(No Model.) 5 Sheets—Sheet 1.

E. A. MARSH.

MACHINE FOR TURNING AND POLISHING THE RIMS OF WATCH BALANCES.

No. 369,866. Patented Sept. 13, 1887.

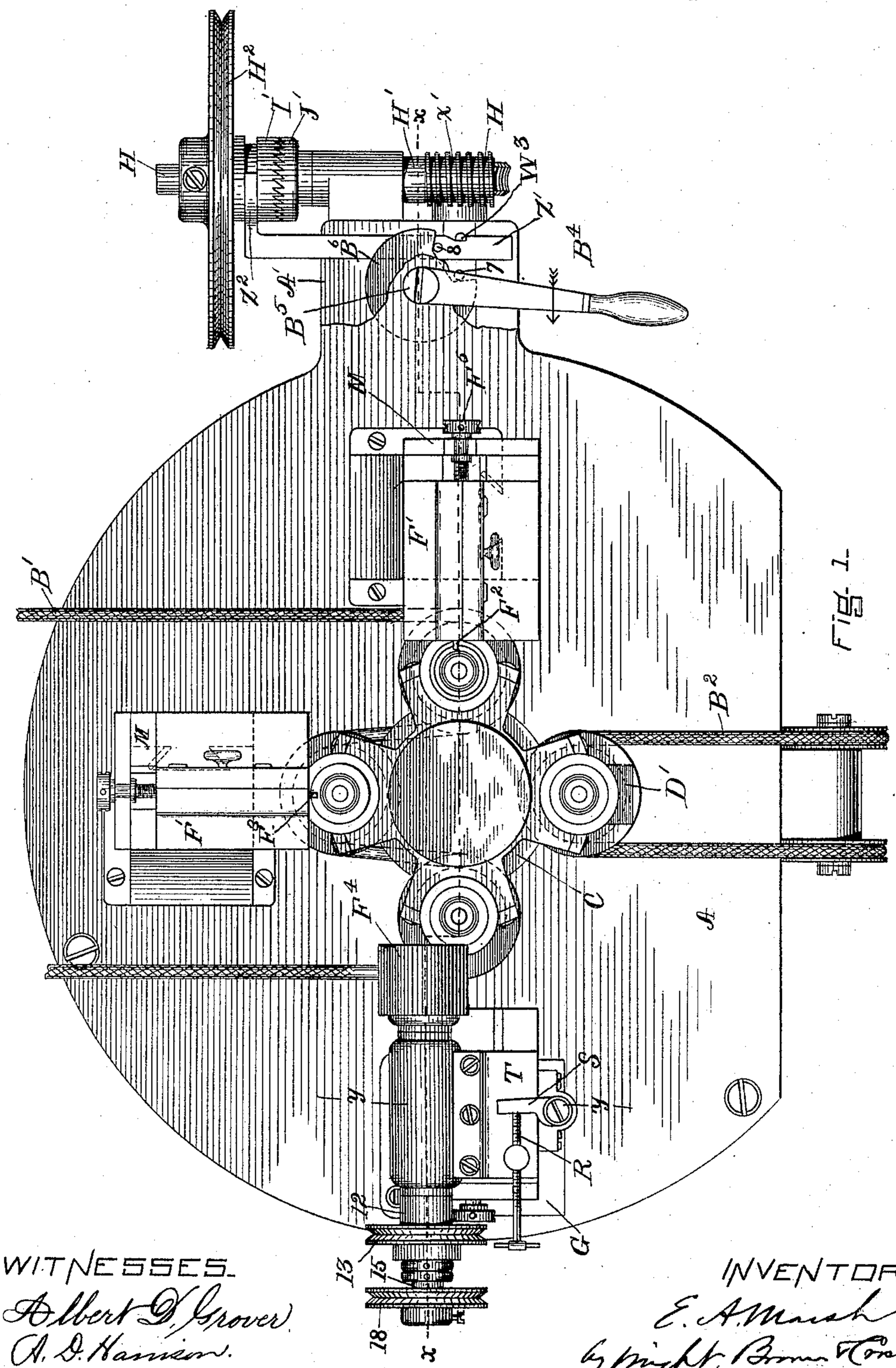

Fig. 1.

