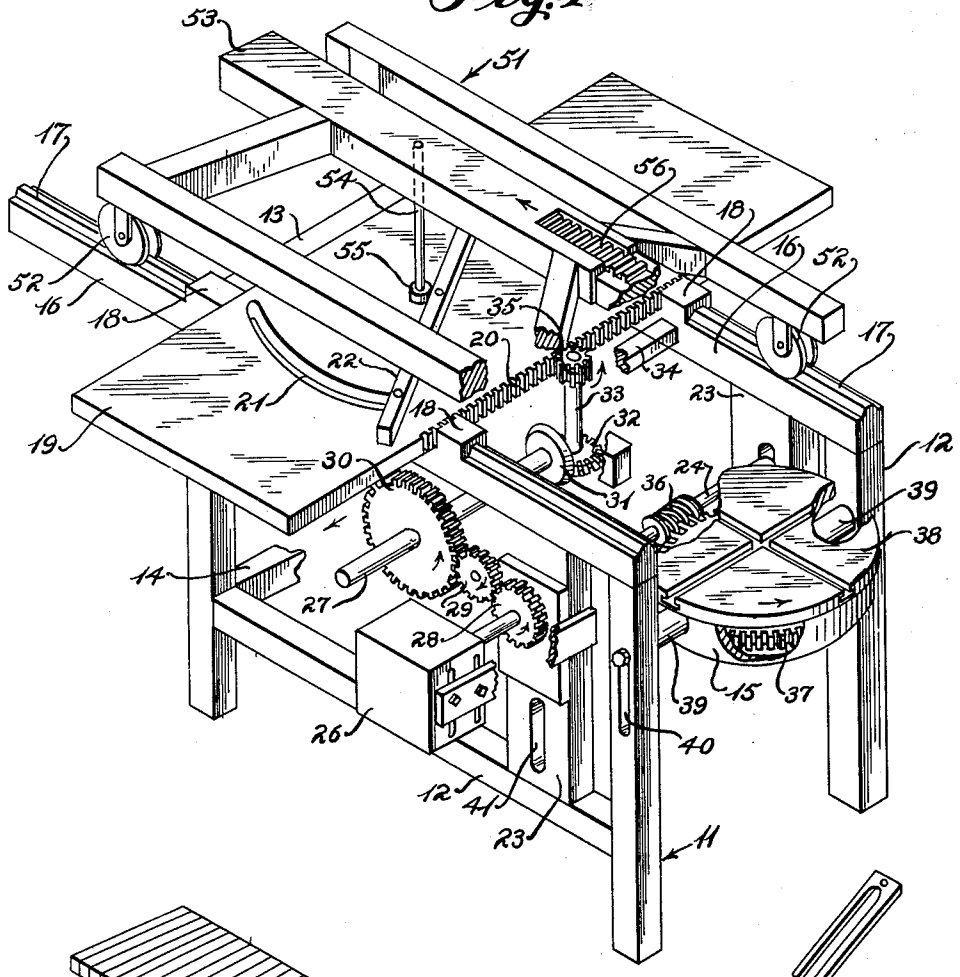
Dec. 9, 1947. G. X. JOHNSTON 2,432,161

CAM GENERATING MACHINE

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Fig. 1



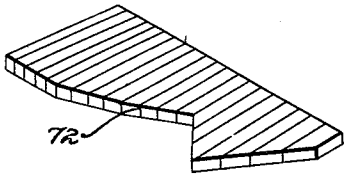


