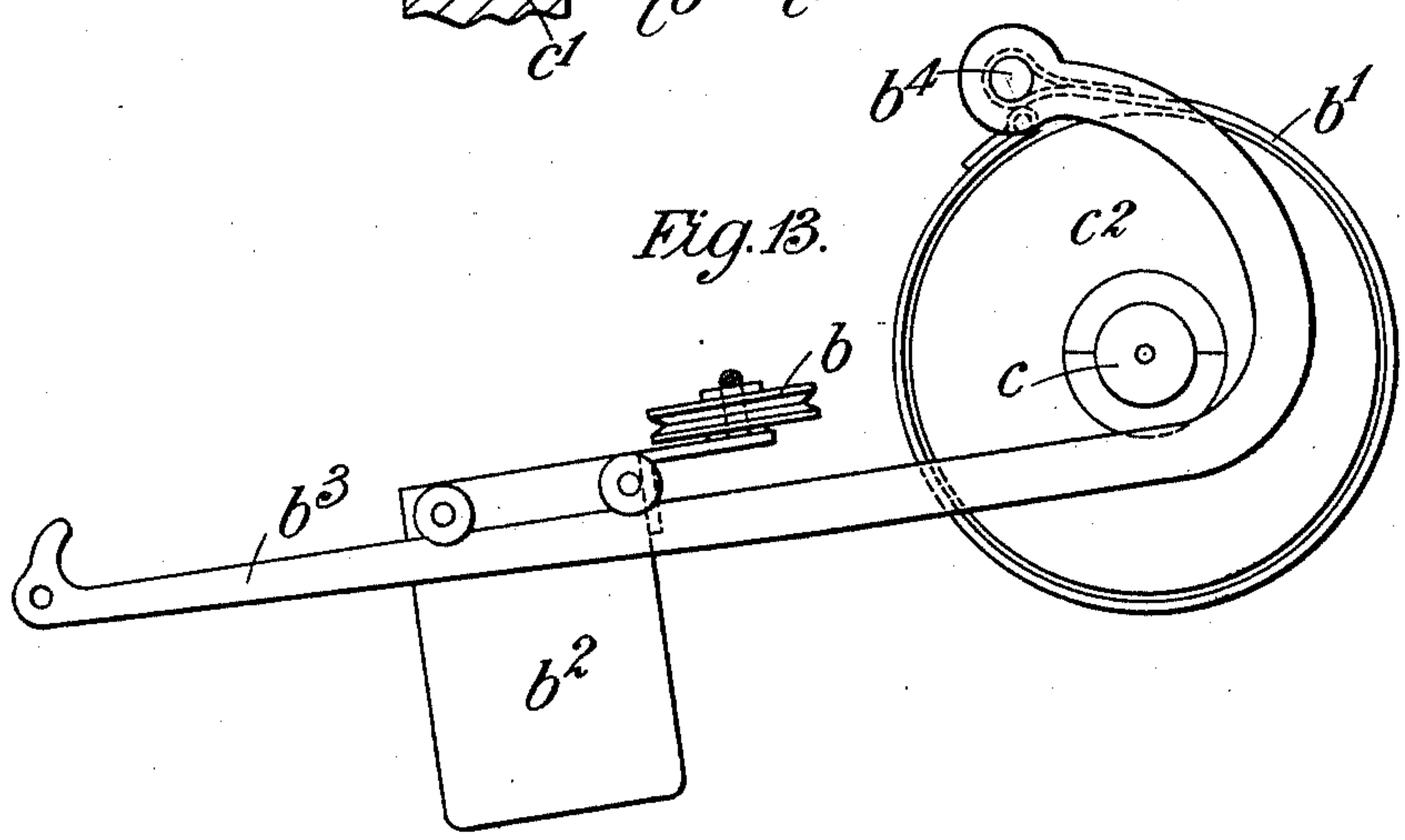
SPINNING OR TWISTING AND BALLING MACHINE.

