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ENGRAVING MACHINE.

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3 Sheets-Sheet 1

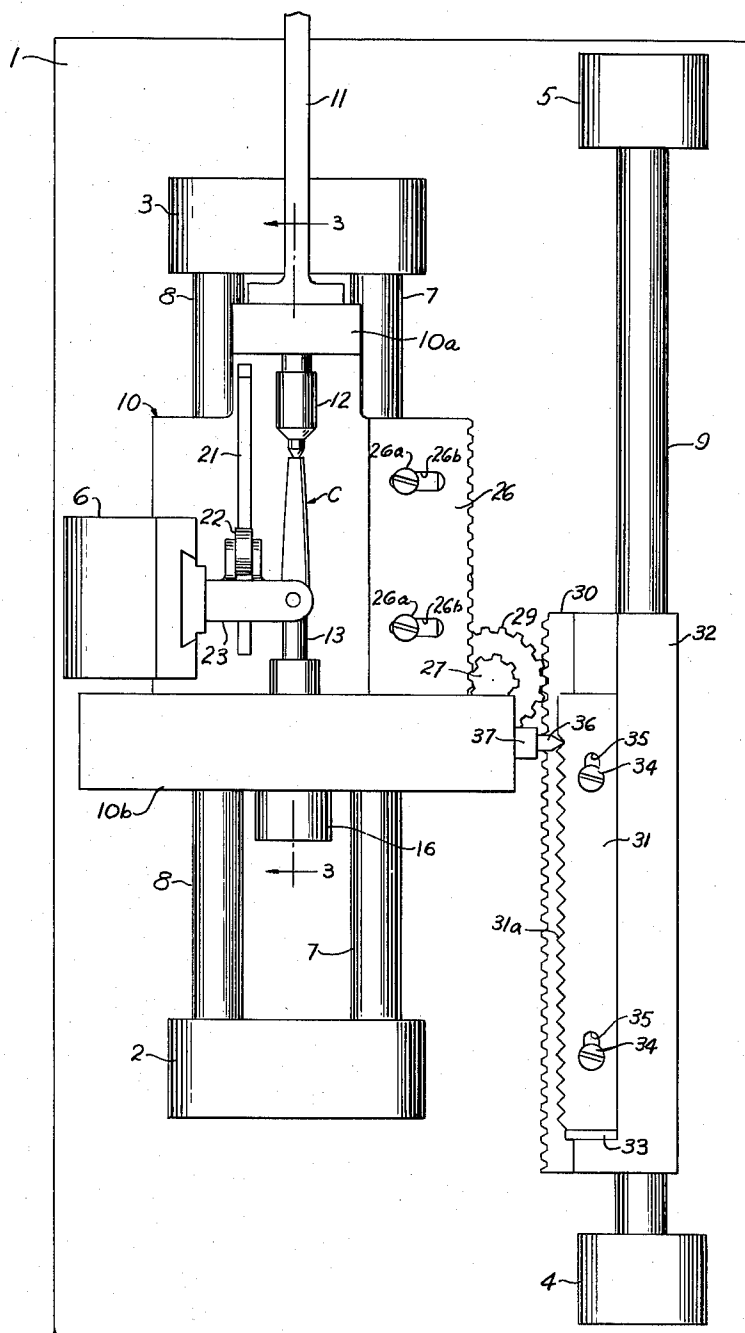


FIG. 1

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3 Sheets-Sheet 2

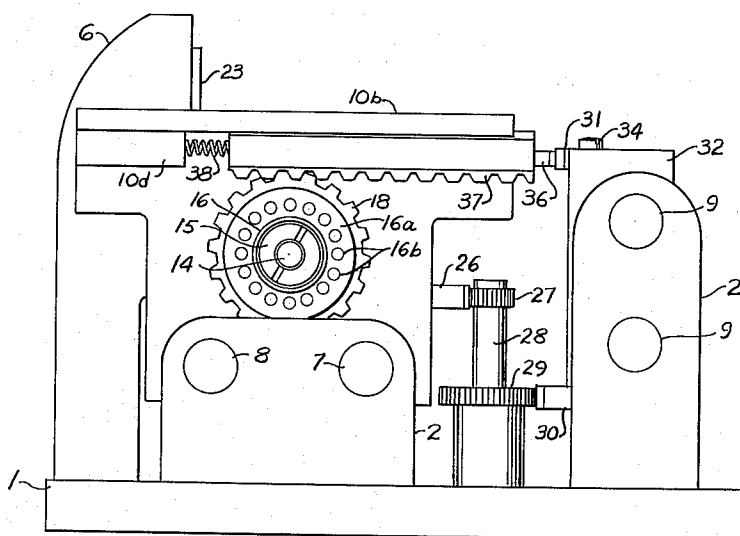


FIG. 2

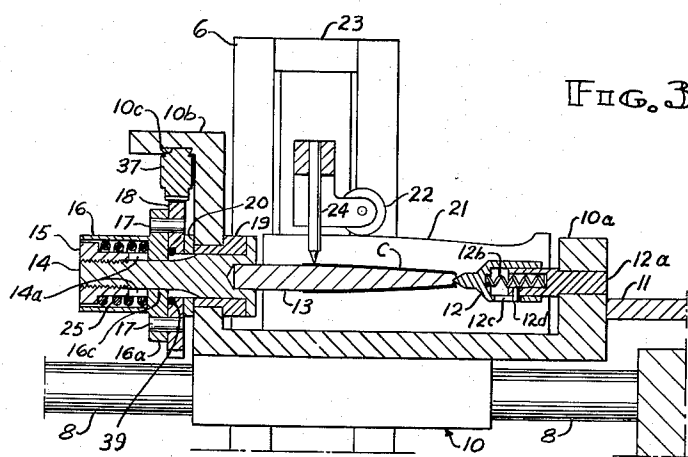


FIG. 3

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1

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ENGRAVING MACHINE

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1 Claim. (Cl. 33—21)

This invention relates to an engraving means and method for applying to the surface of a tapered rod-like article a reversible line pattern such as a pattern comprising zig-zag lines or sine wave lines or arc segment lines or combinations of such lines. Patterns such as a series of diamonds and football-shaped ellipses include such reversible line patterns.

One of the problems of prior art techniques for applying such patterns to such tapered articles is that, if the pattern is to be close or to mesh, it many times overlaps at the small diameter portions of the article and it looks unbalanced or out of proportion when comparing a large diameter portion of the article to a small diameter portion of the article.

This invention solves said problem by providing novel means for and method of proportioning the pattern with respect to the circumference of the article.

It is an object of the invention to provide means for relatively moving a tapered rod-like article and an engraving tool to create a reversible line pattern thereon which is proportioned with respect to the circumference of the article.

A further object is to provide such means wherein a series of said patterns are placed on said article and are proportionally spaced about the circumference of the article.

It is another object to provide means for holding an engraving tool fixed, except for riding the contour of the tapered article, while simultaneously oscillating the article about its axis and moving the article along its axis.

These and other objects will become apparent from the following description when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a plan view of an engraving machine embodying the invention;

Fig. 2 is an end elevational view of an end of the machine;

Fig. 3 is a front elevational view, partly in section, of a portion of the machine;

Fig. 4 is a perspective view of a portion of the machine;

Fig. 5 is a perspective view of a tapered tubular article in one stage of having had a pattern applied thereto; and Fig. 6 is a perspective view of said article in a further stage of having had a pattern applied thereto.

Referring to the drawings, the invention is shown embodied in an engraving machine for applying a decorative reversible line pattern *p* to a tapered tubular fountain pen cap C.