Fig. 9

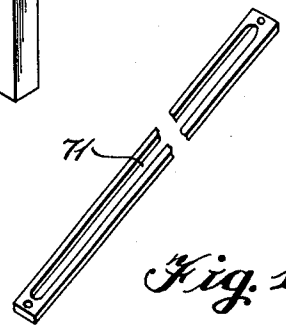


Fig. 11

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Fig. 2

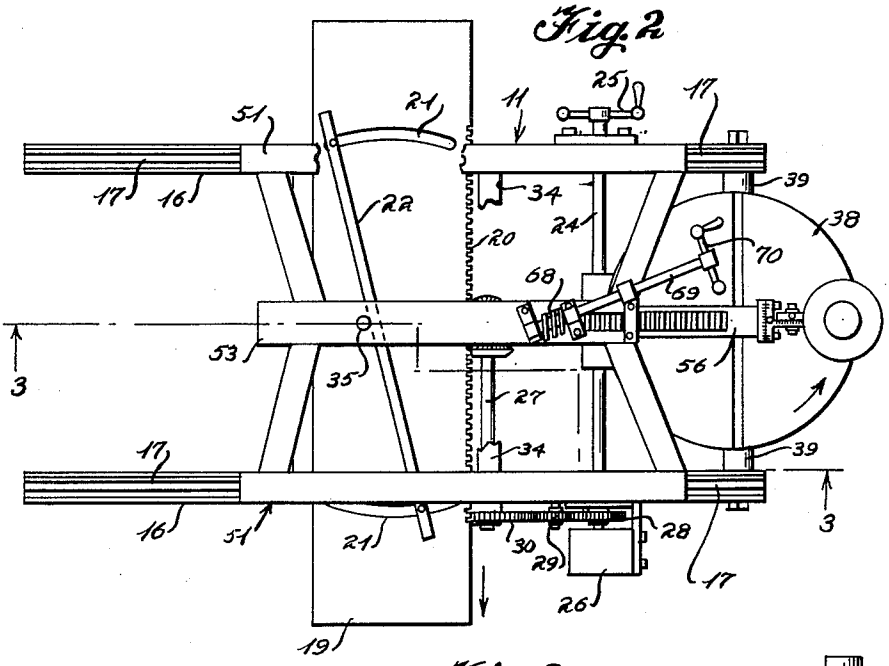
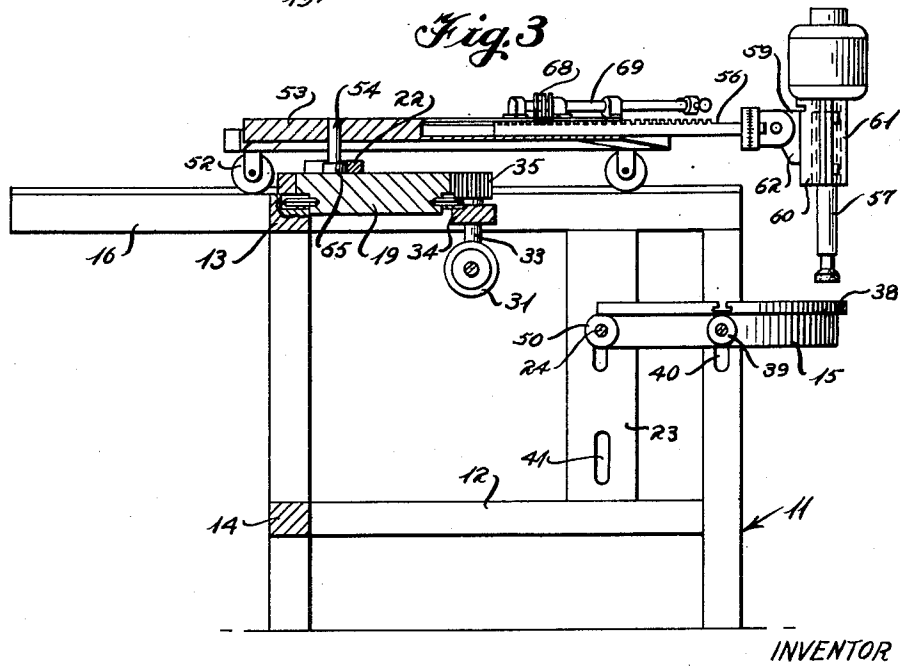


