Aug. 6, 1935. H. L. SHUTTLEWORTH 2,010,115

LOOM

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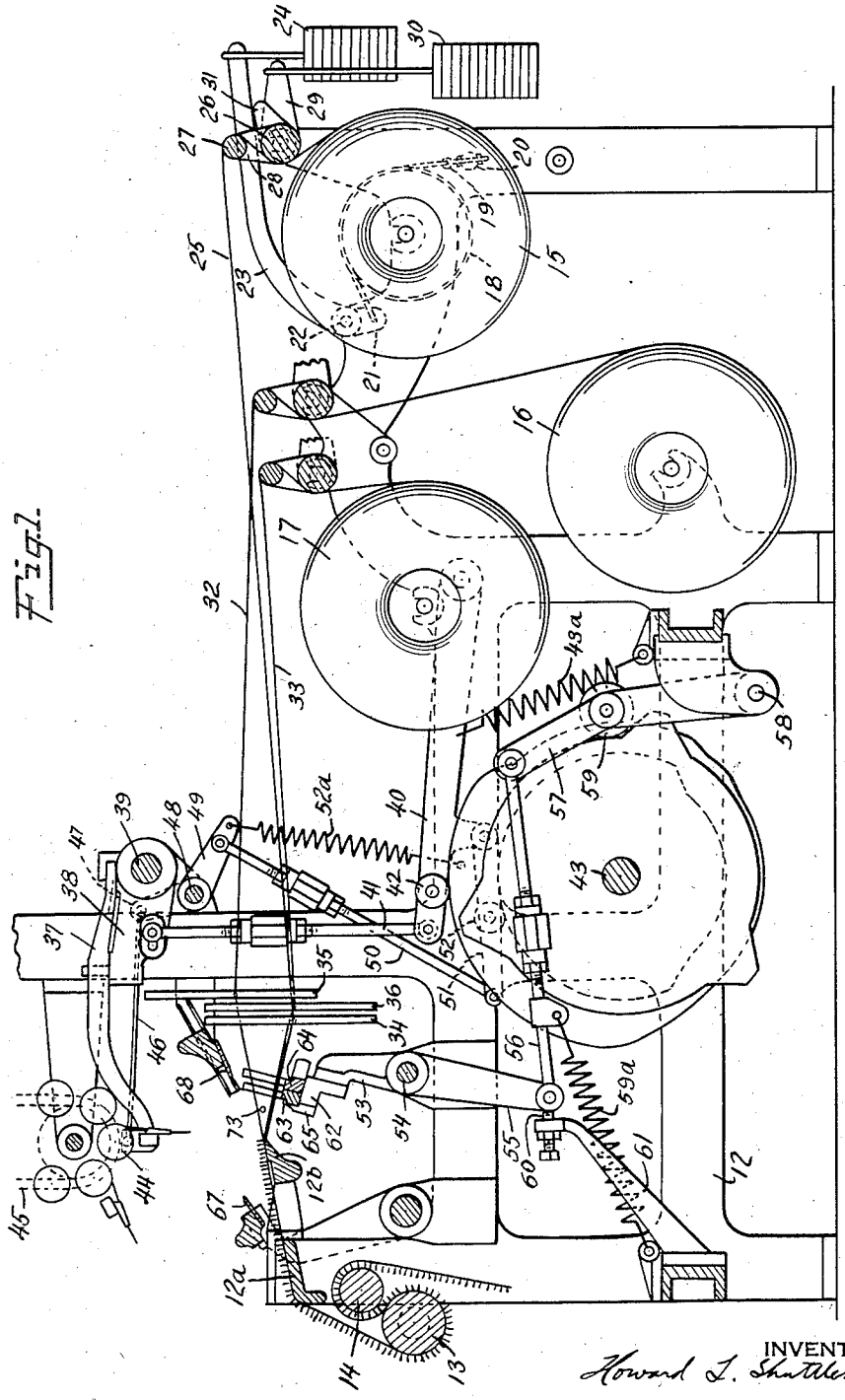


Fig. 1.

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Fig. 2.

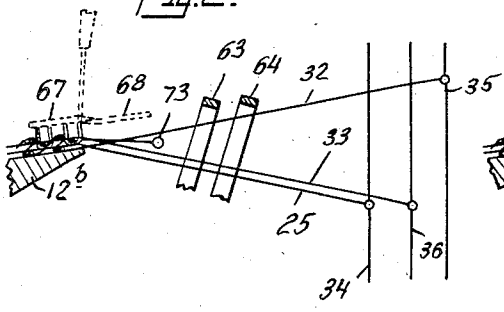


Fig. 4.

