Nov. 30, 1954 P. MILLER ET AL 2,695,634

METHOD AND APPARATUS FOR MAKING PILE FABRIC

Filed Feb. 18, 1950 3 Sheets-Sheet 1

Fig. 1.

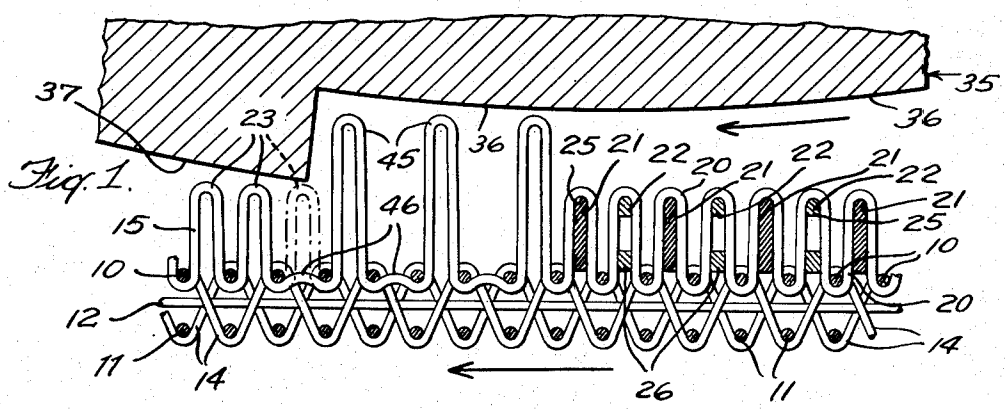


Fig. 2.

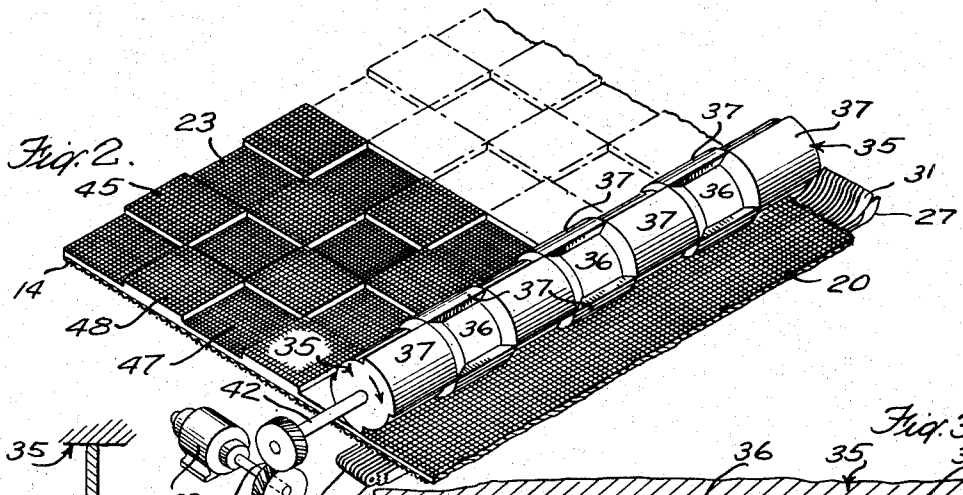


Fig. 3.

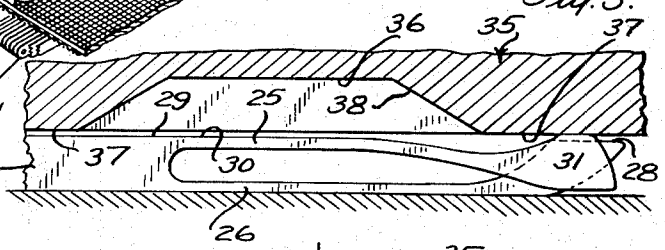


Fig. 5.

