



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.06.2020 Bulletin 2020/26

(51) Int Cl.:
D03D 27/10 (2006.01)

(21) Application number: **19214540.7**

(22) Date of filing: **09.12.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Vandewiele NV**
8510 Kortrijk / Marke (BE)

(72) Inventor: **SMISSAERT, Ludo**
8310 ASSEBROEK (BE)

(74) Representative: **Ostyn, Frans et al**
KOB NV
President Kennedypark 31 c
8500 Kortrijk (BE)

(30) Priority: **21.12.2018 BE 201805930**

(54) **METHOD FOR MANUFACTURING PILE FABRICS**

(57) The present invention relates to a method and a weaving machine for manufacturing pile fabrics (PW1),(PW2) comprising base fabrics (B1), (B2) composed of first ground warp threads (1-3, 3a, 3b, 13),(4-6, 6a, 6b, 14) and first weft threads (20,20b,20R,22),(21,21b,21R,22), respectively, and comprising pile warp threads (P1)-(P16) whose pile-forming parts extending between the base fabrics

(B1),(B2) are cut between both base fabrics (B1),(B2) in order to obtain two pile fabrics (PW1),(PW2), and wherein non-pile-forming parts of the pile warp threads (P1)-(P16) are woven in, together with second weft threads (20), (21), (22), before the pile-forming parts are cut, to form at least one additional fabric (Z); (Z1),(Z2) which is subsequently removed.

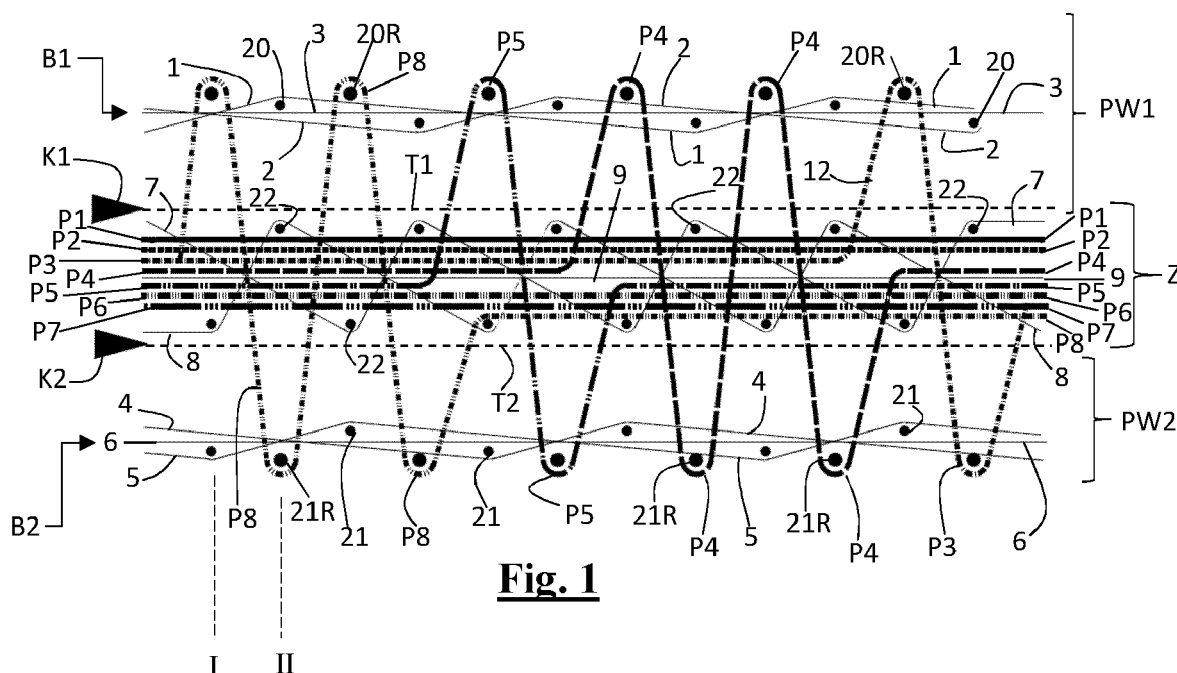


Fig. 1

Description

[0001] The present invention relates, on the one hand, to a method for manufacturing pile fabrics, such as for example carpets, wherein two base fabrics are woven composed of first ground warp threads and first weft threads, respectively, while each base fabric comprises at least one pile warp thread, parts of which extend between both base fabrics in a pile-forming manner, wherein at least some pile warp threads are non-pile-forming over at least a part of their length, and wherein the pile-forming parts of the pile warp threads between both base fabrics are cut, so that two pile fabrics are obtained.

[0002] The present invention relates, on the other hand, also to a weaving machine, such as for example a double-face weaving machine, for manufacturing pile fabrics, such as for example carpets, comprising a weft insertion device configured to insert in each case at least two weft threads at different weft insertion levels between ground warp threads and pile warp threads in successive weft introduction cycles, a shed-forming device provided to position said ground warp threads and pile warp threads in each weft introduction cycle with respect to the weft insertion levels in such a way, that two base fabrics are woven one above the other from first ground warp threads and first weft threads, respectively, whereas parts of pile warp threads extend in a pile-forming manner between both base fabrics and at least some of the pile warp threads are non-pile-forming over at least a part of their length, and a cutting device provided to cut the pile-forming parts of the pile warp threads between both base fabrics, so that two pile fabrics are obtained.

[0003] The present invention relates in particular to such a method and a weaving machine for manufacturing carpets whose properties come very close to replicating the typical properties of hand-knotted carpets. More particularly, it relates to manufacturing relatively lightweight and flexible and relatively easily pliable carpets, whose pile exhibits a multicoloured pattern (or design or motif) which is readily recognisable on the back of the carpet.

[0004] It is known to manufacture carpets having an appearance resembling the appearance of hand-knotted carpets on a double-face weaving machine according to a double-face weaving method with the above-mentioned properties. In this case, the non-pile-forming parts of pile warp threads are bound in in the base fabrics. However, these carpets are relatively heavy and stiff, as a result of which they still differ considerably from hand-knotted carpets.

[0005] It is known from EP 1 746 190 A1 to allow the non-pile-forming parts of pile warp threads to float between both carpets when using such a double-face weaving method, and to subject the two carpets, after they have been separated, to a scraping operation to remove these non-pile-forming parts. The carpets which have thus been obtained are lighter and more pliable, as a result of which they better resemble hand-knotted carpets, but the additional scraping operation renders the

manufacturing process more laborious, slower and more expensive and, in addition, also involves a higher risk of damage to the carpets.

[0006] It is a first object of the present invention to provide a method for simultaneously weaving two pile fabrics which allows pile fabrics to be manufactured which have an appearance resembling the appearance of a hand-knotted fabric and which, after the pile warp threads which run between both pile fabrics have been cut, produces two pile fabrics which do not have to undergo any further treatment in order to remove redundant yarns.

[0007] This object is achieved, according to the present invention, by providing a method having the characteristics which have been indicated in the first paragraph of this description, wherein at least some of the non-pile-forming parts of the pile warp threads are woven in, together with second weft threads, before the pile warp threads are cut to form at least one additional fabric, and wherein each additional fabric is subsequently removed.

[0008] In this patent application, the expression 'non-pile-forming parts of pile warp threads' is understood to refer not only to the parts of pile warp threads which do not form pile, these pile warp threads also having parts which do form pile, but also to refer to the pile warp threads which do not have any pile-forming parts.

[0009] At least some of the non-pile-forming parts - preferably all non-pile-forming parts - of the pile warp threads are thus held together in one or several additional fabrics which may be removed as a coherent whole during weaving on the weaving machine. This may be achieved, for example, by providing means on the weaving machine which advances each additional fabric, as weaving progresses, and transports it away towards a receiving device. These means comprise, for example, a picker roll. Transporting away the additional fabrics hardly delays the weaving procedure, if at all, and the two pile fabrics no longer have to undergo an aftertreatment in order to remove redundant parts of pile warp threads, as a result of which this method results in a higher productivity and a reduced risk of damage compared to the known method.

[0010] Consequently, the method according to the invention makes it possible simultaneously to manufacture, in a highly productive manner, two high-quality carpets having the properties of hand-knotted carpets, these properties more specifically meaning that the pile has a multicoloured and clearly defined pattern whereas no, or hardly any non-pile-forming parts of pile warp threads are bound in in the base fabrics. As a result thereof, the pattern is clearly visible on the back of the carpets and the carpets also have the typical lightness and pliability of hand-knotted carpets. These typical properties can also be maintained when the pile density is relatively high.

[0011] According to a first preferred method, a respective associated additional fabric is formed on the back of each base fabric, at least some of the non-pile-forming parts of the pile warp threads are woven in with the additional fabrics, and the pile-forming parts of the pile warp

threads between both base fabrics are cut along a cutting plane which is situated between the base fabrics.

[0012] The additional fabric which is associated with the upper base fabric is formed above the upper base fabric, whereas the additional fabric which is associated with the lower base fabric is formed below the lower base fabric.

[0013] After cutting the pile warp threads, a number of pieces of pile warp thread are in this case preferably obtained which comprise a pile-forming part and a non-pile-forming part, at least one pile leg is formed on each pile fabric by a pile-forming part of a piece of pile warp thread whereas a non-pile-forming part thereof is woven into the associated additional fabric, and said pile leg, which is formed by the pile-forming part of said piece of pile warp thread, is pulled out of the pile fabric when the associated additional fabric is removed.

[0014] According to a second preferred method, two additional fabrics are formed between the base fabrics and are respectively associated with the one and with the other pile fabric, at least some of the non-pile-forming parts of the pile warp threads are woven into the additional fabrics, and the pile-forming parts of the pile warp threads are cut according to a cutting plane situated between the additional fabrics.

[0015] Preferably, the pile-forming parts which are cut are pile-forming parts of pile warp threads which are successively interlaced with the one and in the other base fabric, and/or are pile-forming parts of pile warp threads which are successively interlaced with the one base fabric and an additional fabric associated with the other base fabric, and/or are pile-forming parts of pile warp threads which are successively interlaced with the one and the other additional fabric.

[0016] According to a third preferred method, an additional fabric is formed between the two base fabrics, at least one pile warp thread partly woven into the additional fabric runs from the additional fabric to the one base fabric in a pile-forming manner, at least one pile warp thread partly woven into the additional fabric runs from the additional fabric to the other base fabric in a pile-forming manner, and the pile-forming parts of pile warp threads between both base fabrics are cut along a first cutting plane which is situated between the additional fabric and the one base fabric and along a second cutting plane which is situated between the additional fabric and the other base fabric, so that the additional fabric is separated from the two pile fabrics.

[0017] With the above-mentioned preferred methods, preferably more than half, more preferably more than three quarters of the non-pile-forming parts of the pile warp threads, still more preferably all non-pile-forming parts of the pile warp threads are woven in, together with second weft threads, before the pile warp threads are cut, to form at least one additional fabric.

[0018] The second weft threads may be bound in in each additional fabric by second ground warp threads and/or by non-pile-forming parts of pile warp threads.

[0019] Said first weft threads preferably comprise ground warp threads and backing weft threads, whereas each base fabric is woven from respectively first weft threads which are bound in by respectively first ground warp threads and/or by respectively non-pile-forming parts of pile warp threads, and from respectively backing weft threads which are situated on the back of the base fabric, and that the pile-forming parts of the pile warp threads which form pile on the pile fabric are interlaced in each case over a backing weft thread.

[0020] As a result thereof, the pile-forming pile warp threads are also clearly visible on the back of the pile fabric at the location of each pile leg formed on the pile side. As a result thereof, the pattern formed by the pile legs is also very clearly visible on the back of the pile fabrics.

[0021] If these backing weft threads have a thickness which is greater than that of the ground warp threads, the pile-forming pile warp threads are even more clearly visible.

[0022] Preferably, connecting warp threads are provided in each base fabric which, in the base fabric, run alternately on the pile side of one or several first weft threads and run over a backing weft thread which is situated on the back of the respective base fabric, so that each base fabric is connected to at least some of the backing weft threads which are situated on the back thereof.

[0023] A second object of the present invention is to provide a weaving machine for simultaneously weaving two pile fabrics which is adapted to manufacture pile fabrics having an appearance resembling the appearance of a hand-knotted fabric, and to obtain, after the pile warp threads running between both pile fabrics have been cut, two pile fabrics which do not have to undergo any further treatment in order to remove redundant yarns.

[0024] According to the present invention, this object is achieved by providing a weaving machine having the characteristics indicated in the second paragraph of the present description, wherein the weaving machine is adapted to weave in, before the pile warp threads are cut, at least some of the non-pile-forming parts of the pile warp threads, together with second weft threads, to form at least one additional fabric.

[0025] In order to carry out this method, this weaving machine is preferably provided with one or several of the above-mentioned characteristics according to the present invention.

[0026] This weaving machine then preferably comprises two movement devices in order to, during weaving, exert a tensile force on the respective pile fabrics in order to move these with respect to the weaving machine, and at least one additional movement device in order to, during weaving, exert a tensile force on an additional fabric in order to also move this additional fabric with respect to the weaving machine.

[0027] Preferably, this weaving machine comprises an additional movement device for each additional fabric.

Said movement devices preferably comprise a respective picker roll. Such a weaving machine according to the present invention then comprises at least three picker rolls.

[0028] The present invention will now be explained in more detail by means of the following detailed description of a number of preferred methods according to the invention. The sole aim of this description is to give an illustrative example and to indicate further advantages and particulars of the present invention and can therefore by no means be interpreted as a limitation of the area of application of the invention or of patent rights defined in the claims.

[0029] Reference numerals are used in this detailed description to refer to the attached drawings, in which:

- Figs. 1 and 2 show, for a different method according to the present invention, a diagrammatic cross section of two simultaneously woven pile fabrics, and one additional fabric into which the non-pile-forming parts of pile warp threads are woven;

- Figs. 3, 4a, 5a, 6a, 7a, 8a, 9a and 10a show a diagrammatic cross section of two simultaneously woven pile fabrics, and two additional fabrics into which the non-pile-forming parts of pile warp threads are woven, wherein

- in Fig. 3, two additional fabrics are woven between the pile fabrics woven using a third method according to the present invention;
- in Figs. 4a, 5a, 6a, 7a, 8a, 9a and 10a two additional fabrics are woven which are situated on a respective back of the two pile fabrics, respectively using a fourth, a fifth, a sixth, a seventh, an eighth, a ninth and a tenth method according to the present invention;

- Figs. 4b, 5b, 6b, 7b, 8b, 9b and 10b diagrammatically show a cross section of a part of the two pile fabrics which have been obtained by respective use of the fourth, the fifth, the sixth, the seventh, the eighth, the ninth and the tenth method according to the present invention; and

- Figs. 11a, 11b, 11c and 11d are diagrammatic representations of two pile fabrics and two additional fabrics situated on the respective backs thereof, wherein each figure shows a different situation in which a first pile warp thread stops forming pile and a second pile warp thread starts forming pile.

