April 9, 1940. F. N. JACOB 2,196,416

CAM CONSTRUCTION

Original Filed Feb. 1, 1936

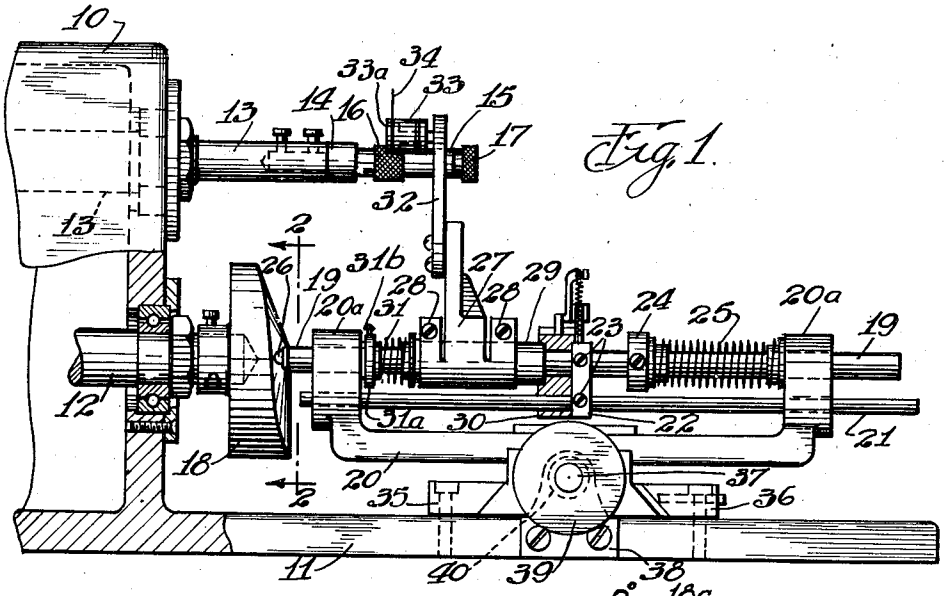


Fig. 1.

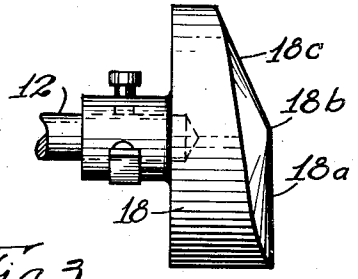


Fig. 3.

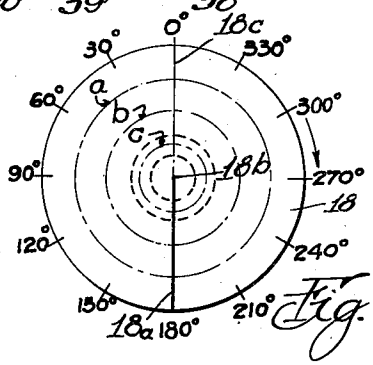


Fig. 2.

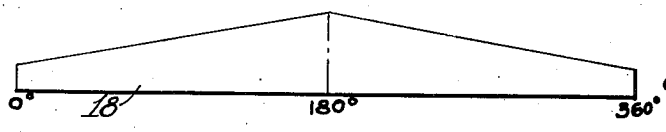


Fig. 4

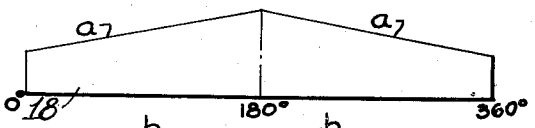


Fig. 5.

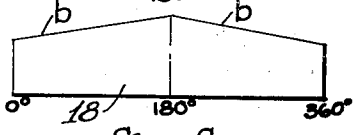


Fig. 6.

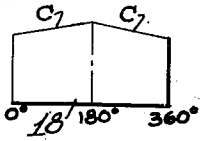


Fig. 7

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CAM CONSTRUCTION

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Original application February 1, 1936, Serial No. 61,874. Divided and this application July 3, 1939, Serial No. 282,725

6 Claims. (Cl. 74—567)

This invention relates to an improved cam construction adapted to operate the wire feeding mechanism of machines for winding electrical coils, particularly of the duolateral type and also adapted for other purposes requiring a cam having an end surface for effecting a variable travel of a follower member, according to the position of the follower member on the cam, and for any position of the follower member, providing a travel thereof proportional to the angular movement of the cam.

The present application is a division of my copending application Serial No. 61,874 filed February 1, 1936, for an improvement in Machines for winding duolateral electrical coils.

