(No Model.) 3 Sheets—Sheet 1.

C. V. WOERD.

MACHINE FOR POINTING, DRILLING, AND TAPPING WATCH BALANCES.

No. 271,967. Patented Feb. 6, 1883.

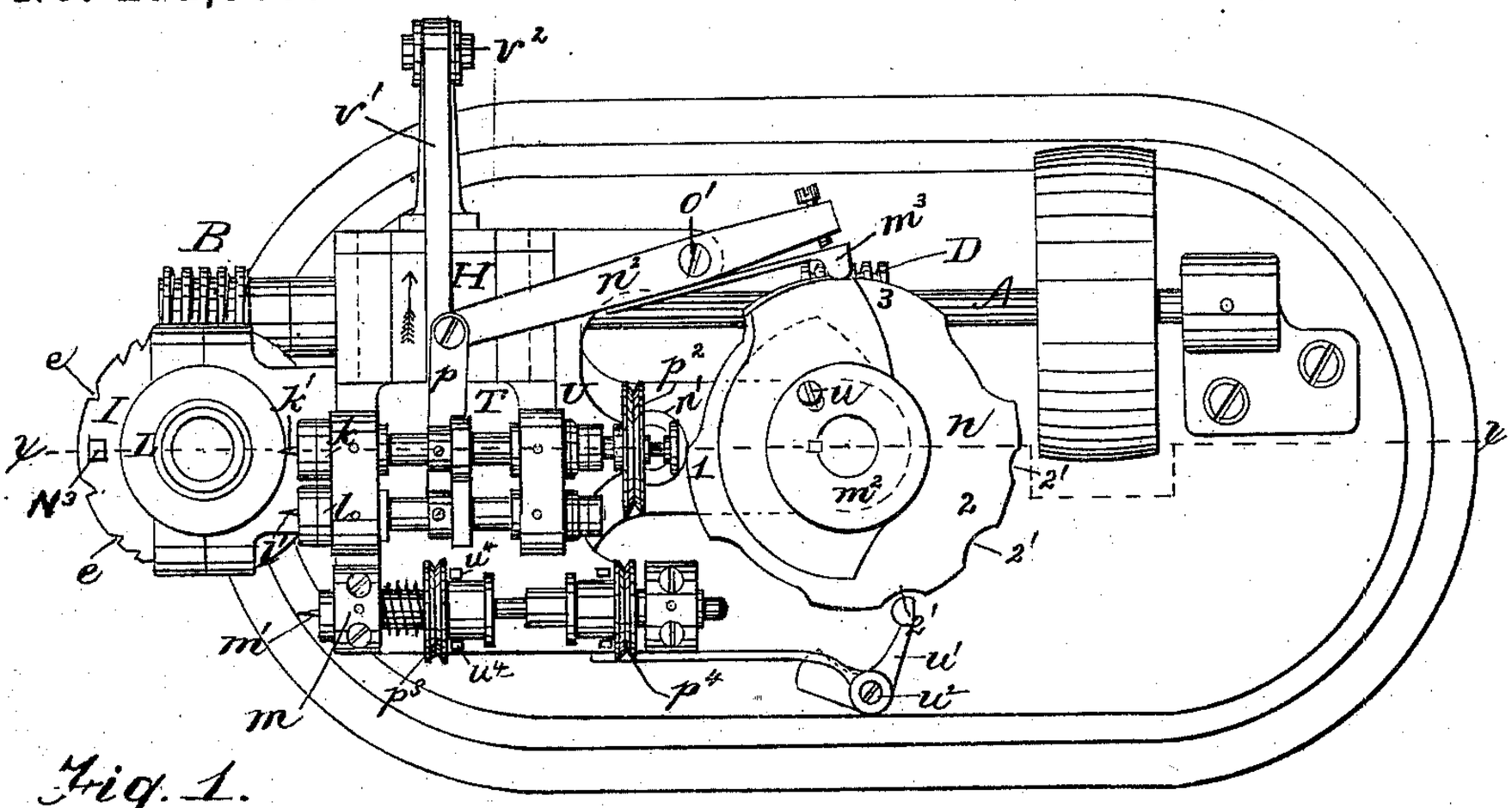

Fig. 1.

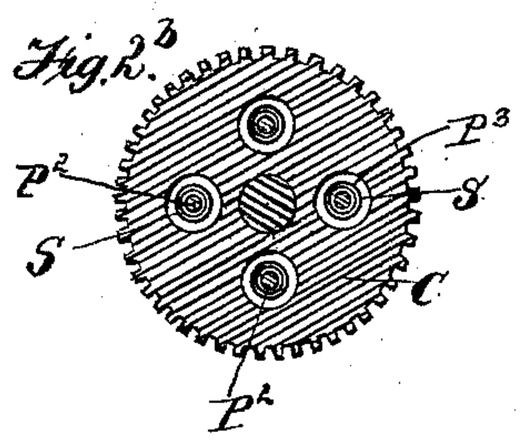

Fig. 2³.

