No. 852,189. PATENTED APR. 30, 1907.

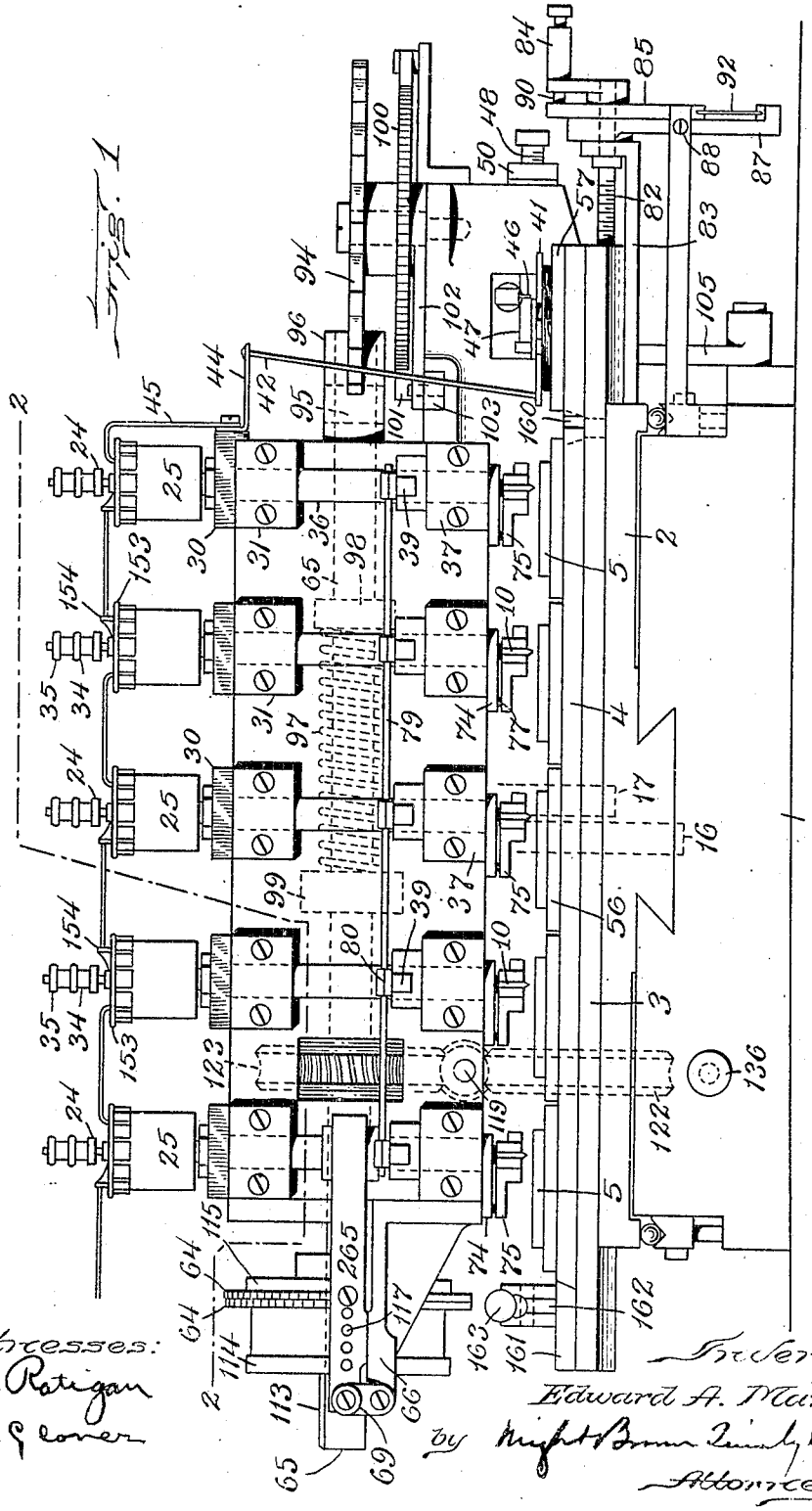
E. A. MARSH.

MACHINE FOR ORNAMENTING DIALS.

APPLICATION FILED JAN. 31, 1907.

7 SHEETS—SHEET 1.

Fig. 1.



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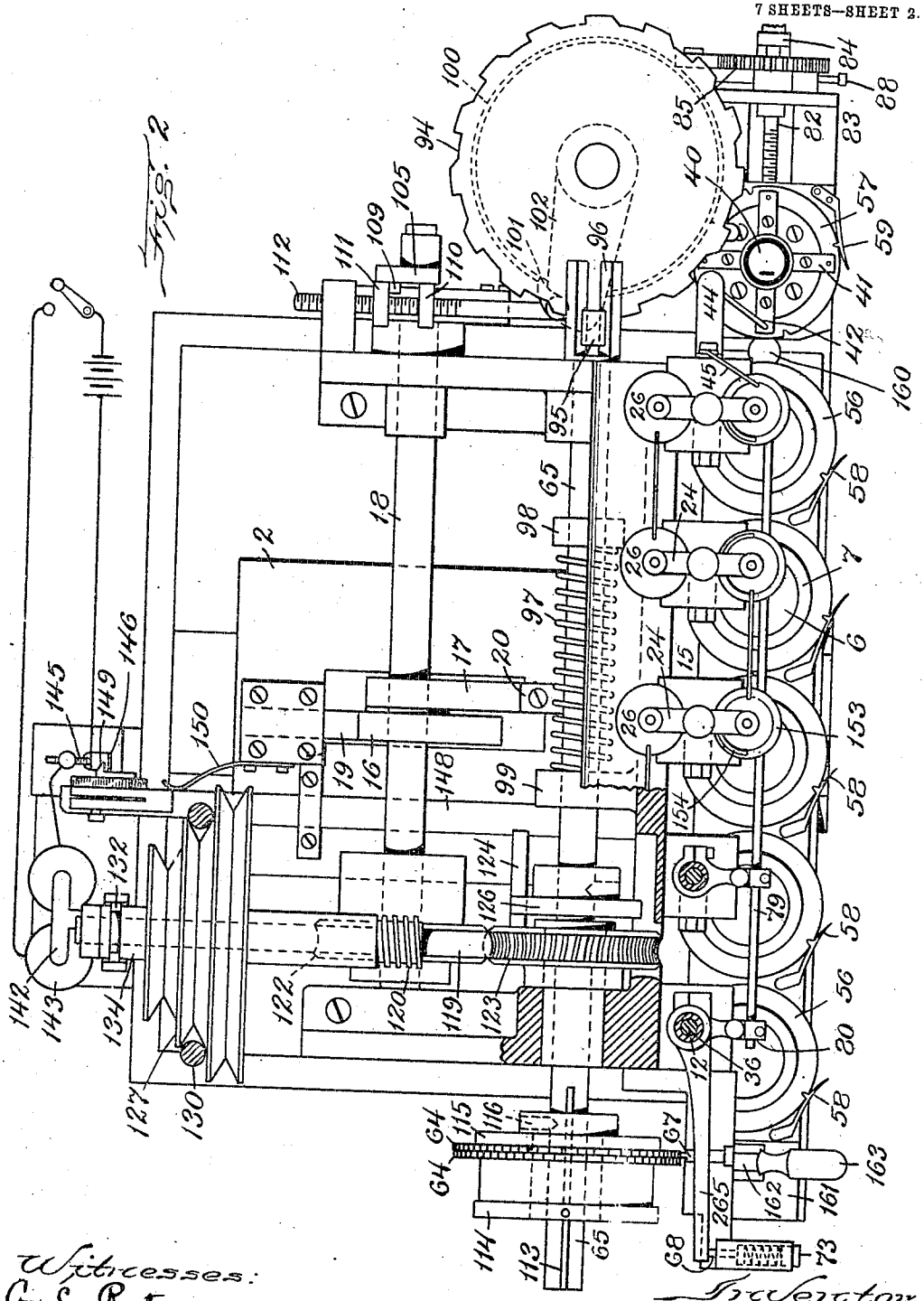
7 SHEETS—SHEET 2.

