Feb. 12, 1935. H. L. SHUTTLEWORTH 1,991,179

PILE FABRIC AND METHOD OF WEAVING THE SAME

Filed Oct. 18, 1933

Fig. 1.

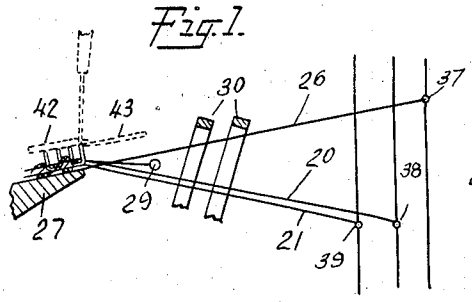


Fig. 3.

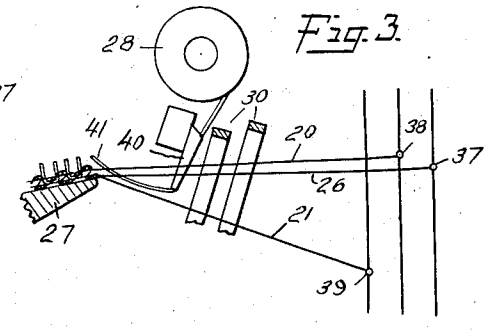


Fig. 2.

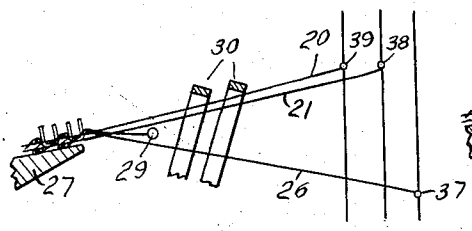


Fig. 4.

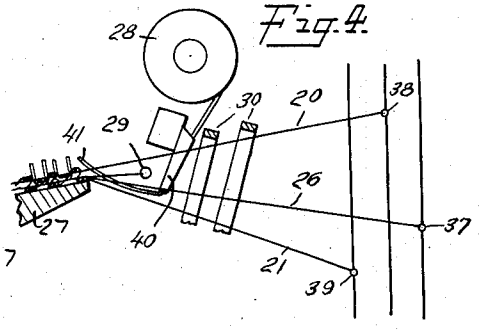


Fig. 6.

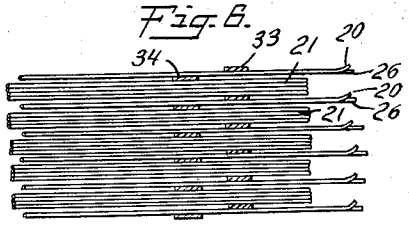


Fig. 5.

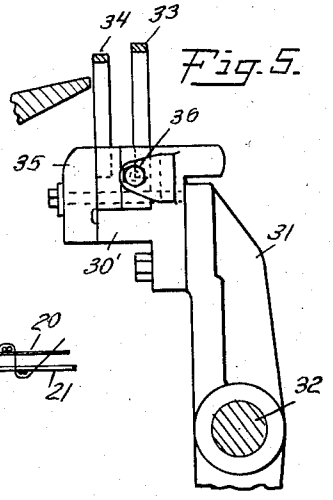


Fig. 7.

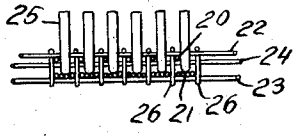
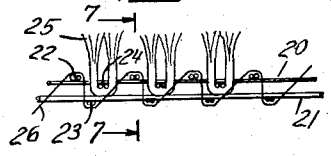


Fig. 8.



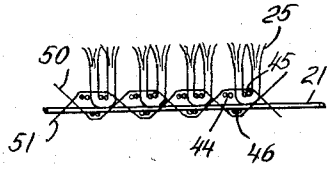


Fig. 9.

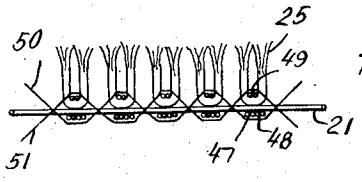


Fig. 10.

