

March 29, 1966

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3,243,131

CONTROL SYSTEM FOR BOBBIN-BUILDING MECHANISM

Filed Sept. 24, 1963

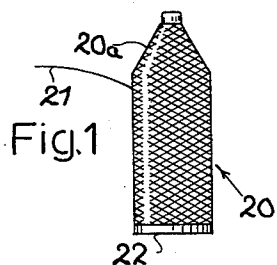
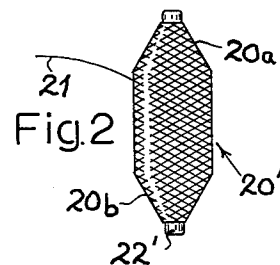
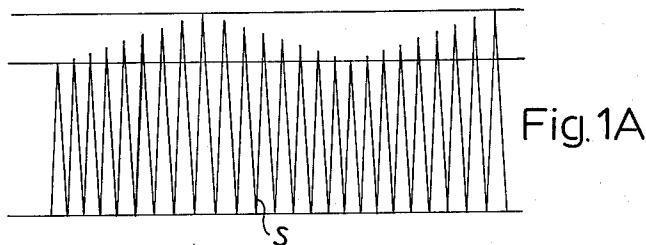
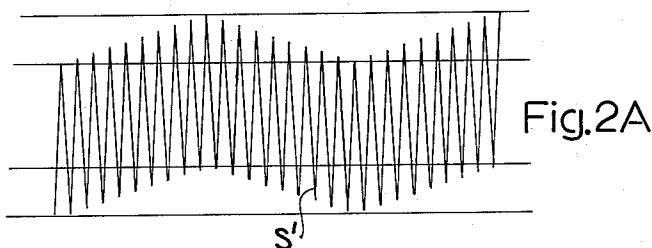
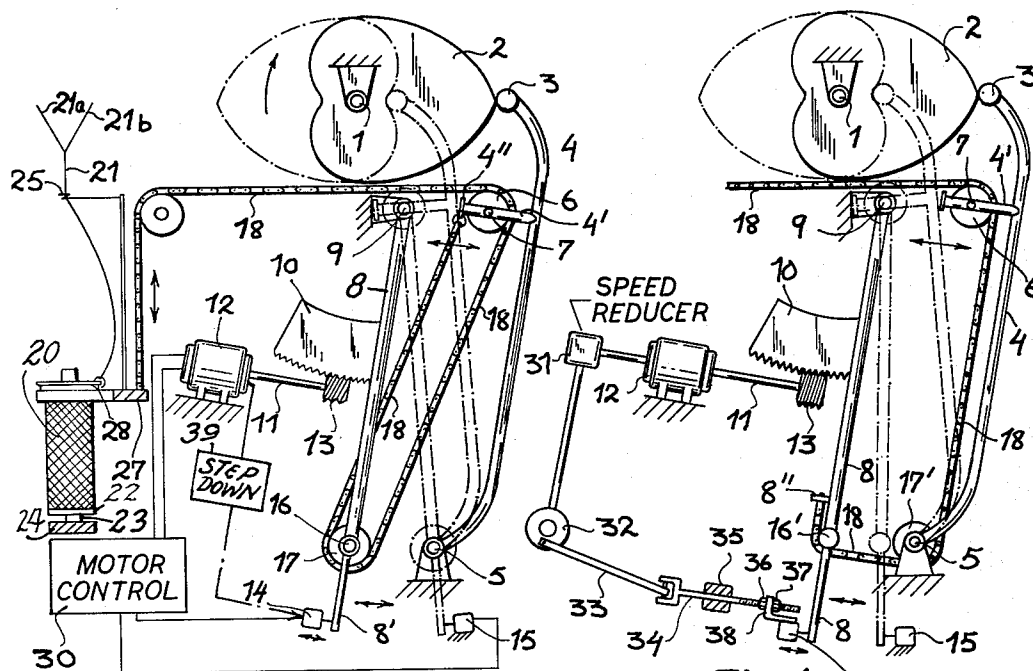


Fig. 3

Fig. 4

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3,243,131 CONTROL SYSTEM FOR BOBBIN-BUILDING MECHANISM

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Filed Sept. 24, 1963, Ser. No. 311,039
5 Claims. (Cl. 242—26.3)

My present invention relates to a system for the control of bobbin-building mechanism wherein one or more bobbin-carrying spindles and a like number of thread-guiding traveler rings are relatively reciprocable to wind a thread about the bobbin core with a desired mode of lay.