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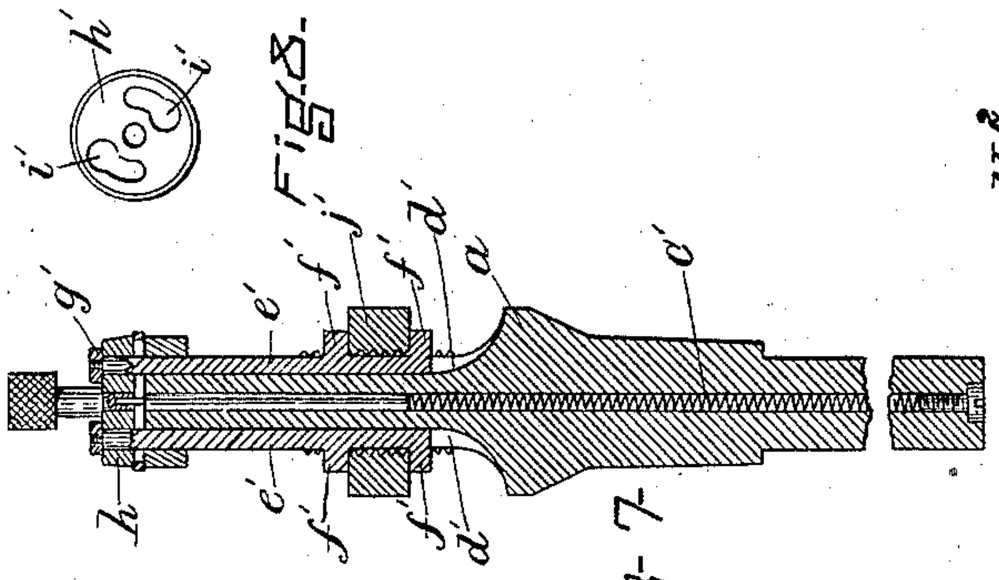

Fig. 7.

Fig. 2.

Fig. 6.

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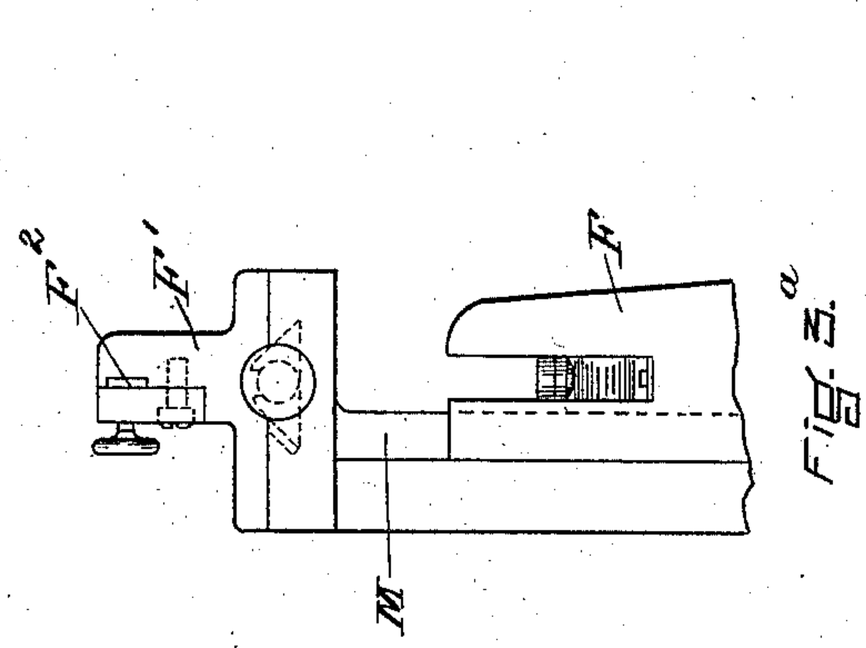

Fig. 3a.

Fig. 3.

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MACHINE FOR TURNING AND POLISHING THE RIMS OF WATCH BALANCES.

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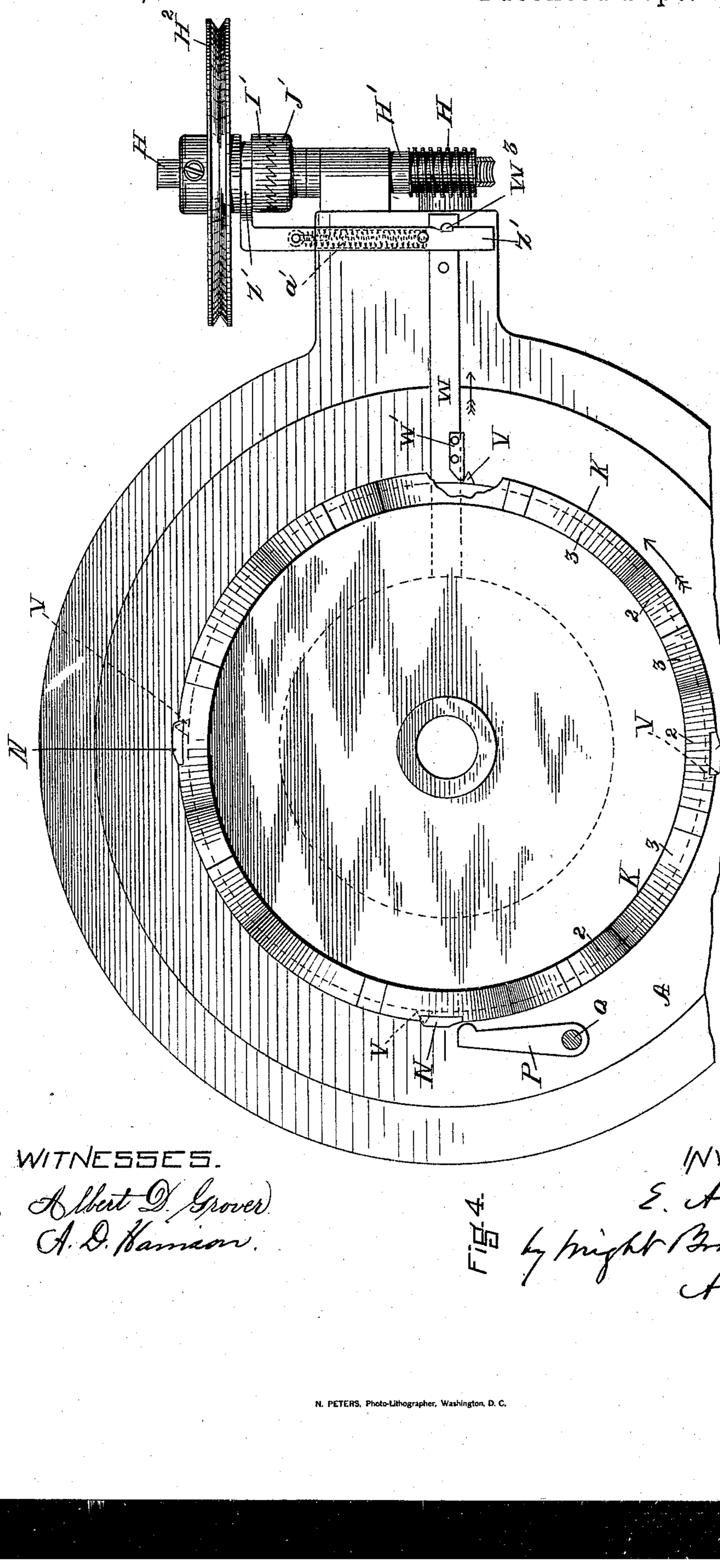

