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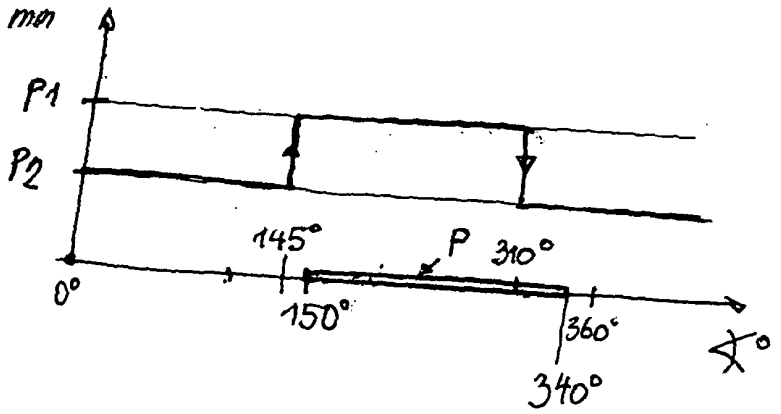
(54) Weaving machine, yarn feeder and method for inserting a weft yarn

(57) A projectile-weaving machine W is equipped with a weft yarn feeder F having a stationary storage body 6 for intermediately storing a yarn store 7 consisting of windings, the weft feeder F comprising a passive hollow balloon breaker 8 functionally associated to a withdrawal rim 14 of the storage body 6. In addition to the passive balloon breaker 8, several yarn control elements 11 are separated in circumferential direction for being actively moved by a drive 10 from an outer rest position P1 into an inner operative position P2 which without totally stopping withdrawn weft yarn Y are brought into a mechanical engagement on the weft yarn upstream from the withdrawal rim 14 and starting with an end phase of an insertion on the weft yarn Y while the weft yarn Y is taken off from the yarn store 7 over the withdrawal rim 14.

FIG 10



EP 2 058 423 A1

Description

[0001] The present invention relates to a weaving machine according to the preamble of claim 1, to a weft yarn feeder according to the preamble of claim 2, and to a method according to the preamble of claim 14.

[0002] When weaving fabrics, there exist so called heavy duty applications meaning that coarse yarn qualities are woven such as heavy synthetic yarns or heavy synthetic bands, e.g. made from polypropylene. Special weaving machines are employed for heavy duty applications and also special weft yarn feeders designed to process such yarn qualities. Up to now it was considered to be sufficient to control the unavoidable yarn balloon occurring when withdrawing the weft yarn from the storage body of the yarn feeder with the insertion element of the weaving machine by a passive balloon breaker, e.g. a so-called balloon breaker cone as known from US 5,769,132 A. However, newer and wider weaving machines for heavy duty applications have been developed which, e.g. have a weaving width of more than 5 meters and operate with considerably increased weaving speed. On such newly developed weaving machines, it has been found that a passive balloon breaker does not work satisfactorily enough because weft yarn very frequently becomes entangled in the region between the withdrawal rim of the storage body and the balloon breaker.

[0003] US 5,778,943 A relates to a weft yarn feeder equipped with a controllable output brake for the weft yarn. The output brake comprises a conical brush ring fixed to a housing bracket of the yarn feeder such that the bristles of the conical output brake cooperate with the rounded withdrawal rim of the storage body directly at the front end of the storage body. However, for heavy duty applications, the known yarn feeder does not work properly because the weft yarn may form entangled yarn loops between subsequent insertions in the region upstream from the entrance into the output brake.

[0004] US 3,411,548 A (Figures 8 and 13) relates to a weft yarn feeder for a projectile weaving machine. The stationary storage body has a conical withdrawal rim which directly continues from a cylindrical region of the storage body where the yarn store is stored intermediately for being taken off by the projectile. A circumferentially closed brush ring is supported at the housing of the yarn feeder such that the ends of the inwardly projecting bristles contact the withdrawal rim in order to generate a desirable yarn tension during each insertion. In order to vary the yarn tension generated by the brush ring during each insertion in adapt action to the weaving cycle, the brush ring is moved back and forth parallel to the axis of the storage body. In one embodiment, an end flange forms the front end of the stationary storage body. The outer diameter of the end flange is larger than the diameter of the storage body in the region where the yarn store is stored intermediately. The brush ring cooperates with the end flange. The brush ring can even be moved axially in relation to the withdrawal rim until the bristles are completely lifted from the withdrawal rim and do not impart any tensioning action on the weft yarn. In a heavy duty application, the weft yarn tends to get entangled around the front end of the storage body.

[0005] It is an object of the invention to provide a weaving machine, a yarn feeder, and a method for inserting weft yarn which avoids the drawbacks encountered with heavy duty applications, i.e. allow fabrics to be woven from very coarse yarn qualities without operation disturbances caused by entangled weft yarn.

[0006] This object is achieved by the features of claim 1, of claim 2 and of claim 14.

[0007] The weaving machine processes coarse yarn qualities with an extremly low quota of disturbances even in heavy duty applications when weaving fabric with considerable weaving width and extremely high weaving speed because the actively controlled yarn control elements, acting in addition to the passive balloon breaker on the region of the storage body between the yarn store and the withdrawal rim, assure that at the end of an insertion, and prior to the start of a subsequent insertion, the weft yarn is prevented from becoming entangled. The mechanical influence of the yarn control elements, i.e. of at least one of the yarn control elements, on the withdrawn weft yarn reliably suppresses a balloon formation in the region of the yarn control elements and assures that after the insertion the weft yarn does not get slacky and that the front most windings in the yarn store do not lose their correct order. The yarn control elements only impart the mechanical influence on the weft yarn beginning with the end phase of the insertion but are held in their rest position during the main part of the insertion. The balloon suppressing effect of the yarn control elements then also assists the balloon suppressing effect of the passive balloon breaker to assure that the weft yarn follows an orderly path inside the balloon breaker during the end phase of the insertion and after the insertion of the weft yarn has stopped. When a subsequent insertion is started, the yarn control elements are already brought into the rest positions such that the weft yarn takes an orderly, unobstructed course from the yarn store over the withdrawal rim into the balloon breaker. The high acceleration of the weft yarn in the start phase of the subsequent insertion is not at all negatively influenced by the yarn control elements. Controlling the weft yarn beginning with the end phase of the insertion by the yarn control elements reliably prevents the weft yarn from becoming entangled. This avoids operation disturbances and undesirable fabric faults even in the case of very coarse yarn qualities such as band-shaped yarns made from polypropylene.

