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(54) **HEALD FRAME FOR WEAVING LOOMS, COMPRISING A BRAKING DEVICE OF THE HEALD MOVEMENT BY INERTIA DURING THE MOTION REVERSAL PHASES OF THE HEALD FRAMES**

(57) Heald frame for weaving looms comprising two sidepieces (F) and two crossbars (H) mutually fixed at right angles by coupling joints, each crossbar (H) consisting of a metal extruded profile which comprises an appendix (C), at the longitudinal inner edge of the crossbar (H), to which a heald-bearing plate (S) is fixed, the hooked ends of a plurality of healds (L) being hooked with a play (G) to said heald-bearing plate (S). The heald frame further comprises a braking device of the heald (L) free movement by inertia allowed by said play (G), said braking device consisting of a deformable profile (1) fixed to the longitudinal inner edge of each of said crossbars (H) in such a position as to interfere with said free movement of the healds (L) and having a predetermined stiffness in order to allow a deformation of the deformable profile (1), upon contacting the ends of the moving healds (L). Said predetermined stiffness is low enough to allow said free movement of the healds (L) up to the limit stop contact of the healds (L) against one of said heald-bearing plates (S), and at the same time is high enough to lower the speed of said free movement of the healds (L).

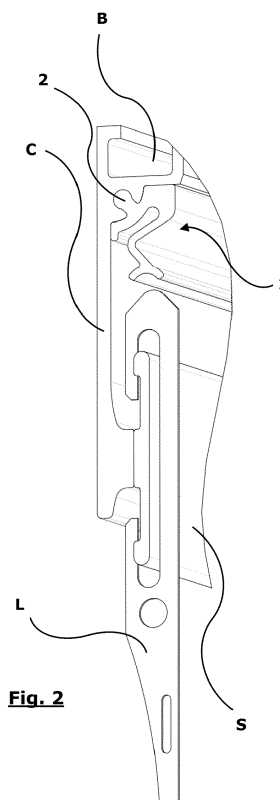


Fig. 2

Description

FIELD OF THE INVENTION

[0001] The present invention is related to a heald frame for weaving looms which comprises a braking device of the heald movement by inertia. In particular, such braking device comes into operation during the motion reversal phases of the heald frames and is apt to lower the speed of the heald movement by inertia, so as to control the extent of heald impact against the respective support structure, while allowing them to fully exploit their own assembly clearance on the heald-bearing plates during said movement by inertia. It should be noted, in fact, that in the present description, when speaking of heald movement we refer exclusively to the mutual movement of the healds and the heald-bearing plates - which movement occurs precisely at each motion reversal of a heald frame - and we do not refer instead to the normal translational movement of the healds dragged by the heald frame, while standing on the heald-bearing plates. The present invention is therefore especially useful for heald frames meant to be used in high-speed looms, wherein the healds are subjected to major impacts which significantly reduce their service life.

BACKGROUND OF THE PRIOR ART

[0002] As known, heald frames are devices used in weaving looms where - through their alternate movement, controlled by a weaving machine, along a plane perpendicular to the weaving plane - they control the movement of groups of warp threads in order to form the shed wherein the weft thread is synchronically inserted. When manufacturing the simplest fabric, the so-called cloth, the heald frames are two and the warp threads are alternately linked to one or the other of said heald frames. For fabrics with a more complex pattern, there are more heald frames, e.g., up to the number of 24 heald frames, each operating on a smaller number of warp threads in order to create more complex patterns, also by using warp threads and weft threads of different quality or colour.

[0003] The heald frames slide within suitable lateral guides, between an upper and a lower position with respect to the plane of fabric formation, and they are controlled in this movement by actuating tie rods hooked to the heald frame. A weaving machine imparts the movement to said tie rods in a known manner, in order to form a desired and predetermined fabric pattern.

[0004] Each heald frame consists of two parallel crossbars - on which thin rods of steel or other materials (the "healds" indeed) are inserted with a specified play and which are provided with a central eyelet through which one or more warp threads run - and two sidepieces laterally connecting the opposite ends of the crossbars. Furthermore, the sidepieces cooperate with the above-mentioned side guides to determine the alternate movement

of the heald frame. With the aim to have a steady frame structure, sidepieces and crossbars are mutually fixed at the four corners of the heald frame by suitable coupling joints.

[0005] As already mentioned above, the healds are assembled with wide play on the crossbars or, more precisely, on the heald-bearing plates which project from the inner edge of the crossbars and are integral thereto. This assembly clearance of the healds should be such that it allows both an easier and quicker insertion of the healds on the heald frame and, most importantly, a continuous automatic alignment of the healds along the heald frame, at an even mutual distance, while the heald frame is in motion. As a matter of fact, in the alternate motion reversal phases of heald frame, and right because of the abovementioned assembly clearance and of heald inertia, the healds cannot immediately follow the heald frame reversal and therefore will remain for a few moments in a "suspended" position, in which they have only a lateral contact with both the upper and lower heald-bearing plates, since they are no longer resting on said heald-bearing plates with their hooked end, under the pressure determined by the warp threads tension. Just at the end of this heald "suspension" phase the impact of the heald-bearing plate occurs, which takes again contact with the hooked end of the healds, which impact, as a matter of fact, causes vibrations which facilitate the natural alignment of the healds under the action of the low mutual lateral forces existing between the individual healds. These forces are therefore constantly being levelled at each motion reversal of the heald frame, thus maintaining a perfectly even distribution of the healds over time along the heald frame with the desired consequent result that an even fabric is woven.