Fig. 5.

Fig. 4.

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MACHINE FOR TURNING AND POLISHING THE RIMS OF WATCH BALANCES.

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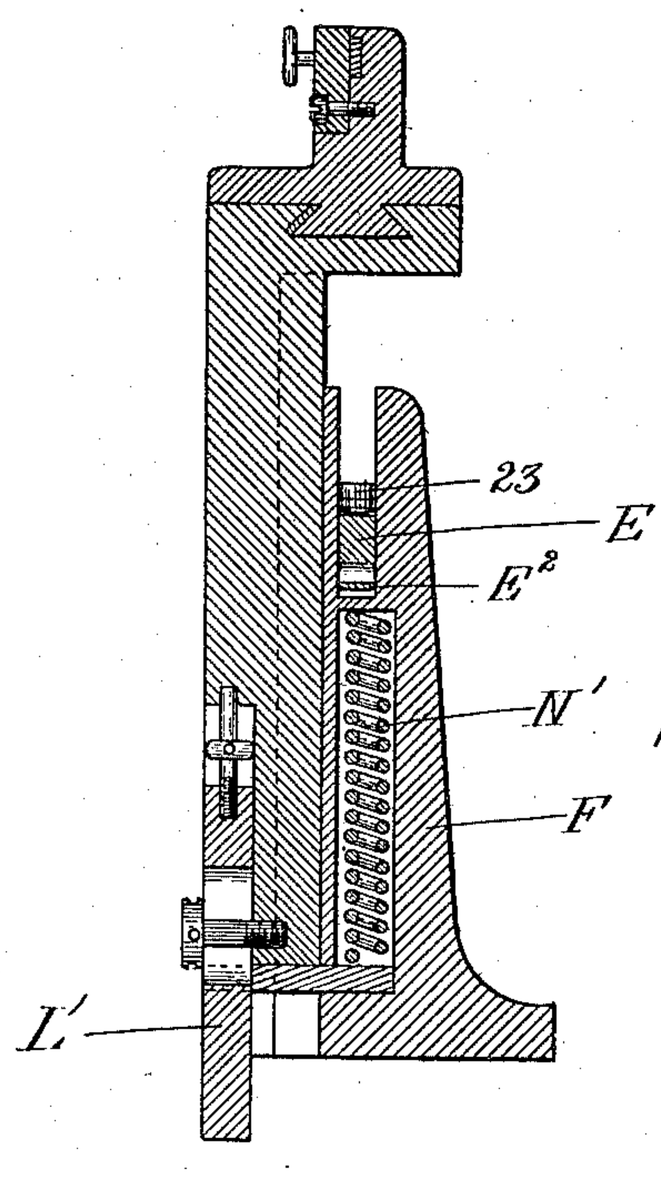

Fig. 10.

