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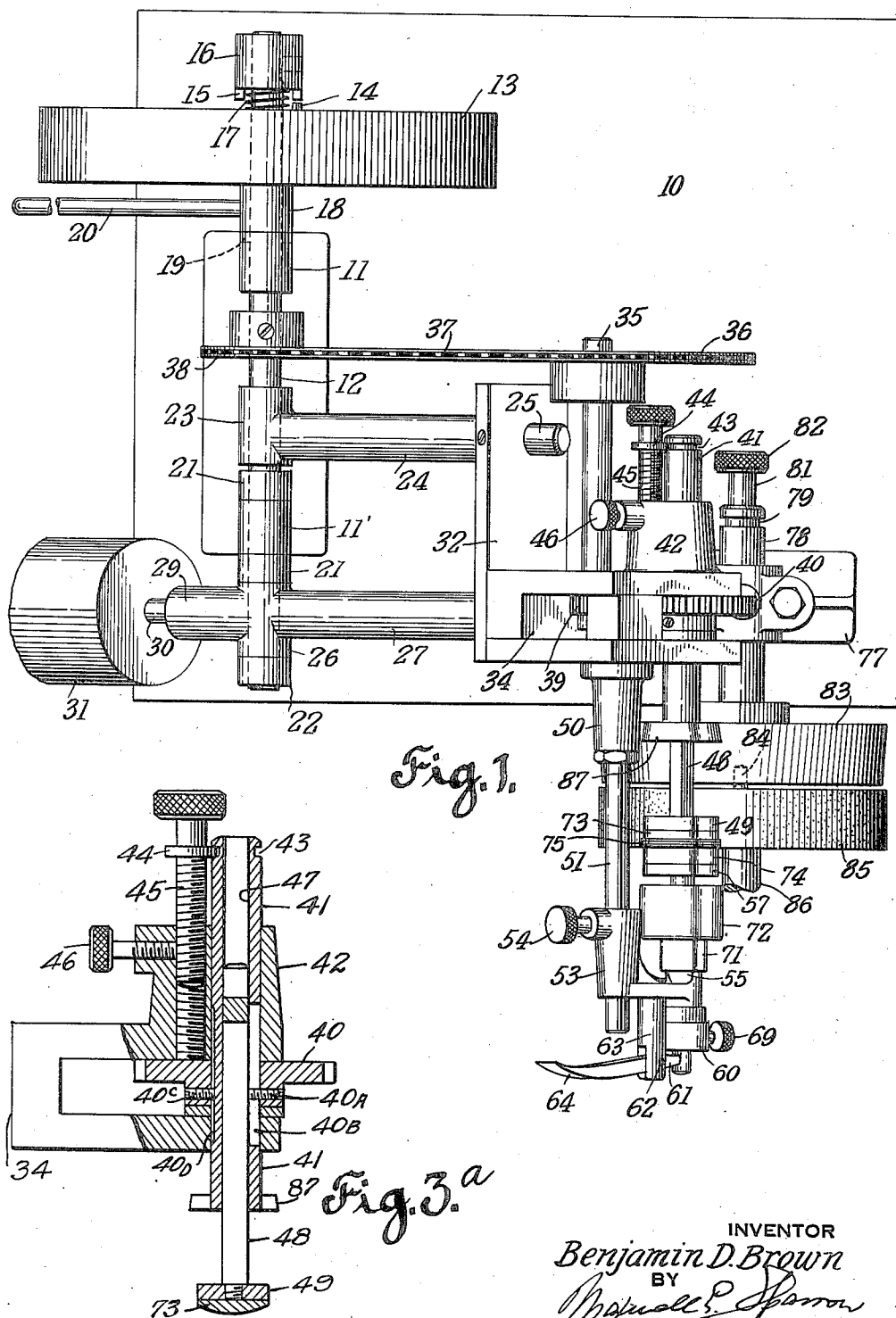
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2,118,806