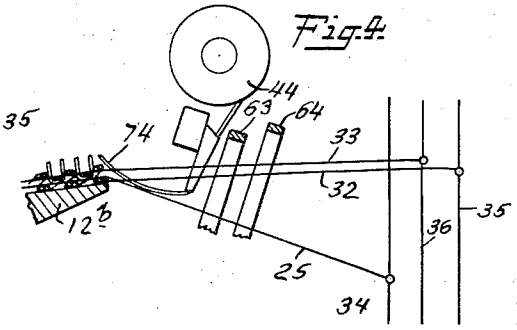


Fig. 3.

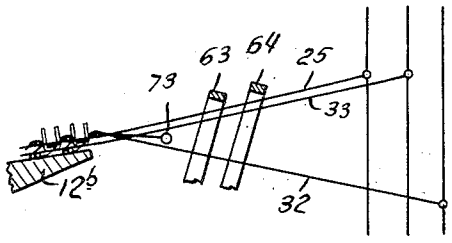


Fig. 5.

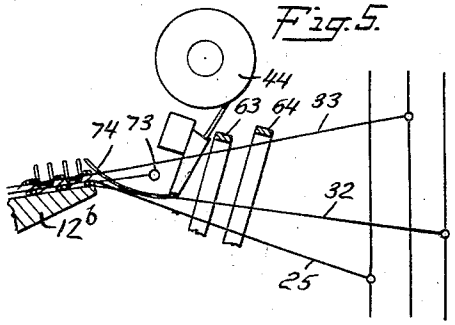


Fig. 7.

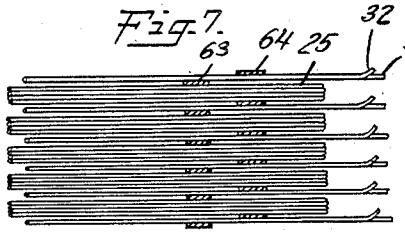


Fig. 6.

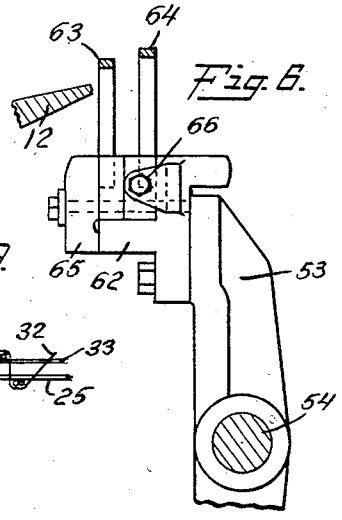


Fig. 8.

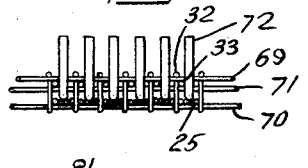
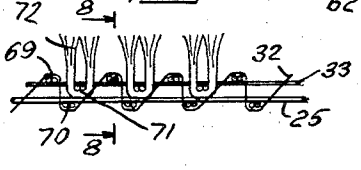


Fig. 9.



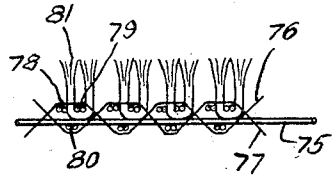
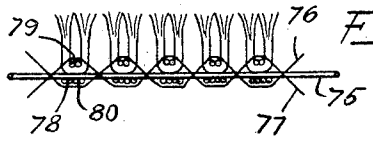


Fig. 10.

Fig. 11.



