

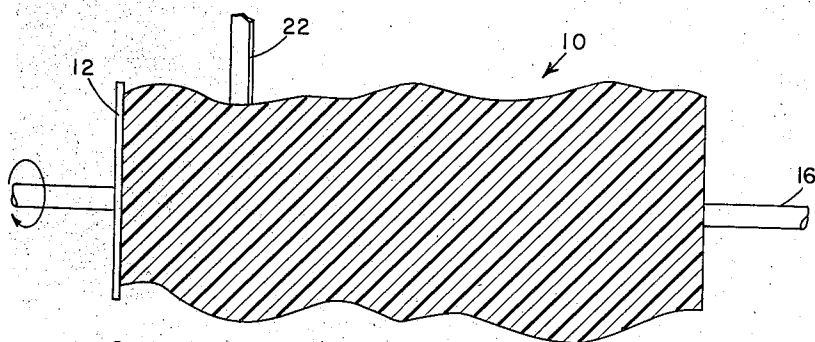
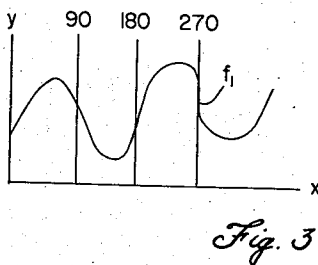
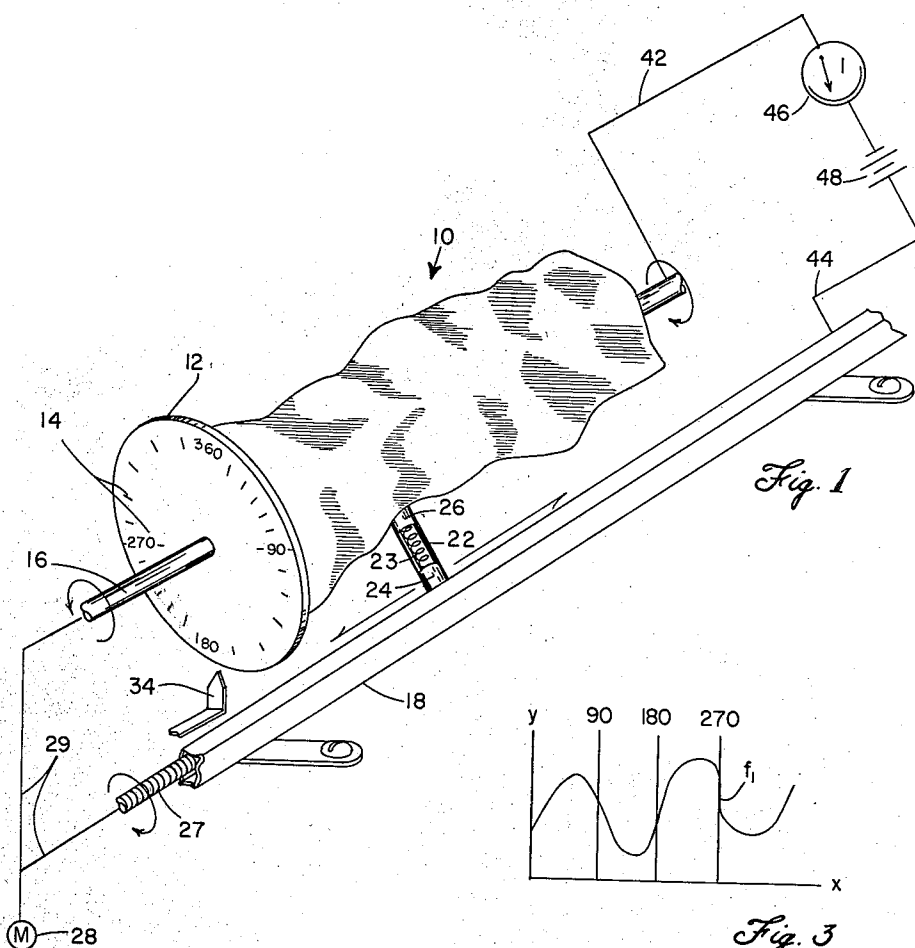
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ELECTRICAL THREE DIMENSIONAL FUNCTION PROGRAMMER