Fig. 2.

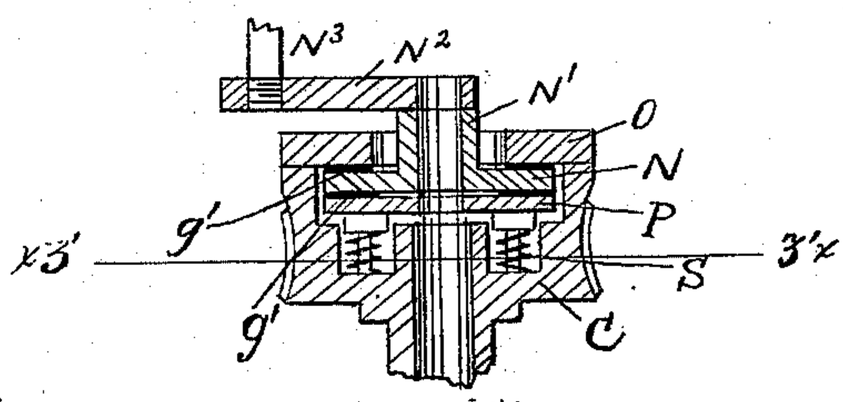

Fig. 2ª.

Witnesses.
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(No Model.) 3 Sheets—Sheet 2.

C. V. WOERD.

MACHINE FOR POINTING, DRILLING, AND TAPPING WATCH BALANCES.

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Fig. 8.

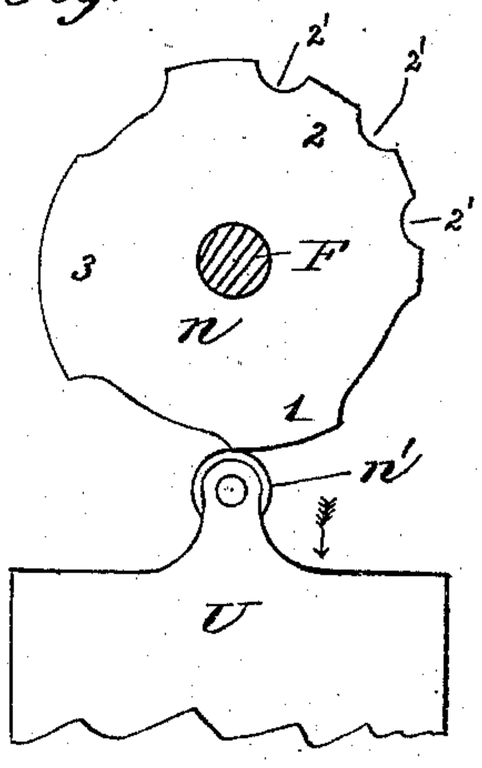


Fig. 5.

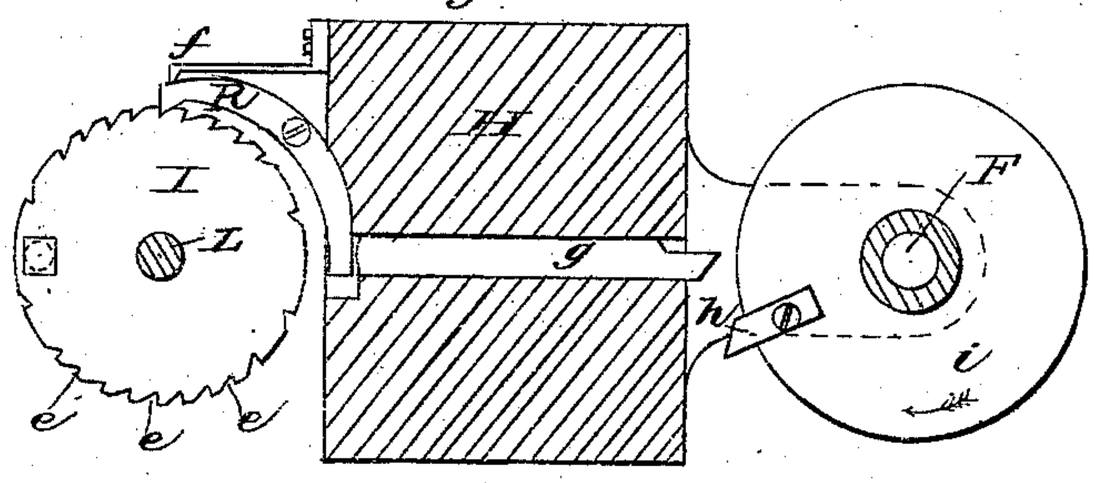


Fig. 6.