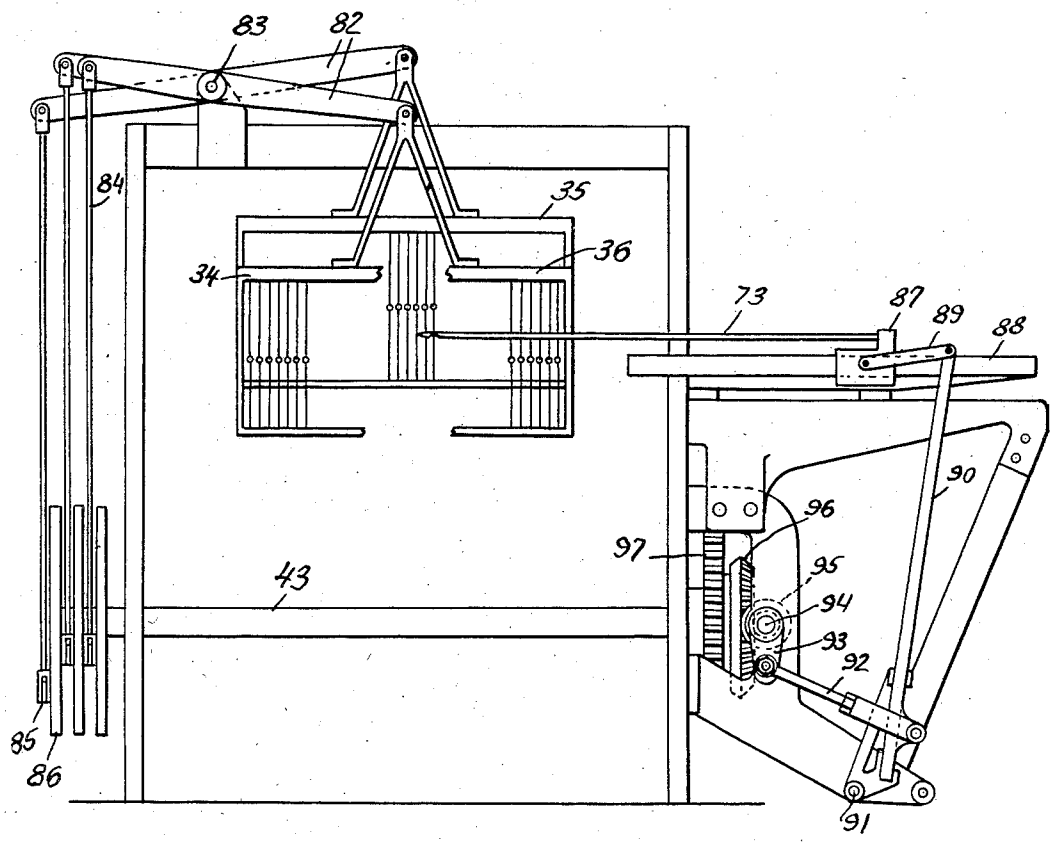
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Fig. 12.



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UNITED STATES PATENT OFFICE

2,010,115

LOOM

Howard L. Shuttleworth, Amsterdam, N. Y., assignor to Mohawk Carpet Mills, Inc., Amsterdam, N. Y., a corporation of New York

Application October 20, 1933, Serial No. 694,361

1 Claim. (Cl. 139—7)

This invention relates to the manufacture of tuft pile fabrics of the Axminster type and is concerned more particularly with a novel loom for making a new tuft pile fabric which is superior to Axminster fabrics as heretofore produced in that it contains a greater number of straight warp threads than have previously been employed in fabrics of this variety, the new material consequently having a firmer and more solid back and having its pile tufts bound more securely in place than prior Axminster fabrics. The new loom for weaving this fabric resembles an ordinary Axminster loom in its general features of construction and offers the advantages of the high efficiency operation characteristic of such looms. It differs from the usual Axminster loom in various respects and these novel features make it possible to weave the new fabric therein.

The looms to which this invention relates are those in which the pile of the fabric is made of yarns which are drawn from separate supplies during the operation of the loom, inserted in the fabric, and looped about weft shots, and the term "Axminster" is used throughout this description to designate fabrics which have a pile produced in this manner. Since in the weaving of such fabrics, each pile tuft is made of yarn drawn from its separate supply, 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 produced. Such fabrics thus have an advantage over Wilton materials in which the number of colors in the pile pattern is limited to a relatively small number.

Another feature of Axminster fabrics which makes them preferable to those of both the Wilton and tapestry varieties is that the pile may have a substantially greater height, whereas in Wilton and tapestry fabrics, the height of the pile that can be produced is restricted by practical limitations on the height of the wire used in the loom for making the pile loops. Also, in Axminster fabrics, the tuft yarns are employed only for the tufts and there are no portions of the yarns which extend through the fabric as dead yarns and, therefore, represent a waste as in Wilton goods.