[0030] Figs. 1, 2, 3, 4a, 5a, 6a, 7a and 10a illustrate methods for simultaneously weaving two carpets having the appearance of a hand-knotted carpet which are carried out on a three-rapier weaving machine. During weaving, in each case three weft threads (20), (21), (22) can be inserted one above the other at respective weft insertion levels in successive weft introduction cycles by means of the three rapiers. In the description of these

methods, we refer to the upper, middle and lower weft insertion level, the upper, middle and lower rapier, and the upper (20), middle (22) and lower weft threads (21).

[0031] When carrying out these methods, a number of pile warp threads in every weft introduction cycle are positioned with respect to the three weft insertion levels by means of a four-position jacquard machine. More specifically, these four positions are: above the upper weft insertion level, between the upper and the middle weft insertion level, between the middle and the lower weft insertion level and below the lower weft insertion level. In the meantime, first and second ground warp threads are positioned by means of weaving frames.

[0032] Figs. 8a and 9a illustrate methods for simultaneously weaving two carpets having the appearance of a hand-knotted carpet which are carried out on a two-rapier weaving machine. During weaving, in each case two weft threads (20), (21) are inserted one above the other at respective weft insertion levels in successive weft introduction cycles by means of the two rapiers. When describing these methods, we refer to the upper and the lower weft insertion level, the upper and the lower rapier, and the upper (20) and the lower weft threads (21).

[0033] When carrying out these methods, a number of pile warp threads in every weft introduction cycle are positioned with respect to the two weft insertion levels by means of a three-position jacquard machine. More specifically, these three positions are: above the upper weft insertion level, between the two weft insertion levels, and below the lower weft insertion level. In the meantime, first and second ground warp threads are positioned by means of weaving frames.

[0034] With these methods, certain weft threads have a greater thickness than other weft threads. In this description, we refer to relatively thick and relatively thin weft threads to indicate the weft threads having the greatest thickness and the weft threads having the smallest thickness when carrying out a specific method.

[0035] In every method, a plurality of warp thread systems are provided on the weaving machine, distributed across the width of the weaving machine. In Figs. 1, 2, 3, 4a, 5a, 6a, 7a, 8a, 9a and 10a, the warp threads of one warp thread system are illustrated in each case.

[0036] In a first method (see Fig. 1), each warp thread system comprises six binding warp threads (1, 2, 4, 5, 7, 8), three tight-warp threads (3, 6, 9) and eight differently coloured pile warp threads (P1)-(P8). In every weft introduction cycle, these ground warp threads (1-9) and these pile warp threads (P1-P8) are positioned in such a way by the weaving frames and the jacquard machine, respectively, that the weave structure illustrated in the figure is obtained.

[0037] At the upper weft insertion level, a weft thread (20) is inserted in each case in the odd weft introduction cycles which is thicker than the other weft threads (21), (22). At the lower weft insertion level, a weft thread (21) is inserted in each case in the even weft introduction cycles which is thicker than the other weft threads (20),

(22). In the following text, these relatively thick weft threads (20),(21) will be referred to as the upper (20R) and the lower backing weft threads (21R), respectively, or they are referred to collectively by the term backing weft threads (20R),(21R). In the drawings, their reference numeral (20),(21) is followed by the letter R.

[0038] The relatively thin weft threads (20) which have been inserted at the upper weft insertion level in each warp thread system in the even weft introduction cycles are in this case bound in by a first set of two binding warp threads (1),(2), so that they form an upper base fabric (B1) and so that a first tight-warp thread (3) is incorporated in this base fabric (B1). The successive relatively thin weft threads (20) in this upper base fabric (B1) are alternately above and below the tight-warp thread (3). In this base fabric, the binding warp threads (1),(2) repeatedly intersect in which case an opening is formed between every two successive intersections which contains two successive relatively thin weft threads (20).

[0039] The relatively thin weft threads (21) which have been inserted are at the lower weft insertion level in each warp thread system in the odd weft introduction cycles, are bound in by a second set of two binding warp threads (4),(5), so that they form a lower base fabric (B2) and so that a second tight-warp thread (6) is incorporated in this base fabric (B2). In this lower base fabric (B2), the successive relatively thin weft threads (21) are alternately situated above and below the tight-warp thread (6). In this base fabric (B2), the binding warp threads (4),(5) repeatedly intersect, in which case an opening is formed between every two successive intersections which contains two successive relatively thin weft threads (21).

[0040] The upper backing weft threads (20R) are situated on the back of the upper base fabric (B1) and the lower backing weft threads (21R) are situated on the back of the lower base fabric (B2).

[0041] The weft threads (22) on the middle weft insertion level which are inserted in each warp thread system are bound in by a third set of two binding warp threads (7),(8), so that they form an additional fabric (Z) which is situated between both base fabrics (B1), (B2) and so that a third tight-warp thread (9) is incorporated in this additional fabric (Z). The successive weft threads (22) are situated in this additional fabric (Z) alternately above and below the tight-warp thread (9). The binding warp threads (7),(8) repeatedly intersect, so that an opening is formed between every two successive intersections which contains two successive weft threads (22). For the binding warp threads (7), (8), this is a 2/2 weave structure, whereas a 1/1 weave structure is used for the tight-warp thread (9).

[0042] The pile warp threads (P1-P8) are positioned in such a way that certain pile warp threads form pile according to a predetermined weave structure scheme at well-defined locations in order to form a predetermined multicoloured pattern or design. For the pile-forming pile warp threads, a 1/2 V weave structure is used, in which a pile-forming pile warp thread is interlaced alternately

over an upper backing weft thread (20R) and over a lower backing weft thread (21R), so that the pile-forming parts thereof extend between both base fabrics (B1),(B2). The non-pile-forming pile warp threads (P1),(P2),(P6),(P7) and the non-pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P8) are bound in in the additional fabric (Z) in an extended state.

[0043] The weaving machine is provided with two knives (K1), (K2) which are movable according to respective horizontal movement paths which are situated one above the other. The pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P8) are cut by the movement of these knives (K1), (K2) according to their movement paths along two cutting planes (T1), (T2) situated one above the other. The upper cutting plane (T1) is situated between the additional fabric (Z) and the upper base fabric (B1) and the lower cutting plane (T2) is situated between the additional fabric (Z) and the lower base fabric (B2). By this cutting action, the additional fabric (Z) is separated from the upper (PW1) and the lower pile fabric (PW2).

[0044] The resulting pile fabrics (PW1),(PW2) are identical carpets consisting of a respective base fabric (B1),(B2), woven from first ground warp threads (1-3) and (4-6), respectively, and from first weft threads (20),(20R) and (21),(21R), respectively, on which the cut pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P8) form upright pile legs and in which these pile legs together form a pile zone which has a multicoloured pattern. In addition to the second weft threads (22) and the second ground warp threads (7-9), the additional fabric (Z) contains all non-pile-forming pile warp threads (P1),(P2),(P6),(P7) and all non-pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P8) and can easily be removed as a coherent whole during weaving on the double-face weaving machine by means of an additional picker roll provided for this purpose. This means that, in addition to the two picker rolls which are normally provided on the weaving machine in order to advance the two simultaneously woven fabrics during weaving, the weaving machine is additionally provided with a third picker roll for advancing the additional fabric (Z).

[0045] As the carpets (PW1),(PW2) do not contain non-pile-forming pile warp threads (P1),(P2),(P6),(P7) or non-pile-forming parts of pile-forming pile warp threads (P3),(P4),(P5),(P8), they are lightweight and flexible and readily pliable, even if a large number of different coloured pile warp threads are provided for each warp thread system and if weaving takes place at a high pile density. As a result thereof, the pattern may be multicoloured and also very fine and clearly defined, and may, in addition, also be free from mixing contours. Another advantage is the fact that pile transitions (i.e. the transition of pile formation by a pile warp thread having a first colour to pile formation by a pile warp thread having a second colour) can be achieved without loss of pile legs. The weave structure shown in Fig. 1 makes it possible

to weave at a high manufacturing speed. The repeat of the pile weave structure is 2 picks, the repeat of the standard weave structure of the base fabrics (B1), (B2) is 8 picks.

[0046] Due to the fact that the pile-forming pile warp threads (P3),(P4),(P5),(P8) are also interlaced in each case over a relatively thick backing weft thread (20R), (21R) when forming a pile leg on the base fabrics (B1), (B2), while these backing weft threads (20R), (21R) are situated on the back of the base fabrics (B1),(B2), the pattern formed by the pile is clearly visible on the back of the carpets. Such a carpet resembles all properties of a hand-knotted carpet to a high degree.

[0047] In a second method (see Fig. 2), each warp thread system also comprises six binding warp threads (1),(2),(4),(5),(7),(8), three tight-warp threads (3),(6),(9) and eight different coloured pile warp threads (P1)-(P8), as is the case with the method from Fig. 1.

[0048] This method differs from the above-described method from Fig. 1 in that the pile weave structure repeat is 3 picks, as a result of which the manufacturing speed is lower than with the method from Fig. 1. Another difference is the fact that the middle rapier inserts a weft thread (22) in two successive weft introduction cycles and does not insert a weft thread in the successive weft introduction cycle. The locations (30) where the middle rapier would normally insert a weft thread but where this has not occurred (in Fig. 2, this is weft introduction cycle III), are denoted symbolically by a circled X. Not inserting a weft thread (22) may be achieved by introducing the middle rapier without a weft thread between the warp threads (1-9, P1-P8) or by switching off the middle rapier in these weft introduction cycles, that is to say that the middle rapier is not inserted between the warp threads (1-9, P1-P8).

[0049] It is possible to determine successive series of three successive weft introduction cycles (I), (II), (III), in which in each case the following weft threads are inserted in the successive weft introduction cycles in each series:

- in the first weft introduction cycle (I), the upper rapier inserts a weft thread (20b) which is thinner than the two other weft threads (21R),(22), the middle rapier inserts a relatively thick weft thread (22), and the lower rapier also inserts a relatively thick weft thread (21R).
- in the second weft introduction cycle (II), the upper rapier inserts a relatively thick weft thread (20R), the middle rapier inserts a relatively thick weft thread (22), and the lower rapier inserts a weft thread (21b) which is thinner than the two other weft threads (20R),(22), and
- in the third weft introduction cycle (III), the upper rapier inserts a relatively thick weft thread (20), the middle rapier does not insert a weft thread - at the location (30) marked with a circled X - and the lower rapier also inserts a relatively thick weft thread (21).

[0050] The upper weft threads (20b),(20) which have been inserted in each case in the first (I) and the third weft introduction cycle (III) of a series, are bound in in each warp thread system by a first set of two binding warp threads (1),(2), so that they form an upper base fabric (B1) and so that a first tight-warp thread (3) is incorporated in this base fabric (B1). The weft threads (20b),(20) which have been inserted in the first (I) and the third weft introduction cycle (III) of a series in each case, are situated in the successive openings between the repeatedly intersecting binding warp threads (1),(2).

[0051] The successive weft threads (20b),(20) in this upper base fabric (B1) are situated alternately above and below the tight-warp thread (3), with the relatively thin weft thread (20b) in each case being situated on the back of the tight-warp thread (3).

[0052] The upper weft threads (20R) which have been inserted in the second weft introduction cycle (II) of a series in each case, are situated on the back of the upper base fabric (B1) and are hereafter referred to as upper backing weft threads (20R).

[0053] In the same way, the lower weft threads (21b),(21) which have been inserted in the second (II) and the third weft introduction cycle (III) of a series in each case, are bound in in each warp thread system by a second set of two binding warp threads (4),(5), so that they form a lower base fabric (B2) and so that a second tight-warp thread (6) is incorporated in this base fabric (B2). The weft threads (21b), (21) which have been inserted in the second (II) and the third weft introduction cycle (III) of a series in each case, are situated, in each case, in the successive openings between the repeatedly intersecting binding warp threads (4),(5).

[0054] The successive weft threads (21b),(21) in this lower base fabric (B2) are situated alternately above and below the tight-warp thread (6), with the relatively thin weft thread (21b) in each case being situated on the back of the tight-warp thread (6).

[0055] The lower weft threads (21R) which have been inserted in the first weft introduction cycle (I) of a series in each case, are situated on the back of the lower base fabric (B2) and are hereafter referred to as lower backing weft threads (21R).

[0056] The backing weft threads (20R), (21R) may be thicker than the weft threads (20), (21), (22).

[0057] The weft threads (22) which have been inserted at the middle weft insertion level in each warp thread system are bound in by a third set of two binding warp threads (7),(8), so that they form an additional fabric (Z) situated between both base fabrics (B1), (B2), and so that a third tight-warp thread (9) is incorporated in this additional fabric (Z). The successive weft threads (22) in this additional fabric (Z) are situated alternately above and below the tight-warp thread (9). The binding warp threads (7),(8) intersect repeatedly, so that an opening is formed between every two successive intersections, in which two successive weft threads (22) are situated. For the binding warp threads (7),(8), this is a 2/2 weave

structure, whereas a 1/1 weave structure is used for the tight-warp thread (9).

[0058] For the pile-forming pile warp threads (P3),(P4),(P5),(P8), a 1/3 V weave structure is used, in which a pile-forming pile warp thread is interlaced alternately over an upper backing weft thread (20R) and over a lower backing weft thread (21R). The non-pile-forming pile warp threads (P1),(P2),(P6),(P7) and the non-pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P8) are bound in in the additional fabric (Z) in an extended state.

[0059] The weaving machine is also provided with two knives (K1), (K2) in order to cut the pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P8) along two cutting planes (T1), (T2) situated one above the other and thus to separate the additional fabric (Z) from the upper (PW1) and the lower pile fabric (PW2). The upper cutting plane (T1) is situated between the additional fabric (Z) and the upper base fabric (B1), and the lower cutting plane (T2) is situated between the additional fabric (Z) and the lower base fabric (B2).