Fig. 2



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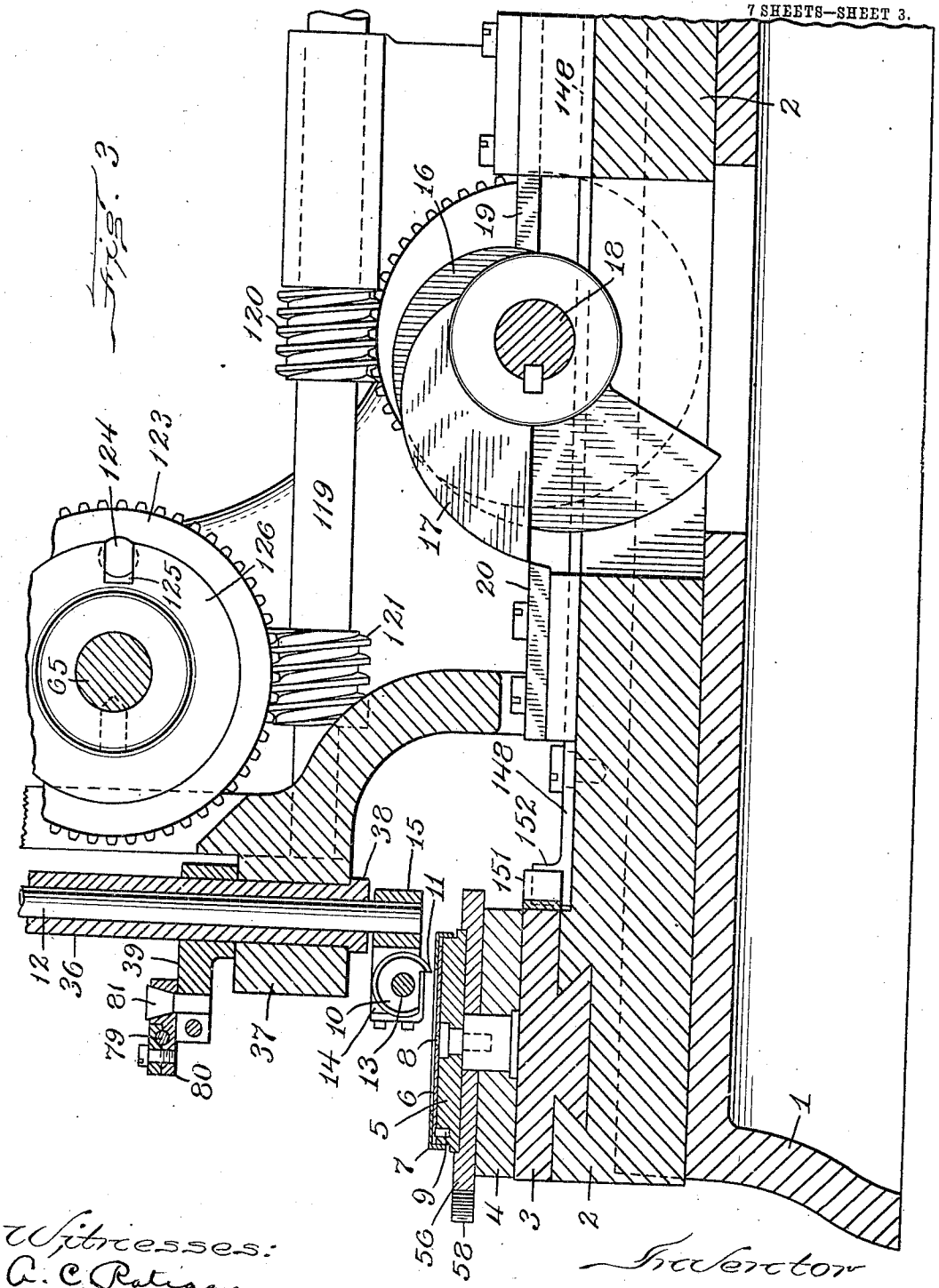
7 SHEETS—SHEET 3.

Fig. 3.



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7 SHEETS—SHEET 4.