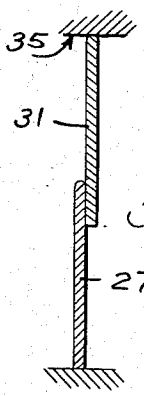
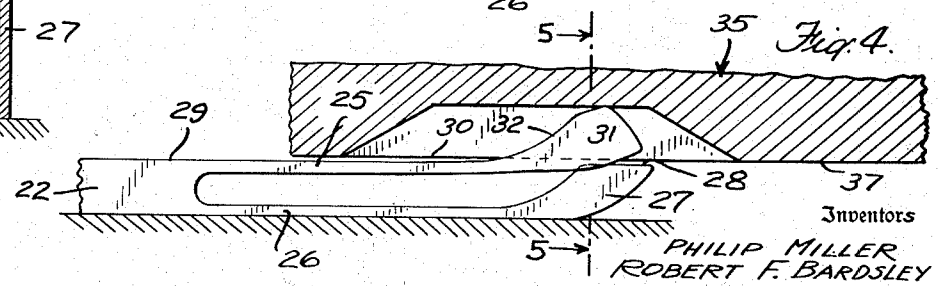


Fig. 4.



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METHOD AND APPARATUS FOR MAKING PILE FABRIC

Filed Feb. 18, 1950 3 Sheets-Sheet 2

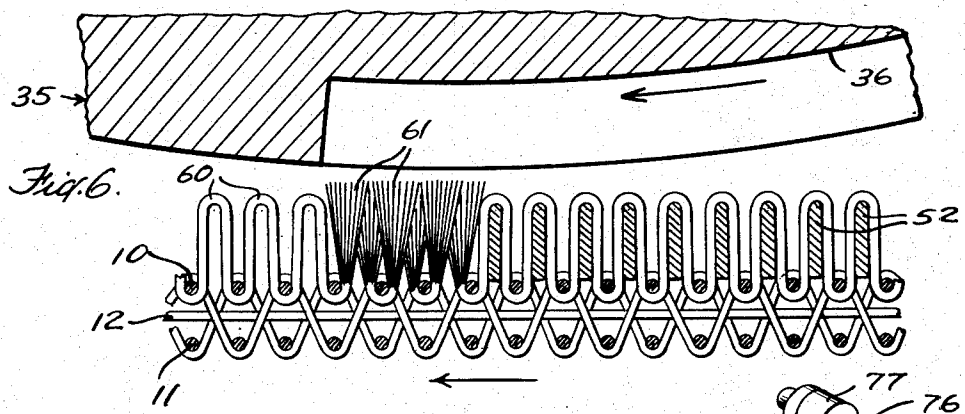


Fig. 6.

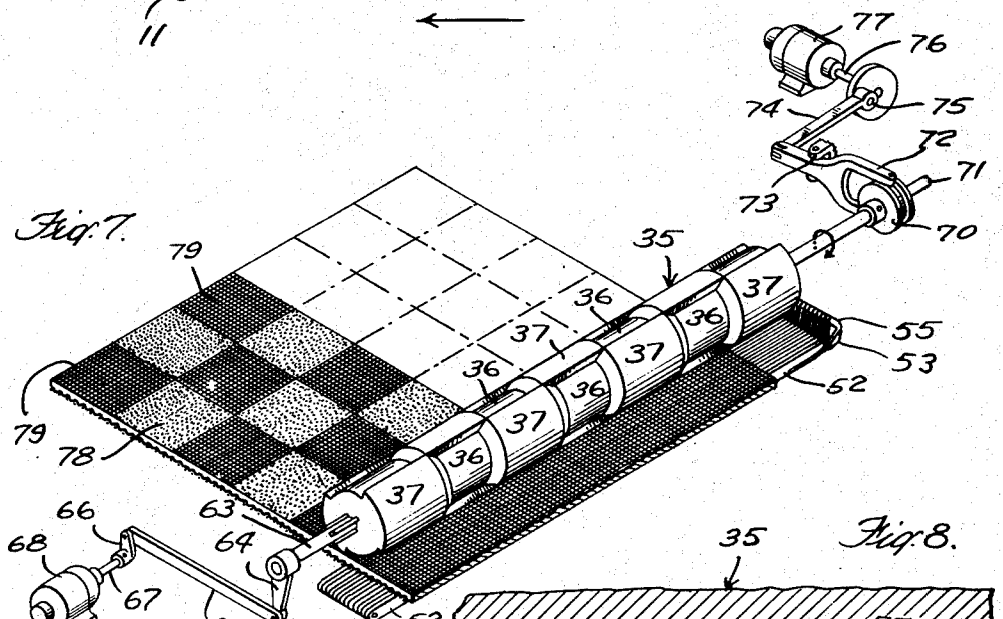


Fig. 7.

