WEFT INSERTION NEEDLES IN WEAVING MACHINES
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ABSTRACT OF THE DISCLOSURE

In looms in which a weft is fed to the warp from stationary bobbins located outside the shed by reciprocating weft inserting needles which are comprised of a flexible ribbon attached at its leading end to a head portion which carries the weft, the trailing end of such ribbon reciprocates in a bow shaped guide and in order to reduce the resistance to bending of the trailing end of the ribbon such as provided with a shaped prolongation which allows said portion to more readily conform to the shape of the bow.

The invention relates to the needles used in weaving machines, particularly of the comparatively wide type, with a continuous weft feed provided by large bobbins situated outside the shed.

These needles usually consist of two elements, i.e., a flexible ribbon and a rigid part, and this latter itself comprises a needle body and a head, the front part of the ribbon being affixed to the said needle body.

In a conventional type of machine for this purpose, such as that described, for example, in the applicant's U.S. Patent No. 2,323,321, a driving wheel, with teeth or projections, engages perforations in the ribbon and causes the needle to move to and fro; outside the shed, the edges of the ribbon are held in a straight slide bar continuing in the form of a restoring device or arch, guiding the ribbon towards the lower part of the machine.

In such machines the ribbon usually consists of two superimposed strips, generally of a material known as "Celron." These superimposed tapes are only integral with each other in the place where they are affixed to the needle body, while over the remainder of their length they are not affixed to each other, and this enables them to adjust themselves in their position in relation to each other in the curved parts of their trajectory.

The invention particularly concerns the flexible ribbon and, still more specifically, the rear extremity thereof.

It will be easily understood that when a ribbon of this kind performs its movements in the bow-shaped guide it tends to remain straight and that owing to the inevitable play between the ribbon and the parts of the bow the back of the rear extremity of the ribbon forms a certain angle with the wall of the corresponding guide part, i.e., with the wall having the maximum radius of curvature; this end of the ribbon thus exerts an intense scraping effect on the said guiding element, as the local pressure in that position is increased. The bending of the rear extremity of the ribbon brings three forces into action, namely: (i) the above mentioned pressure at the terminal part of the ribbon; (ii), a pressure of the same direction and on the other side of the bearing point of the interior of the ribbon against the wall of the guiding element having the minimum radius of curvature; and (iii) at said bearing point, the opposite force resulting from the two mentioned pressures. The resistance to the sliding motion of the ribbon created by said three forces has, in turn, an effect upon the driving of the ribbon by the wheel, and, through the radial meshing component, has also an effect

upon the friction of the upper face of the ribbon against the guiding plates which prevent rising of the ribbon in the meshing zone. There is consequently an abnormal degree of fatigue of the said ribbon as well as of the guides and of the driving means.

The purpose of the invention, which relates in particular to ribbons consisting of two superimposed strips but which may also be applied to ribbons of one single thickness, is to bring about a high reduction of the total pressure exerted by the end of the ribbon on its guiding devices and to reduce and even nullify the angle of attack formed between the end of the back of the ribbon, on the one hand, and the wall of the bow-shaped guide, on the other, ensuring that a relatively wide area of the ribbon instead of one single terminal edge thereof bears on the bow, thus considerably reducing the pressure per unit of area.

For this purpose, the invention provides that the rear end of the ribbon is to have a prolongation of which the cross section is far smaller than that of the ribbon itself, the length and the said cross section of the prolongation being such that the greater part of the back of the latter bears against the corresponding wall of the bow or other return movement device.

This particular construction not only prevents the terminal edge of the back of the ribbon from continuing to bear on the bow in accordance with a certain angle but also ensures that the prolongation is applied against the bow over a considerable length and with a total pressure highly reduced, in such a way that the contact pressure per unit of area, between the extremity of the ribbon and the bow-shaped guide is considerably reduced.

The advantage of this construction is increased: when certain of the guiding devices for the flexible ribbon consist of solid lubricants since by reducing the pressure of the rear terminal part of the prolongation of the ribbon against its guiding elements the strain to which these latter are subjected is reduced, so that they undergo less wear.

The invention also relates to methods by which it can be carried out, embodying at least one of the following characteristics:

(a) The cross section of the prolongation of the ribbon decreases towards its extremity, in order to form a solid of substantially equal strength throughout.

(b) The terminal part of the ribbon prolongation of decreasing cross section is of the same thickness as the ribbon itself and is bevelled on the back.

(c) The progressive reduction in the cross section of the prolongation of the ribbon is produced by providing transversal grooves thereon, their depth increasing as the extremity of the prolongation is approached.

(d) If the ribbon consists of two superimposed strips, the aforementioned prolongation of the ribbon consists of an excess length of the external strip in relation to the internal strip.

(e) The prolongation of the external strip is made thinner, so that its cross section will decrease as its extremity is approached.

(f) The prolongation of the external strip is made thinner on the back, the terminal part having the entire thickness of the strip and comprising a chamfer on the back.

(g) That end of the back of the internal strip which bears on the back of the external strip is chamfered.