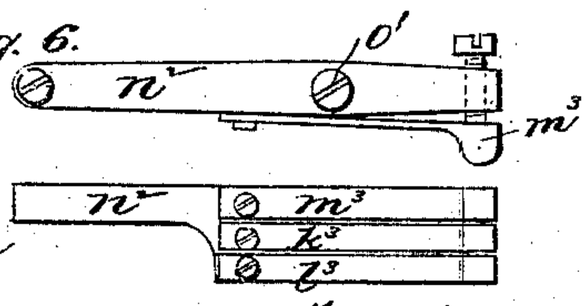


Fig. 7.

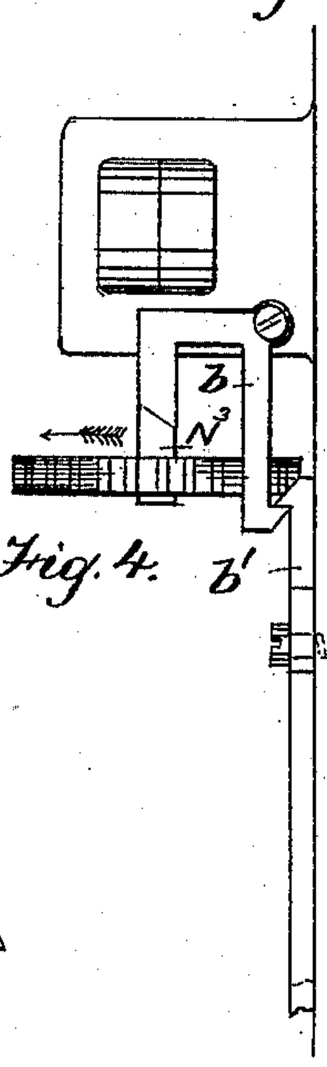
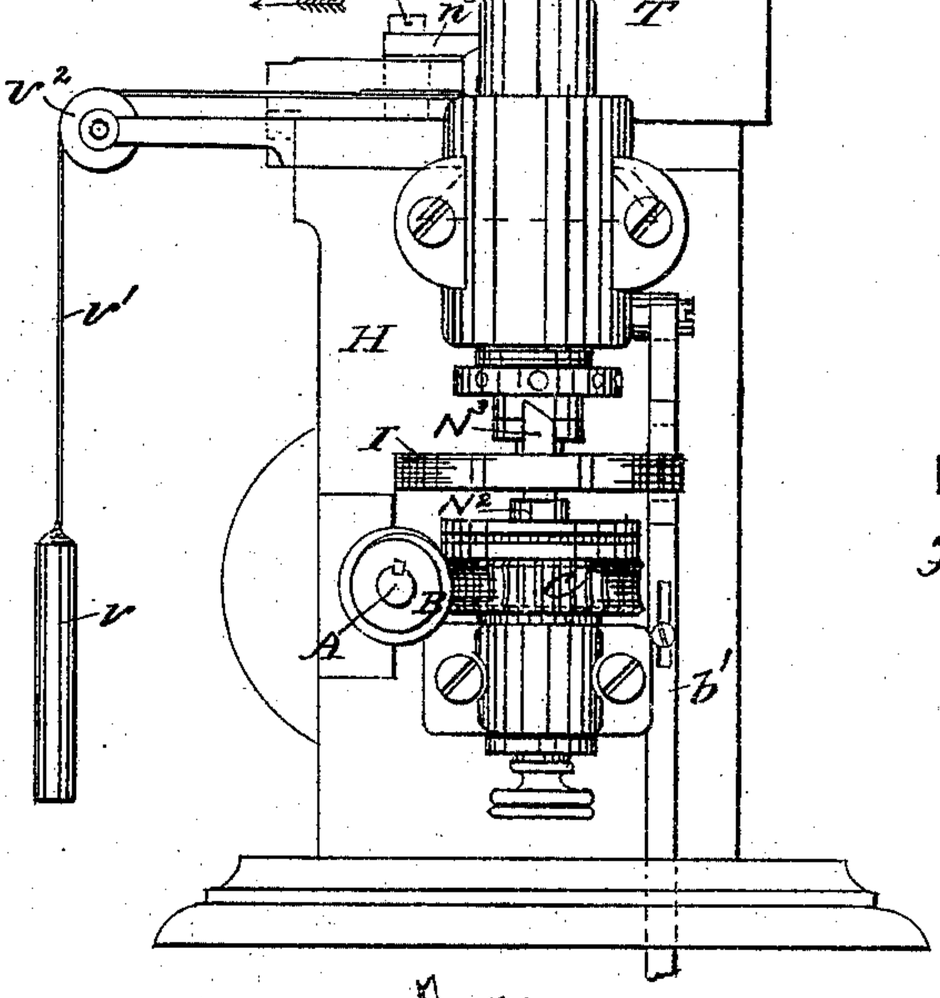


Fig. 4.

Fig. 3.