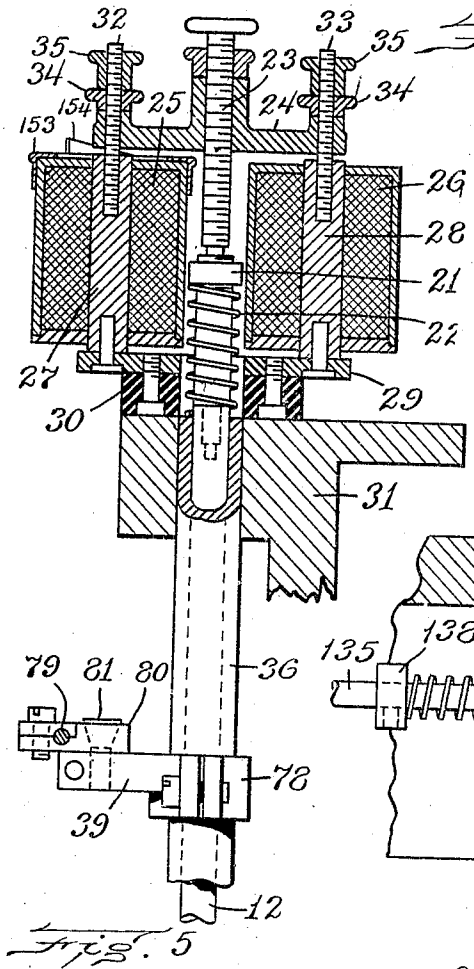

Fig. 4

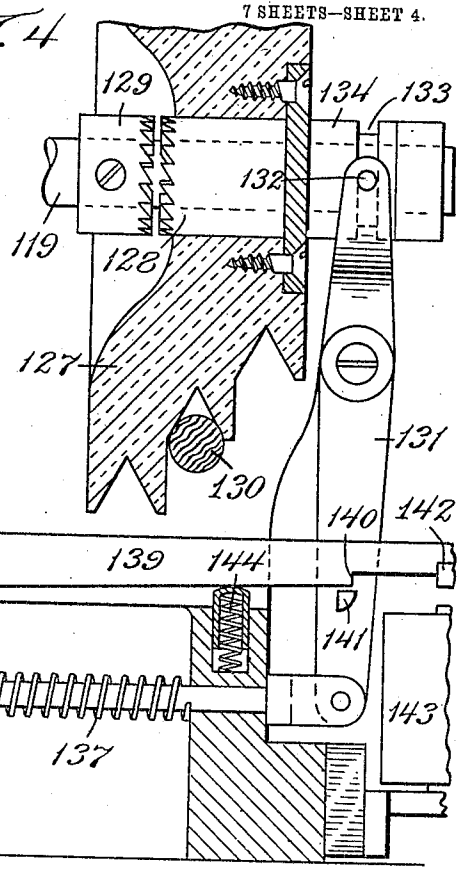

Fig. 5

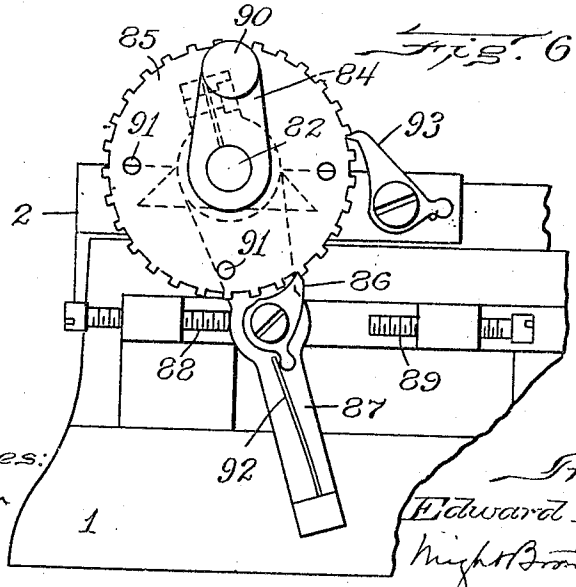

Fig. 6

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7 SHEETS—SHEET 5.

Fig. 7

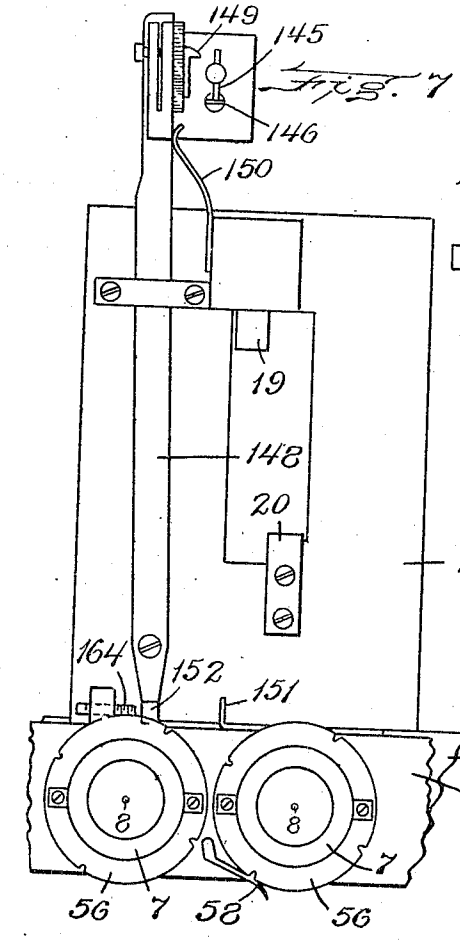


Fig. 9

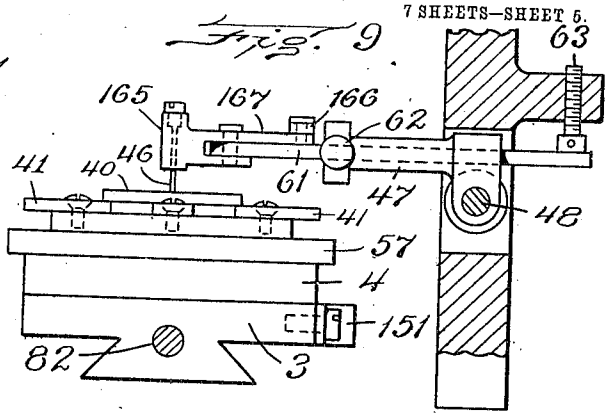


Fig. 8.

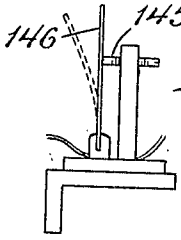
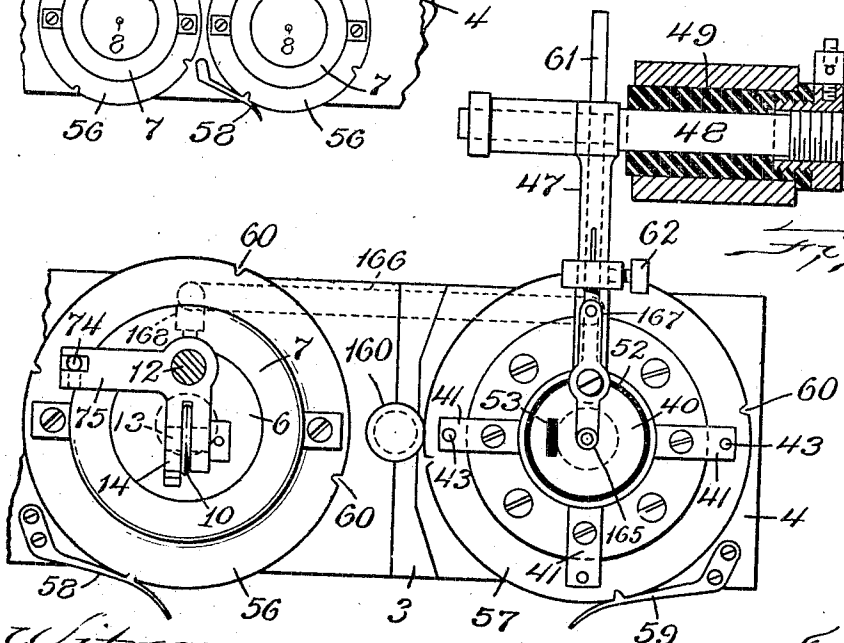


Fig. 10



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7 SHEETS—SHEET 6.

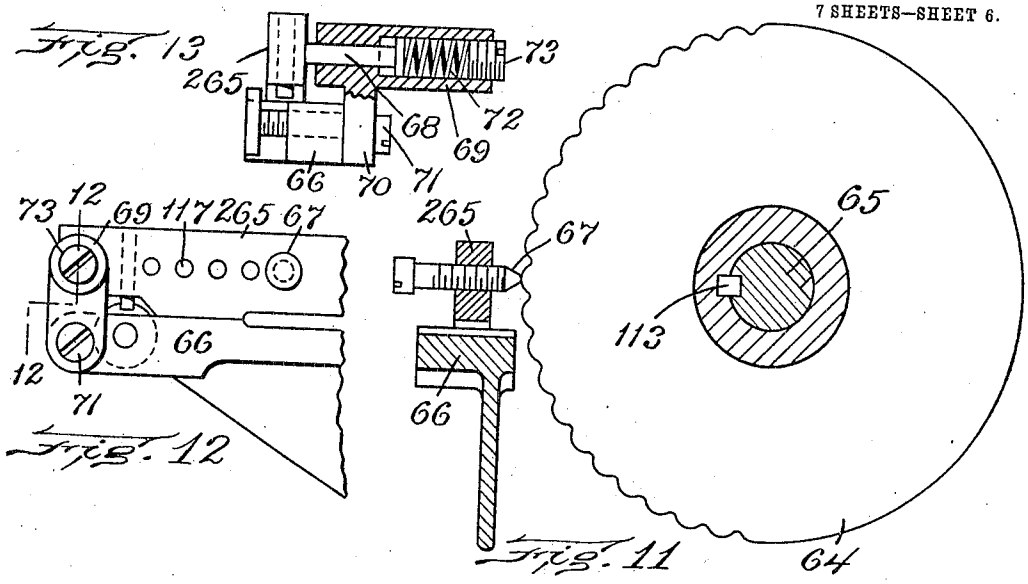

Fig. 13. Fig. 12. Fig. 11.

