DEVELOPMENT FOR AT LEAST TEMPORARILY INACTIVATING RECIPROCATING CONTROL MEMBERS OF MACHINES, ESPECIALLY OF EMBROIDERY MACHINES

Fig. 1

Fig. 2

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DEVICE FOR AT LEAST TEMPORARILY INACTIVATING RECIPROCATING CONTROL MEMBERS OF MACHINES, ESPECIALLY OF EMBROIDERY MACHINES

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Application February 16, 1955, Serial No. 488,628

14 Claims. (Cl. 112—221)

The invention relates to improvements in devices for at least temporarily inactivating control members of machines, especially high speed machines.

With multi-needle embroidery machines for example it is often necessary to inactivate reciprocating control members, in order to avoid the production of a series of large stitches when the embroidery frames are automatically displaced for bringing a remote portion of the fabric in register with the needles, inasmuch as such large stitches must be removed subsequently by hand. Also with other machines, for instance counting machines, textile machines, other than embroidery machines, packing machines as such for foods, control members are to be brought to a stop in order to avoid break of a machine part.

When machine parts or a whole machine are brought to a standstill by braking, kinetic energy is to be dissipated. With fast running machines, however, great difficulties arise, because, in consequence of the high speed of the moving masses the kinetic energy is large enough to produce strong shocks at a sudden stop.

It is an object of the invention to provide an improved device for at least temporarily inactivating reciprocating control members of machines in such a manner as to avoid uncoupling of elements of the mechanism and to eliminate undesired actions of inertia forces of moving masses.

It is another object of the invention to provide an improved device for at least temporarily inactivating reciprocating control members of machines such as to cause the changing over from one kind of operation to another kind of operation to occur in the dead center position wherein the velocity is zero, in order to avoid shocks and disturbances of operation even of very fast running machines.

Other objects and structural details of the invention will be apparent from the following description when read in conjunction with the accompanying drawings forming part of this specification, wherein the invention is illustrated when applied to a multi-needle embroidery machine, special needs requiring consideration with this kind of machines. In the drawings:

Fig. 1 is a side view of an embroidery head in part sectional elevation.

Fig. 2 is a front elevational view of the head shown in Fig. 1 with the rocking center locked, the casing being omitted.

Fig. 3 is a view similar to that of Fig. 2, the needle shaft being locked.

Fig. 4 is a view in front elevation of a detail, the needle shaft being locked.

Fig. 5 is a diagrammatic view of the kinematic chain of the mechanism.

Fig. 6 is a diagrammatic view similar to that of Fig. 5 but drawn to a smaller scale, the needle shaft being movable, and

Fig. 7 is a view similar to that of Fig. 6, the needle shaft, however, being locked.

Referring now to Figs. 1–3, within the casing 1 the reciprocating needle shaft 2 of circular cross section is arranged to slide vertically in an upper guide 3 and a lower guide 4. Between the two guides a square shaped head 5 is secured to the needle shaft 2 (Fig. 2). The head carries a pin 6 to which one end of a link 7 is swingingly attached. The other end of the link is formed as a bearing 8 engaged by a journal 9 secured to a link 10, a coupling link 11 being engaged with the outer circumference of bearing 8 to rock about the axis thereof. The axis of joint 8, 9 is therefore common to three hinges. The upper end of the coupling link 11 is hinged to a pin 12 secured to a crank disc 13. The crank disc driving the needle shaft 2 is secured to and rotated by the shaft 14. Link 10 is pivotally attached by means of a pin 16 to a lever 15 arranged to rock about a pivot 17 secured to an inner side wall of casing 1.

From Figs. 6 and 7, diagrammatically illustrating the members of the mechanism, it is to be seen that the whole drive constitutes a closed kinematic chain, wherein crank 13, coupling rod 11, two links 7 and 10, needle shaft 2 being a slide rod, and rocking lever 15 form the movable links and the casing 1 constitutes the stationary link.

From the drawings, especially Fig. 5, it results that at the joint 8, 9 the chain is braced such as to be capable to transmit the movement as well through link 10 and rocking lever 15 as through link 7 and slide rod 2.

If now the rocking center 16 is fixed the movement is transmitted from crank 13 through coupling link 11 and link 7 to the driven member, i. e. the sliding needle shaft 2. Link 10 becomes the rocking lever of the four-bar link mechanism.

