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APPARATUS FOR FORMING MASTER CAMS

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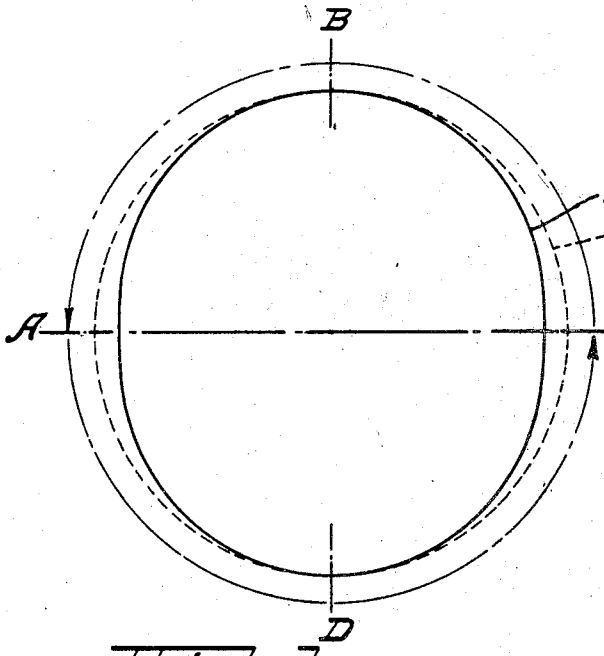


Fig. 1.

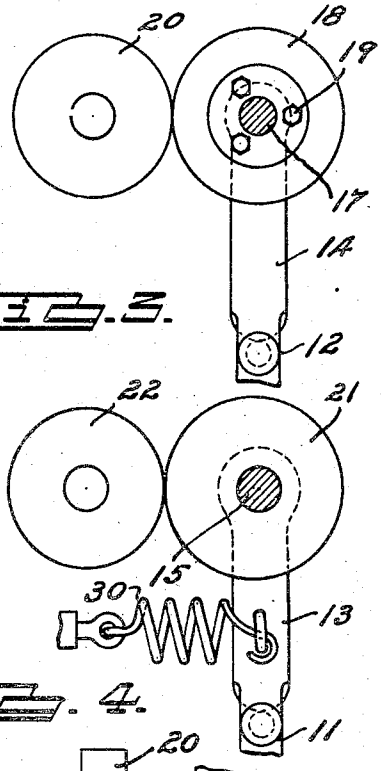


Fig. 3.

Fig. 4.