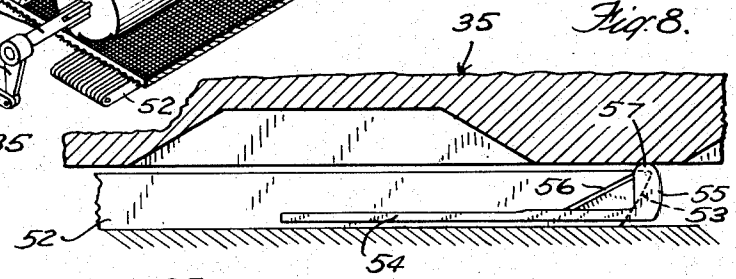


Fig. 8.

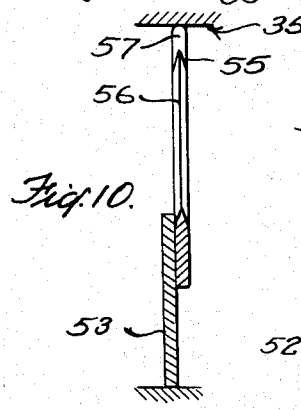


Fig. 10.

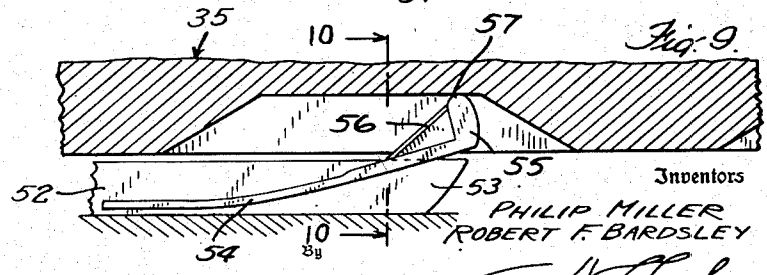


Fig. 9.

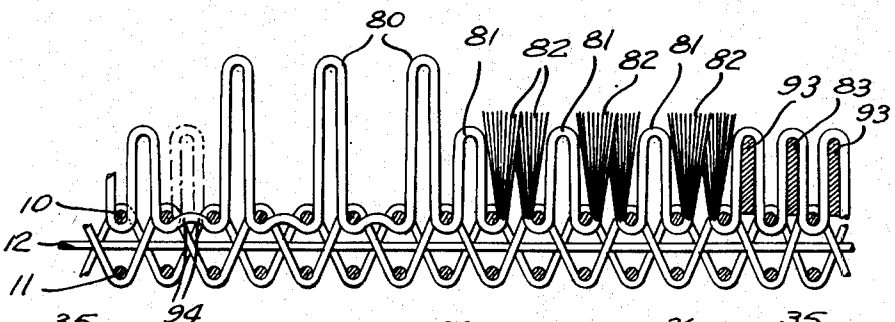
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METHOD AND APPARATUS FOR MAKING PILE FABRIC

Filed Feb. 18, 1950 3 Sheets-Sheet 3

Fig. 11.



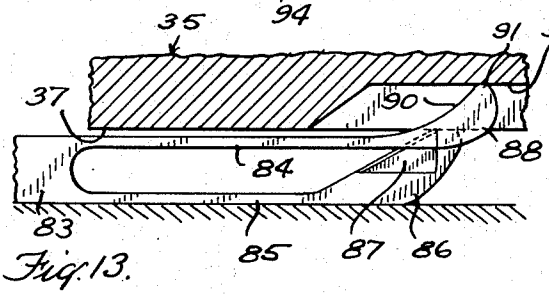


Fig. 13.