AUTOMATIC CONTOUR SHAPING FIXTURE

Filed Nov. 29, 1929

2 Sheets-Sheet 1



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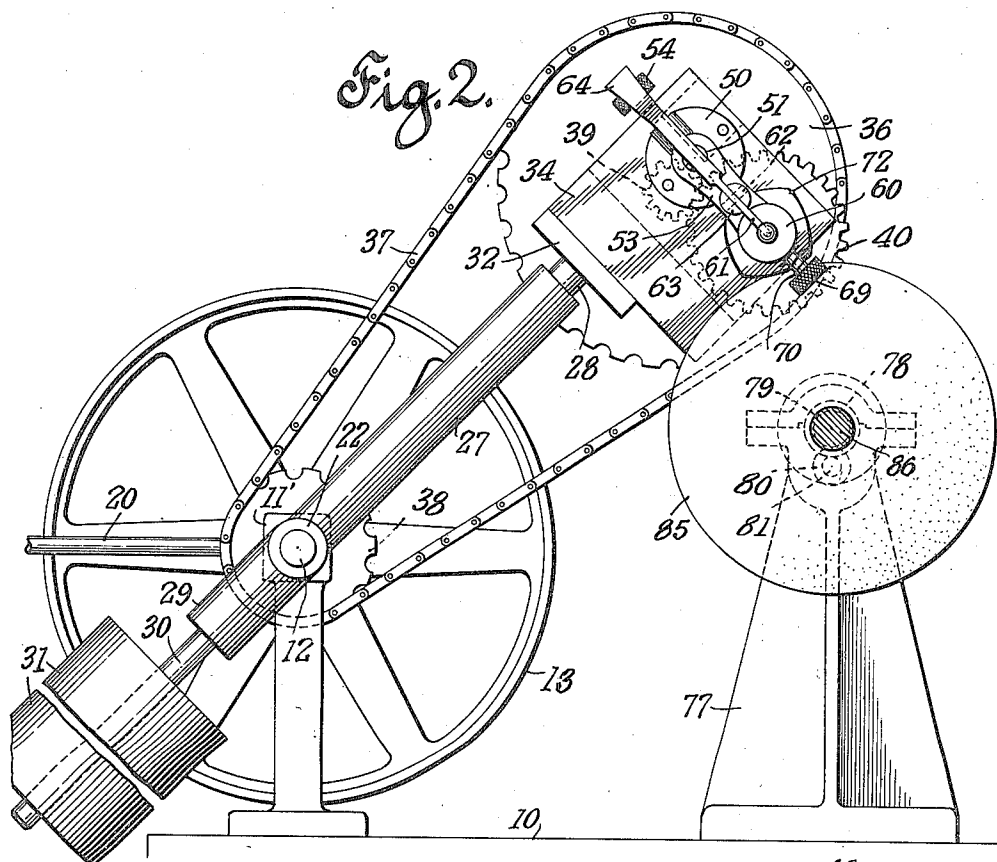
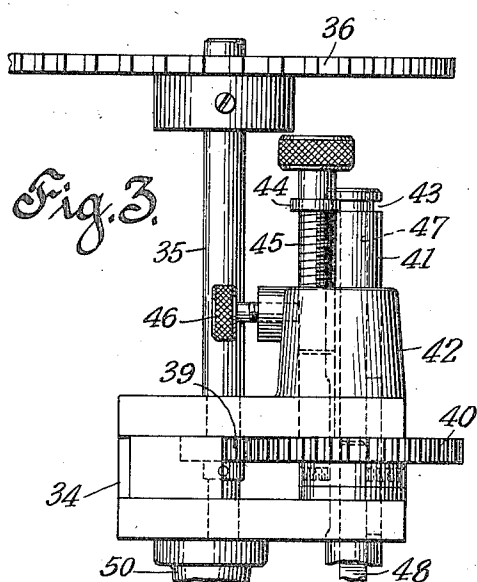
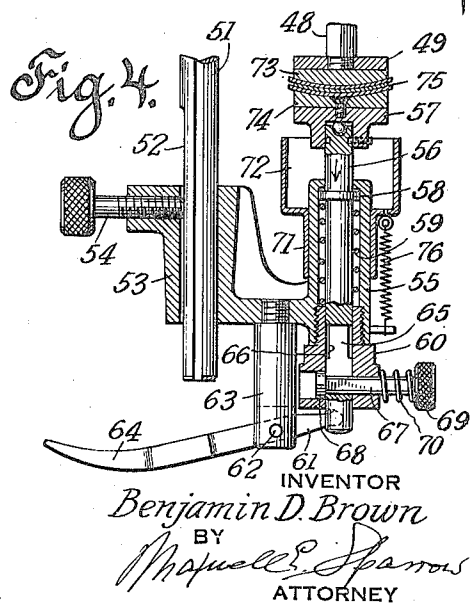
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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AUTOMATIC CONTOUR SHAPING FIXTURE