The bobbins here contemplated are provided with headless cores which are generally rotatable about vertical axes while the filamentary material to be wound thereon is fed from above through suitable thread guides; in use, the completed bobbin is unwound in an inverse manner, i.e. the thread is drawn off in an upward direction. In order to prevent the uppermost turns of the thread winding from being sloughed off before or during the unreeling operation, it is customary to stagger successive layers of thread by progressively displacing one or both dead-center positions of the reciprocable system in an oscillatory motion which is slow in comparison with the rate of reciprocation used to build up the winding layers. In one mode of operation, known as differential winding, the stroke length is held constant so that both dead-center positions shift concurrently, the result being a tapering of both the upper and the lower end of the bobbin; in another mode of operation, designed to increase the amount of thread stored in the bobbin, only the top of the bobbin is tapered while the remainder of its body remains cylindrical, this being accomplished by maintaining a fixed lower dead-center position of the traveler ring relative to the bobbin and shifting only the upper dead-center position. Known arrangements for producing either type of staggered winding have been relatively cumbersome and not readily adjustable for shifting from one type to the other.

The general object of my present invention is to provide simplified means for controlling a bobbin-building mechanism in the manner and for the purpose set forth.

A more specific object is to provide means of this character adapted for a quick changeover from single to double taper or vice versa.

I have found, in accordance with my present invention, that the aforesaid objects can be realized with the aid of two levers whose respective fulcra define diagonally opposite corners of a quadrangle having a pair of nonadjacent sides constituted by these levers, the remaining corners of the quadrangle being defined by deflecting rollers or other means on the two levers engaging a flexible link, such as a chain, which is attached at one end to the reciprocable member of the winding mechanism. The two levers are oscillated at different rates about their respective fulcra, one of the deflecting elements of the link-engaging means being carried on the faster-moving lever in such manner that the flexible link is alternately released and retracted to cause the high-frequency oscillations of the winding mechanism. More specifically, the link engages the two levers at locations having substantially the same distance from their respective fulcra so that, in a predetermined reference position of each lever, the quadrangle turns into a parallelogram. Advantageously, each lever is oscillated between substantially its aforementioned reference position and another extreme position in which its link-engaging point approximately coincides with the fulcrum of the other lever.

A system of this description may be used for progressively shifting only the upper dead-center position or

both upper and lower dead-center positions of the reciprocating member, according to whether the other end of the link is attached to the fast or the slow lever. The link-engaging means of the fast lever may include in either case a deflecting roller whose axis coincides in a limited position of its oscillatory motion with the fulcrum of the slow lever. For building bobbins that taper only at the top, the flexible link is anchored to the fast lever at a location close to the deflecting roller thereof, then passes around a deflecting roller on an extremity of the slow lever and subsequently engages the first-mentioned roller so that, in the aforesaid limiting position of the fast lever, the length of the loop formed by the link around the two rollers will always be the same, irrespectively of the position of the slow lever, and the lower dead-center position of the reciprocating member will therefore remain unaltered. If symmetrical bobbins are to be formed, the link is anchored to the slow lever at either the free extremity thereof or at some other point and, after branching off this lever at said extremity, advantageously moves around a further deflecting roller at the fulcrum of the fast lever before embracing the deflecting roller first referred to.

The invention will be described in greater detail hereafter, reference being made to the enclosed drawing in which:

FIG. 1 is a diagrammatic illustration of a bobbin with tapering upper end;

FIG. 1A is a graph showing the oscillations of the reciprocating system in building the bobbin of FIG. 1;

FIG. 2 is a view similar to FIG. 1, showing a bobbin tapered at both ends;

FIG. 2A is a graph similar to that of FIG. 1A, relating to the bobbin of FIG. 2;

FIG. 3 is a somewhat schematic illustration of a system for displacing a winding mechanism to build a bobbin as shown in FIG. 1; and

FIG. 4 is a view similar to FIG. 3, illustrating the system as modified for building the bobbin shown in FIG. 2.

In FIG. 1 I have shown a bobbin 20 with a generally cylindrical body of wound thread 21, supported on a headless core 22 with a circular base of the same diameter as the cylindrical bobbin portion; this cylindrical portion is topped by a tapered portion 20a. As shown in FIG. 1A, the configuration of bobbin 20 is obtained by a succession of reciprocating strokes S of the thread-winding mechanism (shown in FIG. 3), the length of the strokes varying progressively at a frequency which is slow compared to the oscillatory frequency of the reciprocating system.

The bobbin 20' of FIG. 2 has a core 22' without head or base, its body being cylindrical in its main central portion and tapered in its end portions 20a and 20b. The pattern of reciprocations S' illustrated in FIG. 2A shows a constant stroke length with a progressive shifting of both upper and lower turnabout points at the same slow rate as the modulation of the stroke length in FIG. 1A. The cylindrical central portion is defined by the overlapping parts of all strokes S'.