[0008] In the yarn feeder, the temporary engagement of the actively controlled yarn control elements beginning with the end phase of insertion is of assistance for the balloon suppressing effect of the passive balloon breaker and assures that no critical entanglements occur neither when an insertion is terminated nor before the subsequent insertion is started.

[0009] According to the method, the interaction between the actively controlled yarn control elements and the withdrawn weft yarn is only limited and begins at the end phase of an insertion, while during the main part of the insertion, the weft yarn can be withdrawn without disturbance by the yarn control elements with full speed and high acceleration. The yarn control elements are controlled such that they add an additional balloon suppressing action to the given balloon suppressing action of the passive balloon braking when the weft yarn is decelerated and finally brought to a stop because then the passive balloon breaker cannot generate any influence on the weft yarn in the region between the yarn store on the storage body and the withdrawal rim. The engagement of the yarn control elements first starts in the end phase of the insertion and is actively terminated shortly before the start of the subsequent insertion. The engagement must, in any case, not stop the weft yarn but has to create a mechanical obstacle only which prevents the weft yarn section between the yarn store and the withdrawal rim from becoming slack and avoids that the front most windings in the yarn store lose their orderly placements on the storage body and inadvertently travel further forward while the weft yarn is decelerated abruptly.

[0010] In a preferred embodiment, the yarn control elements are distributed regularly in circumferential direction in a common plane which is perpendicular to the axis of the storage body. This arrangement assures that with certainty at least one of the yarn control elements, or preferably several of the yarn control elements, will mechanically engage on the weft yarn.

[0011] Expediently, two to four yarn control elements may be provided such that the intermediate distance between adjacent yarn control elements is larger in circumferential direction than the circumferential dimension of each yarn control element. As the weft yarn rotates during withdrawal around the front end of the storage body, even such a small number of yarn control elements suffice to assure that the mechanical engagement takes place accordingly.

[0012] In an expedient embodiment, the yarn control elements are aligned with a region of the storage body upstream from the withdrawal rim, which region defines the maximum diameter of the storage body and which extends continuously in circumferential direction. Preferably, this region has a larger diameter than another region of the storage body provided for carrying the yarn store. The circumferentially continuous region of the storage body provides a smooth and continuous guiding and supporting surface for the rotating weft yarn.

[0013] In an expedient embodiment, each yarn control element is a pin which is movable substantially radially with respect to the axis of the storage body. In order to avoid that the pin stops in the operative position completely, the withdrawal movement of the weft yarn, the free end of the pin forms a gap with the storage body in the operative position which gap is wider than the yarn thickness. Due to centrifugal force tending to lift the weft yarn from the storage body in the end phase of the insertion, the weft yarn then comes into mechanical engagement with at least one of the yarn control elements.

[0014] Expediently, the yarn control element is driven by a linear drive such as a pneumatic cylinder or a solenoid. In some cases, the drive may only fulfill a stroke of the yarn control element in one direction against the force of a spring which acts the opposite direction. Alternatively, the linear drive could actively control the yarn control elements in both moving directions.

[0015] In a preferred embodiment, the yarn control elements and a common drive for all yarn control elements or separate drives are arranged in a ring body surrounding a front end of the storage body with radial distance. The ring body not only serves as the carrier for the yarn control elements and the drive or the drives but also fulfills a supplemental balloon suppressing function during the insertion.

[0016] The part of the yarn control element which engages in the operative position at the weft yarn is either rigid in circumferential direction or is flexible. If the part is rigid, the part has to keep a certain distance from the storage body in the operative position of the yarn control element. If the part is flexible, the part even may contact the storage body in the operative position of the yarn control element because then this part will yield when the weft yarn is passing beneath.

[0017] In a preferred embodiment, the ring body is arranged such in a housing bracket of the weft yarn feeder that the ring body can be adjusted in the direction of the axis of the storage body. The housing bracket comprises a linear adjustment mechanism for the ring body allowing the ring body to be optimally placed in relation to the storage body and/or the withdrawal rim. Expediently, the passive balloon breaker is removeably arranged at the ring body. As such, the ring body fulfills several tasks.

[0018] In an alternative embodiment, the yarn control element is either designed as a brush having bristles, or fingers pointing towards the storage body, or carrying a foam material layer or a felt layer. In the case of bristles or fingers, the bristles may be oriented either substantially radially with respect to the axis of the storage body or may be inclined in the direction in which the weft yarn is rotating during withdrawal.

[0019] In another preferred embodiment, the yarn control element may be a leaf spring. The leaf spring can be bent in the direction which the weft yarn is rotating during withdrawal. The drive for adjusting the leaf spring between the rest position and the operative position may be either a radial linear drive or a pivot drive for pivoting the leaf spring.

[0020] In another preferred embodiment, the yarn control element may be designed as a pivot arm or a pivotable brush having fingers or bristles oriented towards the storage body. In both cases the drive may be a pivot drive like a pneumatic piston, a solenoid or an electric step motor.

