

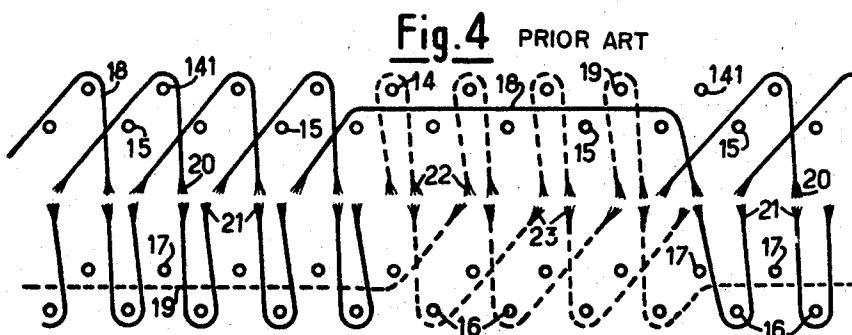
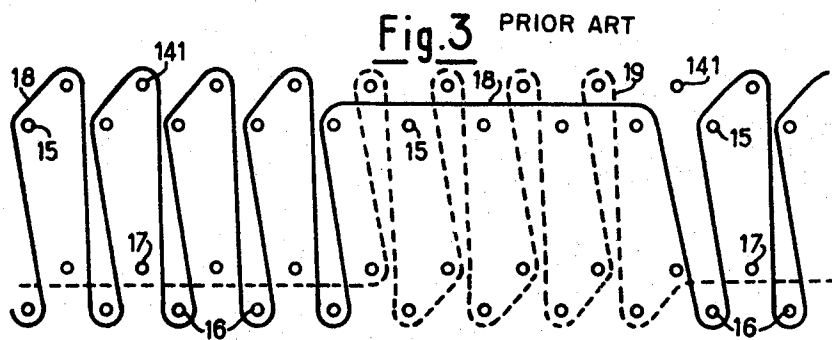
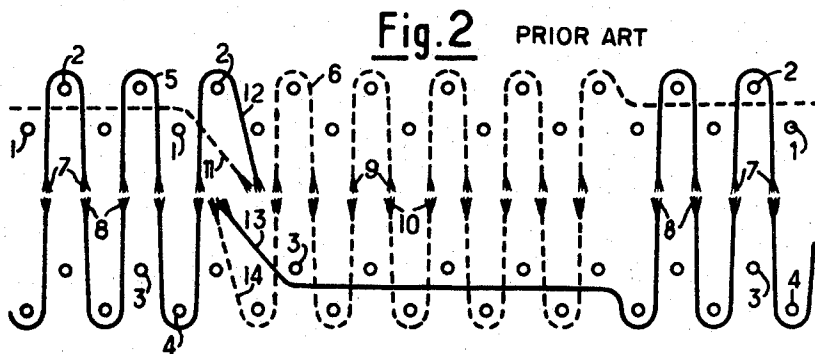
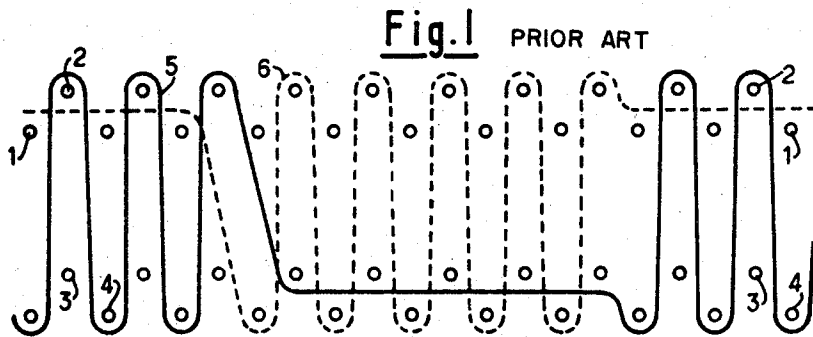
July 7, 1970