[0006] However, although the assembly clearance of the healds and the consequent continuous impacts of the healds against the heald-bearing plates are a key factor in order to produce a good quality fabric, due to the reasons examined above, such impacts are also a source of possible serious mechanical drawbacks when the loom operating speed becomes high. In this case, in fact, the overload caused by said impacts - regularly and alternately repeated the two opposite end of the healds and having a high amount of energy - can easily lead over time to a progressive wear and tear of the mechanical structure of the healds, resulting in deformations and warping thereof, which cause a less regular operation of the healds at first and eventually their possible breakage, reducing in any case their service life. Another undesired consequence of such repetitive impacts having a high amount of energy, is the generated high noise, which is indeed typically the greater noise emission of a weaving loom.

[0007] Several solutions have been disclosed in the known art to overcome this drawback, for example such as those disclosed in patents EP1240371, US20030150506, EP1176237, EP1498521, EP1639165, EP1675984, EP1769111, and EP2669413.

All these solutions, however, offer different embodiments of a single inventive concept, namely the insertion of a shock absorbing profile at the opposite ends of the motion path of the healds, which profile is made of a plastic material having suitable elastic and damping features. Said shock absorbing profile replaces therefore the function of the heald-bearing plate in forming the limit stop of the heald ends in the motion reversal phases of the heald frames.

[0008] The various solutions disclosed in the above documents differ from each other substantially in the anchorage point of the shock absorbing profile, which can in fact be fixed either on the crossbar or on the heald-bearing plate; in both cases, however, the function of the shock absorbing profile is to prevent the healds end from coming into contact with the opposite parts of the heald-bearing plates against which the healds would otherwise normally hit. In other words, all these known solutions have the purpose of preventing the traditional metal/metal limit stop contact between the healds ends and their respective heald-bearing plates, by replacing it with a metal/plastic contact between the healds ends and said shock absorbing profile which is fixed to the crossbar profile or to the heald-bearing plates by different means.

[0009] Therefore, the solutions disclosed by the above prior art documents do actually solve the problem of the impacts between healds and heald-bearing plates, which are in fact completely eliminated, but nevertheless causes, due to this same reason, a considerable impairment of the weaving quality, since the absence of the continuous impacts of the healds against the heald-bearing plates significantly worsens the natural alignment of the healds along the heald frame. The evenness of the warp threads arrangement in the fabric is thus compromised.

[0010] In the textile practice of the weaving rooms, therefore, the above illustrated shock absorbing known devices can be currently used only in a minority of cases wherein the number and the kind of warp threads are such as to still allow a correct automatic alignment of the healds along the heald frame, despite the absence of any heald impact against the heald-bearing plates. In all other cases the shock absorbing plastic profiles need instead to be relinquished, and thus the weaving is carried out under usual conditions, i.e. the healds directly hit against the heald-bearing plates, obviously suffering from the abovementioned drawbacks as regards the duration of the heald service life and the high noise generated when weaving with high-speed looms.

[0011] The problem addressed by the present invention is therefore that of protecting the healds from the damaging effects deriving from the repeated impacts against the heald-bearing plates, by limiting the amount of energy of said impacts without however reducing the extent of the free movement of the healds by inertia during the heald frame motion reversals, so as to maintain a metal/metal limit stop contact between the healds and the heald-bearing plates with a lower amount of energy, such as to facilitate the natural alignment of the healds

along the heald frame, while they are in a condition of only lateral contact onto the heald-bearing plates, without however damaging the mechanical structure of the healds.

[0012] While addressing this problem, a first object of the invention is therefore to provide a braking device of the heald movement which allows to lower the speed of the healds during the motion reversal phases of the heald frame, without however limiting the length their normal path, so as to significantly control the energy amount of the healds impacts against the heald-bearing plates and thus increase heald service life.

[0013] A further object of the invention is also to provide a braking device for healds of the type indicated above which provides an increasing braking force, preferably in a progressive manner, while the healds approach the impact position, so as to be able to correctly modulate the residual impact energy when the healds hit the heald-bearing plates, in various possible working conditions, as in particular with different loom operation speeds, which means different impact energy of the healds. While indeed a braking device having a constant braking force can be optimized just for a narrow range of loom operating speeds, a braking device having an increasing stiffness could more easily be optimized for a much wider range of loom operating speeds, thus making much more flexible the application thereof to different working conditions.

SUMMARY OF THE INVENTION

[0014] This problem is solved and these objects achieved by means of a heald frame for weaving looms comprising a braking device of the heald movement during the motion reversal phases of the heald frame having the features defined in claim 1. Other preferred features of said braking device are defined in the secondary claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Further features and advantages of the heald frame provided with a braking device according to the present invention will however become more evident from the following detailed description of a preferred embodiment thereof, given as a mere and non-restrictive example and shown in the attached drawings, wherein:

Fig. 1 is a perspective view of an angular upper portion of a heald frame provided with a braking device of the heald movement by inertia comprising a deformable profile according to the present invention; Fig. 2 is an enlarged perspective view showing a cross section of the portion of Fig. 1 enclosed in a circle;

Fig. 3 is a strongly enlarged perspective view of a first embodiment of the deformable profile shown in Fig. 1;

Fig. 4 is a strongly enlarged perspective view of a second embodiment of the deformable profile of Fig. 1;

Fig. 5 is a graph qualitatively showing the trend of the braking force exerted by said deformable profile on the healds, as a function of the shifting of the healds after the first contact with said deformable profile, and

Fig. 6 schematically depicts the A-D different phases of the movement of a heald upper end of, during the motion reversal of the heald frame.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] After having fully investigated the drawbacks of the shock absorbing known profiles, the present invention is based on the insight of its inventors to completely leave the traditional approach of a shock absorbing element positioned at the limit stop of the free movement by inertia of the healds, in order to prevent them from hitting the heald-bearing plate with a metal/metal contact. According to the invention, in the same position a braking device is instead provided, said braking device being apt to lower the heald speed, during the free movement by inertia of the healds occurring at every motion reversal of the heald frame, by means of a progressive folding of its own shape, so as not to prevent the healds from reaching their natural limit stop against the heald-bearing plate S. Based on this first insight, the present invention, and in particular a braking device of the free movement by inertia of the healds, has been developed, of which a preferred embodiment will be shown in the following.