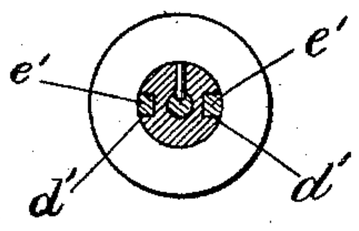

Fig. 9.ª

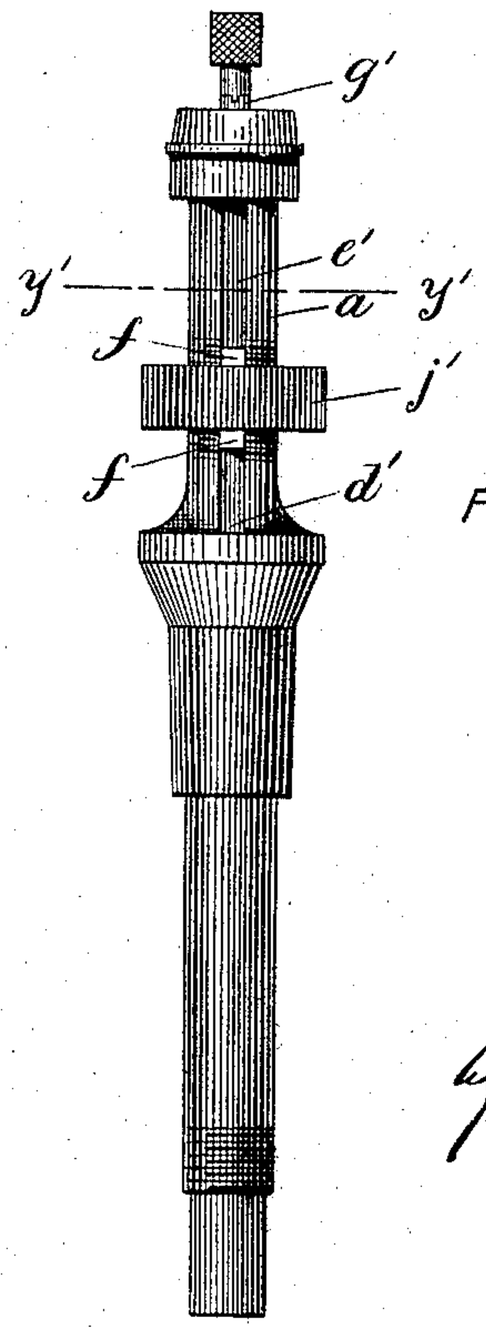

Fig. 9.

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UNITED STATES PATENT OFFICE.

EDWARD A. MARSH, OF NEWTON, MASSACHUSETTS.

MACHINE FOR TURNING AND POLISHING THE RIMS OF WATCH-BALANCES.

SPECIFICATION forming part of Letters Patent No. 369,866, dated September 13, 1887.

Application filed April 1, 1887. Serial No. 233,282. (No model.)

To all whom it may concern:

Be it known that I, EDWARD A. MARSH, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Machines for Turning and Polishing the Rims of Watch-Balances, of which the following is a specification.

The uniform and accurate running of a watch is dependent in a great degree upon the truth and uniformity of the balance; and to obtain and insure such accuracy it is the custom in the various and successive operations required in the construction of the balance to hold or govern it by the central hole in which the staff is to be inserted. One of the most exact and difficult of these operations is that of turning off the rim. The requirements are exact truth, uniformity in size, and excellence in finish. The common method of performing this part of the work is to place the balance on a central pin firmly attached to a running chuck, which is provided with a flange or shell a trifle less in diameter than the finished balance. The central pin or arbor has a slight taper, and the balance being placed upon it is bedded in cement, the cement and balance being heated by a small flame until the cement is sufficiently plastic to allow the balance to be "trued up" by pressure of a tool of wood or soft metal, which is held against the rim while the balance and chuck are revolved, and when the balance is true the cement is cooled by the application of water. The operator then, by the use of suitable tools, turns off the periphery of the balance, and then brings to acting position a rapidly-running polishing disk or wheel, so as to produce the desired finish or polish on the surface of the rim. The balance and cement are then again heated and the balance removed.

All of the operations above described involve the necessity for great care and considerable skill, much depending upon the judgment of the operator. There is also great objection to the application of so high a degree of heat as is required for cementing the balance to the chuck, with the danger of overheating and warping the balance.

The object of my invention is to avoid the objections inseparable from the ordinary methods of turning balances; also, to avoid the necessity for skilled operatives, and, further, to greatly expedite and cheapen the work.

To this end I construct a machine which is automatic in some of its operations, and which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 represents a plan view of the machine. Fig. 2 shows a vertical section on line *x x*, Fig. 1. Fig. 3 represents a side elevation. Fig. 3ª represents a rear elevation of the tool-holder and a part of its support. (Shown in Fig. 3.) Fig. 4 represents a plan view of the lower portion of the base of the machine, the top portion thereof being removed. Fig. 5 represents an edge view of the cam-wheel and the sliding bar operated thereby. Fig. 6 represents a section on line *y y*, Fig. 1. Fig. 7 represents a section on line *z z*, Fig. 2. Fig. 8 represents a top view of the cap shown in section in Fig. 7. Fig. 9 represents a side view of one of the chuck-spindles. Fig. 9ª represents a section on line *y' y'*, Fig. 9. Fig. 10 represents a section on line *x' x'*, Fig. 2.

The same letters of reference indicate the same parts in all the figures.

