Nov. 14, 1950 W. H. KREAMER 2,529,559

TRAVERSE MECHANISM FOR WINDING MACHINES

Filed Dec. 27, 1946 3 Sheets-Sheet 1

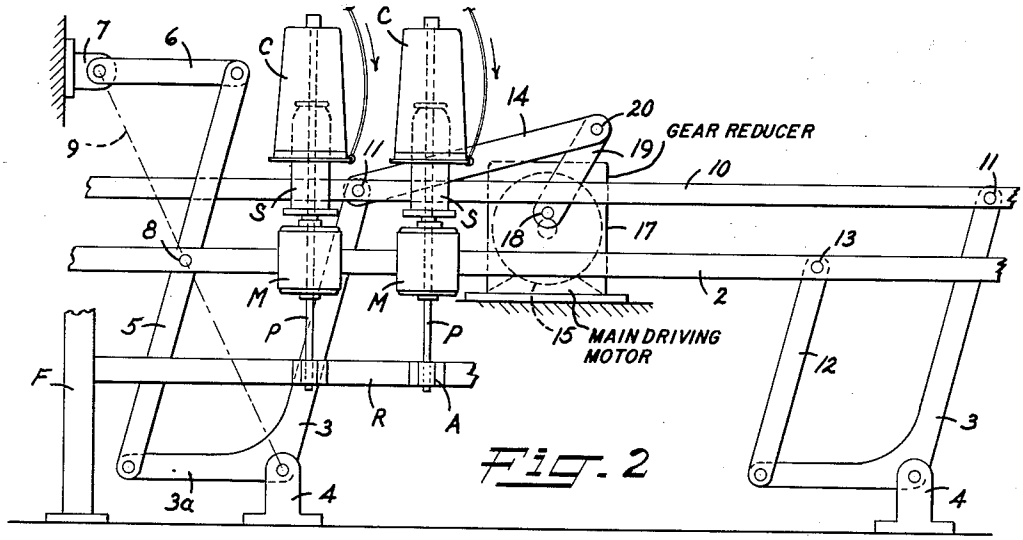


