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Gripper and weft insertion device for a gripper weaving machine

The invention relates to a gripper for a gripper weaving machine according to the pre-characterizing clause of Claim 1 and to a weft insertion device with a gripper.

To insert a weft thread, either one gripper is used for leading the weft thread through the shed or a feed gripper and pick-up gripper are employed, the weft thread being transferred from the feed gripper to the pick-up gripper inside the shed. The grippers have thread clamps which are controlled positively, that is to say forcibly, outside the shed in the first-mentioned version and inside the shed in the second version. For this purpose mechanical or electromechanical means are employed, the operating element for opening or closing the thread clamp being arranged outside or below the shed. Particularly in the case of thread transfer inside the shed, this results in essentially the following disadvantages.

If mechanical means are used, the operating element must be introduced between the warp threads in order to operate the thread clamp.

If electromagnetic means are used, the trigger magnet must be arranged outside the shed. The airgap between the armature and magnetic core consequently becomes large, and because of this a higher field strength has to be generated, that is to say a winding with a greater number of ampere-turns is required. Since this trigger magnet is capable of slow-action switching, this results in a reduction in the speed of the weaving machine.

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In the case of thread transfer inside the shed, the travels of the grippers intersect in the transfer region. That is to say, thread transfer takes place while the feed gripper and pick-up gripper are still in motion. The activation of the thread clamp takes place at this moment, during which the operating element exerts pressure on the gripper. This results in a greater load and higher wear on the elements involved in operating the thread clamp, such as the gripper band or gripper rod or the batten and band guide or rod guide. Moreover, as a result of pressure being exerted in this way, the band gripper is pressed against the warp threads, thus causing breaks in the warp threads. For this reason, the gripper band and its guides have to be reinforced. As a consequence of this, the moved masses become greater, thus contradicting the requirement for masses which are as low as possible and therefore a reduction in the rotational speed of the weaving machine. It must also be taken into account that inside the shed, because of the high rate of production, the grippers may oscillate in the transfer region and collide with the operating elements. Special measures therefore become necessary in order as far as possible to reduce oscillations with such a frequency and amplitude.

As is known, the clamping force is predetermined by the type of thread. In both the mechanical and the electromechanical control of the thread clamp, therefore, the clamping force has to be set accordingly. For weaving with different types of thread, controls of this type prove at the very least to be restrictive, because, on the one hand, an average clamping force has to be fixed by means of tests and, on the other hand, adaptation of the clamping force while the weaving machine is in operation is not possible and is therefore not provided.

The embodiments described above also have the disadvantage that each point of influence is assigned an arrangement of operating elements for controlling the thread clamp, specifically:

a) feed gripper: activation in the shed centre,
b) pick-up gripper: activation in the shed centre,
c) feed gripper: activation of the thread read-in on the insertion side,
d) pick-up gripper: thread release on the catching side, and
e) feed gripper: activation of venting on the insertion side.

Up to five arrangements are therefore necessary, which have to be activated individually.

This results in the following disadvantages:

1) maintenance of up to five arrangements;
2) a high failure rate;
3) drop in performance, and
4) a high cost outlay.

The known versions are therefore unsuitable for controlling the thread clamp.

The invention, as characterized in the claims, achieves the object of improving a gripper and a weft insertion device.

The thread clamp of the gripper is controlled positively, that is to say without forces acting from outside, by means of an actuator arranged in the gripper, so that any load on the gripper head, the gripper guide and the warp threads is avoided. Readjustments and repairs to the gripper elements may therefore largely be dispensed with. Breaks in the warp threads are avoided, with the result that the operating

costs are lowered considerably and the weaving output is increased considerably. The thread clamp can be influenced weft by weft, while the weaving machine is in operation and within a weaving cycle, in accordance with the physical and weaving data of the weft thread to be inserted. The desired value of the clamping force of the thread clamp is set and regulated by means of the control.

In the course of the weft insertion cycle, the following functions are performed by the thread clamp:

1. The feed gripper takes over the weft thread from the thread feeder and
2. transports the weft thread into the shed;
3. the weft thread is transferred from the feed gripper to the pick-up gripper approximately in the shed centre;
4. at the end of the insertion operation, the thread clamp of the pick-up gripper releases the weft thread;
5. the thread clamps are vented for cleaning, and
6. if necessary, the clamping force of the thread clamps is changed.