In fabrics of the tapestry type, there are no dead pile yarns but the pile is made of warp threads, and in order to provide such fabrics with a pattern on the pile, the warp pile yarns are printed before they enter the loom and the areas of different color on the pile threads must correspond exactly in length to the lengths of the tufts. As the printing is done on a drum, the circumference of which 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 on tapestry fabrics require the use of drums of different diameters, and because of the cost of the drums and particularly those of the large diameter required for pile of a substantial height, there is a practical limit to the height of the pile that such a fabric can have and to the amount of variation in the pile height.

Axminster fabrics not only have the numerous features of advantage over Wilton and tapestry goods above mentioned but, in addition, they can be produced more cheaply, since Axminster looms, in which the filling is inserted by a needle, operate more efficiently and with less attention than Wilton and tapestry looms. Because of the lower cost as well as the possibility of producing elaborate patterns with a high pile, Axminster fabrics have thus enjoyed the greatest vogue, but as heretofore made, they are inferior to Wilton and tapestry fabrics with respect to the fullness and stiffness of the back.

In the weaving of Axminster materials, it is customary to employ both straight warp threads and binder warp threads, and the number and stiffness of the straight warp threads used determines the weight of the body of the goods. For the insertion of the tuft yarns, two types of mechanism are used, and most looms in this country are of the tube frame insertion type, in which the pile yarn is supplied to the loom by tube frames, each of which contains a spool on which the supplies of yarns for a row of tufts across the fabric are wound with the ends of the yarns from the supplies passing out through tubes mounted on the frame. In the operation of inserting the tuft yarns in this type of loom as heretofore constructed, the frames are successively removed from their transporting chains and dipped into the warp threads so that the ends of the tubes pass between the warp threads with the exposed lengths of pile yarns lying below the warp threads. As the ends of the tubes pass through the group of warp threads during the dipping, all the warp threads enter the spaces between adjacent tubes on the frame. After the yarns have thus been passed between the warp threads, a weft shot is inserted and beaten up to hold them in place and the tube frames are then raised so as to draw off from each supply the amount of yarn required for one tuft. Thereafter, the yarn

ends which lie below the warp threads are passed upwardly between the warp threads to loop the yarns about the holding weft shot and this is done by a comb which is raised so that the teeth effect the looping of the yarns while the warp threads enter the spaces between the teeth.

The ends of the tubes on the frame lie so close together that the spaces between them can accommodate only a few small threads and this is true also of the spaces between the teeth of the comb. Because of these space limitations, Axminster fabrics as now made usually include only a few straight warp threads and one customary Axminster weave includes a single set of binder warps and one or two sets of straight warps, with a straight warp thread of each set lying between adjacent binder warps. In another Axminster fabric, two sets of binder warps are employed and they cross the weft shots in pairs made up of a warp thread of each set. In that case, there is a straight warp of each set lying between adjacent pairs of binder warps. In all these Axminster fabrics, the pile tufts lie between the warp threads in adjacent reed splits and it has not been possible to employ more than two straight warp threads beneath each pile tuft. The spaces beneath the tufts are thus not completely filled with straight warp threads and the fabrics have a soft flimsy back and the tufts are not firmly bound in place at the bottom of each tuft loop. The result is that it is necessary to use sizing on the back of the fabric to give it the required stiffness and body and to bind the tufts properly in place and this adds substantially to the cost of production without giving as full and stiff a body as could be produced if it were possible to use more and heavier straight warp threads below the tufts.

In my co-pending application, Serial No. 694,070 filed Oct. 18, 1933, now Pat. No. 1,991,179, issued Feb. 12, 1935, I have disclosed a novel Axminster fabric and a method of weaving such a fabric, the new fabric containing sufficient warp threads in the plane below the bottom of the pile tufts to fill these spaces completely and make the back heavy and stiff. In this new fabric, the straight warp threads may be both of larger size and also greater in number than those previously used and the new fabric thus not only has the stiff full body characteristic of Wilton materials but also may be produced with the sharp clean-cut and elaborate pile designs and with the economy in manufacture hitherto attained only in the weaving of Axminster fabrics.

The present invention is directed to the provision of a loom for the weaving of the new material and offers an advantageous mechanism for the practice of the new method.