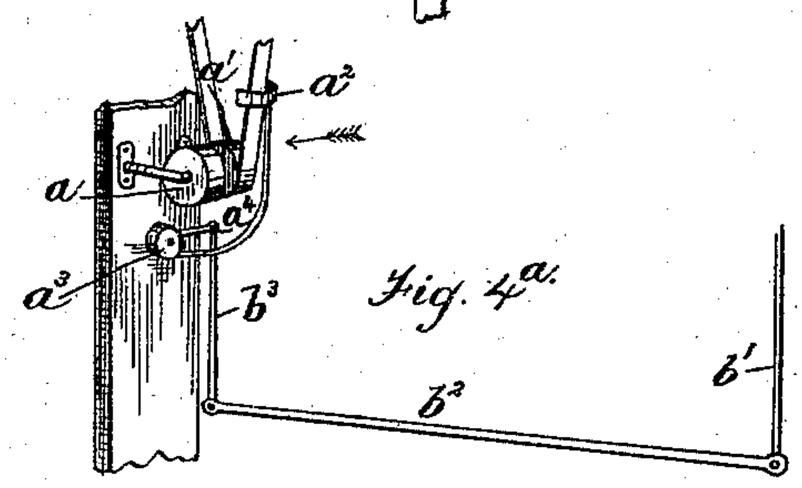


Fig. 4ª.

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(No Model.) 3 Sheets—Sheet 3.

C. V. WOERD.

MACHINE FOR POINTING, DRILLING, AND TAPPING WATCH BALANCES.

No. 271,967. Patented Feb. 6, 1883.

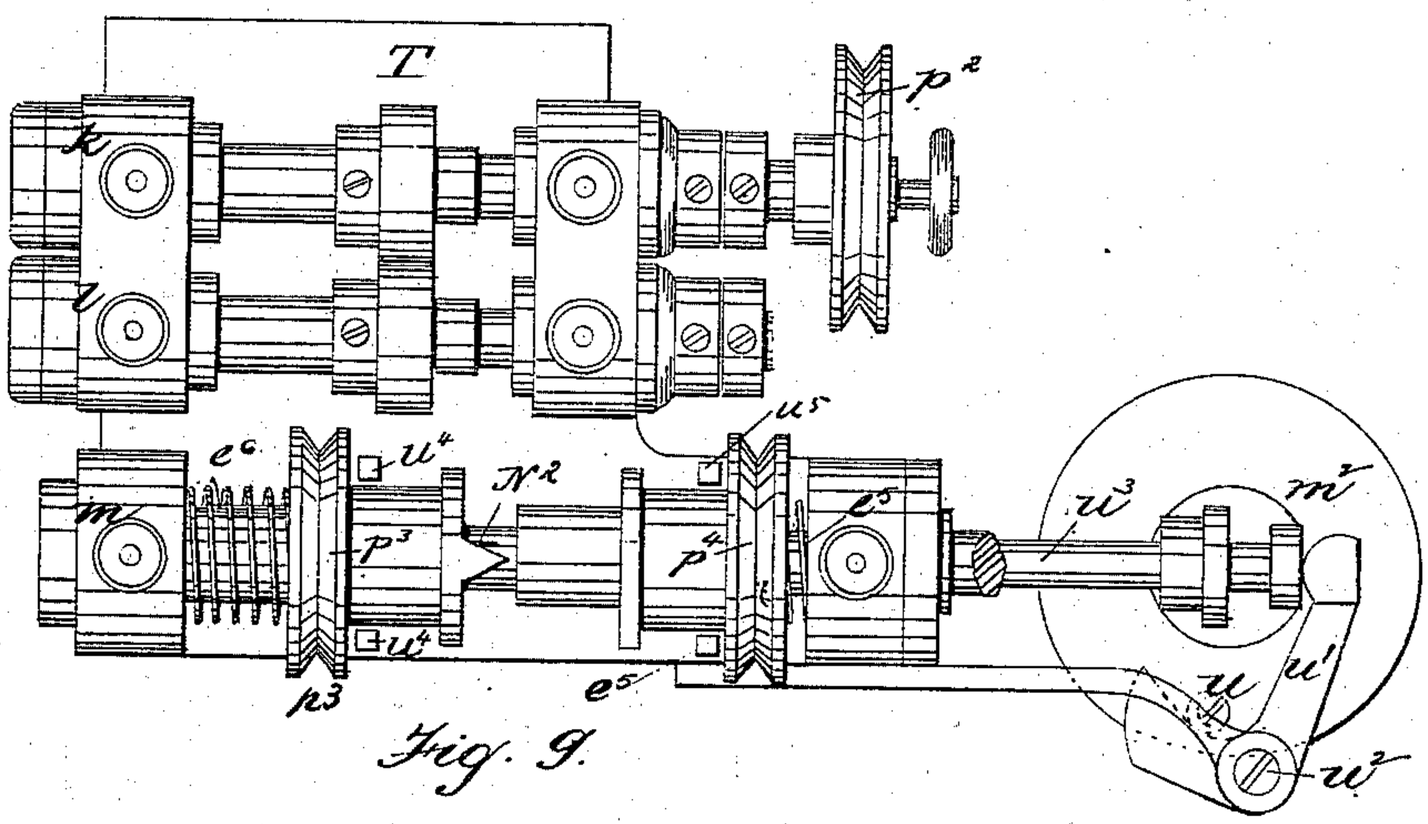

Fig. 9.