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PILE FABRICS

3,519,032

Filed Feb. 9, 1968

3 Sheets-Sheet 1



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Fig. 5

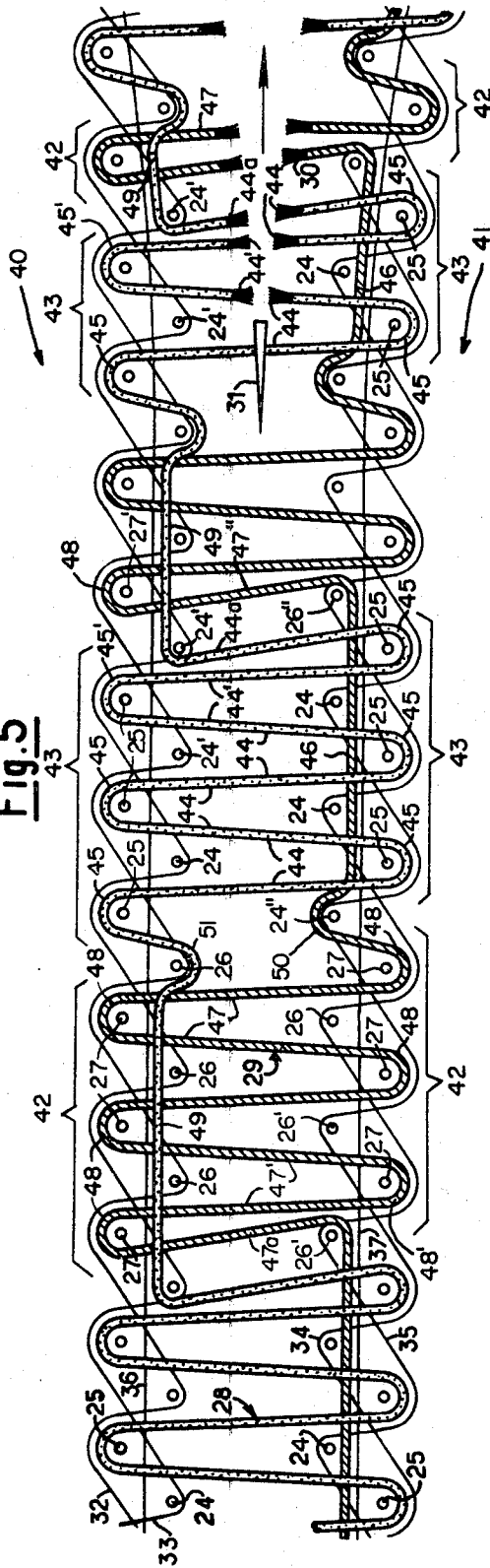


Fig.

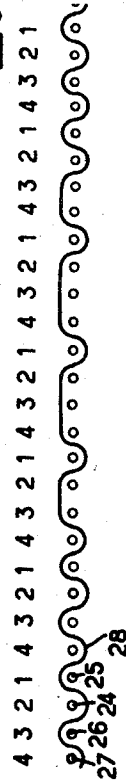
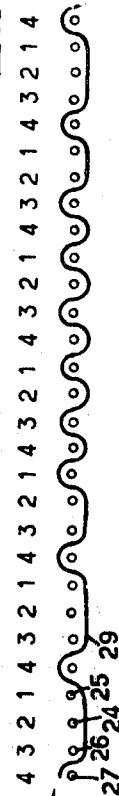


Fig.



