June 10, 1952 K. HAMILTON, JR 2,600,241

METHOD AND APPARATUS FOR MAKING PILE FABRICS

Filed May 16, 1951 3 Sheets-Sheet 1

Fig. 1,

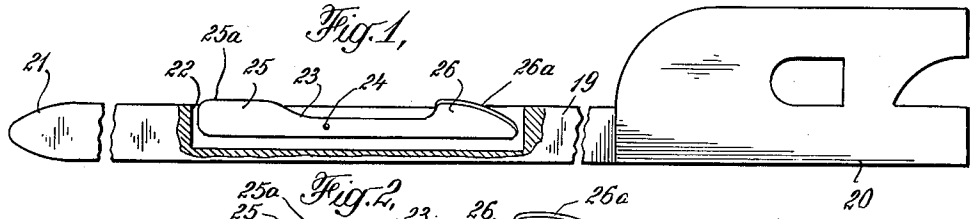


Fig. 2,

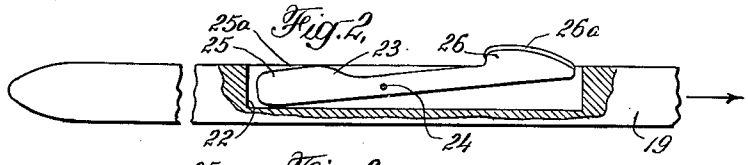


Fig. 3,

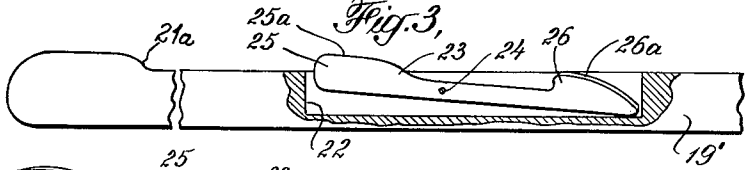


Fig. 4,

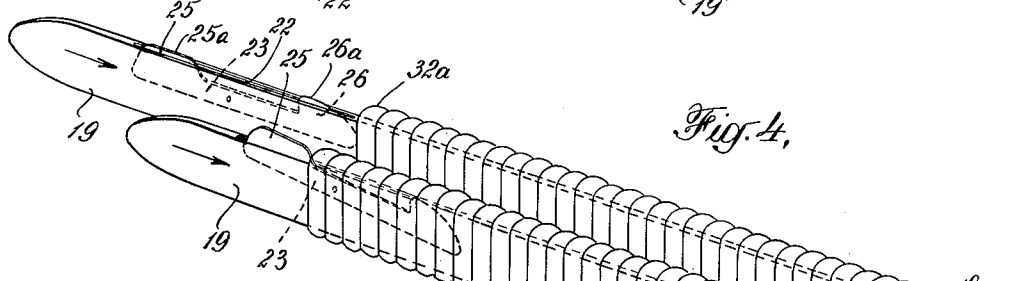


Fig. 5,

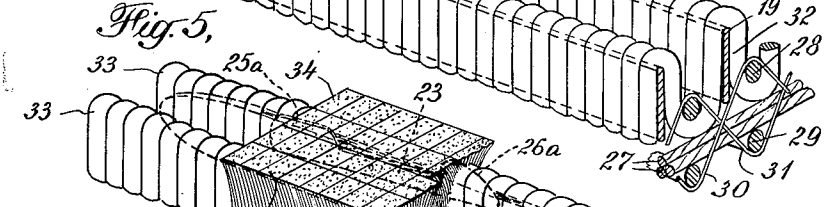


Fig. 6,

