

SPECIFICATION

Method and means for feeding a continuous core to a coiling station in the manufacture of coiled coupling elements for slide fasteners

Description

This invention relates to the manufacture of a continuous length of coupling element of the known helicoidal-coil type together with a continuous length of core received in place therein, for use in slide fasteners. More specifically, the invention is directed to a method of, and means for, feeding the core to a coiling station in which a continuous filament of desired material is coiled while receiving the core in place within its successive turns or convolutions.

Apparatus for the manufacture of a continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein is disclosed in Japanese Patent Publication No. 45-40939. Further, of this apparatus, means for feeding at a controlled rate the continuous core to be received within the continuous coupling element is separately disclosed in Japanese Patent Publication No. 46-1132.

According to the second mentioned Japanese patent, the continuous core travelling from a payoff bobbin to a coiler mechanism is made to pass over a guide roll rotatably mounted on a reciprocating lever. This lever is oscillated in step with the reciprocation of a mandrel holder towards and away from the coiler mechanism so that successive unit lengths of the core may be taken away from the payoff bobbin by the oscillatory motion of the guide roll.

It has been subsequently found that according to this prior art core feed mechanism, the successive core lengths taken away from the payoff bobbin tend to fluctuate. Another serious disadvantage is that the successive core lengths are fed into the coiler mechanism in a variably tensioned or extended state. This is objectionable for the following reason.

In stitching helicoidal-coil type coupling elements onto carrier tapes, the stitches are usually passed through the cores within the coupling elements. Receiving the stitches, the cores tend to meander and to bulge or swell at intervals. This results in some reduction in the lengths of the cores. It will therefore be seen that the core must be fed into the coiler mechanism at a rate compensating for the above lengthwise reduction on stitching, a fact not appreciated hitherto.

The noted prior art core feed mechanism is further disadvantageous in that it does not permit ready adjustment of the unit length of the core to be fed into the coiler mechanism or to be taken away from the payoff bobbin. This disadvantage is a direct result of the fact that the reciprocation of the mandrel holder is utilized both for pulling successive core lengths away from the payoff bobbin and for feeding them into the coiler mechanism. Each unit core length to be taken away from the payoff bobbin must be readjusted when, for example, a change is made from one core to another of different material

or make. If such re-adjustment is not effected, the rate at which the new core is actually fed into the coiler mechanism may inordinately increase or decrease because of the different degree of frictional resistance to which the core is subjected on its way from payoff bobbin to coiler mechanism.

According to one aspect of this invention there is provided a method of manufacture of a continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein, comprising feeding the core to a coiling station, whereat the coil is formed from a continuous filament while receiving the core in place within its convolutions, by the step of forcibly pulling away from core payoff means a unit length of the core required for each convolution of the coil, and the step of delivering the unit length of the core to the coiling station, the foregoing steps being repeated with the formation of each convolution of the coil, wherein the step of delivering the unit length of the core to the coiling station is carried out by reciprocating movement in a delivery direction and a return direction of a member which frictionally engages the core, said member being upstream of the coiling station relative to the direction of delivery of the core to the coiling station, whereby the core is substantially slack at the coiling station during the movement in the delivery direction of said member, to allow for possible subsequent lengthwise reduction of the core.

According to another aspect of the invention there is provided apparatus for the manufacture of a continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein, the apparatus being of a type including a coiler mechanism for coiling a continuous filament while introducing the core into place within the convolutions of the coil, and a reciprocating member disposed adjacent to the coiler mechanism and arranged to be controlled by a reciprocating mechanism to make a single reciprocation relative to the coiler mechanism during the formation of each convolution of the coil, the apparatus comprising means for paying off the core, means adapted to be actuated intermittently for forcibly pulling away from the payoff means successive unit lengths of the core required for successive convolutions of the coil, and a passageway in the reciprocating member through which the core passes from the pulling means to the coiler mechanism, the passageway being adapted to hold the core at least partly in frictional contact with the reciprocating member, the reciprocation of which is towards and away from the pulling means whereby the successive unit lengths of the core are delivered to the coiler mechanism in step with the formation of the successive convolutions of the coil and whereby the core is substantially slack at the point of delivery to the coiler mechanism during the time that the reciprocating member is moving away from the pulling means, to allow for possible subsequent lengthwise reduction of the core.