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Fig. 6

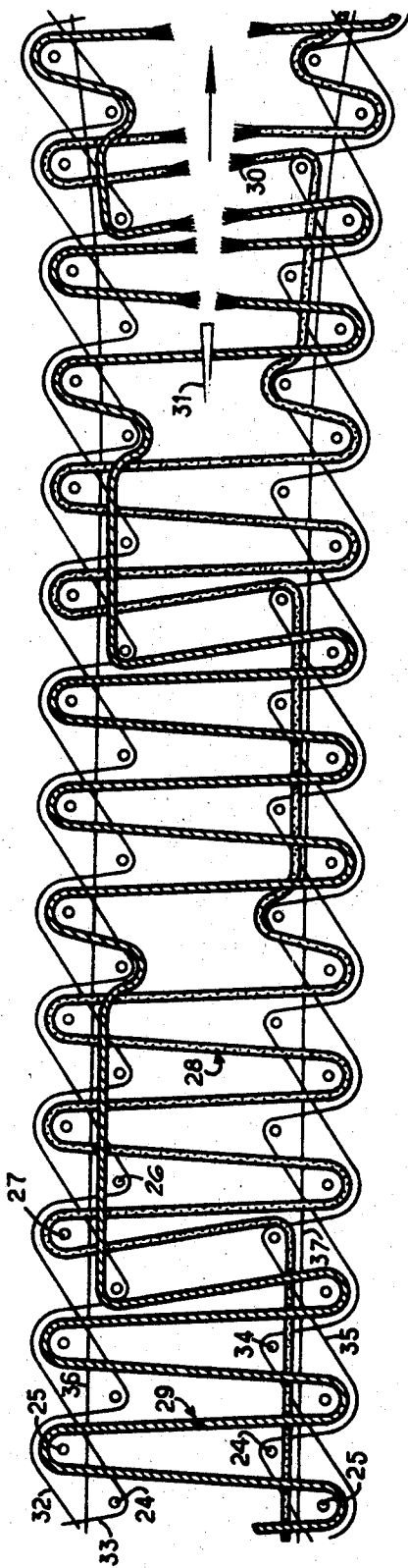


Fig. 7

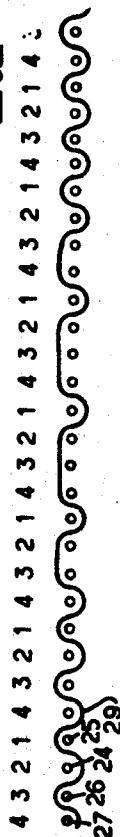
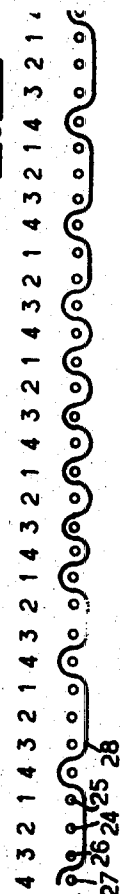


Fig. 10



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4 Claims

ABSTRACT OF THE DISCLOSURE

A pile fabric produced on a loom with a single shuttle by weaving two backing fabrics face-to-face with tuft forming portions extending between the backing fabrics, and float or reserve yarn portions bound in one or other of the backing fabrics by respective face weft yarns. The float yarn portions are equally distributed in the two backing fabrics such that certain warp yarns which do not form tufts form floats yarn portions which are bound into the one of the backing fabrics, and that other warp yarns which do not form tufts form float yarn portions which are bound in the other of the backing fabrics. Each pair of tufts is secured by a single pile supporting weft yarn and held erect on the respective backing fabric by two adjacent weft yarns. A last tuft formed by a warp yarn starting to form a float yarn portion extending from a backing fabric opposite to that in which its float yarn portion lies and a last pair of adjacent tufts immediately adjacent the last tuft as a unit are held erect therebetween by two adjacent weft yarns, thereby the last tuft tending to move towards the adjacent last pair of adjacent tufts formed of the same respective pile warp yarn.

The present invention relates to the production of pile fabrics, and is concerned with pile fabrics produced on a single shuttle loom and woven face-to-face, that is having two backing fabrics with a single sheet of pile yarns therebetween. More particularly the present invention relates to a carpet having a multi-colored design pattern and woven on a single shuttle loom with a Jacquard mechanism.

It is known that two carpets can be produced simultaneously by weaving both face-to-face, that is with a double backing fabric and a single sheet of pile yarns therebetween, and thereafter separating them from each other on the loom by a cutter which is displaced on a rail in a direction parallel to the path of the shuttle. Such carpets can be woven on a loom having one or two shuttles. Each carpet comprises a backing web or fabric and tufts forming the pile, the backing web or fabric being formed by binding warp yarns which secure the weft yarns, and by reinforcing or stuffer warp yarns which prevent deformation of the carpet. The tufts are formed by pile warp yarns which pass alternately from one backing fabric to the other during the weaving process, prior to the separation by means of the cutter. The carpets present in general five colors: blue, red, black, green and white, and the appearance of the colors in the design pattern is determined by a Jacquard mechanism. When a yarn of one color appears, the yarns of the other four colors are either woven into the backing fabric or are free under the backing of the carpet and are called "float yarns." In a certain manufacturing process the "float yarns" appear on one carpet only and are subsequently pulled out. The result is that one of the two carpets is of inferior quality.

The backing fabric comprises on the one hand "pile supporting weft yarns" which are embraced by pile-forming warp yarns and which secure the tufts produced therefrom, and on the other hand "incorporated weft yarns" or "face weft yarns" which secure the float (or reserve warp) yarns in the backing of the carpet.