When, on the contrary, needle shaft 2 and thereby joint 6 are fixed, the motion is transmitted from crank 13 through coupling link 11 and link 10 to the rocking lever 15. The former link 7 is now the rocking lever of the four-bar link mechanism.

In both cases the link mechanism constitutes a six-bar link mechanism. Depending upon the fixing of the position of the pivot 6 or 16, respectively, the energy of the chain is transmitted either through branch 13 or through branch 7, 2, while either the reciprocating control link 2 or the reciprocating control link 15 is rendered inactive as a driving member.

In a system of this type, the common hinge 8, 9, i. e. the branching point of the kinematic chain moves through three dead center positions I, II and III (Fig. 5). If the rocking center 16 is in fixed position, for example as described above in connection with Fig. 6, the vertically reciprocating needle shaft 2 is in its upper dead center position I when the linkage is in the position shown in full lines in Fig. 5, while said needle shaft 2 reaches its lower dead center position II when the linkage is in the position shown in dash and dot lines. It may be readily gathered from Fig. 5, that during a movement from dead center position I to dead center position II and vice versa the joint 8, 9 moves along a circular path described by the end of rocking lever 10. However, if the position of the pivot 6 is fixed, for example as described above in connection with Fig. 7, during a movement of the linkage from the dead center position I, the joint 8, 9 travels along the circular path c described by the rocking lever 7, so that another lower dead center position III of the linkage as shown by dash lines is obtained. In this case the lower dead center position III is swung to the right. It is characteristic that the upper dead center position I is common to both positions. This is very important, since the changing over of the branches of the kinematic chain is made while the linkage is in this upper dead center position I.

The means for performing the changing over will be later described in detail.
In the dead center position I the needle shaft 2 is in its highest position and the energy in the kinematic chain equals zero. In order to have sufficient time for changing over or switching the movement from one channel branch into the other, the duration of the dead center position I is extended. According to the present invention this is effected by causing the circular arc R described by coupling link 11 while passing through the dead center position to coincide with the circular arc S described by the crank pin 13 over the crank radius RA such as from point a to point b, as shown in the drawing. This coincidence causes an extension in time of the dead center position I which, thus remains at a standoff from a practical point of view. When point 12 moves on a suitably shaped curve, the coincidence may be still longer if the radius of coupling link 11 equals the radius of curvature of said curve. This prolongation of the dead center position I is of extreme importance with fast running machines in order to get sufficient time for locking the links when the changing over operations are made.

The changing over operation for stopping the needle shaft 2 may be carried out manually or automatically. A manual changing over may be for a brief or for a long period of time.

The stopping of the needle shaft 2 or of the rocking lever 15 is performed by a suitable snap locking mechanism. As shown in Figs. 1 and 2 the axial 19 to which the locking lever 18 is secured is journaled in a bearing 20 attached to the casing I. The locking lever 18 carries on two projections conical locking teeth 21, 21' each capable of engagement with one of correspondingly shaped and sized notches 22, 22'. The notch 22 is provided in the needle shaft 2, the notch 22' in the extension 13 of the rocking lever 15, the upper edge of this extension being formed as a circular arc with its center in the axis of pivot 17. The locking lever 18 carries a pin 24 to which a tension spring 25 is attached, the other end thereof being attached to a pin 26 secured to a control lever 27. A shaft 28 secured to the lever 27 is arranged for rotation and axial displacement in bearings 29 and 30. Between these bearings shaft 28 has a collar 31. A pressure spring is arranged on shaft 28 between the collar 31 and the bearing 29. The left hand end, Fig. 1, of shaft 28 carries a knob 33 provided with a drop-in pin 34. To the other end of shaft 28 a coupling lever 35 is secured carrying a pin 36 engaged with a control bar 37 of a linkage for the automatic release. The control bar is carried by several levers 38 of which only one is shown in the drawing. These levers are parallel to one another and their lower ends that of the coupling lever 35. They are pivotally attached to the control bar 37 and journaled on pins 39 secured within the casing I.