In the drawings, A represents the bed of the machine, which is composed of a top and a bottom section, as shown in Fig. 2, and is preferably circular or nearly so, and is provided with a central vertical column, B. Fitted to slide vertically on said column is an annular frame, C, having bearings for four driving or clutch shafts, C', the upper ends of which are provided with clutches C^2, formed to engage with similar clutches, C^3, on four chuck-spindles, *a*, mounted in a rotary turret, D, above the clutch-shafts, as hereinafter described. The driving or clutch shafts are driven by belts B' B^2, running on pulleys on the lower ends of said shafts, the belt B' driving three of said shafts, while the belt B^2 drives the fourth, as shown in Fig. 1.

The annular frame C is supported by springs A', Fig. 2, which enable it to be depressed to separate the clutch-shafts C' from the chuck-spindles *a*, as hereinafter described, and normally hold said frame with the clutch-shafts in engagement with the chuck-spindles, as shown in Fig. 2. A rod, A^2, secured to a cross-bar, A^3, extending across the annular frame C is suitably connected with a treadle below the base A, so that the frame C and its chuck-

spindles may be depressed by the operator's foot. A slot, A^4, is formed in the column B to permit the vertical movements of the cross-bar A^3.

D represents a turret which is fitted to rotate on the upper portion of the column B, and is provided with bearings in which are journaled four chuck-spindles, *a*, each of which is provided at its upper end with means, hereinafter described, for holding a balance-rim. The chuck-spindles *a* are provided at their lower ends with clutches C^3, formed to engage the clutches C^2 on the clutch-shafts C'.

F represents an upright or post affixed to the base A, and M represents a slide having a dovetail rib fitted to move in a dovetail guide in one side of said upright. The upper end of the slide M has a dovetail groove in which is fitted the base of a slide, F', which holds a tool, F^2, adapted to turn off the periphery of a balance held and rotated by one of the chuck-spindles *a*. The tool-holder F' is adjustable horizontally and is held by a screw, F^5, in any position to which it may be adjusted.

To the upright F is pivoted a latch, E, which is supported against a fixed stop, E', Fig. 2, by a spring, E^2, and is adapted to swing downwardly against the pressure of said spring. On the turret D are four projections, D', placed at equal distances apart and provided with sockets D^2, adapted to receive the latch E. The under surface of each projection D' is beveled from its forward end backwardly, as shown in Fig. 3, so that when each projection approaches the latch E it will depress the latter until the socket D^2 coincides with the latch, when the latch will spring up into said socket and lock the turret. The turret is thus adapted to be locked in four different positions, the arrangement of the latch and latch-receiving sockets being such that the turret is locked whenever its chuck-spindles are in position to present the balances held thereby to the tool F^2 and to the finishing and polishing tools hereinafter described.

The slide M and the tool-holder F' thereon are reciprocated vertically to cause the tool to move across the periphery of a balance presented to it by means of, first, a cam-wheel, K, which is fitted to rotate on a boss or journal within the base A, and is provided on its upper edge with a series of inclines, 2, and a series of opposite inclines, 3, and, secondly, a vertical rod, L', Fig. 3, attached to the slide M and pressed downwardly against the upper edge of the cam-wheel by a spring, N', located in a cavity in the upright F, and bearing at its lower end on a part of the slide M. (See Fig. 2.) It will be seen that when the cam-wheel is rotated in the direction indicated by the arrow in Fig. 4 the inclines 2 of said wheel will raise the slide M and the tool carried thereby, while the opposite inclines, 3, will permit said slide and its tool to be depressed by the spring N', the latter keeping the rod L' at all times in close contact with the cam-wheel.

G represents a shaft, which is journaled in a bearing in the bottom section of the base A, and is provided with a bevel-pinion, I, meshing with a bevel-gear, J, attached to or formed on the cam-wheel K. Said shaft rotates the cam-wheel, and is provided at its outer end with a worm-wheel, G', which meshes with a worm, H, on a shaft, H', journaled in a bracket attached to the base A.

H^2 represents a pulley mounted loosely on the shaft H', and adapted to slide thereon, and provided with a clutch, I', formed to engage a clutch, J', affixed to said shaft. The pulley H^2 receives motion through a belt from a prime motor, and when engaged with the clutch J' imparts motion to the shaft H', the latter rotating the cam-wheel K. I have provided means whereby the pulley H^2 and its clutch are automatically moved to disconnect the latter from the clutch J' and stop the rotation of the cam-wheel K and the vertical movements of the tool F^2 after a given number of said movements. To this end I provide the periphery of the cam-wheel K with a series of projections, V, four in number, and place in a guide in the base A a sliding bar, W, having a lug, W', arranged to be acted on by each of the projections V in succession, and forced thereby with the bar W in the direction indicated by the arrow in Fig. 4, a spring, W^2, Fig. 2, being arranged in a cavity in the base A to bear on a lug on the bar W and press it normally toward the cam-wheel K. When the bar W is forced outwardly by a projection, V, a stud, W^3, on its upper surface is disengaged from a notch in a bar, Z', which is adapted to slide in the base A, and is provided at its outer end with a fork, Z^2, which engages a groove in the clutch I'. A spring, *a'*, (shown in dotted lines in Fig. 4,) moves the bar Z' in the direction required to cause it to separate the clutch I' from the clutch J' when the bar W is moved to disengage the pin W^3 from the notch of the bar Z'. It will be seen, therefore, that when each projection V strikes and displaces the bar W the driving-pulley is thrown out of engagement with the shaft H' and the vertical movements of the tool F^2 are stopped, this automatic stoppage taking place after each quarter-rotation of the cam-wheel, so that the tool is repeatedly reciprocated by the inclines occupying one-quarter of the circumference of the cam-wheel and then stopped. The number of movements given the tool in each direction during this period of continuous operation will of course depend upon the number of inclines on the cam-wheel. I have in this instance shown two tool-raising inclines on each quarter-section of the cam; but it is obvious that this number may be increased or diminished. If desired, every alternate incline may be longer than the others, (the total rise of each being the same as that of the others,) so that every alternate operative movement of the tool may be retarded.

