Oct. 14, 1958 A. A. MEYER 2,855,667

METHOD OF FORMING CAMS

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Fig. 1

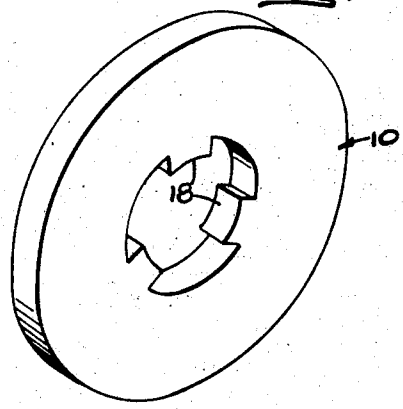


Fig. 2

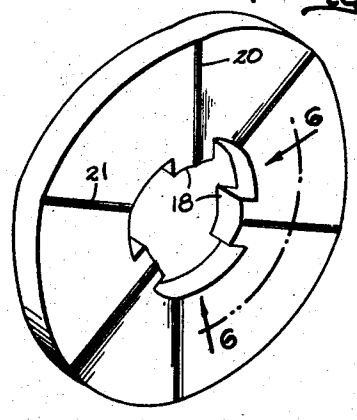


Fig. 3

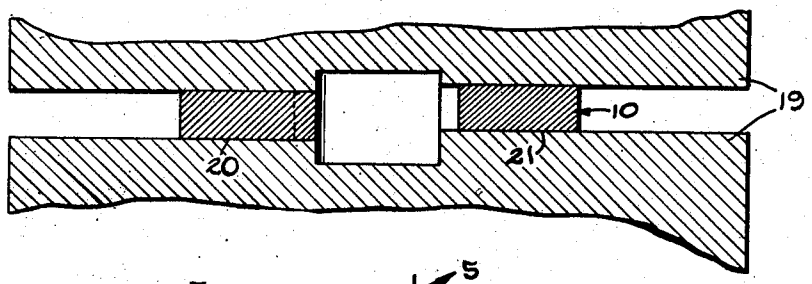


Fig. 5

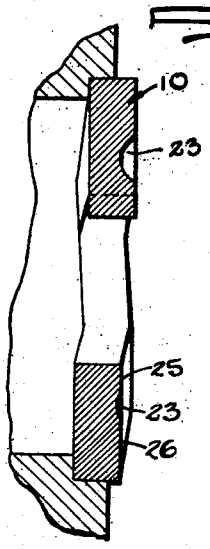
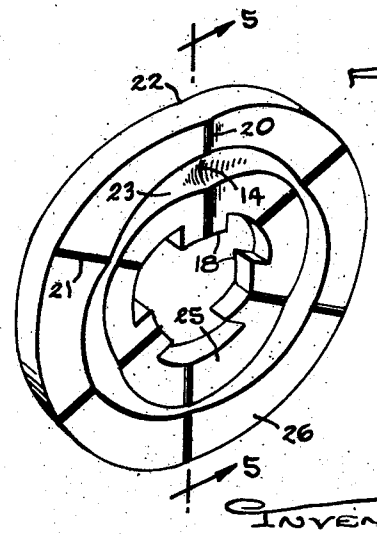