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U.S. Pat. No. 3,327,738 which issued on June 27, 1967 describes a binding structure, wherein the number of pile supporting weft yarns is greater than the number of face weft yarns.

The present invention relates to a binding structure having an equal number of face weft yarns and pile supporting weft yarns.

Such binding structures have already been realized either with two shuttles or with one shuttle. In known double faced carpet structures produced by one or two shuttles and having an equal number of face weft yarns and pile supporting weft yarns, after separation of the double faced structures at the point where a color is changed there is an interference between two colors producing mingled contours which causes a lack of distinctness of design. Moreover, with double faced carpet structures produced with two shuttles, one of the two tufts of the alternating color yarns falls obliquely after separating the double face carpets and as a result in the two separated carpets certain tufts are not held erect.

Furthermore, in the known weaving with two shuttles the latter are thrown simultaneously between the two sheets of warp yarns constituting the shed, either in the same direction or in opposite directions. In these looms the lower shuttle is properly supported and guided by the shuttle inserting device as in looms with a single shuttle. In contrast, the upper shuttle is very poorly supported and guided by the yarns of the upper sheet of warp yarns. It happens very frequently that this upper shuttle breaks one or more yarns in the upper sheet or passes incorrectly under one or more yarns, which are more or less well lifted by the Jacquard mechanism. The result is that the upper carpet often has many defects. Moreover, the weaver must frequently stop the loom in order to renew warp yarns or to correct the placing of the shuttle, so that the theoretical advantage according to which weaving is effected twice as fast with a loom with two shuttles, is not obtained in practice. The economic balance sheet for the use of looms with two shuttles reveals in the end a disadvantage with respect to looms with one shuttle. For this reason, many weavers prefer to use this latter type of loom.

It is an object of the present invention to avoid the various disadvantages mentioned above, yet produce a weave having two weft yarns per tuft.

It is another object of the present invention to provide a novel binding structure of pile fabrics woven face-to-face on a loom with a single shuttle, having two weft yarns per tuft and having an equal number of face weft yarns and pile supporting weft yarns, with face weft yarns which secure the float pile warp yarns or reserve yarns, wherein the float pile warp yarns are equally distributed in number and in color in the two backing fabrics. The pile warp yarns which form a tuft embrace a single pile supporting weft yarn and are held erect on the backing fabric by two face weft yarns, even when colors are changed, except in relation to a float pile warp yarn starting to form a first tuft and a warp yarn forming a last tuft before starting to form a float yarn, which first and last tufts can direct themselves only towards another tuft of the same respective warp yarn and consequently of the same respective color.

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings in which:

FIG. 1 is a vertical section through a known double-faced carpet structure, obtained with a single shuttle;

FIG. 2 is a view of the carpet of FIG. 1 after being separated into two carpets by a cutter;

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FIG. 3 is a vertical section through a known double-faced carpet structure, obtained with two shuttles;

FIG. 4 is a view of the carpet of FIG. 3, after being separated into two carpets by a cutter; and

FIGS. 5 and 6 are vertical sections through binding structures designed in accordance with the present invention.

Referring now to the drawings, and more particularly to FIGS. 1-4, illustrating the disadvantages of the known carpet structures, in the known structure of FIG. 1, when the pile warp yarn 5 embraces the pile supporting weft yarns 2 and 4, the pile warp yarn 6 is woven into the backing between the face weft yarns 1 and the pile supporting weft yarns 2. Conversely, when the pile warp yarn 6 embraces the pile supporting weft yarns 2 and 4 the pile warp yarn 5 is held between the face weft yarns 3 and the pile supporting weft yarns 4 and is thus woven into the backing fabric. In fact, only a single color must appear in the design pattern so that the latter are neat and precise. After separation of this double face-to-face woven structure (FIG. 2), the pile warp yarn 5 forms tufts 7 in the upper carpet and tufts 8 in the lower carpet. In the region of tufts 7 in the upper carpet there is the float or reserve pile warp yarn 6 which is woven into the backing fabric, whereas there is no float or reserve pile warp yarn 6 in the region of tufts 8. Similarly the pile warp yarn 6 forms tufts 9 in the upper carpet and tufts 10 in the lower carpet. In the region of tufts 9 in the upper carpet there is no float pile warp yarn, whereas in the region of tufts 10 of the lower carpet, there extends the float pile warp yarn 5 which is now woven into the backing fabric.