The new loom may be used for producing all the usual forms of ordinary Axminster fabric as well as of the new fabric, but its construction and mode of operation vary slightly, depending on the type of the fabric being made. Accordingly, for purposes of explanation, one form of the new loom is illustrated and described which is suitable for the production of a fabric of the standard three-shot three-plane variety which includes straight warps in upper and lower levels and a single set of binder warps. In this fabric, the straight warps of the upper level are relatively few in number and preferably of soft cotton thread, while many warp threads are used in the lower level and these warp threads are of heavier material and may be made of jute, for example. The new loom contains separate beams for the binder warp threads, the light straight warp threads, and the heavy straight warp threads and separate heddles for these three sets of warp threads and means by which these heddles may be manipulated for the purpose of carrying on the new method. It also preferably contains a reed of novel construction by means of which the binder warp threads and small straight warp threads are kept in proper relative position during the weaving operation. The loom has no comb and it is so constructed that the looping of the pile yarns is carried on by the means by which the yarns are inserted.

For a better understanding of the loom of the invention, reference may be made to the drawings, in which

Figure 1 shows one form of the new loom in longitudinal section, various parts being shown conventionally and other parts of standard construction being omitted;

Figures 2, 3, 4, and 5 are detail sectional views of certain parts of the loom, showing the manner in which the loom operates;

Figure 6 is an end view partly in section of one form of reed which can be employed advantageously in the new loom;

Figure 7 is a sectional view of the new reed;

Figure 8 is a transverse sectional view on the line 8—8 of Figure 9 of a fabric which can be produced on the loom;

Figures 9, 10, and 11 are longitudinal sectional views of different forms of fabric that can be woven on the loom, and

Figure 12 is a fragmentary transverse section of the loom showing the heddle mechanism and needle motion.

Referring to the drawings, the loom as shown includes side frame members 12, between which extend a breastbeam 12a and a breastplate 12b over which the completed fabric is drawn by take-up rolls 13 and 14. The loom is provided with three warp beams 15, 16, and 17 in suitable mountings on the loom frame and associated with each beam is a suitable let-off mechanism, only one of which is illustrated.

Any suitable let-off mechanism can be used and that shown includes a drum 18 at the end of the beam around which is looped a brakeband 19, one end of which is anchored at 20. The other end of the brakeband is attached to one arm 21 of a bell crank pivotally mounted at 22, the other arm 23 of the bell crank carrying suitable weights 24. The warp threads 25 from the beam are led to one side of a shaft 26, and passed partly around that shaft and around a shaft 27 to their heddle. The shaft 27 is mounted in arms 28 fast on the shaft 26 and this shaft is also provided with an arm 29 carrying weights 30 and another arm 31 which has a projection in position to engage the arm 23 of the bell crank from the under side.

In the operation of the let-off, the weights 24 tend to keep the brakeband tight on its drum and thus prevent rotation of the beam. Similarly, the weights 30 act to swing the arms 28 clockwise so that the shaft 27 takes up slack in the warp threads. When the fabric take-up roll advances, it pulls on the warp threads, and when the tension becomes sufficiently great, the shaft 27 is moved counterclockwise against the weights 30. This movement of the shaft causes the arm 31 to engage the arm 23 of the bell crank from beneath and swing the bell crank counterclockwise. This action releases the brakeband and the beam is free to turn counterclockwise and let off the warp threads. As soon as the beam moves and the

warp threads become slack, the shaft 27 takes up the slack by being swung clockwise by weights 30. The movement of the shaft frees the arm 31 from arm 23 of the bell crank and the weights 24 tighten the brakeband and prevent further rotation of the beam.

The warp threads 25, 32 and 33 from the beam 15, 16, and 17, respectively, pass through the eyes in heddles 34, 35, and 36, respectively, and these heddles are actuated by cam mechanism not shown. The cams for the heddles 35 and 36 are of standard construction but the cam for heddle 34 is so designed as to give that heddle a movement beyond ordinary lower shedding position at one stage in the operation of the loom.

The loom is equipped with a transfer mechanism which includes the usual transfer arms 37 pivoted on supporting arms 38 journaled on a rod 39, the arms 38 being swung about the rod by levers 40 pivoted on the loom frame and connected to arms 38 by rods 41. The levers 40 are provided with rollers 42 held against the surface of a cam on the shaft 43 by means of a spring 43a. The arms 37 are provided at their ends with the usual clutches for removing the tube frames 44 from the transporting chains 45, and the clutches are capable of being swung relative to the arms by rods 46 actuated by arms 47 on a shaft 48 which has an arm 49 fast thereon. The arm 49 is connected by a rod 50 to a lever 51 pivoted on a projection from the lever 40 and carrying a roller 52 held against the surface of a cam on the shaft 43 by a spring 52a.