Fig. 3



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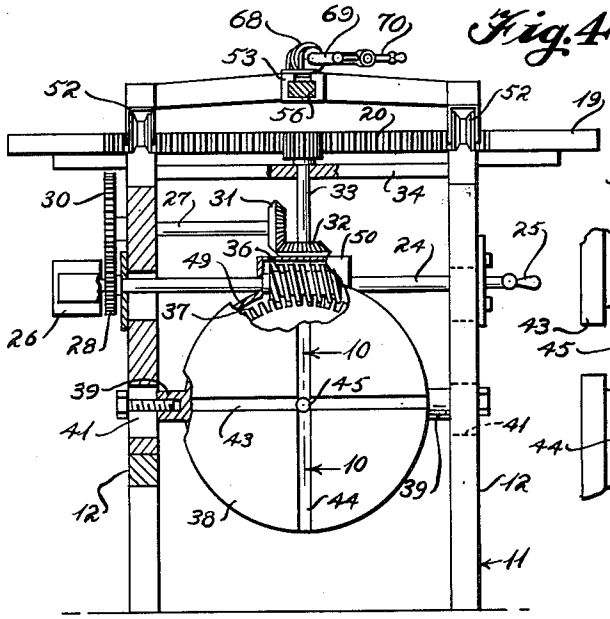
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Fig. 4



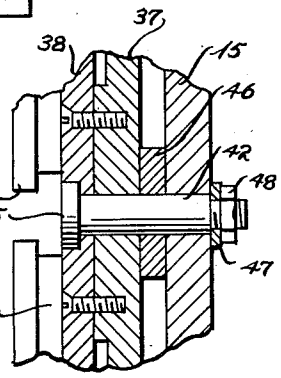


Fig. 10

Fig. 5

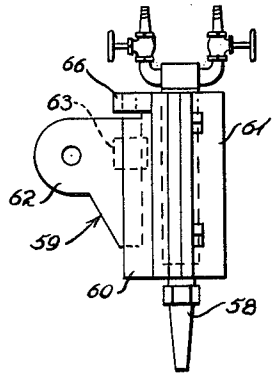


Fig. 6

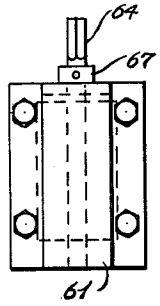
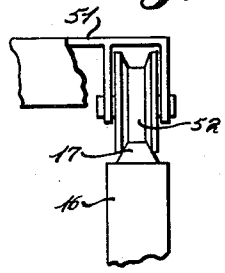


Fig. 7



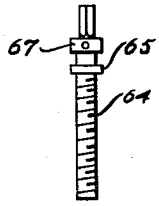


Fig. 8

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UNITED STATES PATENT OFFICE

2,432,161

CAM GENERATING MACHINE

George X. Johnston, St. Clair, Mich.

Application August 13, 1946, Serial No. 690,286

7 Claims. (Cl. 51—50)

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This invention relates to cam manufacturing machines, and more particularly to a machine for manufacturing cams of either the radial or axial type without the use of a master cam.

A main object of the invention is to provide a novel and improved cam generating machine which is very simple in structure, easy to operate and accurate in performance.

A further object of the invention is to provide an improved device for manufacturing cams of either the radial-type, wherein the cam surface is generated around the periphery of a disc-like planar element, or of the axial type, wherein the cam surface is generated along the longitudinal contour of an axially rotatable three-dimensional element, the generation of the cam in either type being accomplished by moving a follower transversely of the machine along a guide track formed to provide longitudinal movement of the generating follower in accordance with the longitudinal movement which it is desired to impart to the cam follower which must ultimately cooperate with the finished cam, the movement of the generating follower being transmitted to the cam forming tool and the cam blank being rotated synchronously with the movement of the forming tool.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a perspective view of a cam forming machine constructed in accordance with the present invention, partly broken away to show structural details.

Figure 2 is a top plan view of the machine of Figure 1.

Figure 3 is a vertical cross-sectional view taken on line 3—3 of Figure 2.