It will be seen that the two carpets are not strictly identical, but this is no defect of the carpets. The main defect occurs at the point where one pile warp yarn which passes alternately from one fabric to the other is woven into the one fabric and where another pile warp yarn which was woven into the one fabric starts to extend to the other fabric.

The tufts 7, 8, 9, 10 are constituted by a yarn, bent like a hairpin to embrace a weft yarn 2 or a weft yarn 4. The shape of the tuft is maintained by the face weft yarns 1 and 3, that is, for example, a tuft 7 embracing a pile supporting weft yarn 2 is maintained by two face weft yarns 1 and in this manner it is embedded in the backing web. Similarly a tuft 10 embracing a pile supporting weft yarn 4 is maintained by two face weft yarns 3. In this manner, the piles are maintained perpendicularly to the plane of the backing fabric. This important disposition, which is of particular interest, is not preserved at the instant when colors are changed.

In fact, at the point, where the float pile warp yarn 6, woven into the upper carpet, starts to extend to the lower carpet, it embraces a face weft yarn 1, instead of embracing a pile supporting weft yarn 2; a tuft 11 formed from the yarn 6 cannot be held upright by face weft yarns and therefore has a tendency to place itself obliquely with respect to the plane of the backing fabric and to lean towards a tuft 12 formed by the last preceding tuft of another color. Similarly, a pile warp yarn 5, which passes from one fabric to the other, and which is now woven into the lower carpet embraces at this instant a face weft yarn 3 of the lower carpet instead of embracing a pile supporting weft yarn 4. A tuft 13, which is formed therefrom after the cutter has passed cannot be held upright by a face weft yarn and therefore has the tendency to locate itself obliquely with respect to the plane of the backing fabric of the lower carpet and to mingle with a tuft 14, formed by the other pile warp yarn.

The result of all this is, that at the point where a color is changed in a carpet there is in the first two piles after the change, an interference between two colors, which is disadvantageous for the neatness of the contour of the design pattern and also there is prevented the realization of fine details in the patterns, when for example,

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the change of colors must be effected after three or even two picks. This defect is called "mingled contour" and this is a major obstacle to realizing carpets, which have a design pattern with great fineness of detail.

FIG. 3 illustrates two known carpets, woven face to face in a loom, comprising face weft yarns 15, 17 and pile supporting weft yarns 141, 16, as well as a pile warp yarn 18 for a first color and a pile warp yarn 19 for a second color. When the pile warp yarn 18 embraces pile supporting weft yarns 141 and 16, as well as face weft yarns 15, the pile warp yarn 19 is woven into the backing, held between the face weft yarns 17 and the pile supporting weft yarns 16. Conversely, when the pile warp yarn 19 embraces pile supporting weft yarns 141 and 16, as well as face weft yarns 17, the pile warp yarn 18 is held between the face weft yarns 15 and pile supporting weft yarns 141, thus being woven into the backing fabric. In fact only a single color must appear in the design pattern in order that the latter is neat and precise.

After the passage of the cutter, which separates the two carpets by cutting the pile warp yarns, which extend from one carpet fabric to the other in order to constitute the tufts and the pile, as shown in FIG. 4, the pile warp yarn 18 forms tufts 20 in the upper carpet and tufts 21 in the lower carpet. In the region of the tufts 21, the float or reserve pile warp yarn 19 is woven into the fabric, whereas in the region of tufts 20 there is no woven-in float pile warp yarn. Similarly, pile warp yarn 19 forms tufts 22 in the upper carpet and tufts 23 in the lower carpet. In the region of tufts 23 in the lower carpet, there is no woven-in float pile warp yarn, whereas in the region of tufts 22 in the upper carpet, there extends the float pile warp yarn 18, which is now woven into the fabric.

The two carpets are not strictly identical. But the main defect occurs at the tufts in the region in which there is no woven-in float warp yarn, and particularly where a change of color occurs, that is, at the point where a pile warp yarn which passes alternately from one carpet fabric to the other, is being incorporated in the one carpet, and/or one pile warp yarn woven into the one carpet starts to extend from the one carpet to the other in order to constitute the pile.