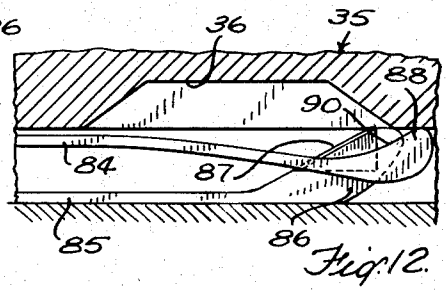


Fig. 12.

Fig. 14.

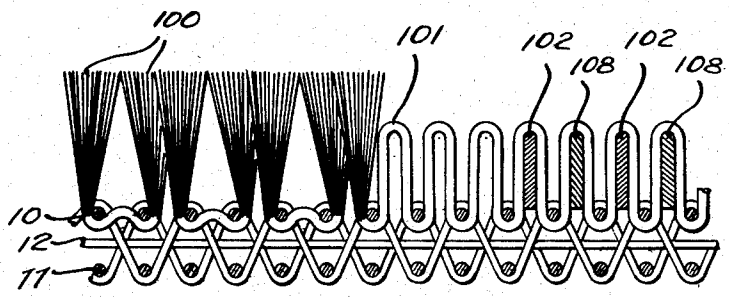


Fig. 16.

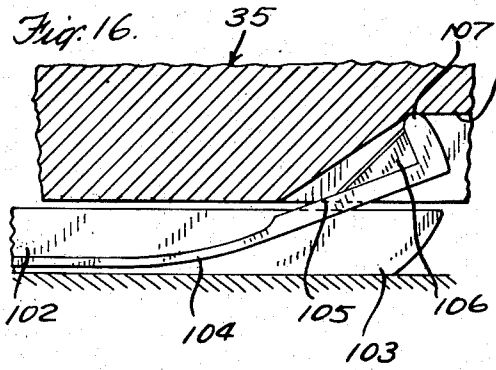
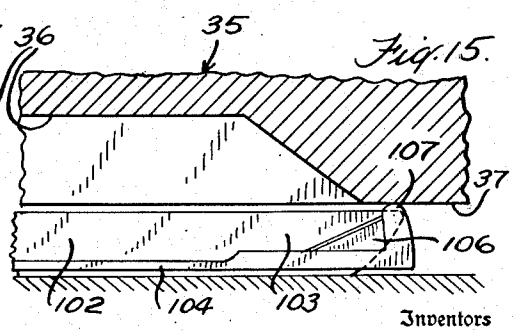


Fig. 15.



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2,695,634

METHOD AND APPARATUS FOR MAKING PILE FABRIC

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Application February 18, 1950, Serial No. 144,882

17 Claims. (Cl. 139—39)

This invention relates to woven pile fabrics of the Wilton or velvet types in which the pile is formed by the use of pile wires inserted in the warp shed during the weaving operation and has for an object to provide a pile fabric of the above type having novel and improved characteristics.

Another object is to provide a novel and improved pile wire for imparting selected pattern characteristics to the woven fabric and which can be utilized on standard looms.

Another object is to provide a novel and improved method of weaving.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

In Wilton and velvet looms, pile wires are normally inserted in the warp shed between the warp used in forming the body or backing of the fabric and the pile warp, and are bound in place temporarily by loops of the pile warp as the fabric is woven. Each wire remains in place until a plurality of wires have been inserted, whereupon the leading wire is withdrawn longitudinally from the fabric. If the wire is provided on its trailing end with a knife edge, the loops are cut as the wire is withdrawn, forming a cut pile fabric. If the wire has no knife edge uncut pile loops remain when the wire is withdrawn. In other cases the wire may be formed with a shoulder to enlarge the loops as the wire is withdrawn.

In fabrics so produced all of the pile in any one transverse row must be similar which is a limitation on the design of the fabric.