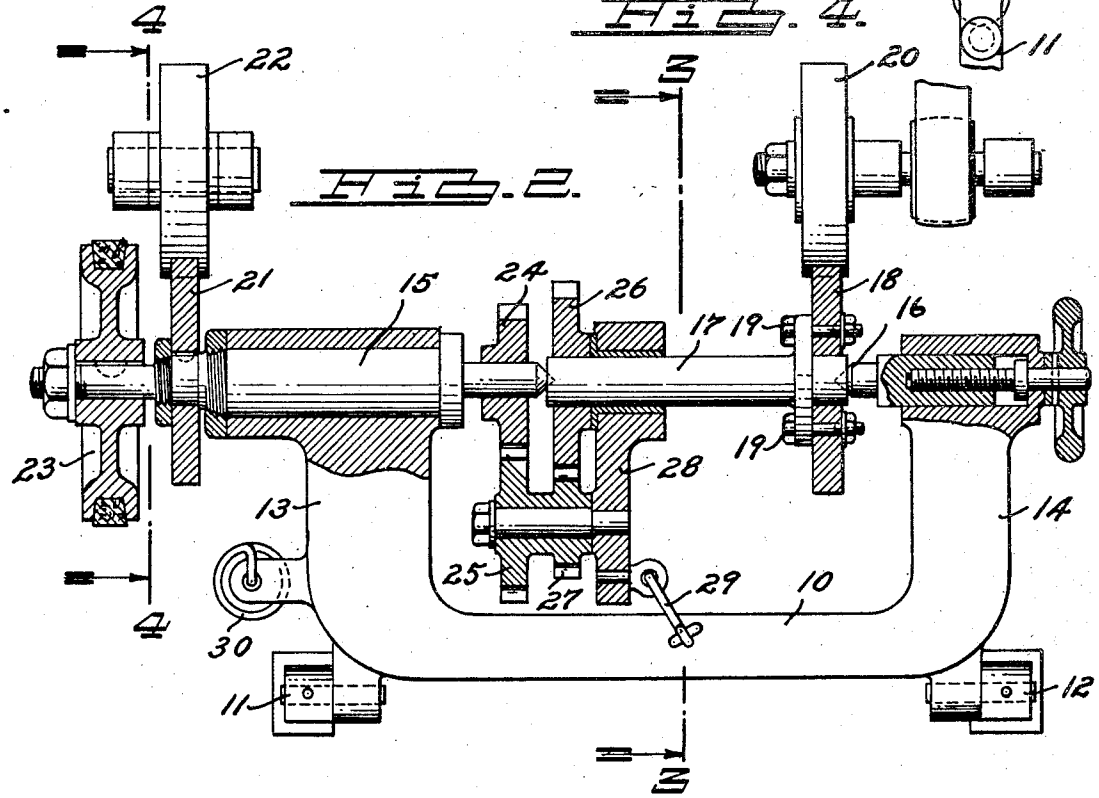


Fig. 2.

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APPARATUS FOR FORMING MASTER CAMS

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2 Claims. (Cl. 51—101)

This invention relates to method and apparatus for forming master cams used to grind articles to oval or other non-circular form.

An important feature of the invention resides in the fact that an eccentric, a simple geometric form that is very easy to produce in an accurate shape, is used to guide the forming instrument.

In certain operations, such as in finishing pistons for automobile engines, it is sometimes desired to give the finished article a slightly oval instead of a cylindrical form. This is usually done at the time the pistons are being finished on a grinding wheel, and the accepted method of producing the oval shape is to regulate the movement of the grinding wheel relative to the piston by means of an oval master cam.

The prior art method of forming these master cams was to calculate certain points on the cam and then to interpolate the rest of the cam. This "laying out" involves considerable labor and a cam thus laid out is not absolutely accurate over its entire periphery because of irregularities which mar its form.

In carrying out the present invention the master oval cam is formed mechanically by using an eccentric to reciprocate the cam blank relative to the grinding wheel during the process of grinding the master cam. In this process a perfectly regular oval contour is generated on the cam blank mechanically and expeditiously.

In the drawing:

Fig. 1 is a diagram illustrating the method.

Fig. 2 is a longitudinal section partly in elevation of an apparatus incorporating the invention.

Fig. 3 is a diagrammatic cross-section taken on line 3—3 of Fig. 2.

Fig. 4 is a diagrammatic cross-section taken on the line 4—4 of Fig. 2.

The method of the present invention consists essentially in rotating a cam blank in contact with a rotating grinding wheel and in moving the cam blank relative to the grinding wheel by means including an eccentric. Means is provided for rotating the cam blank at a predetermined speed slower than the rotation of the eccentric. Thus, where an oval cam, which may be called a "two-lobed" cam, is to be produced, the cam blank is rotated at half the speed of the eccentric.

The application of this method is illustrated diagrammatically in Fig. 1 where the dotted line 10 shows the original round contour of the cam blank and the oval line 11 shows the finished oval contour of the master cam. The operation of this eccentric in reciprocating the blank relative to the grinding wheel will be followed consecutively beginning at the point A.

At the point A the low part of the eccentric permits the cam blank to move the maximum distance toward the grinding wheel. While the cam blank rotates 90°, namely, the sector AB, the eccentric, which is rotating at twice the speed of the cam blank has turned through 180°, and has moved the cam blank the maximum distance away from the grinding wheel. While the cam blank turns through the next 90°, namely, the sector BC, the eccentric completes its first revolution and the low part of the eccentric is again in control at point C, similarly the second revolution of the eccentric controls the formation of the semi-circular cam contour C, D, A.

