A selvedge tucker for the formation of a cloth edge in a weaving machine is presented which comprises a selvedge tucking needle for tucking in one or more weft thread ends into a shed as well as an electrical drive for moving the selvedge tucking needle, with an emergency operating system and/or emergency drive being provided for the selvedge tucking needle in order to move the latter into a safe position in the event of a disturbance.
SELVEDGE TUCKER FOR WEFT THREADS

[0001] The invention relates to a selvedge tucker for forming a cloth edge in a weaving machine in accordance with the preamble of claim 1 and to a weaving machine with a selvedge tucker of this kind.

[0002] In order to form a firm cloth edge, the ends of the weft threads which are inserted into a shed are cut off with excessive length in a weaving machine after the completion of the weft insertion and the free ends are tucked into the open shed after one of the next shed changes, but however still prior to the corresponding beating up of the weft thread. As a rule the tucking in of the weft thread ends takes place either mechanically, pneumatically or pneumo-mechanically. An example of a purely mechanical tucking apparatus with a selvedge tucking needle is disclosed for example in the specification EP-A-0 454 238. An example of a pneumo-mechanical embodiment is known from EP-A-0 134 377. In this pneumo-mechanical embodiment a selvedge tucking needle with an eye is used, into which the thread end is threaded by means of compressed air. The disadvantage of both the mechanical and the pneumo-mechanical tucking apparatuses consists in the fact that their use is limited by reason of the mechanical drive of the selvedge tucking needle to certain maximum speeds of rotation of the weaving machine and that the mechanical drive is complicated and expensive.

[0003] In order nevertheless to enable higher speeds of rotation of the weaving machine in the manufacture of cloths with selvedge edges, purely pneumatic tucking apparatuses, so-called air tuckers, are used. A typical example of a pneumatic tucking apparatus of this kind, which is also termed a jet selvedge tucker or air tucker, can be found in the specification EP-A-1 088 922. The tucking apparatus which is described in that document comprises a jet arrangement with a plurality of jets which is arranged outside the cloth width in order to blow the weft thread ends into a shed.

[0004] In the case of harderv and/or stiffer yarns it is however difficult to manufacture an unobjectionable cloth edge with a selvedge tucker of this kind. Thus, by way of example, the thread ends of stiffer yarns can completely or partly jump back out of the tucked in position (the latter leads to the formation of loops at the cloth edge) and/or the thread ends of such yarns can penetrate completely or partly through the upper or lower shed before the thread ends together with the following weft thread are beaten up and bound in. The penetration of the upper or lower shed by the weft thread ends is also designated as through bleeding. Because of the cloth faults which are caused by the incorrect tucking in of the weft thread ends the cloth is classed as lower quality. Problems can also arise with normally pliable yarns if a plurality of weft thread ends, e.g. two weft thread ends are inserted into the same shed. In this case one weft thread end is frequently tucked in properly, whereas the other weft thread end is not correctly positioned.

[0005] A tucking apparatus is disclosed in the specification U.S. Pat. No. 5,158,119 which comprises one electrical linear motor with a position sensor each in order to drive each of the linear movement and the rotational movement of a selvedge tucking needle. In the event that the position sensors detect a functional fault, the movement of the linear motors can be stopped in order to avoid collisions between the reed and the selvedge tucking needle. The tucking apparatus which is disclosed in U.S. Pat. No. 5,158,119 has the disadvantage that it is not possible to avoid a collision between the reed and the selvedge tucking needle in all cases of disturbance which arise in practice. Thus, by way of example, in the event of a power failure the reed will still execute at least one beat-up movement as a result of the kinetic energy which is stored in the moving parts of the weaving machine, whereas the linear motors which drive the selvedge tucking needle stop practically instantly and can not in general be stopped in a safe position. A similar situation occurs when, for example, the supply voltage of the linear motors which drive the selvedge tucking needles fails, for example through overloading or short circuit. In this case as well it is not possible to stop the linear motors in a position in which a collision between the reed and the selvedge tucking needle is reliably avoided.

[0006] The object of the invention is to make available a selvedge tucker for forming a cloth edge in a weaving machine which can be used at higher speeds of rotation of the weaving machine, in particular at 1000 insertions per minute and more, and which produces an unobjectionable cloth edge even in the case of stiffer yarns. In addition, in cases of disturbance, such as for example in the case of power failures, a collision between the selvedge tucking needle and the remaining parts of the weaving machine should be avoided. A further object of the invention consists in making available a weaving machine with a selvedge tucker of this kind.