FIG. 3 shows the bobbin 20 with its core 22 supported on a spindle 23 which in turn rises from a rail 24, the latter carrying a number of such bobbins next to one another. Each bobbin receives thread 21 from a suitable supply source not shown, the thread being here illustrated as twisted together from filaments 21a, 21b before passing through an eye 25 which, by means of an arm 26, is supported on a rail 27 also carrying a traveler ring 28 of conventional construction (see, for example, commonly owned U.S. Patent No. 2,972,856, issued Feb. 28, 1961 to Edmund Hamel). One of the two rails 24 and 27, here the ring rail 27, is vertically reciprocable by hav-

ing attached to it an end of a control chain 18 passing around an idler roller 29.

The system embodying my invention, which controls the movement of ring rail 27 through the intermediary of chain 18, comprises a cardioid cam 2 on a shaft 1 continuously rotated in fixed bearings by a suitable power source, not shown, as indicated by the arrow. A cam follower 3 is mounted on the free extremity of a lever 4 having a fixed fulcrum 5. Another lever 8 has a fixed fulcrum 9 and, in the position illustrated in full lines, is substantially parallel to lever 4 so that the fulcrum 5, 9 define diagonally opposite corners of a quadrangle approximating a parallelogram whose remaining corners are defined by a pair of deflecting rollers 6 and 17 having journals 7 and 16 respectively carried on an arm 4' of lever 4 and the free end of lever 8.

Lever 8 is periodically oscillated about its fulcrum 9 by a motor 12 driving a worm 13 via its shaft 11, this worm meshing with a worm-gear segment 10 on that lever. An abutment 8', formed as an extension of lever 8 beyond roller 17, cooperates with a pair of limit switches 14 and 15 to reverse the motor 12 with the aid of a suitable control circuit diagrammatically indicated at 30. Thus, lever 8 is swung back and forth, at a rate which is slow in comparison with that of lever 4, between its reference position (full lines) and another extreme position (dot-dash lines) in which the axis of roller 17 substantially coincides with the fulcrum 5 of lever 4. Conversely, as the lever 4 is swung into its alternate extreme position also shown in dot-dash lines, the axis of its roller 6 substantially coincides with the fulcrum 9 of lever 8. Chain 18 has its end remote from rail 27 secured to lever 4 at the tip 4'' of arm 4', thus at a location close to roller 6, the chain being looped around the rollers 6 and 17 so that the length of the loop changes with the motion of both levers 4 and 8. It should be noted, however, that the loop length will be independent of the position of the slow lever 8 whenever the fast lever 4 occupies its dot-dash position since at that instant the distance between the centers of rollers 6 and 17 will always equal the length of lever 8. As a result, an oscillation as illustrated in FIG. 1A is produced.

The modified system of FIG. 4 differs from that of FIG. 3 in that the roller 17 has been replaced by a fixedly positioned roller 17' journaled on the fulcrum 5 of lever 4, the angular path of chain 18 leading around rollers 6 and 17' and to the free extremity of lever 8 where the chain is engaged by a boss 16', the end of the chain being shown fastened to lever 3 at a location 8'' in the vicinity of that boss. The location of the point of attachment 8'' along lever 8 is, however, not critical.

In both FIGS. 3 and 4 the distance between the fulcrum 5, 9 is substantially equal to the distance between roller 6 and fulcrum 5 and also to the distance between chain-engaging element 17 or 16' and fulcrum 9. Since the latter fulcrum lies directly in the arcuate path of roller 6 (and, in FIG. 3, of the point of attachment 4''), the displacement of ring rail 27 under the control of cam 2 will be directly proportional to the changing radius of that cam; similarly, the fulcrum 5 lies in the path of roller 16 or boss 16', defining the point of engagement of chain 18 with lever 8, so that the shift in the dead-center position of the ring rail will be directly proportional to the displacement of lever 8 under the control of worm 13. Unlike the arrangement of FIG. 3, in which the chain 18 is looped around rollers 6, 16 on both levers so that the stroke length is jointly determined by both, the arrangement of FIG. 4 makes the stroke length dependent solely upon the amplitude of the swing of lever 4 whereas lever 8 determines only the stroke position.

In some instances it will be desirable, for the purpose of securing a more slender taper, to vary (i.e., lengthen or shorten) the swing of lever 8 at a rate which is even slower than the rate of its own oscillations. This can be accomplished by a step-down transmission indicated

schematically at 39 in FIG. 3 and illustrated in greater detail in FIG. 4 where the motor 12 drives, by way of a speed reducer 31, a crank disk 32 linked through a pitman 33 with a rod 34 slidable in a bearing 35; a threaded extremity of rod 34 carries nuts 36, 37 by which it is adjustably secured to a bracket 38 supporting the limit switch 14. The position of this limit switch is thereby progressively varied, to an extent which will be a fraction of the swing of lever 8 and in practice may amount to only a few millimeters, whereby the peaks of the strokes S, S' in FIGS. 1A and 2A are correspondingly modulated in a superimposed sine-wave pattern. The nuts 36, 37 serve to change the base line of these peaks, according to existing operating conditions such as bobbin length.