According to another aspect of the invention there is provided apparatus for the manufacture of a continuous length of helicoidal-coil type coupling

element together with a continuous core received in place therein, the apparatus comprising means for paying off the core, means actuated intermittently for forcibly pulling away from the payoff means successive unit lengths of the core required for successive convolutions of the coil, a mandrel around which a continuous filament is coiled, the mandrel having a guide channel formed longitudinally therein for slidably receiving the core to be positioned within the convolutions of the coil, and a mandrel holder holding the mandrel adjacent one end thereof and reciprocating with the latter in the longitudinal direction thereof away from and towards the pulling means in step with the formation of each convolution of the coil around the mandrel, the mandrel holder having formed therein a passageway through which the core travels from the pulling means to the entrance end of the guide channel in the mandrel at said one end thereof, the passageway being adapted to hold the core at least partly in frictional contact with the mandrel holder, whereby the successive unit lengths of the core are delivered to the guide channel in the mandrel in step with the formation of the successive convolutions of the coil, and whereby the core is substantially slack at the point of delivery to the guide channel in the mandrel during the time that the mandrel and mandrel holder are moving away from the pulling means, to allow for possible subsequent lengthwise reduction of the core.

Preferably, the reciprocating member is a mandrel holder holding a mandrel which is included in the coiler mechanism and around which a filament is coiled. The mandrel has formed therein a guide channel into which the successive unit core lengths are fed by the reciprocation of the mandrel holder together with the mandrel.

Also preferably, the forcibly pulling means comprises a pair of pullout rolls urged toward each other and intermittently actuated as by a ratchet mechanism in step with the operation of the coiler mechanism. Each unit core length to be fed into the guide channel in the mandrel can be adjustably varied through adjustment of the angle through which the pullout roll pair is rotated each time by the ratchet mechanism.

The invention will be described by way of example with reference to the accompanying drawings wherein:-

Figure 1 is a schematic representation, partly in elevation and partly in section, explanatory of the way a continuous length of core is fed from payoff bobbin to a coiler mechanism in accordance with this invention;

Figure 2 is a partial side elevational view, partly in section, showing in greater detail some essential parts of a preferred core feed mechanism in accordance with the invention, as well as some pertinent parts of the apparatus in which the mechanism is incorporated;

Figure 3 is a partial elevation view of a continuous length of helicoidal-coil type coupling element having the core received in place therein, which has been manufactured by the apparatus of Figures 1

and 2;

Figure 4 is an enlarged cross sectional view of a mandrel used in the apparatus of Figures 1 and 2; and

Figure 5 is an elevational view of a pair of pullout rolls and associated means used in the core feed mechanism of Figures 1 and 2.

Generally designated 10 in Figures 1 and 2 of the drawings is a coiling station or coiler mechanism included in an apparatus for the manufacture of a continuous length of helicoidal-coil type coupling element 11, Figure 3, together with a continuous core such as cord 12 received in place therein, for use in slide fasteners. As better seen in Figure 1, the coiler mechanism 10 comprises an upstanding mandrel 13 around which a continuous filament 14 of a thermoplastic synthetic resin or the like is coiled in a generally helicoidal sense, and a pair of rotary screws 15 disposed on opposite sides of the mandrel for feeding the coiled filament 14' upwardly along same while modifying its shape.

As shown cross-sectionally and on an enlarged scale in Figure 4, the mandrel 13 has formed therein a guide channel 16 extending throughout its length. The guide channel 16 is intended to slidably receive the core cord 12 to be embraced by the turns or convolutions of the coil 14'.

A mandrel holder 17 disposed under the coiler mechanism 10 has embedded therein the downward extension 18 of the mandrel 13 for securely holding same. The mandrel holder 17 is fixedly mounted on the top of a slide 19. This slide is slidably fitted in a stationary, upstanding guide sleeve 20 on the frame 21 of the apparatus for up and down motion relative to same.