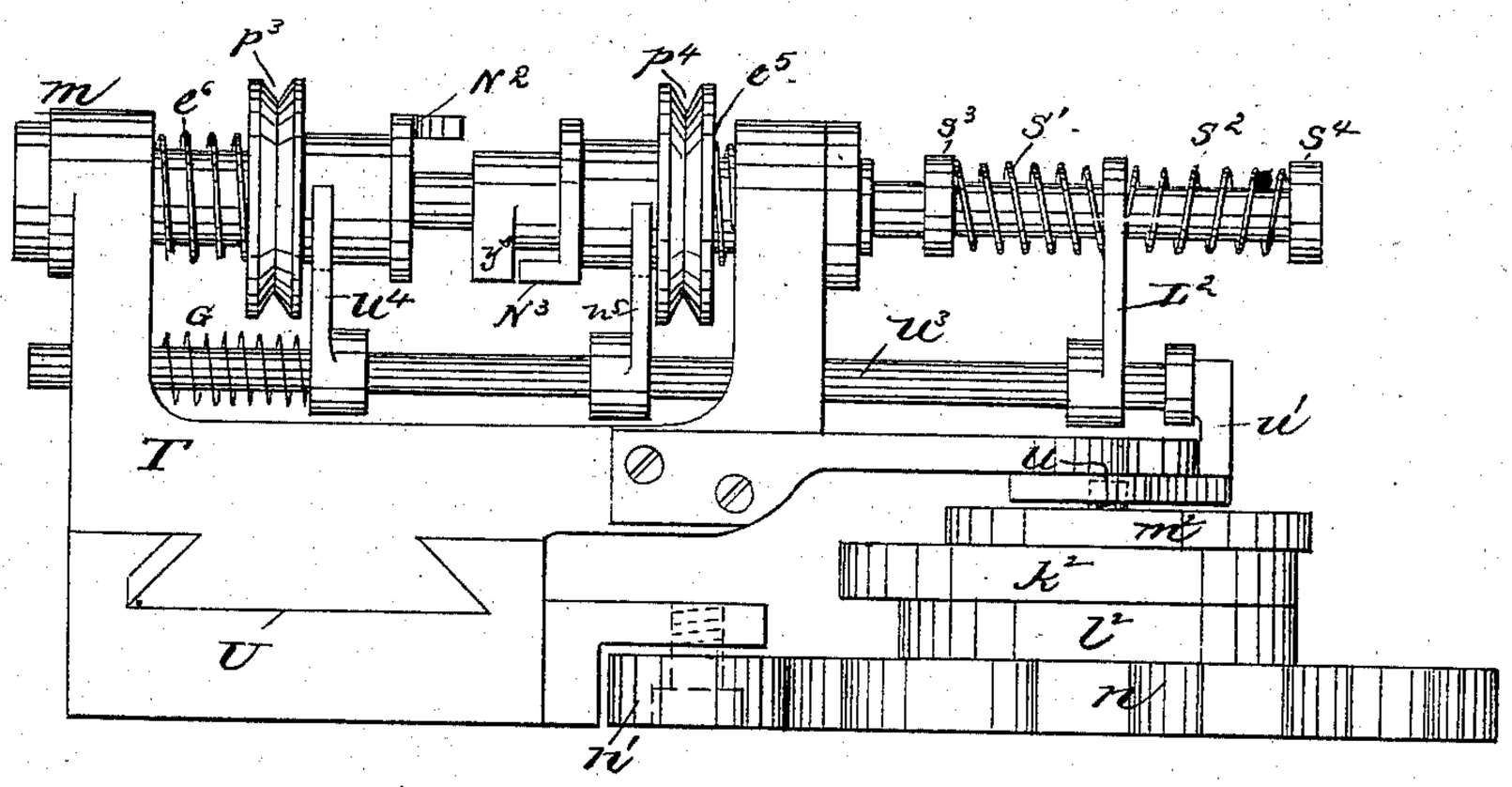

Fig. 10.

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UNITED STATES PATENT OFFICE.

CHARLES V. WOERD, OF WALTHAM, MASSACHUSETTS.

MACHINE FOR POINTING, DRILLING, AND TAPPING WATCH-BALANCES.

SPECIFICATION forming part of Letters Patent No. 271,967, dated February 6, 1883.

Application filed August 22, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES V. WOERD, of Waltham, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Machines for Pointing, Drilling, and Tapping Watch-Balances, of which the following is a specification.