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PILE FABRIC AND METHOD OF WEAVING THE SAME

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Application October 18, 1933, Serial No. 694,070

5 Claims. (Cl. 139—401)

This invention relates to tuft pile fabrics of the Axminster type and is concerned with a novel fabric and a new method by which that fabric may be advantageously produced. The new fabric differs from and is superior to ordinary Axminster fabrics as heretofore made in that the web or body is heavier and fuller, this effect being obtained by the use of straight warps employed in such number and so interwoven in the fabric that they completely fill the longitudinal spaces between the binder warps and provide a warp plane which is substantially continuous across the fabric and against which the bottom of the pile loops is seated. Because of the use of this greater number of straight warps than it has previously been possible to employ in an Axminster fabric, the new material has a firmer and more solid back and the pile loops are bound more securely in place. By the new method, this fabric can be produced on looms which resemble ordinary Axminster looms, except for certain modifications, and operate at the high efficiency of such looms.

The Axminster fabrics to which the invention relates are those in which the pile is made of yarn drawn from separate supplies during the operation of the loom, these yarns being inserted in the fabric and looped about weft shots, and the term "Axminster" is used throughout this description to designate fabrics having a pile produced in this manner. Since in the weaving of such fabrics, each pile tuft is made of yarn drawn from a separate supply, and the yarns are arranged on the supplies in proper order according to the pattern to be produced, the fabrics may have a pattern on the pile which is sharp and clean-cut, and every tuft in the fabric may be of a different color from all the others, so that extremely elaborate patterns may be employed. In Wilton materials, the number of colors is limited to a relatively small number and the height of the pile is restricted by the practical limitations on the height of the wire that can be used in making the pile loops. Also, since the tuft yarns are employed only for the tufts, there are no portions of the tuft yarns which extend through the fabric and represent a waste of tuft yarns, as in the case of Wilton materials. The elimination of the dead yarn which is present in all fabrics of the Wilton type keeps down the cost of the tuft pile fabrics to a substantial extent and the method of insertion of the yarns makes it possible to obtain pattern effects in the pile and at the same time have pile of varying heights. In fabrics of the tapestry type, there is no dead pile yarn, but the pile yarns are warp threads, and in order to make such fabrics with a pattern on the pile, the pile is printed before it enters the loom and the areas of different color on the pile threads must correspond exactly in length to the lengths of the tufts or the height of the pile. As the yarn is printed on a drum and the circumference of the drum is the length of a single strand of pile yarn required in the length of the rug, for example, it will be apparent that variations in the height of the pile of a tapestry fabric require the use of drums of different diameters and because of this, there is a practical limit to the height of the pile that such a fabric can have.

Axminster fabrics can be produced more cheaply than Wilton and tapestry materials because Axminster looms in which the filling is inserted by a needle operate more efficiently than Wilton and tapestry looms and require little attention.

For the reasons set forth, tuft pile fabrics of the Axminster type offer substantial advantages over both Wilton and tapestry fabrics but as woven by the methods heretofore used, Axminster fabrics have been inferior to Wilton and tapestry materials because it has not been possible to weave them with the full heavy back which can be obtained in Wilton and tapestry goods. The reason for this is that because of the manner in which the pile yarns are inserted in Axminster fabrics, it has not been possible heretofore to employ a sufficient number of straight warps so that the spaces between adjacent binder warps are completely filled and there is a warp plane below the tuft loops which is substantially continuous across the fabric.

The looms used for the weaving of Axminster fabrics are in general of the tube frame type and in such a loom, the yarns for the tufts are wound on spools carried on tube frames which are mounted in transporting chains and arranged on the chains in an order determined by the pattern. During the operation of the loom, the chains are advanced with a step by step movement and in each period of rest a tube frame is removed from the chains by a transfer mechanism and presented to the fabric. There is a tube on each frame for each end of tuft yarn and in order to insert the tuft yarns in the fabric, the frames are dipped so that the tubes pass between the warp threads directly in front of the reed and the yarn ends projecting out of the tubes then extend down below all the warp threads. After the tube frame has been lowered to pass the yarn ends between the warp threads, it is raised slightly so that the tubes are clear of the warp threads, while the projecting yarns lie with their lower ends below

the warp threads. The warp threads are then manipulated by the heddles to produce a shed and a weft shot is inserted and beaten up against the yarns. The tube frame is then raised by the transfer mechanism so that the required lengths of yarns are drawn from the spools and the projecting ends of yarns lying below the warp threads are looped about the holding weft shot by means of a comb, the teeth of which pass upward between the warp threads. The inserted lengths of yarn are next severed from the supplies by suitable knives and, while this action is taking place, the succeeding weft shot is being inserted between the warp threads. The tube frame is restored to the chains, and the latter advanced to bring another frame in position to be removed from the chains by the transfer mechanism and presented to the fabric.