Fig. 2

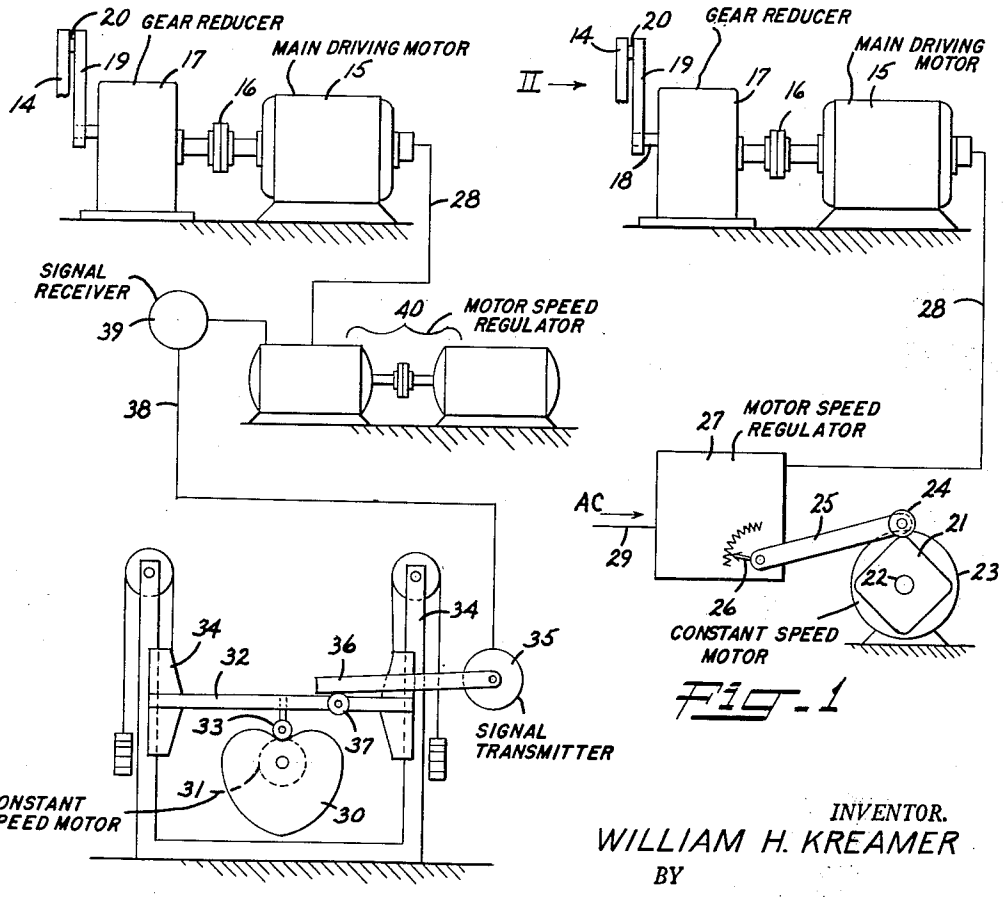


Fig. 1

Fig. 3

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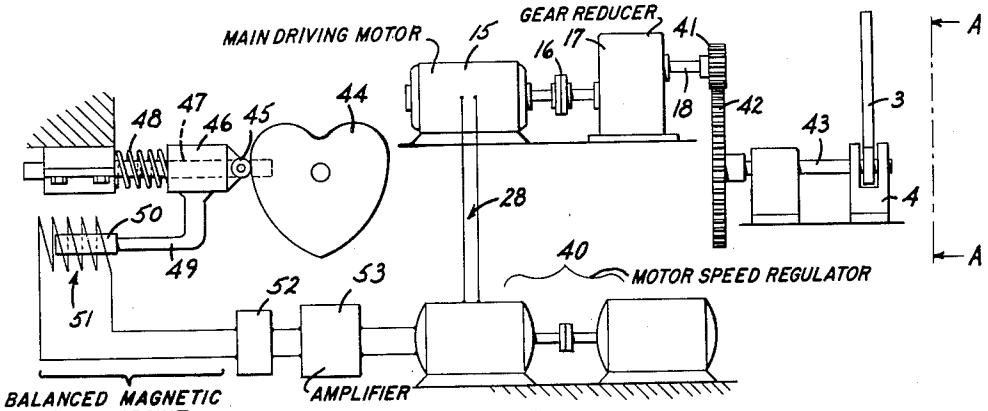


