

March 11, 1958

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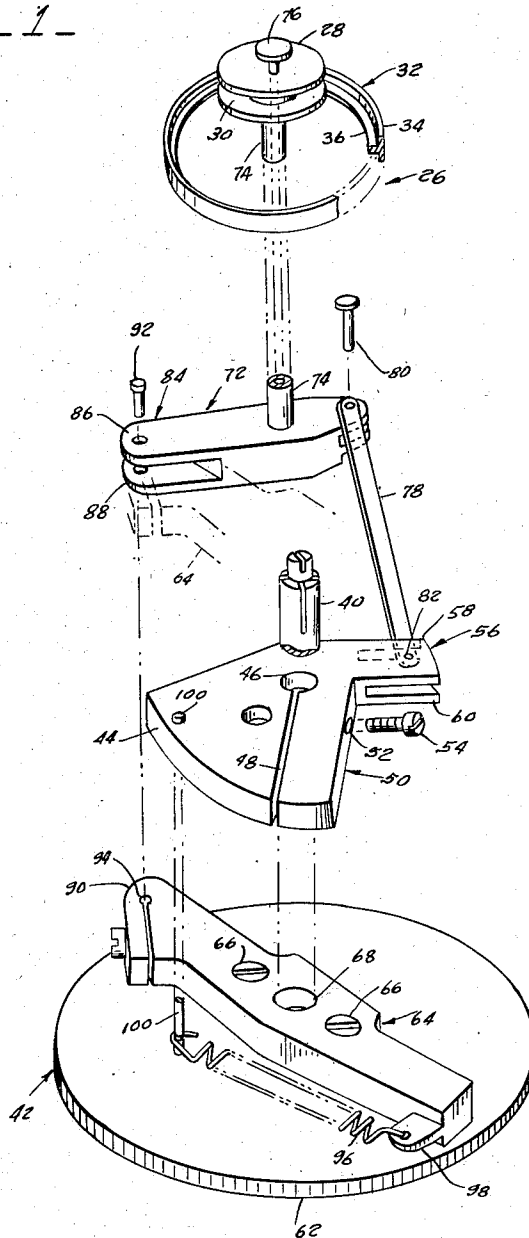
2,826,082