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ELECTRICAL THREE DIMENSIONAL FUNCTION PROGRAMMER

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This invention relates to an electrical three dimensional function programmer and more particularly to a three dimensional cam which is readily shaped to have electrical characteristics which correspond to any desired function.

The use of modern automatic equipment has created the need for devices which are capable of controlling the use of such equipment closely through prearranged or preselected cycles or functions, especially where the cycles are repeated quite frequently, as in mass production. Cam devices which are now available for such purposes are usually quite elaborate mechanical devices which actuate secondary mechanisms through push-rod followers, lever-arms, etc., thus restricting design, as the secondary or driven member must be physically located near to the cam and all bearing points require very critical positioning as dimensional tolerances contribute directly to the accuracy of the output information, thus involving substantial expense and difficulty to build in the function desired.

In the present invention, there is provided a simple, three dimensional type cam which uses the resistive effect of the material itself to incorporate the programming function which is built into the cam when cast or constructed. In accordance with this invention, the three dimensional solid type cam is made of a material having desirable electrical resistance properties and at the same time excellent low friction surface characteristics so that there will not be an adverse change in characteristics after repeated use of the cam.

In accordance with this invention, it has been found that certain types of semiconductive materials such as carbon impregnated diallyl phthalate is an excellent material for this purpose and when cast in the form of the cam as hereinafter described, provides a cam which is relatively inexpensive and permits with great convenience the insertion of the proper function desired and may be recycled many times before the characteristics of the cam changes and the results are affected materially as coupling between the shaped surface of the cam and the driven member is electrical instead of mechanical.

It is hence a first object of this invention to provide a three dimensional cam having desirable electrical resistance properties.

Another object of this invention is the provision of apparatus which may be readily shaped for establishing a programmed function.

Still other objects and advantages of this invention will hereinafter become more readily apparent from the following description of a preferred embodiment of the invention described in connection with the accompanying drawing in which:

FIG. 1 is an isometric view of a cam designed in accordance with the principles of this invention.

FIG. 2 is a typical section through the cam of FIG. 1.

FIG. 3 shows a typical output function produced by this cam.

Referring to the drawing, there is illustrated a solid cam 10 carved or shaped in a manner to be described below, but having a general overall cylindrical configuration and provided with an end plate 12 upon which polar markings 14 are inscribed. Cam 10 is mounted on a

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shaft 16 which is constructed of conductive material such as aluminum, copper, alloy or steel. Shaft 16 would be mounted in any convenient way (not illustrated) as understood in the art. Mounted alongside of cam 10 and parallel to shaft 16 is a rule or guide 18 upon which may be marked off dimensions or calibrations with which to indicate the position of a member 22 which may be mounted to slide along rule or guide 18. Member 22 is provided with a base 24 and a brush 26 for riding or sliding on the surface of cam 10. A spring 23 biases brush 26 against the outer surface of cam 10. By this arrangement, it is seen that as member 22 moves along guide 18, brush 26 rides the outer surface of cam 10 and moves inwardly and outwardly as biased by spring 23. Brush 26, spring 23 and base 24 are conductive to permit for a reason to be explained further below the passage of electrical current there through. A flexible wire (not shown) may be used if desired to connect brush 26 with guide 18.