[0021] For the method, it is important that the yarn con-

trol elements are brought into the operative position first beginning with the end phase of the insertion, i.e. as soon as or before the withdrawn weft yarn is decelerated abruptly. The yarn control elements then mechanically engage on the weft yarn until the weft yarn comes to a stop caused by the stoppage of the insertion element, i.e. the projectile. It is, however, expedient to keep the mechanical engagement of the yarn control elements on the weft yarn even longer, namely, to a point in time shortly before the start of the subsequent insertion, i.e. to return the yarn control element into the rest position first some milli-seconds prior to the start of the subsequent insertion.

[0022] In relation to the angle of rotation of 360°of the main shaft of the weaving machine, the yarn control elements should mechanically engage at the weft yarn for the last about 30° to 70° of the insertion and only up to 5° to 10° ahead of the start of the subsequent insertion. During the main period of the insertion, the yarn control elements then will be held in the rest positions where they do not impart any mechanical influence on the weft yarn.

[0023] Embodiments of the invention will be explained with the help of the drawings. In the drawings are:

Figure 1 a schematic illustration of a projectile weaving machine being equipped with at least one yarn feeder,

Figure 2 a longitudinal section of an embodiment of a yarn feeder as schematically shown in Figure 1, in a first operative phase,

Figure 3 a part of the sectional illustration of Figure 2, in second operative position,

Figure 4 a perspective view of a component of the weft yarn feeder of Figures 2 and 3,

Figure 5 a detail variant partial in sectional illustration,

Figure 6 another detail variant,

Figure 7 another detail variant,

Figure 8 another detail variant, and

Figure 9 another detail variant, and

Figure 10 a schematic diagram illustrating an insertion, e.g. in the weaving machine of Figure 1 indicating the rotation of a main shaft of the weaving machine and strokes of actively controlled yarn control elements.

[0024] A weaving machine W, schematically shown in Figure 1, comprises a weaving shed 1 having a reed 1 a driven by a main shaft 2 of the weaving machine. One of a plurality of projectiles 3 serves as an insertion element E for inserting a weft yarn Y into the weaving shed 1. The weft yarn Y is intermediately stored in a yarn store 7 on a stationary storage body 6 of a weft yarn feeder F which takes off the weft yarn Y from a storage bobbin B. The weft yarn feeder F has a housing 4 and a winding-on-element 5 which can be driven for rotation by a motor 16 in relation to the stationary storage body 6 which might have substantially the form of a drum. A housing bracket 9 supports a hollow passive balloon breaker 8 (e.g. a balloon breaker cone) aligned with the storage body 6 such that the withdrawn weft yarn Y has to pass through the passive balloon breaker 8. Furthermore, several yarn control elements 11 are provided which can be actively driven by either a common or by separate drives 10 as it will be explained in more detail with respect to Figures 2, 3 and 4.

[0025] The weaving machine W, in particular, is a weaving machine for heavy duty applications. The weft yarn feeder F is also prepared (e.g. anti-abrasive coating on the storage body, powerful motor, robust sensor, etc.) for heavy duty applications meaning for a relatively coarse and/or stiff weft yarn Y, e.g. a weft yarn such as a band of synthetic material like polypropylene.

[0026] In a not shown alternative, the weaving machine W could be a rapier weaving machine with drivable rapiers as insertion elements E.

[0027] The weft yarn feeder F in Figure 2 comprises in the housing 4, the drive motor 16 in the housing 4 for driving a main shaft 15 which in the right side section of Figure 2 is hollow and carries the winding-on element 5. The stationary storage body 6 is substantially conventional and is supported on the main shaft 15. The storage body 6 has a circumferential and axial region 12 intended for carrying the yarn store 7 (not shown in Figure 2). This region 12 might consist of spaced apart axial rods between which conventional advance elements operate in order to transport the windings in the yarn store 7 forward and to separate the windings from each other. A sensor device 17 is arranged partly in the storage body 6 and at the lower side of the housing bracket 9. The sensor device 17, e.g. serves to control the drive motor 16. The region 12 is substantially cylindrical and is continued by another cylindrical circumferentially continuous region 13 which in the shown embodiment defines the largest diameter of the storage body 6. At the front end of the storage body 6, a withdrawal rim 14 is provided with a diameter which decreases in withdrawal direction, i.e. is conically tapered or is rounded convexly.

[0028] The front end of the storage body 6 is surrounded by a ring body 18 which is supported via a slider 19 in the housing bracket 9. As adjustment mechanism 20 allows the position of the ring body 18 to be adjusted parallel to the axis of the storage body 6.

[0029] In this embodiment, the passive hollow balloon breaker 8 is removably fixed by the big diameter end to the ring body 18. In another not shown embodiment, the

passive balloon breaker 8 could be fixed to the housing 4, or the housing bracket 9, or to another not shown support. The ring body 18 forms a circumferential continuous gap around the region 13.

The gap width is, e.g. a multiple of the thickness of the weft yarn Y which is to be processed. The ring body 18 here even extends in axial direction beyond the front end of the storage body 6.

[0030] According to the invention, a plurality of actively controlled yarn control elements 11, e.g. arranged at the ring body 18, is distributed with circumferential intermediate distances, preferably regularly, around the front end of the storage body 6. Examples of the number of yarn control elements 11 are two, three or four. The number, however, could even be larger than four. The yarn control elements in Figures 2 and 3 are oriented radially to the axis of the storage body 6 and can be actively driven in a radial direction between an operative position (Figure 2, P2) and a rest position (Figure 3, P1) by a common drive or by separate linear drives such as pneumatic cylinders, solenoids, or electric linear motors, etc. represented by the indicated drive 10 supported on the ring body 18.

[0031] In Figures 2 and 3, the yarn control element is a rigid pin 22. In the operative position P2 in Figure 2, the free end of the pin 22 maintains a predetermined distance from the region 13 of the storage body 6 so that a gap x is kept open with a width a slightly larger than the thickness of the weft yarn Y processed by the weft yarn feeder F and the weaving machine W.