In such a loom, the space between the ends of adjacent tubes on the frame is of small width and the space between adjacent teeth on the comb is also small. During the yarn inserting operation, the ends of the tubes must pass between adjacent warp threads and a number of warp threads must enter each space between adjacent tubes as the latter dip into the fabric. Similarly, in the combing operation, the teeth of the comb pass between adjacent warp threads to loop the pile yarns about the holding weft shot and a number of warp threads must enter each space in the comb. The spaces between the tubes and between the teeth of the comb are so small that they cannot receive more than four warps made of relatively small size threads and, accordingly, one customary Axminster weave includes one set of binder warps and one or two sets of stuffer or straight warps with a straight warp of each set lying between adjacent binder warps. In some fabrics two sets of binders are employed and they cross the weft shots in pairs made up of one warp of each set. In that case, there is a straight warp of each set lying between adjacent pairs of binder warps.

In all the Axminster fabrics thus produced, the pile tufts lie between the warp threads in adjacent reed splits and there are not to exceed two straight warps beneath each pile tuft so that the spaces beneath the tufts are not completely filled with straight warps. Such fabrics have a soft flimsy back and the tufts are not firmly bound at the bottom of each tuft loop, with the result that it is necessary to size the back of the fabric in order to give it the required stiffness, the sizing also assisting in binding the tufts in the body. The use of sizing adds to the cost of production and it is not a satisfactory substitute for a heavy stiff body.

The present invention is directed to the provision of a new Axminster fabric and a novel method of weaving such a fabric, the new fabric containing sufficient warps in the plane below the bottom of the pile tufts to fill the spaces between adjacent binder warps completely and make the back heavy and stiff. In this new fabric, the straight warps may be of larger size as well as greater in number than those previously used, and the new fabric thus has the type of body characteristic of Wilton materials but may be produced with the sharp pile designs and the economy in manufacture heretofore attained only in the weaving of Axminster fabrics. The new method may be carried on in a standard tube frame loom modified in certain respects, these modifications involving simplification of the loom by the elimination of the combing mechanism, the use of a different type of reed, and various changes in the heddle mechanism.

For a better understanding of the invention, reference may be had to the accompanying drawing, in which

Figures 1, 2, 3 and 4 are views in side elevation and partly in section, diagrammatically illustrating successive steps in the carrying out of the new method;

Figure 5 is a view in side elevation showing a form of reed which may be employed in a loom for weaving according to the new method;

Figure 6 is a plan view showing the warp threads passing through the reed;

Figure 7 is a transverse section of one form of the new fabric on the line 7—7 of Figure 8; and

Figures 8, 9, and 10 are longitudinal sectional views showing various forms of the new fabric.

In the drawing, there are illustrated various parts of a loom in which the new method can be practiced and Figures 1 to 4, inclusive, show different steps in the operation of weaving the three-shot three-plane Axminster fabric of the new variety which is illustrated in Figure 7. This fabric consists of straight warps 20 and 21 lying in upper and lower planes, respectively, and weft shots 22, 23 and 24 which lie above straight warps 20, below straight warps 21, and between straight warps 20 and 21, respectively. The weft shots are preferably inserted in the order named and constitute a cycle repeated throughout the fabric. The pile tuft yarns 25 are looped about each weft shot 24 of each cycle and the weft shots 22 and 23 are held in place by binder warps 26. This fabric, instead of having one straight warp 21 in the lower plane for each binder warp thread, as has heretofore been customary in Axminster fabrics of the same type of weave, is woven with a plurality of such warps 21 and the fabric is illustrated in Figure 7 as including a group of four warps 21 for each binder warp 26. The warps 21 in each group completely fill the spaces between adjacent binder warps 26 and thus form a substantially continuous warp plane from one side of the fabric to the other, with the bottoms of the tuft loops resting upon the warps in this plane. The use of the increased number of warps 21 adds to the firmness and stiffness of the bottom of the fabric and these qualities may be enhanced by the use of heavy warp threads, such as jute, in the lower warp plane.

The weaving of the fabric described may be carried on in a loom which includes the usual breast plate 27, tube frames 28, needle 29, and a reed 30, the reed being preferably constructed as shown in Figure 5. This reed comprises a dent holder 30′ mounted on arms 31 fast on a shaft 32 journaled in suitable bearings and rocked so as to cause the reed to beat up weft shots in the usual way at the proper instants in the operation of the loom. Mounted on the reed holder are two rows of dents 33 and 34, respectively, these rows of dents being secured in place by a plate 35 and the dents 33 of the back row being adjustable relative to the dent holder 30′ and to the dents 34 of the front row by means of adjusting screws 36.