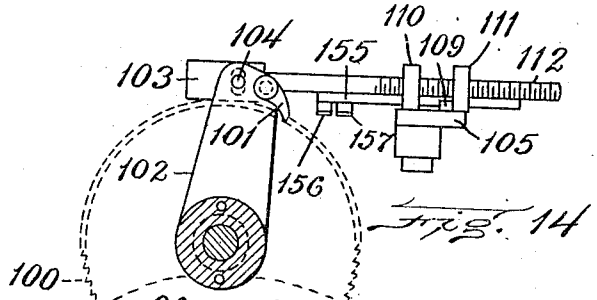

Fig. 14.

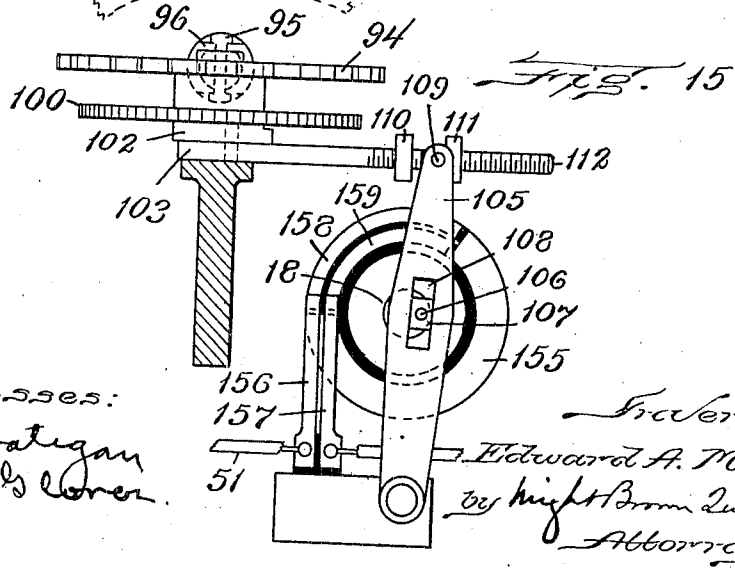

Fig. 15.

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7 SHEETS—SHEET 7.

Fig. 17

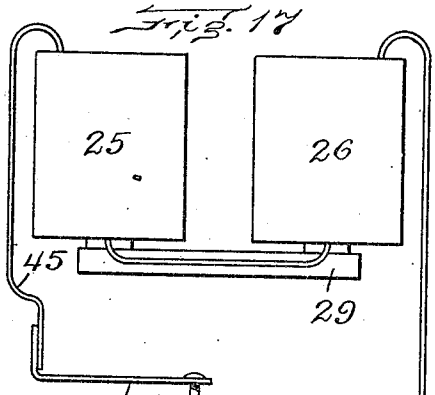
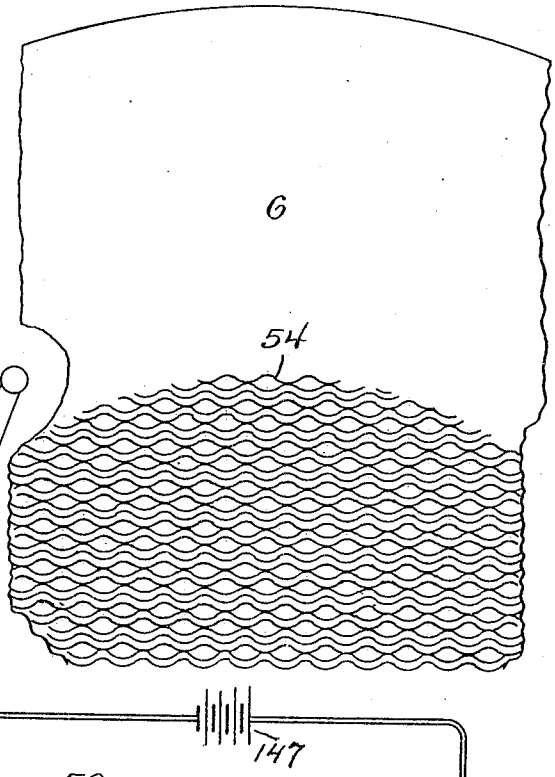


Fig. 18



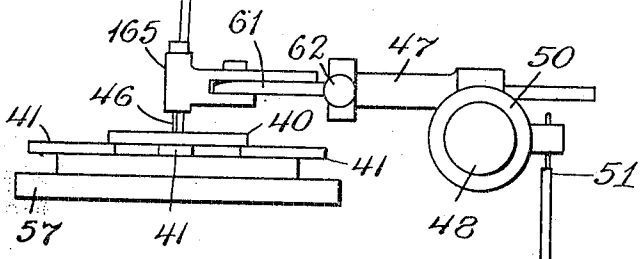
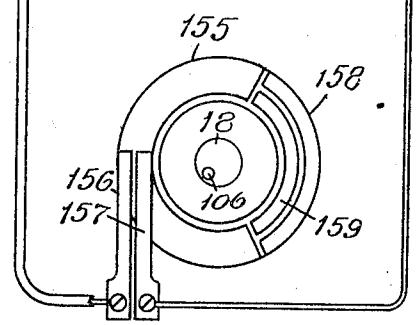
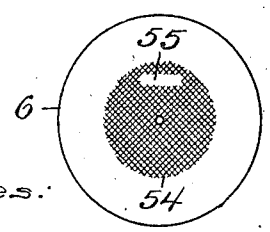


Fig. 16





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UNITED STATES PATENT OFFICE.

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MACHINE FOR ORNAMENTING DIALS.

No. 852,189. Specification of Letters Patent. Patented April 30, 1907.

Application filed January 31, 1907. Serial No. 355,025.

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 Ornamenting Dials, of which the following is a specification.

The present invention consists of a machine for producing engraved ornamentation.

It is designed to engrave the metal parts of watches, especially the metal dials with which some watches are provided, but it is also capable of operating on a wide variety of other articles as well.

The principal object of the machine is to produce the ornamentation automatically, and to engrave a number of objects simultaneously with identically the same pattern.