A pointer 34 may be mounted to indicate on plate 12 the angular position of brush 26. The calibrations on guide 18 indicate, as is now obvious, the axial position of brush 26, or along the x axis. As noted from FIG. 1, guide 18 is a hollow member through which extends a rack 27. While not shown, guide 18 is slotted along the face from which member 22 extends. The bottom of base 24 is provided with a pinion (not shown) to engage with rack 27 so that rotation of the latter moves member 22 axially along cam 10. An electric motor 28 or other means known in the art provides the drive for rack 27 and a conventional transmission arrangement generally designated 29 rotates cam 10 and rack 27 in unison to ensure synchronism between brush 26 and pointer 34.

Cam 10 functions as part of an electrical circuit consisting of leads 42 and 44 which are connected to shaft 16 and guide 18 respectively, a current meter 46, and a battery supply 48. Thus, it is the variation in resistance between brush 26 and shaft 16 which is measured and is a function of the cam shape and thickness from shaft 16 to the outer surface of the material making up cam 10. Current meter 46 in effect measures this resistance and produces a reading which is proportional to the resistance through cam 10 at any particular location of brush 26.

In order for cam 10 to function as described, it should be of solid construction made from a semi-resistive material capable of being readily shaped and have a very low friction surface to avoid excessive wear as a result of continuous use of the cam. A suitable material for this purpose is known as diallyl phthalate (DAP) having a suspended carbon filler. This material and its preparation is described in detail in "Materials and Design Engineering," December 1960, pp. 106-107. This material is ideally suitable for this particular application and represents a unique and novel use of the material as such.

In preparing cam 10, the semi-resistive material may be initially molded or cast or built up in insulated layers to provide the approximate function based on mathematical computations and then, through comparison of the output with the predetermined function, desired adjustments in the outer contour of cam 10 may be made to complete the construction of the latter. Illustrated in FIG. 3 is a trace f_1 which is a function of x and y coordinates. The x coordinate is a distance along guide 18. For a selected rotational velocity of cam 10, this could also be measured in rotational or polar position of cam 10, with the angle, of course, exceeding 360° depending on the number of revolutions made by cam 10. The y coordinate represents the resistance of cam 10 (or reading of meter 46) at any particular point.

With the use of the material described a reduction in wear and electrical noise is obtained due to the smooth low friction surface on which brush 26 rides. While a suitable material has been described, it is understood that other materials may be found to have the desirable characteristics.

Instead of the circuit illustrated in FIG. 1, transistors may be utilized. Each transistor would be controlled to provide an electrical output proportional to the resistance characteristics of the cam. The transistor leakage current might be varied as a form of bias as is understood in the art.

While in the embodiment described above, cam 10 produces a single output, it is understood that it may be possible to obtain several or many different outputs from different brushes provided there is rigorous design of the cam as a basic component of some complex system in which multiple variables are combined and the proper electrical solutions are brought about or insulated layers are individually contacted.

It is thus seen that there has been provided a three dimensional electrical cam, for producing an arbitrary preselected function based upon its electrical resistance characteristics and a new use for a known material. This cam is of relatively inexpensive construction and because of its low surface resistance, long life and little change in electrical characteristics over its life is to be expected.

While, of course, only a preferred embodiment of this invention has been described, it is understood that the invention is intended to be limited not by the description above but by the scope of the appended claims.

What is claimed is:

1. An electrical resistance function programmer comprising, in combination, generally cylindrical shaped electrical resistance means consisting of a solid mass of resistive material, electrically conductive means supporting said resistance means for rotation, brush means urged into contact along the outer surface of said resistance means to transfer electric current flowing through said resistance means, and means for sliding said brush means parallel to the axis of rotation of said resistance means, whereby current flow through said resistance means will be a function of the electrical resistance to current flow in said resistance means between said supporting means and said brush means, said resistance means having an outer profile shaped to have specific electrical resistance properties for each position of said brush means, said resistance means thereby effectively carrying a programmed function.
2. The programmer of claim 1 in which said solid mass is diallyl phthalate having a suspended carbon filler.
3. The programmer of claim 1 in which said resistance means is built up of insulated layers of diallyl phthalate having a suspended carbon filler.

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