[0017] Fig. 1 schematically shows the general configuration of a heald frame comprising a braking device of the heald movement by inertia according to the present invention. Said heald frame comprises, in a per se known manner, two sidepieces F and two crossbars H - i.e. an upper and a lower crossbar - mutually fixed at right angles, at the four corners of the heald frame, by means of suitable coupling joints locked by tightening a screw V. Each crossbar H consists of a metal extruded profile, preferably made of aluminium alloy, or possibly also of a composite material, comprising a hollow main body B and a flat appendix C (often provided with lightening windows) at the longitudinal inner edge of the crossbar H. A heald-bearing plate S is fixed to the appendix C and bear the hooked ends of the healds L.

[0018] As clearly shown in Fig. 1 and in greater detail in the enlarged Fig. 2, in order to solve the problem described above, according to the present invention, a braking device of the heald movement by inertia is fixed on the inner edge of the crossbars H, which movement, as above said, takes place in the motion reversal phases of the heald frame, due to the wide play G (Figs. 1 and 6) existing between the healds and the heald-bearing plate S on which the healds are hooked, and to the movement by inertia of the healds themselves. According to an es-

sential feature of the invention, such a braking device comprises a deformable profile 1 made of plastic material, having the function of lowering the speed of the healds L during their abovementioned movement by inertia, which movement is not controlled by the heald-bearing plates S, so as to significantly control the amount of energy of the heald impacts against the heald-bearing plates S. Any possible breaking of the healds L is therefore avoided or at least significantly reduced, thus extending the service life. According to the other essential feature of the invention, in fact, the deformability extent of the deformable profile 1 should be high enough never to cause halting of the healds L before they hit, at a lowered speed, the usual mechanical limit stop formed by the heald-bearing plate S. Preferably, the above-mentioned braking function is achieved by means of a special foldable shape of the deformable profile 1, which exhibits a progressively increasing stiffness as it progressively folds.

[0019] As a matter of fact, the deformable profile 1 has a special cross-section shape which imparts to the same the inherent feature of lowering to the desired extent the speed of the free-moving healds L, without however offering an alternative limit stop to the usual mechanical one, which consists of the heald-bearing plates S. The above described braking device provides therefore a completely innovative solution compared to the shock absorbing profiles of the prior art discussed above, which, on the contrary, completely absorb the impacts of the healds, preventing any contact thereof with the heald-bearing plates S.

[0020] This innovative outcome is achieved by means of a deformable profile 1 including a base body 6 from one side of which a per se known coupling rib 2 projects; the coupling rib 2 allows the steady coupling of the deformable profile 1 to a corresponding longitudinal cavity 2c formed at the inner edge of the hollow body B of the upper crossbar H. A flexible lip 3 projects from the opposite side of the base body 6, which flexible lip 3 is intended for braking the healds L with its free end provided with a contact lip 5. Said contact lip 5 enters in contact with the upper end of the healds L during their movement by inertia with respect to the heald-bearing plate S.

[0021] According to a feature of the invention, the lip 3 exhibit an increasing rigidity as its folding progresses. In particular, the lip 3 exhibits a lower stiffness in a first folding phase, wherein its structure has a higher buckling length. The lip 3 ends, as above mentioned, with a contact lip 5; in order to offer a correct and stable grip onto the upper end of the healds L, the contact lip 5 has a moderately arched shape, whose concavity faces the healds L, as clearly shown in Figs. 3 and 4. It is therefore against this arc-shaped contact lip 5 that, during the motion reversal phase of heald frame, the healds L apply a force F which then is loaded on the deformable profile 1, causing its progressive elastic folding.

[0022] The deformable profile 1 can have different shapes, depending on the different stiffness/flexibility re-

quirements of the weaving conditions where the respective heald frame operates. By way of mere example, in Figs. 3 and 4 two different embodiments of said deformable profile 1 are shown, in which the rib 2 and the lips 3 and 5 have different arrangements and shapes, nevertheless providing a similar functionality. In both the abovementioned embodiments the deformable profile 1 is made of a homogeneous material, and therefore the different flexibility/stiffness of the lip 3 is obtained through a different shape of said lip and through a change of its buckling length during the profile 1 folding. In principle, the desired flexibility/stiffness of the lip 3 could also be obtained by use of different materials or thicknesses for its manufacture. However, this second solution is not currently preferred due to the major complications involved in the production of the deformable profile 1 and therefore the consequent higher cost.

[0023] The first embodiment of the deformable profile 1 is shown in Fig. 3 and features a coupling rib 2 with a partially round cross-section, connected to the base body 6 through a narrowed portion. The lip 3 is connected to the upper end of the base body 6 through an angular connecting area developing for about 180° and forming the oscillation hinge of said lip. Lip 3 is L-shaped and extends from said oscillation hinge firstly in a direction substantially parallel to the base body 6, and then in a direction substantially perpendicular thereto. Finally, the contact lip 5 is joined to the free end of the lip 3, at a central portion thereof.