Of the accompanying drawings,—Figure 1 represents a front elevation of a machine embodying my invention. Fig. 2 represents a plan view of the same. Fig. 3 represents a central cross section, on an enlarged scale, of the front portion of the machine. Fig. 4 represents a fragmentary section of the driving pulley and an elevation of the mechanism by which the pulley is connected with and disconnected from the main shaft. Fig. 5 represents a sectional view of one of the tool holders and the means for operating the same. Fig. 6 represents an end elevation of the cross feed mechanism of the work holder. Fig. 7 represents a plan view of the automatic devices for causing disconnection of the driving pulley from the shaft. Fig. 8 represents an elevation of the electric contact by which the pulley-connecting devices are controlled. Fig. 9 represents an elevation of the devices for controlling the magnetic graving tool actuators. Fig. 10 represents a plan view of the same, a portion of the support being in section. Fig. 11 represents an elevation of one of the disks for vibrating the graving tool, with a sectional view of the arm which is directly oscillated by the disk. Fig. 12 represents a fragmentary elevation of the same arm and the adjacent parts of the machine frame. Fig. 13 represents an end elevation of the same, part of the latter being in section. Fig. 14 represents an elevation of the pawl and actuator therefor which operates the disk-shifting cam. Fig. 15 represents an elevation of the same, together with a commutator disk governing the circuit of the tool-operating magnets. Fig. 16 represents an elevation of a watch dial, showing arrangement of ornamentation produced by the machine. Fig. 17 represents a diagrammatic view, illustrating the electric circuit of the tool-operating magnets. Fig. 18 represents a fragmentary view of the dial, on an enlarged scale.

The same reference characters indicate the same parts in all the figures.

Referring to Fig. 3, which illustrates most clearly the general operation of the machine, 1 designates the bed upon which is mounted a main carriage 2 which is capable of reciprocating from front to rear, or from left to right, as seen in said figure. Upon the main carriage is a transverse carriage 3 which supports a detachable plate 4 whereon a plurality of work-holders 5 are mounted. The work-holders shown in these drawings have flat upper surfaces to support metal dials 6 which are retained in place by friction-held, annular cap 7. A central stud 8 entering the hand-arbor orifice in the dial, and a pin 9 which projects into a notch near the edge of the dial, locate the latter accurately.

10 represents a graving tool which has a cutting point 11, and is mounted eccentrically on a holder represented by the vertical shaft 12. The cutting tool is directly mounted upon a stud 13, and held between arms 14 which project from a collar 15 secured to the shaft or bar 12. The tool is held relatively stationary, having only a slight up-and-down movement toward and from the work, and a short vibratory motion, to be hereinafter described. To produce the necessary relative travel between the work and tool, for engraving the former, the carriage 2 on which the work is held, is made reciprocable, and is driven by cams 16 and 17 secured to a shaft 18. The first cam bears against a hardened plate 19 and the other cam against a plate 20, these bearing plates being out of line, as shown in Fig. 2, so that only one cam acts against each. The cam 16 which moves the carriage from front to rear, this being the movement during which the cutting takes place, acts during approximately two-thirds of the rotation of the shaft 18, while the other cam acts during the remaining third of the rotation to return the carriage. Thus a relatively slow operating movement and a quick return are provided.

In Fig. 5 is shown the upper end of the

work-holding shaft 12 and the magnet by which it is caused to act upon the work. On the top of the shaft 12 is a collar 21 upon which a spring 22 bears so as to raise the tool holder and separate the tool from the surface of the work. This upward movement is limited by a stop 23 threaded into the armature 24 of an electro-magnet which consists of the two spools of wire 25 and 26 surrounding the pole-pieces 27 and 28. The latter are secured to a cross bar 29 mounted on a base 30 of insulating material, which in turn is supported upon a part 31 of the frame. The armature is guided by the threaded rods 32 and 33 extending from the pole-pieces, and is normally held in the position shown in Fig. 5, by the spring 22. Further separation from the magnet is prevented by stop-nuts 34 screwed upon the threaded rods and lock-nuts 35. The reaction of the spring 22 is against a sleeve 36 surrounding the tool-holding shaft or spindle 12 and passing through a bracket 37 on the frame (Fig. 3), this sleeve being prevented from moving endwise by a collar 38 on its lower end, and the hub of an arm 39 fixed securely thereon just above the bracket 37. By means of the spring, the graving tool is held out of contact from the work except when a current is caused to flow through the magnet. When this is done, the magnet is energized and the armature attracted toward the pole-pieces, thereby forcing the tool into cutting engagement with the work, so that on the next backward movement of the carriage, a line is engraved in the surface of the dial.

For controlling the operation of the magnet, I mount upon the plate 4 which carries the work pieces, a controller or pattern plate 40 which partakes of all the movements given to the work. This plate is electrically connected with clamps 41, any one of which may be connected with the magnets. This connection consists of a rod 42 of which the lower end is set into a socket 43 of a clamp 41, while its upper end is similarly held in a socket in the flexible arm 44 from which a conductor 45 leads to the first electro-magnet of the series. Adapted to make contact with the plate 40 is a style or contact point 46 which is adjustably secured in a holder 47 pivoted upon a pin 48. The latter passes through a bushing 49 of insulating material in the frame of the machine, and has secured to it a collar 50 of conducting material to which is secured the end of a wire 51 forming part of the electric circuit of the magnets. Whenever the style 46 makes contact with that portion of the plate 40 which is of conducting material, a current flows from any suitable source of power through the circuit, thereby magnetizing the magnets and attracting the armatures toward them.

The controller plate 40 has an area of conducting material which is identical in form with the area on the surface of the work where the ornamentation is to be engraved. The limits of the ornamented area are defined by a band 52 of insulating material, and any part within the area which is not to be engraved is inlaid with insulating material, as at 53. As the carriage 3 moves back and forth, the plate slides under the style, and when the portion within the band 52 makes contact, the tools are brought into cutting relation, but as soon as the surrounding band reaches the style, the current is broken and the tools withdrawn from the work. This is also the case when any part of the insulation 53 contacts with the style. The result is indicated in Fig. 16, where in the central part of a watch dial is a circular area 54 in which lines are cut, and within the area is a blank space 55 which is left plain by the insulation 53, so that the name of the manufacturer may be stamped thereon. The direction in which the engraved lines run may be varied by turning the circular plates 56 and 57 on which the work-holder and pattern plate are respectively secured. These plates are retained in any one of four or any number of desired positions by springs 58 and 59, each of which has a tooth to enter the notches 60 of the plates.

An adjustment of the style is permitted by reason of the fact that it is directly secured to a rod 61 which passes through the holder 47 and is secured in position by a screw 62. The holder 47 also may turn about the pin 48 and the elevation of the style is determined by an adjustable stop 63 on the lower end of which the rod 61 bears.