The tufts 21 and 22 are constituted by a yarn, bent like a hairpin to embrace a weft yarn 16 or a weft yarn 141. These tufts 21 and 22 are kept in shape by face weft yarns 15 and 17, in the same manner as in the example of FIGS. 1 and 2, the tufts being maintained erect on the plane of the backing fabric. However, this important disposition, which is of particular interest, is not preserved at the point where the color is changed.

Moreover, it will be seen that tufts 20 and 23 embrace pile supporting weft yarns 141 and 16 respectively, as well as a face weft yarn 15 and 17, respectively. The result is that one of the two tufts is disposed obliquely, as is clearly illustrated in FIG. 4. The consequence is, that in each one of the two carpets certain tufts are not held erect on the plane of the backing fabric of the carpet.

The carpets illustrated in FIGS. 3 and 4 present therefore two kinds of major disadvantages, namely, "mingled contours" and oblique tufts.

These disadvantages may be avoided by weaving with a cycle of three weft yarns per tuft, that is by adding thereto supplementary face weft yarns, which keep the tufts upright on the backing fabric. However, it is easy to understand that this kind of weaving requires more time and more material, and consequently is more burdensome.

Referring now again to the drawings, and in particular to FIG. 5, the present invention avoids these disadvantages of the known carpet structures by providing a carpet structure in accordance with the invention, comprising a loom-produced double-faced connected carpet structure, having two spaced faces 40 and 41, defining first opposed portions 43 of the faces and second opposed por-

tions 42 of the faces longitudinally spaced warp-wise. A first pile warp yarn 28 of one color is arranged to pass to the first opposed portions 43 of the faces 40 and 41 of the carpet in undulating fashion, forming first tufts 44, therebetween joining the first opposed portions of the faces and forming a plurality of first crests 45 adjacent the faces. A second pile warp yarn 29 of another color is disposed linearly along one of the faces 41 at the opposed portions 43 and inward of the first crests 45 adjacent the one face 41, defining a second float yarn portion 46. One first pile supporting weft yarn 25 is in each of the first crests 45 adjacent the faces 40 and 41. The second pile warp yarn 29 extends from its second float yarn portion 46 to the second opposed portion 42 of the faces of the carpet adjacent the first exposed portions 43 and is arranged to pass to the second opposed portions 42 of the faces in undulating fashion, forming second tufts 47, joining the second opposed portions of the faces and forming a plurality of second crests 48 adjacent the faces 40 and 41. One second pile supporting weft yarn 21 is within each of the second crests 48 adjacent the faces 40 and 41. A first weft yarn 24 is disposed inwardly of first pile supporting weft yarns 25 in the faces 40 and 41 between the first crests 25. The second float yarn portion 46 is held between the first weft yarns 24 and the first pile supporting weft yarns 25 adjacent the one face 41. The first pile warp yarn 28 extends from the first tufts 44 and into a linear position along the other face 40 at the opposed portions 42 inwardly of the second crests 48 adjacent the other face 40 and defining thereat a first float yarn portion 49. A second weft yarn 26 is disposed inwardly of the second pile supporting weft yarns 27 in between the second crests 48. The first float yarn portion 49 is disposed between the second weft yarns 26 and the second pile supporting weft yarns 27 adjacent the other face 40. The number of both the first and second weft yarns 24 and 26, respectively, is equal to the number of both the first and second pile supporting weft yarns 25 and 27, respectively.

Each pair of adjacent tufts, forming a crest thereof, namely the two adjacent tufts 44, which form and are connected via crest 45, and adjacent two tufts 47 forming crests 48 therebetween, are secured by a single of the pile supporting weft yarns 25 and 27 in the crest 45 or 48, respectively, and held erect therebetween by two successive adjacent weft yarns, inward of each face, with the exception of a last tuft 44a (or a last tuft 47a), formed by a pile warp yarn 28 (or yarn 29) starting to form a float yarn portion 49 (or portion 46), which last tuft 44a (or 47a) is the tuft which extends from a face 41 (or 40) opposite to the face 40 (or 41), in which its float yarn portion 49 (or 48) lies and with the exception of a last pair of adjacent tufts 44 (or 47), forming a crest 45 (or 48) thereof immediately adjacent the last tuft 44a (or 47a). The last tuft 44a (or 47a) and the last pair of adjacent tufts 44 (or 47) as a unit (i.e., three tufts) held erect therebetween by two adjacent or successive weft yarns 24', 24" (or 26', 26"). Accordingly, these last tufts 44a (or 47a), after a separation of the double-faced carpet structure tend to move, due to an adjacent weft yarn 24' (or 26') towards the adjacent tuft 44' (or 47'), formed by the same respective color pile warp yarn 28 (or 24).