To enable the operator to conveniently engage the pulley-clutch I' with the shaft-clutch

J′, and thus put the cam-wheel in operation, and also to disengage said clutches to stop the operation of the cam-wheel, I provide a hand-lever, B^4, which is pivoted at B^5 to the base A, and is connected to a plate, B^6, having a recess, the ends of which are arranged in such relation to a stud, 7, on the bar W and a stud, 8, on the bar Z′ as that, by turning said lever in the direction indicated by the arrow in Fig. 1, when the clutch I′ is disengaged from the clutch J′, the plate B^3 will act on the stud 8 on the bar Z′ and move the latter, so as to allow stud W^3 on the bar W to enter the notch in bar Z′ and lock the clutch I′ in engagement with the clutch J′. On the other hand, when said clutches are engaged with each other, as shown in Fig. 1, a motion of the lever B^4 in the opposite direction will cause the plate B^6 to encounter stud 7 on bar W, to move the bar W and disengage its stud W^3 from the notch of the bar Z′.

Another upright is secured to the base A, preferably at a distance of ninety degrees of a circle, having its center at the axis of the turret from the upright F and at the same distance from the axis of the turret as the latter. Said upright has a vertically-movable slide, M, carrying a horizontally-adjustable tool-holder, F′, and having a rod, L′, projecting downwardly and pressed against the cam-wheel K by a spring, said slide and tool-holder, except that the latch is omitted, being identical in their construction and operation with the slide M and tool-holder F′, already described, and has a tool, F^3, which differs from the tool F^2 in that it is adapted to impart a smoother surface to the periphery of the balance, said tool F^3 being preferably made of sapphire, while the first tool, F^2, is usually of steel.

G^2 represents a third upright arranged at a distance of ninety degrees from the second upright, and provided at its upper end with horizontal dovetail guides, between which is fitted a dovetail rib on a slide or carriage, T. In said carriage is journaled a horizontal sleeve, 12, which has a pulley, 13, and is rotated by a driving-belt, 14. 15 represents a spindle, which is journaled eccentrically in said sleeve, as shown in Fig. 6, and is rotated by a belt, 17, running on a pulley, 18, affixed to said shaft. To the inner end of the spindle 15 is attached an annular lap or polishing tool, F^4, preferably of boxwood, arranged to present a portion of its annular end to a balance held by one of the chuck-spindles *a*. The eccentric arrangement of the spindle 15 in the rotating collar 12 gives the lap F^4 a slight planetary motion, which heightens its polishing effect and prevents unequal wear of its acting surface. The carriage T is normally pressed by a spring, 19, Fig. 2, toward the turret D, but is forced back from the turret simultaneously with each stoppage of the motion of the tools F^2 F^3 by means of, first, a rock-shaft, Q, journaled in a bearing, 20, on the upright G^2 and another bearing in the base A, and provided at its upper end with an arm, S, which bears against an adjustable stud or screw, R, on the carriage T, and at its lower end with an arm, P, the outer end of which is in close proximity to but does not touch the periphery of the cam-wheel, as shown in Fig. 4; and, secondly, a series of projections, N, on said cam-wheel, said projections corresponding in number and position to the projections V, and being formed to displace the arm P, and thereby turn the rock-shaft Q and cause the arm S to force the carriage T away from the turret against the pressure of the spring 19 and withdraw the lap F^4 from its operative position.

The vertically-movable frame C, carrying the clutch-shafts C′, has an arm, 21, to which is attached a vertical rod, 22, sliding in a socket in the upright F, and having at its upper end a head, 23, bearing on the latch E, these devices acting to depress the latch and disengage it from the turret whenever the sliding frame C is depressed by the operator's foot.