In the position illustrated in Fig. 2 the rocking lever 15 and thereby the rocking center 16 are fixed through the locking lever 18, the locking tooth 21' being engaged with the notch 22' of the extension 23, while the tooth 21 capable of locking the needle shaft 2 is outside of the range of the notch 22. Consequently the needle shaft 2 is capable of reciprocation (Fig. 6). If now by means of a Jaguar card of an automat the needle shaft shall be automatically stopped, the card acts on the eccentrical device or a control mechanism moving the control bar 37 to the left into the position shown in Fig. 3. Simultaneously the control lever 27 is moved upward by the coupling lever 35 through the shaft 28, whereby the trend of the pull of spring 25 with regard to axle 19 is reversed. The locking tooth 21' which reciprocally the movement is transferred to the link 25 of rocking lever 15 is pulled out, however, lever 15 is still locked because of the locking tooth 21 being not yet capable of engagement with notch 22 in the needle shaft 2. Tooth 21 still slides on the needle shaft, until the shaft reaches the dead center position I, wherein the locking tooth 21 engages notch 22 of the needle shaft 2 which hereby is locked. Simultaneously, in the dead center position I, the rocking lever 15 is released and the movement is the movement of the link 10 and rocking lever 15 (Fig. 3). During the next changing over operation the action is reversed. Since the locking tooth 21 slides on the needle shaft 2 and the tooth 21' on the projection 25 of rocking lever 15, at any time a change may be made also manually.

To this purpose a locking lever 13 is provided for the changing over and through shaft 26 the coupling lever 35 with its pin 36 is released from the control bar 37. When turning the knob 33 the direction of locking action of the lever 18 is changed through the tension spring 25 whereby the desired changing over of the branches of the kinematic chain is obtained.

During the rotation of the knob 33 the drop-in pin 34 is moved within the slot 40 in the front wall of casing I (Fig. 4). During the next automatic changing over operation the coupling pin 36 is again engaged with notch 41 in the control bar 37 by means of the pressing action of the spring 32.

When the needle shaft 2 is to be locked permanently the drop-in pin 34 of the knob 33 is withdrawn from the range of slot 40 and engaged with a special cavity 40' next to this slot 40 as illustrated in Fig. 4.

Then the coupling pin 36 remains permanently disengaged from the control bar 37.

With the multi-needle embroidery machines, in spite of the needle shaft being locked, the thread guide must still operate to draw a thread from the bobbin. This occurs when a change in the portion of the fabric to be embroidered takes place and the embroidery frame is displaced so as to bring the new portion of the fabric in position. Consequently, the machine is equipped with a device according to the invention for controlling the movements and stoppages of the needle shaft, it is unnecessary to provide for a separate drive for the thread guide which remains operative during a standstill of the needle shafts. As will be readily understood from above, when a changing over operation for stopping the needle shaft 2 is made, the rotation of the driving shaft 14 continues, so that the latter may be used for actuating the thread guide. Thus, the construction of embroidery machines is considerably simplified.

According to Figs. 1, 2 and 3 a thread guide generally indicated by 49 is driven by a crank pin 12 carrying a bolt 42 (Fig. 1) on which the hub 43 of the thread guide 52 is journaled. The portion 44 of the thread guide 52 represents the coupling link of a four-bar link mechanism, wherein the crank disc 13, coupling link 44, rocking lever 45 form the movable links and the casing 14 constitutes the stationary link. The coupling link 44 is pivoted at 50 to one end of the rocking lever 45, the other end of which is swingingly mounted on a bolt 49 carried by the casing 14. Furthermore, the coupling link 44 has an extension 46 provided with an eye 47 describing a curve 48 during the operation of the machine.

The purpose of the thread guide is, at a suitable instant, to withdraw the thread upward out of the range of the looper and simultaneously to draw the upper thread from the bobbin.

I have described a preferred embodiment of my invention, but it is understood that this disclosure is for the purpose of illustration, and that various omissions and changes in shape, proportion and arrangement of parts, as well as the substitution of equivalent elements for the arrangements shown and described may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

For example the thread guide 52 may be controlled by a drum having a curved cam slot on its cylindrical surface, instead of using above described crank disc 13. In such a case, means should be provided to continue the rotation of the controlling cam drum by the driving shaft 14 during the periods of stopping of the needle shaft 2.
Although the drawings illustrate only a single embroidering head of an embroidery machine, it is understood that the invention may be applied to the needle head of each embroidering head of a multi-needle embroidery machine having a series of embroidering heads.