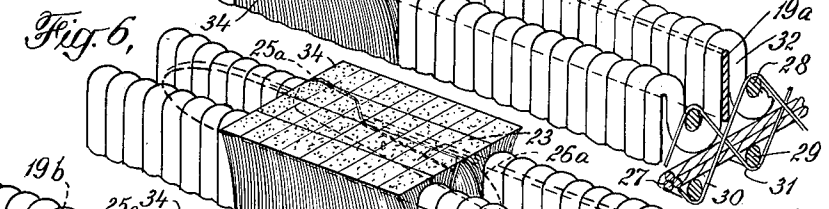
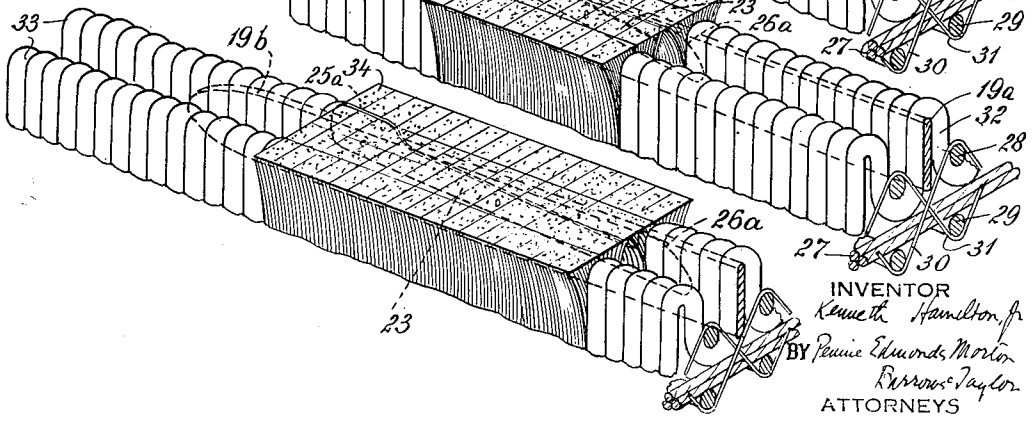


Fig. 7,



INVENTOR
Kenneth Hamilton, Jr.
BY Pennie Edmonds, Morton
Barrows & Taylor
ATTORNEYS

June 10, 1952 K. HAMILTON, JR 2,600,241

METHOD AND APPARATUS FOR MAKING PILE FABRICS

Filed May 16, 1951 3 Sheets-Sheet 2

Fig. 8,

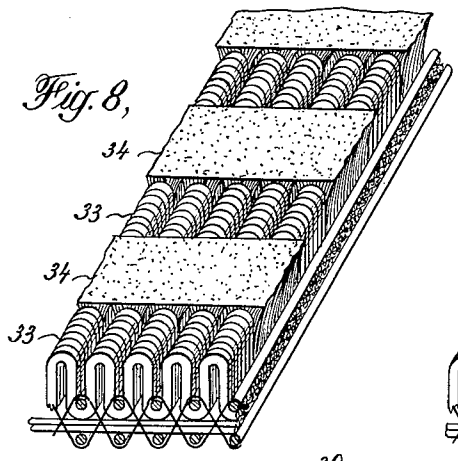
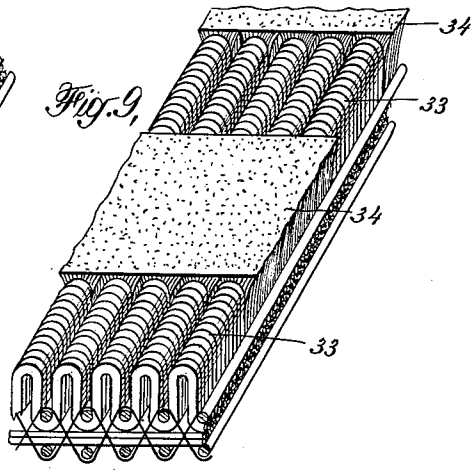


