2 Sheets—Sheet 1.

C. H. FIELD.

ENGRAVING-MACHINE.

No. 192,247. Patented June 19, 1877.

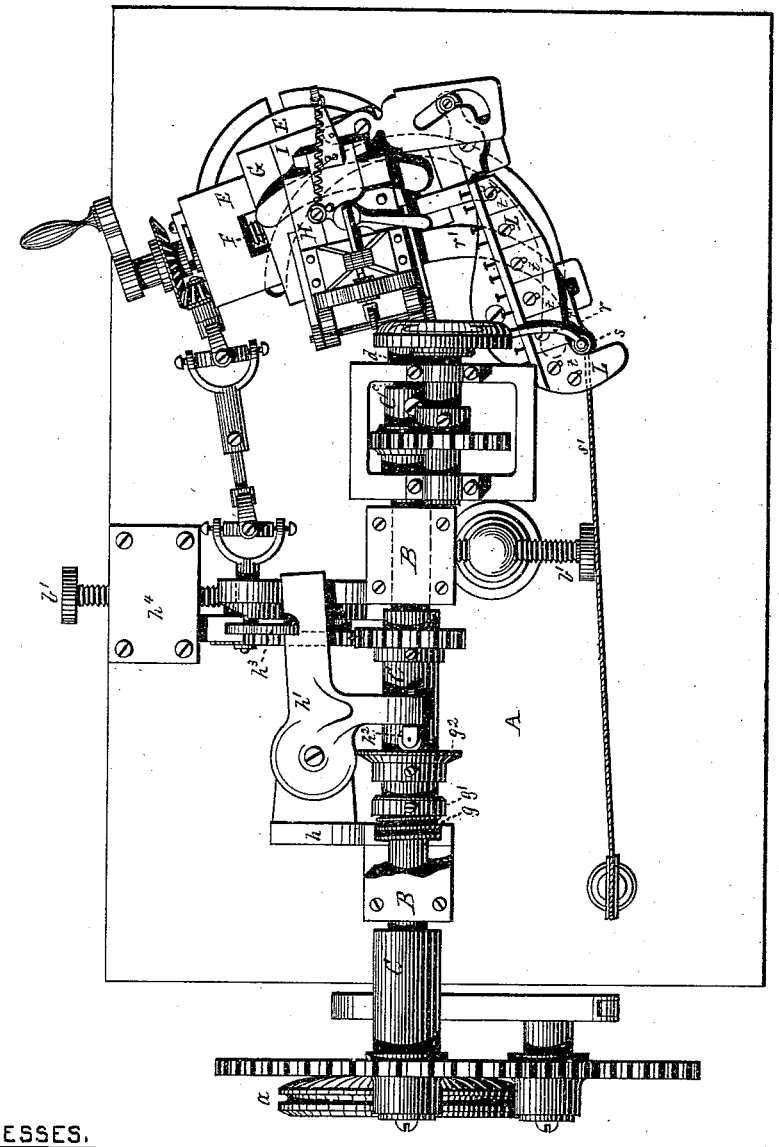

FIG. 1.

WITNESSES.

George A. Hicks

Frank P. Austin

INVENTOR.

Charles H. Field.