Figure 4 is an end view, partly broken away, of the machine of Figure 1, arranged for forming a cam of the axial type.

Figure 5 is a side elevational view of a flame cutting tool and holder adapted to be employed with the machine of Figure 1.

Figure 6 is a front elevational view of the tool holder of Figure 5 with its vertical adjustment screw in place.

Figure 7 is a detail view showing the means employed for supporting the tool carriage of the machine of Figure 1 and for guiding its longitudinal movement.

Figure 8 is a detail view of the vertical adjustment screw employed in the tool holder of Figures 5 and 6.

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Figure 9 is a perspective view of a modified guide track for the cam forming follower of the machine of Figure 1, illustrating the types of cam follower paths which may be produced on cams manufactured by the machine of the present invention.

Figure 10 is an enlarged detail cross-sectional view taken on line 10—10 of Figure 4 and illustrating the manner of rotatively securing the work supporting member to its base.

Figure 11 is a perspective view of a modified guide track member for the cam follower of the machine of Figure 1.

Referring to the drawings, 11 designates a supporting table structure for the machine, said table structure comprising side frames 12, 12 rigidly connected together by rear upper and lower transverse brace bars 13 and 14 and by a work support housing 15 at the forward ends of the side frames in a manner to be subsequently described. The top members of frames 12, 12 consist of elongated longitudinal rails 16, 16 formed with guide ribs 17 at their end portions. Inwardly of each guide rib is formed a guide abutment 18, the guide abutments defining a transverse guideway in which is slidably positioned a rectangular plate member 19 formed at its forward transverse edge with rack teeth 20. Plate member 19 is formed with a pair of opposed arcuate slots 21, 21 and adjustably secured to said slots by suitable fasteners is a guide bar 22. The angle of adjustment of guide bar 22 with respect to the transverse axis of the table is determined by the depth of cut desired along the camming edge or surface of the cam being generated, as will be subsequently pointed out.

Adjacent the forward ends of the frames 12, 12 are opposed vertical support members 23, 23 through which passes a transverse shaft 24 projecting laterally on both sides of the table structure. On one side of the table structure shaft 24 carries a handle 25 for manual actuation of the shaft, and on the other side the shaft is connected to an electric motor 26 for power operation thereof. Rearwardly of shaft 24 is a driven transverse shaft 27 suitably journalled in the table structure. Shaft 27 is coupled to shaft 24 by a gear train comprising a first gear 28 keyed to shaft 24, an idler gear 29 suitably journalled to the table structure and a third gear 30 keyed to shaft 27. On its inner end shaft 27 carries a bevel gear 31. Bevel gear 31 meshes with a bevel gear 32 carried on a vertical shaft 33 journalled in a transverse member 34. At the top end of

shaft 33 is a pinion gear 35 which meshes with rack teeth 20.

Intermediate its length, shaft 24 carries a worm 36. Worm 36 meshes with a worm gear 37 journalled in housing 15, said worm gear carrying a face plate 38 upon which the cam blanks are adapted to be secured in centered relation. Housing 15 has diametrically opposed studs 39, 39. Studs 39, 39 are adapted to be secured in vertically adjusted position by bolts either in slots 40 formed in the front legs of the frames 12, 12 whereby face plate 38 may be supported horizontally, or in slots 41 formed in the vertical support members 23, 23, whereby face plate 38 may be supported in a transverse vertical plane rotated 90 degrees around shaft 24 from the horizontal position of face plate 38 shown in Figure 1. The vertical position of face plate 38 is shown in Figure 4.

As will become apparent, face plate 38 is positioned horizontally when cams of the radial type are to be generated and is positioned vertically when cams of the axial type are to be generated.

As shown in Figure 10, face plate 38 is rotatively secured to housing 15 by a headed stud member 42. Face plate 38 is formed with intersecting T-shaped grooves 43 and 44 at right angles to each other, the intersection of the grooves being in the center of the face plate. Said member 42 is formed with a circular head 45 which is rotatably received in a seat formed therefor at said center. A spacing washer 46 is positioned between gear 37 and the adjacent wall surface of housing 15. The end of stud member 42 is reduced and threaded to receive an external washer 47 and securing nut 48.