In order to improve the appearance of the work, the graving tool is given a vibratory or oscillatory movement, by means of one or more disks 64 secured upon a shaft 65. These disks have peripheral protuberances and indentations which cause rapid oscillations of an arm 265 secured rigidly to the sleeve which surrounds one of the graving tool holders. This arm near its free end rests upon a bracket 66 projecting from the frame of the machine, and carries a pin 67 which bears directly against the periphery of the disk. It is held yieldingly against the disk by means of a pin 68 contained in a tubular socket piece 69, which has a lug 70 secured to the bracket 66 by a screw 71. A spring 72 abutting against an adjustable screw stop 73 in the socket piece presses the pin against the arm. As the disks rotate, the successive irregularities of the one against which the pin 67 bears, cause the arm 265 to be oscillated rapidly, whereby the sleeve to which said arm is connected is given a back-and-forth rotary motion through a slight angle. This motion is communicated to the tool-holding shaft 12 through an arm 74 on the sleeve, and a parallel arm 75 on the tool-holder, these arms being in engagement through a pin 77 secured

to one of them, and entering a hole in the other, such engagement causing the tool to be vibrated without lost motion in a direction transverse to that of the work-holding carriage, while at the same time permitting the required up-and-down movement of the tool-holder relatively to the sleeve which is necessary to bring the tool into and out of cutting position, as previously described.

As one of the objects for which this machine is devised is to produce identical ornamentation on a number of work pieces, there is provided a number of tools and holders, each constructed and operated by magnets in the manner already described. The sleeve surrounding each of the tool-holding shafts has an arm 39 formed upon a collar 78 which is clamped to the sleeve, such arms being all connected together by a single rigid rod 79 and clamping pieces 80 which are pivoted on pins 81 secured to the several arms 39. Through the rod 79, the motion given to one of the tool-holders by arm 265 is communicated to all of them, and as it is a single rod which connects them all, the one most remote from the directly-actuated holder has an equal motion with that nearest the same.

After each cutting stroke of the work-holding carriage, the work is shifted laterally to present a fresh surface to the tool, by means of a feed screw 82 threaded into the cross-feed carriage 3, and supported at its end in the bracket 83 on the main carriage. A crank 84 is secured to the feed-screw by which the latter may be turned by hand to adjust the work, and to bring the transverse carriage back to starting position after completion of one series of operations. An automatic mechanism for feeding the screw shaft step by step during each return stroke is provided in the ratchet wheel 85 and a pawl 86 carried by an arm 87 which is loose on the screw. This arm alternately engages stationary stops 88 and 89, being arrested by the latter stop before the end of the cutting travel of the carriage so as to engage the pawl with another tooth of the ratchet, and by the stop 88 at the end of the return travel, to feed the ratchet forward. The latter is loosely mounted on the feed-screw, but may be connected therewith by a pin 90 carried by the crank 84 which may be pushed into any one of a series of holes 91. A spring 92 holds the toe of the pawl against the ratchet, while a locking pawl 93 is provided to prevent return movement.

In order to give diversity to the undulations in the engraved lines, I provide two or more of the disks 64, which are different either in the character of their irregularities or in their respective positions, and cause them to act one after the other upon the arm 265. This result is attained by having the shaft 65, on which they are mounted, movable endwise and providing a cam 94 for so moving it. This cam in the present instance is made in the form of a disk, of which the periphery acts upon the end of the shaft through the medium of a hardened steel bearing piece 95, which slides in a guide 96 and is pressed against the cam by a spring 97 acting against a collar 98 on the shaft, and reacting against a fixed lug 99 through which the shaft passes. The cam has alternate projections and indentations which cause first one and then the other of the disks to lie adjacent the pin 67. In the arrangement shown in the drawings, there are only two disks shown, but I may apply many more. In the latter case, the projections on the cam 94 will have as many steps as there are disks so that each of the latter may be brought into operative position in turn. A ratchet wheel 100 is secured to the cam and is rotated step-by-step by a pawl 101 carried by an arm 102 which turns loosely about the axial stud that carries the ratchet and cam. A slide 103 has a pin-and-slot connection with the ratchet-carrying arm and is reciprocated so as to oscillate the latter by means of an oscillatory arm 105, which is turned about a fixed pivot by a crank-pin 106 on the shaft 18, the crank-pin having a bearing block 107 adapted to slide in a slot 108 in the arm. The latter carries on its end a pin 109 which plays between two collars 110 and 111 adjustably mounted on a threaded extension 112 of the slide, and alternately engages them, moving the slide first in one and then in the other direction. As the shaft which thus swings the cam-driving pawl is the same as that which moves the carriage 3, it is evident that the cam is fed with each return of the carriage. The amount of the feed may be made as great or as little as desired by adjusting the collars 110 and 111, so that one or a plurality of lines may be cut, while the graving tools are under the control of the same disk. This furnishes one means by which the character of the ornamentation may be varied. Variations may also be made by changing the height or spacing of the protuberances on the disks, and by altering the number which are made operative. Thus, by taking these elements into account, an almost infinite variety of repeated designs may be produced. Conceivably also, designs may be made by suitably shaping the areas of the conducting and non-conducting material in the controller plate 40.

The disks 64 are engaged with a spline 113 on the shaft 65 and held between collars 114 and 115 which may be shifted and secured in any position by a set-screw 116. The pin 67 which is screwed into the arm 265 may be correspondingly shifted and set into the holes 117, and as these holes are at varying distances from the center of oscillation, thereby the amplitude of vibration of the

tools is altered. Thus undulations of greater or less depth in the engraved lines may be produced without changing the disks.

The carriage drive shaft 18 and the tool-oscillating shaft 65 are both driven by means of a single main drive shaft 119 which carries worms 120 and 121 meshing with worm wheels 122 and 123 on the respective shafts. The wheel 123 on shaft 65 is loose so as to permit the previously-described endwise movement of the latter, but has a rigid connection for causing rotation, consisting of a pin 124 extending from the wheel parallel with the shaft, and passing through a notch 125 in a disk 126 pinned to the shaft. This drive shaft 119 is rotated by a loose pulley 127 which has a clutch member 128 adapted to be engaged with a fixed clutch 129 on the shaft, the pulley being continuously rotated by a belt 130 and driving the shaft only when the clutches are connected. A lever 131 has a forked arm carrying pins 132 which enter a groove 133 in the hub 134 of the pulley. This lever is connected with a link 135 which extends out at the front of the machine, and is provided with a knob 136, whereby it may be manually pushed forward to throw the clutch members in engagement. A spring 137 pressing against a collar 138 on the link normally holds the clutch members apart and tends always to separate them. 139 is a pivoted latch, which has a locking shoulder 140 lying above a projection 141 on the lever 131 when the clutch is disconnected, and carries the armature 142 of an electro-magnet 143. The latch is normally raised by a spring 144. If the clutch members are thrown into engagement while the magnet is energized, the attraction on the armature draws down the latch against the force of spring 144, and engages the projection 141 to lock the clutch in connected position. A fixed contact point 145 and spring 146 are in circuit with the magnet and a source of electric power 147. When the parts 145 and 146 are in circuit, the magnet is energized and the armature attracted. This is the normal condition. A device for breaking the circuit is mounted on the work-holding carriage and moved thereby. This device consists of a lever 148 having a hook 149 which is held by a spring 150 so as just clear the contact spring 146 as the carriage reciprocates. On the cross-feed carriage 3 is a projection 151 which strikes the short arm 152 of the lever when the engraving operation is finished, and moves the hook so that on the next movement of the main carriage to the front, the contact spring is engaged and separated from the point 145. The armature 142 is released and the latch raised, allowing the pulley to be disconnected from the shaft and the machine to come to rest. The parts are so arranged that this stopping occurs when the carriage is in forward position ready for the completed work to be removed and replaced by blanks. When the cross-feed carriage is returned ready for a new series of operations, the lever 148 is released and withdrawn out of engagement with the contact spring by the spring 150. If the latter does not act, a stop pin 164 adjustably secured to the cross-feed carriage strikes the part 152 and positively throws the lever over.