[0060] The resulting pile fabrics (PW1),(PW2) are identical light and flexible carpets with the same characteristics and advantageous properties as the carpets which have been obtained by employing the method from Fig. 1, while the additional fabric (Z) in this case as well, contains all non-pile-forming pile warp threads and all non-pile-forming parts of pile warp threads (P1-P7) and can easily be removed during weaving by means of an additional picker roll provided for the purpose.

[0061] In a third method (see Fig. 3), each warp thread system comprises eight binding warp threads (1), (2), (4), (5), (7), (8), (10), (11), two tight-warp threads (3), (6) and eight different coloured pile warp threads (P1)-(P8).

[0062] On a three-ripper weaving machine, three weft threads (20),(20R),(21),(21R),(22) are inserted in every weft introduction cycle between the pile warp threads (P1-P8) positioned by a four-position jacquard machine and the ground warp threads (1-8,10,11) positioned by weaving frames. As is the case with the above-described methods, an upper (B1) and a lower base fabric (B2) are woven.

[0063] The upper ripper alternately inserts a relatively thick (20R) and a relatively thin weft thread (20), with the relatively thick weft thread (20R) being inserted in the odd weft introduction cycles. The lower ripper alternately inserts a relatively thin (21) and a relatively thick weft thread (21R), with the relatively thick weft thread (21R) being inserted in the even weft introduction cycles.

[0064] The upper relatively thin weft threads (20) are bound in by a first set of two binding warp threads (1),(2), so that an upper base fabric (B1) is woven, and so that a first tight-warp thread (3) is incorporated in this upper base fabric (B1). In this case, the binding warp threads (1),(2) run in opposite phases, alternately above two relatively thin weft threads (20) and below two relatively thin weft threads (20). The successive relatively thin weft threads (20) in this upper base fabric (B1) are situated

alternately above and below the tight-warp thread (3). The upper relatively thick weft threads (20R) are situated on the back of this upper base fabric (B1) in each case and are hereafter referred to as the upper backing weft threads (20R).

[0065] The lower relatively thin weft threads (21) are bound in by a second set of two binding warp threads (4),(5), so that a lower base fabric (B2) is woven, and so that a second tight-warp thread (6) is incorporated in this lower base fabric (B2). In this case, the binding warp threads (4),(5) run in opposite phases, alternately above two relatively thin weft threads (21) and below two relatively thin weft threads (21). The successive relatively thin weft threads (21) in this lower base fabric (B2) are situated alternately above and below the tight-warp thread (6). The lower relatively thick weft threads (21R) are situated on the back of this lower base fabric (B2) in each case and are hereafter referred to as the lower backing weft threads (21R).

[0066] The weft threads (22) which have been inserted in the odd weft introduction cycles (I, III, ...) at the middle weft insertion level are bound in by means of a third set of two binding warp threads (7),(8), so that they form a first additional fabric (Z1) situated between the base fabrics (B1),(B2). The weft threads (22) which have been inserted in the even weft introduction cycles (II, IV, ...) at the middle weft insertion level are bound in by means of a fourth set of two binding warp threads (10),(11), so that they form a second additional fabric (Z2) situated between the base fabrics (B1),(B2). Both additional fabrics (Z1),(Z2) are situated between the base fabrics (B1) and (B2), with the first additional fabric (Z1) being situated closer to the upper base fabric (B1) and the second additional fabric (Z2) being situated closer to the lower base fabric (B2). In an ideal situation, the first additional fabric (Z1) will be situated very close to the upper base fabric (B1) and the second additional fabric (Z2) will be situated very close to the lower base fabric (B1) situated. The additional fabrics (Z1),(Z2) may in this case even be in close contact with their respective associated base fabric (B1),(B2). The binding warp threads (7),(8),(10),(11) of these third and fourth sets of binding warp threads in this case run in opposite phases, alternately above and below a weft thread (22) of the respective additional fabric (Z1),(Z2).

[0067] A very common situation of pile formation (below, other situations of pile formation are described) means that the pile-forming pile warp threads (P1),(P3),(P4),(P6) are interlaced alternately over an upper backing weft thread (20R) and over a lower backing weft thread (21R), with a 1/2 V weave structure being used.

[0068] The non-pile-forming pile warp threads (P2),(P5),(P7),(P8) and the non-pile-forming parts of the pile-forming pile warp threads (P1),(P3),(P4),(P6) are bound in in the two additional fabrics (Z1),(Z2), these running alternately above and below the successive weft threads (22) of these respectively additional fabrics

(Z1),(Z2).

[0069] The weaving machine comprises one knife (K) which is provided to cut the pile-forming pile warp threads along a horizontal cutting plane (T) situated between both additional fabrics (Z1),(Z2).

[0070] In the three situations described below, pile is formed in Fig. 3 by a pile-forming pile warp thread (P1),(P4),(P3):

i. One of the pile warp threads (P1) stops forming pile and is interlaced over a weft thread (21R) of the lower base fabric (B2) one last time in the fourth weft introduction cycle (IV), and is interlaced over a weft thread (22) of the upper additional fabric (Z1) in the fifth weft introduction cycle (V) and thus extends in a pile-forming manner between the lower base fabric (B2) and the upper additional fabric (Z1).

ii. The same pile warp thread (P1) is interlaced over a weft thread (22) of the lower additional fabric (Z2) in the sixth weft introduction cycle (VI) in order to be woven further into that additional fabric. As a result thereof, this pile warp thread (P1) extends in a pile-forming manner between both additional fabrics (Z1),(Z2).

iii. Another pile warp thread (P4) is bound in in the upper additional fabric (Z1) in the first five weft introduction cycles (I-V). In order to make this pile warp thread (P4) start with pile formation between both base fabrics (B1),(B2) from the upper base fabric (B1) from the seventh weft introduction cycle (VII), this pile warp thread (P4) is interlaced over a weft thread (22) of the lower additional fabric (Z2) in the sixth weft introduction cycle (VI). This pile warp thread (P4) is also successively interlaced with the one (Z1) and the other additional fabric (Z2) and thus extends in a pile-forming manner between both additional fabrics (Z1),(Z2).

iv. In the seventh weft introduction cycle (VII), the pile warp thread (P4) is interlaced over a weft thread (20R) of the upper fabric (B1). The pile warp thread (P4) consequently extends in a pile-forming manner between the lower additional fabric (Z2) and the upper base fabric (B1). This is also the case for the pile warp thread (P3) which starts to form pile from the eleventh weft introduction cycle (XI).

[0071] In the above-described cases of pile formation, there are thus pile-forming parts of pile warp threads (P1),(P4),(P3) between the two additional fabrics (Z1),(Z2) or between an additional fabric (Z1), (Z2) and a base fabric (B2), (B1) which form pile on the additional fabrics (Z1),(Z2). These pile-forming parts of pile warp threads are also cut through by the knife (K). This serves to illustrate yet again the fact that cutting pile-forming parts of pile-forming pile warp threads, such as referred

to in Claim 1, not only comprises cutting pile-forming parts of pile warp threads which are interlaced over a respective weft thread in successive weft introduction cycles in the one (B1) and the other base fabric (B2), but also cutting pile-forming parts of pile warp threads which are interlaced over a respective weft thread in successive weft introduction cycles in a base fabric (B1),(B2) and in an additional fabric (Z1),(Z2), and also cutting pile-forming parts of pile warp threads which are interlaced over a respective weft thread in successive weft introduction cycles in two different additional fabrics (Z1), (Z2).

[0072] With this method, there is also no pile loss with a pile transition and the pile fabrics are free from mixing contours. This pile weave structure has a repeat of 2, so that it is possible to weave at a high manufacturing speed.

[0073] The weaving machine comprises one knife (K) that is provided to cut the pile-forming pile warp threads along a horizontal cutting plane (T) situated between both additional fabrics (Z1),(Z2).

[0074] The weaving machine which is provided with two picker rolls as standard in order to advance two simultaneously woven fabrics during weaving, may be provided with two extra picker rolls in order to separate the upper pile fabric (PW1) and the lower pile fabric (PW2), respectively, from its associated additional fabric (Z1),(Z2) by guiding these fabrics (PW1),(Z1); (PW2),(Z2) away from each other and consequently pulling them apart after the pile-forming pile warp threads (P1),(P3),(P4),(P6) have been cut. The pile fabrics may also be separated from their respective associated additional fabric (Z1),(Z2) after the weaving process.

[0075] The resulting pile fabrics (PW1),(PW2) are identical light and flexible carpets with the same characteristics and advantageous properties as the carpets which have been obtained by employing the above-described methods.

[0076] In a fourth method (see Fig. 4a), each warp thread system comprises eight binding warp threads (1), (2), (4), (5), (7), (8), (10), (11), six tight-warp threads (3a), (3b), (6a), (6b), (9), (12) and eight different coloured pile warp threads (P1)-(P8).

[0077] This method involves weaving two additional fabrics (Z1), (Z2) in which the non-pile-forming parts of the pile warp threads (P1)-(P8) are situated, with the upper additional fabric (Z1) being situated on the back of the upper pile fabric (PW1) and the lower additional fabric (Z2) being situated on the back of the lower pile fabric (PW2). Thus, the pile fabrics (PW1),(PW2) are situated one above the other in the space between the two additional fabrics (Z1),(Z2) which have been woven one above the other. In an ideal situation, the first additional fabric (Z1) will be situated very close to the upper base fabric (B1) and the second additional fabric (Z2) will be situated very close to the lower base fabric (B2). In this case, the additional fabrics (Z1),(Z2) may even be in close contact with their respective associated base fabric (B1),(B2).

[0078] The positions of the ground warp threads with

respect to the weft threads are in each case repeated after two series of four weft introduction cycles (I-IV). The repeat of this standard weave structure is 8 picks.

[0079] In successive series of four successive weft introduction cycles (I), (II), (III), (IV), the following weft threads are in each case inserted in the successive weft introduction cycles:

- in the first weft introduction cycle (I), the upper rapier inserts a weft thread (20) which is thicker than the two other weft threads (21),(22), the middle rapier inserts a relatively thin weft thread (22) and the lower rapier also inserts a relatively thin weft thread (21);
- in the second weft introduction cycle (II), the upper rapier inserts a relatively thick weft thread (20R), the middle rapier inserts a relatively thin weft thread (22) and the lower rapier inserts a relatively thick weft thread (21);
- in the third weft introduction cycle (III), the upper rapier inserts a relatively thick weft thread (20), the middle rapier inserts a relatively thin weft thread (22) and the lower rapier inserts a relatively thick weft thread (21R);
- in the fourth weft introduction cycle (IV), the upper rapier inserts a relatively thin weft thread (20), the middle rapier inserts a relatively thin weft thread (22) and the lower rapier inserts a relatively thick weft thread (21).

[0080] The upper relatively thick weft threads (20) which have been inserted during the first (I) and the third weft introduction cycle (III) of every series, are bound in by a first set of two binding warp threads (7),(8), so that an upper additional fabric (Z1) is woven, and so that a first tight-warp thread (9) is incorporated in this upper additional fabric (Z1). In this case, the binding warp threads (7),(8) run in opposite phases, alternately above two relatively thick weft threads (20) and below two relatively thick weft threads (20) of the additional fabric (Z1).

[0081] The lower relatively thick weft threads (21) which have been inserted during the second (II) and the fourth weft introduction cycle (IV), are bound in by a second set of two binding warp threads (10),(11), so that a lower additional fabric (Z2) is woven, and so that a second tight-warp thread (12) is incorporated in this lower additional fabric (Z2). In this case, the binding warp threads (10),(11) run in opposite phases, alternately above two relatively thick weft threads (21) and below two relatively thick weft threads (21) of the additional fabric (Z2).

[0082] The relatively thin middle weft threads (22) which have been inserted in the first (I) and the third weft introduction cycle (III) of every series and the relatively thin upper weft thread (20) which has been inserted in the fourth weft introduction cycle (IV) of every series are bound in by means of a third set of two binding warp threads (1),(2), so that they form an upper base fabric (B1) situated between the additional fabrics (Z1),(Z2), and so that two tight-warp threads (3a),(3b) are incorpo-

rated in this base fabric. The relatively thick upper weft threads (20R) which have been inserted in every series in the second weft introduction cycle (II), are situated on the back of the upper base fabric (B1) and are hereafter referred to as upper backing weft threads (20R).

[0083] The relatively thin lower weft thread (21) which has been inserted in the first weft introduction cycle (I) of every series and the relatively thin middle weft threads (22) which have been inserted in the second (II) and the fourth weft introduction cycle (IV) of every series are bound in by means of a fourth set of two binding warp threads (4),(5), so that they form a lower base fabric (B2) situated between the additional fabrics (Z1),(Z2), and so that two tight-warp threads (6a),(6b) are incorporated in this base fabric (B2). The relatively thick lower weft threads (21R) which have been inserted in the third weft introduction cycle (III) of every series are situated on the back of the lower base fabric (B2) and are hereafter referred to as lower backing weft threads (21R).

[0084] The binding warp threads (1),(2); (4),(5) of this third and fourth set of binding warp threads in this case run in opposite phases, alternately above and below a series of three relatively thin weft threads (22), (20) and (22),(21), respectively, of the respective base fabric (B1),(B2). In each such series of three successive relatively thin weft threads (20),(21),(22) of the base fabrics (B1), (B2), these three weft threads run respectively above, between and below the two tight-warp threads (3a),(3b);(6a),(6b) of the respective base fabric (B1),(B2).

[0085] The base fabrics (B1),(B2) are woven from respective first ground warp threads (1),(2),(3a),(3b); (4),(5),(6a),(6b) and respective first weft threads (20),(20R),(22); (21),(21R),(22). The pile-forming pile warp threads (P3),(P4),(P5),(P6) are interlaced alternately over an upper backing weft thread (20R) and over a lower backing weft thread (21R), with a 1/4 V weave structure being used. Thus, for every four weft introduction cycles, one pile loop for each pile fabric (PW1),(PW2) is formed.

[0086] The non-pile-forming pile warp threads (P1),(P2),(P7),(P8) and the non-pile-forming parts of the pile-forming pile warp threads (P3),(P4),(P5),(P6) are bound in in the two additional fabrics (Z1),(Z2), which also contain the second (relatively thick) weft threads (20); (21) and the second ground warp threads (7-9); (10-12), respectively, in which case these run along with the tight-warp threads (9),(12) in the extended state, so that the successive relatively thick weft threads (20),(21) of these fabrics (Z1),(Z2) are situated alternately above and below these non-pile-forming parts.

[0087] The weaving machine comprises one knife (K) which is provided to cut the pile-forming pile warp threads along a horizontal cutting plane (T) situated between both base fabrics (B1),(B2).