In carrying on the new method of weaving, the first shot of weft 22 in the cycle, as shown in Figure 1, is inserted by the needle 29 in a shed in which the binder warps 26 are raised by their heddle 37 and the straight warps 20 and 21 are lowered by their heddles 38 and 39, respectively.

After the needle has inserted the shot which consists of a double strand of filling material, it is retracted and the reed is moved forward so that the shot is beaten up in the usual way by the dents 34 in the front row of the reed. A new shed is then formed in which the binder warps 26 are down and the straight warps 20 and 21 up and in this shed, the weft shot 23 is inserted. Prior to the beating up of the shots by the reed, the heddles operate in the usual way to level off the warp threads and bring them substantially in the same plane.

After the weft shot 23 has been inserted, a row of tuft yarns is introduced into the fabric by the dipping of a tube frame into the warp threads. Before this occurs, however, the heddle 39 is lowered to move the straight warps 21 down below their ordinary shedding position, and when the warps 21, which are greater in number than the warps 20, have been thus lowered, the tube frame 28, which has been removed from the chains and presented to the fabric, is moved down by the transfer mechanism, so that the tubes 40 pass between the warp threads 20 and 26 only. The movement of the tube frame for this purpose is downward away from the breastplate and toward the reed so that free ends of the tuft yarns 41 projecting out of the ends of the tubes lie near the fell of the fabric and above all the warp threads, while the ends of the tubes lie below the warp threads 20 and 26 and above the warp threads 21. The portions of the tuft yarns exposed beyond the ends of the tubes may then rest upon the warp threads 21 and be supported thereby, and while the tube frame and tuft yarns are in this position, the warp threads 26 are lowered to ordinary shedding position, as shown in Figure 4, while warp threads 20 are raised. The needle 29 now advances to insert the shot 24, and after the needle is retracted, the tube frame rises slightly to clear the warp threads 20 and 26. All the warp threads are then moved toward level position and the reed advances to beat up the shot. This shot, when beaten up, holds the tuft yarns between it and the preceding shot, and while the reed is moving back, the tube frame is raised by the transfer mechanism and the required amount of yarn for the tufts is drawn from the supplies, the inserted lengths of yarn being looped tightly about the holding shot in this operation. A new shed is now made in which warps 26 are raised and warps 20 and 21 lowered to ordinary shedding position and the shot 22 is inserted in this shed. During these operations, the tuft yarns are severed from the supplies by means of the usual cooperating knives 42 and 43, the tube frame is restored to the chains and another frame picked up by the transfer mechanism. The cycle of operations described is then repeated indefinitely throughout the operation of the loom.

It will be noted that, according to the new method, the warps 21 are so manipulated that prior to the actual dipping of the tuft yarns between the warp threads, the warps 21 have been moved out of the way and do not have to enter the spaces between the tubes. As a consequence, there may be many more of the warps 21 than it has heretofore been possible to employ and likewise these warps may be of heavier thread. It is desirable that the number and size of the warps 21 should be such as to fill completely the spaces between adjacent binder warps in the finished fabric and in practice, I find that each space referred to can be filled by four warps 21 of thread of a size which is convenient to handle.

It will also be noted that in a loom for practicing the new method, the tuft yarns are dipped into the fabric by a movement down and away from the breastplate toward the reed so that the holding weft shot is inserted in bights of the yarn. If the yarns were not dipped into the fabric in this manner, it would be necessary to employ a comb in order to complete the looping and the limited amount of space between adjacent teeth of the comb would prevent the use of the large number of warps 21. By inserting the pile yarns in the manner described, the comb can be omitted and there is thus no restriction from this source on the number and size of the warps 21 that may be used. Accordingly, in the new method of weaving, the limitations on the number and size of the warp threads in the plane below the bottoms of the tuft loops which are ordinarily imposed by the size of the spaces between the tubes of the tube frame and between the teeth of the comb have been overcome, in one instance, by so manipulating the warps in this plane that the tubes do not pass between them and, in the other, by so inserting the tuft yarns that no comb is required for the completion of the loops.