Fig-4

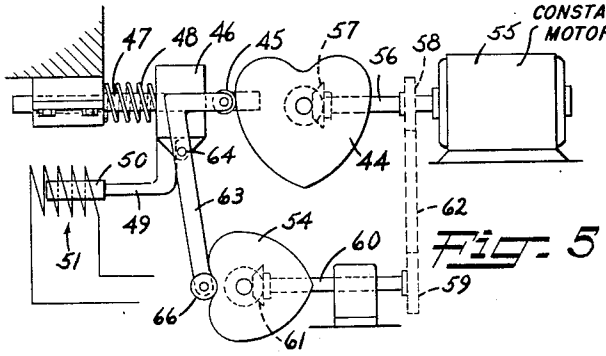


Fig-5

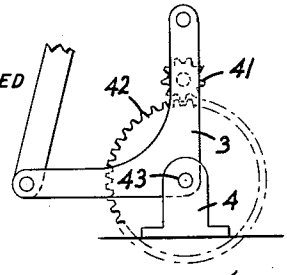


Fig-4a

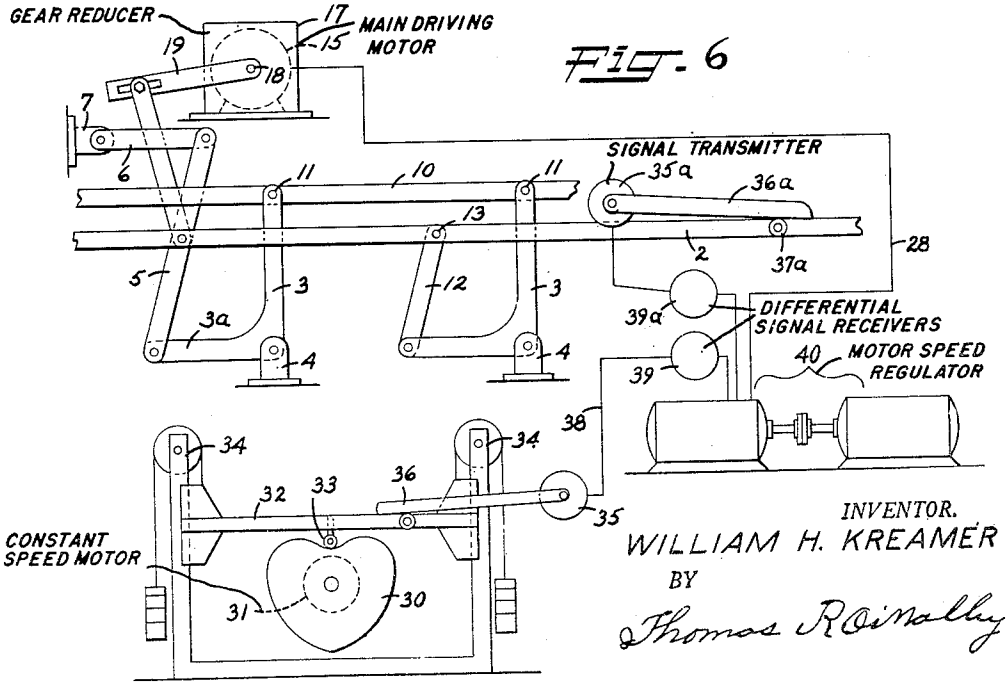


Fig-6

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TRAVERSE MECHANISM FOR WINDING MACHINES

Filed Dec. 27, 1946 3 Sheets-Sheet 3

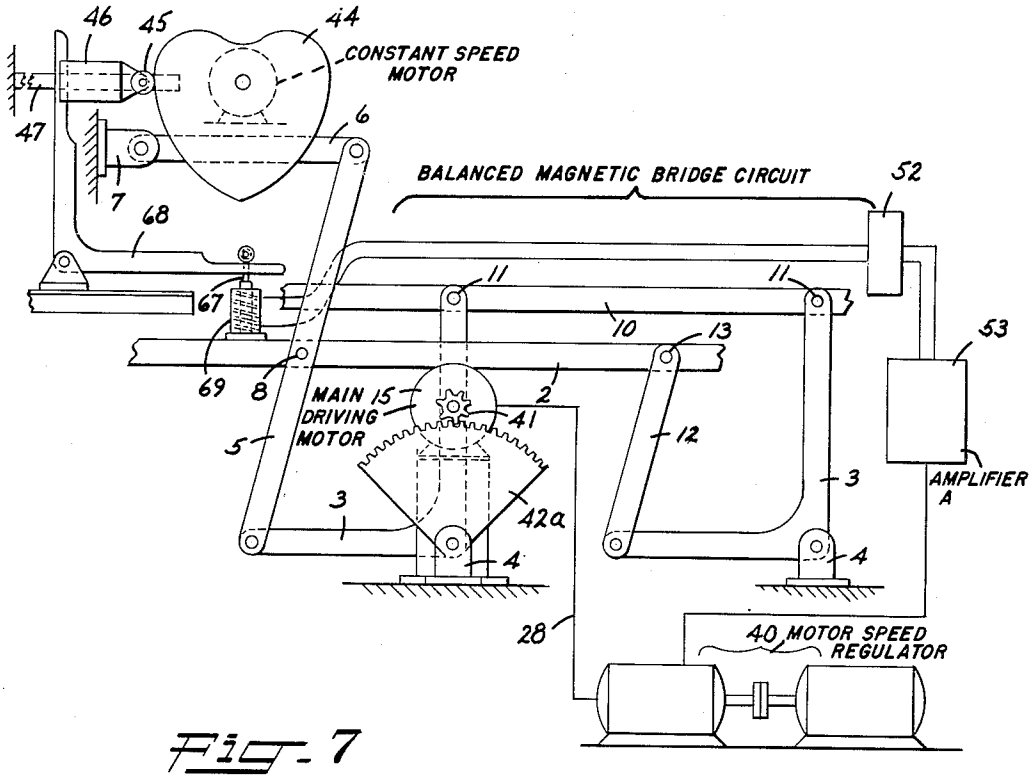


Fig. 7

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UNITED STATES PATENT OFFICE

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TRAVERSE MECHANISM FOR WINDING MACHINES

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Application December 27, 1946, Serial No. 718,830

9 Claims. (Cl. 242—43)

1

The present invention relates to an improved traverse mechanism for winding and twisting machines.