The specific embodiments described and illustrated may, of course, be modified in various respects, readily apparent to persons skilled in the art, without departing from the spirit and scope of my invention as defined in the appended claims.

I claim:

1. A control system for a bobbin-building mechanism provided with a reciprocable member having at least one shiftable dead-center position, comprising:

- 25 a flexible link attached at one end to said reciprocable member;
- a first lever pivotable about a first fulcrum;
- a second lever pivotable about a second fulcrum, the other end of said flexible link being attached to said first lever at a point whose distance from said first fulcrum is substantially equal to the distance between said fulcrum, the latter defining diagonally opposite corners of a quadrangle having a pair of non-adjacent sides constituted by said levers;
- 35 first drive means for periodically oscillating one of said levers about its fulcrum at a relatively fast rate;
- second drive means for oscillating the other of said levers about its fulcrum at a relatively slow rate,
- 40 said second drive means including a reversible power source and a pair of limit switches actuatable by said other of said levers in respective extreme positions thereof for reversing the direction of operation of said power source;
- guide means engaged by said link for leading it around an angular path including at least two corners of said quadrangle other than those defined by said fulcrum, said guide means comprising a deflecting element carried on said one of said levers at a location remote from its fulcrum; and
- 50 third drive means for periodically displacing one of said limit switches at a rate still slower than the rate of oscillation of said other of said levers.

2. A control system for a bobbin-building mechanism provided with a reciprocable member having a fixed and

- 55 a shiftable dead-center position, comprising:
- a flexible link attached at one end to said reciprocating member;
- a first lever pivotable about a first fulcrum;
- a second lever pivotable about a second fulcrum, said fulcrum defining diagonally opposite corners of a quadrangle having a pair of nonadjacent sides constituted by said levers;
- a first deflecting roller mounted on said first lever in engagement with said link at a location defining a third corner of said quadrangle;
- 60 a second deflecting roller mounted on said second lever in engagement with said link at a location defining the fourth corner of said quadrangle, the distance between said first fulcrum and said first roller being substantially equal to the distance between said second fulcrum and said second roller, said link having its other end attached to said first lever at a location close to said third corner and passing from said location successively around said second and first rollers;
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first drive means for periodically oscillating said first lever about said first fulcrum between two dead-center positions at a relatively fast rate;

and second drive means independent of said first drive means for periodically oscillating said second lever about said second fulcrum at a relatively slow rate, said first roller having an axis substantially coinciding with said first fulcrum in one dead-center position of said first lever for establishing said fixed dead-center position of said member independently of the displacement of said second lever by said second drive means.

3. A control system for a bobbin-building mechanism provided with a reciprocable member having at least one shiftable dead-center position, comprising:

a flexible link attached at one end to said reciprocating member;

a first lever pivotable about a first fulcrum;

a second lever pivotable about a second fulcrum, said fulcrum defining diagonally opposite corners of a parallelogram having a pair of nonadjacent sides constituted by said levers in respective reference positions thereof;

a deflecting roller on said first lever at a location defining a third corner of said parallelogram in the reference position thereof;

link-engaging means on said second lever at a location defining the fourth corner of said parallelogram in the reference position thereof;

guide means including said link-engaging means and said deflecting roller for leading said link around an angular path including at least said third and fourth corners; first drive means for periodically oscillating said first lever about said first fulcrum at a relatively fast rate between substantially said reference position

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thereof and a position of substantial coincidence of said deflecting roller with said second fulcrum; second drive means independent of said first drive means for periodically oscillating said second lever about said second fulcrum at a relatively slow rate between said reference position thereof and a position of substantial coincidence of said link-engaging means with said first fulcrum, said second drive means including a reversible power source and a pair of limit switches actuatable by said second lever in respective extreme positions thereof for reversing the direction of operation of said power source; and third drive means for periodically displacing one of said limit switches at a rate still lower than the rate of oscillation of said second lever.

4. A system as defined in claim 3 wherein said link-engaging means comprises a further deflecting roller, said link having its other end attached to said first lever at a location close to said third corner and passing from said location successively around said further roller and the first-mentioned roller.

5. A system as defined in claim 3 wherein said guide means includes a further deflecting roller at said first fulcrum, said link having its other end attached to said second lever and passing from said link-engaging means successively around said further roller and the first-mentioned roller.

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