The thread clamps for the feed gripper and pick-up gripper are essentially of similar design, with the result that the actuators are activated by means of the same control device. The production costs are thereby reduced considerably. By transformers being used in order to operate the thread clamp, the action of force on the grippers is avoided. By virtue of these measures, it is possible to operate a gripper weaving machine at up to a 1000 revolutions per minute, with different yarns, such as zero twist or knub yarn, being processed simultaneously.

The invention is explained below with reference to the accompanying drawings in which:

Figure 1 shows a first embodiment of a gripper according to the invention;

Figure 2 shows a second embodiment of a gripper according to the invention;

Figure 3 shows a third embodiment of a gripper according to the invention;

Figure 4 shows a fourth embodiment of a gripper according to the invention;

Figure 5 shows a force/time diagram of the cycle of the thread-clamping action within one weft insertion, and

Figure 6 shows an embodiment of a weft insertion device according to the invention.

Reference is made to Figure 1 which shows one embodiment of a gripper according to the invention. The gripper contains a housing 1, an electromagnet 2 and a thread clamp 3. The housing 1 consists of a basic body 4 and of a cover part 5 which are connected to one another by means not illustrated. The electromagnet 2 is arranged, on one side, on the basic body. The thread clamp 3 comprises a clamping lever 6 which is designed as a two-armed lever and is arranged pivotably on a shaft 7, and a clamping surface 8 formed on the basic body 4. One lever arm has a clamping portion 9, which co-operates with the clamping surface formed on the basic body 4, and, at the free end, an angled portion 10 which, together with the basic body, forms an entry gap for a weft thread (not illustrated). At the end facing away from the entry side of the gripper, a connecting portion 11 for a transport unit is formed on the basic body 4. Furthermore, a spring 12 is provided,

in order to prestress the clamping portion 9 against the clamping surface 8. Moreover, the gripper is equipped with a stop member 15 for the weft thread. In order to generate the translational movement for operating the clamping lever, a linear motor or a servomotor may be employed. If drive means of this type are used, the clamping lever is advantageously coupled to the drive shaft of the motor.

In the embodiment according to the invention, as shown in Figure 2, the gripper contains a housing 21, a thread clamp 22 and a piezoelectric quartz element 23. The housing consists of a basic body 24 and a cover part 25. The thread clamp comprises a strip-like clamping part 26, which consists of a resilient material, and a clamping portion 17 formed on the basic body 24. The clamping part 26 is fastened at one end to the basic body 24 and at the other end is provided with an angled portion 27 which forms with the basic body an entry gap for a weft thread which is not illustrated. The clamping part 26 is provided with an extension 28 and a pin 29 which projects transversely to the extension. The piezoelectric quartz element 23 is fastened, on one side, to the basic body and, on the other side, is provided with a coupling part 30 which is in engagement with the pin 29. At the end facing away from the entry side of the gripper, the connecting portion 11 for the transport unit is formed on the basic body 24.

The embodiment according to the invention, as shown in Figure 3, differs from that of Figure 1 in the design and arrangement of the electromagnet. The gripper contains a housing 31, a thread clamp 32 and an electromagnet 33. The housing consists of a basic body 34 and of a cover part 35. The thread clamp 32 contains a guide member 36 for a weft thread, not illustrated, and a clamping part 37. The guide member 38 is of

strip-like design and has an angled portion 38. The clamping part 37 is likewise of strip-like design and has an angled portion 39. The clamping part is arranged so as to rest on the guide part, so that the angled portions 38, 39 form a V-shaped entry gap for a weft thread which is not illustrated. The electromagnet 33 has a U-shaped core 43 and a winding 40 and is arranged below the guide part in such a way that the guide part rests on the end faces of the legs of the core. In this embodiment, the guide part 36 consists of magnetically non-conductive material, whilst the clamping part 37 forms a magnet armature and consists of magnetically conductive material. The basic body 34 likewise has the connecting portion 11 for the transport unit. In this embodiment, a stop bar 41 is provided instead of the stop member.

The embodiment according to the invention, as shown in Figure 4, differs from that according to Figure 2 only in the design and arrangement of the piezoelectric quartz element. When electrical current is applied to the piezoelectric quartz element 19, the latter likewise expands in the x-direction and closes the thread gap 55 so that the weft thread is clamped. There is no need for a further detailed description.