The loom includes the usual lay 53 journaled on a rod 54 and movable by an arm 55 connected by a rod 56 to one end of a lever 57 pivoted at 58 on the loom frame and provided with a roller 59 held against the surface of a cam on shaft 43 by a spring 59a. The retractile movement of the lay is limited by a stop pin 60 on an arm 61 on the frame which is engaged by the arm 55. The weft shots are inserted by a needle driven by the usual needle motion, not illustrated.

The reed illustrated comprises a dent holder 62 mounted on the lay and carrying two rows of dents 63 and 64 held in place by a plate 65. The dents in the back row 64 are adjustable relative to the dents in the front row by means of adjusting screws 66 and the dents 64 cooperate with the dents 63 to space the warp threads properly, the beating up of the weft shots being done by the dents 63 in the usual way.

Disposed above the warp threads are the usual cooperating knives 67 and 68 for severing the inserted lengths of yarn from the supplies in the usual way.

Figures 2 to 4, inclusive, disclose four successive stages in the weaving of the fabric, shown in Figure 9, which is of the three-shot three-plane variety with a single set of binder warp threads. This fabric includes weft shots 69 lying above the straight warp threads 33 of the upper level, weft shots 70 lying below the straight warp threads 25 in the lower level, and weft shots 71 lying between the straight warp threads of the upper and lower levels, the pile yarns 72 being looped about the weft shots 71. The binder warp threads 32 cross over all the weft shots 69 and under all the weft shots 70 to hold these weft shots in place in the fabric. The straight warp threads 25 and 33 are supplied from beams 15 and 17, respectively, and these warp threads are manipulated by heddles 34 and 36, respectively. The binder warp threads 32 are supplied from beam 16 and they are manipulated by heddle 35. The straight warp threads 25 are many more in number than the straight warp threads 33 and are usually of heavier material, such as jute.

Considering the shot 69 as the first shot in the cycle, this shot is inserted by needle 73 in a shed formed as illustrated in Figure 2, in which the binder warp threads 32 are raised by their heddle 35 and straight warp threads 25 and 33 are lowered to ordinary shedding position by their needles 34 and 36, respectively. After the needle has been retracted, the lay operates to cause the front dents of the reed to beat up the shot in the usual way, and, as shown in Figure 3, the next shot 70 is insered in a shed in which the binder warp threads 32 are down and the straight warp threads 25 and 33 are raised. The shot is then beaten up as usual with the warp threads levelled off by the heddles, as is customary.

After shot 70 is inserted and beaten up, the pile yarns are to be inserted and in order that the tube frames may not have to pass the yarns between all the warp threads with all these threads received in the spaces between the tube ends, the straight warp threads 25 are first lowered by their heddle 34 to the position shown in Figure 4. The warp threads in this position are substantially below their ordinary lower shedding position and the movement of the heddle required for this purpose is effected by the use of a cam of suitable configuration.

While the straight warp threads 25 are being lowered out of the way of the tube frame as described, the tube frame is dipped between the remaining warp threads 32 and 33. As the frame is lowered by the arms toward the warp threads, it is tilted by the rods 46 so that the tubes are inclined downward and to the left, as the frame is viewed in Figure 4, and as the tubes pass between the warp threads, the frame is straightened up so the yarn ends 74 extend out of the tubes to the left and the extreme ends of the yarns lie above the warp threads. By this movement of the tubes downward and away from the fell of the fabric and toward the reed, the inserted yarns form bights and the bottoms of the yarns rest on a warp plane made up of the straight warp threads 25.

The warp threads 32 and 33 are now opened, as shown in Figure 5, to form a shed and the needle 73 is inserted in the shed and through the bights of the pile yarns. After the needle is retracted, the warp threads 32 and 33 are levelled off and the shot is beaten up, the tube frame first having been raised out of the warp threads so that the lower ends of the tubes will not be struck by the reed. This rising movement of the tube frame causes the exposed end of the pile yarns to be looped about the holding weft shot 71. A new shed is now formed, as illustrated in Figure 2, with the straight warp threads 25 raised from their extreme downward position to their ordinary lower shedding position. As this shot is inserted, the tube frames are raised still further so as to draw off from the supplies the necessary yarn for the formation of the tufts, and the knives 67 and 68 approach each other and sever the inserted lengths of yarn from the supplies.