Fig. 9,



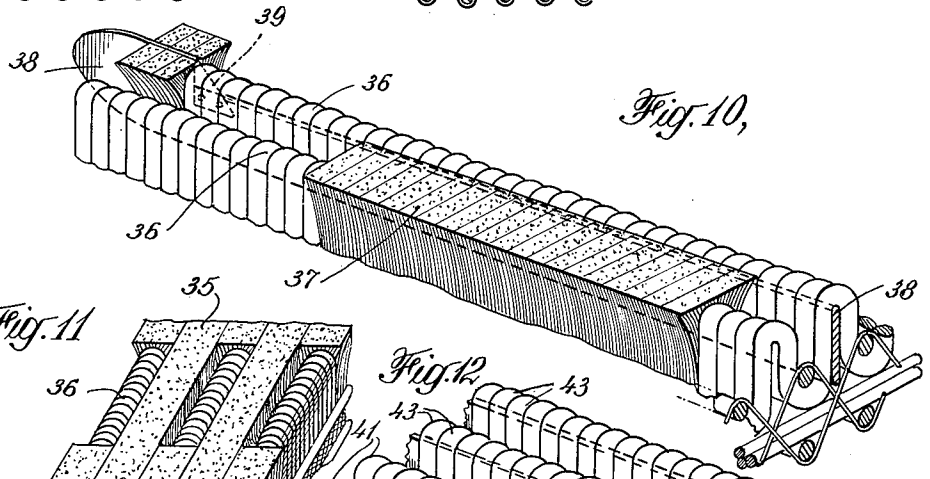


Fig. 10,

Fig. 11

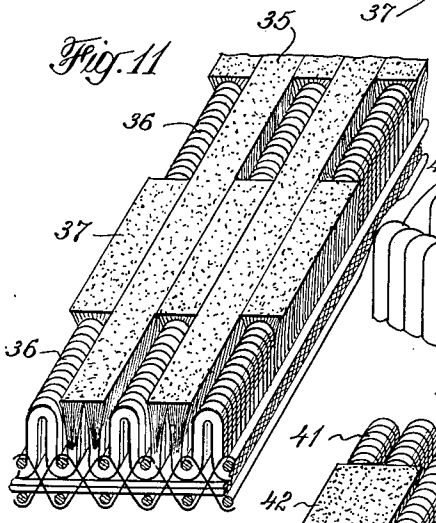
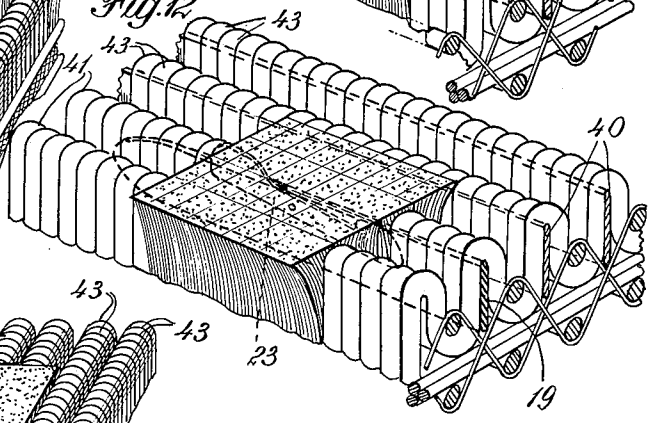


Fig. 12



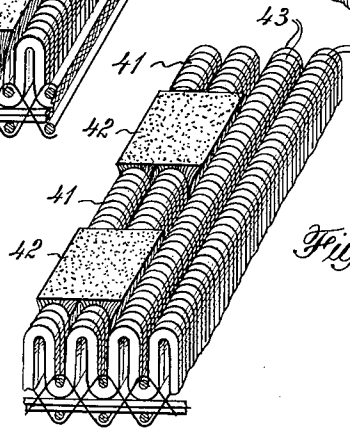


Fig. 13,

INVENTOR
Kenneth Hamilton, Jr.
BY
Pennie, Edmonds, Morton, Barrows & Taylor
ATTORNEYS