Housing 15 has an annular peripheral wall 49 which is formed with an auxiliary housing 50 to receive worm 36, shaft 24 being journalled in the end walls of the auxiliary housing. By removing the securing bolts which engage the studs 39, 39, housing 15 may be swung around shaft 24 from its horizontal position to its vertical position, and vice versa, without disengaging worm 36 from gear 37.

Longitudinally movable on the table structure is a carriage 51 supported by grooved wheels 52 on the ribs 17. Carriage 51 includes a hollow central longitudinal beam member 53 from which depends a vertical shaft 54 carrying at its bottom end a guide roller 55 which engages guide bar 22 with rolling contact whereby longitudinal thrust is delivered to carriage 51 responsive to transverse movement of plate member 19. Slidably received in the forward end portion of beam member 53 is a rack bar 56 to the forward end of which is adjustably secured the cam cutting tool, which may be a motor driven grinding tool 57 as shown in Figures 2 and 3, or any other suitable cutting tool, such as a flame cutting tool 58, as shown in Figure 5.

The cutting tool is supported in a bracket device 59 universally adjustably secured to rack bar 56. Bracket device 59 comprises a rear channeled segment 60 and a forward channeled segment 61 bolted to rear segment 60, the cutting tool being clampingly secured in the opposed channel portions of said segments. Rear segment 60 is vertically slidable in a supporting member 62 which includes an internally threaded nut element 63. An adjusting stud 64 is adapted to be threadedly engaged in said nut element, said stud being formed with a collar 65. Collar 65 is arranged to underly an apertured lug 66 carried by rear segment 60, the upper portion of the stud 64 passing vertically through the aperture in lug 66 and being secured by an overlying removable collar 67. The top end of stud 64 is formed for engagement by a wrench. Rotation of stud 64 moves the tool clamping segments vertically, whereby the vertical position of the tool may be adjusted as desired.

Rack bar 56 is engaged by a worm 68 carried on a shaft 69 journalled in brackets secured to beam member 53. Shaft 69 is provided with a handle 70 for manually rotating the shaft to adjust the forward position of the rack bar. In operation, a cam blank is clamped to face plate 38 in centered relation therewith and handle 70 is rotated until the cutting element of the tool is in engagement with the surface of the blank. Rotation of shaft 24, either manually or by means of motor 26 causes plate member 19 to move transversely and at the same time causes face plate 38 to rotate. The transverse movement of plate member 19 is converted to longitudinal movement of beam member 53 by the cooperation of roller 55 with guide bar 22. The cutting tool thus moves against the rotating cam blank in a path determined by the configuration of the guide bar 22 and the depth of cut of the cam is thus automatically regulated in accordance with the shape of the guide bar.

Guide bar 22 may have any one of various contours, depending upon the specific camming contour required in the finished cam. Figure 9 illustrates at 72 an example of the contour which the guide bar may have in order to generate a cam providing follower action corresponding to the variation in the edge contour of the guide bar.

A straight guide bar, such as shown at 22 in Figures 1 and 2 would generate a simple spiral cam. More complex cam shapes would be generated by guide bars of the type illustrated in Figure 9.

Instead of employing a guide bar such as 22, a slotted bar, such as illustrated in Figure 11 may be employed, wherein roller 55 would be received in the slot 71 of the guide bar and would cooperate therewith to move beam 53 longitudinally responsive to transverse movement of plate member 19 in the same manner as accomplished by the straight bar 22. Slot 71 may, of course, have any desired shape, whereby other than a simple spiral cam may be generated.

While a cam generating machine has been disclosed in specific detail in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention other than as defined by the scope of the appended claims.