It will be noted that with the loom operating to lower the straight warp threads 25 to a position below ordinary lower shedding position prior to the insertion of the pile yarns by the dipping of the tube frame among the warp threads, the only warp threads which need be received in the spaces between the tubes are those designated 32

and 33. As shown in Figure 8, the fabric being woven has only one binder warp thread and one straight warp thread 33 for each longitudinal row of pile tufts 72, but there are four straight warp threads 25 for each tuft. Since the warp threads 25 are out of the way of the tube frames during the tuft inserting operation, only one binder warp thread 32 and one straight warp thread 33 have to be received in each space between adjacent tubes and the space available is quite sufficient for the purpose and there is no difficulty involved in the yarn insertion.

It will also be noted that in the new loom, no comb is employed and the omission of the comb is possible because of the manner in which the tube frames are handled during the tuft insertion. As the tube frames are dipped down and away from the fell of the fabric so as to form bights of yarn in which the holding weft shot is inserted, the rising of the tube frame causes the yarns to be looped about the shot and, therefore, no comb is required. If the tube frames were manipulated in the ordinary manner and had the usual movement downward and toward the fell of the fabric, the free ends of the tuft yarns projecting out of the tubes would lie below the warp threads and the looping would have to be completed by a comb. The advantages of lowering the straight warp threads 25 would then be lost, because the limited space between a pair of teeth on the comb would prevent the use of the large number of straight warp threads 25 which is required to give the fabric a full heavy body. It is thus the combined use in the loom of the mechanisms for manipulating the warp threads 25 so that they are out of the way of the tube frames during tuft insertion and for dipping the tube frames so that they also effect the looping of the tuft yarns about the holding weft shot which makes it possible to use the large number of warp threads 25 in the fabric.

Because of the manner in which the warp threads are handled in the loom, the loom itself permits the use of even a larger number of these threads than may be desirable in the fabric, but ordinarily the warp threads 25 are used in a sufficient number and size so that the space beneath each tuft yarn in the fabric is closed and the bottoms of the tuft loops rest upon these threads. The threads consequently form a substantially continuous warp plane across the fabric and they thus give the fabric the desired full stiff body and also help in binding the tuft yarns in position.

Separate beams are used in the loom for the straight warp threads 25 and 33 because the warp threads 25 are handled differently from warp threads 33 and at one stage in each cycle, the warp threads 25 are lowered to a substantial extent beyond ordinary shedding position. If both sets of warp threads 25 and 33 were mounted on the same beam, they would be under the same tension and this would interfere with the movement of the warp threads 25 by their heddle to the position referred to.

In the weaving of a fabric in this loom, it is desirable to insure that the binder warp threads 32 and the straight warp threads 33 are maintained in their proper relative positions and are not moved out of those positions by the lowering of the straight warp threads 25 beyond ordinary shedding position. The movement of the warp threads 25 to the position described appears to have a tendency to displace the binder warp threads 32 and the straight warp threads 33 and this effect is more pronounced when the warp threads 25 are of rough material, such as jute. Accordingly, I have provided the new loom with the double reed previously described and in the use of this reed, the corresponding dents of the two rows 63 and 64 are adjusted to slightly offset positions and warp threads 32 and 33 are passed through the reed in such manner that a dent 63 and its corresponding dent 64 bear on opposite sides of individual warp threads 32 and 33 and thus prevent these warp threads from being displaced during weaving.

The new loom can be used to produce fabrics other than those shown in Fig. 9, such for example as those illustrated in Figures 10 and 11. The fabrics shown in the latter two figures are of the three-shot two-plane variety and include a set of straight warp threads 75 and two sets of binder warp threads 76 and 77. In the fabric of Figure 10, a cycle of three weft shots includes two shots 78 and 79 which lie above the straight warp threads 75 and one shot 80 which lies below, the pile yarns 81 being looped about the shot 79. The fabric shown in Figure 11 is the same as that shown in Figure 10 except that both shots 78 and 80 of each cycle lie below the straight warp threads 75.