My invention will be best understood by reference to the accompanying drawing illustrating the above and other objects thereof, in which—

Fig. 1 shows the cam of my invention as included in coil winding mechanism in front elevation;

Fig. 2 shows to an enlarged scale and in end elevation, the cam illustrated in Fig. 1 to control the guiding of the winding wire to the coil being wound, this view being taken along the line 2—2 in Fig. 1;

Fig. 3 shows the cam structure of Fig. 2, in side elevation; and

Figs. 4, 5, 6 and 7 are developed views of the cam surface of the cam shown in Figs. 2 and 3, at different radii of said surface, to illustrate respectively the different amounts of movement of the cam follower when moving along the paths of travel illustrated in Figs. 4 to 7 inclusive, in winding coils of different axial lengths with the same cam.

Similar numerals refer to similar parts throughout the several views.

As shown in Fig. 1, the machine illustrated includes a housing 10 from the right hand end of which a base 11 extends to support the winding mechanism. The housing 10 supports a cam shaft 12 and a winding shaft 13, each in suitable bearings carried by the end walls of the housing. The winding shaft 13 carries at its right hand end, a winding spindle 14 to support the core 15 of the coil 16 being wound, said core being held against rotation on said spindle by a thumb nut 17. The cam shaft 12 carries on its right hand end, a cam 18 having an end cam surface against which the left hand end of a follower rod 19 rests, which rod is supported for longitudinal, reciprocating movement in bushings carried by the upwardly extending end arms 20*a* of a carriage 20.

The shafts 12 and 13 are horizontal and substantially parallel, and the follower rod 19 is also horizontal and substantially parallel with the axes of the shafts 12 and 13, the center line of the follower rod 19 being preferably at the same distance from the base 11, as is the center line of the cam shaft 12 and cam 18. Below the rod 19, the carriage arms 20*a* support in bushings therefor, a guide rod 21 substantially parallel with the follower rod 19, said rod 21 being free to move longitudinally in its said supports. The rods 19 and 21 extend through a yoke 22 located between the arms 20*a*, which yoke is rigidly secured to said rods, for example, by set screws 23. The rod 19 has secured thereto between the yoke 22 and tne right hand arm 20*a*, a collar 24 between which and said right hand arm, a compression spring 25 is disposed around said rod, to hold said rod as far to the left as the cam 18 will permit. The end of the rod 19 adjacent the cam 18, is provided with an anti-friction ball 26, preferably of hardened steel, to reduce to a minimum by its rotation in the end of the rod 19, the friction resulting from the engagement of the follower rod with the rotating end surface of the cam 18.

The rod 19 carries between the yoke 22 and the left hand arm 20*a*, a bracket 27 on a sleeve 29 and secured to said sleeve by clamping screws 28, said sleeve being a sliding fit on the rod and capable of angular and longitudinal movement thereon. The right hand end of the sleeve 29 rests against a spacing cam 30 more fully described in said original application, which in turn rests against the yoke 22, there being a compression spring 31 weaker than the spring 25, around the rod 19, between the other end of said sleeve and a collar 31*a* secured to the rod 19 by a set screw 31*b*, holding said sleeve 29 as far to the right as the spacing cam 30 will permit.

The bracket 27 carries an upwardly extending arm 32 on the upper end of which a rotary guiding roller or equivalent wire guiding device 33 is supported, having a groove 33*a* to lead the winding wire 34 to the coil 16. The cam 30, the sleeve 29, the bracket 27 and the wire guide 33 thus move with the follower rod 19 and to the same extent, when the latter is reciprocated by the cam 18.

As more clearly shown in Figs. 2 and 3, the end surface of the cam 18 is made so its lowest point is at its outer edge at the position marked 0° in Fig. 2, and its highest point is at its outer edge at the position marked 180° in Fig. 2. The rate of change of elevation of the cam surface is preferably proportional to the angular displace-

ment from 0°, so the intersection of the cam surface with the outer, cylindrical surface of the cam is helical and ascending in either direction around said cylindrical surface, from 0° to 180°. The highest point above referred to, is connected with the axis or center line of the cam, by a radial, straight line 18a of the cam surface, which line 18a is perpendicular to said center line, as a result of which any point in the line 18a, is of the same cam elevation as any other point therein. The intersection of the line 18a, with the center line of the cam, is the center 18b of the cam surface and is connected by an inclined straight line 18c with the low point of the cam surface at 0°, above referred to. The cam surface is made up of successive straight lines extending from successive points in the helical intersection of the cam surface with the cylindrical surface of the cam, to the center 18b of the cam surface. The cam surface thus produced, affords many possible paths of travel of the follower rod 19 on said cam surface, at different distances from the center 18b of the cam surface, with different total displacements of the follower rod 19 axially, which are proportional to the distances of the paths from the center 18b, because, although the high points of said paths are the same since they are all in the line 18a, the low points of said paths are all in the line 18c, and said low point has a continuously greater elevation relatively to the lowest point of said cam surface, as the distance of its path of travel from the center 18b is decreased. Furthermore, for any said path of travel, the displacement axially of the follower rod 19 from instant to instant, is proportional to the amount of angular movement of the cam relatively to the follower 19. The relations described are illustrated in Figs. 4, 5, 6 and 7, Fig. 4 showing in developed view the path of the follower rod 19 at the outer edge of the cam surface, and Figs. 5, 6 and 7 similarly showing the paths of travel indicated by the broken line circles a, b and c respectively in Fig. 2.