[0024] The second embodiment of the deformable profile 1 is shown in Fig. 4 and features a coupling rib 2 having a partially square cross-section, connected to the base body 6 through a narrowed portion. The lip 3 is connected to the lower end of the base body 6 through an angular connecting area developing for about 180° and forming the oscillation hinge of said lip. The contact lip 5 is joined at one of its ends to the free end of the lip 3 and extends in an opposite direction thereto, so as to give nearly an S-shape to the assembly formed by the lip 3 and the lip 5. Finally, in this embodiment the base body 6 is provided with a protuberance 4 having a generally trapezoidal cross-section, provided with a central longitudinal chamber which determines its wall thickness and therefore its stiffness.

[0025] According to the main feature of the present invention the deformable profile 1, due to its special foldable shape with controlled stiffness, lowers the speed of healds L before they come into contact with the heald-bearing plate S, without limiting in any way the length of their normal path up to the mechanical limit stop. During the rapid motion reversals of the heald frame, therefore, said healds L still hit against the limit stop formed by the heald-bearing plates S, so as to still enable the automatic alignment of the healds L along the heald frame during the weaving operation, which alignment is precisely facilitated by such impacts. However, these impacts now occur at a lowered speed and therefore induce quite lower stresses in the healds L, whose service life is therefore

considerably lengthened, without undergoing any textile inconvenience as instead happens in the shock absorbing devices of the prior art.

[0026] The above described behaviour of the deformable profile 1, according to the present invention, is clearly schematically depicted in the four drawings which make up Fig. 6, which drawings represent as many phases A-D of the mutual positioning of the heald-bearing plate S and of a relative heald L during the motion reversal of the heald frame.

[0027] In phase A, the heald frame is moving upward and the upper end of the heald-bearing plate S is in contact with the upper loop of the heald L hook and drags the heald L in the direction of the arrow. The whole assembly clearance G of the heald L onto the heald-bearing plate S therefore is located between the lower end of the heald-bearing plate S and the lower loop of the heald L hook.

[0028] In phase B the heald frame has reversed its motion starting the down travel, while the heald L continues its up movement by inertia. In this phase the play G is located between the two loops of the heald L hook, and thus the direct thrust contact between the heald-bearing plate S and the heald L is interrupted. The healds L, free from such contact, thus initiate an automatic alignment along the heald frame, rebalancing the lateral forces that may have been generated in the up travel of the heald frame; in the final part of this phase does begin the contact between the upper end of the heald L and the contact lip 5 of the deformable profile 1.

[0029] In phase C the mutual movement of the heald L and the heald-bearing plate S proceeds, while the speed of the heald L is progressively lowered, due to the lip 3 folding around its hinge points, and the play G gradually moves onto the upper loop of the heald L hook. In the meantime, the lip 3 has partially folded until touching the base body 6 with its angular portion, thus reducing its buckling length and consequently increasing its own stiffness.

[0030] In the final step D, the lip 1 continues its folding with increased stiffness while the mutual movement of the heald L and the heald-bearing plate S comes to an end when the heald-bearing plate S hits against the lower loop of the heald L hook; thanks to this impact the action of automatic alignment of the healds L is thus facilitated and completed. The play G has now completely shifted onto the upper loop of the heald L hook and the heald-bearing plate S is in contact with the lower loop of the heald L hook initiating its down travel, in the direction indicated by the arrow.

[0031] The deformable profile 1 according to the second embodiment, shown in Fig. 4, behaves completely similarly. The first two phases A and B of the mutual positioning of the heald L and the heald-bearing plate S are completely identical. In phase C the lip 3 continues the folding until it enters in contact with the protuberance 4. In this embodiment too the contact between the lip 3 and the protuberance 4 of the body 6 causes an abrupt re-

duction of the buckling length of the lip 3 and therefore a sharp increase in its stiffness. In this case the increased stiffness of lip 3 is partly compensated by a limited resilience of the protuberance 4.

[0032] Thus, when the healds L enter in contact with the contact lip 5, the deformable profile 1 according to the first embodiment has a specific low stiffness Ra, substantially determined by the folding stiffness of the entire lip 3 only. With the increasing shifting of the healds L from their original position, the lip 3 enters in contact, due to its own folding, with the base body 6 of the deformable profile 1, which abruptly reduces its buckling length, with the consequence that the lip 3 stiffness rises now to a higher value Rb. This variable stiffness of the deformable profile 1 is graphically represented in Fig. 5, from the qualitative point of view, with a curve having two linear branches of different slope.

[0033] The deformable profile 1 according to the second embodiment, shown in Fig. 4, behaves completely similarly to the profile of the first embodiment described above, despite the lip 3 has a different shape in this second embodiment. In phase C, in fact, the lip 3 folding continues until such lip comes into contact with the protuberance 4 which, completely similarly to what described for the first embodiment of the deformable profile 1, abruptly reduces the buckling length of lip 3, thus increasing its stiffness. Therefore, in step D the lip 3 folds further, while also the protuberance 4 undergoes a moderate deformation, both said elements thus contributing to determine the overall stiffness Rb of the deformable profile 1 in this phase. Also in this case, thus, the curve having two linear branches of different slope shown in Fig. 5 qualitatively represents the stiffness of the deformable profile 1 as a function of the relative shifting of the heald L with respect to the heald-bearing plate S.