What I claim is:

1. A system for transmitting reciprocating motion comprising a support, a continuously rotating driving member, a pair of driven members arranged for movement by said driving member relative to said support, a link motion mechanism comprising three connecting links each having an end articulated to one of said members, respectively with each of said members being connected to one of said links, and having their remaining ends connected to form a generally elongated member having an outer surface generally uniform in curvature, a slot formed in each of said outer surfaces, said projections respectively being positioned adjacent one of said outer surfaces and movable laterally thereof into the respective slot thereof when aligned with the latter, each member being movable so as to move its said surface transversely of its respective projection, said projections being movable through movement of said lever alternately into bearing relationship along their respective facing surface as said surface is moving laterally of said projection, a control element movably mounted on said support, said spring means connecting said control element with said lever, said spring means extending laterally of the pivotal axis of said lever and being movable across the latter axis through movement of said control element to urge said projections alternately against their associated said surfaces, said control element being movable to cause a snap action rotation of said lever between said limit positions, said spring means functioning to urge one or the other of said projections against its respective surface while the said member on which the latter respective surface is mounted is in motion for sliding contact between the latter projection and the latter surface with said spring being operable to urge said projection into its associated slot as the latter moves into alignment with said latter projection during movement of said latter member.

2. A system for converting rotary motion into reciprocating motion comprising a support, a continuously rotating driving member upon said support having a crank, a coupling link having an end articulated to said crank, a pair of driven members mounted for movement relative to said support, a link motion mechanism comprising two connecting links each of said driven members being articulately connected to one of said connecting links, said connecting links being articulately connected to said coupling link at a common point to form a freely moving articulate joint, and of said driven members being articulately connected to one of said limit positions, whereby to transmit driving motion to the other driven member by said mechanism.

3. A system for converting rotary motion into reciprocating motion comprising a support, a continuously rotating driving member upon said support having a crank, a coupling link having an end articulated to said crank, a pair of driven members mounted for movement relative to said support, a link motion mechanism comprising two connecting links each of said driven members being articulately connected to one of said connecting links, said connecting links being articulately connected to said coupling link at a common point to form a freely moving articulate joint, and control means operable to a pair of limit positions, to selectively lock either of said driven members to said support in one of said limit positions, whereby to transmit driving motion to the other driven member by said mechanism.

4. A system for converting rotary motion into reciprocating motion comprising a support, a continuously rotating driving member upon said support having a crank, a coupling link having an end articulated to said crank, a pair of driven members mounted for movement relative to said support, a link motion mechanism comprising two connecting links each of said driven members being articulately connected to one of said connecting links, said connecting links being articulately connected to said coupling link at a common point to form a freely moving articulate joint, whereby locking of either driven member to said support causes driving motion to be transmitted to the other driven member through said mechanism and whereby said joint passes through a common dead center position during operation of either of said driven members, and control means operable to a pair of limit positions and adapted to selectively lockingly engage either of said driven members to said support upon reaching said dead center position by said mechanism, whereby to transmit driving motion to the other driven member by said mechanism.

5. In a system as claimed in claim 4, wherein said control means is comprised of a snap-action lever pivotally mounted on said support locking means on each of said members, means on said lever for engaging the locking means on one of said members when in one of said limit positions and for engaging the locking means on the other of said members when in the other of said limit positions when said mechanism is in said dead center position to alternately lock one or the other of said members with respect to said driving member, means for moving said lever from one of said equilibrium positions to the other with a snap action comprising a resilient means connected to said lever at a point spaced radially from the pivotal connection of said lever to said support, a second lever movably mounted on said support, said spring being connected to said second lever at a place spaced radially from said point with respect to said said second lever, said spring being in tension so as to urge said levers toward each other, means for operating said second lever to move said place of connection of said spring laterally across the radial line extending through said point and said pivotal connection.

6. In a system as claimed in claim 4, the length of said coupling link being equal to the length of one of said connecting links to cause the movements of the common joint thereof while the first mentioned joint is passing through said dead center position to coincide over an extended path, to substantially extend the duration of passage of said mechanism through its dead center position.