2 Sheets—Sheet 2.

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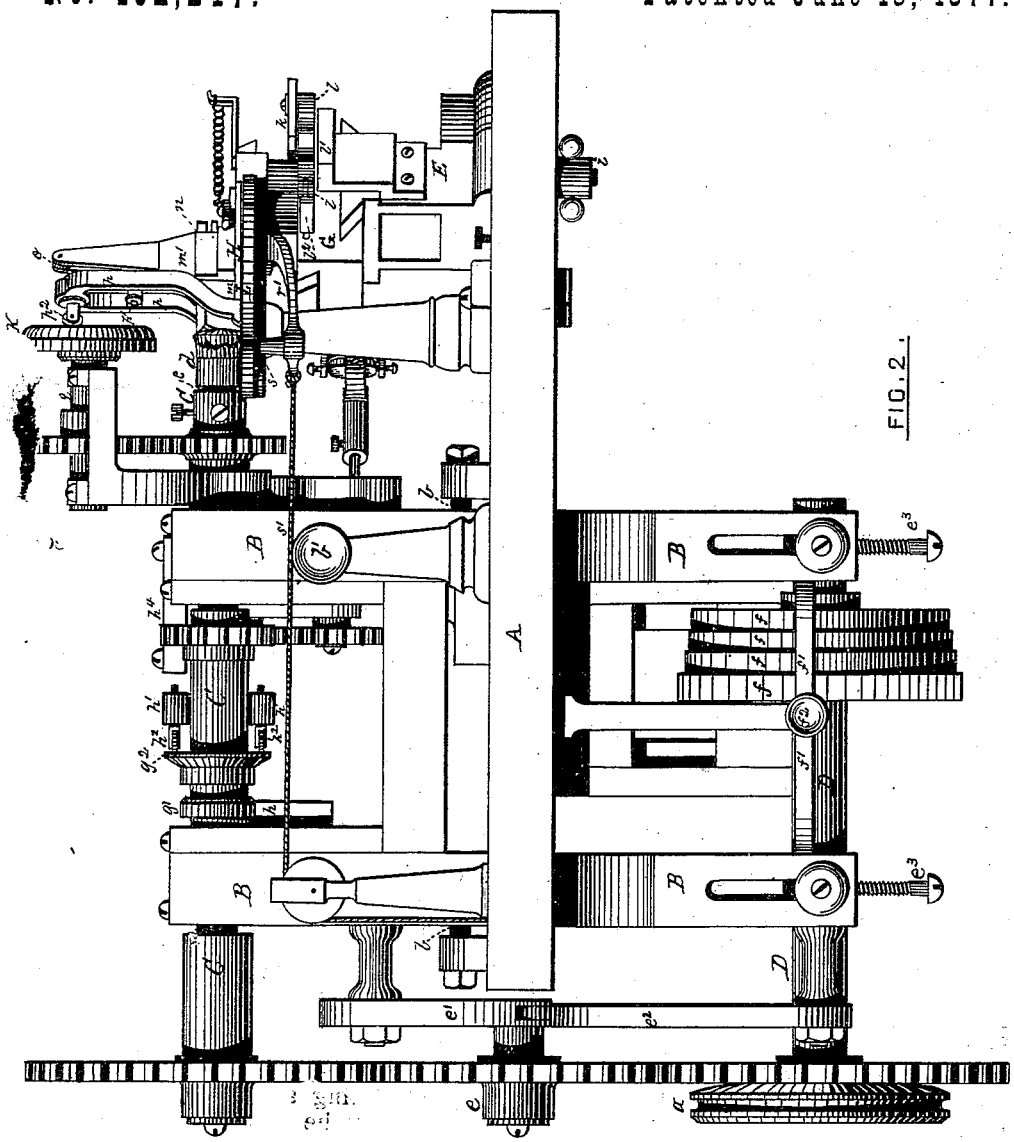

FIG. 2.

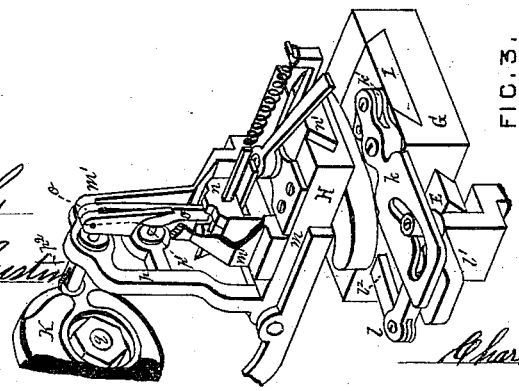

FIG. 3.

WITNESSES.

George A. Hicks

Frank P. Austin

INVENTOR.

Charles H. Field

UNITED STATES PATENT OFFICE

CHARLES H. FIELD, OF PROVIDENCE, RHODE ISLAND.

IMPROVEMENT IN ENGRAVING-MACHINES.

Specification forming part of Letters Patent No. **192,247**, dated June 19, 1877; application filed March 23, 1877.

To all whom it may concern:

Be it known that I, CHARLES H. FIELD, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Rosette-Engines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part thereof, is a clear, true, and complete description thereof.

My said improvements relate to that class of rosette-engines which are automatic in their operation, an example of which will be found in my Letters Patent of the United States No. 66,819, dated July 16, 1867.

These engines are employed for engraving watch and locket cases, napkin-rings, cups, and numerous other articles, whether the surface to be engraved be flat, concave, or convex, and for general utility it is important that they be adapted to operate upon a surface of either character mentioned, or upon a surface which is varied in such characteristics.