This invention relates to mechanism adapted to form the screw-holes in the rim of a watch-balance for the reception of the usual screws or weights. Said holes are made at varying distances apart, and each hole is usually formed by the successive operation of a pointing, drilling, and tapping tool, the balance being held by a rotary spindle, which is turned partially after each hole is completed to present a new portion of the rim to the tools, which are brought forward to enter the rim, and are located side by side on a sliding carriage, so that each tool can not only move forward to enter the balance, but also sidewise, so that after it has acted on the balance it can give place to the succeeding tool. The partial rotations of the balance to bring it into position to receive the action of the hole-forming tools are limited by an index-wheel having notches corresponding in number and arrangement to the holes to be formed in the balance, and a spring-catch adapted to coincide with each notch in succession and arrest the rotation of the balance-holding spindle at the proper points.

Heretofore the rotation of the index-wheel and of the balance and the described movements of the hole-forming tools have been effected by the attendant of the machine, who is obliged to give it his entire time and attention.

My invention has for its object to enable the entire operation to be performed automatically, so that the attendant will only have to apply and remove the balances, and will therefore be enabled to attend to several machines, the machine stopping automatically after each balance is completed.

To this end my invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming part of this specification, Figure 1 represents a plan view of a machine embodying my invention. Fig. 2 represents a longitudinal vertical section on line *x x*, Fig. 1. Fig. 2^a represents an enlarged section of the friction device shown in Fig. 2. Fig. 2^b represents a section on line *z' z'*, Fig. 2^a. Fig. 3 represents an end elevation. Fig. 4 represents a partial side elevation, showing a part of the automatic stopping mechanism. Fig. 4^a represents a perspective view of other parts of the stopping mechanism. Fig. 5 represents a section on line *y y*, Fig. 2. Figs. 6 and 7 represent detail views. Fig. 8 represents a section on line *z z*, Fig. 2. Figs. 9 and 10 represent respectively side and plan views of the tool-carrying stocks and their operating mechanism.

The same letters refer to the same parts in all the figures.

In the drawings, H represents a supporting-frame of suitable construction, having bearings for the driving-shaft A. Said shaft is provided with worms B D, which impart motion respectively to worm-gears C E, the gear C effecting the rotation of the vertical balance-holding spindle L, which rotation is made intermittingly through intermediate mechanism hereinafter described, and the gear D, continuously rotating a vertical cam-shaft, F, having cams whereby the hole-forming tools are successively presented to the balance and moved laterally after finishing their work, as hereinafter described. The spindle L is provided at its upper end with a suitable chuck or clamping device for holding the balance *d* to be acted on. To the lower end of said spindle is rigidly attached the index-wheel I, having in its periphery notches *e*, formed like those of ratchet-wheels, and corresponding in number and relative position to the holes drilled in a balance-wheel.

R represents a pawl, which is pivoted to a fixed part of the frame H, and is pressed against the periphery of the index-wheel by a spring, *f*, so as to engage with either of the notches *e*, and thereby prevent the index-wheel from rotating. The pawl is adapted to hold the index-wheel during the operation of forming each hole in the balance, and after the hole is completed the pawl is thrown out of its engagement with the index-wheel by a sliding rod, *g*, adapted to be forced against the rear end of the pawl by a nose, *h*, on a wheel, *i*, said wheel being located on the cam-shaft F and

rotated thereby. When the index-wheel is released it is rotated by the worm-wheel B through the medium of a friction device, which enables the index-wheel to remain stationary when locked by the pawl and to rotate with the worm-wheel B when the pawl is disengaged, the worm-wheel being continuously rotated, so that the index-wheel will be rotated immediately upon the disengagement of the pawl. Said friction device is composed of a metal plate, N, interposed between two opposing surfaces, O P, which are so connected to the worm-wheel C as to rotate therewith, and springs S, arranged to press the surface P against the plate N, and thereby press the latter against the surface O, the surface P being a plate having pins P^2, adapted to slide in and out of sockets P^3 in the worm-wheel C, so that it can be moved by the springs S, and at the same time rotated by the worm-wheel. The plate N has a hub, N′, inclosing the chuck-operating screw-rod *j*, which passes through the worm-wheel C and spindle L, and on the hub N′ is formed an arm, N^2, having a pin, N^3, which passes through the index-wheel, thereby rigidly connecting the index-wheel with the plate N.

g′ g′ represent washers interposed between the plate N and the surfaces O and P.