The second float yarn position 46 has two end portions, extending integrally into the second tufts 47 of the second pile warp yarn 29. One of the end portions passes inwardly thereat over one of the first weft yarns 24' adjacent face 4, forming a second inwardly pointing crest 50. This end portion from thence running in an outward direction toward the next adjacent first pile supporting weft yarn in the faces 41 about which it forms one of the second crests 48. The other of the end portions, passes outwardly relative to one of the second weft yarns 26", adjacent the face 41 and from there running into one of the second tufts 47" across the double-faced carpet structure to and about one of the second pile supporting weft yarns

27' on the other face 40 forming thereat another of the second crests 48.

Similarly, one of the ends of the first float yarn portion extends into a first inwardly pointing crest 51, which is substantially adjacent and opposite to the second inwardly pointing crest 50, both inwardly pointing crests 50 and 51 pointing substantially toward each other.

Thus, it will be seen that each of the two fabrics comprises an equal number of first and second weft yarns 24 and 26 respectively and first and second pile supporting weft yarns 25 and 27, respectively. According to the invention the float yarn portions 49 of the pile warp yarn 28 are woven into or held in reserve in the upper illustrated fabric, while the float yarn portions 46 of the pile warp yarn 29 are woven into, or held in reserve in the lower fabric. Consequently, they are equally distributed in number and color in the two fabrics. It will also be seen that each of the warp yarns when forming the pile embraces a single pile supporting weft yarn 25 or 27 and is held erect on the backing fabric by two adjacent weft yarns 24 or 26, respectively. This feature is preserved even at the point where there is an interchange between a woven-in float pile warp yarn which is about to form the pile, and the pile warp yarn which is then forming the pile, but which is about to be woven into the fabric. However, there exists one exception in relation to a warp yarn which is to be woven in and forms a tuft, such as tuft 30, or a warp yarn which is woven in and is starting to form tuft 44a, after the passage of the cutter 31. In fact, the tuft 30 can move or lean towards the right in the case of FIG. 5, but it will be observed that it mingles then with a yarn having the same color as the warp yarn 29, and this movement, therefore, is of no importance for the quality of the carpet in respect of the fineness of the design pattern. Similarly the tuft 44a tends to move or lean to the left where it can mingle only with a tuft formed by the same warp yarn as the tuft 44a.

In FIG. 6 the same pile supporting weft yarns, the same face weft yarns and the same binding warp yarns 32, 33 for the upper fabric and 34, 35 for the lower fabric are shown, as well as the reinforcing or stuffer warp yarns 36 and 37. In FIG. 5 the pile warp yarn 28 is woven into the upper fabric; however a corresponding pile warp yarn 28 is woven into the lower fabric in FIG. 6, whereas the warp yarn 29 which was incorporated in the lower fabric in FIG. 5 is woven into the upper fabric in FIG. 6.

The warp yarns forming the pile can appear at different positions according to the requirements of the design pattern. Moreover, the figures are simplified because they illustrate pile warp yarns of two different colors only; in a practical embodiment warp such as a carpet, yarns of five colors will be present. In FIGS. 5 and 6 let it be assumed that warp yarn 28 is blue and that warp yarn 29 is red. In practice, however, pile warp yarns of five different colors: blue, red, black, green and white are generally used. As a single warp yarn "forms" tufts as well as it constitutes the design pattern of the pile fabric, such as a carpet, four float or reserve warp yarns remain always woven in. According to the invention the arrangement is made so that two reserve warp yarns are woven into the upper fabric and two reserve warp yarns are woven into the lower fabric.

When a color is to appear in the carpet, the corresponding warp yarn must be alternately lifted and lowered exactly as in an ordinary fabric. This is a very interesting feature of the invention, because in this manner the work of an operator charged with producing the Jacquard cards is enormously simplified.

The other advantages of this binding structure are that after separation by the cutter 31 two exactly similar fabrics are obtained which have the same quality, do not call for the removal of float yarns and does not involve a reduction of the density of the pile. Moreover, the back-

ings of each fabric are very dense and without any gaps.