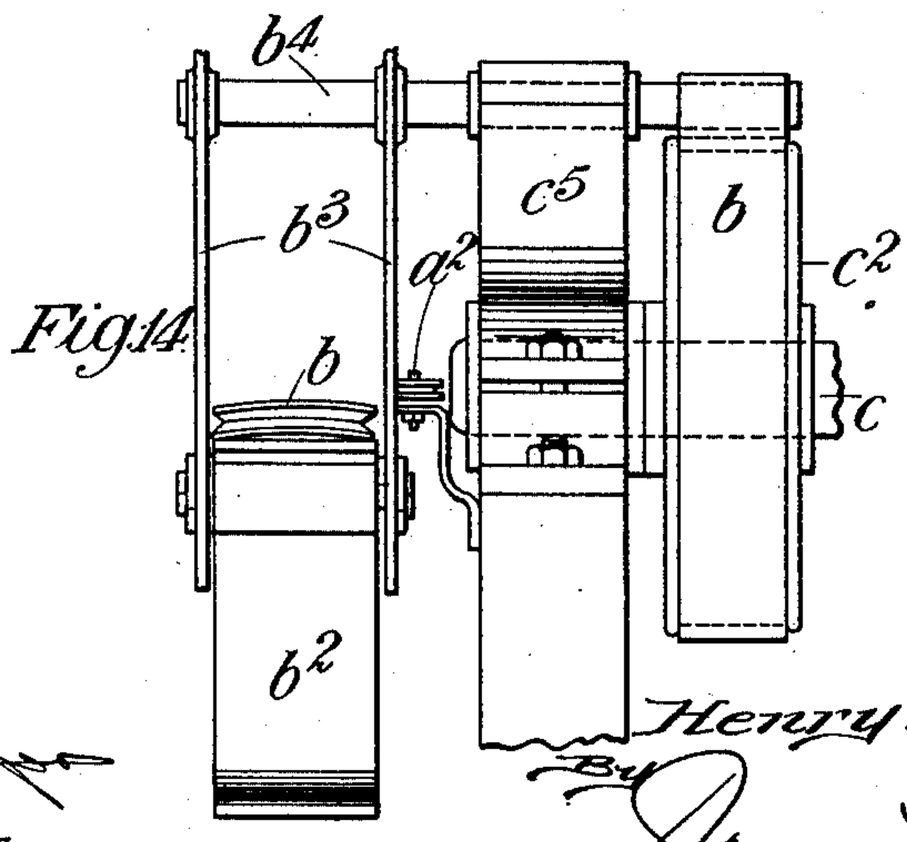
APPLICATION FILED APR. 15, 1910.

997,128. Patented July 4, 1911.

6 SHEETS—SHEET 6.







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UNITED STATES PATENT OFFICE.

HENRY WILLIAM HERBST, OF LONDON, ENGLAND.

SPINNING OR TWISTING AND BALLING MACHINE.

997,128. Specification of Letters Patent. **Patented July 4, 1911.**

Application filed April 15, 1910. Serial No. 555,720.

To all whom it may concern:

Be it known that I, HENRY WILLIAM HERBST, a subject of the King of Great Britain and Ireland, residing at London, in the county of Middlesex, England, have invented a new and useful Improved Spinning or Twisting and Balling Machine, of which the following is a specification.

This invention relates to that class of combined machine for spinning or twisting, and balling hemp, cotton, or other yarn, when formed into string, or cord, wherein the balling is performed simultaneously with the spinning or twisting of the yarn, and my invention has primarily for its object, to govern the balling according to the speed at which the yarn is being produced, and to insure that the string, or other material, shall be efficiently wound into a ball at the same time as the spinning or twisting is being effected.

Broadly speaking, the machine comprises, as its essential features, an improved construction of balling-head and means for operating the same; means for automatically regulating the speed of rotation of the balling-arm to correspond with the amount of yarn produced, and in course of delivery to the balling-head; and means for regulating the laying and winding of the twisted yarn into a ball. And in order that my invention may be readily understood and carried into effect, I will now describe it fully with reference to the accompanying drawings, forming part of this specification, and in which:

Figure 1 is a plan, partly in section, of the improved machine. Fig. 2 a side elevation of the balling-head, detached, and Fig. 3 a face view taken on the line x—x, of Fig. 2, of the cams employed in the machine. Fig. 4 is a section of the said cams. Fig. 5 shows one of these cams developed. Fig. 6 is an enlarged view, partly in section, of the means for regulating the number of layers applied around the circumference of the ball, and Fig. 7 a face view corresponding with Fig. 5. Fig. 8 is a detail view of the pawl shown in Fig. 7. Fig. 9 a detail view of the means for feeding the ball. Fig. 10 a plan of the means for automatically changing the feed of the ball as the latter increases in diameter. Figs. 11 and 12 are sections taken on the lines z, z, and y, y, respectively, of Fig. 10. Fig. 13 is a side elevation of the means for governing or controlling the speed of the balling, and Fig. 14 an end elevation of the said means.