VARIABLE CAM AND TRACKING MECHANISM

Filed March 17, 1953

2 Sheets-Sheet 1

FIG. 1



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FIG. 2

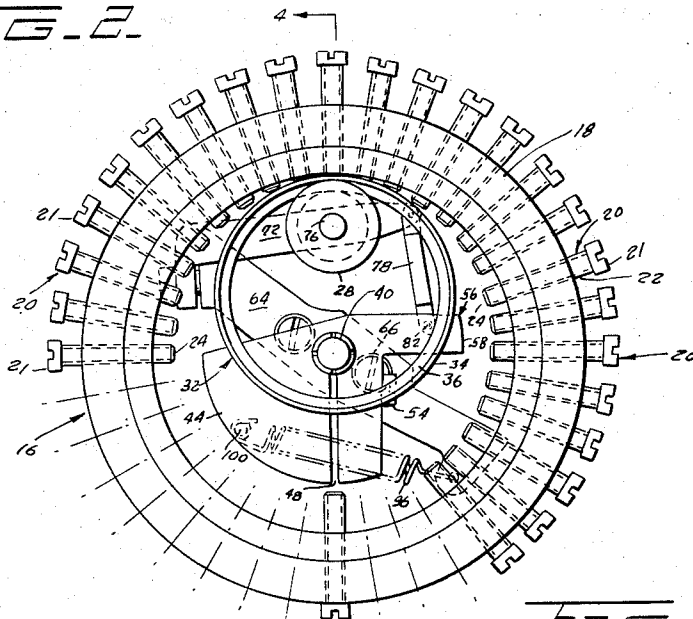


FIG. 3

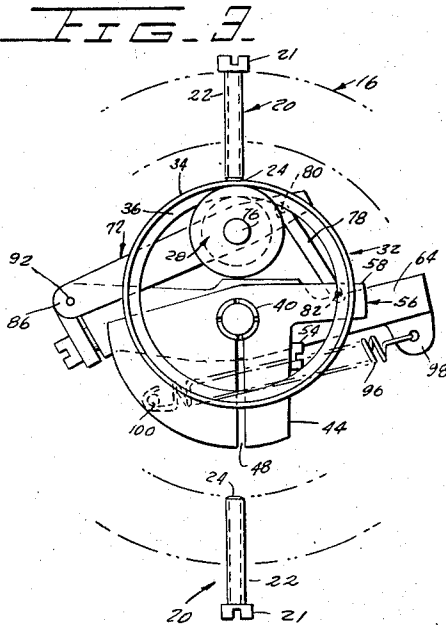
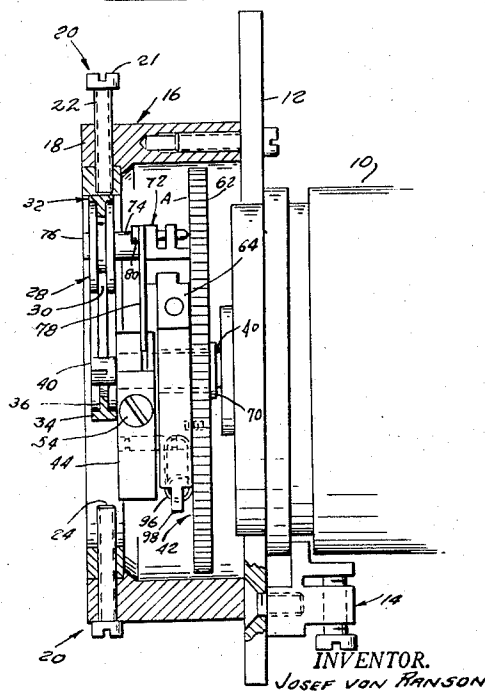


FIG. 4



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VARIABLE CAM AND TRACKING MECHANISM

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4 Claims. (Cl. 74-63)

The present invention relates to camming devices having adjustable track surfaces presettable to provide a desired lay-out or configuration and particularly to tracking mechanisms embodying such variable cams and arranged to adjust relative angular motion between two rotating members.

In a wide variety of automatic machines and electrical devices, it is necessary to coordinate relative motion between two rotating mechanisms, such as a drive shaft and a driven shaft. Coordinating devices for this purpose broadly embody variable cams to obtain the desired flexibility in interrelating the motion between the rotary mechanisms.

Accordingly, it is an object of the present invention to provide a novel cam track and follower arrangement arranged to facilitate adjustment of the contour or configuration of the cam track.

In accordance with this aspect of the present invention, a high degree of flexibility can be obtained by employing elongated supporting members each independently movable and including extremities adjustable to preset positions lying generally along a desired cam track contour or configuration. Heretofore it has been commonplace to support relatively flexible tapes or bands on the extremities of the adjusted supporting members to define the cam track. The disadvantages of employing a flexible tape or band are manifest, and often incompatible with the provision of relatively simple, trouble-free mechanisms.

It is, therefore, another object of the present invention to provide a novel variable cam highly flexible with respect to the track contours obtainable therewith, yet relatively simple, sturdy and reliable.

A further object of the present invention is incorporation of a novel variable cam of the aforesaid character into a tracking mechanism for coordinating variations in relative angular positions between two rotating members in accordance with the cam contour or configuration. As to this aspect of the present invention, it is a further aim to accomplish the desired coordination by positive acting mechanisms which may be readily incorporated into portable instruments and the like where weight, size, and compactness are often prime considerations.

Many other objects, features and advantages of the present invention will occur to those skilled in the art as the description proceeds. In order to render understanding complete and lucid and further to comply with the statutes relating to the same and point out where I have made a patentable advance in the arts and sciences, there is shown and described the invention in all its detail in connection with a specific embodiment thereof shown in the accompanying drawings wherein:

Figure 1 is an exploded perspective view showing the novel variable cam of the present invention incorporated into a tracking mechanism embodying features of the present invention.

Figure 2 is a top plan view of the variable cam when incorporated into the tracking mechanism by combining the various components of Figure 1,

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Figure 3 is a top plan view similar to Figure 2 with parts omitted for the sake of clarity and showing the details of the variable cam and the operative connections to drive and driven members.

Figure 4 is a sectional view taken substantially along the line 4-4 of Figure 2 and looking in the direction of the arrows.

Referring now to the drawings, there is shown a variable cam constructed in accordance with the principles of the present invention as incorporated into a tracking device for producing variations in relative angular motion between two rotary mechanisms, commonly a drive shaft and a driven shaft. Specifically, an upstanding base or pedestal 10 carries a horizontal supporting plate 12 which is connected to the base 10 by clamp mechanisms 14 disclosed and claimed in co-pending application Serial No. 342,934; now Patent No. 2,766,502, filed concurrently herewith. Fixed to the supporting plate 12 is an upstanding circular frame 16 terminating in an enlarged annular shoulder 18.