(h) The ribbon arranged as described under (d) comprises an internal strip provided with a prolongation, the external strip being itself prolonged in relation to the internal strip.

(i) The prolongations of the internal strip and of the external strip of the ribbon as described under (h) are
made thinner so that their cross section will decrease as their extremity is approached.

The invention will be better understood from the following description and from a study of the attached drawings, in which embodiments of the invention are illustrated as examples and without any limiting effect.

On the said drawings:

FIG. 1 is a front elevation of the left-hand side of a weaving machine to which the invention is applied.

FIG. 2 is a cross section, on a larger scale, along the line III—III of FIG. 1. The bow shown in FIG. 1.

FIG. 3 is a schematic diagram, on a large scale, of a portion of the bow, in longitudinal section along the line III—III of FIG. 2, and showing, by way of comparison, a portion of the ribbon of which the rear end is shaped in accordance with prior art.

FIG. 4 is a view similar to FIG. 3, but in this case the ribbon is in accordance with the invention.

FIG. 5 shows a first alternative version of the extremity of the ribbon illustrated in FIG. 4.

FIG. 6 shows a second alternative.

FIG. 7 shows a further constructional version of the end of the ribbon.

In FIGS. 3, 4, 5 and 7, in order to show more distinctly the positions of the clearances and of the points of contact of the various elements, the thicknesses of the ribbon have been exaggerated in the radial direction in relation to the radius of curvature.

The batten is marked 1, while the support 2, controlled in a known manner by the crankshaft (not shown) oscillates about a horizontal shaft 3 supported by the frame 4 of the machine. The batten 1 is provided in the known manner with guides 5 for the weft inserting needle which is comprised of the flexible ribbon 6 attached to its leading end to a head portion comprising (not shown in the drawing) the needle body and the head. To drive and guide the trailing portion of the weft inserting needle a frame 7 is affixed, at 8, to the upper part of the batten 1.

A bow 9 is affixed to the upper part and to the lower part of the frame 7, at 10 and 11 respectively; it guides the ribbon 6 in its return movement towards the lower part of the machine, where it is received in a conduit 12. In the embodiment illustrated the frame 7 comprises two inclined uprights 7A and 7B, which are affixed, by their lower extremities, at 13 and 13' respectively, to the upper part of an oscillating case 14 of the type described in the applicant's U.S. Patent No. 2,688,344. This case contains a cam 15 with a groove 16 taking a sinusoidal course and engaged by a roller 17 mounted on the lower end of an oscillating lever 18 supported by a shaft 19 orthogonal to the shaft 3 and supported by the oscillating case 14.

The cam 15 is integral with the shaft 3, which is caused to perform one rotation by each rotation of the crankshaft. The upper end of the lever 18 is equipped with a toothed sector 20 which engages with a pinion 23 integral with a cogwheel 24 of which the teeth engage central perforations in the ribbon 6. The cogwheel 24 and the pinion 23 are borne by a shaft 25 secured at each end in a support 26 integral with the frame 7 and with the bow 9.

The rotation of the shaft 3 thus sets up an oscillating movement in the toothed sector 20, resulting in an alternating rotation of the cogwheel 24, which, in turn, imparts its reciprocating movement to the ribbon 6.

The structure hitherto described is of the known type. Likewise in accordance with prior art, the ribbon 6 is formed by the superimposition of two strips 6A and 6B (FIG. 3) which are of the same length in the rectilinear state made integral with each other at their front extremities (not shown) where affixed to the needle body. In view of the curvature assumed by the ribbon when moving into the bow-shaped guide, the strip 6B, which is situated inside, i.e. on a smaller radius, assumes an apparent length slightly greater than that of the external strip 6A, so that its extremity projects slightly in relation to that of the external strip, as shown.

The ribbon formed by the two strips 6A and 6B shows the greater resistance to bending, the smaller the distance between the points of application of the forces, this being the case with the terminal portion CD, of which the shape is almost rectilinear as a result of the rigidity, resulting in the minimum distance between the extremities C and D.

The extremity of the external strip 6A thus bears firmly against the ribbon guiding element 31 at the point C, the said element consisting, in the example shown, of a strip of steel providing an internal closure for the bow-shaped guide, in the interior of which the said ribbon slides, while the internal strip 6B exerts on the bow 9, in the zone D, a high pressure which is the resultant of the above mentioned pressure at the point C and of a force applying the back of the strip 6A on the guiding element 31 in the zone E.

Despite the chamfer 36 provided on the end of the back of the external strip 6A, as shown, the angle "a" formed between the terminal portion of this strip and the guiding element 31 and the high value of the pressures involve the drawbacks already explained.

In order to remedy these drawbacks, in accordance with the invention, the rear extremity of the ribbon has been provided with a prolongation, i.e. in the particular case of a ribbon consisting of two strips 6A and 6B this prolongation has been provided in the form of an excess length for the strip 6A in relation to the strip 6B, as shown at 33 in FIG. 4.