Seen at 22 in Figure 2 is a turntable coaxially surrounding the guide sleeve 20 for revolution around same. A spool 23 mounted eccentrically on the turntable 22 has the continuous filament 14 wound thereon. With the revolution of the turntable 22, therefore, the filament 14 unwound from the spool 23 is coiled around the mandrel 13 and around the core cord 12 slidably received in its guide channel 16. The mandrel holder 17 together with the mandrel 13 thereon is to be moved up and down by the slide 19 in the guide sleeve 20, completing a single reciprocation with the formation of each convolution of the coil 14'.

Reference is directed to the aforementioned Japanese Patent Publication No. 45-40939 for further details on the construction and operation of this apparatus. A similar apparatus is also disclosed in U.S. Patent 3,262,157, although the apparatus has no provision for introducing a core into a coil simultaneously with its manufacture.

The present invention is specifically directed to an improved method of, and means for, feeding the core cord 12 to the coil mechanism 10 or, more specifically, to the entrance end of the guide channel 16 in the mandrel 13 of the coiler mechanism, in step with the formation of the successive convolutions of the coil 14'. As illustrated schematically in Figure 1, the preferred core feed mechanism of the invention comprises a bobbin 24 for paying off the core cord 12, a pair of pullout rolls 25 and 26 actuated intermittently for forcibly pulling successive unit

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lengths of the core cord from the payoff bobbin 24, and passageways 27 and 28 formed in the mandrel holder 17 for delivering therethrough the successive unit lengths of the core cord to the coiler mechanism 10.

As shown in greater detail in Figures 2 and 5, the pullout rolls 25 and 26 are coaxially provided with spur gears 29 and 30 respectively. These spur gears 29 and 30 are in mesh with each other and rotatable jointly with the respective pullout rolls 25 and 26. The pullout roll 25 together with the gear 29 is rotatably mounted on a lever 31 intermediate the ends of the lever 31. One end of the lever 31 is pivotally mounted at 32 on the frame 21, and a helical extension spring 33 extends between the other end of the lever and a spring retainer 34 on the frame. The pullout roll 25 is thus spring biased toward the other roll 26 for exerting pressure on the core cord 12 passing therebetween.

The other pullout roll 26 together with the gear 30 is fixedly mounted on a rotatable, stepped shaft 35 at one end thereof. Mounted on the other end of the shaft 35 is a ratchet mechanism 36 for intermittently rotating the pullout roll 26 and gear 30 through a predetermined angle. The ratchet mechanism 36 comprises a ratchet wheel 37 fixedly mounted on the shaft 35, and an actuating pawl 38 mounted on a reciprocating lever 39 and engageable with the peripheral teeth on the ratchet wheel for propelling same in a clockwise direction as viewed in Figures 1 and 5. The reciprocating lever 39 is supported at 40 by means not shown for pivotal motion about the axis of the shaft 35.

The reciprocating lever 39 of the above ratchet mechanism 36 is assumed to be driven intermittently, in timed relationship to the progress of the coiling operation by the coiler mechanism 10, completing a single reciprocation with the formation of each convolution of the coil 14' around the mandrel 13. The intermittent clockwise rotation of the pullout roll 26 is transmitted to the other pullout roll 25 via the intermeshing gears 29 and 30, so that the successive unit lengths of the core cord 12 are pulled away from the payoff bobbin 24 by such intermittent joint rotation of the pullout rolls 25 and 26. It is further to be understood that the pullout rolls 25 and 26 are thus rotated at a speed slightly higher than the speed at which each coil convolution is formed around the mandrel 13, to keep the core cord 12 adequately slack in order to compensate for lengthwise reduction of the core upon stitching. Seen at 41 is a brake for arresting the rotation of the shaft 35 as required.