Rosette-engines made in accordance with my previous invention operate well on flat surfaces and on such as are slightly concave or convex. My improved machines can perform all that it is possible for the old machines to do, and they can do much which is not possible with said machines, and the character of the work executed by the new machines is, as I believe, superior to any machine-engraving heretofore accomplished.

Briefly stated, the objects of my invention are to render these machines capable of automatically engraving, in barleycorn or analogous styles, certain portions only of a surface, leaving in reserve one or more plain portions thereof, with any desired outlines for a plain finish or for the introduction of hand-engraving; also to increase the durability of the machine and to enable certain expensive parts thereof to perform good service even after they have been worn to a degree which, in previous machines, would render such parts practically useless; and also to generally increase its practical efficiency.

One feature of my invention consists in the combination, with the vibrating and revolving work-spindle in a rosette-engine, of a revolving and vibrating pattern-block, whereby the tool-post and graver is moved backward from the chuck in the work-spindle for the attainment of plain and irregular reserve spaces, which are partially or wholly surrounded by the engraving executed by the engine.

Another feature of my invention consists in the combination, with the work-spindle, of a vibrating frame which is centrally pivoted, and is weighted so that the portion thereof with the mechanism thereon above the pivots is practically balanced by the portion of the frame which is below the pivots, whereby the vibration of the work-spindle is easily and smoothly effected; and, further, in the combination, with a vibrating frame centrally pivoted, of a work-spindle mounted in the frame above the pivots and a rosette-shaft mounted in said frame below said pivots; also, in a rosette-shaft adjustably mounted in the vibrating frame, so that it can be set at any desired position with reference to the pivots of the frame, whereby the degree of vibration may be varied in proportion to the distance of said shaft from said pivots.

Another feature of my invention consists in the combination, with a work-spindle which is laterally vibrated by a rosette or other means, of a spring which forces the spindle forward, and a lever which overcomes the power of the spring and forces the spindle backward during the lateral movement of the spindle in one direction, but which permits the spring to act when said spindle is moved laterally in the opposite direction, whereby a longitudinal movement is imparted to the spindle simultaneously with and depending wholly upon the lateral movement thereof.

Another feature of my said invention consists of a graver-carriage, a traversing screw, and a traversing block moved longitudinally by the screw, in combination with a slide mounted on said traversing block, which has a movement at right angles to the axis of the screw, and is connected with the graver-carriage by a vertical pivot, whereby, in engraving concave or convex surfaces, the graver-carriage is moved bodily toward and away from the surface to be engraved in a line at right angles to the path of the traversing block; and, further, in the combination with the

graver-carriage, the traversing block, and its slide, of a cam-slotted lever attached to the traversing block, and the slide and a friction-roller and stud within the cam-slot, whereby the movement of the traversing block causes a rectangular movement of its slide; and, further, in the combination, with the traversing block, its slide, and its cam-slotted lever, of a lever which, at one end, is connected with the traversing-block, and at the other is provided with a stud and friction-roller, which occupies the cam-slot in the slotted lever, whereby the desired rectangular movement of the slide is effected smoothly and rapidly. Certain other minor features of my invention will be hereafter fully specified.

To more particularly describe my invention I will refer to the accompanying drawings, in which—

Figure 1, Sheet 1, represents, in plan or top view, a machine embodying my improvements. Fig. 2, Sheet 2, represents the same in side elevation. Fig. 3, Sheet 2, represents, in perspective, the tool-holder carriage and a portion of the revolving pattern-surface.

A denotes the bed-plate of the machine. It is mounted on legs, between which, at the ends, bars are provided for supporting a longitudinal driving-shaft, (not shown,) from which power is communicated by a round belt to the grooved pulley *a*. A hand crank-shaft (not shown) is conveniently located at the front end of the machine, which communicates with the driving-shaft, for the purpose of operating the mechanism by hand during preliminary adjustment.

B denotes a vibrating frame, which is vertically mounted on the bed-plate, so that somewhat less than one-half thereof is above the plate, and the remainder below it. It is supported by two pivot-screws, as at *b*, housed in lugs which project upward from the bed-plate. Above the bed-plate, on standards, are two adjusting screws, as at *b'*, on opposite sides of the machine, which serve as adjustable stops, which prescribe the limits within which the frame can vibrate.