It is sometimes desirable to render some of the graving tools inoperative, and for this purpose, I mount upon the coil 25 of each magnet, a cap 153 which can rotate thereon, and is frictionally retained in place. Each of these caps has an inclined stop projection 154 which may be brought, by turning the cap, under its respective armature, so as to prevent movement of the latter when attracted by the magnet. Thus the particular tool whose armature is arrested by one of the stops 154, is held out of operation.

It will be noticed that the style 146 makes contact with the plate 40 during the return or non-cutting motion of the carriage as well as during the cutting movement. In order that the tools may not thereby be brought into engagement with the work while the latter is being retracted for a new cut and is being fed laterally, I provide a circuit breaker or commutator in the magnetic circuit so as to disable the tool-controlling magnets during the entire return stroke. This commutator consists of a disk 155 secured to the shaft 18 against which bear two spring terminals or brushes 156 and 157 which are insulated from each other and connected with parts of the magnetic circuit. The portion of the commutator disk with which the brushes engage during the whole of the cutting stroke, consists of an annular strip of conducting material which allows the current to flow from one to the other of the brushes. The remaining portion of the disk, however, is made of two narrow annular pieces 158 and 159 which are insulated from each other and from the wide strip. During the return of the carriage, the brushes bear each against one of these separated strips, and thereby the circuit is interrupted.

For convenience in placing and removing the work pieces, the plate which carries all of the work-holders is bodily removable from the cross-feed carriage 3. One end of this plate has a semi-circular conical notch which takes under and bears against the tapered head of a pin 160. The other end of the plates slips under the beveled edge of a locking plate 161 which may be loosened and raised slightly from the cross-feed carriage and clamped against the beveled end of plate 4 by a cam-shaped clamp 162 having an operating handle 163.

It is sometimes desirable to prevent the undulations in the engraved lines running

over the limits of the areas within which the ornamentation is to be confined. For this purpose, I have provided a connection which may or may not be used at will, whereby the control style 46 may be vibrated simultaneously with the driving tool. It will be understood that if the style remains stationary, the graving tool is vibrated and cuts an irregular line as long as contact is made between the style and controller plate, and thus the limits of the blank space 55 which corresponds to the area 53 of insulation, will be bounded by irregular or wavy lines instead of straight lines, as in the controller plate. If, however, the style is vibrated, it will ride over the insulation 53 at a number of points, while adjacent thereto, and thus release the cutting tool from work whenever the latter approaches the area 55. Thereby the latter will be left with approximately straight boundaries. In the same way, the graving tool will be prevented from running over the outer limits of the ornamented area. The means for so vibrating the style consists in mounting the latter in an arm 165 which is pivoted to the rod 61 and connecting a link 166 with an arm 167 which is rigid or integral with the style-holding arm 165. This link is pivoted to a stud 168 removably attached to the tool-holder. Thereby the vibrations given to the style are similar in direction to those of the tool.

I claim:

1. An automatic engraving machine, comprising a work-holding member, a graving member, mechanism for moving one of said members in a substantially straight line, mechanism independent of the movement of said member for producing vibratory movements of the other member, and controlling means for bringing the graving member into cutting engagement with the work at the points where the design is to be cut and for rendering the graving member inoperative at other points.

2. An automatic engraving machine, comprising a work-holder, a graving tool means for moving one relatively to the other to produce the effect of a travel of the tool across the face of the work, mechanism for moving the tool back and forth transversely of the said traveling motion, said mechanism being independent of any traveling part or member, and controlling devices for bringing the tool into cutting engagement with the work at the desired points and for disabling the tool at other points.

3. An automatic engraving machine, comprising a work-holder, a tool-holder, a graving tool eccentrically mounted on said tool-holder, mechanism for moving the work-holder and work back and forth past the tool, electro-magnetic devices automatically controlled to bring the tool into and out of cutting engagement with the work at the points necessary for producing the designs, and mechanism for vibrating the tool holder to displace the tool transversely of the motion of the work, whereby undulating engraved lines are produced.

4. A machine for automatically producing identical ornamentation on a plurality of parts, comprising a plurality of work-holders; a plurality of graving tools; mechanism for reciprocating the holders past the tools; electro-magnets operable to bring the tools into cutting relation with the work; a controller including a point and a plate, the latter movable simultaneously with the work-holders, in circuit with the magnets, for causing them to be energized when the parts of the work on which the ornamentation is to be cut are adjacent the tools; and means independent of the work-holders or the carrier therefor for vibrating the tools transversely of the motion of the work, while the cutting takes place.

5. A machine for automatically producing engraved ornamentation, consisting of a graving tool, an oscillatable and reciprocable holder therefor; a work-holding carriage movable to carry the face of the work past the tool; opposed means, consisting of an electro-magnet and a spring for reciprocating the tool-holder and the tool toward and from the work; a controller having portions made of conducting material carried with the work-holder on the carriage; a contact style, the controller and style being in circuit with the magnet, and when making electric contact with each other, serving to energize the same, thereby locating the position of the ornamentation on the work; a lateral arm on the tool-holder; a cam member; and connections between said lateral arm and cam member for vibrating the tool while in its cutting position.

6. A machine for producing engraved ornamentation, comprising a reciprocable and oscillatable tool-holder; a graving tool eccentrically mounted on the holder; a work-holding carriage movable to carry work past the tool in close propinquity thereto; suitably controlled magnetic means for moving the tool into contact with the work to cut the ornamentation; a rotating pattern cam having projections and indentations; an arm engaged and oscillated by said cam; and connections between said arm and the tool for vibrating the latter transversely to the operative movement of the carriage.

7. A machine for producing engraved ornamentation, comprising a reciprocable and oscillatable tool-holder, a graving tool eccentrically mounted on the holder; a work-holding carriage movable to carry work past the tool in close propinquity thereto; suitably controlled magnetic means for moving the tool to the work to cut the ornamentation; a rotating cam having projections and indenta-

tions, a sleeve surrounding the tool-holder; an arm secured to said sleeve, engaged and oscillated by said cam; and arms on the sleeve and tool-holder engaged with each other, through which the tool is vibrated.

8. A machine for producing engraved ornamentation, comprising a reciprocable and oscillatable tool-holder; a graving tool eccentrically mounted on the holder; a work-holding carriage movable to carry work past the tool in close propinquity thereto; suitably controlled magnetic means for moving the tool to the work to cut the ornamentation; a rotating shaft; a plurality of pattern cams thereon, connections between the tool-holder and the cams, operated by the latter to vibrate the tool; and mechanism for periodically moving said cams transversely to bring one or another thereof into operative position.