[0088] Four picker rolls may be provided on the weaving machine for advancing the two pile fabrics (PW1),(PW2) and the two additional fabrics (Z1),(Z2).

The pile fabrics (PW1), (PW2) and their associated additional fabric (Z1), (Z2) may also be separated after the weaving process.

[0089] This method is simpler than the methods from Figs. 1 to 3 because the non-pile-forming parts of the pile-forming pile warp threads and the non-pile-forming pile warp threads are not situated between the two pile fabrics (PW1), (PW2) being produced. In addition, in contrast with the methods from Figs. 1 and 2, there is only one horizontal cutting plane (T).

[0090] This method results in carpets with pure pile transitions and without mixing contours. The resulting pile fabrics (PW1), (PW2) are light and flexible carpets with the same characteristics and advantageous properties as the carpets which have been obtained employing the above-described methods.

[0091] Fig. 4b shows a diagrammatic cross section of a portion of the two carpets which have been obtained by employing this fourth method from Fig. 4a, after the removal of the additional fabrics (Z1), (Z2). The two carpets (PW1), (PW2) are represented with the pile sides facing each other. The pile loops which have been formed by pile warp threads (P3), (P4), (P5), (P6) are denoted in this figure by a respective reference numeral (L3), (L4), (L5), (L6).

[0092] Pile legs of the pile fabrics (PW1), (PW2) which still have a non-pile-forming part which is woven into an additional fabric (Z1), (Z2) after the pile-forming parts of the pile warp threads have been cut, are pulled out of the associated pile fabric (PW1), (PW2) when removing the additional fabric (Z1), (Z2). Consequently, the resulting pile fabrics (PW1) and (PW2) are not identical carpets, as can be seen in Fig. 4b.

[0093] A fifth method (see Fig. 5a) differs from the above-described fourth method from Fig. 4a in that an extended standard 2/2 weave structure is used in each additional fabric (Z1), (Z2) for the two binding warp threads (7), (8); (10), (11). A 1/1 weave structure is used for the tight-warp threads (9), (12).

[0094] This method also differs from the fourth method in that, in each series of eight successive weft introduction cycles, in each case in the second (II) and the third weft introduction cycle (III) and in the sixth (VI) and seventh weft introduction cycle (VII), the middle rapier does not insert any weft thread.

[0095] Only the relatively thick weft thread (20) which is inserted by the upper rapier in the first (I) and the fifth weft introduction cycle (V) of every series (I-VIII) of eight successive weft introduction cycles is bound in in the upper additional fabric (Z1). The binding warp threads (7), (8) run in opposite phases with respect to each other, alternately above two successive relatively thick weft threads (20) and below two successive relatively thick weft threads (20) of the additional fabric (Z1). The tight-warp thread (9) runs alternately above and below the successive relatively thick weft threads (20) of the fabric (Z1).

[0096] Only the relatively thick weft thread (21) which

is inserted by the lower rapier in the fourth (IV) and the eighth weft introduction cycle (VIII) of every series (I)-(VI-II) is bound in in the lower additional fabric (Z2). The binding warp threads (10), (11) run in opposite phases with respect to each other, alternately above two successive relatively thick weft threads (21) and below two successive relatively thick weft threads (21) of the fabric (Z2). The tight-warp thread (12) runs alternately above and below the successive relatively thick weft threads (20) of the fabric (Z2).

[0097] The non-pile-forming parts of the pile-forming pile warp threads (P3)-(P6) and the non-pile-forming pile warp threads (P1), (P2), (P7), (P8) run together with the tight-warp threads (9), (12) in each additional fabric (Z1), (Z2).

[0098] The weaving machine comprises one knife (K) which is provided to cut the pile-forming pile warp threads along a horizontal cutting plane (T) situated between both base fabrics (B1), (B2).

[0099] Four picker rolls may be provided on the weaving machine for advancing the two pile fabrics (PW1), (PW2) and the two additional fabrics (Z1), (Z2), in which case the pile fabrics (PW1), (PW2) are separated from their respective associated additional fabric (Z1), (Z2). The pile fabrics may also be separated from their respective associated additional fabric after the weaving process.

[0100] The resulting pile fabrics (PW1), (PW2) are light and flexible carpets with the same characteristics and advantageous properties as the carpets which have been obtained by employing the above-described methods.

[0101] Fig. 5b shows a diagrammatic cross section of a portion of the two carpets which were obtained by employing this fifth method from Fig. 5a, after the removal of the additional fabrics (Z1), (Z2). The two carpets (PW1), (PW2) are represented with their pile sides facing each other.

[0102] In this figure, every pile loop (L3), (L4), (L5), (L6) is denoted by the letter L followed by the same numeral as the pile-forming pile warp thread (P3), (P4), (P5), (P6) which formed the respective pile loop.

[0103] Pile legs of the pile fabrics which still have a non-pile-forming part which is woven into an additional fabric (Z1), (Z2) after the pile-forming parts of the pile-forming pile warp threads (P3)-(P6) have been cut, are pulled out of the associated pile fabric (PW1), (PW2) when removing the additional fabric (Z1), (Z2). Consequently, the resulting pile fabrics (PW1) and (PW2) are not identical carpets, as can be seen in Fig. 5b.

[0104] A sixth method (see Fig. 6a) differs from the above-described fifth method from Fig. 5a in that one of the two binding warp threads (7), (8); (10), (11) has been omitted in each additional fabric (Z1), (Z2) in each warp thread system. The extended standard weave structure is now a 1/1 weave structure. The one binding warp thread (7); (10) holds the additional fabric (Z1), (Z2) together sufficiently well.

[0105] Fig. 6b shows a diagrammatic cross section of

a portion of the two carpets which have been obtained by employing this sixth method from Fig. 6a after the removal of the additional fabrics (Z1),(Z2). The two carpets (PW1),(PW2) are shown with their pile sides facing each other.

[0106] In this figure, every pile loop (L3),(L4),(L5),(L6) is denoted by the letter L followed by the same numeral as the pile-forming pile warp thread (P3), (P4), (P5), (P6) which formed the respective pile loop.

[0107] Pile legs of the pile fabrics which, after cutting the pile-forming parts of the pile-forming pile warp threads, still have a non-pile-forming part which is woven into an additional fabric (Z1), (Z2) are pulled out of the associated pile fabric (PW1), (PW2) when removing the additional fabric (Z1), (Z2). Consequently, the pile fabrics (PW1) and (PW2) are not identical carpets, as can be seen in Fig. 6b.

[0108] The resulting pile fabrics (PW1),(PW2) are light and flexible carpets with the same characteristics and advantageous properties as the carpets which have been obtained by employing the above-described methods.

[0109] In a seventh method (see Fig. 7a), two additional fabrics (Z1), (Z2) are also woven in which the non-pile-forming parts of the pile warp threads (P1)-(P16) are situated, wherein the upper additional fabric (Z1) is situated on the back of the upper pile fabric (PW1) and the lower additional fabric (Z2) is situated on the back of the lower pile fabric (PW2).

[0110] The pile warp threads form pile according to a 1/3 V opposite phases weave structure.

[0111] In contrast to Figs. 5a and 6a, the locations (30) where no weft thread is inserted by the middle rapier in the second (II) and the third weft introduction cycle (III) are now symbolically denoted by a circled X.

[0112] Every warp thread system comprises six binding warp threads (1),(2),(4),(5),(7),(10), four tight-warp threads (3),(6),(9),(12) and sixteen pile warp threads in eight different colours, with two pile warp threads in each case having the same colour. The non-pile-forming parts of eight differently coloured pile warp threads (P1),(P2),(P3),(P4),(P5),(P6),(P7),(P8) are bound in in the upper additional fabric (Z1), and the non-pile-forming parts of eight other, likewise differently coloured pile warp threads (P9),(P10),(P11),(P12),(P13),(P14),(P15),(P16) with the same colours as the former eight pile warp threads, are bound in in the lower additional fabric (Z2).

[0113] In contrast to Figs. 4a, 5a and 6a, only one tight-warp thread (3),(6) per base fabric (B1),(B2) is provided per warp thread system.

[0114] By weaving in opposite phases, the resulting carpets are completely identical. Pile legs of the pile fabrics which still have a non-pile-forming part which is woven into an additional fabric (Z1), (Z2) after the pile-forming parts of the pile warp threads have been cut, are pulled out of the associated pile fabric (PW1),(PW2) when removing the additional fabric (Z1), (Z2). A particular characteristic of this weave structure is the fact that an entire pile loop is lost at a pile transition 1, both in the

upper base fabric (B1) and in the lower base fabric (B2).

[0115] Fig. 7b shows a diagrammatic cross section of a portion of the two carpets which have been obtained by employing this seventh method from Fig. 7a, after the removal of the additional fabrics (Z1),(Z2). The two carpets (PW1),(PW2) are represented with their pile sides facing each other.

[0116] In this figure, every pile loop (L5),(L9),(L10),(L6),(L14),(L3),(L13),(L4) is denoted by the letter L followed by the same numeral as the pile-forming pile warp thread (P5), (P9), (P10), (P6), (P14), (P3), (P13), (P4) which formed the respective pile loop.

[0117] The resulting pile fabrics (PW1),(PW2) are light and flexible carpets with the same characteristics and advantageous properties as the carpets which have been obtained by employing the above-described methods.

[0118] In an eighth method (see Fig. 8a), two additional fabrics (Z1), (Z2) are woven in which the non-pile-forming parts of the pile warp threads (P1)-(P4) are bound in. The upper additional fabric (Z1) is situated on the back of the upper pile fabric (PW1) and the lower additional fabric (Z2) is situated on the back of the lower pile fabric (PW2).

[0119] To this end, a two-ropier weaving machine is used, in which, in successive weft introduction cycles, in each case one weft thread (20) is inserted at an upper weft insertion level and one weft thread (21) is inserted at a lower weft insertion level.

[0120] With this method, no second ground warp threads are used. The additional fabrics (Z1),(Z2) are formed without binding warp threads and without tight-warp threads. Here, the non-pile-forming parts of the pile warp threads (P1)-(P4) are used to bind the weft threads (20),(21) in in the additional fabrics (Z1),(Z2). These non-pile-forming parts alternately run above and below the successive weft threads (20),(21) of the additional fabrics. The pile warp threads form pile according to a 1/3 V weave structure.

[0121] In successive series of three successive weft introduction cycles (I), (II), (III), the upper (20) and the lower weft thread (21) which are inserted during the third weft introduction cycle (III) are bound in in the upper (Z1) and the lower additional fabric (Z2), respectively. The upper weft threads (20) which are inserted during the first (I) and the second weft introduction cycle (II) are in each case bound in in the upper base fabric (B1). The lower weft threads (21) which are inserted during the first (I) and the second weft introduction cycle (II) are in each case bound in in the lower base fabric (B2).

[0122] For each warp thread system, a tight-warp thread (3), (6) is provided in the upper (B1) and the lower base fabric (B2). In each base fabric (B1),(B2), there are two binding warp threads (1),(2),(4),(5) for each warp thread system which run in opposite phases with respect to each other, alternately above two successive weft threads (20),(21) and below two successive weft threads (20),(21) of the respective base fabric. In the openings between the intersecting binding warp threads (1),(2),(4),(5), there are in each case two weft threads

(20),(21), one of which runs above the tight-warp thread (3),(6) and the other one runs below the tight-warp thread (3),(6).

[0123] In the illustrated warp thread system, a supporting warp thread (15) is provided below the lower weft insertion level in order to support the lower rapier when it is being inserted into the shed between the warp threads. A supporting warp thread is not present in each warp thread system, a typical frequency is, for example, 1 for every cm or for every 2 cm weaving width. These supporting-warp threads are not woven in and are removed later.

[0124] These supporting warp threads are also used with the other methods according to the invention, if the lower rapier cannot be supported by the ground warp threads which are present during insertion of a weft thread.

[0125] The weaving machine comprises one knife (K) in order to cut the pile-forming parts of the pile warp threads along a cutting plane between the two base fabrics. The weaving machine may be provided with four picker rolls for advancing both the two pile fabrics (PW1),(PW2) and the two additional fabrics (Z1),(Z2) during weaving, and thus also to separate the pile fabrics (PW1),(PW2) from their respective associated additional fabric (Z1),(Z2). The pile fabrics (PW1),(PW2) may also be separated from their respective associated additional fabric (Z1),(Z2) after the weaving process.

[0126] Fig. 8b shows a diagrammatic cross section of a portion of the two carpets (PW1) (PW2) which have been obtained by employing this eighth method from Fig. 8a, after removal of the additional fabrics (Z1),(Z2). The two carpets (PW1),(PW2) are shown with their pile sides facing each other.

[0127] In this figure, every pile loop (L1),(L2),(L3),(L4) is denoted by the letter L followed by the same numeral as the pile-forming pile warp thread (P1),(P2),(P3),(P4) which formed the respective pile loop.

[0128] Pile legs of the pile fabrics which still have a non-pile-forming part which is woven into an additional fabric after the pile-forming parts of the pile-forming pile warp threads have been cut, are pulled out of the associated pile fabric when removing the additional fabric.

[0129] A ninth method (see Fig. 9a) differs from the eighth method from Fig. 8a in that a different weave structure is used for the base fabrics (B1),(B2). The weft threads (20R), (21R) over which the pile-forming pile warp threads (P1)-(P4) are interlaced are now situated on the back of the base fabrics (B1),(B2) and relatively thick weft yarns are also used for these weft threads (20R), (21R). These weft threads are hereafter referred to as backing weft threads (20R), (21R).

[0130] Only the weft threads (20) which are inserted in the first weft introduction cycle (I) of every series of three weft introduction cycles are now bound in in the upper base fabric (B1). Only the weft threads (21) which are inserted in the second weft introduction cycle (II) of every series are now bound in in the lower base fabric (B2).

The binding warp threads (1),(2); (4),(5) of the base fabrics (B1),(B2) run in opposite phases, alternately above two successive weft threads (20),(21) and below two successive weft threads (20),(21) of the respective base fabric. The tight-warp threads (3), (6) are situated on the back of the weft threads (20),(21) of the respectively base fabrics (B1),(B2).