Preferably, a guide tube may be provided as at 42 in Figure 2 for directing the core cord 12, forcibly pulled away from the payoff bobbin 24 by the pullout rolls 25 and 26 as above, upwardly therethrough to a vertical passageway 43 formed centrally through the slide 19. This passageway 43 is in open communication with the passageway 27 in the mandrel holder 17.

The mandrel holder passageway 27 is angled outwardly and upwardly from the centre of the mandrel holder 17 and has an outlet opening 44 at the circumference thereof. The other mandrel holder

passageway 28 has its inlet opening 45 located right above the outlet opening 44 of the passageway 27 and is angled upwardly and inwardly therefrom. The outlet opening 46 of the passageway 28 is located at the lower entrance end of the guide channel 16 in the mandrel 13 and is aligned with the guide channel.

It will be noted that the complete path of the cord 12 through the mandrel holder 17 is bent at obtuse angles in several locations. These obtuse-angled bends are intended to establish frictional contact between core cord 12 and mandrel holder 17 as the former passes through the latter.

In the use of the apparatus the core cord 12 unwound from the payoff bobbin 24 is first threaded between the pair of pullout rolls 25 and 26, upwardly through the passageway 43 in the slide 19, into and out of the passageway 27 in the mandrel holder 17, and then into and out of the other mandrel holder passageway 28. On emerging from the outlet opening 46 of the mandrel holder passageway 28, the core cord 12 is immediately introduced into the entrance end of the guide channel 16 in the mandrel 13.

As the apparatus is set in operation, the pair of pullout rolls 25 and 26 are rotated at regular intervals by the ratchet mechanism 36, at a speed slightly higher than the speed at which each convolution of the coil 14' is completed around the mandrel 13. The pullout rolls 25 and 26 on each actuation thus operate to forcibly pull away from the payoff bobbin 24 a unit length of the core cord 12 long enough, in relation to the pitch of the coil 14', to compensate for the lengthwise reduction of the core cord 12 occurring upon stitching thereof onto carrier tapes.

The unit length of the core cord 12 thus pulled away from the payoff bobbin 24 is introduced into the passageways 27 and 28 in the mandrel holder 17 each time the latter is lowered. Since this mandrel holder reciprocates up and down with the mandrel 13 thereon, the unit length of the core cord 12 is received in the guide channel 16 in the mandrel upon descent of the mandrel holder therewith. This unit core cord length is fed without tension into the coiler mechanism 10 as the mandrel holder 17 is raised subsequently, because the succeeding core cord portion passing through the meandering path in the mandrel holder is held in frictional contact therewith.

Thus, by the repetition of the foregoing procedure, the successive unit lengths of the core cord 12 can be fed without tension into the coiler mechanism 10, at a rate exactly corresponding to the rate of formation of the successive convolutions of the coil 14'. It will be evident that the feeding rate of the core cord 12 is easy to control through adjustment of the angle through which the pair of pullout rolls 25 and 26 are rotated on each actuation by the ratchet mechanism 36.

CLAIMS

1. A method of manufacture of a continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein, comprising feeding the core to a coiling station, whereat the coil is formed from a continuous



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lengths of the core cord from the payoff bobbin 24, and passageways 27 and 28 formed in the mandrel holder 17 for delivering therethrough the successive unit lengths of the core cord to the coiler mechanism 5 10.

As shown in greater detail in Figures 2 and 5, the pullout rolls 25 and 26 are coaxially provided with spur gears 29 and 30 respectively. These spur gears 29 and 30 are in mesh with each other and rotatable jointly with the respective pullout rolls 25 and 26. The pullout roll 25 together with the gear 29 is rotatably mounted on a lever 31 intermediate the ends of the lever 31. One end of the lever 31 is pivotally mounted at 32 on the frame 21, and a helical extension spring 33 extends between the other end of the lever and a spring retainer 34 on the frame. The pullout roll 25 is thus spring biased toward the other roll 26 for exerting pressure on the core cord 12 passing therebetween.