C denotes the work shaft or spindle, which is provided at *c* with a socket and set-screws for receiving and holding the chuck *d*, on the end of which the piece of metal to be engraved or ornamented is secured by cement, in a manner well known.

D denotes the rosette-shaft, which is mounted in bearings at the lower end of the frame B, parallel with the work-shaft. Power is communicated to it from the driving-shaft (not shown) through the grooved pulley *a*, and from thence to the gear on the spindle-shaft through the intermediate gear *e*, which has its axial stud on an adjustable arm, e^1, which, with the link e^2, enables the gear *e* to be properly located with reference to the gears on the work-shaft and the rosette-shaft, regardless of the position of the latter, which is vertically adjustable in the frame B by means of the screws e^3. The rosette-wheels are shown at *f* keyed to the shaft D. They are as heretofore constructed, and require no detailed description. As heretofore, a round-faced stationary stud (not shown) engages with the corrugated face of a rosette-wheel, and this contact of these two imparts to the rosette-shaft and the frame in which it is mounted a movement away from the stud at each corrugation, and the return movement is effected by a spring, which is, in this instance, bow-formed, as at f^1, and has its fulcrum at the end of a screw, as at f^2.

As the portions of the machine thus far described embrace certain important features of my invention, I will now explain their operation, and designate wherein the novelties exist.

It will be remembered that the work-shaft must be vibrated in order to produce that well-known effect termed "barleycorn" engraving. Heretofore the vibrating frame has always been mounted wholly above the bed-plate and pivoted thereto, and the rosette-wheels have been mounted upon a shaft in the upper part of the frame, near the work-shaft, and therefore this heavily-burdened frame is moved to and fro on its pivots as so much dead weight, involving the use of a spring of considerable power, and the consequent friction and wear of the rosette which are incident to overcoming the power of such a spring. It will be seen that in my improved machine, the frame B constitues a vertical lever, and that the weight of the mechanism at the upper and lower ends is about equal, and that the axes of the work-shaft and rosette-shaft are in line with each other, and with the pivots on which the frame vibrates, and that therefore the frame is well balanced, and normally occupies a truly vertical position, instead of being wholly upon the one side or the other, as with the previous frames. The frame B, partly above and partly below the bed-plate, and the work-shaft and rosette-shaft being located at opposite ends of the frame, as shown, enables the machine to be easily operated, which lessens the wear of the several parts, and especially of the rosette-wheel, which, in itself, is a matter of very considerable importance. In previous machines having the rosette-wheels in the upper part of the frame, near the work-shaft, the character of the engraving varies as the corrugations in the rosettes become worn, and this necessitates their frequent renewal. With the balanced frame in accordance with my invention, when the rosette-wheel is new the rosette-shaft is adjusted at the lowest point possible, and as the corrugations in the rosette become worn the shaft is raised by its adjusting-screws, so that the distance between it and the frame-pivots is lessened, which enables me to attain the same degree of vibration with a rosette from the time it is new until it is worn out and practically inoperative. The frame being balanced and operating as a lever, as described, it will be seen that a very light spring may be

employed for maintaining the rosette-wheel in contact with its stud. Although it is in every way preferable that the rosette shaft and the work-shaft be on opposite sides of the frame-pivot, as shown, it is to be understood that a frame partly above the bed and partly below it, balanced on central pivots, constitutes a valuable feature of my invention, because the work-shaft and rosette-shaft may both be mounted at the upper end of the frame, and the machine be rendered much easier in operation, provided the frame be extended below its pivots and weighted, so that it will be balanced and maintain normally a vertical position.

Rosette-engines are relied upon for performing varied lines of service, some of which require, in addition to the lateral vibratory movement of the work-shaft, a simultaneous longitudinal movement, and this has been provided for heretofore by mounting the work-shaft in bearings which admit of its sliding therein, by combining with the shaft a spring which forces it in one direction, and by mounting on the shaft a rosette-wheel which is corrugated on its side. A round-edged stud, engaging with these side corrugations, moves the rosette-wheel and the work-shaft, so as to overcome the spring, and the latter effects the return movement, or, in other words, the spring causes the corrugated side of the rosette-wheel to maintain contact with its stud. It will be understood, therefore, that machines of this class, as heretofore constructed, involve the use of two kinds of rosette-wheels, one with the corrugations on the periphery or edge thereof, and the other with the corrugations on the side of the wheel adjacent to its periphery. Usually complex rosette-wheels have been employed embodying both systems of corrugation. The longitudinal movement of the work-shaft is seldom required without the lateral movement, and I have so constructed my machine that a single rosette with a corrugated edge imparts to the shaft a longitudinal movement as well as a lateral movement, and this is effected without entailing upon the rosette as much actual labor as was heretofore performed by it in the execution of either of those movements.