[0034] In practice, in both the above described embodiments the effect of stiffness increase resulting from the reduction of the lip 3 buckling length is progressive, during the heald L shifting and the progressive folding of the deformable profile 1, so that the real reaction force opposed to the healds L by the deformable profile 1 follows the curved trend schematically represented by the curve R of the same Fig. 5. With the braking device of the heald movement according to the present invention it is therefore possible to gradually and effectively slow down the healds L, accompanying the healds L up to the contact with the heald-bearing plate S in a controlled way, i.e. with a residual impact energy which is low enough not to impart any negative effect on the integrity of the healds L, but still high enough to be more than sufficient to facilitate the automatic alignment of the healds L.

[0035] From the preceding description it is therefore clearly apparent how the braking device of the heald movement according to the present invention has fully achieved the first object of the invention by providing a braking device which lowers the healds L speed in the motion reversal phases of the heald frame, thus allowing the reduction within acceptable values of the stresses

induced on the healds L by the repeated impacts against the heald-bearing plates S, without however limiting the length of the free movement of the healds by inertia allowed by play G. The second object of the invention is then fully achieved too, since the elastic reaction force of the deformable profile 1 is increased throughout its deformation, so that the braking device of the invention lends itself to be effectively optimized also for different loom operation speeds.

[0036] It is then understood that the invention should not be considered as limited to the arrangements shown above, which are only exemplary embodiments thereof. Different variants of such embodiments are in fact possible - for example by modifying the shape and arrangement of the lip 3 or of the protuberance 4 or modifying in part its composition to obtain a variable stiffness at the desired extent - all these variants being within the obvious reach of a person skilled in the art and therefore included in the scope of protection of the invention, which is only defined by the following claims.

Claims

1. Heald frame for weaving looms comprising two sidepieces (F) and two crossbars (H) mutually fixed at right angles by coupling joints, each crossbar (H) consisting of a profile comprising an appendix (C), at the longitudinal inner edge of the crossbar (H), to which a heald-bearing plate (S) is fixed, the hooked ends of a plurality of healds (L) being hooked with a play (G) to said heald-bearing plate (S), **characterized in that** it further comprises a braking device of the heald (L) free movement by inertia allowed by said play (G), said braking device consisting of a deformable profile (1) fixed to the longitudinal inner edge of each of said crossbars (H) in such a position as to interfere with said free movement of the healds (L), and having a predetermined stiffness in order to allow a deformation of the deformable profile (1), upon contacting the ends of the moving healds (L), **and in that** said predetermined stiffness is low enough to allow said free movement of the healds (L) up to the limit stop contact of the healds (L) against one of said heald-bearing plates (S), and at the same time is high enough to lower the speed of said free movement of the healds (L).
2. Heald frame for weaving looms according to claim 1, wherein said deformable profile (1) comprises a base body (6) from which project, on one side, a coupling rib (2) coupled to a corresponding longitudinal chamber (2c) formed in said crossbar (H), and, on the opposite side, at least one flexible lip (3), which enters in contact with said healds (L) during their free movement by inertia with respect to the heald-bearing plates (S), through a contact lip (5) joined to said lip (3).

3. Heald frame for weaving looms according to claim 2, wherein said lip (3) in a first folding phase has a stiffness (Ra) lower than the stiffness value (Rb) of the same lip (3) in a second folding phase, so as to determine an increasing overall stiffness (R) of the deformable profile (1) with the progressive folding of said lip (3). 5
4. Heald frame for weaving looms according to any one of the preceding claims, wherein said deformable profile 1 is made of plastic material. 10
5. Heald frame for weaving looms according to claim 4, wherein the different stiffness (Ra, Rb) of said lip (3) during its folding are determined by an abrupt reduction of the buckling length of the lip (3) caused by the contact of an intermediate portion thereof with said base body (6) or with a protuberance (4) thereof. 15
6. Heald frame for weaving looms according to claim 5, wherein said protuberance (4) develops from one end of the base body (6) opposite to the other end thereof from which the lip (3) develops, has a trapezoidal cross-section, and is provided with a longitudinal central chamber. 20
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7. Heald frame for weaving looms according to claim 4, wherein the different stiffness (Ra, Rb) of said lip (3) during its folding are determined by a different composition or shape of different portions of said lip (3). 30
8. Heald frame for weaving looms according to claim 5, 6 or 7, wherein said lip (3) is joined to an end of said base body (6) through an angular connecting area developing for about 180° and forming an oscillation hinge thereof, and has an L-shape extending from said oscillation hinge, firstly in a direction parallel to said base body (6) and then in a direction perpendicular thereto. 35
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9. Heald frame for weaving looms according to claim 8, wherein said contact lip (5) has an arched shape, whose concavity faces the healds (L) , and is joined to the free end of the lip (3), at a central portion thereof. 45
10. Heald frame for weaving looms according to claim 5, 6 or 7, wherein said lip (3) is joined to an end of said base body (6), through an angular connecting area developing for about 180° and forming an oscillation hinge thereof, and has an arched shape extending in a direction substantially perpendicular to the base body (6). 50
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11. Heald frame for weaving looms according to claim 10, wherein said contact lip (5) has an arched shape, whose concavity faces the

healds (L), is joined with one of its ends to the free end of the lip (3), and extends in the opposite direction thereto, to give an S-shape to the assembly formed by the lip (3) and the lip (5).