[0032] In a not shown embodiment, the pin 22 could instead be flexible in circumferential direction and also axial direction of the storage body 6. In this case, it is possible that the pin 22 even slightly contacts the region 13 of the storage body 6 in the operative position P2.

[0033] Figure 2 shows that the ring body 18 has a smooth, substantially cylindrical inner surface 21 such that the ring body 18 also fulfills a balloon suppressing function for the withdrawn weft yarn Y. In the rest position P1 in Figure 3, the yarn control element 11 is moved outwardly so that the free end is either substantially flush with the cylindrical surface 21 or is even set back to a small extent.

[0034] The respective drive 10 is controlled in relation to the weaving cycle of the weaving machine 2 such that the yarn control elements 11 are brought into the operative positions P2 first in the end phase of a insertion and before the weft yarn is stopped by a stoppage of the projectile 3, are then kept in the operative positions to a point in time shortly before the start of the subsequent insertion and are then moved into the rest positions P1 before the subsequent insertion starts and are finally kept in the rest positions P1 over the major part of the insertion.

[0035] Figure 4 illustrates the ring body 18 serving at the carrier for the drives 10, which in this case are linear drives 23, and receiving the yarn control elements 11. In this case, there are three yarn control elements 11 regularly distributed in a common plane about the extension of the ring body 18 such that the intermediate distance between adjacent yarn control elements 11 is larger than the circumferential dimension of the respective yarn control element 11.

[0036] The ring body 18 carries the slider 19 and e.g. is prepared with fastening holes 24 for removeably fixing the passive hollow balloon breaker 8.

[0037] Figure 10 illustrates one insertion P within a rotation of 360° of the main shaft 2 of the weaving machine W. The insertions, e.g. starts at 150° and is terminated at 340°. The remaining angular range within the 360° revolution of the main shaft 2 is used for cutting the weft yarn, for beating up the inserted weft yarn by the weaving reed, for carrying out the shed change, for transmitting the weft yarn to a projectile 3 and e.g. also for selecting the respective weft yarn. Some degrees prior to the start of the insertion P, e.g. at 145°, the yarn control elements 11 are actively moved from the operating positions P2 into the rest positions P1 and are then kept in the rest positions P1 up to , e.g. 310°. At 310°, for example, the yarn control elements 11 are again actively moved into the operative position P2 so that the yarn control elements 11 remain in the operative positions P2 for the last about 30° to about 70° of the insertion P. Expediently, the yarn control elements 11 are further kept in the operative positions P2 up to again about 145° before the subsequent insertion P or are actively moved into the rest positions P1 some mili-seconds prior to the start of the subsequent insertion P.

[0038] The yarn control element 11 in the embodiment of Figure 5 is a brush 25 having bristles or fingers 26 oriented toward the region 13 of the storage body 6. Figure 5 illustrates the rest position. The drive 10 is a linear drive 23, e.g. a pneumatic cylinder with a piston 23' acting, e.g. against a return spring 29. In Figure 5, the bristles or fingers 26, which are flexible, are oriented substantially radially with respect to the axis of the storage body.

[0039] Figure 6 illustrates a similar embodiment in which the brush 25 has flexible bristles or fingers 26 which are inclined in relation to a radial orientation in the rotating direction 27 of the withdrawn weft yarn. Alternatively, instead of the flexible fingers or bristles 26, a layer of felt or foam material 26 could be provided on the brush 25.

[0040] In the embodiment of Figure 7, the yarn control element 11 is a leaf spring 28 which is either curved or straight and is inclined in the direction 27 of rotation of the withdrawn weft yarn. The drive 10 is a linear drive 23, e.g. a solenoid which is adapted to move the yarn control element 11 in both directions between the rest position and the operative position. In the operative position as shown in Figure 7, there might be a small gap between the free end of the leaf spring 28 and the region 13. Alternatively, the leaf spring 28 may even contact the region 13.

[0041] In the embodiment of Figure 8, the yarn control element 11 is a rigid or flexible pivot arm 30 fixed to a pivot axis 31. The drive 10 is a pivot drive 32 like a rotary solenoid, a pneumatic piston, a step motor, or the like.

At least in the operative position, the pivot arm 13 might be inclined in the direction 27 of the rotation of the withdrawn weft yarn.

[0042] As a not shown alternative embodiment, the leaf spring 28 of Figure 7 could instead be moved by a pivot drive 32 between both positions.

[0043] In Figure 9 the yarn control element 11 is a pivotably supported small brush 33 having several flexible bristles 34. The bristles 34 can be pivoted by a pivot drive 32, e.g. into contact with the region 13 of the storage body 6.

Claims

1. Weaving machine (W) having driven projectiles (3) or rapiers as weft yarn insertion elements (E) and at least one weft yarn feeder (F) with a stationary storage body (6) for intermediately storing a yarn store (7) consisting of windings and further comprising a passive hollow balloon breaker (8) which is functionally associated to the storage body (6) having a front end withdrawal rim (14) the diameter of which decreases in withdrawal direction of the weft yarn
characterized in that
in addition to the passive balloon breaker (8) several yarn control elements (11) are provided at the weft yarn feeder (F) which yarn control elements (11) are distributed in circumferential direction with intermediate distances in between and which can be adjusted actively by at least one drive (10) from an outer rest position (P1) in an end phase of an insertion (P) into an inner operative position (P2) upstream from the withdrawal rim (14) and into a mechanical engagement on the weft yarn (Y) which is taken off from the yarn store (7) via the withdrawal rim (14) without completely stopping the weft yarn (Y).

