Feb. 12, 1935. H. L. SHUTTLEWORTH 1,990,674

METHOD OF WEAVING PILE FABRICS

Filed Aug. 15, 1933

Fig. 1.

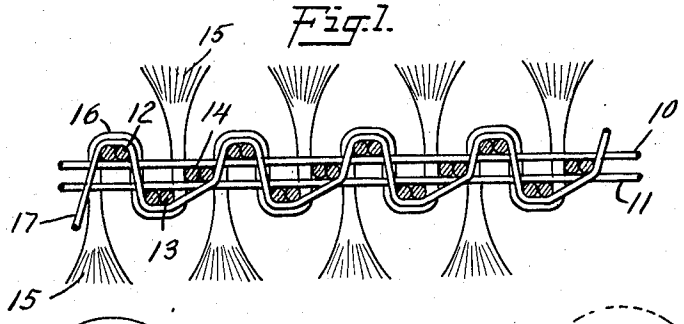


Fig. 2.

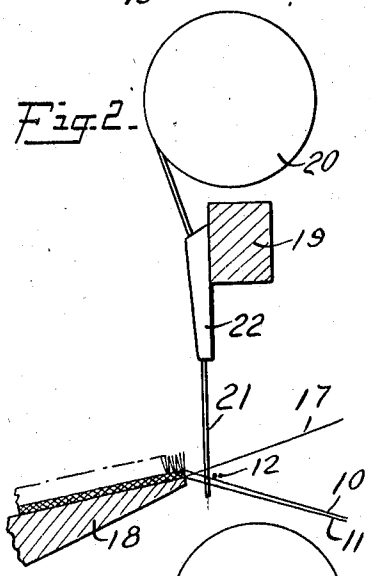


Fig. 4.

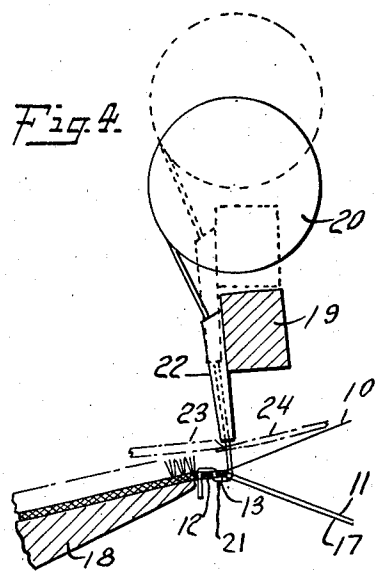


Fig. 3.

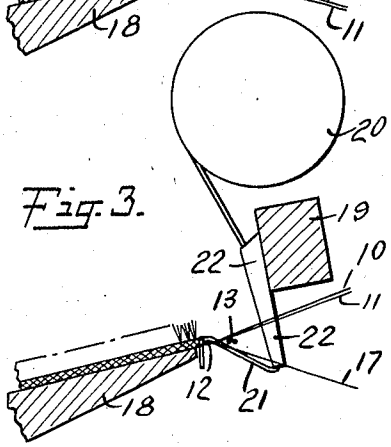


Fig. 5.

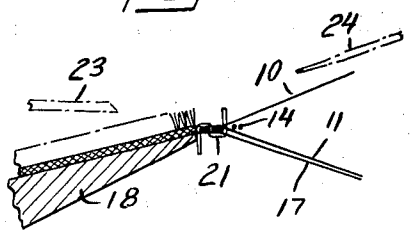
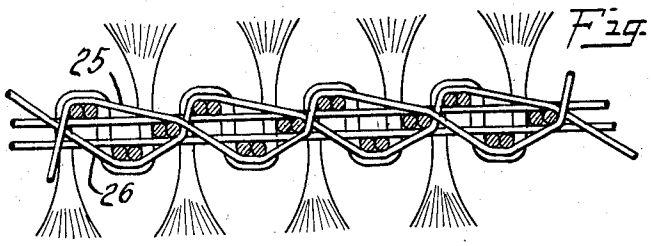


Fig. 6.



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METHOD OF WEAVING PILE FABRICS

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Application August 15, 1933, Serial No. 685,163

2 Claims. (Cl. 139—401)

This invention relates to pile fabrics of the Axminster type as commonly used for rugs and carpets and is concerned more particularly with a novel Axminster fabric having a pile on both faces and, therefore, reversible and adapted for use with either face uppermost. The invention includes both the new fabric, which is superior to reversible Axminster fabrics as heretofore woven in that the tufts are bound more securely in place, and a novel method of weaving this fabric which can be carried on at low cost on ordinary Axminster power looms of the tube frame insertion type, modified in certain particulars.

In the manufacture of Axminster pile fabrics having a single pile surface, it is the usual procedure to coat the back of the fabric with a sizing solution in order to stiffen the fabric and also to assist in binding the pile tufts in the body of the fabric so that they cannot be readily pulled out in normal service. While the pile tuft yarns are ordinarily looped about weft shots in such a way that adjacent weft shots bind the yarns in place to some extent, the yarns are not bound in place merely by adjacent weft shots to an extent such that the fabric has a long life, and durability is imparted to the fabric only by the sizing treatment.