Another essential advantage is that the tufts have no tendency to place themselves obliquely with respect to the plane of the backing fabric and to mingle with the tufts produced by warp yarn of another color thereby giving rise to a mingled contour. With one exception only, which however is not disadvantageous as has been explained further above, all tufts of the carpet according to the invention remain erect on the backing fabric.

Finally, apart from the exception, each tuft is constituted by a yarn which is constrained between two weft yarns and which embraces a pile supporting weft yarn whereby it is reliably and efficiently secured.

I claim:

1. A loom produced double-faced connected carpet structure, having two spaced faces defining first opposed portions of the faces and second opposed portions of the faces longitudinally spaced warp-wise, comprising

at least one first pile warp yarn,

at least one second pile warp yarn,

said first pile warp yarn arranged to pass to said first opposed portions of the faces of said carpet in undulating fashion forming first tufts joining said first opposed portions of the faces and forming a plurality of first crests adjacent said faces,

said second pile warp yarn disposed linearly along one of the faces at said first opposed portions and inward of said first crests adjacent said one face defining a second float yarn portion,

one first pile supporting weft yarn in each of said first crests adjacent said faces,

said second pile warp yarn extending from said second float yarn portion to said second opposed portion of said faces of said carpet adjacent said first opposed portions of said faces of said carpet and arranged to pass to said second opposed portions of the faces in undulating fashion forming second tufts joining said second opposed portions of said faces and forming a plurality of second crests adjacent said faces,

one second pile supporting weft yarn within each of said second crests adjacent said faces,

a first weft yarn disposed inwardly of said first pile supporting weft yarns in between said first crests,

said second float yarn portion disposed between said first weft yarns and said first pile supporting weft yarns adjacent said one face,

said first pile warp yarn extending from said first tufts and disposed linearly along the other face of said second opposed portions inward of said second crests adjacent said other face and defining a first float yarn portion,

a second weft yarn disposed inwardly of said second pile supporting weft yarns in between said second crests,

said first float yarn portion disposed between said second weft yarns and said second pile supporting weft yarns adjacent said other of said faces, and

the number of said first and second weft yarns being equal to the number of said first and second pile supporting weft yarns, each pair of adjacent tufts forming a crest thereof being secured by a single of said pile supporting weft yarn in said crest thereof and held erect therebetween by two adjacent of said weft yarns inward of each face, with the exception of a last tuft formed by a pile warp yarn starting to form

a float yarn portion, said last tuft extending from a face opposite to the face in which its float yarn portion lies and a last pair of adjacent tufts forming a crest thereof immediately adjacent said last tuft, said last tuft and said last pair of adjacent tufts as a unit held erect therebetween by two adjacent of said weft yarns, said last tufts, after a separation of said double-faced carpet structure, tending to move due to an adjacent weft yarn, towards the adjacent tuft formed by the same respective pile warp yarn.

2. The carpet structure, as set forth in claim 1, wherein said pile warp yarns have different colors.

3. The carpet structure, as set forth in claim 1, wherein said second float yarn portion has two end portions extending integrally into said second tufts of said second pile warp yarn,

one of said end portions passing inwardly thereat over one of said first weft yarns adjacent said one of said faces forming a second inwardly pointing crest, said one of said end portions from there running in an outward direction toward the adjacent first pile supporting weft yarn in said one of said faces about which it forms one of said second crests, and

the other of said end portions passing outwardly relative to one of said second weft yarns adjacent said one of said faces and from there running into one of said second tufts across said double-faced carpet structure to and about one of said second pile supporting weft yarns on the other of said faces forming thereat another of said second crests.

4. The carpet structure, as set forth in claim 3, wherein said first float yarn portion having two end portions extending integrally into said first tufts of said first pile warp yarn,

one of said end portions of said first float yarn portion passing inwardly thereof over one of said second weft yarns adjacent said other of said faces forming a first inwardly pointing crest, said one of said end portions of said first float yarn portion from there running in an outward direction toward the adjacent second pile supporting weft yarn in said other of said faces about which it forms one of said first crests,

the other of said end portions of said first float yarn portion passing outwardly relative to one of said first weft yarns adjacent said other of said faces and from there running into one of said first tufts across said double-faced carpet structure to and about one of said first pile supporting weft yarns on said one of said faces forming thereat another of said first crests, and

said first and second inwardly pointing crests being substantially adjacent each other on opposite faces of said structure and pointing substantially toward each other.

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