Referring to the several parts of the machine shown in Fig. 1, a is any suitable device for twisting the sliver which, after being twisted, passes by way of the guide-pulley a^1, to a pulley b, whence it passes by way of another guide-pulley a^2, through the center of a hollow shaft c. Upon leaving this shaft, it is passed around guide-pulleys a^3, a^4, mounted upon one of a pair of flier arms d, d, mounted on a rotatable disk d^1, and thence by way of a guide pulley a^5, pivoted in an oscillating ring e, arranged between the said arms d, d, to the rotatable balling-arm f, which is driven by the disk d^1.

Motion is transmitted to the machine by a driving pulley g, mounted upon a sleeve g^1, through which the hollow shaft c passes; this pulley serving to rotate the disk d^1, whereon are the arms d, d; and also by frictional resistance to rotate a disk c^1, secured to the hollow shaft c, thereby driving this shaft. The rotation of the disk c^1 and its shaft c is, however, regulated, during the balling operation, by the pulley b, which, for this purpose, is mounted upon a weighted carriage b^2, supported upon a pair of arms b^3, b^3. These arms (as shown more clearly in Figs. 13 and 14) are secured to the one end of a shaft b^4, mounted in bearings formed above the bearing c^5, carrying the shaft c, and are inclined downward, so that, normally, the carriage will be at the lower ends of the arms b^3, b^3. The other end of the shaft b^4 is connected to the extremities of a band-brake b^1, passing around the pulley c^2 mounted upon the shaft c. When the carriage b^2 is at the lower ends of the arms b^3, b^3, the brake will be applied, so that the driving of the shaft c and the disk c^1, by the disk d^1, is resisted. As balling proceeds, however, the carriage b^2 is caused (in the manner hereinafter described) to move up the arms b^3, b^3, thus reducing the frictional resistance of the band-brake b^1 and permitting the rotation of the disk c^1

The disk c^1 mounted on the shaft c, is formed with a rim in the shape of a cam c^3 (Figs. 2, 3, and 4) and encircling this rim is an annular cam c^4 similar in shape, but of opposite hand, to the cam c^3. The cam c^4 fits into a rabbet, or groove, c^5, in the disk c^1, so as to be capable of adjustment,

relatively to the cam c^3. For adjusting the cams, one of them may be provided with a projecting means while the other is formed with a slot in which the projecting means works and engaged by a nut which clamps the two cams together when adjusted. Any other suitable means may be employed for fixing the adjustment of the cams. The two cams are so arranged that their faces present an even, or like rise and fall, but upon turning one cam $\frac{1}{8}$th of a revolution in one direction, the combined faces of the cams will present a level portion for $\frac{3}{8}$ths of their circumference, a gradual drop for $\frac{1}{8}$th, a level portion for $\frac{3}{8}$ths, and then a gradual rise to the first level for $\frac{1}{8}$th. This position of the cams is shown by the dotted lines in Fig. 4, while Fig. 5 shows the cam c^3 developed. In Fig. 5 the circumference of the cam is marked off in $\frac{1}{8}$ths, and reading from left to right, it will be seen that there is a level portion for $\frac{1}{8}$th, a rise for $\frac{1}{4}$th of the circumference, a level portion for $\frac{1}{4}$th of the circumference, a fall for $\frac{1}{8}$th of the circumference, and finally a level portion for $\frac{2}{8}$th of the circumference. The cam c^4 is similarly formed, but in the reverse order. During the early stages of the winding of the ball, the cams c^3, c^4, are in the position to impart an even oscillation to the ring e, but upon the ball approaching the final layer of winding the cam c^4 is moved $\frac{1}{8}$th of a revolution, whereupon the ring is caused to pause when at its extreme positions and to move more rapidly between these two positions. The object of this movement of the ring e is to pass the string down the ball at a less oblique angle, and to pass the string across the ends of the ball so as to cover the previous layer, and, finally, to impart to the ball a suitable marketable appearance. Instead of the inner cam c^3 being a fixture, it may be made adjustable, and the outer cam c^4, be formed as a rim on the disk c^1. These cams operate levers d^2, d^2, furnished with rollers d^3, and which are respectively pivotally mounted upon the arms d, d. The opposite ends of each lever d^2 are connected by means of links d^4, d^4, to the ring e, and when the disk d^1 is revolving faster than the disk c^1, the rollers d^3 will travel around the cams c^3, c^4, with the result that the ring e will be oscillated. The disk c^1, being in frictional contact with the disk d^1, will travel around with the latter disk, but at a speed which is controlled by the weighted pulley b, to correspond with the yarn produced. As balling proceeds, the ball increases in diameter, consequently the amount of yarn that can be taken up by the ball also increases at each revolution of the balling arm f. Owing to this arm rotating in the same direction as the flier arms d, d, the latter at the commencement of the balling operation, are considerably in advance of the balling arm, that is to say rotate at a relatively much greater speed, but as balling proceeds and more yarn can be taken up at each revolution of the balling arm f, the speed of the latter must be increased in order to diminish the amount of advance of the flier arms d, d. Owing to the balling-arm f being connected to the disk c^1, and to the difference of speed between this disk and the disk d^1, whereby it is driven, there will be a pull exerted upon the material which will tend to draw the carriage b^2 up the inclined arms b^3. When this pull is excessive, owing to the speed of the disk c^1 being too slow, thereby causing a drag on the yarn, the carriage b^2 travels up the arms b^3, b^3, with the effect that the latter will rotate the brake shaft b^4 in the direction to loosen the band b^1 about the pulley c^2, and thereby permit the speed of rotation of the hollow shaft c, with the disk c^1, to become greater. Thus it will be seen that, as the production of the yarn proceeds and the ball increases in diameter, thereby causing the yarn to tighten, the brake is released to increase the speed of the disk c^1 relatively to the disk d^1.