The present invention overcomes this design limitation and provides mechanism for cutting or enlarging a selected portion only of any row of pile loops as the pile wire is withdrawn. The invention also provides for forming cut or uncut pile of different heights in different selected portions of a row. Various combinations of the above effects can also be obtained.

More specifically the invention utilizes pile wires having spring mounted members at their trailing ends cooperating with a cam surface disposed above the pile loops to cause the members to be selectively raised or depressed as desired. The wires are arranged to produce different effects depending upon whether the wires are elevated or depressed. In one embodiment the wires produce high and low uncut pile loops as they are raised or depressed. In other embodiments cut and uncut pile are formed which may be of the same or of different heights. In any case the portions of each row of pile tufts which are selected for the different effects is dependent upon the contour of the cam. Means are also provided for rotating or reciprocating the cam to produce other effects.

The nature of the invention and its mode of application will be better understood from the following description, taken in connection with the accompanying drawings in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

Fig. 1 is an enlarged section through a portion of a pile fabric and cam roller on the loom, showing a fabric having high and low, uncut pile loops;

Fig. 2 is a perspective view of the cam roller and woven fabric showing the pile wires in place;

Fig. 3 is a detail view of the trailing end of a pile wire embodying the invention with its spring member retracted by the cam surface;

Fig. 4 is a similar detail view showing the spring member in raised position;

Fig. 5 is a section taken on the line 5—5 of Fig. 4, but on a larger scale;

Fig. 6 is a sectional view similar to Fig. 1, but showing a fabric having cut and uncut pile of the same height;

Fig. 7 is a perspective view of the fabric of Fig. 6 showing the cam roller and wires in place;

Fig. 8 is a detail view of the trailing end of a pile wire adapted to produce the fabric of Figs. 6 and 7 showing the spring member depressed;

Fig. 9 is a similar detail view showing the spring member raised;

Fig. 10 is a section taken on the line 10—10 of Fig. 9, but on a larger scale;

Fig. 11 is a section similar to Fig. 1 illustrating a fabric having high uncut pile loops and low loops and cut pile;

Fig. 12 is a detail view of the trailing end of a pile wire for forming the fabric of Fig. 11 showing the spring member depressed;

Fig. 13 is a similar detail view showing the spring member raised;

Fig. 14 is a section similar to Fig. 1 showing a fabric having high cut pile tufts and low uncut pile loops;

Fig. 15 is a detail view of the trailing end of a pile wire for forming the fabric of Fig. 14, showing the spring member depressed; and

Fig. 16 is a similar detail view showing the spring member raised.

Referring to the drawings more in detail, the backing which may be of any standard type is shown in Fig. 1 for convenience as of the two shot velvet type comprising upper and lower filler yarns **10** and **11** with a stuffer yarn **12** therebetween and with pile yarns **15**, all bound by a pair of chain yarns **14**. It is to be understood, however, that the invention is also applicable to fabrics of the Wilton type in which a plurality of pile yarns are provided which are individually selected by jacquard mechanism in accordance with the desired pattern. The backing may include various numbers of filler yarns and various numbers of stuffer yarns. A selected type has been shown for purposes of illustration only.

In the embodiment of Figs. 1 to 5 the fabric is assumed to move from right to left on the loom and a plurality of low pile loops **20** have been formed by the insertion of pile wires **21** and **22**. The loops **20** and wires **21** and **22** are bound to the backing by the chain, stuffer, and filler yarns as above described.

The wires **21** are standard loom wires which are adapted, when withdrawn, to leave uncut pile loops **23**. The wires **22** are of the type shown in Figs. 3 and 4 and are split at their trailing ends to provide upper and lower arms **25** and **26** respectively. The lower surface of the arm **26** is a continuation of the lower surface of the body of the wire **22** to provide support for the wire. The trailing end of the arm **26** carries a flange **27** having an upper surface **28** in the plane of the upper surface **29** of the wire body.

The arm **25** is flexible and has an upper surface **30** forming a continuation of the upper surface **29** of the wire body and terminating in a shoulder **32** on an upstanding flange **31**. The shoulder **32** is inclined to enlarge the pile loops as the wires are withdrawn therethrough when the arm **25** is in its raised position as shown in Fig. 4. The flange **31** when depressed, as shown in Fig. 3, is equal in height to the flange **27** and pulls through the pile loops without enlarging the same.