2. Weft yarn feeder (F) for a weaving machine (W) having driven projectiles (3) or rapiers as weft yarn insertion elements (E), the weft yarn feeder (F) comprising a stationary, drum-shaped storage body (6) for intermediately storing a yarn store (7) consisting of windings, out of which yarn store the weft yarn (Y) intermittently is taken off over head of a withdrawal rim (14) at a front end of the storage body (6), the weft yarn feeder including a hollow passive balloon breaker (8) functionally associated to the storage body (6)
characterized in that
in addition to the passive balloon breaker (8) several yarn control elements (11) are provided at the weft yarn feeder (F) which yarn control elements (11) are distributed in circumferential direction with intermediate distances in between and which can be adjusted actively by at least one drive (10) from an outer rest position (P1) in an end phase of an insertion (P) into an inner operative position (P2) upstream from the withdrawal rim (14) and into a mechanical engagement on the weft yarn (Y) which is taken off from the yarn store (7) via the withdrawal rim (14) without completely stopping the weft yarn (Y).

3. Weft yarn feeder according to claim 2 **characterized in that** the yarn control elements (11) are regularly distributed in circumferential direction in a common plane which is perpendicular to the axis of the storage body (6).

4. Weft yarn feeder according to claim 2 **characterized in that** two to four yarn control elements (11) are provided and that the intermediate distance between adjacent yarn control elements (11) is larger in circumferential direction than the circumferential dimension of each yarn control element (11).

5. Weft yarn feeder according to claim 2 **characterized in that** the yarn control elements (11) point toward a region (13) of the storage body (6) upstream from the withdrawal rim (14), which region (13) of the storage body (6) extends continuously in circumferential direction, preferably to a region (13) having a larger diameter than a region (12) of the storage body (6) provided for carrying the yarn store (7).

6. Weft yarn feeder according to claim 2 **characterized in that** each yarn control element (11) is a rigid pin (22) which is movable substantially radially and the free end of which maintains in the operative position (P2) of the yarn control element (11) a gap (x) with storage body (6) wider than the thickness of the weft yarn (Y).

7. Weft yarn feeder according to claim 2 **characterized in that** the yarn control element (11) is connected to a linear drive (23) such as a pneumatic cylinder or a solenoid and that the yarn control element (11) is either driven by the linear drive (23) in both movement directions or, in some cases, in one movement direction against spring force (29).

8. Weft yarn feeder according to at least one of the preceding claims 2-7 **characterized in that** the yarn control elements (11) and either a common drive for all yarn control elements or single discrete yarn control elements-drives (10) are arranged at a ring body (18) surrounding a front end of the storage body (6) with radial distance.

9. Weft yarn feeder according to claim 2 **characterized in that** a part of the yarn control element (11) engaging in the operative position (P2) on the weft yarn (Y) is either rigid in circumferential direction or is flexible at least in circumferential direction.

10. Weft yarn feeder according to claim 8 **characterized**

in that the ring body (18) is provided at a housing bracket (9) of the weft yarn feeder (F) for an adjustment substantially in the direction of the axis of the storage body (6), that the housing bracket (9) comprises a linear adjusting mechanism (20) for the ring body (18), and that the passive balloon breaker (8) removeably is secured to the ring body (18).

11. Weft yarn feeder according to claim 2 **characterized in that** the yarn control element (11) is either a brush (25) having bristles or fingers (26) pointing to the storage body (6) which bristles or fingers (26) preferably either are oriented substantially radially or are inclined in the direction (27) of the rotation of the weft yarn (Y) during withdrawal, or is a brush (25) having a layer (26') consisting of foam material or felt.

12. Weft yarn feeding device according to claim 2 **characterized in that** the yarn control element (11) is a leaf spring (28), which, preferably, is bent in the direction (27) of the rotation of the weft yarn (Y) during withdrawal, and that the drive (10) is either a linear drive (23) for linearly moving the leaf spring (28) or is a pivot drive (32) for pivoting the leaf spring (28).

13. Weft yarn feeding device according to claim 2 **characterized in that** the yarn control element (11) is either a pivot arm (30) or a pivotable brush (33) having fingers or bristles (34) oriented toward the storage body (6), and that the drive (10) is a pivot drive (32).

14. A method for inserting a weft yarn (Y) into a weaving machine (W) having driven projectiles (3) or rapiers as insertion elements (E) and comprising at least one weft yarn feeder (F) having a stationary storage body (6) for intermediately storing a yarn store (7) consisting of windings, according to which method the weft yarn (Y) is taken off intermittently by the insertion elements (E) from the yarn store (7) over head and over a withdrawal rim (14) of the storage body (6) and through a passive hollow balloon breaker (8) and is transported through the weaving shed (1) of the weaving machine
characterized in that
at least one yarn control element (11) placed upstream from the withdrawal rim (14) is moved at the end of an insertion (P) from an outer rest position (P1) actively into an operative position (P2) maximally into contact with the storage body (6) upstream from the withdrawal rim (14) by a drive (10) and without totally stopping the weft yarn (Y), and that the yarn control element (11) is returned actively into the rest position (P1) just shortly before the start of the subsequent insertion (P).

15. Method according to claim 14 **characterized in that** in relation to an angle of rotation of 360° of a main shaft (2) of the weaving machine (W), the yarn control element (11) is brought into the operative position (P2) within about the last 30° to 70° of the insertion (P) and up to about 5° to 10° or some milli-seconds prior to the start of the next insertion (P).

Amended claims in accordance with Rule 137(2) EPC.