June 10, 1952 K. HAMILTON, JR 2,600,241

METHOD AND APPARATUS FOR MAKING PILE FABRICS

Filed May 16, 1951 3 Sheets-Sheet 3

Fig. 15,

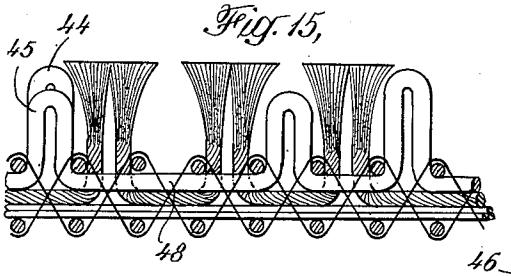


Fig. 16,

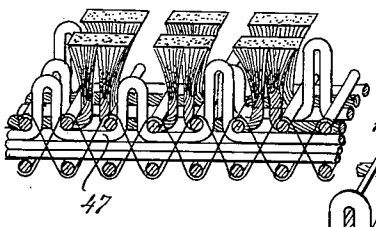


Fig. 14,

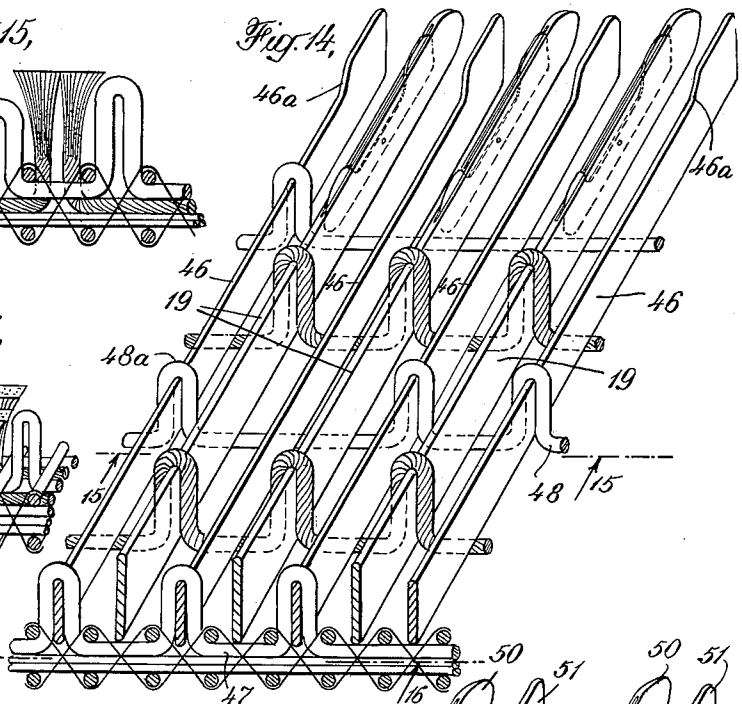


Fig. 18.

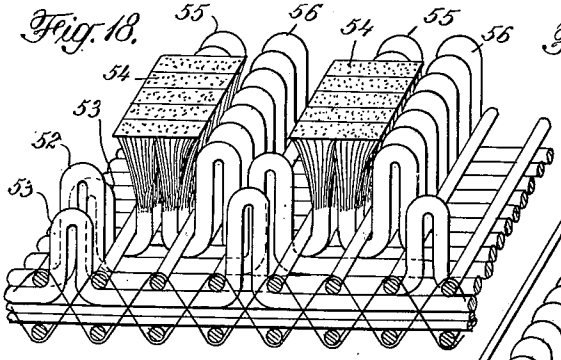
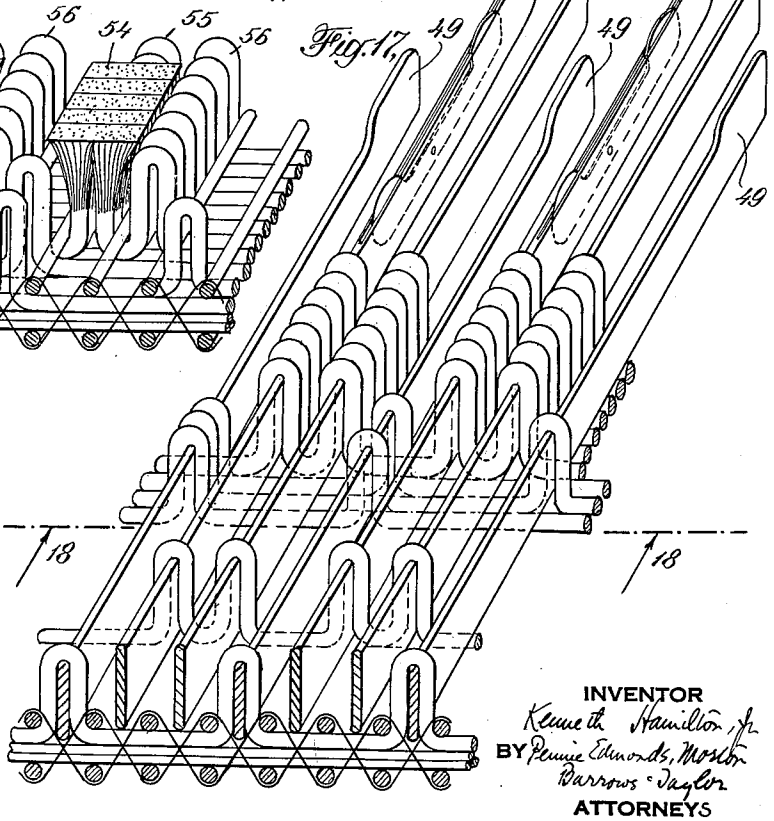


Fig. 17,



INVENTOR
Kenneth Hamilton, Jr.
BY Pennie Edmonds, Morton
Barrows & Taylor
ATTORNEYS

Patented June 10, 1952

2,600,241

UNITED STATES PATENT OFFICE

2,600,241

METHOD AND APPARATUS FOR MAKING PILE FABRICS

Kenneth Hamilton, Jr., Harrowers, N. Y., assignor to Mohawk Carpet Mills, Inc., Amsterdam, N. Y., a corporation of New York

Application May 16, 1951, Serial No. 226,706

6 Claims. (Cl. 139—44)

1

This invention relates to woven pile fabrics, such as rugs and carpets, in which the pile is formed by raising pile yarns over wires inserted into the shed during the weaving operation. More particularly, the invention is concerned with a method of weaving such fabrics having decorative effects in the pile surface by reason of the presence in the pile of both loops and tufts, and with a new pile wire, which may be utilized with others to make a set suitable for use in the loom in the production of the fabrics referred to.