The operation of the machine is as follows: The operator, having secured a balance to the chuck projecting toward the side of the base that is not obstructed by a tool or tool-carrier, will first depress the frame C by pressure of his foot on the treadle connected with said frame, thereby separating the clutch-shafts C′ from the chuck-spindles *a* and disengaging the latch E from the turret, and then turn the turret by hand until the balance just secured is presented to the first cutter, F^2, the balances previously presented, respectively, to the second cutter, F^3, and polishing-tool F^4 being at the same time moved on, the one to the polishing-cutter and the other (now completed) to the position for renewal. The turret is locked in the last-named position by the latch E, and the operator then, by turning the lever B^4, moves the pulley H^2 and its clutch I′, engaging the latter with the clutch J′, thus causing the rotation of the cam-wheel K, the inclines of which (conjointly with the springs N′) reciprocate the tools F^2 F^3, the projection N, which last caused the displacement of the lap F^4, being at the same time removed from the arm P of the rock-shaft, so that the lap is forced to its operative position by the spring 19. The tools F^2 F^3 and lap F^4 now operate simultaneously on the balances held by three of the chuck-spindles until the cam-wheel has made a quarter-rotation, whereupon the motion of the tools F^2 F^3 is arrested by contact of one of the projections V with the slide W, and at the same time the lap F^4 is forced back by contact of one of the projections N with the arm P. The operator then depresses the frame C, as before, and again rotates the turret and removes the finished balance and applies another. The operation continues in the manner described, the three tools being simultaneously put in operation by the operator and made inoperative by the rotation of the cam-wheel and the devices co-operating therewith.

It has been found, however, that an experienced and skillful operator is able to rotate the turret the quarter-revolution required without the stoppage of the mechanism, which, of course, involves the continuous engagement of the clutches I′ J′, the devices for automatically separating said clutches being removed or made inoperative; hence I do not limit myself to the employment of said devices, although I regard their presence as highly desirable.

It will be seen that the clutch-shafts of the three chuck-spindles that present the balance-rims to the tools F^2, F^3, and F^4 are those that are rotated by the belt B′, the other clutch-shaft which is engaged with the chuck-spindle in the vacant space between the tools F^2 and F^4 being driven by the belt B^2, which belt drives only the shaft last mentioned. By this arrangement I am enabled to rotate the chuck-spindle holding the finished balance-rim more rapidly than the other spindles while a cleaning device is being presented to the finished balance-rim and to stop said chuck-spindle without stopping the others while removing and applying the work.

To avoid the objectionable heating of the balance ordinarily made necessary for the purpose of cementing it firmly and truly to the running chuck, and also to greatly facilitate and cheapen the work, I provide each of the four balance-holding spindles *a* with a clamp-chuck, constructed as follows: Each of the spindles has drilled through its entire length a small hole, and at the upper end this hole is ground so as to be run perfectly true. Into this hole is nicely fitted a sliding plug, *b′*, the projecting end of which is ground with a slight taper and of size to fit the center hole of the balance. This sliding plug, commonly called a "pump-center," is pressed outwardly by a spiral spring, *c′*, as shown.

In two opposite sides of the spindle *a* are cut grooves *d′ d′*, in which are fitted the slides *e′*, having their lower ends projecting outward, so as to form shoulders or hooks *f′*. The top ends of said slides are cut with screw-threads, on which are screwed the adjusting-nuts *g′*. Each spindle is provided with a cap, *h′*, having a central hole which receives the pump-center *b′*. The cap also has two holes, *i′ i′*, to allow the cap to pass over the nuts *g′* on the ends of slides *e′*. These holes have narrowed extensions so formed, as shown in Fig. 8, that when the cap has passed the nuts *g′* it can be turned to bring its narrowed portions under the nuts *g′*, so that when the slides are drawn down by means of a nut, *j′*, engaged with a threaded portion of the periphery of the spindle and acting against the projecting shoulders *f′ f′*, the nuts *g′* will exert a downward pressure on the cap.

The balance is secured to the spindle by placing it on the taper end of pump-center *b′*, then putting on the cap *h′*, which is then turned, as described, the turning down of the milled nut *j′* drawing down the cap *h′* and clamping the balance firmly.

I claim—

1. In a machine for turning and polishing the rims of watch-balances, the combination of a series of tools, including turning or reducing tools and a polishing-tool, adapted to act simultaneously on a series of balance-rims and perform the several operations required, devices for simultaneously operating said tools, a rotary turret having a series of balance-holding chuck-spindles, and a corresponding series of clutch shafts or drivers for said spindles adapted to be operatively engaged therewith to continuously rotate the balances simultaneously, and when disengaged from the spindles to stop the rotation of the balances, as set forth.

2. In a machine for turning and polishing the rims of watch-balances, the combination of a series of tools, including turning or reducing tools and a polishing-tool, adapted to act simultaneously on a series of balance-rims and perform the several operations required, devices for simultaneously operating said tools, a rotary turret having a series of balance-holding chuck-spindles, a corresponding series of clutch shafts or drivers for said spindles adapted to be engaged therewith to continously rotate the balances, and when disengaged therefrom to stop the rotation of the balances, and means for locking said turret in different positions, as set forth.