The machine includes a base plate 1 having a pair of upright supports 2, 3 supporting a pair of slide rods 7, 8 on which is slidably disposed a work holder carriage 10. One end 10a of the carriage supports a conical center mount 12. The other end of the carriage 10 supports an arbor mount 13 held in an arbor plug 14 and an arbor plug collar 15. The work, pen cap C, is mounted on the arbor 13, and the conic center mount engages the end of

2

the arbor. The center mount 12 includes a carriage mount plug 12a fixed in the carriage, and a spring 12b resiliently biasing the conic tip therefrom. A pin 12d and a slot 12c provide simple assembly means for the conic structure 12.

Also mounted on the carriage 10 is a work profile cam 21 having a contour corresponding to the tapered contour of the work C.

A connector member 11 connects the carriage 10 to any suitable prime mover (not shown) for enabling the carriage 10 and thus the work C and the work profile cam 21 to be moved in the direction of the axis of the work, i.e. to the left and to the right in Fig. 3, or up and down as viewed in Fig. 1.

A cam follower such as wheel 22 is mounted on a tool holder 23 in which the engraving tool or scriber 24 is fixedly mounted. The tool holder 23 is slidably mounted in an upright tool holder support 6, being fixed therein against movement in any direction except the direction it can slide in the tool holder support. As the carriage moves, either left or right (in Fig. 3), the cam follower 22 rides cam 21 and causes the tool to move either down or up (in Fig. 3). In this way, the tool is caused to be moved transversely of the axis of the work to stay on the surface of the work in a fixed cutting depth relation with the work.

For applying a zig-zag line to the work C, as shown in Figs. 4, 5 and 6, means are provided for oscillating the work C about its axis as the work C moves along with the carriage. Such means is described hereinbelow.

A rack 26 is fixed to the carriage 10, and a pinion gear 27 is associated therewith. A shaft 28, which is fixed to pinion gear 27, has another pinion gear 29 fixed to its opposite end. Engaging the pinion gear 29 is a rack 30 carried by a pattern cam carriage 32 which also carries a zig-zag pattern cam 31 comprising a series of teeth 31a. The carriage 32 is slidably mounted on a pair of slide rods 9, 9 supported by upright supports 4, 5.

As the work carriage 10 moves, the pattern cam carriage 32 is moved in the opposite direction, through the pinion and rack connection of rack 26, pinions 27 and 29, and rack 30.

Riding on the teeth 31a of pattern cam 31 is a pattern cam follower 36 which is fixed in a rack 37.

Engaging the rack 37 is a gear wheel 18, which, when rotated, rotates the arbor 13 and thus the work C. Arbor plug 14 has grooves 14a, 14a therein into which ride lugs 16c of an index member 16 which has a flange 16a having a plurality of circumferentially spaced holes 16b therethrough. A pair of diametrically opposite holes 16b, 16b engage the pins 17, 17 fixed to gear wheel 18. The member 16 is restrained against rotation relative to arbor plug 14 in having a pair of lugs 16c, 16c riding in grooves 14a, 14a in arbor plug 14. A spring 25 between arbor plug collar 15 and index member 16 biases the index member against the gear wheel 18. A washer 20 is disposed between the gear wheel 18 and the carriage 10. A bushing 19 is provided for the arbor plug 14.

Rack 37 rides in a groove 10c in the end portion 10b of carriage 10 and the rack is thus restrained against movement in any direction except the direction of this groove, i.e. either left or right in Figs. 1 and 2. A spring 38 disposed between a portion 10d of carriage 10 and rack 37 resiliently urges the rack 37 and cam follower 36 against the pattern cam 31.

As the work carriage 10 moves along its slide rods 7, 8, the work moves with the carriage past tool 24, and the cam pattern carriage 32 is moved along its slide rods 9, 9 through the pinion and rack connection 26, 27, 29, and 30. The pattern cam follower 36 and rack 37 thus reciprocate and the gear wheel 18 is thereby oscillated,

The work thus simultaneously moves along its axis and oscillates about its axis, and a zig-zag line *p* is thus produced on the work C.