Arranged along the generally circular path defined by the shoulder 18 of the frame 16 are a series of radially extending cam members 20 each in the form of an adjustment screw or bolt including a slotted head 21 and a threaded body 22 projecting from the head and terminating in a flat end face or extremity 24. Appropriately tapped holes are provided in the shoulder 18 for the respective adjustment screws 20 permitting independent adjustment of the screws relative to each other.

As is apparent to those skilled in the art, the inner extremities 24 of the screw members 20 can be arranged to define a cam track of a desired contour or configuration. This arrangement is highly flexible but exhibits the shortcoming that a large number of screws 20 have to be provided so that the gaps or interruptions between adjacent track-defining faces 24 are relatively small.

In accordance with the present invention, the spacing between adjacent adjustable screws 20 is not critical and it is not necessary to provide a flexible tape or the like interconnected between the respective screws. Specifically, a composite cam follower 26, seen best in Figure 1, is adapted to ride along the cam track defined by the end faces 24 in a smooth and continuous manner even though the cam track itself is interrupted at spaced intervals between adjacent screws. Specifically, the composite follower 26 includes a cam roller 28 formed with a circumferential guideway 30 in the peripheral bearing surface which normally would ride against the cam track. Surrounding the cam roller 28 is a cam ring 32 which is interposed between the cam roller 28 and the cam track. The ring 32 acts as a floating slip member or tire and presents a continuous and uninterrupted cam surface to the cam roller 28. The bearing portion of the ring 32 which is interposed between the cam roller 28 and the cam track always remains substantially tangential to the roller and the track as the roller moves therearound.

The cam ring 32 includes an angular body part 34 serving as a tire and commensurate in height with the cam roller 30 and an inwardly projecting flange or ledge 36 substantially normal to the angular or ring-like body 34. This flange is adapted to be conformably received within the guideway 30 of the cam roller 28 to preclude lateral displacement of the cam ring 32 relative to the roller 28. It is to be noted that the ledge or flange 36 and the bounding walls of the guideway 30 provide interengaging guide means, yet permit the requisite floating action between the cam roller and the cam ring.

The composite follower 26 forms a part of a mechanical linkage system which interconnects two rotary mechanisms arranged to translate motion of the follower along the cam contour defined by the adjustable screws 20 into

changes in relative angular position of the two rotary mechanisms.

In the illustrative embodiment, a drive shaft 40 projects above the base 10 and terminates at a level adjacent the adjustable screws 20. Journaled on the drive shaft is a driven rotary mechanism, designated by the reference numeral 42, which will be subsequently described in detail and is to be coordinated to the movement of the shaft. Overlying the driven rotary mechanism 42 is a segmental drive plate 44 provided with a suitable bore 46 for the extension therethrough of the drive shaft 40 which is keyed to the plate 44.

In the illustrative embodiment, and as best seen in Figure 1, the plate 44 is provided with a slot 48 communicating with the bore 46 and defining a clamping part 50. Traversing the clamping part 50 is a tapped hole 52 adapted to receive a lock bolt 54, the bolt being extendible into the threaded opening 52 and thereupon into the plate proper to key the shaft 40 to the drive plate 44. Integral with the segmental drive plate is a bifurcated extension 56 including superposed legs 58, 60.

The driven mechanism 42 includes a circular disc or body 62 and a superposed member or arm 64 fixed over the disc 62 by screws 66. The discs 62 and the arm 64 are provided with a suitable opening 68 for the extension therethrough of the drive shaft 40, a bushing or sleeve 70 being interposed therebetween to permit free rotation of the driven rotary assembly 42 relative to the drive assembly of the shaft 40 and the segmental plate 44.

The cam follower 26 is supported by an arm 72 which is normally disposed above the disc or plate 62 and is bifurcated contiguous to the opposite ends thereof. Intermediate its ends the supporting arm 72 carries an upwardly projecting stub shaft 74 which supports the cam roller 28, the latter being fixed in position by means of a screw 76 received within a suitably tapped opening in the shaft 74. One end of the supporting arm 72 is connected to the drive assembly by a linkage 78 having one end pivoted by pin 80 to the supporting arm 72 and having the other end receivable between the legs 58, 60 of the bifurcated extension 56 and pivoted therebetween by a pin 82. The other end of the supporting arm 72 has an integral bifurcated extension 84 including superposed legs 86, 88 spaced apart to accommodate an enlarged head 90 formed adjacent one end of the driven arm 64 and the follower supporting arm 72 by a pin 92 receivable within openings within the superposed legs 86, 88 of the bifurcated extension 84 and in an aligned bore 94 in the head 90 of the driven arm 64.