3. The combination of a series of tools adapted to act simultaneously on a series of balance-rims and perform the several operations required, devices for simultaneously operating said tools, a rotary turret having a series of balance-holding chuck-spindles, a corresponding series of clutch shafts or drivers for said spindles supported by a movable frame which is adapted to be moved to engage said drivers with and disengage them from said spindles, locking devices for securing said turret in different positions, and a connection between the driver-carrying frame and the locking devices, whereby the turret is unlocked simultaneously with the disengagement of the drivers from the chuck-spindles.

4. The combination of a series of tools adapted to simultaneously act on a series of balance-rims and perform the required successive operations on each rim of the series, mechanism substantially such as a multiple-faced rotary cam-wheel and tool-supporting slides operated thereby for giving said tools their required movements, automatic means for making said tools inoperative after a given period of operation, a rotary turret having a series of balance-holding chuck-spindles, and a corresponding series of clutch shafts or drivers for said spindles adapted to be engaged therewith and disengaged therefrom, as set forth.

5. The combination of the base or support, a rotary cam-wheel supported thereby and provided with a series of inclines, the mov-

able slides having the turning-tools and operated by the inclined faces of the cam-wheel, the rotary polishing tool or lap and means for rotating it, and means for displacing the lap-carriage at each stoppage of the cam-wheel, as set forth.

6. The combination of the base or support, the rotary cam-wheel supported thereby and provided with a series of inclines, movable slides having the turning-tools and operated by the inclined faces of the cam-wheel, automatic mechanism, substantially as described, whereby the motion of the cam-wheel is arrested after a given period of rotation, the rotary polishing tool or lap, the sliding carriage for said lap, the series of projections N on the cam-wheel, and intermediate devices, substantially as described, co-operating with said projections, whereby the lap is displaced simultaneously with each stoppage of the cam-wheel, as set forth.

7. The combination of the turning-tools, the polishing-tool, the cam-wheel K, the intermediate mechanism co-operating with the inclines of the cam-wheel to reciprocate the turning-tools, the projections N on the cam-wheel, the devices acted on by said projections to displace the lap, the projections V on the cam-wheel, the spring-pressed slide W, arranged to be displaced by the projections V, the shafts G H, connected by gearing and arranged to communicate motion to the cam-wheel, the driving-pulley adapted to slide on the shaft H and provided with a clutch formed to engage a clutch on said shaft, and the spring-pressed bar Z', engaged with said pulley and adapted to be locked by the bar W when the latter is in its normal position and released by the displacement of said bar, as set forth.

8. The combination of the supporting-base having a central column, B, the turret fitted to rotate thereon and provided with a series of chuck-spindles having clutches at their inner ends, and the sliding frame C, provided with a series of shafts, C', having clutches formed to engage the clutches of the chuck-spindles, as set forth.

9. The combination of the supporting-base having a central column, B, the turret fitted to rotate thereon and provided with the series of chuck-spindles having clutches at their inner ends, the sliding frame C, provided with a series of clutch-shafts having clutches formed to engage the clutches of the chuck-spindles, springs arranged to support said carriage with a yielding pressure, and a rod, A^2, through which the carriage may be moved against the pressure of its supporting-springs to disconnect the clutches of its shafts from those of the chuck-spindles, as set forth.

10. A chuck-spindle having a pump center at its end and longitudinal grooves in its sides, combined with a cap, h', formed to bear on a balance-rim laid on the end of the spindle, slides e' e', fitted in the grooves of the spindle and having shoulders f' f' and heads or nuts g', and a nut, j', fitted between the shoulders f' f' and engaged with a thread on the periphery of the spindle, as set forth.

11. The combination of the series of tools, mechanism, substantially as described, for simultaneously operating said tools, automatic mechanism for making said tools inoperative after a given period of operation, and means for simultaneously presenting a series of balance-rims to said tools and for moving said series of rims simultaneously, and thereby presenting each rim successively to the different tools of the series, as set forth.

12. The combination of the series of tools, mechanism, substantially as described, for simultaneously operating said tools, automatic mechanism, substantially as described, whereby said tools are made inoperative after a given period of operation, a rotary turret provided with a series of chuck-spindles arranged to present a series of balance-rims simultaneously to said tools, a series of clutch shafts or drivers normally engaged with said spindles, but separable therefrom, and means for locking the turret in a series of positions, as set forth.

13. The combination of the fixed uprights arranged as described, the series of tools F^2, F^3, and F^4, supported by said uprights, mechanism, substantially as described, for reciprocating the tools F^2 F^3, means for rotating the tool F^4, the rotary turret having a series of balance-holding chuck-spindles exceeding the tools in number, the corresponding series of clutch shafts or drivers for said spindles, the belt B', arranged to rotate all but one of said drivers, and the independent belt B^2, arranged to rotate the other driver, as set forth.

14. The combination of the lap F^4, its shaft 15, the sleeve 12, in which said shaft is eccentrically journaled, the fixed bearing for said sleeve, means for rotating said shaft and sleeve and thereby giving a planetary motion to the lap, and means, substantially as described, for presenting a balance-rim to the lap.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 29th day of March, 1887.

EDWARD A. MARSH.

Witnesses:
C. F. BROWN,
A. D. HARRISON.