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

Figs. 1 and 2 are side elevational views, with parts broken away, showing one form of the pile wire of the invention with its lever in different positions;

Fig. 3 is a side elevational view, with parts broken away, showing another form of the pile wire of the invention with its lever shown in another position;

Figs. 4–6, inc., are perspective views showing the manner, in which the lever of the new pile wire operates upon withdrawal of the wire to cut pile loops in groups and leave pile loops in other groups uncut;

Fig. 7 is a perspective view similar to Fig. 6 and showing the effect of using a pile wire with a longer lever than that in the wire of Fig. 6;

Fig. 8 is a perspective view of a carpet made by the use of the levers of Fig. 6;

Fig. 9 is a perspective view of a carpet made by the use of the levers of Fig. 7;

Fig. 10 is a perspective view showing a step in the weaving of a carpet by the use of the new pile wires and standard cutting pile wires employed in alternation;

Fig. 11 is a perspective view of a carpet made by the weaving operation, including the step of Fig. 10;

Fig. 12 is a perspective view showing a step in the weaving of a carpet by the use of the new pile wires and standard non-cutting pile wires arranged two-and-two;

Fig. 13 is a perspective of a carpet made by the weaving operation, including the step of Fig. 12;

Fig. 14 is an exploded perspective view showing a step in a weaving operation, in which the new pile wires are used in alternation with non-cutting knob wires;

Figs. 15 and 16 are sectional views on the lines 15—15 and 16—16 of Fig. 14;

Fig. 17 is an exploded perspective view showing a step in a weaving operation, in which the new pile wires are employed with standard non-cutting and knob wires; and

Fig. 18 is a sectional view on the line 18—18 of Fig. 17.

2

The new pile wire 19, as illustrated in Fig. 1, is ordinarily made of flat steel stock and it has a head 20 at one end, by which the wire is gripped by the means for inserting and withdrawing it. The free end 21 of the wire is referred to as the "blade" and it terminates in a blunt point. Adjacent the blade, the wire is formed with a lengthwise slot 22 leading inward from its top surface. A lever 23 is pivotally mounted on a pin 24 between its ends within the slot and the lever has an upward projection 25 at its end toward the blade and an upward projection 26 at its other end. The top surface 25*a* of projection 25 is relatively flat and blunt, while the top surface of projection 26 curves upwardly toward the middle of the lever and is formed with a top cutting edge 26*a*. When the lever is in level position (Fig. 1), the top of projection 25 lies exposed above the top of the wire, as does also the inner end of the cutting edge 26*a*. The lever is rockable between a position (Fig. 2), in which the top surface of projection 25 lies wholly within the slot and the cutting edge 26*a* is wholly exposed, and a second position (Fig. 3), in which the top surface of projection 25 is wholly exposed and the projection 26 lies wholly within the slot. The wire illustrated is of uniform height from end to end but, if desired, the wire may have the form of wire 19′ which includes a knob 21*a* at its blade end, as illustrated in Fig. 3.

Decorative effects in the pile surface of a fabric may be obtained by using the new pile wires alone or by employing them in combination with conventional pile wires of the cutting, non-cutting, and knob varieties. When the new pile wires are used alone, they produce a pile surface made up of transverse rows of pile elements with each row containing both pile loops and pile tufts. When the wires are alike and have levers of the same length, the pile surface of the fabric has longitudinal stripes of pile loops alternating with stripes of pile tufts, the stripes being of equal width. The operation of the new wire to produce these effects is made clear in Figs. 4–9, inc., in which the use of the wire in weaving a tapestry carpet is illustrated.