For controlling the position of the flange **31** a cam member **35** is provided having depressed cam portion **36** to receive the flange **31** without depressing the same, and having raised portions **37** which engage and depress the flange **31** as shown in Fig. 3. The portions **36** and **37** are joined by inclined surfaces **38** over which the flange **31** rides as the wire is withdrawn. The cam member **35** is shown as a roller, but may take other forms such as a flat plate.

The roller **35** is shown in Fig. 2 as mounted to rotate above the pile loops at a point above the wire which is to be withdrawn from the fabric. Means, shown as a motor **40**, connected to the roller **35** by gears **41** and

shaft 42, are provided to rotate the roller 35 at a selected speed according to the pattern. The roller may of course be driven from a convenient loom shaft if desired.

In this embodiment the wires 22 are inserted alternately with standard wires 21. As each standard wire 21 is withdrawn a row of low pile loops 23 is formed. As each wire 22 is withdrawn, if the flange 31 engages a raised portion 37 of the cam roller 35 and is depressed as in Fig. 3, a low pile loop 23 is formed. However, when the flange 31 enters a recess in the cam roller 35 as shown in Fig. 4 and is brought to elevated position, the loops, riding over the shoulder 32, become enlarged, pulling the necessary yarn length from the preceding loop 23, thus forming high loops 45, each preceded by a link 46 spanning the space previously occupied by a loop 23.

The fabric thus formed has areas 47 of the usual low pile loops and areas 48 of high pile loops spaced by two filler shots 10. The location of the various areas is determined by the rotation of the cam roller 35 which is synchronized by suitable means with the feed of the woven fabric to produce the desired repeated pattern. The roller may be oscillated or reciprocated as shown in Fig. 7 instead of or in addition to its rotation, or may have an irregular motion imparted thereto by a cam or the like.

Referring to Figs. 6 to 10 a wire is shown which is capable of producing cut or uncut pile selectively. This wire comprises a body 52 having a thin trailing end portion 53 carrying a spring arm 54 having at its end a flange 55 carrying a knife blade 56. The knife blade 56 is urged upwardly by the spring arm 54 to the position shown in Fig. 9 wherein the knife blade cuts the pile loops as the wire is withdrawn therethrough. A rounded cam surface 57 on the flange 55 extends above the knife blade to engage the lower surface of the cam roller 35 and is adapted to hold the knife blade out of cutting position as in Fig. 8 when the cam surface 57 engages the raised portions of the cam roller 35.

In this embodiment uncut loops 60 (Fig. 6) are formed at points corresponding to the raised cam roller surfaces 37 and cut pile tufts 61 are formed at points corresponding to depressed cam roller surfaces 36.

In Fig. 7 the cam roller 35 is mounted on a splined shaft 63 which is adapted to be oscillated by an arm 64 actuated by a link 65 driven by a crank arm 66 on the shaft 67 of a motor 68.

The roller 35 is also reciprocable axially on the splined shaft 63 by means of a grooved disc 70 mounted on a shaft 71 fixed to the end of the roller 35 and engaged by a forked arm 72 pivoted at 73 and reciprocated by a link 74 driven from a crank pin 75 carried by the shaft 76 of a motor 77. Obviously either the reciprocating motion or the oscillating motion may be used independently or the roller may be rotated as in Fig. 2. In any case the drive is synchronized with the fabric feed to produce the desired pattern.

The fabric backing of Figs. 6 and 7 is similar to that of Figs. 1 and 2. The fabric is characterized by areas 79 of uncut pile loops and areas 78 of cut pile tufts. The tufts are slightly higher than the uncut loops due to the straightening of the yarn after cutting, as shown in Fig. 6. The warpwise edges of the areas 78 and 79 would be wavy when the motor 77 is operating.