In balling the yarn, the latter is caused to pass obliquely across the balling-arm f, and to insure that each successive diagonal winding shall be in its proper position, I arrange, on opposite sides of the disk c^1, and freely mounted upon the hollow shaft c, two spur wheels h, h^1, of equal diameter which respectively mesh with pinions h^2, h^3, of equal diameter, and mounted upon an axle h^4 which passes through the disk c^1. The spur wheel h is secured to the disk d^1 and drives, by way of the pinions h^2, h^3, the spur wheel h^1, which, in turn, rotates an arm h^5 secured thereto (Figs. 6 and 7). In this manner, the arm h^5 is rotated at the same speed, and in the same direction, as the disk d^1. The arm h^5 is furnished with a spring-controlled pawl h^6, which is provided with a roller h^7, and this roller travels, during the rotation of the arm h^5, around the inner face of a crescent-shaped member h^8, formed integral with the disk c^1 and the inner periphery of which is concentric with the hollow shaft c (see Figs. 7 and 10). Around the outer face of the crescent h^8, is loosely fitted a ring i so as to move or slide around as required, and which is held in position between the crescent h^8 and the projecting rim $c^\times$ on the disk c^1. The ring i is formed, as to its inner face, with a recess i^1 disposed between the horns of the crescent h^8, and which permits the pawl h^6 to engage with a ratchet wheel j, mounted to rotate freely upon the hollow shaft c. In this manner, the ratchet wheel j is moved during only a portion of a revolution of the arm h^5, and therefore of the disk d^1; the pawl h^6 upon arriving at the end of the recess i^1 becoming disengaged