In the practice of the new method, I have found it desirable to insure that the warps 20 and 26 may be properly spaced transversely of the fabric so that the tube frames may pass freely between these warps and it is particularly desirable to maintain this spacing when the warps 21 are of heavy, rough material, such as jute. The reed illustrated in Figure 6 may be used for the specified purpose and the warps pass through the reed in such manner that each warp 20 and 26 passes to one side of a dent 33 in one row and to the opposite side of the corresponding dent 34 in the other row. The two dents thus hold these warps securely and prevent their being displaced during the weaving operation.

In Figures 9 and 10, there are disclosed two other forms of fabric embodying the principles of my invention, both fabrics being of the two-plane three-shot variety with two sets of binder warps. In the fabric shown in Figure 9, the weft shots 44 and 45 of each cycle lie above the straight warps 21 and the weft shot 46 lies below, the pile tufts 25 being looped about the shot 45. In the fabric shown in Figure 10, there are two shots 47 and 48 per cycle lying below the straight warps 21 and one shot 49 above, the pile tufts 25 being looped about the shot 49. In both these fabrics, there are two sets of binder warps 50 and 51 and in such fabrics, the straight warps may correspond in number and size to the straight warps 21 in the fabric shown in Figure 7, since during the insertion of the pile yarns, the shed for holding weft shot is formed between the binder warps 50 and 51. In the fabric shown in Figure 7, in which a single set of binder warps issued, two sets of stuffer warps are required, and since the warps 20 lying in the upper level form part of the shed for the holding weft shot and have to be received in the spaces between the tubes and between the teeth of the comb, these warps are of relatively soft small-sized thread. When two sets of binder warps are employed as shown in Figures 9 and 10, these small-sized straight warps are not required, although they may be used if desired.

While I have disclosed three different fabrics embodying the principles of my invention and woven in accordance with the new method, it will

be apparent that various other weaves may also be used.

The new fabric of the invention differs from ordinary Axminster fabrics in that there is a substantially continuous plane of straight warps below the bottoms of the pile tufts, and these warp threads close the bottom of the spaces in which the pile tufts lie and support and bind the pile tufts in position, and give the fabric a greater fullness and stiffness in the body than has heretofore been attainable in Axminster goods. While the new fabric has a body resembling that of Wilton material, it differs from Wilton fabrics in that the pile tufts are formed of yarn drawn from separate supplies and there is no dead pile yarn representing a waste in the fabric. The new fabric also differs from both Wilton and tapestry materials in that the weft shots are double strands and the fabric may have sharp clean-cut patterns on the pile which cannot be obtained in tapestry goods. The new fabric is also much cheaper to weave than both Wilton and tapestry materials because it can be produced on a loom of the Axminster type which is superior in efficiency to either a Wilton or tapestry loom.

The new method of weaving differs from the ordinary method carried on in a loom of the tube frame type in that the tube frames are dipped between only a part of the warp threads and the looping of the tuft yarns is effected without the use of a comb. This method of weaving thus makes it possible to produce Axminster fabrics having a much larger number of straight warps than it has heretofore been possible to employ and as the new method can be carried on in a loom of the Axminster type, it affords a cheap and efficient way of producing a fabric superior to Axminster fabrics woven by prior methods.

While I have disclosed my novel method of weaving in connection with a loom of the tube frame insertion type, it is to be understood that the method can be practiced on a loom of the gripper type and it can be used to produce Axminster fabrics on such a loom which it has been impossible heretofore to weave on that loom. In a gripper loom, the necessity of passing the grippers between the warp threads to insert the severed lengths of tuft yarns places a limitation on the number of straight warp threads which can be used since, if there are too great a number of straight warp threads, the grippers cannot be passed between them. With my method, the large number of warp threads, which are desirable in the plane below the pile tufts, can be employed since in practice of the new method, these straight warp threads are lowered beyond ordinary lower shedding position during the insertion of the tufts and the grippers, therefore, do not have to pass between them. Gripper looms ordinarily include a slotted breastplate but that feature cannot be used in a gripper loom producing my new fabrics because of the impossibility of passing the large number of straight warps which I use through the slots of the breastplate.