The part of the strip 6B nearest to its end rests, by its interior, and in the zone D, against the bow-shaped guide 9, while the extremity of its back rests against the interior of the external strip 6A, and the pressure at the end of the said external strip is produced solely by the resistance of this one external strip to bending, while in the systems adopted hitherto it was the sum of the resistances of the two strips; furthermore, the grazing angle a is considerably reduced, and the contact surfaces presented by the strip to their respective guiding systems are increased, resulting in much lower pressures per unit of area.

In an advantageous version, shown in FIG. 5, the prolongation 35 of the external strip 6A is made thinner on the inside in order to give it a cross section even decreasing as its extremity is approached, so that the said prolongation forms a solid of substantially equal strength.

To preserve the firmness desirable at the extremity of the said prolongation, the terminal part of the latter has the entire thickness of the strip 6A, as illustrated, the extremity of its back being chamfered, as shown at 36.

The external strip thus provided with a prolongation 35 constructed in the form of a solid of even strength favours a uniform contact pressure of the back of the said prolongation against the guiding device and ensures that the ribbon will be able to move with the desired flexibility in the bow-shaped guide, particularly when the movement takes place in the direction in which the needle is withdrawn from the fabric.

FIG. 6 shows an alternative to FIG. 5, differing from the latter in the means used to provide the prolongation of the strip, in the form of a solid of equal resistance. For this purpose, transversal grooves 38 are made in the interior of the prolongation 39 of the strip 6A, at depths progressively increasing as the extremity of the said prolongation is approached, as illustrated. The diagram also shows the chamfer 36 extremity of the back of the prolongation 39. If the external strip 6A is provided with perforations in its prolongation 39, as shown at 41, the transversal grooves 38 are preferably provided in the intervals between the said perforations.

In the constructional version shown in FIG. 7, the two strips 6A and 6B each have an additional length, the prolongation 42 of the internal strip 6B being shaped so as to conform with prolongation 35 of the external strip 6A of FIG. 5 the said prolongation 42 of the internal strip 6B terminating at the point where the prolongation 35
of the external strip 6A commences to show a decreasing cross section.

This structure, which provides a further increase in the contact area between the back of the external strip and the guiding element, enhances the advantages explained in connection with FIG. 5.

Although the invention has been described in the form of a prolongation of the ribbon, formed by a supplementary length for one or both the strips of the said ribbon, assumed to consist of two superimposed strips, the invention is likewise applicable to ribbons consisting of more than two strips and also to ribbons of one single thickness. In this latter case, the prolongation has a smaller cross section than that of the ribbon, and all the characteristics explained can be applied to it, particularly the decrease in the cross section as the extremity is approached, by any means available, so that it takes the form of a solid of substantially equal strength, and the presence of a terminal chamfer on the back, the terminal part of the said prolongation then having preferably retained the total thickness of the ribbon.

Needless to say, the invention is not confined to the embodiments described and illustrated, and modifications can be introduced without thereby departing from the scope of the invention.

I claim:

1. In a weaving machine wherein a weft is supplied from stationary packages and inserted by at least one reciprocating weft inserting needle of the type consisting of a flexible ribbon and a rigid head portion comprising a needle body and a needle head, the leading portion of the ribbon being affixed to the said needle body, needle guide means located outside the shed and operating to guide the ribbon during its reciprocating movement, a portion of said guide being generally in the form of a bow which guides the trailing portion of said ribbon towards the lower part of the machine, the improvement comprising, forming the rear extremity of the ribbon with a prolongation having a cross section substantially smaller than that of the said ribbon and in which the length of said prolongation in combination with said cross sectional shape is sufficient to allow the entire outer extremity of the said prolongation to rest against the corresponding surface of the bow.

2. A weft inserting needle in accordance with claim 1, wherein the cross section of the prolongation decreases towards its trailing extremity.

3. A weft inserting needle in accordance with claim 2, wherein the terminal portion of the prolongation is provided with a chamfered tip of the same thickness as that of the ribbon.

4. A weft inserting needle in accordance with claim 2, wherein the progressive reduction in the cross section of the prolongation is obtained by providing transversal grooves in the said prolongation, at depths which increase as the trailing end of the latter is approached.

5. A weft inserting needle in accordance with claim 1, wherein the ribbons are formed of superimposed strips and the prolongation constitutes an excess in length of the external strip relative to the internal strip.

6. A weft inserting needle in accordance with claim 5, wherein the prolongation of the external strip is thinner, so that its trailing cross section will decrease towards its extremity.

7. A weft inserting needle in accordance with claim 5, wherein the prolongation of the external strip is thinner in an intermediate portion and its trailing terminal portion is formed with a chamfered tip equal in thickness to that of the strip.

8. A weft inserting needle in accordance with claim 5, wherein the inner extremity of the internal strip at its trailing extremity is chamfered.

9. A weft inserting needle in accordance with claim 5, in which the internal strip is provided with a prolongation, and in which the external strip is itself prolonged in relation to the internal strip.

10. A weft inserting needle in accordance with claim 9, wherein the prolongations of the internal strip and of the external strip of the ribbon are thinner, so that their cross sections will decrease as their extremities are approached.

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