The principal object of the present invention is to provide a traverse mechanism for reciprocating a rail or carriage in the winding machine without the necessity of subjecting driving cams to the full weight or inertia of the rail, such as is encountered in the case of mechanical traverse motions and mechanical builder motions. An ancillary object of the present invention is to provide an electrically controlled traverse mechanism which is free from the above mentioned disadvantage of mechanical traverse mechanisms. Other objects and advantages of the invention will be apparent from the drawing and the description thereof hereinafter.

In general, the invention comprises an electric motor for reciprocating a rail or carrier. The velocity of the motor is controlled in response to an electrical signal developed by a continuously driven constant speed cam. Such signal may be imposed upon any suitable form of regulating or controlling device coupled with the motor for translating variations in the signal into variations in the speed of the motor. Such regulating or controlling devices are now standard equipment and it is within the skill of the worker in the electrical art to select a suitable unit for the specific application in accordance with the disclosures hereinafter. Accordingly, it will suffice herein to indicate the connections generally without going into the details of the structure of such controlling units. Examples of such units include the General Electric Thymotrol, and the Westinghouse "DT3 Speed Control," the details of which may be found in numerous technical textbooks including catalogues of the specific companies referred to and "Industrial Electronic Control" by W. D. Cockrell, first edition published 1944 by McGraw-Hill Book Company, New York, (pages 167 to 176). Further examples are the Westinghouse "Rototrol" and the Allis Chalmers "Regulex" and the General Electric "Ampledyne," in connection with which reference may be had to the catalogues of the respective companies and "Controllers for Electric Motors" by James & Markle, first edition, published 1945 by McGraw-Hill Book Company, New York, (pages 157 to 160). See also "Combined Thyratron & Tachometer Speed Control of Small Motors" A. I. E. E. Trans., vol. 57 (1938) (pages 565 to 568). The electric signal imposed upon such regulators may be voltage signals resulting from the shifting of a

2

potentiometer in resistance bridge circuits of such controls, or to the core (or coil) of a variable inductance in a magnetic bridge circuit; or they may be voltage signals imposed upon the grids in phase-shift circuits. To develop such signals, a constant speed cam may be utilized and the follower may connect directly to the variable terminal of a potentiometer in a resistance bridge circuit, or to the core (or coil) in a magnetic bridge circuit. In addition, inductive systems may be used for developing the voltage signals, such as those known by the trade names Selsyn, Synchro, or Autosyn in connection with which reference may be had to "The Selsyn System of Position Indication" by E. M. Hewlett, G. E. Rev. volume 24 (1921) pages 210 to 218. A specifically improved form of Selsyn System is found in Patent 2,407,084. See also "The Electronic Control Handbook," Balcher & Moulic, published by Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N. Y., 1946, pp. 233–246. The signal voltage may also be derived from a tachometer generator, driven by a motor, in connection with which reference may be had to the texts of Cockrell or of James & Markle.

In the drawing which is illustrative of the invention—

Figure 1 is a somewhat diagrammatic view showing the operative connections of one embodiment of the invention,

Figure 2 is a front view of the traversing rail linkage, as viewed in the direction of the arrow II in Figure 1,

Figure 3 is a diagrammatic view similar to that of Figure 1, but of a different embodiment illustrating a modified system of electrical connection,

Figure 4 is another diagrammatic view illustrating a third embodiment of the electrical driving system,

Figure 4a is a detail view taken on line A—A of Figure 4,

Figure 5 illustrates a modification of the embodiment of Figure 4 in which a builder mechanism is provided.

Figure 6 is a diagrammatic view illustrating another embodiment, and

Figure 7 illustrates a preferred embodiment.

As shown in Figures 1 and 2 of the drawing, the traverse mechanism serves to reciprocate the bobbin rail or carrier 2 vertically, though it could be used to traverse any other rail of a winding machine transversely or longitudinally of its length. For example, in the cap twister shown,

it is applied to move the bobbin rail. In a ring twister, it could traverse either the ring rail or the bobbin rail. It could likewise serve to traverse a thread guide rail longitudinally.