Fig. 4



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Fig. 6

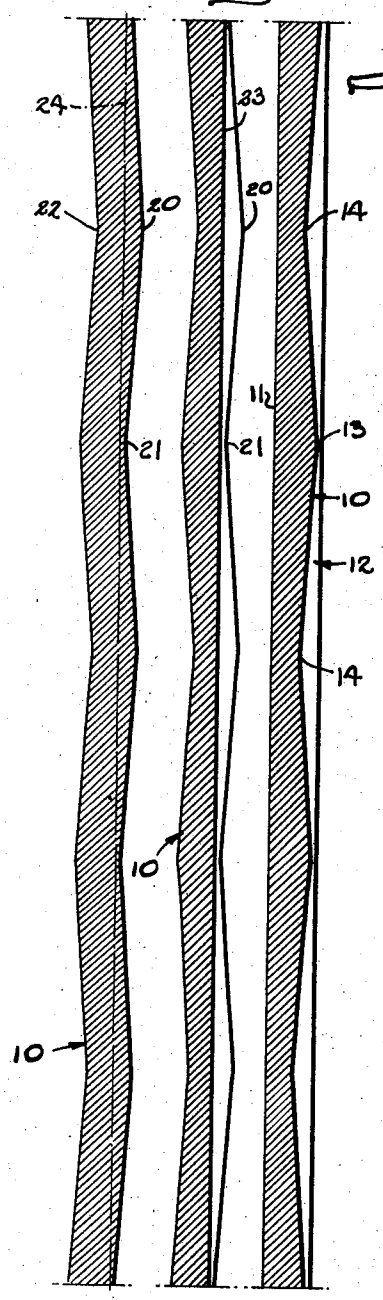
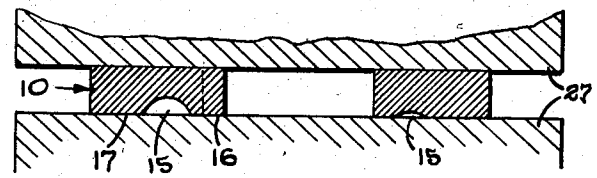


Fig. 7

Fig. 8

Fig. 9



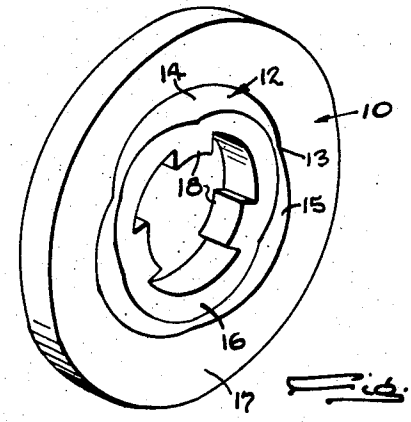


Fig. 10

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METHOD OF FORMING CAMS

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Application July 25, 1956, Serial No. 600,036

3 Claims. (Cl. 29—555)

This invention relates to the art of forming a cam having an elongated surface with rises and falls therein for converting one motion into a thrust in a perpendicular direction. Heretofore such cams have been formed in a so-called profiling operation by causing the metal removing cutter to follow the contour of a master pattern.

The primary object of the present invention is to reduce the cost of forming such cams by enabling the contour of the cam surface to be determined by working the metal of a blank in a stamping operation.

A more detailed object is to deform the blank to a contour which is the reverse of that desired in the final cam, and, after machining of the contoured face to produce a surface thereon of the same contour as the original blank, again deforming the blank reversely to restore its original contour and thereby convert the machined surface to the desired contour.

The invention also resides in the novel manner of performing the material removing operation to permit the desired cam contour to be produced by a subsequent flattening of the blank.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of a blank from which the cam is to be formed.

Fig. 2 is a perspective view of the Fig. 1 blank following the first step in the forming operation.

Fig. 3 is a fragmentary sectional view of the die set up for performing the deforming step.

Fig. 4 is a perspective view of the deformed blank after machining thereof.

Fig. 5 is a diametrical sectional view of the machined blank taken along the line 5—5 of Fig. 4.

Fig. 6 is a sectional development view of the deformed blank taken along the circle 6—6 in Fig. 2.

Fig. 7 is a similar development view of the blank after machining thereof.

Fig. 8 is a similar view of the completed cam.

Fig. 9 is a sectional view of the die set up for restoring the original flatness of the blank.

Fig. 10 is a perspective view of a finished cam.