k l m represent three head-stocks, provided respectively with pointing, drilling, and tapping tools, the head-stock *k* having a pointing-tool, *k′*, the head-stock *l* a drill, *l′*, and the head-stock *m* a tap, *m′*, said head-stocks having suitable chucks to grasp said tools. The head-stocks are movable longitudinally toward and from the balance-holding spindle L, so that each tool can be forced into the rim of the balance, and also so that the tools can act successively at the same point on the balance. The movement of the head-stocks toward the balance is effected by means of a primary carriage, U, supporting said head-stocks, and movable in guides on the frame H, a cam, *n*, acting on a roller, *n′*, on said carriage to force the latter toward the balance, and a spring, *o*, to force the carriage in the opposite direction when permitted by the cam. The head-stocks are directly supported by a secondary carriage, T, which is movable upon the primary carriage, U, in a direction at right angles to the line of movement of the latter. The lateral movement of the head-stocks is effected by a weight, *v*, or its equivalent, acting on the carriage T through a strap, *v′*, running over a pulley, v^2, to draw the carriage T in the direction indicated by the arrow in Figs. 1 and 3; a series of cams, k^2 l^2 m^2, on the cam-shaft F, and a lever, n^2, pivoted to the frame of the machine at *o′*, said lever having adjustable bearings, k^3 l^3 m^3, for the cams k^2 l^2 m^2, and being connected to the carriage T by a connecting-rod, *p*. It will be seen that the tendency of the weight *v* is to press the bearing-surfaces of the lever n^2 against the cams k^3 l^3 m^3, so that when the projecting portion of either of said cams strikes one of said bearing-surfaces it moves the carriage T in the opposite direction to that in which said carriage is moved by its weight *v*, and when the recessed portion reaches the bearing-surface the weight, causing the bearing-surface to follow the undulations of the cam, moves the carriage T in the opposite direction. The cam k^2 is arranged to act on the lever-bearing k^3, and is adapted to hold the head-stock *k* in position, and for a sufficient length of time for the pointing-tool to act on the balance, when the carriages U T are moved forward by the cam *n*. The cam l^2, arranged to act on the bearing l^3, has a shorter radius than the cam k^2, and is adapted to hold the head-stock *l* in position for the drill *l′* to act on the balance for a greater length of time than the pointing-tool. The cam m^2 is arranged to act on the bearing m^3, and is adapted to hold the head-stock *m* in position for the tap *m′* to act on the balances. The cam *n* is so formed and timed that it moves the primary carriage, U, supported carriage T, and the head-stocks forward and permits the same to be returned by the spring *o* once during the time that each head-stock is held opposite the balance. The portion 1 of the cam *n* is formed and timed to move the head-stocks forward while the pointing-tool *k′* is opposite the balance, and sufficiently to enable the pointing-tool to make a slight cavity in the balance. The portion 2 is formed and timed to move the head-stocks forward while the drill *l′* is opposite the balance and farther than the portion 1, so that the drill can pass through the balance, and is also adapted to give the drill a series of backward movements by means of depressions 2′ 2′ 2′, to enable the drill to clear itself from its cuttings. The portion 3 is formed and timed to move the head-stocks forward while the tap *m′* is opposite the balance and sufficiently far to present the tap to the mouth of the previously-drilled hole, the movement of the tap into said hole being effected by a pin, *u*, on the disk m^2 acting on one arm of a bell-crank lever, *u′*, pivoted at u^2 to an arm on the carriage T. The other arm of said lever bears upon a sliding rod, u^3, having forks u^4 u^5, bearing alternately upon pulleys p^3 p^4, which are fitted in sleeves and are actuated by springs e^5 e^6, and run loosely on the tap-spindle. The sleeves of the pulleys p^3 p^4 are provided with prongs N^2 N^3, which engage alternately clutch y^5, which is firmly secured on the tap-spindle. The arm L^2 on the sliding rod u^3 embraces the tap-spindle and acts directly on the springs S′ S^2 between it and the collars S^3 S^4. During the forward movement of the sliding rod u^3 the arm L^2 compresses the spring S′, which in turn causes the tap-spindle to move forward. The revolving pulley p^4, however, being actuated by spring e^5, and not longer detained by fork u^5 on sliding rod u^3, which moves simultaneously with the rod, passes quickly forward and engages its prong N^3 with the clutch y^5, and thus gives rotation to the tap-spindle, allowing the tap to enter

freely the opposing hole of the balance and cut the screw-thread therein. During this operation the fork u^4 has moved pulley p^3 forward and against its spring e^6. As soon as pin u releases the bell-crank lever u' the spring S′ on the sliding rod causes a return motion of the latter with the forks u^4 u^5. Pulley p^3 is now free to follow, engaging clutch y^5 and revolving the tap-spindle in a contrary direction to that of the forward movement, the pulley p^3 being driven by a belt running in the opposite direction to the belt that drives the pulley p^4. The tap is thus unscrewed and freed from the balance. It will be seen, therefore, that after the head-stocks have been moved forward by the portion 3 of the cam n, and while they are being held by said portion, the tap is given a secondary forward movement, which carries it through the drilled hole in the balance and forms the thread in said hole, and a backward movement which withdraws the tap from the hole. The chucks or spindles holding the pointing and drilling tools are geared together and rotated by a belt running on a pulley, p^2, on one of said spindles.