As shown more specifically in Figure 2, the rail 2 supports hollow spindle motors M for driving spools S carried thereby. Caps C are supported on stationary posts P shackled to A to a stationary rail R carried by the frame of the spinning machine comprising the end frame structure F shown.

Figure 2 particularly shows the traverse linkage comprising a plurality of bell crank levers 3 whose fulcrums are pivotally mounted in stationary supports or bracket 4.

Means is provided for constraining the motion of the rail 2 to a straight line path at right angles to the rail. This motion-controlling means is constructed of the following elements. At least one of the levers 3 has one arm 3a constituting a link connected to one end of a lever 5 which has its other end connected to a link 6 pivotally mounted on a stationary support or bracket 7. The arm 3a and link 6 may be or may not be equal in length but the rail 2 is pivotally connected to the lever 5 at a point 8 which is the point of intersection of a line 9 extending between the pivots in brackets 4 and 7 with the rail 2 when the rail is at an intermediate position, preferably near or at the mid-position of its longest stroke. It will be observed that this controlling means is free of translatory sliding motions, all links being pivotally connected.

Means is also provided for bracing the rail 2 at intervals with suitable follower levers. To accomplish this all of the levers 3 are connected to a common rod 10 at points 11 and one or more of the levers 3 (other than those connected to levers 5) are connected to links 12 which are connected to the rail 2 at 13. If desired, each lever 3 may be connected to the rail 2 by a lever 5 and in this case, no links 12 are needed. It will thus be seen that the rail 2 has a plurality of points 8 and optionally 13 at which it is supported by levers 5 and optionally links 12 and any movement of the rod 10 transfers motion to rail 2 simultaneously through levers 3, levers 5, and links 12 (when the latter are used).

Any suitable means for traversing the rail is operatively connected to the system just described at one of the points 11 by means of a link 14. While the terms "rod," "lever" and "link" used herein generally connote an element of simple structure, it is to be understood that they include as well composite structures, such as a link formed of two parallel strips secured together at intervals.

The present invention provides the following improved electrical driving means comprising a motor 15, preferably D. C., coupled as by a flexible coupling 16 and through a gear reducer 17 to a driving shaft 18 carrying fixedly mounted thereon a crank arm 19 pivotally connected to the link 14 at 20. A cam 21 is rotated on shaft 22 by means of a constant speed motor 23 and a follower roll 24 engages the periphery of the cam 21, being biased thereagainst either by gravity or by spring action. The roll 24 is carried by a swingable arm 25. The swinging of such arm adjusts a potentiometer 26 or any equivalent element in a speed regulator 27 electrically coupled with the motor 15 as by a line 28. The regulator 27 may receive power from an A. C. source through line 29. The regulator may consist of any standard unit such as that designated in the trade as a "Thymotrol" and sold by General Electric. Such regulator varies the speed of the motor in response to variation of the potentiometer 26 and thus by suitably selecting the shape of the cam 21, any desired build of package may be obtained.

In Figure 3, the electrical control of driving motor 15 is modified. In this embodiment, a cam 30 is continuously driven at constant speed by a motor 31. A cross head 32 has a projection 33 resting in engagement on the periphery of cam 30 so that the cross head moves up and down within the lateral guides 34 provided for this purpose. A "Selsyn" transmitter 35 has an arm 36 secured to its rotor and adapted to follow a roll 37 carried upon the cross head 32. The "Selsyn" transmitter 35 is connected by a line 38 to a "Selsyn" receiver 39. The "Selsyn" receiver develops a voltage which is imposed upon an Amplidyne control unit 40 connected by the line 28 to the motor 15. As in Figures 1 and 2, motor 15 is connected through the crank arm 19 and a link 14 to the traverse rail and a variation in voltage signal transmitted by the "Selsyn" causes variation in speed of the motor. Selection of the shape of the cam determines the build of package.