As heretofore, the work shaft or spindle C has bearings in the frame B, in which it can move longitudinally within certain limits, bounded by collars or shoulders on the shaft. An expansive spiral spring, as at g, encircles the shaft, and abuts against the frame and the fixed collar on the shaft, as at g^1, so as to force the shaft endwise away from the abutting portion of the frame. A hanger, as at h, projects laterally from the portion of the frame with which the spring g abuts, and on this is a vertical stud or pin, on which a horizontal bell-crank lever is mounted, as at h^1. The short end of this lever is forked, so that one portion of it is beneath and the other portion above the work-shaft, and each of these portions is provided with a friction-wheel, as at h^2, for engaging with the side of a collar, g^2, which is secured to the shaft. The long arm of lever h^1 has an abutment, at its edge opposite to the work-shaft, against an arm, as at h^3, which is longitudinally and laterally adjustable, but is immovable with relation to its contact with the lever when the machine is in operation. When in the position as shown in Fig. 1, it will be seen that, if the long arm of lever h^1 were advanced toward the work-shaft C, said shaft would be forced toward the spring g, and compress it. Precisely the same effect is produced by the vibration of the frame, because, while the fulcrum-stud of lever h^1 moves with the frame and shaft, the long arm of said lever remains stationary. It will be seen that the system of leverage employed between the rosette-wheel and the arm h^3, which abuts against the long arm of lever h^1, enables the longitudinal reciprocation of the work-shaft to be easily and smoothly effected with the expenditure of but little power, and that the rosette is but little liable to be worn in the performance of its duties.

It is not to be understood that this bell-crank lever h^1 can only be used when the novel frame B is employed. However the frame may be constructed, and wherever the rosette may be located therein, the longitudinal movement of the work-shaft will be effected by the lateral reciprocation of the frame if the lever h^1 be mounted on a fulcrum which is attached to and is moved with the frame. As heretofore constructed, the extent or degree of the longitudinal movement of the work-spindle depended wholly upon the depth of the corrugations in the side of the rosette-wheel, and, therefore, numerous wheels were requisite from which to select the proper one for producing a desired effect. With my lever-motion the degree of longitudinal movement on the part of the spindle can be increased or lessened by the lateral adjustment of the arm h^3, which is clamped by screws between a plate, h^4, and the standard which supports the arm. The greater the distance between said arm and the pivot of lever h^1 the less the spindle will be moved longitudinally, and vice versa.

I will next describe those portions of my machine by which the "graver" is controlled in the performance of its work, referring briefly, meantime, to the machine patented by me July 16, 1867. In said prior machine the graver is secured in a tool-post, which is mounted on a sliding block fitted to a bed, which is pivoted at its front end to a traversing block tapped so as to connect with a traversing screw, which, when revolved, moves the graver gradually outward from the center of a watch-back, for instance, to its periphery. The tool-post bed is turned on its pivot by a lever and weight or spring. The old machine is capable of doing good service on flat plates, but operates indifferently on concave and convex surfaces, because the graver has but two positive movements, one of which is due to

the traverse-screw and the other to the semi-rotation of the graver-bed on its pivot, and with these movements only it is impossible to attain a desirable uniformity of work. In my present machine the graver-carriage has three positive movements: first, that due to the traversing screw; second, that due to the pivoting of its bed, both as heretofore; third, a movement of the carriage in a line at right angles to the axis of the traversing screw. In both machines the tool-post is mounted on a slide controlled by a spring, which forces the graver toward the chuck which carries the plate to be engraved. In the new machine the graver travels from the periphery of the watch-cover to the center, instead of from the center outward, as in the old machine. It is unimportant, however, whether the machine be adapted to commence at the periphery of the case or at the center, although I prefer to commence on the periphery and work toward the center. The new machine possesses an entirely novel capacity, in that it is capable of "barleycorn" engraving any desired portion of the plate, leaving portions thereof with any required outline as reserve spaces for the introduction of hand-engraving.