The other pullout roll 26 together with the gear 30 is fixedly mounted on a rotatable, stepped shaft 35 at one end thereof. Mounted on the other end of the shaft 35 is a ratchet mechanism 36 for intermittently rotating the pullout roll 26 and gear 30 through a predetermined angle. The ratchet mechanism 36 comprises a ratchet wheel 37 fixedly mounted on the shaft 35, and an actuating pawl 38 mounted on a reciprocating lever 39 and engageable with the peripheral teeth on the ratchet wheel for propelling same in a clockwise direction as viewed in Figures 1 and 5. The reciprocating lever 39 is supported at 40 by means not shown for pivotal motion about the axis of the shaft 35.

The reciprocating lever 39 of the above ratchet mechanism 36 is assumed to be driven intermittently, in timed relationship to the progress of the coiling operation by the coiler mechanism 10, completing a single reciprocation with the formation of each convolution of the coil 14' around the mandrel 13. The intermittent clockwise rotation of the pullout roll 26 is transmitted to the other pullout roll 25 via the intermeshing gears 29 and 30, so that the successive unit lengths of the core cord 12 are pulled away from the payoff bobbin 24 by such intermittent joint rotation of the pullout rolls 25 and 26. It is further to be understood that the pullout rolls 25 and 26 are thus rotated at a speed slightly higher than the speed at which each coil convolution is formed around the mandrel 13, to keep the cord 12 adequately slack in order to compensate for lengthwise reduction of the core upon stitching. Seen at 41 is a brake for arresting the rotation of the shaft 35 as required.

Preferably, a guide tube may be provided as at 42 in Figure 2 for directing the core cord 12, forcibly pulled away from the payoff bobbin 24 by the pullout rolls 25 and 26 as above, upwardly therethrough to a vertical passageway 43 formed centrally through the slide 19. This passageway 43 is in open communication with the passageway 27 in the mandrel holder 17.

The mandrel holder passageway 27 is angled outwardly and upwardly from the centre of the mandrel holder 17 and has an outlet opening 44 at the circumference thereof. The other mandrel holder

passageway 28 has its inlet opening 45 located right above the outlet opening 44 of the passageway 27 and is angled upwardly and inwardly therefrom. The outlet opening 46 of the passageway 28 is located at the lower entrance end of the guide channel 16 in the mandrel 13 and is aligned with the guide channel.

It will be noted that the complete path of the cord 12 through the mandrel holder 17 is bent at obtuse angles in several locations. These obtuse-angled bends are intended to establish frictional contact between core cord 12 and mandrel holder 17 as the former passes through the latter.

In the use of the apparatus the core cord 12 unwound from the payoff bobbin 24 is first threaded between the pair of pullout rolls 25 and 26, upwardly through the passageway 43 in the slide 19, into and out of the passageway 27 in the mandrel holder 17, and then into and out of the other mandrel holder passageway 28. On emerging from the outlet opening 46 of the mandrel holder passageway 28, the core cord 12 is immediately introduced into the entrance end of the guide channel 16 in the mandrel 13.

As the apparatus is set in operation, the pair of pullout rolls 25 and 26 are rotated at regular intervals by the ratchet mechanism 36, at a speed slightly higher than the speed at which each convolution of the coil 14' is completed around the mandrel 13. The pullout rolls 25 and 26 on each actuation thus operate to forcibly pull away from the payoff bobbin 24 a unit length of the core cord 12 long enough, in relation to the pitch of the coil 14', to compensate for the lengthwise reduction of the core cord 12 occurring upon stitching thereof onto carrier tapes.

The unit length of the core cord 12 thus pulled away from the payoff bobbin 24 is introduced into the passageways 27 and 28 in the mandrel holder 17 each time the latter is lowered. Since this mandrel holder reciprocates up and down with the mandrel 13 thereon, the unit length of the core cord 12 is received in the guide channel 16 in the mandrel upon descent of the mandrel holder therewith. This unit core cord length is fed without tension into the coiler mechanism 10 as the mandrel holder 17 is raised subsequently, because the succeeding core cord portion passing through the meandering path in the mandrel holder is held in frictional contact therewith.