What I claim is:

1. A method of weaving an Axminster fabric consisting of binder and stuffer warps in sets, one set of warps being made up of relatively heavy stiff threads and containing more threads than the other sets of warps, pile tuft yarns, and weft shots, a plurality of said shots constituting a weaving cycle, which comprises lowering said set of heavy warps beyond ordinary lower shedding position, inserting tuft yarns through the other sets of warps only by moving supplies of said yarns downward and away from the fell of the fabric, said movement of the supplies forming bights of yarn extending through said other sets of warps only with the free ends of the yarns lying adjacent the fell of the fabric, forming a shed of said other sets of warps while maintaining said heavy warps beyond ordinary lower shedding position, inserting a weft shot in said shed, said shot passing through said bights, moving all said warps toward level position, beating up said shot, raising said supplies to loop the inserted yarns about said shot, severing the inserted lengths of yarn from said supplies, forming sheds of all the warps in the ordinary way for the succeeding shots of the cycle, and inserting and beating up said succeeding shots.

2. A method of weaving an Axminster fabric consisting of a set of binder warps and two sets of stuffer warps, one set of stuffer warps containing more threads than the other and said threads being relatively stiff and heavy, pile tuft yarns, and weft shots, a plurality of said shots constituting a cycle, which comprises lowering said set of heavy warps beyond ordinary lower shedding position, inserting tuft yarns through the other sets of warps only by moving supplies of said yarns downward and away from the fell of the fabric, said movement of the supplies forming bights of yarn extending through said other sets of warps only with the free ends of the yarns lying adjacent the fell of the fabric, forming a shed of said other sets of warps while maintaining said heavy warps beyond ordinary lower shedding position, inserting a weft shot in said shed, said shot passing through said bights, moving all said warps toward level position, beating up said shot, raising said supplies to loop the inserted yarns about said shot, severing the inserted lengths of yarn from said supplies, forming sheds of all the warps in the ordinary way for the succeeding shots of the cycle, and inserting and beating up said succeeding shots.

3. A method of weaving an Axminster fabric consisting of a set of relatively stiff and heavy stuffer warps, two sets of binder warps, said set of stiff warps containing more threads than either of said sets of binder warps, weft shots inserted in cycles, a plurality of shots per cycle, and tuft yarns, which comprises lowering said heavy stuffer warps beyond ordinary lower shedding position, inserting tuft yarns through the sets of binder warps only by moving supplies of said yarns downward and away from the fell of the fabric, said movement of the supplies forming bights of yarn extending through said sets of binder warps only with the free ends of the yarns lying adjacent the fell of the fabric, forming a shed of said sets of binder warps while maintaining said heavy warps beyond ordinary lower shedding position, inserting a weft shot in said shed to pass through said bights, moving all said warps toward level position, beating up said shot, raising said supplies to loop the inserted yarns about said shot, severing the inserted lengths of yarn from said supplies, forming sheds of all the warps in the ordinary way for the succeeding shots of the cycle, and inserting and beating up said succeeding shots.

4. In a method of weaving an Axminster fabric consisting of binder and stuffer warps in sets, one set of said warps being made up of relatively heavy stiff threads and containing more threads than the other sets of warps, pile tuft yarns, and weft shots, a plurality of said shots constituting

a weaving cycle, the steps of lowering said set of heavy warps beyond ordinary lower shedding position, inserting portions of tuft yarn through the other sets of warps only with said portions forming bights extending through said other sets of warps only and with the free ends of said portions lying above all said warps and adjacent the fell of the fabric, forming a shed of said other sets of warps while said heavy warps remain beyond ordinary lower shedding position, inserting a weft shot in said shed and through said bights, moving all said warps toward level position, beating up said shot, and drawing said portions of yarn tightly about said shot.

5. A tuft pile Axminster fabric which comprises straight warp threads of large size and of relatively stiff material, such as jute, in a lower plane, straight warp threads of relatively soft small sized thread in an upper plane, weft shots inserted in cycles of three with one shot of each cycle lying above the straight warp threads in the upper plane, another shot per cycle lying below the straight warp threads in the lower plane, and another shot per cycle lying between the straight warp threads in the upper and lower planes, pile yarns looped about a single weft shot only of each cycle which lies between the straight warp threads in the upper and lower plane, and binder warp threads crossing over and binding the weft shots lying above the straight warp threads in the upper plane and crossing under and binding the weft shots lying below the straight warp threads in the lower plane, the number of straight warp threads in the lower level substantially exceeding the number of straight warp threads in the upper level and being abnormal in number for an Axminster fabric, said relatively large warp threads of the lower level filling the space beneath each tuft yarn and forming a substantially continuous warp plane across the fabric.

HOWARD L. SHUTTLEWORTH.