In the embodiment of Figures 4 and 4a, the motor 15 is connected by a flexible coupling 16 and a gear reducer 17 to a shaft 18 for driving a pinion 41 which engages a gear 42 which in turn transmits rotation to a shaft 43. In this embodiment, the shaft 43 is fixedly secured to one of the bell crank levers 3 at the fulcrum thereof supported in bearing 4.

A pilot cam 44 is continuously driven at constant speed. A follower roll 45 is carried on a slide block 46 slidably mounted on a fixed bar 47. A spring 48 normally urges the slide block 46 to the right so that the cam follower 45 follows the surface of the cam 44. The slide block 46 has an offset projecting arm 49 carrying an iron core 50 within a fixed coil 51, or carrying or abutting against the armature of any equivalent form of magnetic gauge head. The coil 51 comprises part of a balanced magnetic bridge circuit represented by the unit designated 52 in the drawing and the signal developed therein may be connected through an amplifier 53 to an Amplidyne unit 40 connected by line 28 to the motor 15. In this embodiment, the motor 15 is completely reversed at each of the high and low points of the cam 44 as a result of the reversal of direction of relative motion between the core 50 and the coil 51. The shape of the build of the package can be controlled by the cam 44. A simple cylindrical build can be obtained or the package may be tapered at one or both ends in any fashion desired.

In Figure 5, the embodiment of Figure 4 is modified by providing a separate cam 54 which can be termed a "builder cam" to vary the shape of the package. Assuming cam 44 is driven by motor 55 through a shaft 56 and bevel gears 57, the builder cam 54 may be driven in timed relation thereto by a sprocket 58 on shaft 56, a sprocket 59 on shaft 60 driving bevel gears 61 for driving the builder cam, a chain 62 connecting sprocket 58 and 59. If desired, an independent motor may be provided for driving the cam 54 at constant speed, or a clutch may be provided so that cam 54 may be driven or not driven at will independently of the rotation of cam 44. The slide block 46 carries the offset part 49 and the core 50 within coil 51 as in Figure 4 but the follower roll 45 instead of being mounted on a bear-

ing which is secured in fixed relation to the block 46 is carried upon a lever 63 pivotally mounted on the block 46 at 64. A spring 48 tends to bias the block 46 to press the roll 45 against cam 44 and a roll 66 on the other end of the lever 63 engages builder cam 54. It will thus be seen that the motion imparted to the block 46 and core 50 depends jointly upon the main pilot cam 44 and the builder pilot cam 54. This embodiment allows the use of a single main cam for producing a package of any shape, the specific shape obtained being dependent upon the smaller builder cam which may be exchanged at will to obtain different shapes.

Figure 6 illustrates an embodiment similar in all respects to that in Figure 3 except that the voltage signal imparted to the "Amplidyne" unit 40 is the result of the differential "Selsyns" 39 and 39*a*, which may be connected either to add or subtract their individual voltage signals. The "Selsyn" receiver 39 obtains its impulse from the pilot cam 30 whereas 39*a* receives its impulse from the traverse rail 2, through the transmitter "Selsyn" 35*a*. The rotor of the "Selsyn" 35*a* carries an arm 36*a* which follows a lateral projection 37*a* on the rail 2.

The most important advantage of the differential "Selsyn" system as shown in Figure 6 over the "Selsyn" system shown in Figure 3 is that the rail motion is kept in exact phase relation with the motion set by the pilot cam. In the arrangements shown in Figures 1 through 5, the rail motion may at times tend to fall out of exact phase with the motion set up by the pilot cam. Both Figures 6 and 7 have this feature of exact synchronism of rail motion to pilot motion but Figure 7 embodies a simplified design.

The embodiment of Figure 7 is analogous to that of Figure 4. As shown, the cam 44 operates a slide block 46 on a fixed bar 47 and the follower roll 45 is fixedly related to the block 46. In this embodiment, however, the core 67 is carried by one arm of a bell crank lever 68, the other arm of which follows the slide block. The coil 69 is secured to the rail 2 and this coil 69 occupies the same relation to the balanced magnetic bridge circuit 52 and amplifier 53 as the coil 51 in Figure 4. The voltage signal is transmitted from the amplifier through the Amplidyne unit and line 28 to the motor 15 which drives pinion 41 in engagement with a sector gear 42*a*. Such sector gear is secured to the bell crank lever 3 at its fulcrum so that oscillation of the sector gear accomplishes reciprocation of the traverse rail. If desired, instead of relying upon the shape of the pilot cam 44 to provide a special form of package with one or both ends tapered, an auxiliary cam, similar to cam 54 of Figure 5, may be provided and a lever carrying the followers for the two cams may be secured pivotally to the slide block 46 as in Figure 5.