In my machine I provide means for moving the follower rod 19 across the cam surface of the cam 18, to secure any said path of travel on the cam surface, as follows: As shown in Fig. 1, the carriage 20 is mounted on the base 11 in guideways 35 and 36 which are preferably horizontal and substantially at right angles to the axes of the shafts 12 and 13 and of the follower rod 19. The carriage 20 is engaged by a feed screw 37 parallel with the guideways 35 and 36 and extending at its forward end, through a bracket 38 extending upwardly from the base 11, said feed screw having a hand knob 39 secured to its outer end, and carrying a collar 40 secured to said feed screw just back of said bracket 38, said knob and said collar preventing longitudinal movement of said feed screw through said bracket without interfering with rotation of said feed screw. By rotating the feed screw 37, the carriage 20 may be moved forwardly and rearwardly across the base 11, correspondingly moving the follower rod 19 across the cam surface of the cam 18 to secure any desired path of travel of said follower rod on said cam surface.

While I have shown my invention in the particular embodiment above described, it will be understood that I do not limit myself thereto, as I may employ equivalents thereof known to the art at the time of the filing of this application, without departing from the scope of the appended claims.

Having thus described my invention, what I claim is:

1. A cam comprising a rotary body having an end cam surface, said cam surface covering the entire end surface of said body and having a high line extending from the cam axis to the outer edge of the cam surface and having a low line extending from the axial end of said high line to the outer edge of said cam surface, said high line being axially displaced above said low line for all radii of said cam surface, whereby the extent of movement of the cam follower will be controlled by the extent of its radial displacement from said axis.

2. A cam comprising a rotary body having an end cam surface, said cam surface covering the entire end surface of said body and having a high line extending from the cam axis to the outer edge of the cam surface and having a low line extending from the axial end of said high line to the outer edge of said cam surface, said high line being axially displaced above said low line for all radii of said cam surface, the axial displacement of said high line above said low line being proportional to the radius of the path of follower travel on said cam surface, whereby the extent of movement of the cam follower will be controlled by the extent of its radial displacement from said axis.

3. A cam comprising a rotary body having an end cam surface, said cam surface covering the entire end surface of said body and having a high line extending from the cam axis to the outer edge of the cam surface and having a low line extending from the axial end of said high line to the outer edge of said cam surface, said high line being axially displaced above said low line for all radii of said cam surface, the rise from said low line at any radius of said cam surface being proportional to the angular displacement from said low line, whereby the extent of movement of the cam follower will be controlled by the extent of its radial displacement from said axis.

4. A cam comprising a rotary body having an end cam surface, said cam surface covering the entire end surface of said body and having a high line extending at right angles from the cam axis to the outer edge of the cam surface and having a low line extending from the axial end of said high line to the outer edge of said cam surface, said high line being axially displaced above said low line for all radii of said cam surface, the axial displacement of said high line above said low line being proportional to the radius of the path of follower travel on said cam surface, and the rise from said low line at any radius of said cam surface being proportional to the angular displacement from said low line, whereby the extent of movement of the cam follower will be controlled by the extent of its radial displacement from said axis.

5. A cam comprising a cylindrical body having an end cam surface, said cam surface extending over the entire end surface of said body and having a form produced by passing a surface-generating straight line through a fixed point in the axis of said body and with said generating line always containing said fixed point moving said generating line angularly along the path of a closed curve on the cylindrical surface of said body, said closed curve comprising two reversed helical curves.

6. A cam comprising a cylindrical body having an end cam surface, said cam surface ex-

tending over the entire end surface of said body and having a form produced by passing a surface-generating straight line through a fixed point in the axis of said body and with said generating line always containing said fixed point moving said generating line angularly along the path of a closed curve on the cylindrical surface of said body, said closed curve comprising two reversed helical curves, said helical curves being similar and of equal length.

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