1. Weft yarn feeder (F) for a weaving machine (W) having driven projectiles (3) or rapiers constituting weft yarn insertion elements (E) of the weaving machine, the weft yarn feeder (F) comprising a stationary, drum-shaped storage body (6) for intermediately storing a yarn store (7) consisting of windings, out of which yarn store the weft yarn (Y) intermittently is taken off overhead of a withdrawal rim (14) at a front end of the storage body (6), the weft yarn feeder including a hollow passive balloon breaker (8) functionally associated to the storage body (6), the hollow passive balloon breaker (8) being supported stationarily with respect to and without contacting the storage body (6), and having a large diameter end located in the region of the withdrawal rim (14) of the storage body, **characterised in that** the large diameter end of the balloon breaker (8) is fixed by or removably secured to a stationary ring body (18) surrounding with radial distance the front end of the storage body (6), that several yarn control elements (11) are provided at the ring body (18) upstream of the withdrawal rim (14), which yarn control elements (11) are distributed in circumferential direction with intermediate distances in-between and which can be adjusted actively by at least one drive (10) carried by the ring body (18) from an outer rest position (P1) into an inner operative position (P2) for assisting in the inner operative position (P2) the balloon breaker's balloon suppressing effect with an additional balloon suppressing effect.

2. Weft yarn feeder according to claim 1, **characterised in that** two to four yarn control elements (11) are provided in the ring body (18) and that the intermediate distance between adjacent yarn control elements (11) is larger in circumferential direction than the circumferential dimension of each yarn control element (11).

3. Weft yarn feeder according to claim 1, **characterised in that** the yarn control elements (11) point toward a circumferentially continuous region (13) of the storage body (6) upstream of the withdrawal rim (14), which region (13) has a larger diameter than a further upstream yarn store carrying region (12) of the storage body (6).

4. Weft yarn feeder according to claim 1, **character-**

ised in that each yarn control element (11) is a substantially radially movable rigid pin (22) having a free end, the free end forming a gap (x) with storage body (6) in the operative position (P2) of the yarn control element (11), the gap (x) having a width wider than the thickness of the weft yarn (Y).

5. Weft yarn feeder according to claim 1, **characterised in that** the yarn control element (11) is connected to a linear drive (23) like a pneumatic cylinder or a solenoid, and that the yarn control element (11) is either driven by the linear drive (23) in both movement directions or against a spring (29) in one movement direction.

6. Weft yarn feeder according to at least one of the preceding claims 1 to 5, **characterised in that** that the yarn control elements (11) have either a common drive (10) or single discrete drives (10).

7. Weft yarn according to claim 1, **characterised in that** a part of the yarn control element (11) engaging in the operative position (P2) on the weft yarn (Y) is flexible at least in circumferential direction.

8. Weft yarn feeder according to claim 1, **characterised in that** the yarn control element (11) is a brush (25) either having bristles or fingers (26) or having a layer (26') consisting of foam material or felt.

9. Weft yarn feeding device according to claim 1, **characterised in that** the yarn control element (11) is a bent leaf spring (28), and that the drive (10) is either a linear drive (23) for linearly moving the leaf spring (28) or is a pivot drive (32) for pivoting the leaf spring (28).

10. Weft yarn feeding device according to claim 1, **characterised in that** the yarn control element (11) is a pivot arm (30) or a pivotable brush (33), and that the drive (10) is a pivot drive (32).

11. A method for inserting a weft yarn (Y) into a weaving machine (W) having driven projectiles (3) or rapiers constituting insertion elements (E) of the weaving machine, and comprising at least one weft yarn feeder (F) having a stationary storage body (6) for intermediately storing a yarn store (7) consisting of windings, according to which method the weft yarn (Y) is taken off intermittently by the insertion elements (E) from the yarn store (7) over a withdrawal rim (14) of the storage body (6) and through a passive hollow balloon breaker (8) stationarily fixed with a large diameter end in the region of the withdrawal rim (14) with a contact-free space between the passive hollow balloon breaker (8) and the storage body (6), **characterised in that** the balloon breaker's balloon suppressing effect is assisted by an additional balloon suppressing effect of at least one yarn control element (11) upstream of the withdrawal rim (14) by actively moving the at least one yarn control element (11) at the end of an insertion (P) from an outer rest position (P1) into an inner operative position (P2) close to or maximally into contact with the storage body (6).

12. Method according to claim 11, **characterised in that** in relation to a total angle of rotation of 360° of a main shaft (2) of the weaving machine (W), the at least one yarn control element (11) is moved from the rest position (P1) into the operative position (P2) within the 360° at about the last 30° to 70° of a current insertion (P) and is maintained in the operative position (P2) up to about 5° to 10° ahead of or some milli-seconds prior to the start of the insertion (P).