[0131] In each base fabric (B1),(B2), a connecting warp thread (13),(14) is provided in the illustrated warp thread system which extends in the base fabric (B1),(B2) and, in some weft introduction cycles, runs over the relatively thick backing weft thread (20R), (21R). In this way, the backing weft threads (20R),(21R) are connected to the base fabric. In Fig. 9a, the connecting warp thread (13) of the upper base fabric (B1) runs above one backing weft thread (20R) of that base fabric (B1) in the second weft introduction cycle (II), and the connecting warp thread (14) of the lower base fabric (B2) runs below the backing weft thread (21R) of that base fabric (B2) in the first weft introduction cycle (I).

[0132] As the tight-warp threads (3),(6) slightly cover the backing weft threads (20R),(21R) of the base fabric (B1),(B2), these backing weft threads (20R),(21R) and the pile warp threads (P1)-(P4) interlaced thereover are not securely fastened in the base fabrics. The connecting warp threads (13),(14) are provided in order to improve the connection of the backing weft threads (20R),(21R) with the base fabric (B1),(B2). However, it should be noted that if the weft thread density is sufficiently high, the base fabric (B1),(B2) is compressed in such a manner (by beating up the weft threads) that the pile-forming pile warp threads (P1)-(P4) are fastened sufficiently well and connecting warp threads are superfluous.

[0133] The connecting warp threads (13),(14) do not necessarily have to be provided in each warp thread system (for each tooth of the weaving reed), but it may suffice, for example, to provide one such connecting warp thread for each series of four warp thread systems in one warp thread system. The connecting warp thread (13) of the upper base fabric (B1) and the connecting warp thread (14) of the lower base fabric (B2) may also be provided in a different warp thread system. The connecting warp threads (13),(14) are positioned in the successive weft introduction cycles by the jacquard machine.

[0134] The weaving machine comprises one knife (K) for cutting the pile-forming part of the pile warp threads (P1)-(P4) along a horizontal cutting plane (T) situated between both base fabrics. The weaving machine may comprise four picker rolls.

[0135] Fig. 9b shows a diagrammatic cross section of a portion of the two carpets which have been obtained by employing this ninth method from Fig. 9a, after the removal of the additional fabrics (Z1),(Z2). The two carpets (PW1),(PW2) are represented with both sides facing one another.

[0136] In this figure, every pile loop (L1),(L2),(L3),(L4) is denoted by the letter L followed by the same numeral as the pile-forming pile warp thread (P1),(P2),(P3),(P4)

which formed the respective pile loop.

[0137] Pile legs of the pile fabrics which still have a non-pile-forming part which is woven into an additional fabric after the pile-forming parts of the pile-forming pile warp threads have been cut, are pulled out of the associated pile fabric when removing the additional fabric.

[0138] A tenth method (see Fig. 10a) differs from the above-described eighth and ninth method in that it is carried out on a three-rapier weaving machine and in that yet another weave structure is used for the standard weave structure of the base fabrics (B1),(B2).

[0139] Two additional fabrics (Z1), (Z2) are woven, in which the non-pile-forming parts of the pile warp threads (P1)-(P4) are bound in. The upper additional fabric (Z1) is situated on the back of the upper pile fabric (PW1) and the lower additional fabric (Z2) is situated on the back of the lower pile fabric (PW2).

[0140] According to this method, the additional fabrics (Z1),(Z2) are also formed without binding warp threads and without tight-warp threads. Here, the non-pile-forming parts of the pile warp threads (P1)-(P4) are used to bind the weft threads (20),(21) in the additional fabrics (Z1),(Z2). These non-pile-forming parts run alternately above and below the successive weft threads (20),(21) of the additional fabrics.

[0141] The pile warp threads form pile according to a 1/2 V weave structure (1 pile loop for every two weft introduction cycles), wherein they interlace alternately over a backing weft thread (20R) of the upper base fabric (B1) and a backing weft thread (21R) of the lower base fabric (B2). If the additional fabrics are also taken into consideration, 2 pile loops are formed for every 3 weft introduction cycles.

[0142] In successive series of three successive weft introduction cycles (I), (II), (III), the upper weft thread (20) and the lower weft thread (21) which are inserted during the third weft introduction cycle are bound in in the upper (Z1) and the lower additional fabric (Z2), respectively. The middle weft thread (22) which is inserted during the first (I) weft introduction cycle (I) and the upper weft thread (20) which is inserted during the second weft introduction cycle (II), are in each case bound in in the upper base fabric (B1). The lower weft thread (21) which is inserted during the first (I) weft introduction cycle (I) and the middle weft thread (22) which is inserted during the second weft introduction cycle (II) are in each case bound in in the lower base fabric (B2). The upper weft thread (20R) which is inserted during the first weft introduction cycle (I) and the lower weft thread (21R) which is inserted during the second weft introduction cycle (II) are relatively thick backing weft threads (20R),(21R) which are in each case arranged on the back of the upper (B1) and the lower base fabric (B2), respectively.

[0143] In every third weft introduction cycle (III) of the successive series, the middle rapier does not insert weft thread. The locations (30) where no weft thread is inserted are denoted symbolically in Fig. 10a with a circled X.

[0144] In the upper (B1) and the lower base fabric (B2),

in each case two tight-warp threads (3a),(3b) and (6a),(6b), respectively, are provided for each warp thread system.

[0145] Each base fabric (B1),(B2) comprises two binding warp threads (1),(2);(4),(5) for each warp thread system which run in opposite phases with respect to each other, alternately above two successive weft threads (20),(21) and below two successive weft threads (20),(21) of the respective base fabric. In the openings between the intersecting binding warp threads (1),(2);(4),(5), there are in each case two weft threads (20),(21), one of which runs above the tight-warp thread (3a),(6a) and the other one of which runs below the tight-warp thread (3a),(6a). In every base fabric (3),(6), a second tight-warp thread (3b),(6b) slightly covers the backing weft threads (20R),(21R) of the base fabric (B1),(B2). As a result thereof, these backing weft threads (20R),(21R) and the pile warp threads (P1)-(P4) interlaced thereover are not securely fastened in the base fabrics and connecting warp threads (13), (14) are used again, as is the case in the ninth method, described with reference to Fig. 9a.

[0146] In order to support the rapier, certain warp thread systems also comprise a supporting warp thread (15), as mentioned in the description of Fig. 8a.

[0147] The weaving machine comprises one knife (K) for cutting the pile-forming part of the pile warp threads along a cutting plane between the two base fabrics. Four picker rolls are provided for advancing the two pile fabrics (PW1), (PW2) and the two additional fabrics (Z1),(Z2) during weaving.

[0148] Fig. 10b shows a diagrammatic cross section of a portion of the two carpets (PW1), (PW2) which have been obtained by employing this fourth method from Fig. 10a, after the removal of the additional fabrics (Z1),(Z2). The two carpets (PW1),(PW2) are represented with the pile sides facing each other.

[0149] In this figure, every pile loop (L1),(L2),(L3),(L4) is denoted by the letter L followed by the same numeral as the pile-forming pile warp thread (P1),(P2),(P3), (P4) which formed the respective pile loop.

[0150] Pile legs of the pile fabrics which still have a non-pile-forming part which is woven into an additional fabric after the pile-forming parts of the pile-forming pile warp threads have been cut, are pulled out of the associated pile fabric when removing the additional fabric.

[0151] Figs. 11a to 11d are diagrammatic representations of the weft threads of two pile fabrics (PW1),(PW2) and two additional fabrics (Z1),(Z2) while employing the eighth method according to the present invention (see Fig. 8a), in which four respective different pile transitions are illustrated, being the transition from pile formation by a first pile warp thread (P1) to pile formation by a second pile warp thread (P2).

[0152] Fig. 11a shows the transition from pile formation by a pile warp thread (P1) which is bound in in the lower additional fabric (Z2) to pile formation by another pile warp thread (P2) which is bound in in the lower additional

fabric (Z2).

[0153] Fig. 11b shows the transition from pile formation by a pile warp thread (P1) which is bound in in the lower additional fabric (Z2) to pile formation by another pile warp thread (P2) which is bound in in the upper additional fabric (Z1).

[0154] Fig. 11c shows the transition from pile formation by a pile warp thread (P1) which is bound in in the upper additional fabric (Z1) to pile formation by another pile warp thread (P2) which is bound in in the lower additional fabric (Z2).

[0155] Fig. 11d shows the transition from pile formation by a pile warp thread (P1) which is bound in in the upper additional fabric (Z1) to pile formation by another pile warp thread (P2) which is bound in in the upper additional fabric (Z1).

[0156] These Figs. 11a-11d demonstrate that these pile transitions do not produce any mixing contours.

Claims

1. Method for manufacturing pile fabrics (PW1),(PW2), wherein two base fabrics (B1), (B2) are woven composed of first ground warp yarns (1-3, 3a, 3b, 13),(4-6, 6a, 6b, 14) and first weft threads (20,20b,20R,22) ; (21, 21b,21R, 22), respectively, while each base fabric (B1),(B2) comprises at least one pile warp thread (P1)-(P16), parts of which extend between both base fabrics (B1),(B2) in a pile-forming manner, wherein at least some of the pile warp threads (P1)-(P16) are non-pile-forming over at least part of their length, and wherein the pile-forming parts of the pile-warp threads (P1)-(P16) between both base fabrics (B1),(B2) are cut, so that two pile fabrics (PW1),(PW2) are obtained, **characterized in that** at least some of the non-pile-forming parts of the pile warp threads (P1)-(P16) are woven in, together with second weft threads (20), (21), (22) before the pile warp threads are cut, to form at least one additional fabric (Z); (Z1),(Z2), and **in that** each additional fabric (Z); (Z1),(Z2) is subsequently removed.
2. Method for manufacturing pile fabrics according to Claim 1, **characterized in that** a respective associated additional fabric (Z1),(Z2) is formed on the back of each base fabric (B1),(B2), **in that** at least some of the non-pile-forming parts of the pile warp threads (P1)-(P16) are woven in with the additional fabrics (Z1),(Z2), and **in that** the pile-forming parts of the pile warp threads (P1)-(P16) between both base fabrics (B1),(B2) are cut along a cutting plane (T) which is situated between the base fabrics.
3. Method for manufacturing pile fabrics according to Claim 2, **characterized in that**, after cutting the pile warp threads (P1)-(P16), a number of pieces of pile

warp thread are obtained which comprise a pile-forming part and a non-pile-forming part, **in that** at least one pile leg is formed on each pile fabric (PW1),(PW2) by a pile-forming part of a piece of pile warp thread (P1)-(P16), whereas a non-pile-forming part thereof is woven into the associated additional fabric (Z1),(Z2), and **in that** said pile leg, which is formed by the pile-forming part of said piece of pile warp thread, is pulled out of the pile fabric (PW1),(PW2) when the associated additional fabric (Z1),(Z2) is removed.

4. Method for manufacturing pile fabrics according to Claim 1, **characterized in that** two additional fabrics (Z1),(Z2) are formed between the base fabrics and are respectively associated with the one (PW1) and with the other pile fabric (PW2), **in that** at least some of the non-pile-forming parts of the pile warp threads (P1)-(P8) are woven into the additional fabrics (Z1),(Z2), and **in that** the pile-forming parts of the pile warp threads are cut according to a cutting plane (T) situated between the additional fabrics (Z1),(Z2).
5. Method for manufacturing pile fabrics according to Claim 4, **characterized in that** the pile-forming parts which are cut are pile-forming parts of pile warp threads (P1)-(P8) which are successively interlaced with the one (B1) and the other base fabric (B2), and/or are pile-forming parts of pile warp threads which are successively interlaced with the one base fabric (B1),(B2) and an additional fabric (Z2),(Z1) associated with the other base fabric (B2),(B1), and/or are pile-forming parts of pile warp threads (P1)-(P8) which are successively interlaced with the one (Z1) and the other additional fabric (Z2).
6. Method for manufacturing pile fabrics according to Claim 1, **characterized in that** an additional fabric (Z) is formed **between** the two base fabrics (B1),(B2), **in that** at least one pile warp thread partly woven into the additional fabric (Z) runs from the additional fabric (Z) to the one base fabric (B1) in a pile-forming manner and that at least one pile warp thread partly woven into the additional fabric (Z) runs from the additional fabric (Z) to the other base fabric (B2) in a pile-forming manner, and **in that** the pile-forming parts of pile warp threads between both base fabrics (B1),(B2) are cut along a first cutting plane (T1) which is situated between the additional fabric (Z) and the one base fabric (B1) and along a second cutting plane (T2) which is situated between the additional fabric (Z) and the other base fabric (B2), so that the additional fabric (Z) is separated from the two pile fabrics (PW1),(PW2).
7. Method for manufacturing pile fabrics according to one of the preceding claims, **characterized in that** more than half, preferably more than three quarters

of the non-pile-forming parts of the pile warp threads (P1)-(P16), more preferably all non-pile-forming parts of the pile warp threads (P1)-(P16) are woven in, together with second weft threads (20), (21), (22), before the pile warp threads are cut, to form at least one additional fabric (Z); (Z1),(Z2).