[0007] This object is satisfied in accordance with the invention by the selvedge tucker which is characterized in claim 1 as well as by the weaving machine which is characterized in claim 8.

[0008] The selvedge tucker in accordance with the invention for the formation of a cloth edge in a weaving machine comprises a selvedge tucking needle for tucking one or more weft thread ends into a shed as well as an electrical drive for moving the selvedge tucking needle, with an emergency operating system and/or emergency drive additionally being provided for the selvedge tucking needle in order to move the latter into a safe position and hold it there in the event of a disturbance. A safe position is understood in this context to mean a position in which collisions between the selvedge tucking needle and the remaining parts of the weaving machine are avoided. Thus, in particular, collisions of the selvedge tucking needle with moving parts of the weaving machine such as for example with the reed or a rapier of a rapier weaving machine or a projectile of a projectile weaving machine are avoided. Collisions of this kind generally lead to damage to the selvedge tucking needle and, in the event of a collision with the reed, to damage to the reed as well.

[0009] In a preferred embodiment the selvedge tucking needle is pivotally and/or displaceably mounted. Optionally a shaft which is connected to the selvedge tucking needle can be pivotally and/or displaceably mounted.

[0010] In a preferred variant the selvedge tucker comprises an active connection between the electrical drive and the selvedge tucking needle and/or the shaft, in order to displace the selvedge tucking needle forward or backward by means of the electrical drive, as well as an additional compulsory guide for the selvedge tucking needle and/or for the shaft, such that a pivotal movement of the selvedge
tucking needle is additionally produced by the forward and backward displacements respectively.

[0011] In a further preferred variant the selvedge tucker comprises an active connection between the electrical drive and the selvedge tucking needle and/or the shaft such that the selvedge tucking needle can be pivoted in and out by means of the electrical drive, as well as an additional compulsory guide for the selvedge tucking needle and/or for the shaft in such a manner that a forward or backward displacement is additionally associated with the pivoting in and out respectively.

[0012] The electrical drive can for example be constructed such that it comprises at least one electrical coil and at least one permanent magnet as well as a pivot axis about which the coil or the permanent magnet is pivotally journaled. The coil is expediently arranged in the magnetic field of the permanent magnet so that a current which flows through the coil produces an attractive or repulsive force and thus a pivotal movement between the coil and the permanent magnet.

[0013] In a further preferred embodiment the emergency operating system and/or emergency drive comprises at least one mechanical or pneumatic drive, preferably an automatic mechanical or pneumatic drive, which can be designed for example as a spring, preferably as a mechanical or pneumatic spring.

[0014] The selvedge tucking needle preferably comprises an additional holding device in order to hold the selvedge tucking needle in a safe position in the event of a disturbance. The holding device is important, since no holding force is normally exerted by linear motors and simple electromagnetic drives in the absence of current. The emergency operating system and/or emergency drive is preferably designed as a holding device at the same time, for example in that a spring is provided for the emergency operating system or emergency drive respectively.

[0015] The invention additionally comprises a weaving machine with a selvedge tucker in accordance with any one of the embodiments described above.

[0016] The selvedge tucker in accordance with the invention has the advantage that it can be used at higher speeds of rotation of the weaving machine, in particular at 1000 insertions per minute and more, and that it produces an unobjectionable cloth edge even in the case of stiffer yarns. The emergency operating system and/or emergency drive which is provided in the selvedge tucker in accordance with the invention can be designed such that in cases of disturbance, such as for example power failures, a collision between the selvedge tucking needle and the remaining parts of the weaving machine is reliably avoided. Advantageous in addition are the substantially more favorable manufacturing costs in comparison with mechanically driven selvedge tuckers.

[0017] Further advantageous embodiments result from the subordinate claims and the drawings.

[0018] The invention will be explained in the following in more detail with reference to the exemplary embodiment and with reference to the drawings. Shown are:

[0019] FIG. 1 a perspective view of an exemplary embodiment of a selvedge tucker in accordance with the present invention,

[0020] FIG. 2 a plan view of the tip of a selvedge tucking needle from the exemplary embodiment shown in FIG. 1, in a schematic representation,

[0021] FIG. 3 a variant of a compulsory guide for the exemplary embodiment which is shown in FIG. 1,

[0022] FIG. 4 a variant of an electrical drive for the exemplary embodiment which is shown in FIG. 1, and

[0023] FIG. 5 a further variant of an electrical drive.