In the fabrics shown in Figures 10 and 11, the straight warp threads 75 correspond in number, size, and mode of handling to the straight warp threads 25 of the fabric shown in Figure 9. The warp threads 75 are lowered beyond ordinary lower shedding position during the insertion of the tuft yarns and the yarns thus need be inserted only between warp threads 76 and 77. The shed for the holding weft shot is then formed between binder warp threads 76 and 77. For the weaving of the fabrics of Figures 10 and 11, the loom requires only two beams, since both sets of binder warp threads are handled in the same manner and thus may be wound on the same beam. A separate beam is required for the straight warp threads 75 because of the difference in the way these threads are handled during the weaving.

The mechanism for operating the heddles of the loom is generally of standard construction, and each heddle is suspended from the end of a lever 82 pivotally mounted at 83 on a suitable part of the loom. Each of the levers 82 is provided with an operating rod 84 connected to a lever 85 pivoted on a suitable part of the loom and provided with a roller bearing on the surface of a cam on the main cam shaft 43 of the loom. The cams for the heddles 35 and 36 are of standard construction, but the cam for the heddle 34, which controls the warp threads 25, is so formed as to give that heddle a downward movement beyond ordinary lower shedding position at one stage in the operation of the loom.

The mechanism for inserting the weft is of standard construction, the weft shots being introduced into the sheds by the needle 73 mounted in the ordinary manner on a carriage 87, which is movable on a fixed guide member 88 supported by a suitable extension from the side of the frame. The carriage 87 is connected by a link 89 to the upper end of a swinging lever 90, which is pivotally mounted at 91 on the extension from the loom. A connecting rod 92 is pivotally connected at one end to a stud at a suitable location on the lever 90, and the other end of the connecting rod is pivotally connected by a crank pin to the outer end of a crank 93 fast on a shaft 94, mounted in suitable bearings in the extension from the frame.

The shaft **94** is driven by a gear **95** meshing with a gear **96** on the cam shaft **43**. The cam shaft is driven in any suitable manner as, for example, by means of a gear **97**.

The new loom may be used for producing various Axminster fabrics other than those disclosed and its use for such purposes will be readily understood by a skilled weaver. For example, it may be employed in the weaving of a two-plane three-shot fabric with a single set of binder warps, but when such a fabric is woven, it is necessary to employ two sets of straight warp threads, all of which, however, lie in the same plane in the finished goods. One set of these straight warp threads correspond in number, size, and mode of handling to the warp threads **75** in the fabric of Figure 10, while the other set is few in number and the threads are of small size and preferably of cotton. In the weaving of this fabric, the set of heavy straight warps is moved beyond ordinary shedding position during the insertion of the tuft yarns and the shed, in which the holding weft shot is inserted, is formed between the binder warps and the light straight warps. The use of the additional set of light straight warps in such a fabric is required in order that a shed may be formed for the holding weft shot.

While I have disclosed the application of the principles of my invention in a loom of the tube frame insertion type, it is to be understood that the utility of the invention is not limited to looms in which the tuft yarns are introduced by dipping the tube frames into the warp threads, but the invention may also be incorporated in looms of the well-known gripper type.

What I claim:

A loom for weaving an Axminster fabric consisting of binder and stuffer warps in sets, one set of warps consisting 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 weft shots constituting a weaving cycle, which comprises a plurality of heddles, one for each set of warp threads, for manipulating said sets of warp threads, individual operating means for said heddles for raising and lowering said heddles to produce sheds, said operating means for the heddle for said set of relatively heavy stiff warp threads lowering said heddle to lower said set of heavy warps beyond ordinary lower shedding position at one stage in each cycle while said operating means for the other heddles maintain said heddles in a position in which the warp threads controlled thereby are substantially parallel, tuft yarn inserting means operating to introduce portions of tuft yarns only through the warps maintained substantially parallel with said portions forming bights extending through said parallel warps and with the free ends of said portions lying adjacent the fell of the fabric and above all said sets of warps, a needle and operating mechanism therefor for inserting a weft shot in each shed formed by the heddles, the shot inserted immediately after the introduction of the portions of tuft yarn lying within the bights thereof and said heddle operating mechanism moving the heddles for all said sets of warps to place said warps in substantially parallel position immediately following the insertion of said shot through said bights, and a reed for beating up inserted weft shots, said tuft yarn inserting means drawing said inserted portions of yarn tightly about the shot inserted in said bights immediately after the beating up of said shot by said reed.

HOWARD L. SHUTTLEWORTH.