The carpet shown in Figs. 4–9, inc. comprises stuffer warps 27 lying in a plane, filling yarns 28, 29 lying above and below the stuffer warps,

and two sets of binder warps or fine chains 30, 31 binding the filling yarns in place. The pile is made of heavy pile yarns 32, which are raised over the new pile wires 19 between adjacent filling yarns 28 in the upper level. In the weaving operation, the wires used have their levers so disposed that, when the wires are inserted in the shed in the usual way, the lever 23 of each wire lies beyond the pile yarns. After all the wires in the set have been inserted, the first wire is withdrawn from the loops of pile yarns thereover and is re-inserted in the shed. As the wire is withdrawn, its lever functions to cut certain loops of pile yarn and leave others uncut, as follows:

When the withdrawal of the wire starts, the lever projection 26, with the cutting edge 26*a*, first enters the adjacent pile loop 32*a*, and the engagement of the cutting edge with the loop causes the lever to be rocked, so that the cutting projection is depressed and the projection 25 with the blunt top edge 25*a* is moved up out of the slot 22 in the wire. The lever is held in this position, until the cutting projection 26 has passed beneath a plurality of pile loops, leaving them uncut. The number of loops left intact depends on the length of the lever between the highest part of its cutting edge 26*a* and the blunt top surface 25*a* of projection 25. When the blunt surface 25*a* on the lever engages the edge loop 32*a*, the end of the lever carrying the projection 25 is depressed, and this raises the cutting edge 26*a*, so that it then cuts pile loops to form tufts. The lever continues to be held with its cutting edge 26*a* raised in position to cut, until projection 25 ultimately reaches the tufts formed by the severance of loops. As soon as this occurs, the cutting projection 26 is again depressed by contact of its cutting edge 26*a* with the loops, and the blunt projection 25 rises between the legs of the tufts. The lever remains in this position with the cutting edge ineffective, until the blunt projection 25 passes beyond the group of tufts and again engages a loop, whereupon the lever is rocked to raise its cutting edge and the severing of loops to form tufts again takes place. The sequence of operations described continues throughout the withdrawal of the wire and, as a result of the actions described, the transverse row of pile loops raised over the wire is converted into groups of loops alternating with groups of tufts. If all the pile wires used in the loom are identical, the pile surface of the finished fabric will be made up of longitudinal stripes of loops alternating with longitudinal stripes of tufts.

In Fig. 5, a portion of the pile of the fabric, produced as above described, is shown, after one wire has been withdrawn to leave a transverse row made up of loops 33 and tufts 34. The adjacent wire 19*a* is partially withdrawn and is at a stage, where loops are being severed to form tufts. In Fig. 6, the wire 19*a* is shown in a position where its blunt projection has risen between tufts 34, so that its cutting projection is depressed and ineffective to cut loops.

As pointed out above, the number of loops left uncut and the number of loops cut to make tufts in the withdrawal of a wire 19 depends on the length of the lever 23 and, in Fig. 7, there is illustrated a portion of the pile of a fabric produced by the use of a wire 19*b* having a lever longer than that of wire 19, so that there is a greater distance between the blunt and cutting top edges. With the longer lever, there are more loops and tufts in each group thereof in a transverse row in the fabric than in the corresponding groups made by the use of wire 19 with the shorter lever.

The fabric shown in Figs. 8 and 9 have been made by the use of the short lever wire 19 and the long lever wire 19*b*, respectively. In each fabric, the pile includes longitudinal stripes of loops 33 alternating with similar stripes of tufts 34 and the stripes are of uniform width.

The fabric shown in Fig. 11 is one having a pile made up of transverse rows of tufts 35 alternating with rows made up of groups of loops 36 alternating with groups of tufts 37. This fabric is produced by the use of a set of pile wires, in which the new lever wire 19 is employed in alternation with a plain wire 38 having a cutting blade 39 adjacent its free end and of the same height as the lever wire. At the stage, shown in Fig. 10, of weaving the fabric of Fig. 11, the lever wire has been wholly withdrawn and the cutting wire 38 has been partially withdrawn.

The fabric shown in Fig. 13 is one made by the use of a set of wires made up of pairs of the new lever wires employed in alternation with pairs of conventional non-cutting wires 40. When the lever wires are withdrawn, the rows of pile loops thereover are converted into groups of loops 41 alternating with groups of tufts 42. The withdrawal of the plain wires leaves rows of loops 43. The height of the plain wires employed in such a set is the same as the height of the lever wires or lower. This insures that the tufts formed by cutting loops will have ends projecting slightly above the tops of the loops, so that the ends of the tufts can be sheared in finishing operations.