After one line *p* is completed, another line *p* parallel thereto may be produced. This is accomplished by pulling index member 16 away from gear wheel 18 to disengage holes 16*b* and pins 17, rotating the index member 16 the desired amount, and replacing it against gear wheel 18 with a different pair of holes 16*b* engaging pins 17. If desired, a snap ring 39 may be provided to prevent axial movement of the gear wheel 18 during the indexing operation. Another zig-zag line, parallel to the one just completed, may be made by again moving the work carriage on its slide rods. A design such as shown in Fig. 5 can thus be completed by repeating the above operations.

A design such as shown in Fig. 6 can be made by, first making the design shown in Fig. 5, as explained above, then shifting pattern cam 31 a half of a pitch, and then repeating the procedure utilized to produce the design shown in Fig. 5. A shim 33 having a width of one-half a pitch (one-half the width of a tooth 31*a*) is provided at one end of cam 31. By means of slots 35, 35 and fasteners 34, 34, the removal or replacement of the shim 33 is conveniently accomplished.

By varying the size of the pinion gear 27, and accordingly adjusting the position of rack 26 by means of slots 26*b*, 26*b* and fasteners 26*a*, 26*a*, one varies the speed of movement of work carriage 10 relative to cam pattern carriage 32, and thus varies the length and slope of the zig-zag pattern lines *p* produced upon the work. A variety of differing pattern lines can thus be obtained.

By removing the pattern cam and exchanging it for one with deeper teeth or shallower, one can provide a pattern line *p* of greater or lesser width, as desired.

By removing the pattern cam and exchanging it for one with other patterns such as a sine-wave pattern or an arc segment D.-C. pulse wave pattern, one can provide any desired reversible line pattern, and one is not limited to the zig-zag pattern illustrated herein.

The outstanding advantage of the invention is that the pattern line designs vary in width automatically in proportion to the varying diameter of the work and thus proportionally space themselves circumferentially about the work.

Another advantage is that the pattern cam is, if desired, uniform over its entire length.

Another advantage is that, by varying the sizes of both pinion gear 27 and pinion gear 29, one may vary the relative speed of movement of work carriage 10 and cam pattern carriage 32, without the necessity of relocating or repositioning rack 26; i.e. the shaft 23 merely takes up a new position but the distance between racks 26 and 30 remains the same.

Another advantage is that, by removing either one or both of pinion gears 27, 29 to disconnect racks 26 and 30, one may lock carriage 32 in place and thereby obtain still another relative speed of carriages 10 and 32 to thereby obtain still another pattern, i.e. a zig-zag pattern with a shorter length and sharper slope.

Other advantages will become apparent to those skilled in the art. Although but one embodiment of the invention is described herein, various other embodiments may be made without departing from the spirit of the invention and the scope of the appended claim.

We claim:

In an engraving machine for applying a decorative uniform reversing line pattern longitudinally along the surface of a tapered rod-like article; the combination of an engraving tool; a work carriage carrying said article and movable to move said article past said tool in a direction along the longitudinal axis of the article; a profile cam matching the tapered contour of said article and fixed to said carriage for engaging said tool to cause the tool to follow the tapered contour of said article; a uniformly toothed pattern cam movable parallel to the longitudinal movement of said article; a first rack mounted on and movable with said carriage; a second rack fixed to and movable with said pattern cam; pinion gear means connecting said first and second racks for moving said pattern cam parallel to, but in the opposite direction of, the longitudinal movement of said article; said pattern cam being adjustably positionable on said second rack for moving the pattern cam one-half of the pitch of the teeth of said uniformly toothed pattern cam along the direction of the movement thereof; said pinion gear means being removable for replacing same with other pinion gear means of different diameter, said first rack being adjustably positionable on said carriage for moving said first rack in the direction perpendicular to said longitudinal movement for varying the distance between said racks to accommodate pinion gear means of different diameters; oscillating means responsive to the movement of said pattern cam for oscillating the article about its axis; and index means for rotatably setting said article step by step about its axis to a plurality of equidistantly spaced settings.

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