[0024] FIG. 1 shows a perspective view of an exemplary embodiment of a selvedge tucker in accordance with the present invention. In the exemplary embodiment the selvedge tucker 10 comprises a selvedge tucking needle 11 and a shaft 12 which is connected to the selvedge tucking needle 11 and which is pivotally and displaceably mounted in one or more guides 13. Furthermore, the selvedge tucker 10 comprises an electrical drive 14 in order to move the shaft 12 and the selvedge tucking needle 11. The electrical drive 14 can for example, as shown in FIG. 1, be connected via an active connection 17 to the shaft 12 in order to move the shaft 12 and the selvedge tucking needle 11 forward and backward. In addition, an emergency operating system and/or emergency drive 15 is provided for the selvedge tucking needle 11 in order to move the latter into a safe position in the event of a disturbance.

[0025] In an advantageous variant the selvedge tucker is provided with an additional compulsory guide 16 for the selvedge tucking needle 11 and the shaft 12, said compulsory guide additionally producing a pivotal movement of the selvedge tucking needle from the forward and backward movement. Thanks to the additional compulsory guide 16 the selvedge tucker 10 requires only a single drive for the forward and backward movement. Also the emergency operating system and/or emergency drive 15 in order to move the selvedge tucking needle into a safe position in the event of a disturbance is highly simplified through the additional compulsory guide 16. Thus, the selvedge tucking needle 11 can, for example, be moved into a safe position by means of a simple spring, e.g. a spiral spring or a pneumatic spring. The additional compulsory guide, which couples the displacement to the rotational movement of the selvedge tucking needle, can also be considered as an independent subject.

[0026] The additional compulsory guide can, for example, be designed such that it comprises a guide cam which is connected to the shaft 12 and a guide groove which is formed in a stationary part 16 in which the guide cam is guided, with at least a portion of the guide groove extending obliquely to the axis of the shaft 12. Through this, during the forward and backward movement of the shaft a pivotal movement is additionally produced or, in an alternative embodiment, a forward and backward movement is produced during the pivotal movement of the shaft. Optionally the guide groove can also be formed in the shaft 12 and the guide cam in a stationary part.

[0027] The electrical drive 14 is designed in the exemplary embodiment as an electromechanical pivotal drive. A detailed description of a drive of this kind can be found for example in EP 1 016 743 A1. The pivotal drive which is shown in FIG. 1 comprises two stationary permanent magnets 14.1, a coil carrier 14.2 with an electrical coil and a pivot axle 14.3, about which the coil carrier 14.2 is pivotally journaled. The coil is arranged in the magnetic field of the permanent
magnets 14.1, so that a current which flows through the coil produces an attractive or repulsive force and thus a pivotal movement of the coil carrier 14.2. The electrodynamic pivotal drive shown can be manufactured comparatively economically and has a short reaction time, since the moving masses of the coil carrier and the coil can be kept low. Of course other suitable electrical drives can also be used, for example a short linear motor or a linear electrodynamic drive.

0028] The tucking in of a weft thread will be described in more detail in the following with reference to FIGS. 1 and 2. In the exemplary embodiment the selvedge tucking needle 11 is designed in the shape of a hook and is provided at its tip with an eye 11a for the reception of a weft thread. A selvedge tucking needle of this kind is described for example in EP 0 134 377 A1. Of course other embodiments of the selvedge tucking needle can also be used, with it possibly being necessary for the course of the movement and the reception of the weft thread to be adapted where appropriate. In the present exemplary embodiment a weft thread 7 is first inserted into a shed and beaten up by a reed 4. Then a change of shed takes place, after which the warp threads 6.1, 6.2 form a new shed and the reed 4 is in a drawn-back position, as is shown in FIGS. 1 and 2. The selvedge tucking needle 11 is now displaced in the direction towards the reed 4 and pivoted outwardly as seen from the shed, with the front part of the selvedge tucking needle with the eye 11a pivoting through the upper warp threads 6.1 into the shed until the eye reaches the position which is shown in FIGS. 1 and 2. In the position shown the eye 11a is located above the weft thread 7 and the opening of a blowing nozzle which is arranged in a carrier 2 laterally adjacent to the cloth edge which is to be formed. The end of the inserted weft thread is cut to a definite length by means of a cutting device 3 and blown by the blowing nozzle in the carrier 2 into the eye 11a of the selvedge tucking needle 11. Then the selvedge tucking needle 11 is pivoted out in the opposite direction, with the weft thread end being tucked into the tip of the shed and the selvedge tucking needle leaving the shed. The pivoting out movement of the selvedge tucking needle 11 is coupled with a backward movement, so that, at the end of the pivoting-out and backward movement, the selvedge tucking needle is located behind the beat-up edge of the cloth 8 as viewed from the reed 4. Then a new weft thread is inserted, which can now be beat up together with the tucked in weft thread end without the reed coming in contact with the selvedge tucking needle 11.