The fabric illustrated in Figs. 15 and 16 is one, in which the pile includes rows of pile elements made up of both high loops 44 and low loops 45, and other rows containing groups of loops alternating with groups of tufts. This fabric is produced by the use of a set of wires, which includes the new lever wires 19 alternating with knob wires 46. Each knob wire has a knob 46*a* at its free or blade end, which is either as high as or somewhat lower than the lever wires employed in the set, while the major part of the length of each knob wire has a height substantially lower than the knob. In producing the fabric by the use of the lever wires alternating with the knob wires, the pile yarns are raised selectively over the wires by a Jacquard mechanism, with the following results.

Whenever a pile yarn, such as that designated 47, is raised over a number of knob wires and buried beneath intervening lever wires, the yarns raised over the first knob wire are formed initially into low loops. When the wire is withdrawn, the loops are converted into high loops, the additional yarn for the purpose being obtained by stretching lengths of the yarns buried in the backing or by lowering the height of loops of such yarns raised over the immediately preceding knob wire and left as high loops upon withdrawal of that wire. When the second knob wire is withdrawn and the low loops initially formed thereover are converted into high loops, each high loop of a yarn, which was raised over the immediately preceding knob wire, is lowered, and this action continues for all the knob wires, over which a yarn is successively raised. If a yarn, such as that designated 48, is raised over the first knob wire and then buried beneath a number of wires, before being again raised over

a knob wire, the withdrawal of the first wire leaves a high loop **48***a* of the yarn. Upon withdrawal of the next knob wire, over which the yarn is raised, the initial low loop of the yarn over that wire is converted into a high loop, but this conversion does not reduce the height of loop **48***a*. Accordingly, by raising the yarns over the knob wires in accordance with a pattern, it is possible to obtain both high and low loops of the yarn in the pile, and the high and low loops may lie in the same transverse row. The yarns raised over the lever wires are converted into groups of loops alternating with groups of tufts, as above explained.

In such a fabric, it is not objectionable to raise a yarn over a knob wire and then over the next lever wire, but it is undesirable to raise a yarn over a lever wire and then over the next knob wire. The reason is that, in the second case, the withdrawal of the knob wire increases the height of the low loops initially formed thereover and the additional yarn for this purpose is withdrawn from the pile elements in the preceding row produced over the lever wire. Wherever those elements are tufts, one leg of each tuft is shortened by the withdrawal of the knob wire so that, in the finished fabric, there will be short tuft legs, which will be buried in the pile and not visible.

The fabric shown in Fig. 18 is one made by the use of the set of wires illustrated in Fig. 17. This set is made up of sub-groups, each consisting of a knob wire **49**, a lever wire **50**, and a plain non-cutting wire **51** arranged in that order. In such a set, the height of the knob of the knob wire and the height of the plain wire are no greater than the height of the lever wire and if desired, the plain wire may be of lower height than the knob of the knob wire. By proper raising of the pile yarns over the knob, lever, and plain wires in accordance with the pattern, it is possible to produce a pile, in which there are rows of loops containing both high loops **52** and low loops **53**, other rows containing groups of tufts **54** alternating with groups of loops **55**, and still other rows containing only loops **56**.

The fabric illustrated in Fig. 18 has a pile, in which the major proportion of the pile elements are loops, and there are a relatively few tufts in the rows formed by the use of the lever wires. If it is desired to produce a pile with a larger proportion of tufts, the non-cutting wires **51** in the set may be replaced by cutting wires, in which event each group of three rows of pile elements in the pile surface consists of a row of tufts, a row made up of groups of tufts alternating with groups of loops, and a row made up of loops of two different heights.

In the use of a set of wires **19'**, the yarns are raised selectively over the wires, as in the case of weaving with an ordinary knob wire. It is then possible, by proper manipulation of the yarns, to produce rows of pile elements made up of groups of tufts alternating with groups of loops of two different heights.

I claim:

1. A pile wire for use in a wire loom, which comprises a blade and a head, the wire having a lengthwise slot leading inward through its top adjacent its end remote from the head, and a lever pivotally mounted within the slot, the lever having a cutting edge at its top at its end toward the head and a blunt top surface at its other end, the lever being rockable between two positions, in the first of which the cutting edge is outside and the blunt edge within the slot and, in the second of which, the cutting edge is within and the blunt edge outside the slot.