Referring now to the drawings, the graver-carriage standard is shown at E. It is secured to the bed of the machine by means of a slot in its base and a clamping-screw at *i*, which occupies a curved slot in the bed-plate, which admits of the adjustability of the standard with relation to the end of the work-spindle. The traversing screw is shown at F provided with a hand-crank, a gear, and spring-pawl, and it is connected with driving-gearing mounted on the frame by means of a shaft having universal joints, so that the screw may be revolved regardless of the particular position of the standard E. The spring-pawl admits of the disconnection of the gearing from the screw, which can then be revolved by its hand-crank.

G denotes the traversing block, dovetailed to the standard and connected with the traversing screw. H denotes the graver-carriage. It is secured to the traversing block by means a vertical pivot at its front end (not shown) and the dovetailed slide I, which is fitted into a recess in the traversing block, so that said slide may move to and fro in a line at right angles to the axis of the traversing screw. This movement of the slide I is wholly automatic, and is effected by the movement of the traversing block which is due to the revolution of its screw. It will be seen in Fig. 3 that a horizontal lever, *k*, is pivoted to the top of the traversing block at one side, at its rear end, and that this lever is connected with the slide I by a link, *k'*. The outer end of the lever *k* is provided with a cam-slot, which is occupied by a friction-wheel on a vertical stud at one end of a horizontal lever, *l*, which is pivoted centrally to the top of a bracket, l^1, secured to the side of the standard. The opposite end of lever *l* is connected to the traversing block by a pivoted link, l^2. The cam-slot in lever *k* has a form corresponding to the curve of a watch-cover near its periphery. It will readily be seen that the movement to and fro of the traversing block on its screw will move the friction-wheel on lever *l* toward or away from the block, as the case may be, and that the cam-slot, by its engagement with the wheel, will move the slide I in or out in a line at right angles to the path of the traversing block. This novel feature, whereby the graver-carriage is moved automatically at right angles to the path of the traversing screw, constitutes an important part of my invention; and I do not limit myself to the precise construction shown, for I am well aware that this movement may be effected by other mechanism, which will readily be suggested to persons skilled in the art. The employment of the lever *l* with the lever *k* enables me to effect the requisite movement of the slide in much quicker time than would be the case if the friction-wheel in the cam-slot was mounted on a fixed stud. Returning now to the graver-carriage H, it will be seen to embrace a bed, *m*, a tool-post, *n*, a slide. *n'*, on which the tool-post is mounted, a hand-lever pivoted to the bed *m*, and connected by a spiral spring to the slide *n'*, so that the spring may be controlled for forcing the tool-post forward, or so that the slide may be released from the action of the spring when the tool-post is to be withdrawn pending adjustment. These parts thus referred to as embraced within the term "graver-carriage" are not materially unlike those shown in my former patent, and heretofore used by me on these machines.

The vertical standards *m'*, mounted on the bed *m* near its front end, are arranged to support at their upper ends a pendent lever, *o*, the lower end of which engages with the tool-post *n*, so that when this pendent lever is forced backward it moves the tool-post and the graver backward by overcoming the power of the spiral spring before described. In front of the standards *m'* is a vertical bow-shaped lever, *p*, the feet of which are pivoted to the bed *m* on each side thereof. A cross-bar extends from side to side of this lever *p* centrally, which is provided with a thumb-screw, as at p^1, the end of which abuts centrally against the front side of the pendent lever *o*.

Above the work shaft or spindle C, at its front end, is a short shaft, *q*, mounted on a bracket secured to the front end of frame B and geared to the spindle, so that it revolves with it at the same speed, but in an opposite direction. On the outer end of this short shaft *q*, above the chuck on the spindle, is a revolving pattern-block, K, the front surface of which corresponds in contour with the surface of the plate or article to be engraved. Portions of the pattern-block have a raised surface. At the upper end of the bow-lever *p* is a finger, p^2, provided with a friction-wheel on a horizontal axis, which, by the force of the spiral spring exerted through the slide, the tool-post,

and pendent lever *o*, is always maintained in close relation to the lowest surface of the pattern-block, so that when said friction-wheel is in contact with the raised surfaces on the revolving pattern-block the tool-post is thrown backward and the graver withdrawn from contact with the plate which is being engraved; but when said friction-wheel is not riding upon said raised surfaces the graver will operate in engraving. The raised surfaces on the pattern-block therefore cause portions of the plate or watch-case to be reserved or plain, and these portions accurately correspond in the their outline with the outlines of the raised surfaces on the pattern-block, although on a much smaller scale.