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6 Claims. (Cl. 51—101)

This invention relates to profile shaping apparatus and more particularly to devices for grinding contours on objects in conformity with a predetermined shape, and has special reference to apparatus for grinding watch crystals, thin lenses of optical devices, and the like, either curved or straight in cross section.

Up to the present time, machines for grinding irregular contours, e. g. on lenses, have not been able to duplicate micrometrically the outline of a master pattern. This necessitated either hand grinding of the lense to fit a given frame, or stretching or otherwise altering a frame to suit the lense. These machines have never been able to grind straight lines. Watch crystals, on the other hand, since they must be ground to micrometrically fit a metal bezel, have hitherto been ground by hand to a master pattern. Variation in hand pressure and lack of proper means of accurate adjustment have always resulted in a lack of micrometric precision with its resultant scrapping of a proportion of the finished product.

The following will explain why all other machines have failed to produce micrometric similarity or proportionality to a master pattern:—

In order to duplicate micrometrically the irregular contour of a given master pattern, the points of tangency, between any two given points on the master pattern and its stop or gauge must have the same included angle with respect to the centre of curvature of the gauge as the relative two points of tangency between the work and the cutting diameter have with respect to the centre of the cutting diameter. Any eccentricity between the centre of curvature of the master-pattern, gauge and the centre of the cutting diameter will cause a change in the included angle relationship mentioned above with a resultant dissimilarity between the contour of the master pattern and finished work. As the eccentricity increases, the dissimilarity increases, until, with a master pattern stop of infinite radius, or the reverse, it reaches its extremes. Within the range of ordinary usage, the dissimilarity is not very marked to the naked eye when dealing with contours made up of continuous curves. When, however, the contour is made up of intersecting curves, particularly flat curves, or when the contour is made up of straight lines, the dissimilarity is quite evident even to the naked eye.

No machine, up to the present, made any provision for having and maintaining, during all adjustments, a concentric relationship between

the cutting diameter and the master-pattern-gauge working diameter.

The main object of this invention is to provide a machine to duplicate with micrometric precision the contour shapes of watch crystals, lenses, and the like.

Further purposes of a machine made in accordance with the invention are (1) to grind irregular contours micrometrically similar to the contour of a master pattern, (2) to grind contours made up of straight lines micrometrically similar to the contour of a master pattern, (3) to grind either irregular contours or straight line contours micrometrically proportional to the master pattern, (4) to grind either irregular contours or straight line contours either micrometrically similar or proportional to a master pattern, with either a square or bevelled edge.

A further object of the present invention is to provide a machine having a counterbalanced work-carrying head guided with respect to the abrading wheel by a former or master having the required shape.

A further feature is in the provisions of means for minutely varying the size of the part to be ground from that of the master guide.

Another purpose is to produce a chuck or holder to grip the object, provisions also being made to centralize and properly index the object with respect to the master guide and the holder.

These and other important objects such as the production of accurate work by essentially automatic methods, the provision of a simple and easily operated mechanism, and means for making fine adjustments in the grinding operation, are accomplished by the novel and practical construction, combination and arrangement of parts, hereinafter described and illustrated in the accompanying drawings, forming a material component of this disclosure, and in which:—

Figure 1 is a top plan view of an embodiment of the invention, indicating its use.

Figure 2 is a side elevational view of the same, shown as in operation.

Figure 3 is a plan view showing part of the work holding head.

Figure 3a is a portion of Figure 3 in cross section.

Figure 4 is a partial longitudinal sectional view of the work clamping and moving device.