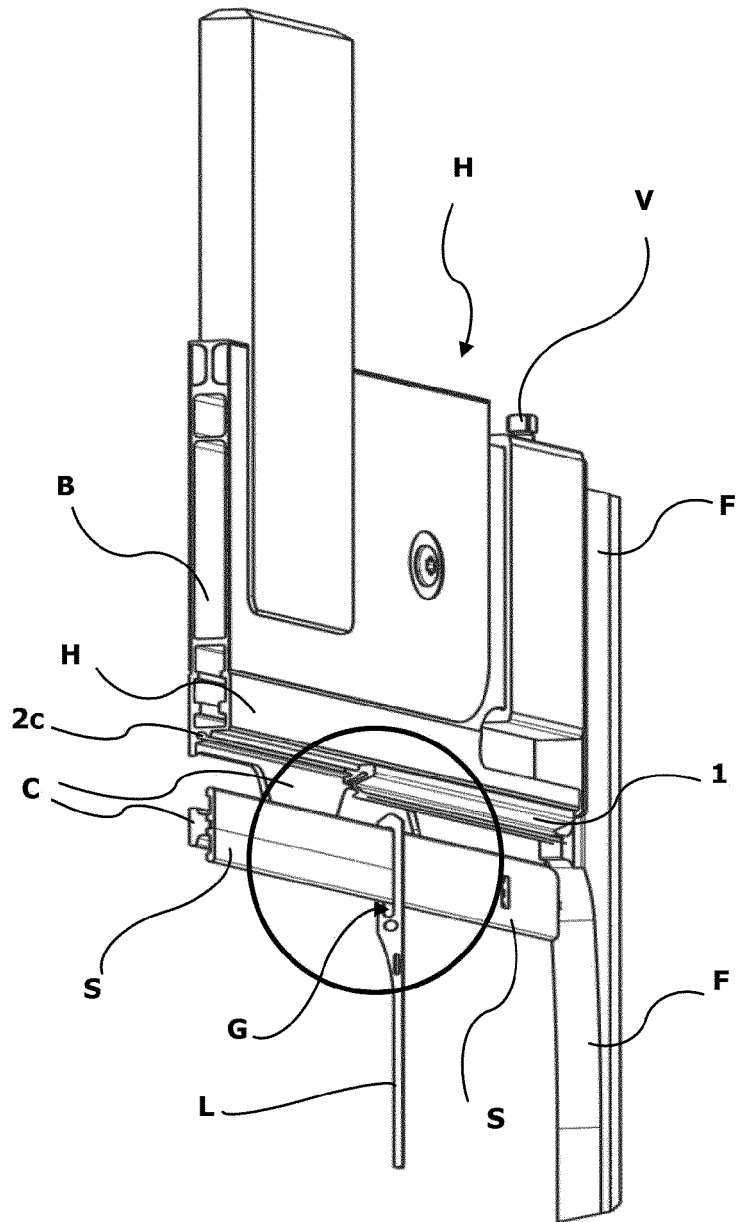


Fig. 1

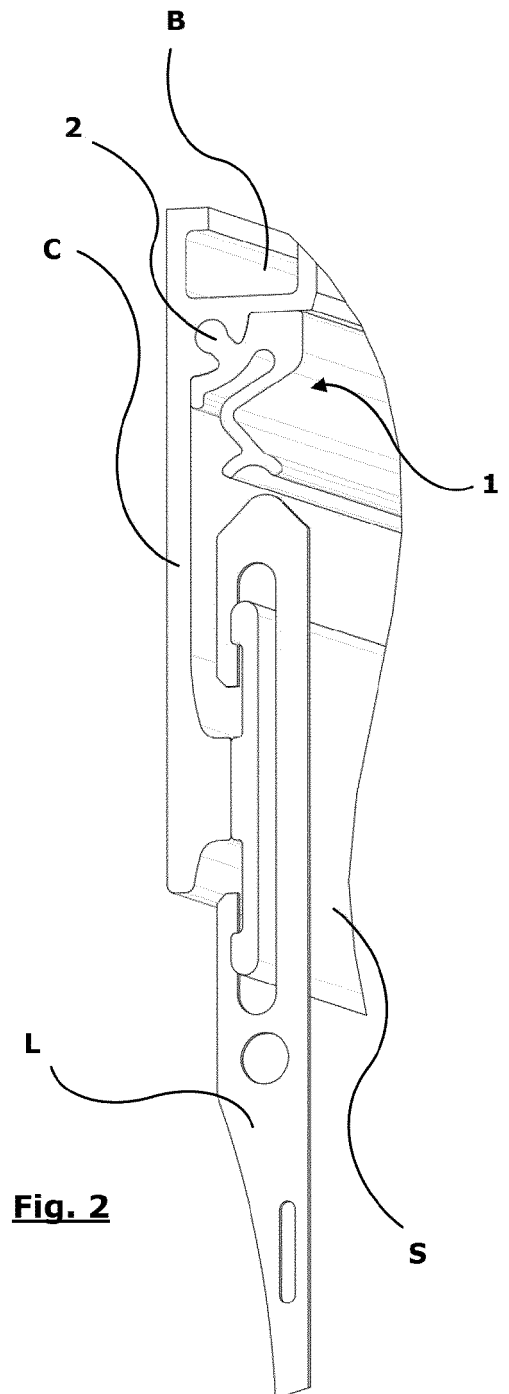