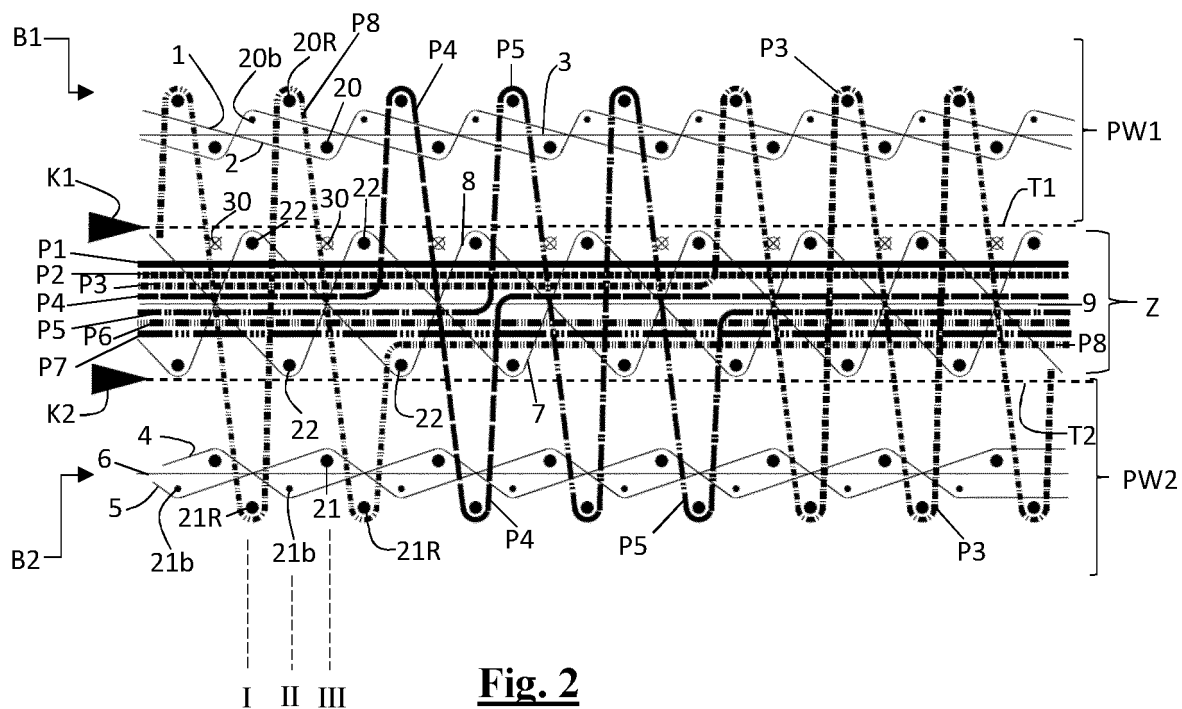
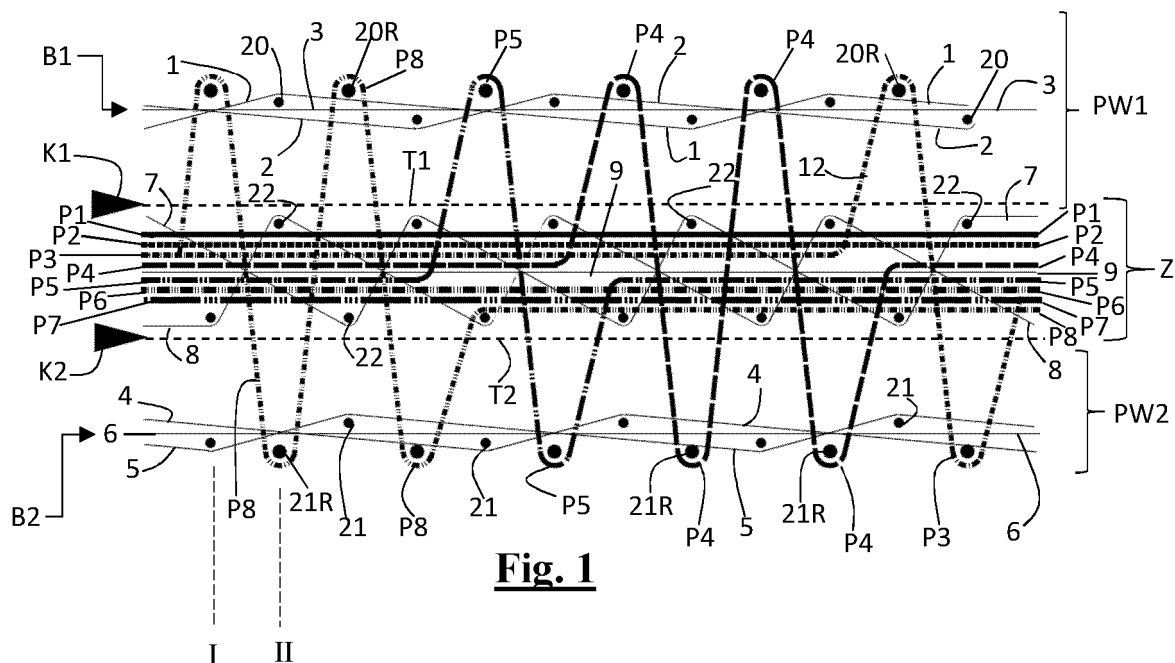
8. Method for manufacturing pile fabrics according to one of the preceding claims, **characterized in that** the second weft threads (20), (21), (22) are bound in in each additional fabric by second ground warp threads (7, 8), (10, 11) and/or by non-pile-forming parts of pile warp threads.
9. Method for manufacturing pile fabrics according to one of the preceding claims, **characterized in that** the first weft threads (20),(20b),(20R),(21),(21b),(21R),(22) comprise ground warp threads (20),(20b),(21), (21b), (22) and backing weft threads (20R), (21R), **in that** each base fabric (B1),(B2) is woven from respectively first weft threads (20),(20b),(21),(21b), (22) which are bound in by respectively first ground warp threads (1, 2), (4, 5) and/or by respectively non-pile-forming parts of pile warp threads, and from respectively backing weft threads (20R),(21R) which are situated on the back of the base fabric (B1), (B2), and **in that** the pile-forming parts of the pile warp threads which form pile on the pile fabric (PW1), (PW2) are interlaced in each case over a backing weft thread (20R),(21R).
10. Method for manufacturing pile fabrics according to Claim 9, **characterized in that** the backing weft threads (20R), (21R) have a thickness which is greater than that of the ground warp threads (20),(20b),(21),(21b),(22).
11. Method for manufacturing pile fabrics according to Claim 9 or 10, **characterized in that** connecting warp threads (13),(14) are provided in each base fabric (B1),(B2) which, in the base fabric, run alternately on the pile side of one or several first weft threads (20),(20b),(21),(21b),(22) and run over a backing weft thread (20R),(21R) which is situated on the back of the respective base fabric, so that each base fabric (B1),(B2) is connected to at least some of the backing weft threads (20R), (21R) which are situated on the back thereof.
12. Weaving machine for simultaneously manufacturing two pile fabrics (PW1),(PW2), comprising
 - a. a weft insertion device configured to insert in each case at least two weft threads (20,20b,20R), (21,21b,21R), (22) at different weft insertion levels between ground warp threads (1-3, 3a, 3b, 13), (4-6, 6a, 6b, 14) and pile warp threads (P1)-(P16) in successive weft

introduction cycles,

- b. a shed-forming device provided to position said ground warp threads and pile warp threads in each weft introduction cycle (I)-(VIII) with respect to the weft insertion levels in such a way, that two base fabrics (B1),(B2) are woven one above the other from first ground warp threads (1-3, 3a, 3b, 13), (4-6, 6a, 6b, 14) and first weft threads (20,20b,20R,22), (21, 21b,21R, 22), respectively, whereas parts of pile warp threads (P1)-(P16) extend in a pile-forming manner between both base fabrics (B1),(B2) and at least some of the pile warp threads (P1)-(P16) are non-pile-forming over at least a part of their length,
- c. a cutting device (K), (K1),(K2) provided to cut the pile-forming parts of the pile warp threads (P1)-(P16) between both base fabrics, so that two pile fabrics (PW1),(PW2) are obtained,

characterized in that the weaving machine is adapted to weave, before the pile warp threads are cut, at least some of the non-pile-forming parts of the pile warp threads (P1)-(P16), together with second weft threads (20), (21), (22) to form at least one additional fabric (Z);(Z1),(Z2).

13. Weaving machine for simultaneously manufacturing two pile fabrics according to Claim 12, **characterized in that** the weaving machine comprises:
 - two movement devices in order to, during weaving, exert a tensile force on the respective pile fabrics so as to move these with respect to the weaving machine, and
 - at least one additional movement device in order to, during weaving, exert a tensile force on an additional fabric.