I will next describe the means whereby the graver-carriage is moved on its axis so as to maintain the graver in a right line to the surface of the metal at the point with which the graver is in cutting contact. Broadly considered, similar means are employed in my former patented machine.

The graver-carriage, at one side, has two laterally-projecting arms. The one at *r* extends from the front end of the carriage at the top thereof, and that at *r'* extends in a curved line from its under surface, and both terminate so that they serve as supports for each end of a vertical stud, on which a friction-pulley, *s*, is mounted. To the lower arm *r'* a cord, *s'*, is attached, which passes over a pulley, thence downward through the bed of the machine, and is weighted or attached to a spring of sufficient range to effect the requisite rotation of the carriage on its pivot. In order that the carriage shall be turned on its pivot only to a degree which shall be in exact proportion to the traversing movement due to the screw, the "former" L is so set that its curved edge affords an abutment, with which the friction-wheel engages, and along which it cannot be moved by the weight, except at a speed corresponding to that at which the carriage is moved toward the former by the traversing screw. At one end the former has a surface which lies across the path of the cord, and therefore, when the friction-wheel reaches that end, it is moved solely by the traversing screw. The former is mounted upon a standard, which is secured to the bed of the machine by a clamping-screw and a curved slot in the bed, which permits of its location and adjustment at any desired point.

This former L differs from those in my previous machines, in that it is made up of numerous sections, as at *t*, each of which can be withdrawn or advanced by screws, and secured in any desired position for varying the character of the edge with which the friction-wheel *s* engages, so as to meet varied requirements incident to the particular service desired.

The manner of using my improved machine will, of course, be varied according to the particular effects which it may be desirable to produce, and it is not deemed necessary for the purposes of this specification to describe all the ways in which the machine can be operated, because persons skilled in the art will readily understand how to produce the several effects of which the machine is capable after comprehending its operation in the production of any one style of engraving.

I will, however, describe the mode of operation involved in barleycorn engraving a watch-case cover which has a fully-rounded or convex periphery, and has portions of its surface reserved for the introduction of hand-engraving, or which are to remain smooth and plain after said reserved portions have been smoothly outlined by a hand-graver.

It will be assumed that the work-spindle chuck has the watch-cover properly mounted thereon, and that the revolving pattern-block has a central portion of its surface raised, so as to represent, for instance, a large five-pointed star. The graver and tool-post is released from the power of its spring and carried rearward. The traverse-block is located by its screw, as far as may be requisite, toward the hand-crank on said screw. The graver-carriage is swung around so that the graver will be nearly (sometimes wholly) at right angles to the axis of the work-spindle. A former, L, is selected and adjusted with reference to the size of the watch-cover, and to the contour of the portion thereof which is curved. The graver is then advanced and the carriage adjusted so that the graver, when the work-spindle is revolved, will properly cut the initial line near the extreme periphery of the cover. The machine is then put in motion. It is now to be remembered that the graver stands at right angles to the line of the work-spindle, and, therefore, the lateral vibration of the spindle in itself merely overcomes intermittingly the power of the spiral spring on the tool-post and its slide, and causes the graver to reciprocate longitudinally without affecting the relations of its point with reference to the surface of the watch-cover. It is also to be remembered, however, that this lateral vibration induces through the bell-crank lever a longitudinal movement of the spindle, and it is this movement which now causes the graver to cut a wave-line. This line is continuous but convolute, the circle described being gradually lessened in diameter by the operation of the screw controlling the traversing block and graver-carriage. As the graver approaches the rounded corner of the cover the weight draws the carriage around on its pivot, maintaining the graver at right angles to the surface with which its point is in contact, and the slotted lever causes the carriage to be moved bodily rearward in proportion to the curve of the watch-case. As the graver gradually changes its position with reference to the axis of the work-spindle the spiral spring which controls the tool-post forces the graver forward, gradually overcoming the power of the spiral spring, which otherwise controls the work-spindle, thus lessen-