Referring to my automatic contour grinding fixture, in general, an adjustable clamp-holder, with a setting gauge, holds the piece to be ground, the latter resting against the face of a rotating grinding wheel. The piece, whose contour is to

be ground, is rotated against the rotating grinding wheel, by means of a pivoted balanced drive which permits the piece to rise and fall to suit the contour and which maintains constant pressure between the piece to be ground and the grinding wheel. Concentric with the piece held in the clamp-holder, is a cam having a shape coincident with that to which the piece is to be ground, the said cam having a tapered edge to suit the tapered face of a cam gauge, the cam gauge being concentric with the grinding wheel. By providing endwise adjustment of either cam or cam gauge proportions of the finished part can be varied or compensation can be made for the wear on the grinding wheel. When the piece is ground to size, the cam rests on the cam gauge and prevents further grinding. In addition to the variation obtainable through endwise adjustment, the size and proportions of the finished ground piece can be increased or decreased as desired by varying the ratio between the maximum outside diameter of the cam gauge and the outside diameter of the grinding wheel and making the cam larger or smaller as desired.

As shown in the drawings the numeral 10 designates the base platform of the machine, from which rises a bracket equipped with a pair of spaced bearings 11—11' for a shaft 12.

A belt receiving pulley 13 is rotatably mounted on the shaft outwardly beyond the bearing 11 and fixed in the outside of the pulley hub is a stud 14 adapted to act as a clutch member with reference to projections 15 at the inner side of a collar 16 held rigidly on the end of the shaft.

Interposed between the collar 16 and pulley hub is a compression spring 17 encircling the shaft and pressing the pulley away from the collar.

Loosely mounted on the shaft, between the pulley hub and bearing 11 is a collar 18 having a cam face 19 to coact with a projection on the outer end of the bearing 11 whereby the cam collar 18 may be forcibly pressed against the pulley hub to move the clutch elements into operative engagement when desired by actuating a handle 20 fixed in the cam collar to extend into a position conveniently to be reached.

Fixed to the shaft 12 on both sides of the bearing 11' are collars 21 and also fixed to the shaft at its end is another collar 22.

Freely mounted on the shaft between its bearing is a sleeve 23 having a stem 24 preferably reduced at its outer portion 25, and between the collars 21 and 22 is another sleeve 26 having a stem 27 reduced at 28.

Also extending from the sleeve 26, in an opposite direction is another stem 29 having a reduced portion 30 on which is adjustably mounted a weight 31.

The reduced stems 25—28 support a plate 32 forming part of brackets 34 in the former of which is rotatably mounted a spindle 35 having fixed on its outer end a sprocket wheel 36 driven by a chain 37 trained over a smaller sprocket 38 fixed on the shaft 12.

On the opposite end of the spindle 35 is a spur pinion 39 meshing with a gear 40 keyed on a spindle 41 rotatably journaled in a boss 42 on the bracket 34.

The above constitutes generally the carriage for supporting the pattern or template and work holder hereinafter described.

A square axial passage 47 is formed through the spindle 41 to slidably receive a bar 48 of rectangular cross section, the outer end of the bar being

threaded into a plate 49 forming one of the jaws of the work holding clamp.

Fig. 3a indicates mechanism for relative positioning of pattern 87 and work holder arm 48; 42 is a boss on bracket 34; screw 45 threaded into this boss has a shoulder 44 engaging groove 43 in sleeve 41 which has a square hole 47 in which slides the square shaft 48. Sleeve 41 holds pattern 87, while shaft 48 holds one-half of work holder 49 and 73. In the hub of gear 40 in Figure 3a are shown two set screws, 40A, 40C, respectively, the one to the right of the figure, namely, 40A passes through a slot 40B in sleeve 41 and locks square shaft 48 to the hub. The set screw 40C in hub of gear 40 abuts against flat 40D in sleeve 41. If the screw to the left, 40C, is locked against flat 40D and the screw to the right, 40A, is loosened, shaft 48 can be moved as desired, while sleeve 41 holding pattern 87 remains in fixed position. On the other hand, screw 40A to the right of hub may be locked in position, while screw 40C to the left of hub may be loosened and operation of screw 45 engaged in groove 43 will move in sleeve 41 as desired, while shaft 48 remains fixed. After adjustment of screw 45, screw 46 will lock 45 in position.

A forwardly extending boss 50 on the bracket 34 has rigidly secured in it a spindle 51 provided with a key way and also with a flattened portion 52 to slidably but not rotatably receive an adjustable bracket 53 equipped with a knurled set screw 54 by which the bracket may be held firmly on the spindle.