In the embodiments described above, the actuator is in each case operated by induction. For this purpose, a primary induction coil 70, which is arranged outside the gripper, and a secondary induction coil 71, which is arranged in the housing 1, 21, 31 of the gripper, are provided. Also arranged in the housing are a current converter and amplifier 72 which are connected to the actuator via junction leads 52. An orifice 75 is provided in each case in the cover part 5, 25, 35.

Reference is made to Figure 5. The following description is based on the embodiment according to

Figure 2. The figure shows a diagram with an abscissa for the angle of rotation of the main shaft of the weaving machine and with an ordinate for the clamping force. As shown in the figure, three operating positions, specifically holding A, clamping A+B and venting A-C, are defined for the thread clamp as a function of the angle of rotation. Each operating position is assigned a force A, B, C. The holding force A is exerted solely by the resilient element 26 and acts even when the weaving machine and the actuator is switched off. The weft thread to be inserted is first introduced into the open thread clamp and is subsequently subjected to the clamping force B generated by the actuator. The clamping of the weft thread takes place with a force which is the sum of the forces A+B. The clamping force B is continuously adjustable up to the maximum, so as reliably to avoid weft thread losses. During the transfer of the weft thread from the feed gripper to the pick-up gripper, the actuators are reversed according to a control program, so that a venting force is generated which is the difference between the forces A-C. After the insertion operation has been concluded, the thread clamp, which is in the venting position, can be blown out. The operation described above applies to the feed gripper and also to the pick-up gripper with a contrary cycle.

Figure 6 shows a weft insertion device with a feed gripper 61, a pick-up gripper 62, a transport unit 64 which conveys the feed gripper and the pick-up gripper in each case over the centre 63 of the weaving width, and a device for operating the actuators. The transport unit 64 comprises a gripper band 66 with a guide 69 and a band wheel 67 which is drive-connected to a drive means not illustrated. The gripper band consists of a flexible material, for example a composite plastic. The device for operating the actuators is arranged in the

region of the thread transfer above the shed formed and on both sides of the centre 63. The device contains two air-core transformers or commutators, which comprise a primary induction coil 70 and the secondary induction coil 71 arranged on the gripper 61, 62, and a control device 65 which is connected via leads 68 in each case to the primary induction coil 70, in order to control the primary induction coils as a function of the angle of rotation of the main shaft of the weaving machine and/or the textile or weaving data.

Patent Claims

1. Gripper for a gripper weaving machine, with a housing (1, 21, 31), with a thread clamp (3, 22, 32, 56) and with a connecting portion (11) for a gripper band or a gripper rod (66), characterized by an electrically operable actuator (2, 23, 33, 19) which is arranged in the housing and is at least drive-connected or directly connected to the thread clamp, in order to control the clamping force and clamping cycle of the thread clamp directly.

2. Gripper according to Claim 1, characterized in that the actuator (2, 23, 33, 19) is connected to the thread clamp (3, 22, 32, 56).

3. Gripper according to Claim 1 or 2, characterized in that the actuator is an electromagnet (2, 33).

4. Gripper according to Claim 1 or 2, characterized in that the actuator is a piezoelectric quartz element (23).

5. Gripper according to Claim 1 or 2, characterized in that the actuator is a linear motor or a stepping motor.

6. Gripper according to one of Claims 1 to 5, characterized by an elastic element (12, 26) in order to prestress the thread clamp.

7. Gripper according to Claim 6, characterized in that the elastic element (12, 26) is intended for generating a partial clamping force which is lower than the clamping force generated by the actuator.

8. Weft insertion device for a gripper weaving machine, with a transport unit (64) for a feed gripper and a pick-up gripper, in order to move the grippers back and forth in translational motion, and with a gripper according to one of Claims 1 to 7, characterized by a device for operating the actuator (2, 23, 33, 19) and by a control device (65) in order to control the actuator (2, 23, 33, 19) as a function of the angle of rotation of the main shaft and/or of the textile or weaving data.

9. Device according to Claim 8, characterized in that the control device (65) has a microprocessor in order to control the actuator by the open-loop or the closed-loop method.