7. In a system as claimed in claim 4 wherein said control means is comprised of a centrally pivoted lever mounted upon said support, said lever having a pair of projections adjacent opposite ends thereof, each of said members comprising a generally elongated member having an outer surface generally uniform in curvature, a slot formed in each of said outer surfaces, said projections respectively being positioned adjacent one of said outer surfaces and movable laterally thereof into the respective slot thereof when aligned with the latter, each member being movable so as to move its said surface transversely of its respective projection, said projections being movable through movement of said lever alternately into bearing relationship along their respective facing surface as said surface is moving laterally of said projection, a control element movably mounted on said support, said spring means connecting said control element with said lever, said spring means extending laterally of the pivotal axis of said lever and being movable across the latter axis through movement of said control element to urge said projections alternately against their associated said surfaces, said control element being movable to cause a snap action rotation of said lever between said limit positions, said spring means functioning to urge one or the other of said projections against its respective surface while the said member on which the latter respective surface is mounted is in motion for sliding contact between the latter projection and the latter surface with said spring being operable to urge said projection into its associated slot as the latter moves into alignment with said latter projection during movement of said latter member.
said motion to said auxiliary member upon locking of said needle bar by said control means, respectively.

9. In an embroidering or the like machine having a support, a continuously running driving means upon and a needle bar arranged for reciprocating motion relative to said support, driving motion transmitting means connecting said driving means with said needle bar comprising an auxiliary rocking member mounted upon said support, a crank driven by said driving means, a coupling link having one end articulated to said crank, a link motion mechanism comprising two connecting links, said needle bar, and said rocking member each being articulately connected to one of said connecting links a common freely moving articulate joint connecting said links, whereby locking of said rocking member in one operative position to said support causes driving motion to be transmitted from said driving means to said needle bar, and locking of said needle bar in another operative position causes diversion of said motion to said rocking member, said mechanism having a common dead center position, and common control means operable to a pair of limit positions and adapted to alternately lock said needle bar and said rocking member when said mechanism is in said dead center, whereby to transmit driving motion from said driving means to said needle bar upon locking of said rocking member and to divert said motion to said rocking member upon locking of said needle bar by said control means.

10. In a system as claimed in claim 9, wherein said control means is comprised of a snap-action lever pivotally mounted upon said support, locking means on said rocking member and said needle bar, means on said lever for engaging the locking means on said rocking member when in one of said limit positions and for engaging the locking means on said needle bar when in the other of said limit positions to alternately lock said rocking member or said needle bar with respect to said support, means for moving said lever from one equilibrium position to the other with a snap action comprising a resilient means connected to said lever at a point spaced radially from the pivotal connection of said lever to said support, a second lever movably mounted on said support, said spring being connected to said second lever at a place spaced radially from said point with respect to said pivotal connection, said spring being in tension so as to urge said levers toward each other, means for operating said second lever to move said place of connection of said spring laterally along the radial line extending through said point and said pivotal connection.

11. In a system as claimed in claim 9, said coupling link being of a length equal to the length of one of said connecting links to cause the movements of the common joint thereof while said mechanism is passing through said dead center position to substantially extend the duration of passage of said mechanism through its dead center position.

12. In a system as claimed in claim 9, wherein said needle bar and rocking member are each provided with a slot and said control means is comprised of a centrally pivoted lever mounted upon said support and having projections at the opposite ends thereof, said projections being adapted to alternately engage one of said slots, said needle bar and said locking member having a uniformly curved surface contiguous their respective slots, the said projections on the said lever each being positioned laterally of one of the respective surfaces when said projections are out of engagement with their respective slots, said needle bar and said rocking member respectively being operable to move their respective surfaces laterally of their respective projections, said lever being movable while said needle bar and said rocking member is moving to bring said projections alternately into engagement with their respective said surface, means engaged with said lever urging said lever to alternately move each projection into its respective slot while its respective surface is moving and said projection is bearing against the latter surface thereby to alternately lock said needle bar and rocking member by operation of said lever, said slots being positioned with respect to their respective projections such that when said lever is operated to move its said projections respectively against said surfaces said slots will alternately be engaged by their respective projection when said mechanism is in said common dead center position.

13. In a system as claimed in claim 9, an oscillating thread guide and motion transmitting means to operate the same directly by said driving means.

14. In a system as claimed in claim 9, a thread guide having a thread receiving eyelet at one end and having its opposite end pivoted to said crank, and a further rocking lever having one end pivoted to said support and having its opposite end articulated to an intermediate point of said thread guide.

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