A hollow sleeve 55 is integral with the bracket 53, its partially closed inner end acting as a guide for spindle 56 the adjacently extending end of which carries the rotatable hub of a plate 57 arranged in opposed relation to and registration with the plate 49, the plate having an antifriction bearing on the spindle end.

Fixed on the spindle 56, within the sleeve 55, is a limiting collar 58 pressed outwardly by a compression spring 59 encircling the spindle and abutting a plug 60 screw threaded into the outer end of the sleeve, these elements being best seen in Figure 4.

The forwardly extending end of the spindle 56 is recessed to receive the entering end of a lever 61, pivoted at 62 in a stud 63 set in the bracket 53, the lever having an extending operative handle 64.

Obviously by raising the handle the lever will act to draw the spindle 56 outwardly, against the pressure of the spring 59, thus separating the plates 49—57, and to provide means for retaining the plates when separated the spindle has a slot 65 having reduced edges 66 at its inner portion.

A detent pin 67 is slidably mounted transversely in the bracket plug 60 to pass through the spindle slot 65 and is provided with an enlarged head 68 engageable with the reduced portions 66 of the slot when the spindle is retracted.

The extending end of the detent pin 67 has secured to it a knurled hand knob 69 and is equipped with an encircling compression spring 70, pressing the detent into a normally engaging position.

Slidably but not rotatably mounted on the sleeve 55, at its inner extending portion, is the hub 71 of a cup-like guide 72 which may be raised in adjusting the work parts 75 between cushion clamp elements 73—74, carried by the respective plates 49—57.

The guide 72 is normally drawn into inoperative position by a tension spring 76 extending

between the cup and a pin set in the outer part of the sleeve 55.

A support bracket 77, fixed on the base 10, carries a spindle 78 having in its outer portions an annular groove 79 receptive of a flange 80 formed on a screw 81 provided with a knurled head 82 and threaded into the bracket 77 in a plane below and parallel with the spindle 78 which is thereby adjusted in a positive manner.

At the outer end of the spindle 78 is a cam gauge 83 having a conical face, the smaller end being outward and in the end of the spindle 78 is an axial opening to receive a guide pin 84 extending from the end of an arbor 86 on which is secured a grinding wheel 85.

This wheel is rotated at a high rate of speed by means not shown, such for instance as a flexible shaft, but it is to be understood that the axis of the arbor is fixed and in exact alignment with the axis of the cam gauge 83, the wheel and gauge being concentric.

Fixed to the forward end of the hollow spindle 41 is a master cam, pattern or former 87 through which the bar 48 passes, the cam being bevelled in the opposite direction from the gauge 83 upon which it normally rests, due to the excess weight of the elements carried by the swing bracket over the weight 31.

By reason of the bevelled contacting surfaces of the cam and gauge, the distance between their axes may be minutely varied by operation of screw 81 or 45 to a definite extent.

In operation the machine may be unclutched by the lever 20 stopping rotation of the spindles, and the head raised, if desired from the abrading wheel.

Thereupon the handle 64 being raised, the work clamping elements are separated and so held if desired, while other work parts are substituted.

Upon pressing the knob 69, the clamps are forced against the work by the spring 59 and the work is adjusted centrally and indexed properly by aid of the cup gauge 72.

It will be understood that the cam element 87 is shaped in exact proportionate conformity with the outline or contour that is to be imparted to the work part and that variations in size of the latter may be readily effected by moving the cam gauge with respect to the master cam or vice versa.

It will be further understood that a suitable cutter (not shown) may be substituted for the grinding wheel 85, and by providing spring means (not shown) extending from pivot arm or stem 27, sufficient pressure may be obtained to maintain contact between the cutter and work parts against the resistance force of the cutter, thereby converting the device into a milling fixture.

If the overall range in diameter of the cutting or grinding wheel 85 is very large, or otherwise, the gauge 83, instead of being the frustum of a cone, can be made up of radial sections of such frustums all attached concentrically to the gauge axis. Under such a condition, the gauge would be locked in position so that the required section faced the master cam 87. The master cam may, of course, be proportionate in size to the desired work, instead of being the exact size, and the gauge diameter arranged to suit.