0029] FIG. 3 shows a variant of a compulsory guide for the exemplary embodiment which is shown in FIG. 1. In this variant a selvedge tucking needle 11 is connected to a shaft 12 which is pivotally and displaceably journaled, for example in one or more guides 13 and/or in a sleeve 16 which partly or completely surrounds the shaft. The compulsory guide of the variant which is shown in FIG. 3 comprises a guide cam 16.1 which is connected to the shaft 12 and a guide groove 16.2 which is formed in the sleeve 16, with at least a portion of the guide groove extending obliquely to the axis of the shaft 12. Through this a pivotal movement is additionally produced during the forward and backward movement of the shaft or, in an alternative embodiment, a forward and backward movement is produced during a pivotal movement of the shaft.

0030] In the variant which is shown in FIG. 4 the electrical drive is designed as a linear drive 14. This enables a direct coupling of the drive to a shaft 12 of a selvedge tucking needle 11 and thus a particularly space saving embodiment of the selvedge tucker. In the variant shown the selvedge tucker 10 additionally comprises a compulsory guide 16, 16.1, 16.2, for example a compulsory guide such as is described above in connection with FIG. 3. The linear drive 14 can be designed for example as a short electrical linear motor, a linear electrodynamic drive or as an electrical positioning motor with a feed rod or screw.

0031] FIG. 5 shows a further variant of an electrical drive with an electrical linear drive 14 and an electrical pivotal drive 14’ which together drive a shaft 12 of a selvedge tucking needle 11. In this variant the emergency operating system and/or emergency drive can for example be designed such that an emergency power supply, e.g. an uninterruptible power supply, and an emergency control for the electrical linear drive 14 and the electrical pivotal drive 14’ are provided in order to move the selvedge tucking needle into a safe position in the event of a disturbance.

0032] The selvedge tucker in accordance with the invention is suitable for the manufacture of high quality cloth edges, such as are typical for mechanical selvedge tuckers. In contrast to mechanically driven selvedge tuckers from the prior art the selvedge tucker in accordance with the invention can however also be used at higher machine speeds of rotation up to 1000 insertions per minute and more, with it being possible to avoid collisions between the selvedge tucking needle and the remaining parts of the weaving machine thanks to the emergency operating system or emergency drive which is active in the event of a disturbance. Additionally advantageous is the economical manufacture in comparison with mechanically driven selvedge tuckers from the prior art.

1. Selvedge tucker for the formation of a cloth edge in a weaving machine, said selvedge tucker comprising a selvedge tucking needle for tucking one or more weft thread ends into a shed as well as an electrical drive for moving the selvedge tucking needle, characterized in that an emergency operating system and/or emergency drive is provided for the selvedge tucking needle in order to move the latter into a safe position in the event of a disturbance.

2. Selvedge tucker in accordance with claim 1, with the selvedge tucking needle or a shaft which is connected to the latter being pivotally and/or displaceably mounted.

3. Selvedge tucker in accordance with claim 1, comprising an active connection between the electrical drive and the selvedge tucking needle and/or the shaft in order to displace the selvedge tucking needle forward or backward by means of the electrical drive, as well as an additional compulsory guide for the selvedge tucking needle and/or for the shaft in such a manner that a pivotal movement of the selvedge tucking needle can be additionally produced by the forward or backward displacement respectively.

4. Selvedge tucker in accordance with claim 1, comprising an active connection between the electrical drive and the selvedge tucking needle and/or the shaft such that the selvedge tucking needle can be pivoted in and out by means of the electrical drive, as well as an additional compulsory guide for the selvedge tucking needle and/or for the shaft in such a manner that a forward or backward displacement is associated with the pivoting in and out respectively.
5. Selvedge tucker in accordance with claim 1, with the electrical drive comprising at least one electrical coil and at least one permanent magnet as well as a pivotal axis about which the coil or the permanent magnet is pivotally journaled.

6. Selvedge tucker in accordance with claim 1, with the emergency operating system and/or emergency drive comprising at least one spring, in particular a mechanical or pneumatic spring.

7. Selvedge tucker in accordance with claim 1, additionally comprising a holding device in order to hold the selvedge tucking needle in a safe position in the event of a disturbance.

8. Weaving machine comprising a selvedge tucker in accordance with claim 1.

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