9. A machine for producing engraved ornamentation, comprising a reciprocable and oscillatable tool-holder; a graving tool eccentrically mounted on the holder; a work-holding carriage movable to carry work past the tool in close propinquity thereto; suitably-controlled magnetic means for moving the tool to the work to cut the ornamentation; an endwise-movable rotating shaft; a plurality of pattern disks thereon having peripheral protuberances and depressions, an arm adapted to bear yieldingly against one of the cams and be oscillated thereby; connections between the arm and tool whereby the latter is vibrated by the former; a cam bearing against the end of said shaft for moving the same to bring one or other of the disks into operative relation with the arm; and pawl-and-ratchet mechanism for rotating said cam step-by-step.

10. A machine for simultaneously engraving identical ornamentation on a plurality of parts, comprising a plurality of graving tools eccentrically mounted on oscillatable holders; oscillatory arms each having connection with one of the holders to communicate oscillations thereto; a clamp pivoted to each of said arms; a single rod secured to all of said clamps; means for oscillating one of said arms, the oscillations thereof being uniformly communicated by said rod to all the arms; and a carriage on which the work is mounted reciprocable to move the same while the graving tools are in engagement therewith.

11. A machine for simultaneously engraving identical ornamentation on a plurality of parts, comprising a plurality of graving tools, oscillatory holders on which said tools are eccentrically mounted; a sleeve surrounding each holder; connections between the sleeves and tool holders for communicating oscillations; an arm rigid with each sleeve; a single connecting rod pivotally joined to all the arms; a second arm on one of the sleeves; a rotating corrugated disk against which said second arm is yieldingly held, for oscillating all the sleeves and tool holders in unison; and a work-holding carriage for moving the work while the tools are in engagement therewith.

12. In a machine of the character described, a sleeve mounted to oscillate; an arm fixed to said sleeve; a rotating disk having peripheral corrugations; a pin on said arm; a spring yieldingly pressing said pin against the disk, whereby the arm may be oscillated; a tool holder passing through said sleeve and reciprocable therein; a graving tool eccentrically mounted on the holder; and lateral projections on the holder and sleeve respectively engaged with each other whereby both oscillate simultaneously.

13. In a machine of the character described, a graving tool suitably supported; a main carriage, means for reciprocating the same; a cross-feed carriage adapted to hold the work mounted on the main carriage and movable transversely of the motion thereof; a feed screw mounted on the main carriage and engaged with the cross-feed carriage; a ratchet and an arm both loose on the screw and relatively movable; a pawl on the arm for engaging the ratchet; a fixed arm by which the screw may be manually turned; means for detachably engaging said fixed arm with the ratchet; and stationary stops for arresting the movable arm before the reversal of the main carriage at each limit of its reciprocations, whereby to rotate the screw and advance the cross-feed carriage.

14. In a machine of the character described, a movable work-holding carriage; a graving tool; a main shaft for operating the machine; a loose driving pulley on the shaft; a clutch for detachably connecting the pulley and shaft; spring means tending to disconnect the clutch; a latch for retaining the clutch in connection; an electro-magnet for securing the latch against yielding resistance; and automatic means for breaking the circuit of the magnet to release the latch and permit disconnection of the clutch at the conclusion of the cutting.

15. In a machine of the character described, a movable work-holding carriage; a cross feed for the work; a graving tool; a main shaft for operating the machine; a loose driving pulley on the shaft; a clutch for detachably connecting the pulley and shaft; spring means tending to disconnect the clutch; a latch for retaining the clutch in connection; an electro-magnet for securing the latch against yielding resistance; and a member carried by the work-holding carriage and operated by the cross-feed to break the circuit of the magnet at the end of the cutting operations and release the latch, thereby permitting the clutch to be disconnected.

16. In a machine of the character described, a movable work-holding carriage;

a cross feed for the work; a graving tool; a main shaft for operating the machine; a loose driving pulley on the shaft; a clutch for detachably connecting the pulley and shaft; a manually-operable lever for connecting the clutch; spring means tending to disconnect the clutch; a latch arranged to abut against a projection on said lever when the latter has been manually displaced for retaining the clutch in connection; an electro-magnet for bringing and securing the latch in locking position against yielding resistance; a separable contact in the circuit of the magnet; and a circuit breaker movable bodily with the carriage and transversely shiftable by the cross feed for separating the contact at the end of the engraving operations.

17. In a machine of the character described, a movable work-holding carriage; a shaft engaged therewith to reciprocate the same; a graving tool holder; a plurality of disks having peripheral irregularities; connections with the tool-holder operated by said disks to oscillate the holder; an endwise-movable shaft on which the disks are mounted; a cam bearing against the end of the latter shaft; a ratchet secured to the cam; a pawl; and mechanism reciprocated by the first shaft for rotating the cam step-by-step.

18. In a machine of the character described, a movable work-holding carriage; a shaft engaged therewith to reciprocate the same; a graving tool holder; a plurality of disks having peripheral irregularities; connections with the tool-holder operated by said disks to oscillate the holder; an endwise-movable shaft on which the disks are mounted; a cam bearing against the end of the latter shaft; a ratchet secured to the cam; a pawl; a reciprocable slide connected with the pawl for operating the same to rotate the ratchet and cam step-by-step; an arm oscillated by the first shaft; and stops secured to the slide between which said arm plays and alternately engaged thereby to reciprocate the slide.

19. In a machine of the character described, a movable work-holding carriage; a shaft engaged therewith to reciprocate the same; a graving tool holder; a plurality of pattern disks having peripheral irregularities; connections with the tool-holder operated by said disks to oscillate the holder; an endwise-movable shaft on which the disks are mounted; a cam bearing against the end of the latter shaft; a ratchet secured to the cam; a pawl; a reciprocable slide connected with the pawl for operating the same to rotate the ratchet and cam step-by-step; adjustable stops secured to the slide; and driving means operated by the first shaft playing between said stops for reciprocating the slide.

20. In a machine of the character described, the combination of a graving tool, a work-holder; one of which moves relatively to the other to engrave the work; an electro-magnet for bringing the tool toward the work, a spring for removing the tool; the devices for locating the position of the ornamentation on the work, consisting of a pattern plate and a style having relative motions similar to those of the work and graving tool and both in circuit with the electro-magnet, the plate having a surface of conducting material similar to the ornamented area, with which the style is adapted to make contact, whereby the magnet is energized and the tool brought into cutting position; means for vibrating the tool while the cutting movement takes place; and a connection from the tool to the style whereby the latter may be given a corresponding simultaneous vibration.

21. In a machine for producing similar ornamentation on a plurality of parts, work-holders, graving tools and holders therefor, a plurality of electro-magnets, an armature for each magnet arranged, when attracted to the latter, to move one of the tools into cutting relation with the work, and a stop on each magnet independently adjustable to prevent movement of the armature of that magnet.

22. In a machine for producing similar ornamentation on a plurality of parts, work-holders, graving tools and holders therefor, a plurality of electro-magnets, an armature for each magnet arranged, when attracted to the latter, to move one of the tools into cutting relation with the work, and a cap frictionally held on each magnet, having a stop projection which can be moved between the magnet and its armature to prevent operation of the latter.

In testimony whereof I have affixed my signature, in presence of two witnesses.

EDWARD A. MARSH.

Witnesses:
A. C. RATIGAN,
ARTHUR H. BROWN.