FIG 1

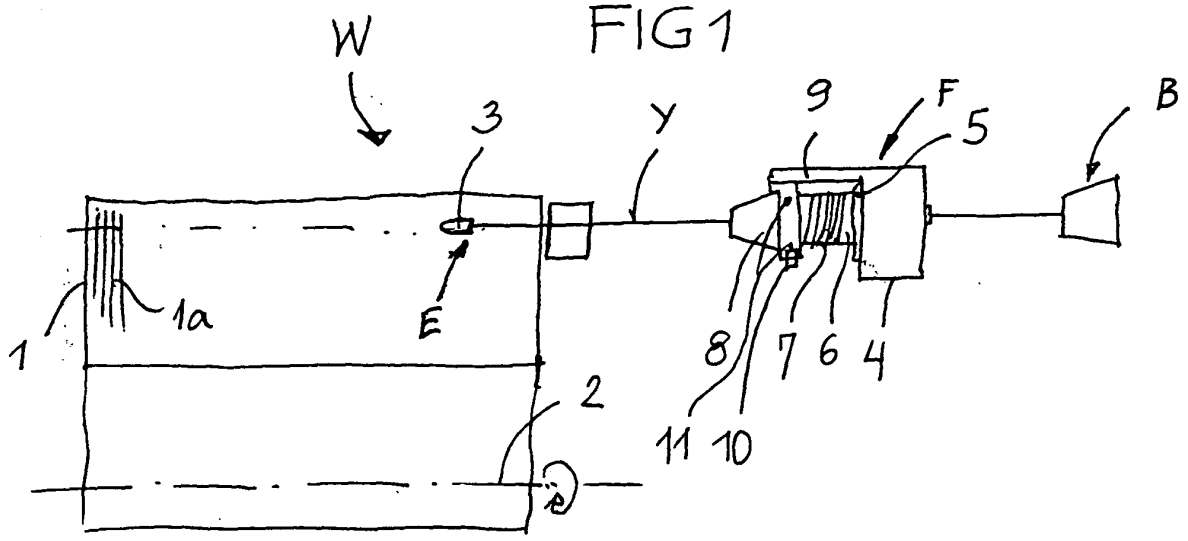


FIG 10

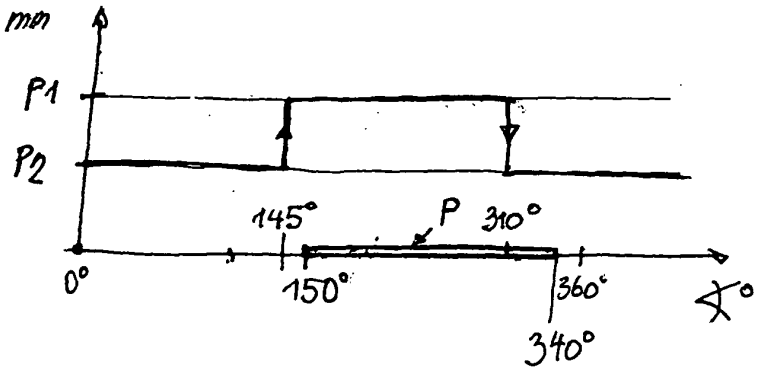


FIG 2

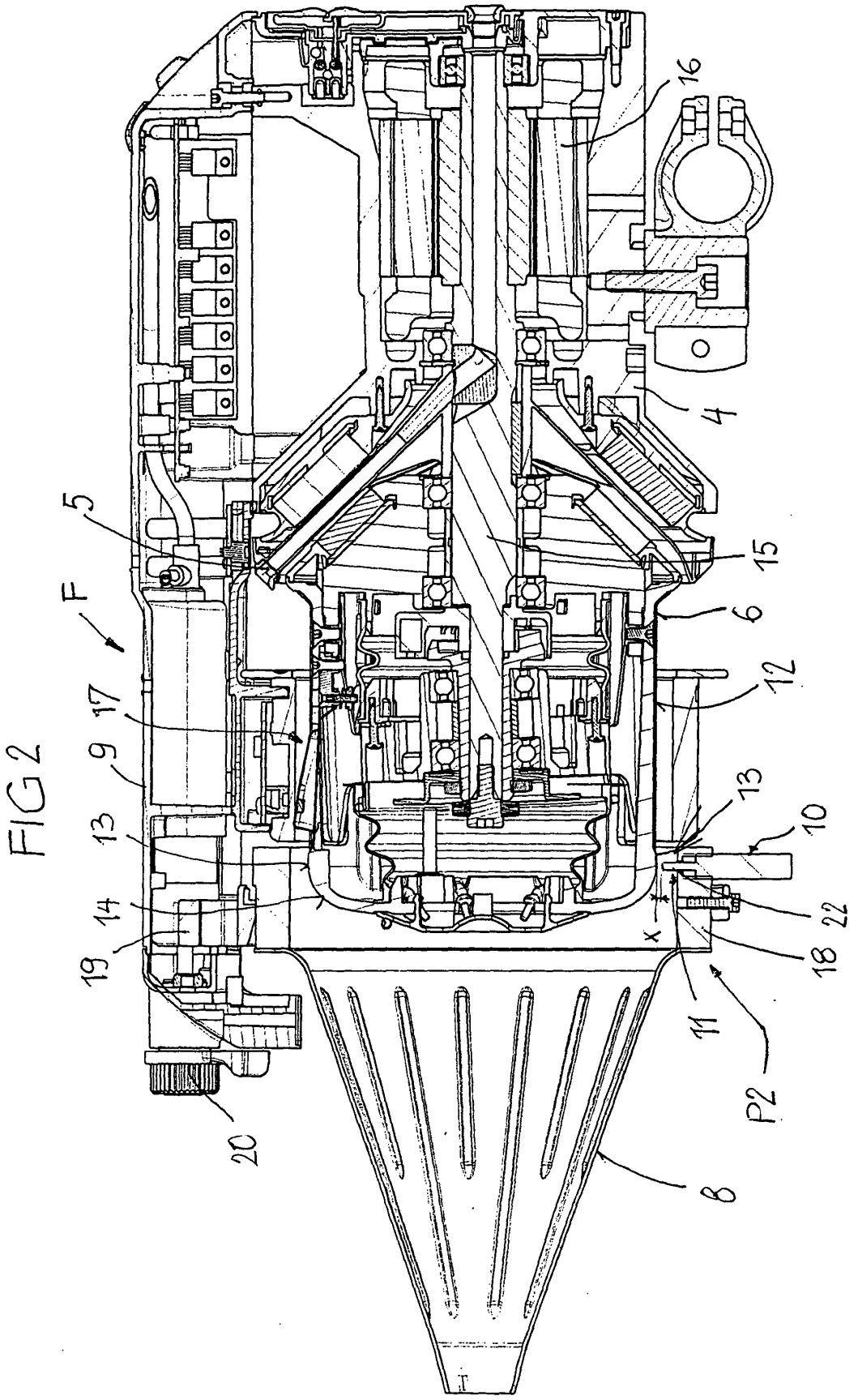


FIG 3

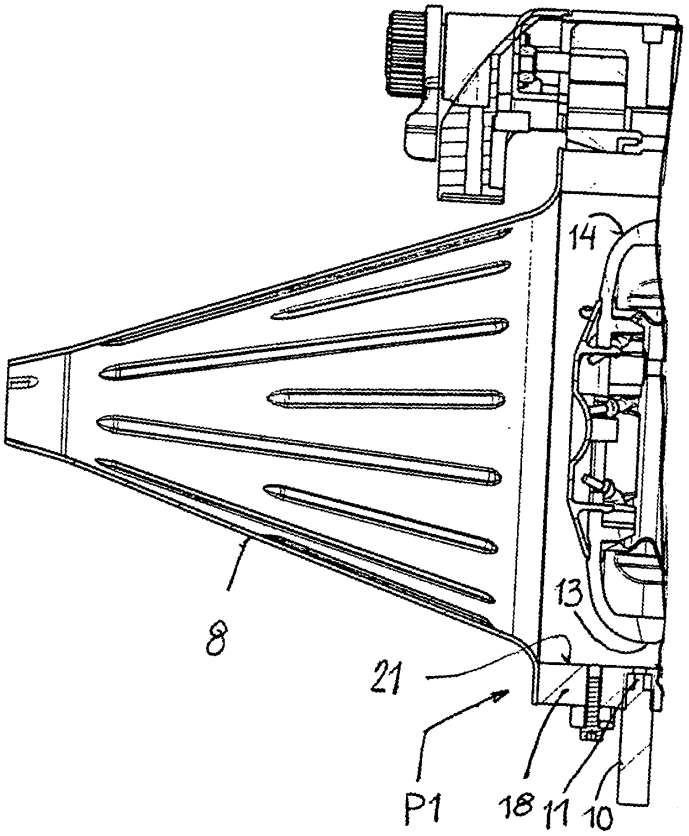
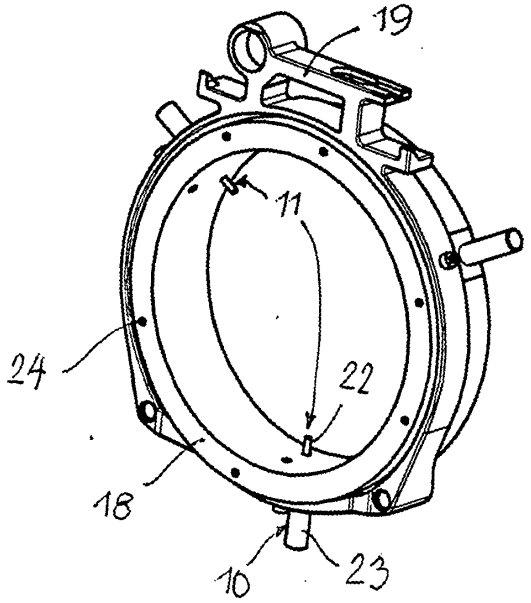


FIG 4



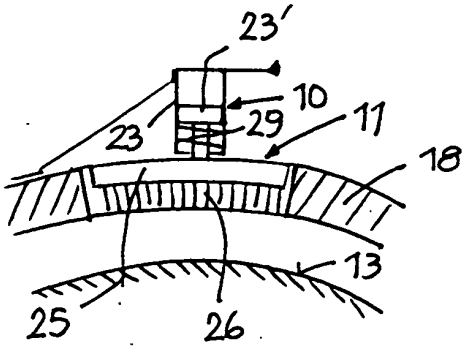


FIG 5

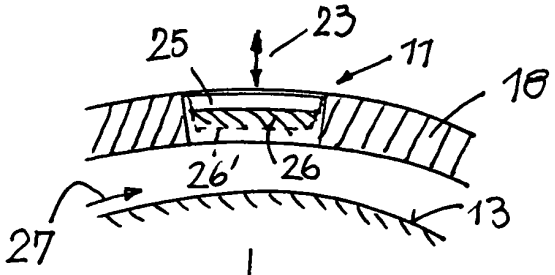


FIG 6

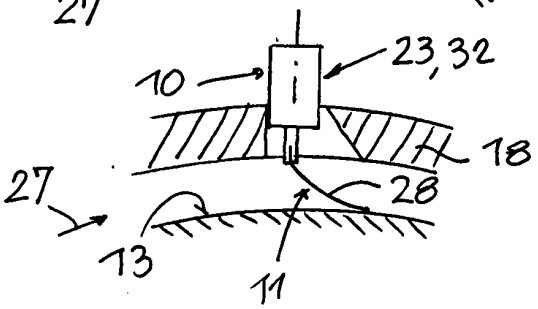


FIG 7

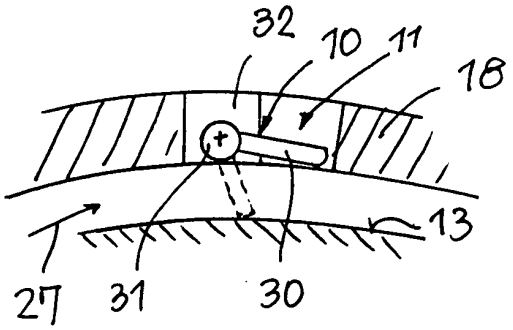


FIG 8

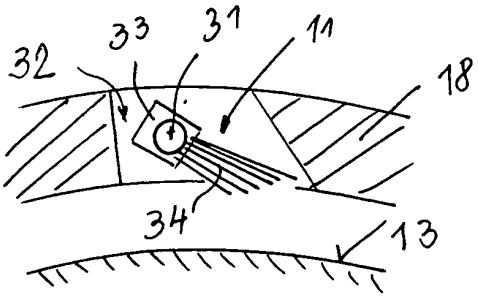


FIG 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 9851

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 343 899 A (JACOBSSON KURT A G [SE] ET AL) 6 September 1994 (1994-09-06) * column 7, line 53 - column 8, line 19 * * column 10, line 53 - column 24, line 22 * * figures 1-38 *	1-15	INV. D03D47/36
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TECHNICAL FIELDS SEARCHED (IPC)

D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 April 2008	Louter, Petrus

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

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08-04-2008

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- US 5778943 A **[0003]**
- US 3411548 A **[0004]**