from the ratchet wheel j, and remaining out of engagement during the remainder of the revolution of the disk d^1. The body j^2 of the ratchet wheel j, is provided with a ring of teeth j^2 corresponding in number with those of the wheel j. The teeth j^2 mesh with a bevel wheel j^3 (Figs. 1 and 9), mounted upon a spindle j^4, carried by a frame j^5, secured to the hollow shaft c. Upon the spindle j^4, is a second bevel wheel j^6, which meshes with a bevel wheel j^7 provided with a worm j^8 engaging with a toothed wheel j^9. This toothed wheel is concentric with the shaft c, and is attached to a hood j^{10} (Fig. 1) with which the balling-arm f is integral. During the rotation of the disk d^1, the disk c^1, as also the hood j^{10}, will be rotating, but at a slower speed; and the object of the mechanism, just described, is to feed forward the balling arm f during each revolution of the disk c^1, and after each diagonal winding of the ball F. This is accomplished, during a portion of each revolution of the disk c^1, by the pawl h^6 rotating the hood j^{10}, during a portion of a revolution, at a speed below that of the said disk. As the ball increases in diameter, a greater number of diagonal windings will be required to surround it, and, to effect this, the position of the recess i^1, in the ring i, is automatically adjusted relatively to the opening in the crescent h^8. This adjustment is accomplished by arranging the ring i inside a projecting rim $c^\times$ (see Fig. 1), upon the disk c^1, and providing the ring with a number of teeth i^2 (see Fig. 10), preferably arranged internally in a recess in the ring, these teeth corresponding with the teeth in the ratchet wheel j. Upon the disk c^1 at $i^\times$, is pivoted a lever i^3, capable of being vibrated by a projection i^5 mounted upon the hood j^{10} carrying the balling-arm f, and this lever i^3 is furnished with an arm i^6 which is formed with a pivot i^7, and housed in a recess i^8 in the disk c^1 (see Fig. 11). The arm i^6 is disposed beneath the ring i, and carries a pawl i^9, mounted upon the pivot i^7; and which is held by means of a spring i^{10} in engagement with the teeth i^2 on the ring i, the spring also serving to return the lever into its normal position. At each revolution of the balling-arm f, the projection i^5 on the hood j^{10}, will move the ring i a distance corresponding to one tooth, thus gradually reducing the space between one extremity of the crescent and the opposite extremity of the recess i^1, with the effect that during each revolution of the hood j^{10}, the rotation of the balling-arm f is reduced, for a portion of a revolution, relatively to the speed of the disk c^1; and the amount the said arm is fed forward gradually decreases as the ball increases in diameter, and requires a greater number of diagonal layers of string to surround it. The number of diagonal layers will increase with each successive revolution of the hood j^{10}, if the pawl i^9 be actuated at each revolution; but where it is desired to provide two or more surrounding diagonal layers of the same number, I provide the following device. Assuming that it be required to wind around the ball two successive layers of equal number, I mount upon the disk c^1 a ratchet wheel i^{12} formed with projections i^{11} disposed at each alternate tooth of the ratchet. Engaging with the ratchet wheel i^{12}, is a pawl i^4, pivoted to the lever i^3, and there is also provided a two armed lever i^{14}, pivoted upon the disk c^1, in such a position that one arm is adapted to engage with the projection i^{11} upon the ratchet-wheel i^{12}. During one revolution of the balling-arm f, the pawl i^9, will be operated in the manner above described to rotate the ring i, and will advance with the ring. Simultaneously with this movement of the pawl i^9, the ratchet-wheel i^{12} will have been rotated, and one of the projections i^{11} thereon, will have been brought into engagement with one arm of the lever i^{14}, whereupon this arm will be moved in one direction, and the other arm in the opposite direction and into the path of the pawl i^9. Upon this pawl being returned to its normal position, by the spring i^{10}, the tail i^{17} of the said pawl will engage with the lever i^{14}, but the opposite end of said pawl will become disengaged from the ratchet i^2. During the next revolution of the balling hood j^{10}, the projection i^5 will again vibrate the lever i^3, with the effect that the ratchet wheel i^{12} will be rotated to release the lever i^{14} from the projection, the pawl i^9, however, will travel forward, without operating the ratchet i^2, and, at the end of its stroke, will disengage from the lever i^{14}, which latter will thereupon resume its normal position. The pawl i^9 will now also resume its normal position by means of the spring i^{10}, ready to operate again the ring i. The ratchet-wheel i^{12} is locked in the position to which it is moved during each revolution of the balling-hood j^{10}, by means of a spring-bolt i^{13}. This ratchet wheel may be readily removed and be substituted by another, adapted to allow of three, or more, encompassing layers of the same number of diagonal windings. To lock the ring i, in the position to which it has been adjusted, a bell-crank lever i^{15} is provided, the same being pivoted upon the disk c^1, and formed with a projection i^{16} adapted to engage with the teeth i^2. Upon vibrating the lever i^{15}, it will disengage from the ratchet i^2, and engage with a projection i^{18} upon the pawl i^9, and thus hold said pawl out of engagement with the ratchet i^2. The ring i may now be moved, by means of an arm i^{19}, and returned to its normal position after each balling operation.

Having now described my invention what

I claim and desire to secure by Letters Patent is:—

1. A machine for balling hemp, cotton, or other material, simultaneously with the spinning or twisting of the yarn, comprising a primary rotatable disk, a secondary disk in frictional contact therewith, a balling arm mounted on said secondary disk, a flier arm mounted on the primary disk, means for guiding the yarn to said flier arm and thence to the balling arm, a shaft whereon said secondary disk is securely mounted, a brake on said shaft, a tension device acting on said yarn, and operable connections between said tension device and said brake whereby braking action on said shaft is automatically regulated according to the tension on the yarn.

2. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith, a balling arm mounted on said secondary disk, a flier arm on said primary disk, an oscillatory member mounted on said flier arm, a cam on said secondary disk, operable connection between said oscillatory member and said cam, and means for regulating the rotation of said secondary disk relatively to said primary disk.

3. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith, a balling arm mounted on said secondary disk, flier arms mounted on said primary disk, a ring pivoted to said flier arms, means for guiding the material to be balled from said flier arm to said ring and thence to said balling arm, a cam on said secondary disk and constituted by an inner member and an outer member, one of said members being adjustable with the other member to regulate the contour of the cam, a rocking lever pivoted on each of said flier arms and supported upon said cam, and links connecting each rocking lever to said ring whereby the latter is oscillated to correspond with said cam.

4. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported on said shaft and furnished with a circular rack, an arm fast on said shaft and in geared connection with said rack to rotate the latter, a flier arm mounted on said primary disk, and means for guiding the material to be balled from said flier arm to said balling arm.

5. A balling machine embracing a primary rotatable disk a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported on said shaft, means actuated by said shaft for rotating said balling arm, and means actuated by said primary disk for intermittently imparting an additional movement to said balling arm during its rotation.

6. A balling machine comprising a primary rotatable disk a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported on said shaft and having an annular rack, a member fast on said shaft and revoluble therewith, a spindle in said member furnished with two pinions one of which drives said rack, while the other inter-meshes with a ring of teeth on a second rack member freely mounted on said shaft, a pawl adapted to engage said second rack member and rotated by said primary disk and a cam on said secondary disk forming a race for said pawl and so shaped as to cause the said pawl to engage intermittently with its rack thereby imparting to said balling arm during its rotation, an additional circular movement.

7. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported on said shaft, primary driving means actuated by said shaft for rotating said balling arm, secondary driving means actuated by the primary disk and coöperating with said primary driving means to impart an additional rotative movement to said balling arm during a portion of each revolution thereof, means operated by said balling arm for automatically regulating the extent of such additional rotative movement to correspond with the increasing diameter of the ball.

8. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported on said shaft, means actuated by said shaft for rotating said balling arm, a toothed disk freely mounted on said shaft and provided with a rack, geared connection between said toothed disk and said balling arm, a pawl rotated by said shaft and adapted to engage with the rack of said toothed disk, a crescent-shaped member mounted on said disk and embraced by a circular recessed member, such recess being disposed opposite the opening in said crescent-shaped member and the two members forming a cam-shaped race for said pawl, a rack on one of said cam members, a pawl for actuating the last mentioned rack, means on said balling arm for actuating the last mentioned pawl to rotate its rack and thereby gradually to close the opening in the other said cam member.

9. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported upon and driven from said shaft, a pawl adapted to rotate about the axis of said shaft, means actuated by said primary disk for rotating said pawl, a ratchet wheel freely mounted on said shaft and intermittently engaged

by said pawl, geared connection between said ratchet wheel and said balling arm, a cam mounted on said secondary disk and forming a race for said pawl, said cam being constituted by an inner member having an opening and an outer adjustable member having a recess disposed opposite to said opening the inner member serving to maintain said pawl disengaged from its rack and the outer member serving to permit engagement with said rack, means for automatically rotating said outer cam member to gradually decrease the amount of the opening in the inner cam member, such means comprising teeth on the outer member, a pawl adapted to engage said teeth, a lever pivotally mounted on said secondary disk and in engagement with said pawl, means on said balling arm for actuating said pivoted lever, and means coöperating with said pivoted lever to control the movement of said pawl.

10. A balling machine comprising a primary rotatable disk, a secondary disk in frictional contact therewith and fast on a shaft, a balling arm supported on and rotated by said shaft, a brake drum fast on said shaft and furnished with a brake strap, lever arms connected to the extremities of said brake strap, a weighted pulley mounted to travel along said arms, and means for guiding the material to be balled around said pulley and thence to said balling arm, said pulley being caused to travel along said arms by the tension of said material and thereby to control the rotation of the shaft whereon said secondary disk is mounted.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY WILLIAM HERBST.

Witnesses:
RIPLEY WILSON,
R. WILLIAMS.