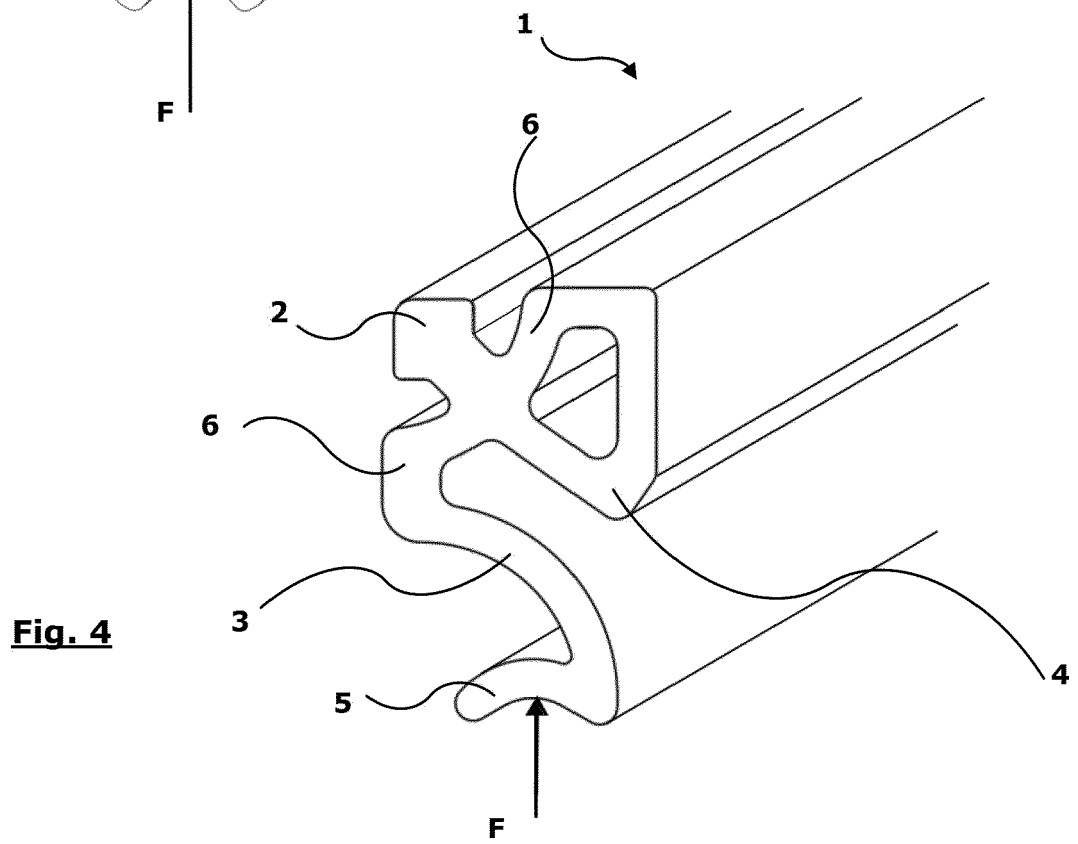
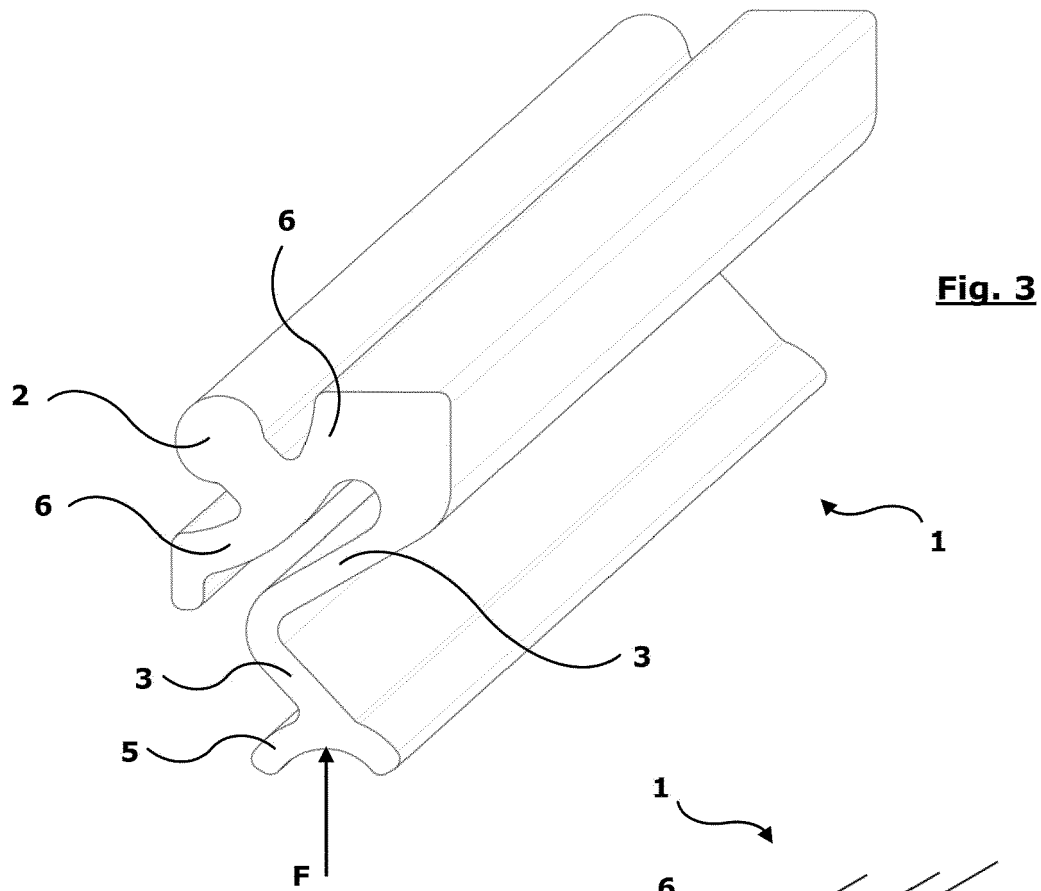