The operation of the machine as a whole is as follows: A balance being secured to the upper end of the spindle L, and the latter being set at the initial rotating point and held by the pawl R of the index-wheel, the pointing, drilling, and tapping tools are successively brought to bear upon the same point on the balance by a single rotation of the cam-shaft F, its cams k^2 l^2 m^2 and cam n acting on the two carriages, as above described, each tool being moved laterally out of line with the balance after it has done its work and been withdrawn. A tapped hole is thus formed in the balance, the tap being withdrawn just before the shaft F completes its first rotation. Immediately after the withdrawal of the tap the nose h on the wheel i pushes the rod g against the rear end of the pawl R and disengages the latter momentarily from the index-wheel I. The index-wheel is then rotated by the worm-wheel C through the interposed friction device until the pawl R drops into the next notch of the index-wheel and stops it, the rotation thus imparted to the index-wheel and spindle L being sufficient to bring the portion of the balance where the next hole is to be made into line with the position successively assumed by the tools k' l' m'. The pointing, drilling, and tapping operations are then repeated by the continued rotation of the shaft F until another hole is made in the balance. The index-wheel is then again released and partially rotated and stopped in position to receive the next hole, and so on until the index-wheel has nearly made a complete rotation and all the holes are formed in the balance. After the last hole is formed and while the index-wheel is completing its first rotation the pin N^3 of said wheel, moving in the direction indicated by the arrow in Fig. 4, trips a catch, b, that holds in suspension a rod, b', connected with a suitable belt-shipping device adapted to be operated upon the dropping of said rod to shift the belt that drives the counter-shaft, from which motion is imparted to the driving-shaft A from a fast to a loose pulley on said counter-shaft. A device illustrating this is shown in Fig. 4ª, a being the fast and a' the loose pulley; a^2, the shipper attached to a spring-impelled pivoted drum, a^3, which has a tendency to move the shipper in the direction of the arrow, and thus transfer the belt from the fast to the loose pulley. The drum is prevented from so moving the shipper as long as the rod b' is supported by the catch b, said rod being connected through an intermediate lever, b^2, and rod b^3 with an arm, a^4, on said drum, and holding the latter, with the shipper, in the position shown. When the rod b' is released and allowed to drop, the drum a^3 is allowed to turn on its pivot and ship the belt. The operation of the machine is thus automatically stopped. When the operation is to be resumed the rod b' is raised by the operator and hung upon the catch b, the shipper being thus moved and caused to transfer the belt to the fast pulley.

A single cam may be used to impart the forward movements to the pointing, drilling, and tapping tools, instead of the series of cams for moving said tools and the devices described for imparting a secondary motion to the tapping-tool. I prefer the means shown, however, for the reason that they obviate the extreme wear which would result from the continual rubbing of a single cam upon a single point on the lever n^2, and assure an easy and perfect adjustment in bringing the head-stocks to their exact position.

Having thus described my invention, I claim—

1. In a machine for pointing, drilling, and tapping balance-wheels, the combination of the balance-holding spindle, the normally-locked index-wheel, the continuously-rotated wheel C, and a friction device rigidly attached to the index-wheel and held in frictional contact with the wheel C, with the driving-shaft and the gears thereon for imparting simultaneously motion to the wheel C and to the vertical shaft F, the said shaft F and its cams, the slide carrying the pointing, drilling, and tapping tools, and having a motion in a line at substantially right angles to the axis of the balance-holding spindle, and the means, substantially as described, for automatically moving the slide transversely to bring the several tools successively into operation on the balance, as set forth.

2. The combination of the balance-holding spindle, the normally-locked index-wheel, a continuously-rotated wheel, C, and a friction device rigidly attached to the index-wheel and held in frictional contact with the wheel C, whereby the index-wheel and friction device are caused to rotate with the wheel C when the index-wheel is released, as set forth.

3. The combination, with continuously-rotating wheel C, of the notched index-wheel,

the friction devices and connections, substantially as described, by which the index-wheel is caused to be rotated from wheel C, the spring locking-pawl R, adapted to engage with the notched wheel, and the sliding rod and cam operating to disengage the pawl and permit the notched wheel to be rotated, as set forth.

4. The combination, with the pointing, drilling, and tapping tools and the laterally-movable supporting-carriage T, of the series of cams k^2 l^2 m^2 and the lever n^2, having bearings corresponding to said cams and connected with said carriage, as set forth.

5. The combination of the tap m' and the described mechanism for moving the same forward to the balance, with the pin u, bell-crank u', sliding rod u^3, arm L^2, collars s^3 s^4, and springs S′ S^2, whereby the tap is given a secondary forward movement into the balance and then a backward movement to free it from the balance, substantially as set forth.

6. The combination of the index-wheel having the pin N^3, the catch or hook adapted to be tripped by said pin, and belt-shipping mechanism, substantially as described, held in place by said hook and allowed to move to ship the belt when said hook is tripped, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 26th day of July, A. D. 1881.

CHAS. V. WOERD.

Witnesses:
M. S. G. WILDE,
CHAS. A. BERRY.