Although different mechanical arrangements might be used to carry out this method, a preferred apparatus is illustrated in Figs. 2, 3 and 4.

In this apparatus a cradle 10 suitably pivoted at 11 and 12 for movement about a horizontal axis carries a head stock 13 and a tail stock 14. A work spindle 15 is journaled in the head stock and the work center 16 is adjustably mounted in the tail stock in a well-known manner. A shaft 17 is held between the centers on the work spindle 15 and the work center 16, and the cam blank 18 is firmly attached to shaft 17, as by the bolts 19. The grinding wheel 20 is set in a fixed position and is rotated by any suitable source of power. An eccentric 21 is keyed to the work spindle 15, and by reason of its engagement with a stationary idler wheel 22 causes rocking of the frame 12 with consequent reciprocation of the cam blank 18 relative to the grinding wheel 20. The work spindle is rotated in a suitable manner as by the pulley 23.

The shaft 17 is driven from the work spindle 15 by suitable reduction gearing which causes shaft 17 to rotate at half the speed of shaft 15. In the form of gearing illustrated, a gear 24 is keyed to the work spindle 15 and drives a spur gear 25 which has the same number of teeth as gear 24. A gear 26 keyed to shaft 17 is in turn driven by spur gear 27 which has half the number of teeth of gear 26, and which is attached to gear 25. The spur gear is mounted on the floating arm 28 which is anchored against rotation by a link 29 connecting it to the cradle 10. A spring 30 biases the cradle 10 toward a position in which the eccentric 21 engages the idler 22, and cam blank 18 engages the grinding wheel 20.

When this machine is operated the rotation of the eccentric 21 against idler 22 causes the cam blank 18 to reciprocate twice relative to the

grinding wheel during a single rotation of the cam blank, which action is illustrated in Fig. 1 and has been described above. Since the eccentric causes the cradle to reciprocate in an even and uniform motion, the oval curve of the finished cam blank will have an even and accurate contour. The amount of difference between the major and minor axis of the finished cam depends of course upon the amount of eccentricity given to the eccentric.

The oval cam thus produced may be called a "two-lobed" cam. By suitable changes in the gearing so as to cause the cam blank to rotate at different speeds relative to the eccentric, cams having more than two lobes can be produced. Thus if the cam rotates at ⅓ or ¼ the speed of the eccentric, cams having three or four lobes would result.

I claim:

1. In combination, a pivoted cradle having a head stock and a tail stock, a work spindle journaled in the head stock, an eccentric keyed to the work spindle, means for driving the work spindle, a work center adjustably mounted in the tail stock, a shaft mounted between and concentric with the work spindle and the work center, said shaft being rotatable relative to the work spindle, reduction gearing connected to the work spindle and to the shaft and causing the shaft to rotate at a slower speed than the work spindle, a cam blank mounted on the shaft and rotatable therewith, a grinding wheel mounted in a fixed position relative to the pivot of the cradle, and an idler wheel mounted in a fixed position relative to the grinding wheel, and means for resiliently pressing the eccentric against the idler wheel, thereby causing the grinding wheel to selectively remove material from the periphery of the cam blank to produce a geometrically uniform cam having a plurality of lobes.

2. In combination, a pivoted cradle having a head stock and a tail stock, a work spindle journaled in the head stock, an eccentric keyed to the work spindle, means for driving the work spindle, a work center adjustably mounted in the tail stock, a shaft mounted between and concentric with the work spindle and the work center, said shaft being rotatable relative to the work spindle, reduction gearing connected to the work spindle and to the shaft and causing the shaft to rotate at half the speed of the work spindle, a cam blank mounted on the shaft and rotatable therewith, a grinding wheel mounted in a fixed position relative to the pivot of the cradle, and an idler wheel mounted in a fixed position relative to the grinding wheel, and means for resiliently pressing the eccentric against the idler wheel, thereby causing the grinding wheel to selectively remove material from the periphery of the cam blank to produce a geometrically uniform oval cam.

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