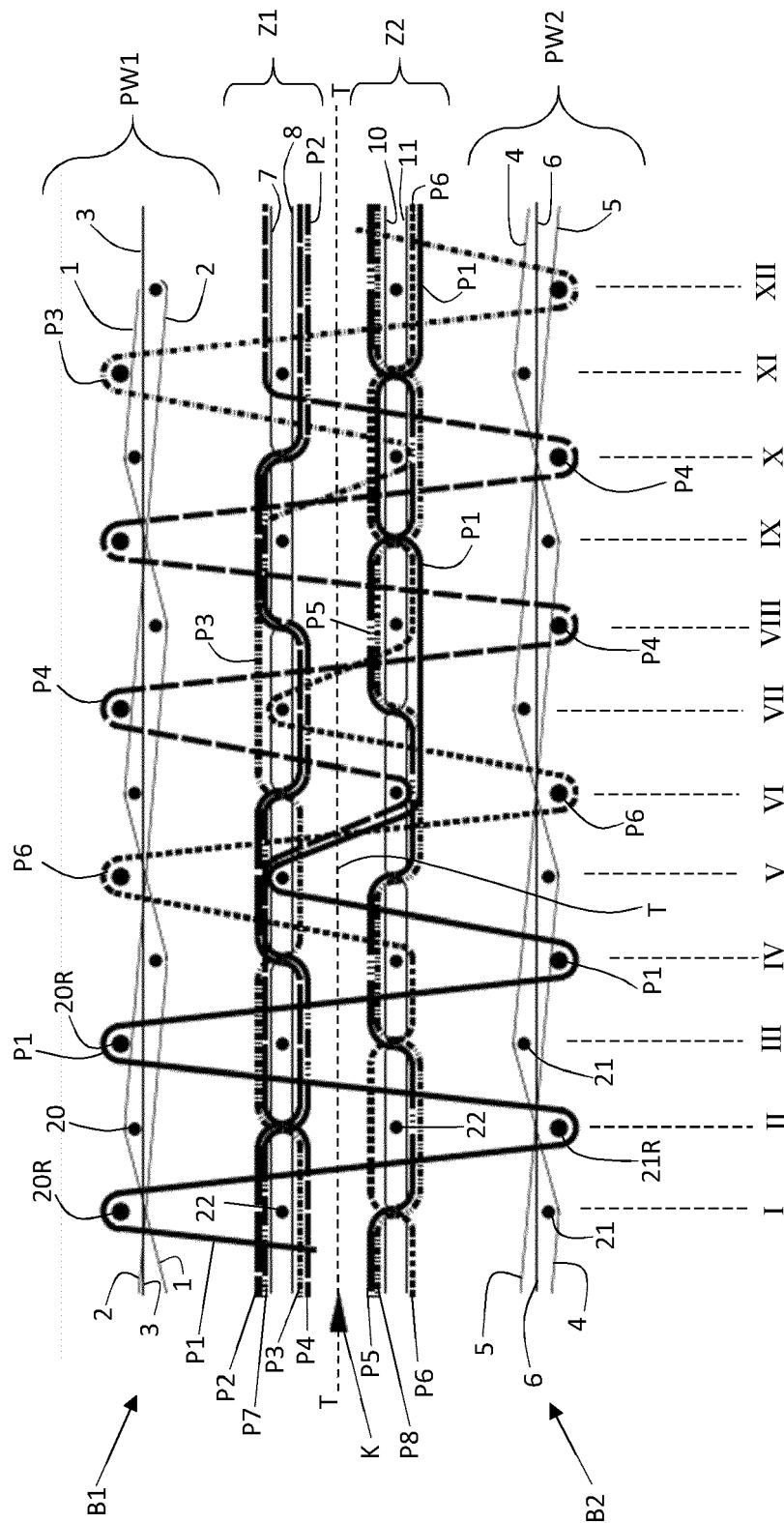


Fig. 3

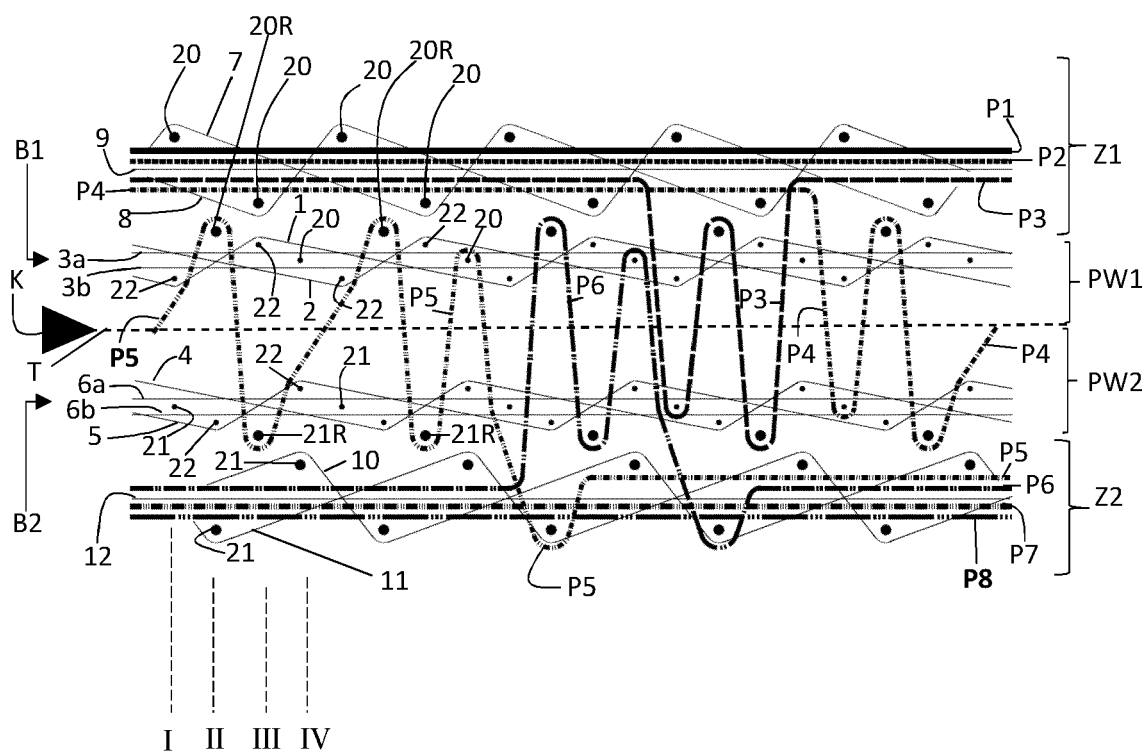


Fig. 4a

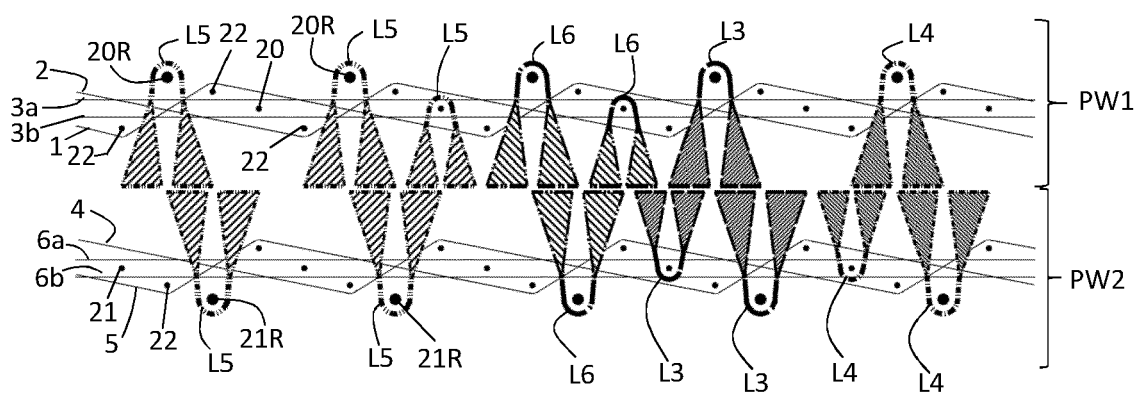


Fig. 4b

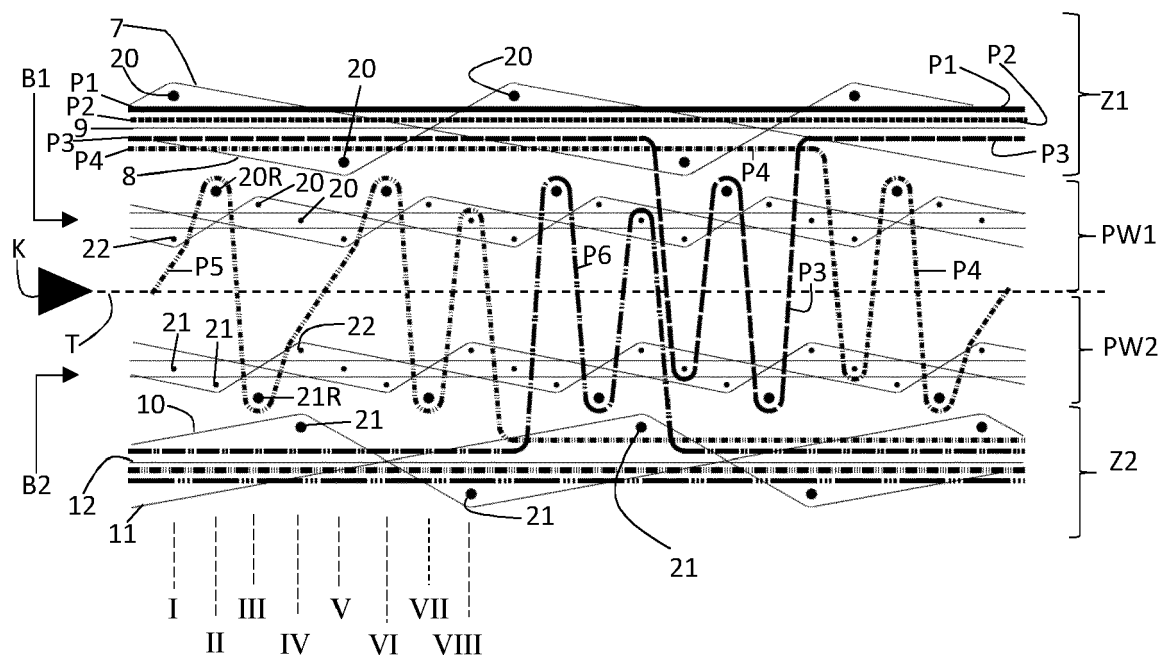


Fig. 5a

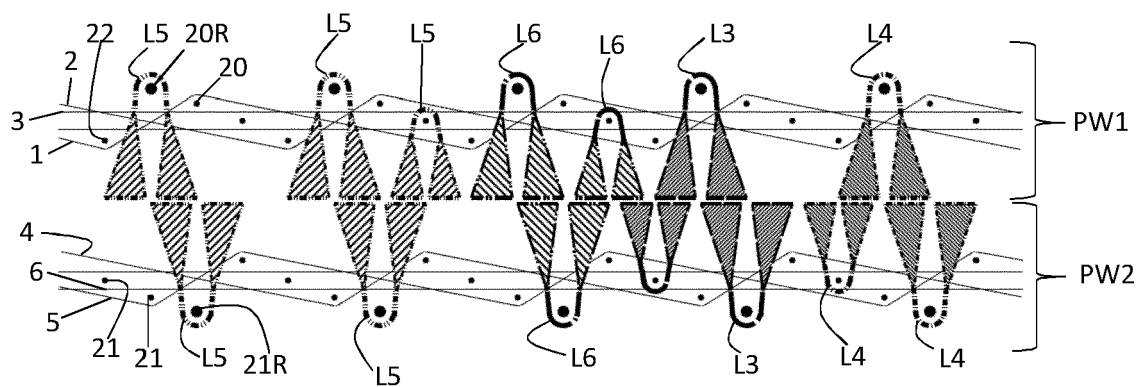


Fig. 5b

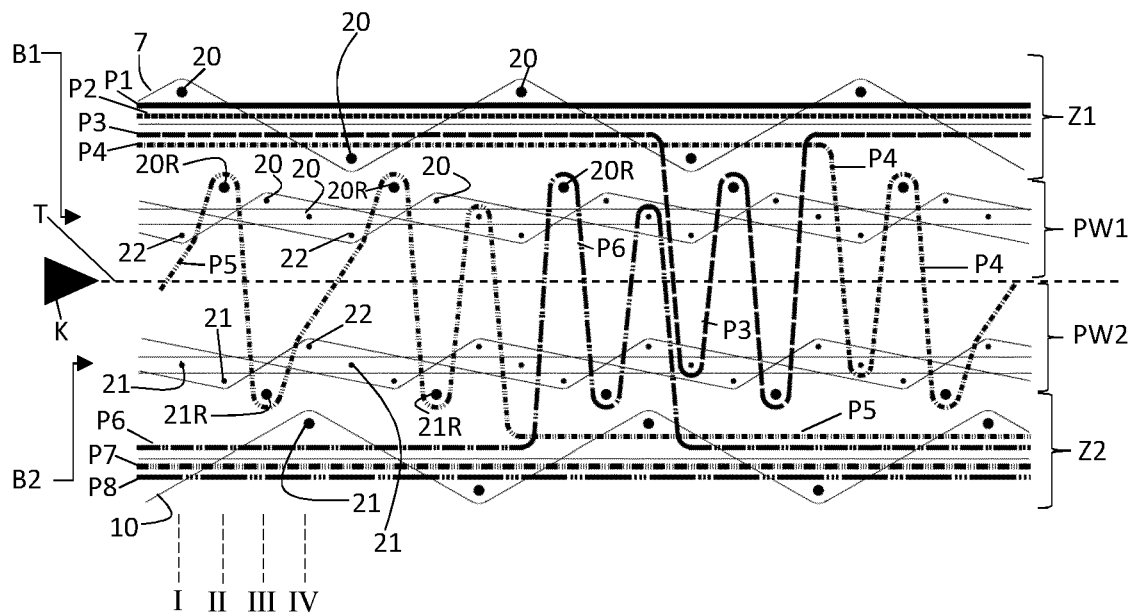


Fig. 6a

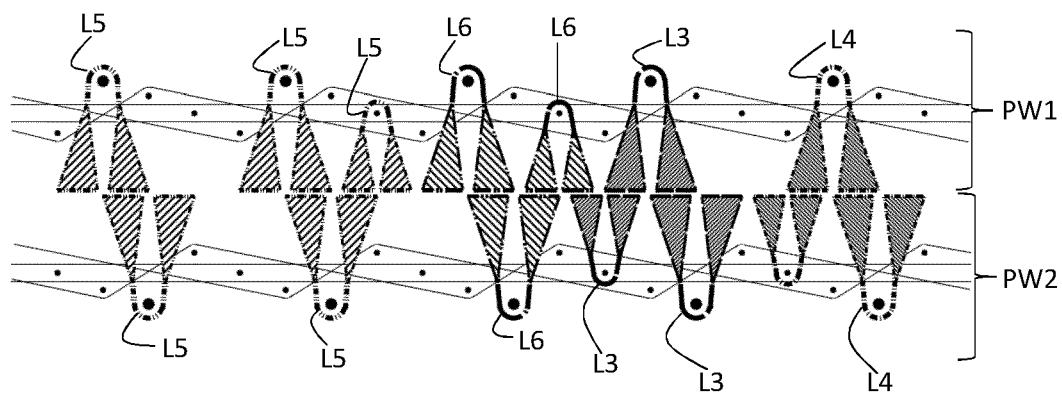


Fig. 6b

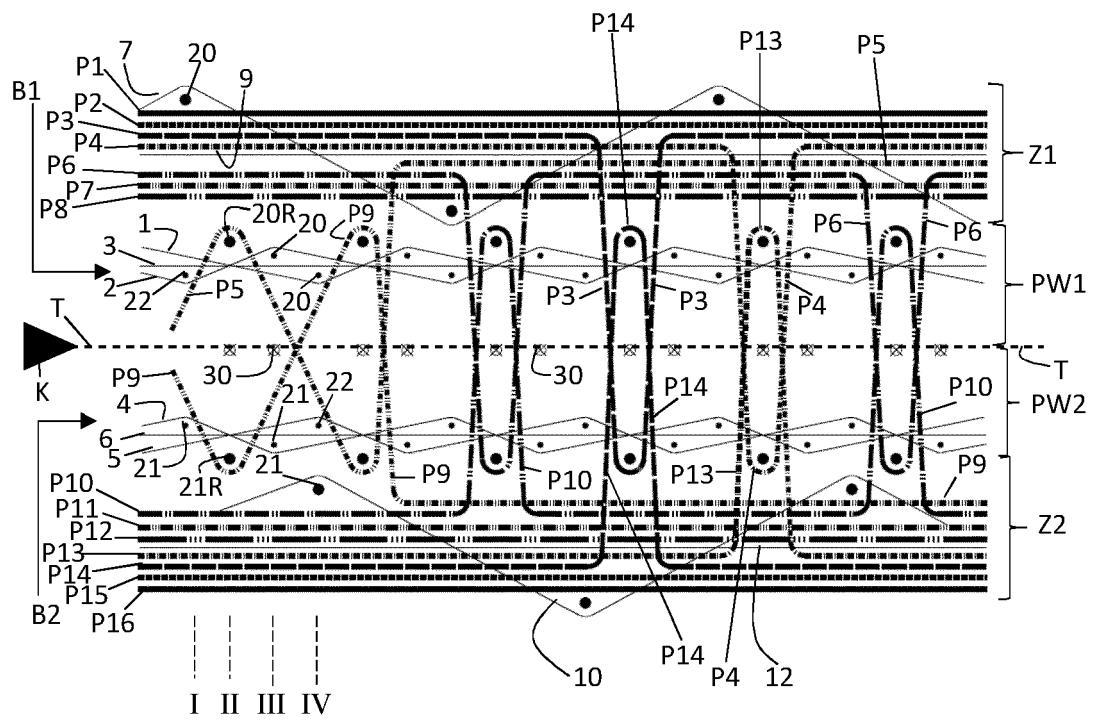


Fig. 7a

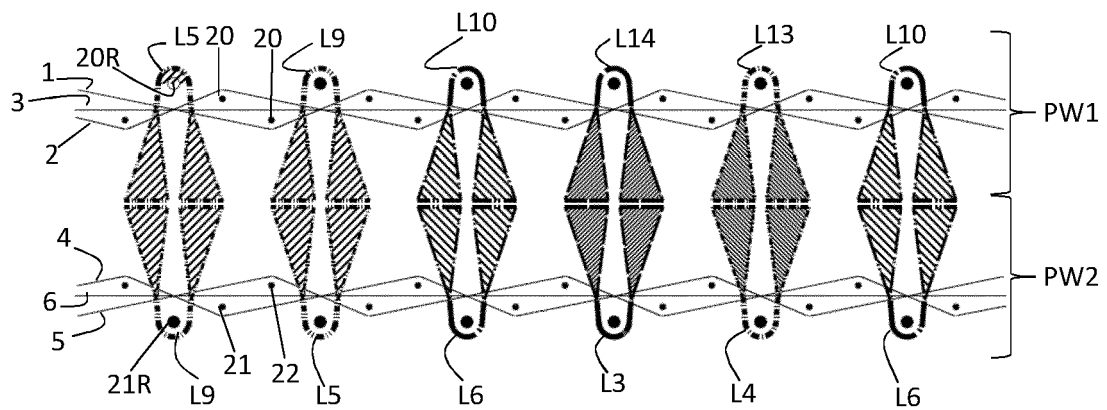


Fig. 7b

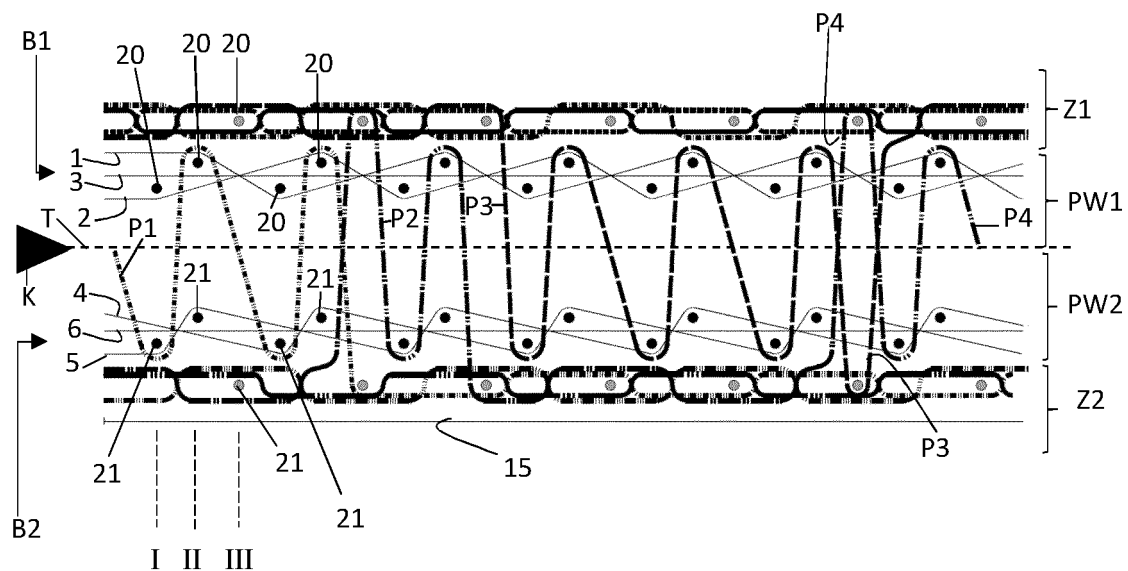


Fig. 8a

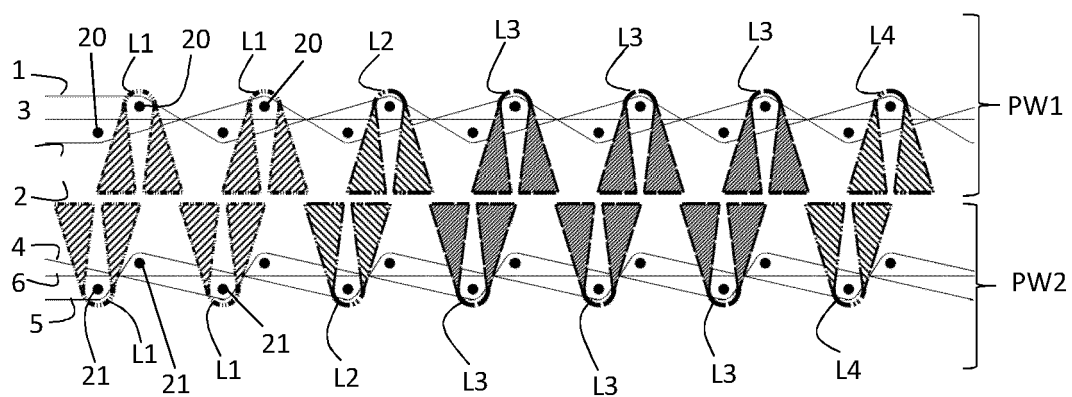


Fig. 8b

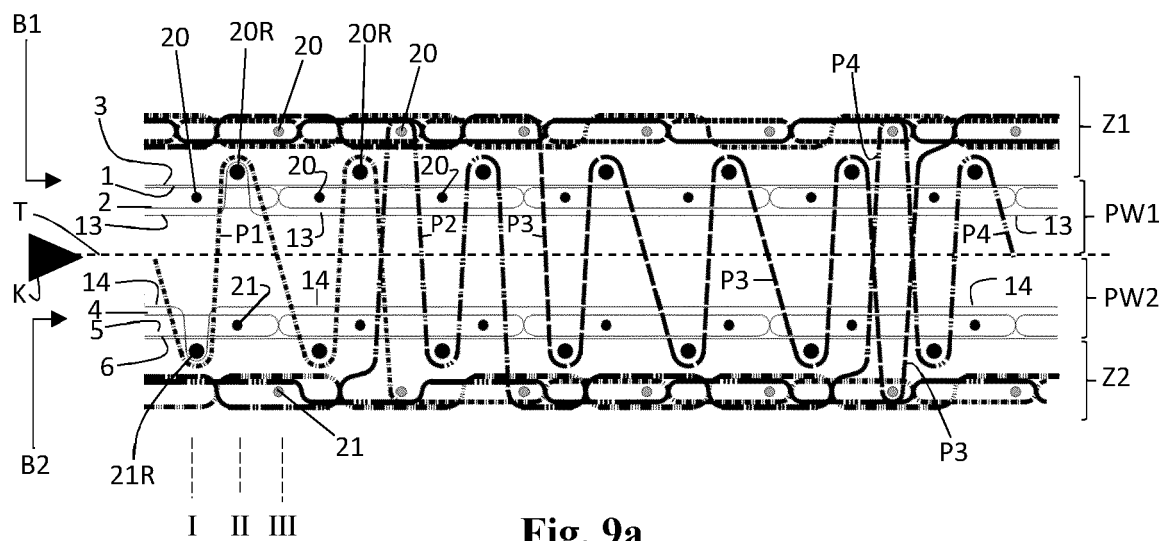


Fig. 9a

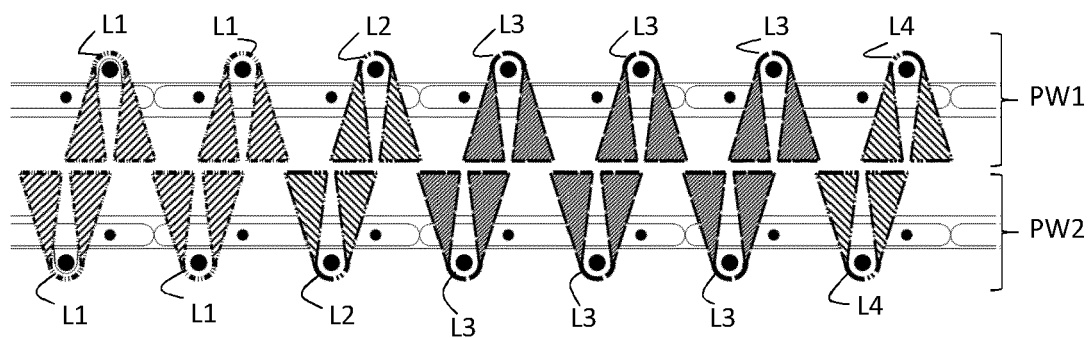
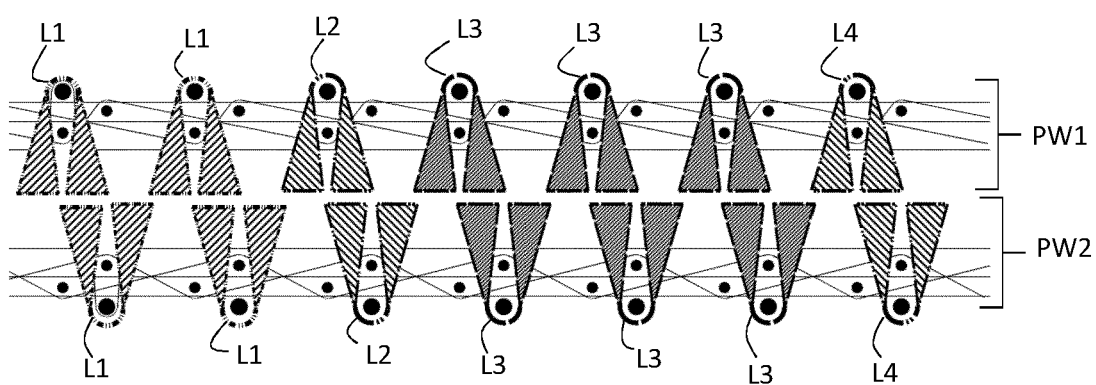
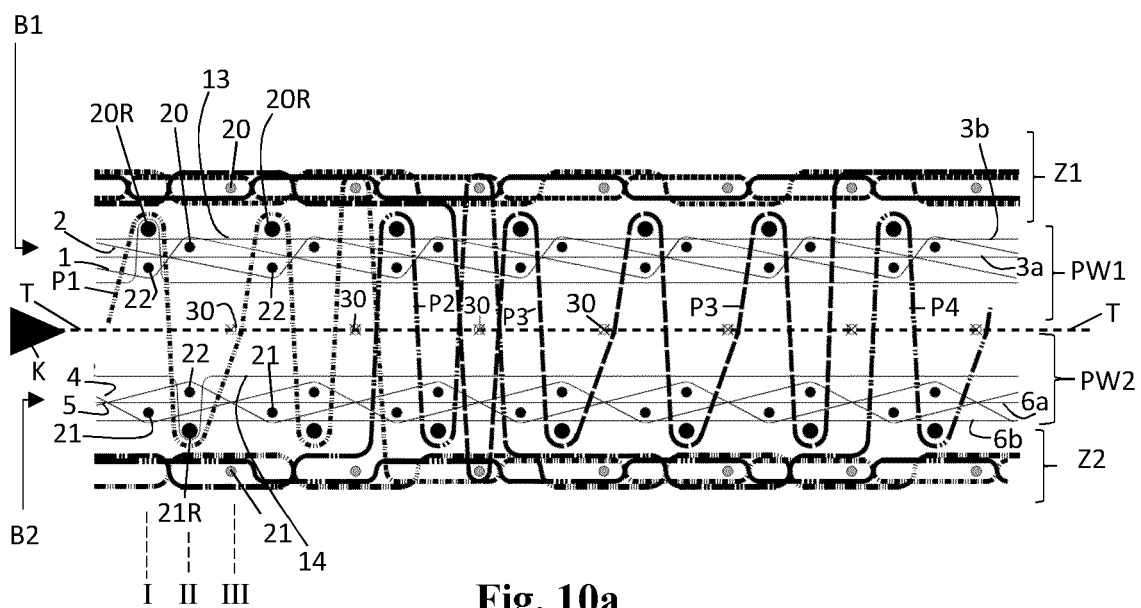
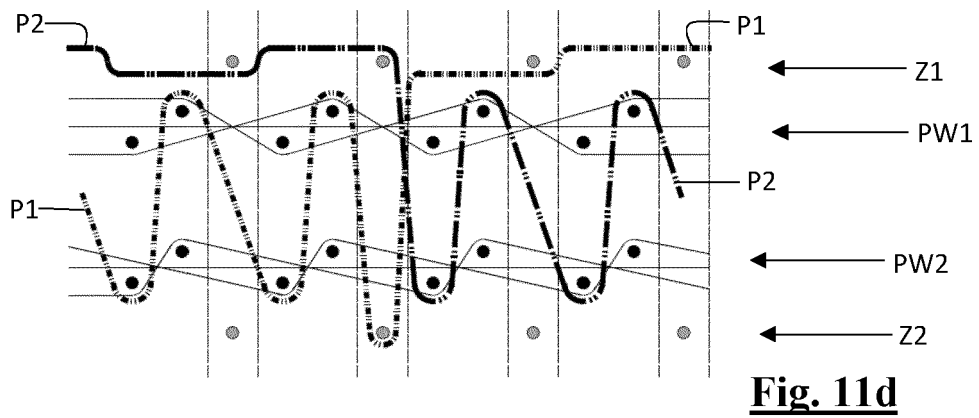
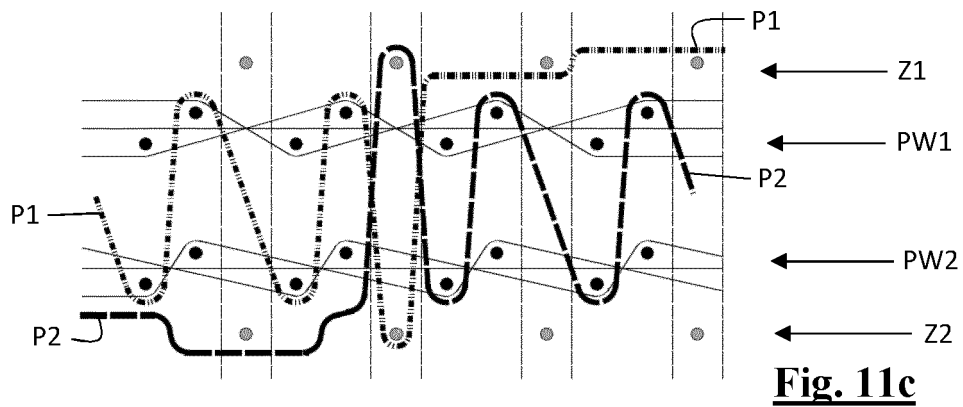
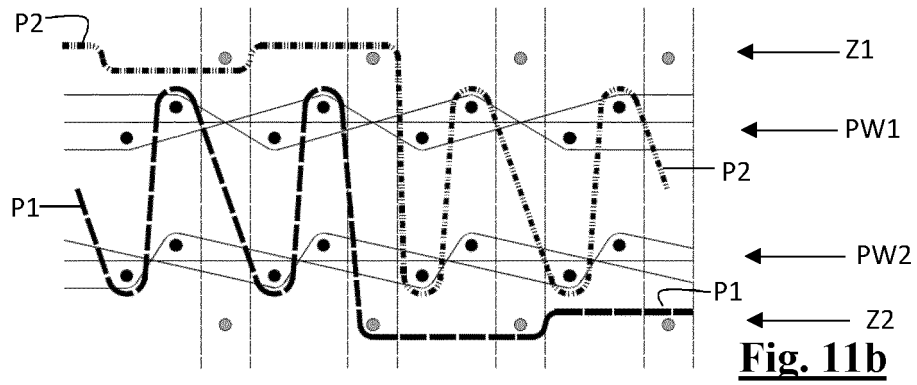
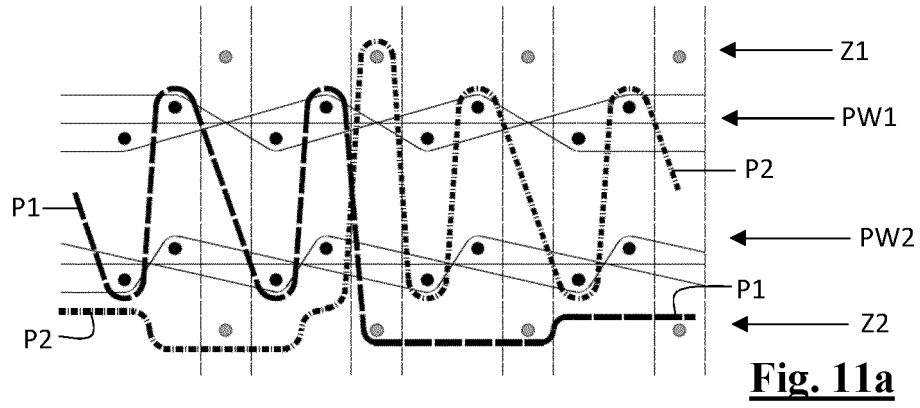


Fig. 9b







EUROPEAN SEARCH REPORT

Application Number
EP 19 21 4540

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 1 746 190 A1 (WIELE MICHEL VAN DE NV [BE]) 24 January 2007 (2007-01-24) * paragraphs [0085] - [0090]; figures 19-21 *	1,4-11	INV. D03D27/10
X	----- BE 891 638 A (TAPIJTENWEVERIJ) 16 April 1982 (1982-04-16) * page 2, paragraph 4 *	12,13	
A	* page 4, paragraph 4 * * page 5, paragraph 2; figures 1-4 *	1-3,7-11	
A	----- DE 60 244 C (REISER, N) 12 December 1891 (1891-12-12) * the whole document *	1-11	

			TECHNICAL FIELDS SEARCHED (IPC)
			D03D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 April 2020	Examiner Louter, Petrus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 21 4540

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-04-2020

10

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1746190	A1	24-01-2007	BE 1016658 A3 EP 1746190 A1	03-04-2007 24-01-2007

BE 891638	A	16-04-1982	NONE	

DE 60244	C	12-12-1891	NONE	

15

20

25

30

35

40

45

50

55

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1746190 A1 [0005]