In the manufacture of reversible fabrics in which the pile yarns extend out of the fabric on opposite faces thereof, it is impossible to employ sizing as a binding agent, and the problem of inserting the tuft yarns in such a way that they are held tightly by adjacent weft shots and the binder warps is, therefore, a serious one. In the double faced Axminster fabrics heretofore woven, various methods of inserting the yarns have been employed in an attempt to secure proper binding of the yarns, but the expedients used for the purpose have been only partly successful, and it has not been possible with the weaving methods previously employed to produce reversible fabrics of the desired durability.

The present invention is, accordingly, directed to the provision of a new reversible fabric in which the tuft yarns are inserted in such fashion that the yarns are bound to a degree similar to that heretofore attainable only by the use of sizing, and the new fabric can be produced on a standard loom with certain modifications. The fabric is completed on the loom, and its production does not require subsequent manual or machine operations to give it a pile surface on both faces. It can thus be woven at relatively low cost and at a relatively high output rate.

The new fabric preferably includes three shots of weft per row of tufts, one or more sets of stuffer warps, and one or more sets of binder warps. It is further preferred that the fabric be of the three plane type, with one weft shot per cycle lying above the upper stuffer warps, one shot lying below the lower stuffer warps, and the remaining shot lying between the upper and lower stuffer warps, and with the binder warps passing over each top weft shot and below each bottom weft shot. However, if desired, the fabric may have more or less planes and have more than three shots per cycle. In all forms of the new fabric, each pile tuft is formed of a single length of yarn having its ends projecting out of the fabric at the opposite faces thereof, and each yarn is inserted in the fabric in such manner that it has the form of the letter S, with the top and bottom shots of its cycle each lying in a bight of the yarn and the ends of the yarn extending from each of these weft shots through the fabric and out of the faces thereof. The middle shot of the cycle lies at one side of the yarn and not in a bight thereof. The yarns are thus held securely bound in position, since each yarn passes through the fabric three times from face to face thereof and the middle weft shots of adjacent cycles, when beaten up, distort the S form of the yarns and cooperate with the top and bottom shots to clamp the yarns in place.

In weaving the fabric by the new method, the tuft yarns are inserted wholly by manipulation of the supplies thereof and no combing operations are required. The fabric may thus be woven on a tube frame loom from which the combing mechanism has been omitted and which has been provided with suitable cams to cause the transfer mechanism to give the tube frames the necessary movements, and the fabric can consequently be produced rapidly and wholly automatically.

For a better understanding of the invention, reference may be had to the accompanying drawing in which Figure 1 is a sectional view of one form of the new fabric with the threads spread apart so that the construction can be readily understood. Figures 2, 3, 4, and 5 illustrate successive steps in the manipulation of the tube frame in the production of the new fabric, and Figure 6 is a modified form of the fabric in which two sets of binder warps are employed.

The fabric shown in Figure 1 is of the three shot three plane variety and this form of fabric is preferred since it has a relatively full body. The fabric is made up of sets of binder warps 10 and 11 lying in upper and lower levels respectively, and

weft shots 12, 13, and 14, these weft shots being inserted in the fabric in cycles of three with the top shots 12 of the cycles lying above the upper stuffer warps 10, the bottom shots 13 lying below the lower stuffer warps 11, and the middle shots 14 lying between upper and lower stuffer warps, respectively. Ordinarily, in the weaving of the fabric, the top shot of a cycle will be introduced first, followed by the bottom and middle shots in that order, although it is to be understood that the order of insertion may be varied as, for example, the middle shot may be first introduced, followed by the top and bottom shots in that order.

The pile tufts 15 are formed by single lengths of yarn 16 which are introduced into the fabric in such manner that each length of yarn passes over the top weft shot of a cycle and beneath the bottom weft shot of that cycle. The top weft shot of each cycle thus lies in a bight of pile yarns opening in one direction and the bottom shot lies in a bight of pile yarns opening in the opposite direction. The middle shot of the cycle is outside the bights of pile yarns.

In the weave illustrated in Figure 1, a single set of binder warps 17 is employed and each binder warp passes over the top of the top shot 12 of each cycle, then beneath the bottom of that cycle, and thence to and over the top shot of the next succeeding cycle. The binder warps pass at one side of the middle shot of each cycle and when the fabric is viewed in the position illustrated in Figure 1, the middle shots lie above the binder warps, although it is to be understood that since the fabric is reversible, the middle shots might be considered as lying below the binder warps.

The weaving of the new fabric can most conveniently be carried on in the loom of the tube frame type which has been modified by the omission of the combing mechanism and by the provision of suitable cams for producing movements of the transfer mechanism presently to be described. For purposes of explanation, the weaving of the fabric shown in Figure 1 by means of such a modified tube frame loom is illustrated diagrammatically in Figures 2 to 4, inclusive. This loom is provided with the usual breastplate 18 to support the fabric adjacent the fell of the goods, and it includes tube frames of the usual construction, one of which is shown. This frame comprises a bar 19 supporting the pile yarn supplies on spools 20 with the ends 21 of the yarns passing through the tubes 22 supported by the bar 19.