2. A pile wire for use in a wire loom, which comprises a blade and a head, the wire having a lengthwise slot leading inward through its top adjacent its end remote from the head, and a lever pivotally mounted within the slot and extending lengthwise of the blade, the lever having an upward projection with a top cutting edge at its end toward the head and an upward projection with a blunt top edge at its other end, the lever being rockable between two positions, in the first of which the cutting edge is outside and the blunt edge within the slot and, in the second of which, the cutting edge is within and the blunt edge outside the slot.

3. A method of weaving on a pile wire loom a pile fabric having a transverse row of pile elements consisting of groups of pile loops alternating with groups of pile tufts by means of a pile wire having a lever pivoted in a slot in the top of the wire, the lever having a cutting top edge at one end and a blunt top edge at the other, the edges being alternately projected out of the slot, when the lever is rocked in opposite directions, which comprises forming a shed containing pile warps only in the top line, inserting the wire into the shed in such direction that the blunt edge of the lever precedes the cutting edge, until at least the cutting edge of the lever lies beyond the shed, lowering the pile warps upon the wire to form loops over the wire, forming other sheds successively and inserting pile wires therein, and withdrawing the wire in a direction opposite to that of its insertion, the engagement of the cutting edge on the lever with the loops over the wire initially rocking the lever to depress said edge into the slot and to project the blunt edge out of the slot, the lever remaining thus rocked until the blunt edge engages the loops and is depressed thereby to rock the lever and project the cutting edge out of the slot to cut loops to form tufts, the lever remaining in its second position, until the blunt edge reaches said tufts and the lever is returned to its first position by engagement of the cutting edge with loops.

4. In a pile wire carpet loom for producing a pile carpet having a pile surface including transverse rows of like pile elements and at least one transverse row of pile elements made up of groups of pile loops alternating with pile tufts, the rows being arranged according to a pattern, said loom having means for inserting pile wires in respective sheds, withdrawing the wires from the woven fabric, and reinserting them in respective sheds in regular order, a set of pile wires including standard pile wires and at least one wire having a head and a blade, said wire having a lengthwise slot leading inward through its top surface, and a lever pivotally mounted in the slot and having a cutting top edge at the end of the lever toward the head and a blunt top edge at the other end, the position of the lever wire in the set corresponding to the position in the pattern of said row of pile elements made up of groups of pile loops alternating with groups of pile tufts.

5. A set of pile wires for use in a pile wire carpet loom adapted to produce a pile carpet having a pile surface including transverse rows of like pile elements and at least one transverse row of pile elements made up of groups of pile loops alternating with pile tufts, the rows being

arranged in a repeat pattern and the loom having means for inserting the pile wires of the set into respective sheds, withdrawing the wires from the woven fabric, and reinserting them in respective sheds in regular order, the set of wires comprising a plurality of wires including standard pile wires and at least one wire having a head and a blade, said wire having a lengthwise slot leading inward through its top surface, and a lever pivotally mounted in the slot and having a cutting top edge at its end toward the head and a blunt top edge at the other end, the position of the lever wire in the set corresponding to the position in the pattern of the row of pile elements made up of groups of pile loops alternating with groups of pile tufts.

6. A method of weaving on a pile wire carpet loom a pile fabric having a pile surface made up of transverse rows of pile elements formed of pile warps raised out of a backing, the pile surface including rows of pile loops of two heights and other rows made up of groups of pile loops alternating with groups of pile tufts, the loom including pile wires of two kinds arranged in alternation, the wires of one kind being of relatively low height for the major part of their length and having a knob of greater height at the free end thereof and the wires of the second kind being of a height at least as great as the height of said knob and formed with a lengthwise slot in the top edge adjacent the free end

of the wire, a lever with a blunt top edge at one end and a cutting top edge at the other being pivoted between its ends in the slot with the blunt edge toward the free end of the wire, which comprises raising pile warps selectively in accordance with a pattern over the wires of the two kinds to form initially rows of low loops alternating with rows of high loops, thereafter withdrawing the wires successively from the rows of loops thereover, simultaneously with the withdrawal of each lever wire leaving uncut and cutting alternate groups of loops over said wire, and simultaneously with the withdrawal of each knob wire converting the low loops thereover to high loops and reducing the height of high loops of the same yarns raised over the immediately preceding knob wire and left as high loops, when said immediately preceding knob wire was withdrawn.

KENNETH HAMILTON, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
690,912	McCollum	Jan. 7, 1902
1,616,347	Behrman	Feb. 1, 1927
2,477,249	Harding	July 26, 1949
2,532,903	Groat	Dec. 5, 1950