What is claimed is:

1. A cam generating machine comprising a support, a face plate rotatively mounted on said support, means for clamping a cam blank on said face plate, a carriage on said support, means for guiding said carriage longitudinally on the support, a tool carried by said carriage, a plate member on said support, means for guiding said plate member for transverse movement on said support, cam profile defining means on said plate member, means on said carriage cooperating with said profile defining means for moving said carriage longitudinally responsive to transverse movement of said plate member, and means for simultane-

ously rotating said face plate and moving said plate member transversely of the support.

2. A cam generating machine comprising a support, a face plate rotatively mounted on said support for rotation in a horizontal plane, means for clamping a cam blank on said face plate, a carriage movably mounted on said support, means for guiding the carriage for longitudinal horizontal movement on the support, a tool secured to the forward end of said carriage, a plate member movably mounted on said support, means for guiding said plate member for transverse horizontal movement on said support, cam profile defining means on said plate member, means on said carriage cooperating with the cam profile defining means for moving said carriage longitudinally responsive to transverse movement of said plate member, and means for simultaneously rotating said face plate and moving said plate member transversely of the support.

3. A cam generating machine comprising a support, a face plate rotatively mounted on said support for rotation in a transverse vertical plane, means for clamping a cam blank on said face plate, a carriage movably mounted on said support, a tool carried by said carriage, means for guiding the carriage for longitudinal horizontal movement on said support, cam profile defining means movably mounted on said support, means for guiding said cam profile defining means for transverse horizontal movement on said support, means on said carriage cooperating with said cam profile defining means for moving said carriage longitudinally responsive to transverse movement of said cam profile defining means, and means for simultaneously rotating said face plate and moving said cam profile defining means transversely of the support.

4. A cam generating machine comprising a support, a work holder rotatively mounted on said support, a tool holder movably mounted on said support, a tool carried by said tool holder, means for guiding said tool holder for longitudinal movement on the support, cam profile defining means movably mounted on the support, means for guiding the cam profile defining means for transverse movement on the support, means on the tool holder cooperating with the cam profile defining means for moving said tool holder longitudinally responsive to transverse movement of said profile defining means, and means for simultaneously rotating said work holder and moving said profile defining means transversely of the support.

5. A cam generating machine comprising a support, a work holder rotatively mounted on said support, means for vertically adjusting said work holder, means for adjusting said work holder for rotation either in a horizontal plane or in a transverse vertical plane, a tool holder movably mounted on said support, a tool carried by said tool holder, means for guiding said tool holder for longitudinal horizontal movement on the support, cam profile defining means movably mounted on the support, means for guiding the cam profile defining means for transverse horizontal movement on the support, means on the tool holder cooperating with the profile defining means for moving said tool holder longitudinally responsive to transverse movement of said profile defining means, and means for simultaneously rotating said work holder and moving said profile defining means transversely of the support.

6. A cam generating machine comprising a support, a work holder rotatively mounted on said support, means for adjusting said work holder for rotation either in a horizontal plane or in a transverse vertical plane, a carriage movably mounted on said support, means for guiding said carriage for longitudinal horizontal movement on said support, a tool holder secured to the forward end of said carriage, a tool carried by said tool holder, means for vertically adjusting said tool holder with respect to said carriage, cam profile defining means movably mounted on the support, means for guiding the cam profile defining means for transverse horizontal movement on the support, means on the carriage cooperating with the profile defining means for moving said carriage longitudinally responsive to transverse movement of the profile defining means, and means for simultaneously rotating said work holder and moving said profile defining means transversely of the support.

7. A cam generating machine comprising a support, a work holder rotatively mounted on said support, a tool holder movably mounted on said support, a cutting tool carried by said tool holder, means providing universal angular adjustment of said cutting tool with respect to said tool holder, means for guiding said tool holder for longitudinal movement on the support, cam profile defining means movably mounted on the support, means for guiding the cam profile defining means for transverse movement on the support, means on the tool holder cooperating with the cam profile defining means for moving said tool holder longitudinally responsive to transverse movement of said profile defining means, and means for simultaneously rotating said work holder and moving said profile defining means transversely of the support.

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