The foregoing disclosure is to be regarded as descriptive and illustrative only, and not as restrictive or limitative of the invention, of which obviously an embodiment may be constructed including many modifications without departing

from the general scope herein indicated and denoted in the appended claims.

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

1. In a contour shaping machine, the combination with a pattern, and a work holder operable therewith, of a shaper, a conical gauge journaled for rotary movement in contact with which the pattern rolls, said shaper and said gauge being mounted on a common axis, said pattern and said work holder being movable in a fixed path relative to said shaper and said gauge, means for rotating said work holder and said pattern, and means to micrometrically longitudinally adjust said gauge along its axis relative to said pattern to compensate for wear of the shaper and without changing the concentricity of said shaper and said gauge, and means for locking said gauge in adjusted position against longitudinal displacement.

2. In a contour shaping machine, the combination with a pattern, and a work holder operable therewith, of a shaper, a conical gauge journaled for rotary movement in contact with which the pattern rolls, said shaper and said gauge being mounted on a common axis, a swingable frame mounting said pattern and said work holder for swinging movement in a fixed path relative to said shaper and said gauge, means for mechanically rotating said work holder and said pattern, and means to micrometrically longitudinally adjust said gauge along its axis relative to said pattern to compensate for wear of the shaper and without changing the concentricity of said shaper and said gauge, and means for locking said gauge in adjusted position against longitudinal displacement.

3. In a contour shaping machine, the combination with a pattern, and work holder operable therewith, of a shaper and a gauge in axial alignment, a carriage for supporting, and moving in a fixed path said pattern and said work holder toward and from said shaper and said gauge, means for rotating said work holder and said pattern, said gauge having a working surface of varying concentric diameters against which the said pattern may ride, said working surface being concentric with the shaping surface of said shaper, means to micrometrically longitudinally adjust said gauge and said pattern relative to each other whereby the peripheral contour of said pattern is accurately reproduced in direct proportion on a piece of work, which may be held by the work holder and shaped by the shaper, at all points of said relative adjustment, and means for lockingly maintaining said adjustment.

4. In a contour shaping apparatus, the combination with a pattern, and a work holder operable therewith, of a gauge against which the pattern may ride, and a shaper, said shaper and said gauge being in axial alignment, a carriage for supporting, and moving in a fixed path said pattern and said work holder toward and from said shaper and said gauge, means for rotating said work holder and said pattern, said gauge having a working surface of varying concentric diameters and having its working surface concentric with the shaping surface of said shaper, means to micrometrically vary the longitudinal relation between said gauge and said pattern whereby the peripheral contour of said pattern is accurately reproduced in direct proportion on a piece of work, which may be held by the work holder and shaped by the shaper, at all points of said rela-

tive adjustment, and means for lockingly maintaining said adjustment.

- 5 In a contour shaping machine, the combination of a rotatable shaper, a tapered gauge, said shaper and gauge being mounted on a common axis, said gauge having a working surface of varying concentric diameters, the working surface of said gauge being concentric with the shaping surface of said shaper, a unit movable in a fixed path relative to said shaper and said gauge, said unit having a work holder and a pattern holder in axial alinement, means for rotating said work holder and said pattern holder, means to micrometrically longitudinally adjust said gauge to vary the limits of movement of said unit while maintaining the aforementioned concentricity whereby the peripheral contour of said pattern is accurately reproduced in direct proportion on a piece of work, which may be held by the work holder and shaped by the shaper,

at all points of said adjustment, and means for lockingly maintaining said adjustment.

6. In a contour shaping machine the combination with a pattern, and a work holder operable therewith, of a shaper, a conical gauge against which the pattern may ride, the said shaper and said gauge being mounted on a common axis, a carriage for supporting, and moving in a fixed path said pattern and said work holder toward and from said shaper and said gauge, means for rotating said work holder and said pattern, and means to micrometrically longitudinally adjust said gauge along its axis relative to said shaper and said pattern whereby the peripheral contour of said pattern is accurately reproduced in direct proportion on a piece of work, which may be held by the work holder and shaped by the shaper, at all points of said relative adjustment, and means for lockingly maintaining said adjustment.

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