In the drawings, the invention is illustrated in connection with the formation of an axial face cam (Fig. 10) comprising a generally flat ring **10** having a flat back surface **11** and a cam track **12** extending partially across the opposite face and formed with alternate rises and falls merging at high and low points **13** and **14**. Preferably, though not necessarily, the machined surface is the bottom of an annular groove **15** (Fig. 9) cut in the face of the blank between the inner and outer peripheral edges thereof so as to leave flat and unmachined surfaces **16** and **17** around the inner and outer margins of the ring. The latter is composed of ductile metal such as steel and is sufficiently thin, for example ¼ of an inch, to permit working of the metal to the desired contour in a stamping operation. To permit the cam

ring to be coupled to a supporting shaft, spline teeth **18** are formed around the inner periphery.

The first step of the improved method involves deforming the blank **10** to the shape shown in Figs. 2 and 6. This is accomplished by compressing the flat ring as shown in Fig. 3 between two die members **19** whose opposed surfaces are contoured to depress angularly spaced portions of the blank axially and produce a contour which is the reverse of that desired in the final cam track **12**. That is to say, the face of the blank which is to provide the final cam surface is formed with high and low points **20** and **21** angularly spaced apart to correspond to the spacing of the low and high points **14** and **13** in the final cam. The back side of the blank is oppositely contoured with low points **22** alined with the low points **14** of the final cam surface.

In the second step of the improved process, metal is removed along the full length of the blank and across part of the radial width of the latter by a simple machining operation such as milling or turning to produce a machined surface **23** whose contour is the same as that of the original blank. Where, as in the present instance, a flat blank (Fig. 1) is used at the start, metal is removed from the deformed blank (Fig. 2) down to a plane **24** (Fig. 6) thus cutting off the high points **20** around the deformed surface. Such machining results in the formation of a groove of varying depth and width as shown in Figs. 4 and 5. Since metal is removed from a band of narrow width around the face of the deformed blank, the deformed contour of the inner and outer portions **25** and **26** is thus retained.

To convert the flat bottomed groove into a cam track of the desired contour, it is only necessary to restore the ring **10** to its original contour or flatness in this instance. This is accomplished simply by compressing the deformed ring between two flat plates **27** (Fig. 9) one engaging the unmachined back face of the blank while the other engages the unmachined portions **25** and **26** on opposite sides of the groove **23**. In this operation of ffattening the unmachined surfaces of the blank, the machined surface is converted into the desired contour as shown in Figs. 9 and 10. That is to say, the portions of the groove bottom adjacent the high points **20** of the deformed blank are displaced axially to form the depressions **14**. At the same time, the shallow points of the groove will be moved axially of the ring a correspondingly lesser amount and thus form the high points **13** of the cam track.

It will be apparent from the foregoing that the cam surface is formed in metal working and removing operations which may be performed at high speed and minimum cost. Since the metal removing operation results in the formation of a flat surface or groove bottom, no master cam pattern is required.

I claim as my invention:

1. In a method of forming a cam surface of a desired undulating contour on one axial face of a flat blank of ductile material, the steps of deforming said blank to cause said face of the blank to assume a contour which is the reverse of said desired contour, removing from said face a layer of material narrower in radial width than the blank to form a machined surface disposed in a plane perpendicular to the axis of the blank, and restoring the unmachined surface of said blank to its original flatness and thereby cause said machined surface to assume said desired contour.

2. The method of forming an axial face cam comprising the steps of bending an annular blank to provide predetermined circumferential wave patterns on front and rear faces of the blank, cutting an annular groove into said front face with the bottom of the groove disposed in a plane perpendicular to the axis of the blank

while retaining said wave pattern in the adjacent portion of the front face, and rebending the bent blank to restore the unmachined portions of said faces to their original form and thereby cause the bottom of the groove to assume a circumferential wave contour which is the reverse of said wave pattern of said front face.

3. In the method of forming a cam surface of a desired undulating contour on the front face of a flat blank of ductile material having front and back faces, the steps of deforming said blank to cause said faces to assume a contour that is the reverse of said desired contour, removing from said front face a layer of material narrower than the blank to form a machined surface

while leaving the adjacent area of said face unmachined, and compressing the blank between two flat parallel surfaces respectively engaging the back face and the unmachined portions of the front face whereby to restore the original flatness of the blank and cause said machined surface to assume said desired contour.

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