In the present invention, the traverse mechanism utilizes cams which are not subject to the weight of the rail. Such cams are merely required to develop an electrical signal and particularly a voltage signal which is transmitted electrically to vary the velocity of the motor, either by varying it from a maximum to a minimum speed and vice versa repeatedly, or by reversing its direction while maintaining a constant speed throughout each of its strokes. In addition, as a modification, the cam may be shaped to vary the build from a simple cylindrical package, to taper one or both ends, such taper being either convergent or divergent relatively to the axis of the package as desired. Such builder cams are not subjected to the weight of the traverse mechanism and hence have greatly reduced wear and lengthened life. The system of the present invention permits the use of the same controlling equipment for any traverse motion and it is highly flexible since any build or any stroke of the traverse rail can be obtained merely by an exchange of one or more of the pilot cams.

It is to be understood that the description hereinabove is purely illustrative and that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Traverse mechanism for winding machines comprising a carrier to be traversed, a variable-velocity motor for driving the carrier, a cam, means for driving the cam at constant speed, a device co-operating with the cam for developing an electrical signal the character of which is dependent on the change in contour of the cam, and means responsive to the electrical signal for controlling the velocity of the motor.

2. Traverse mechanism for winding machines comprising a carrier to be traversed, a variable-speed motor for driving the carrier, a cam, means for driving the cam at constant speed, a device co-operating with the cam for developing an electrical signal the character of which is dependent on the change in contour of the cam, and means responsive to the electrical signal for controlling the speed of the motor.

3. Traverse mechanism for winding machines comprising a carrier to be traversed, a reversible motor for driving the carrier, a cam, means for driving the cam at constant speed, a device co-operating with the cam for developing an electrical signal the character of which is dependent on the change in contour of the cam, and means responsive to the electrical signal for reversing the direction of rotation of the motor.

4. Traverse mechanism for winding machines comprising a carrier to be traversed, a reversible, variable-speed motor for driving the carrier, a cam, means for driving the cam at constant speed, a device co-operating with the cam for developing an electrical signal the character of which is dependent on the change in contour of the cam, and means responsive to the electrical signal for controlling the speed and direction of the motor.

5. Traverse mechanism for winding machines comprising a carrier to be traversed, a variable-velocity motor for driving the carrier, a cam, means for driving the cam at constant speed, means co-operating with the cam and the carrier for developing an electrical signal the character of which is dependent jointly on the change in contour of the cam and the change in position of the carrier, and means responsive to the electrical signal for controlling the velocity of the motor.

6. Traverse mechanism for winding machines comprising a carrier to be traversed, a variable-velocity motor for driving the carrier, a cam, means for driving the cam at constant speed, a device co-operating with the cam for developing an electrical signal the character of which is dependent on the change in contour of the cam, said device comprising two relatively movable inductively related members one of which is moved by said cam, and means responsive to the electrical signal for controlling the velocity of the motor.

7. The mechanism of claim 5 in which the signal-developing means comprises relatively movable inductively related members, one of such members being disposed in engagement with the cam for movement thereby, and another of such members being disposed for movement by the carrier.

8. The mechanism of claim 6 in which a second cam is provided for altering the movement imparted by the first-mentioned cam upon said one of the inductively related members, and means is provided for rotating the second cam at constant speed.

9. Traverse mechanism for winding machines comprising a carrier to be traversed, a variable-velocity motor for driving the carrier, a cam, means for driving the cam at constant speed, a second cam and means for driving it at constant speed, a movable element, a lever pivotally mounted on the element, two cam followers carried by the lever at positions offset from its fulcrum, means for biasing the element so that the followers engage the cams, means comprising inductively related members for developing an electrical signal the character of which depends jointly on the contours of the two cams, one of said members being connected to the movable element, and means responsive to the electrical signal for controlling the velocity of the motor.

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No references cited.