In order to bias the cam follower 26 into engagement with the properly adjusted track defined by the cam members 20, a spring 96 is interconnected between an integral ear 98 on the driven arm 64 and a depending pin 100 on the drive plate 44. As best seen in Figure 2, the spring 96 tends to urge the drive plate 44 in a counter-clockwise direction carrying one end of the follower supporting arm 72 toward the cam track, the spring further tending to urge the driven arm in the clockwise direction carrying the other end of the follower supporting arm 72 to the desired position wherein the cam follower rides along the cam track.

In actual use, if the cam track defining members or screws are adjusted so that their inner extremities 24 are all equidistant from their common center, namely the axis of the drive shaft 40, the track for the cam follower 32 will be circular. This will result in the elements of the mechanical linkages provided by the plate 44, the connecting linkage 78, the supporting arm 72 and the driven arm 64 remaining in the same relative position with respect to each other, and there will be no variations in the angular displacement of the driven and driving units.

If adjustment of the cam members 20 is selected so that the inner extremities 24 are not equidistant from

the axis of the drive shaft 40, the extremities 24 will define a configuration deviating from a perfect circle and prescribing the desired motion for the cam roller 28 which follows the track via the cushioning ring or tire 32.

It is to be expressly understood that even though the shaft 40 has been described as the drive mechanism, while the disc 62 and the member 64 supported thereby as the driven mechanism, the drive could be applied to the disc 62 and the shaft 40 serve as the driven member.

In the foregoing I have described my invention solely in connection with specific illustrative embodiments thereof. Since many variations and modifications of my invention will now be obvious to those skilled in the art, I prefer to be bound not by the specific disclosures herein contained but only by the appended claims.

I claim:

1. A device for producing variations in the relative angular motion between two rotary mechanisms comprising a generally circular frame, a series of co-planar cam members arranged at spaced locations along and radially of said circular frame, said cam members being independently mounted for radial movement into adjusted positions and including end faces cooperating in said adjusted positions to define a periodically interrupted cam track of predetermined contour, mechanical linkages interconnected between said two rotary mechanisms including a cam roller adapted to move along said cam track for translating said predetermined contour into changes in the relative angular positions of said two rotary mechanisms, and a rigid cam ring larger in diameter than said cam roller and interposed between said cam roller and said cam track, said cam ring being successively arranged tangentially of said cam roller and said cam track and presenting a continuous cam surface to said cam roller.

2. A tracking mechanism comprising a drive member movable about an axis, a driven member movable about said axis, and means coordinating relative angular motion between said drive and driven members, said means including a series of co-planar cam members arranged radially of said axis and cooperating to define a periodically interrupted cam track of predetermined contour, a supporting arm, a cam roller pivoted on said supporting arm co-planar with said cam track and adapted to move therealong, a rigid cam ring surrounding said cam roller and interposed between said cam roller and said cam track to present a continuous and uninterrupted camming surface to said cam roller, linkage means pivotally interconnecting one end of said supporting arm and said drive member, linkage means pivotally interconnecting the other end of said supporting arm and said driven member, and resilient means operatively connected to said drive and driven members and urging the assembly of said cam roller and ring into engagement with said cam track.

3. A tracking mechanism comprising a drive member movable about an axis, a driven member movable about said axis, and means coordinating relative angular motion between said drive and driven members, said means including a series of cam members arranged radially of said axis and cooperating to define a cam track of predetermined contour, a supporting arm, a cam roller pivoted on said supporting arm co-planar with said cam track and adapted to move therealong, a rigid cam ring surrounding said cam roller and interposed between said cam roller and said cam track to present a continuous and uninterrupted camming surface to said cam roller, linkage means pivotally interconnecting the opposite ends of said supporting arm with said drive and driven members, resilient means operatively connected to said drive and driven members and urging the assembly of said cam roller and ring into engagement with said cam track, and interengaging means on said cam roller and said cam ring for guiding said cam ring against lateral displacement from the interposed position.

4. A variable cam comprising a plurality of radially

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extending cam members supported in co-planar relation to define a cam track of predetermined configuration, a cam roller adapted to move along said cam track, and a rigid cam ring surrounding said cam roller and interposed between said roller and said cam track; said cam ring having a diameter greater than the cam roller and less than the smallest transverse diametric dimension of said cam track; said cam ring rolling freely between said cam roller and said cam track, and providing an increased diameter bearing surface between said cam roller and said cam track.

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