In the weaving operation, the tube frame is dipped through the warp threads 10, 11, and 17 so that the free ends of the lengths of yarn projecting from the tubes lie below the warp threads. The tube frame then assumes the position illustrated in Figure 2 and a shot 12 of weft is then inserted in a shed in which the binder warps 17 lie above and the stuffer warps 10 and 11 lie below the shot. The insertion of the shot is effected by means of the usual needle. After insertion of this shot, it is beaten up by the lay in the ordinary manner and the warps are then brought to a level position and the tube frame lowered as illustrated in Figure 3 so that the tubes 22 pass between the warp threads. This movement of the tube frame carries the projecting portions of the yarns downward so that a bight is formed in the yarns between the supplies and the inserted weft shot 12. The warps are then manipulated to produce a shed in which the stuffer warps 10 and 11 are up and the binder warps 17 are down. The weft shot 13 is then inserted by means of the needle and the tube frame raised out of the warp threads so that the projecting lengths 21 of the tuft yarns are carried around the shot 13. This shot is then beaten up and the inserted lengths of yarn are then severed from the supplies by means of the usual cooperating knives 23, 24. The shed is now changed so as to bring the stuffer warps 10 up and the stuffer warps 11 and the binder warps 17 down. In this shed the shot 14 is inserted by the needle. The insertion of this shot occurs during the severing operation, and after the inserted lengths of yarn are severed from the supplies, the tube frame is restored to the transporting chains by the transfer mechanism. The chains are advanced by one step, and the next tube frame is removed from the chains by the transfer mechanism and lowered to the fabric. During these operations, the shot 14 has been beaten up and the warps brought into a level position so that the tube frame can be lowered to pass the projecting ends of yarn between the warp threads. The cycle of operation thus described is repeated indefinitely throughout the weaving operation.

The fabric illustrated in Figure 6 is similar to that shown in Figure 1 except that there are two sets of binder warps 25 and 26. The weaving of this fabric will be evident from the illustration of the fabric itself.

It will be seen that in the new fabric, each pile tuft is looped about two shots, one of which lies above the upper stuffer warps and the other below the lower stuffer warps. The shot or the shots of the cycle which lie between the upper and lower stuffer warps are outside any bight of the pile yarns and the consequence is that in the beaten up fabric in the form shown, for example in Figure 1, the shots 14 force the pile yarns in so as to lie partly under the shot 12 and partly over the shot 13. Each yarn is thus firmly bound in position and removal of a yarn from the fabric can be effected only with the utmost difficulty. Each yarn passes through the fabric three times and the portions of the yarn lying within the fabric are firmly held by the middle weft shots on either side thereof. If the middle weft shot lay in a bight of the pile yarns, this gripping action would not be obtained and, therefore, in all forms of the fabric, the pile yarns are looped about weft shots lying on opposite sides of the stuffer warps and there is at least one shot per cycle which is outside a bight of the pile yarns.

The new fabric is far superior to the reversible Axminister fabrics heretofore made, with which I am familiar, because the tuft yarns are so bound in place that they cannot be pulled out of the fabric in normal wear. Thus the life of the fabric is increased and its appearance during use is improved.

I claim:

1. A method of weaving a reversible pile fabric containing stuffer warps, weft shots inserted in cycles of at least three with part of the shots above and part below the stuffer warps, pile yarns looped about weft shots and having their ends projecting out of the fabric, and binder warps all shots above the stuffer warps and all shots below the stuffer warps being bound by said binder warps, which comprises inserting a weft shot in a shed formed by the binder warps, and stuffer warps, moving supplies of tuft yarns to cause the ends of the yarns on said supplies to pass between the warp threads, inserting another weft shot in a shed formed by the binder warps and stuffer warps and beating up said shot against the inserted yarn ends, moving said

supplies to cause the yarns to pass between the warps a second time with said yarns forming a bight between the supplies and the last inserted weft shot, inserting a weft shot in a shed formed by the binder warps and stuffer warps and in said bight, retracting said supplies, severing the inserted lengths of yarn from said supplies, and repeating the operations in the order set forth.

2. A method of weaving reversible pile fabrics containing stuffer warps in two sets, weft shots, pile yarns looped about weft shots, and binder warps crossing over weft shots lying above the stuffer warps and under weft shots lying below the stuffer warps which comprises inserting a shot of weft to lie between said sets of stuffer warps and above said binder warps, moving supplies of tuft yarns to cause the ends of the yarns on said supplies to pass between the warp threads, inserting a weft shot to lie above both sets of stuffer warps and beneath said binder warps and beating up said shot against the inserted yarn ends, moving said supplies to cause the yarns to pass between the warps a second time with said yarns forming a bight between the last inserted weft shot and the supplies, inserting a weft shot in said bight and below said stuffer warps and above said binder warps, beating up said shot, retracting said supplies to draw said yarns taut about said last inserted shot, severing the inserted lengths of yarns from said supplies, and repeating the operations in the order set forth.

HOWARD L. SHUTTLEWORTH.