ing the extent to which said spindle is longitudinally reciprocated; but at the same time the lateral vibration of the spindle begins to perform its service in producing the wave-line by the graver. In other words, as the longitudinal movement loses its capacity to produce the wave-line the lateral movement gains in that capacity, and this exchange of capacities is so evenly and mutually effected that the character of the wave-line is uniform from the time the graver commences its work in a line at right angles to the axis of the work-spindle until it has traversed to a point at which the graver is parallel with the axis of said spindle. As the graver approaches this parallel position the tool-post spring gradually overcomes the power of the spindle-spring until there is no longitudinal movement of the spindle whatever, and the wave is thereafter produced solely by the lateral movement of the spindle. Now, as only the central portion of the revolving pattern-block is elevated, the finger-wheel on the bow-lever has not been affected at all by the block, and the graver has been permitted to cut a continuous convoluted wave-line.

As the finger-wheel reaches that portion of the block occupied by the points of the raised star it overrides them one by one, and this overriding causes the bow-lever, through the pendent lever, to throw the graver rearward until a distance has been rotatively traveled by the cover proportionately equal to the distance traveled by the finger-wheel in overriding a star-point, after which the graver resumes contact with the cover and continues its wave-line, and so on, the said line being broken with an increasing space between the breaks due to the increased width of the arms of the star as its center is approached by the finger-wheel, and when the body of the star is reached by the finger-wheel the machine-engraving of the cover is completed. With the exception of the star thus outlined, the cover will be wholly barleycorned, and will require only that said outline be cut by a hand-tool for perfecting the design and merging the outline of the star with the breaks in the convolute wave-lines.

It will be observed that in this machine the lines cut by the graver will be uniform in their character under all circumstances, because, as before stated, the graver-carriage has a movement transverse to the line of the screw, and the point of the graver is always exactly in line with the axis of the pivot on which the carriage turns.

Having thus described my invention, I claim as new and desire to secure by these Letters Patent—

1. In a rosette-engine, the combination, with a suitable graver-carriage and the vibrating and revolving work-spindle, of a revolving and vibrating pattern-block, substantially as described, whereby portions only of a plate may be machine-engraved, and portions thereof reserved with any desired outline for a plain finish or the introduction of other styles of engraving, as set forth.

2. The combination, with the work-spindle in a rosette-engine, of a vertical vibrating frame which supports the spindle, and a rosette-shaft is centrally pivoted and balanced, substantially as described, whereby the vibration of the work-spindle is easily and smoothly effected, as set forth.

3. The combination, in a rosette-engine, of a vibrating frame centrally pivoted, a work-spindle mounted in said frame above the pivots, and a rosette-shaft mounted in said frame below the pivots, substantially as described.

4. The combination, with a pivoted vibrating frame, of a rosette-shaft adjustably mounted in said frame, substantially as described, whereby said shaft may be located at any desired position with relation to the frame-pivots, and thereby increase or lessen the extent of the vibration of the frame, as set forth.

5. The combination, with a laterally-vibrating work-spindle and a spiral spring which forces said spindle in one direction, of a lever, which, when the frame is vibrated laterally, forces the spindle in the opposite direction, substantially as described, whereby both the longitudinal and lateral reciprocation of the work-spindle are effected simultaneously, as set forth.

6. In a rosette-engine, the combination, with a graver-carriage, a traversing screw, and a traversing block, of a slide in the traversing block which has a movement at right angles to the path of the screw, and to which the graver-carriage is connected by a vertical pivot, substantially as described, whereby the graver-carriage may be moved bodily with the slide in a line at right angles to the path of the traversing block, as set forth.

7. The combination, with the traversing block, its screw, the graver-carriage, and the slide in the block to which the carriage is attached, of the slotted lever and the friction-roller stud which occupies the slot in the lever, substantially as described, whereby, as the traversing block is moved to and fro on its screw, the slide and the carriage are moved bodily at right angles to the axis of the screw, as set forth.

8. The combination, with the traversing block, its slide, to which the graver-carriage is attached, and the slotted lever which is connected to the block and its slide, of a lever which is connected at one end to the traversing block, and carries at its opposite end a stud and roller occupying the slot in the lever which is connected with the slide, substantially as described, whereby the slide and the graver-carriage are moved easily and rapidly, as set forth.

CHARLES H. FIELD.

Witnesses:
J. C. B. WOODS,
THOMAS F. COSGROVE.