Thus, by the repetition of the foregoing procedure, the successive unit lengths of the core cord 12 can be fed without tension into the coiler mechanism 10, at a rate exactly corresponding to the rate of formation of the successive convolutions of the coil 14'. It will be evident that the feeding rate of the core cord 12 is easy to control through adjustment of the angle through which the pair of pullout rolls 25 and 26 are rotated on each actuation by the ratchet mechanism 36.

CLAIMS

1. A method of manufacture of a continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein, comprising feeding the core to a coiling station, whereat the coil is formed from a continuous

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filament while receiving the core in place within its convolutions, by the step of forcibly pulling away from core payoff means a unit length of the core required for each convolution of the coil, and the

- 5 step of delivering the unit length of the core to the coiling station, the foregoing steps being repeated with the formation of each convolution of the coil, wherein the step of delivering the unit length of the core to the coiling station is carried out by
- 10 reciprocating movement in a delivery direction and a return direction of a member which frictionally engages the core, said member being upstream of the coiling station relative to the direction of delivery of the core to the coiling station, whereby the core is
- 15 substantially slack at the coiling station during the movement in the delivery direction of said member, to allow for possible subsequent lengthwise reduction of the core.

2. Apparatus for the manufacture of a
- 20 continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein, the apparatus being of a type including a coiler mechanism for coiling a continuous filament while introducing the core into
- 25 place within the convolutions of the coil, and a reciprocating member disposed adjacent to the coiler mechanism and arranged to be controlled by a reciprocating mechanism to make a single reciprocation relative to the coiler mechanism
- 30 during the formation of each convolution of the coil, the apparatus comprising means for paying off the core, means adapted to be actuated intermittently for forcibly pulling away from the payoff means successive unit lengths of the core required for
- 35 successive convolutions of the coil, and a passageway in the reciprocating member through which the core passes from the pulling means to the coiler mechanism, the passageway being adapted to hold the core at least partly in frictional contact with
- 40 the reciprocating member, the reciprocation of which is towards and away from the pulling means whereby the successive unit lengths of the core are delivered to the coiler mechanism in step with the formation of the successive convolutions of the coil
- 45 and whereby the core is substantially slack at the point of delivery to the coiler mechanism during the time that the reciprocating member is moving away from the pulling means, to allow for possible subsequent lengthwise reduction of the core.

- 50 3. Apparatus for the manufacture of a continuous length of helicoidal-coil type coupling element together with a continuous core received in place therein, the apparatus comprising means for paying off the core, means actuated intermittently
- 55 for forcibly pulling away from the payoff means successive unit lengths of the core required for successive convolutions of the coil, a mandrel around which a continuous filament is coiled, the mandrel having a guide channel formed
- 60 longitudinally therein for slidably receiving the core to be positioned within the convolutions of the coil, and a mandrel holder holding the mandrel adjacent one end thereof and reciprocating with the latter in the longitudinal direction thereof away from and
- 65 towards the pulling means in step with the formation

of each convolution of the coil around the mandrel, the mandrel holder having formed therein a passageway through which the core travels from the pulling means to the entrance end of the guide channel in the mandrel at said one end thereof, the

70 passageway being adapted to hold the core at least partly in frictional contact with the mandrel holder, whereby the successive unit lengths of the core are delivered to the guide channel in the mandrel in step

75 with the formation of the successive convolutions of the coil, and whereby the core is substantially slack at the point of delivery to the guide channel in the mandrel during the time that the mandrel and mandrel holder are moving away from the pulling

80 means, to allow for possible subsequent lengthwise reduction of the core.

4. Apparatus according to claim 2 or 3, wherein the pulling means comprises a pair of rolls urged toward each other.
- 85 5. Apparatus according to claim 4, wherein the pair of rolls are actuated intermittently by a ratchet mechanism.
6. Apparatus according to claim 2 or 3, wherein the passageway is bent to establish the frictional
- 90 contact of the core with the reciprocating member.
7. Apparatus according to claim 2 or 3, wherein the passageway has a plurality of obtuse-angled bends to establish the frictional contact of the core with the reciprocating member.