Fig. 2



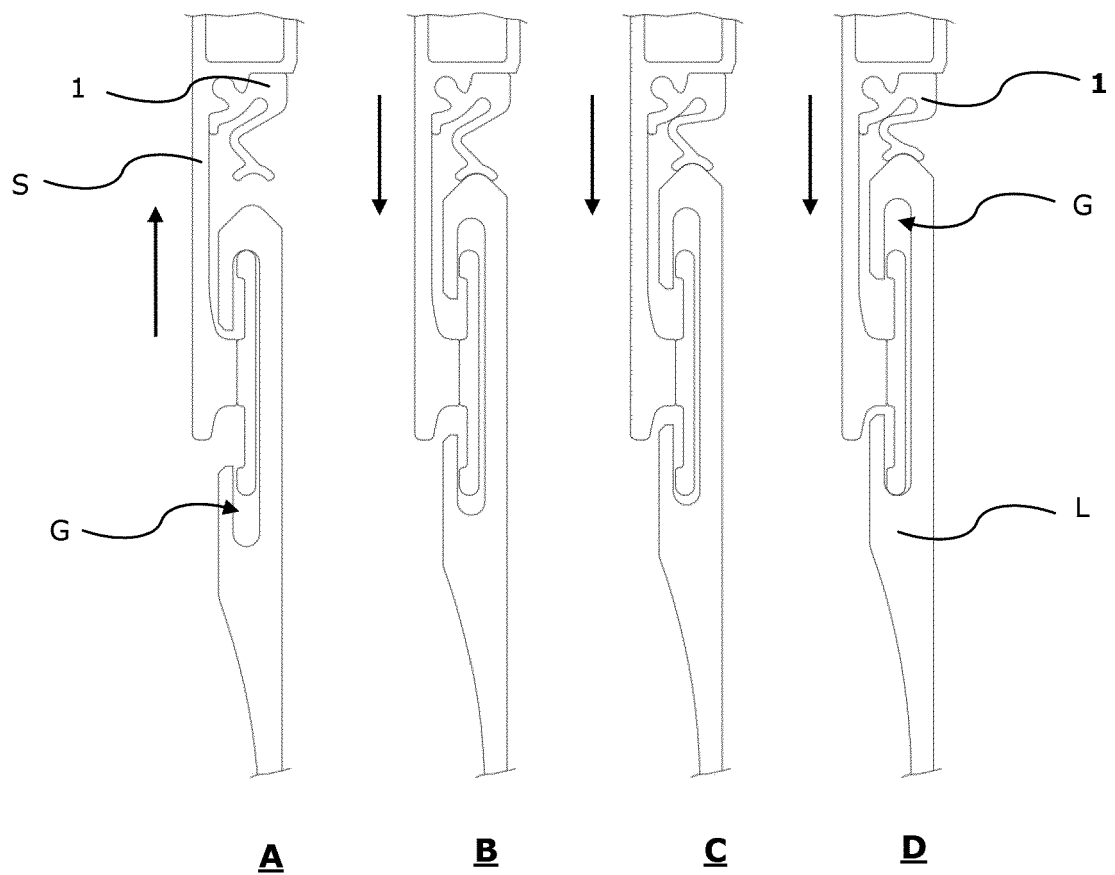
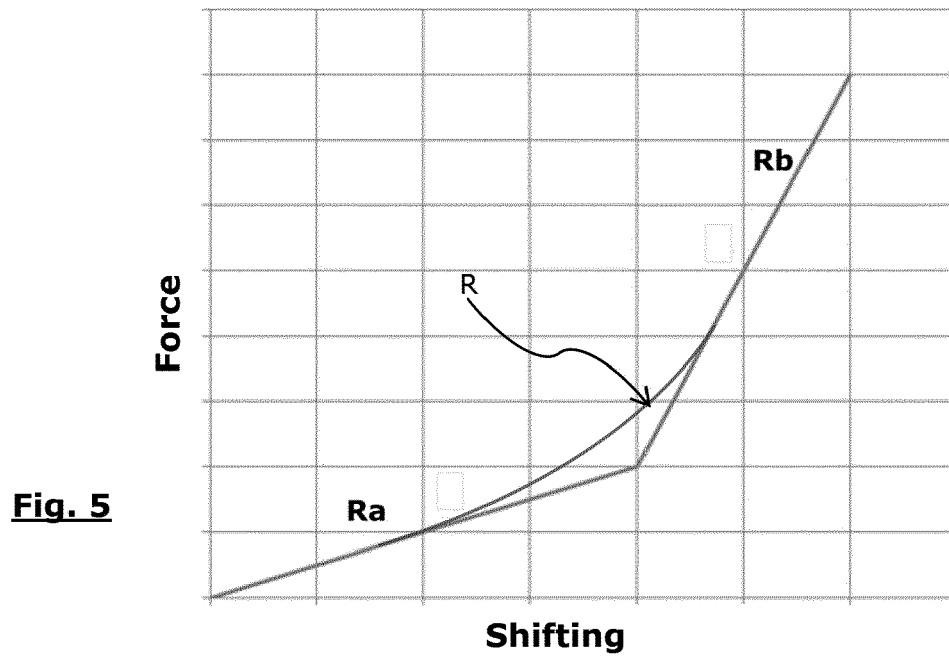


Fig. 6



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