Fig. 11 shows a fabric of the type shown in Fig. 1, but with high uncut pile loops 80, low uncut pile loops 81 and low cut pile tufts 82. The wire for forming this fabric is shown in Figs. 12 and 13 as comprising a body 83 terminating at its trailing end in two arms 84 and 85. The arm 85 has a lower surface which is a continuation of the lower surface of the body and terminates in a flange 86 carrying a knife blade 87 positioned to cut the pile loops when exposed thereto. The arm 84, in its raised position (Fig. 13) has an upper surface forming a continuation of the upper surface of the body 83 and terminating in an upstanding flange 88 having a forward inclined surface 90 shaped to enlarge the pile loops and a top round surface 91 to engage the surface of the cam roller 35.

In weaving the wire 83 above described is alternated with standard wires 93. As a standard wire 93 is withdrawn an uncut row of low pile loops 81 is formed. As the next wire 83 is withdrawn either high uncut pile loops or low cut pile tufts are formed, depending upon the contour of the cam roller 35. When the surface 91 of the flange 88 is opposite a depressed area 36 of the cam roller 35 as in Fig. 13 the loops are enlarged by passing over the surface 90 which prevents them from coming in contact with the knife blade 87, thereby pulling out the preceding loop left by a standard wire 93 to leave a link 94.

When the surface 91 engages and is depressed by a raised surface 37 of the cam roller as in Fig. 12 the knife blade 87 is exposed to the pile loops and cuts the same to form the low cut pile tufts 82. A row of low uncut pile loops is formed adjacent each row of low cut pile tufts by the corresponding standard wires 93.

The embodiment of Fig. 14 illustrates a fabric having a backing similar to that of Fig. 1 and having a combination of high cut pile tufts 100 and low uncut pile loops 101. The wire for forming this fabric is shown in Figs. 15 and 16 as comprising a body 102 terminating at its trailing end in a thin flange 103 having a lower surface forming a continuation of the lower surface of the body and carrying a spring arm 104 terminating in a raised shoulder 105 shaped to enlarge the pile loops and a knife blade 106 positioned to cut the enlarged loops. A cam surface 107 engages the cam roller 35 to raise or lower the spring arm as in the previously described embodiments.

In weaving the spring wires 102 are alternated with standard wires 108. As each standard wire 108 is withdrawn it leaves a row of low uncut pile loops 101. As the spring wire 102 is withdrawn it leaves a low uncut loop or a high cut pile tuft depending upon the contour of the cam roller 35. For example, when the spring arm is raised the shoulder 105 enlarges the loop, thereby pulling out the loop previously formed by a standard wire 108, and the knife blade 106 cuts the enlarged loop. When the spring arm is depressed as in Fig. 15, the knife blade is held below the path of the loops and the wire operates as a standard wire to leave low uncut loops.

It is obvious that various combinations may be made of the above described wires to produce different design effects and that a few specific embodiments have been shown for purposes of illustration only. The invention is applicable to various uses as will be apparent to a person skilled in the art.

What is claimed is:

1. In a loom having means to form rows of pile loops over pile wires, a pile wire to be bound in said loops comprising a body portion over which said loops are to be formed carrying at its trailing end a spring arm normally flexed upwardly and having an upstanding flange above the level of said body portion, said flange being positioned to modify the condition of said pile loops when pulled through said loops in raised position and being adapted to pass through the pile loops without modification thereof when pulled in depressed position, and a cam member disposed above the row of loops from which said wire is to be pulled, said cam member having areas to depress said flange as the flange passes thereunder.

2. A loom, as set forth in claim 1, in which said cam member comprises a roller extending along and above said row of loops and means driving said roller.

3. The invention set forth in claim 2, in which said driving means causes rotation of said roller.

4. The invention set forth in claim 2, in which said driving means causes axial reciprocation of said roller.

5. The invention set forth in claim 2, in which said driving means causes oscillation of said roller.

6. A loom wire for forming pile loops in Wilton or velvet looms having a pattern cam, comprising a body portion having a surface over which pile loops are formed and carrying at its trailing end a spring arm normally flexed upwardly and having a surface extending above said body portion to modify the condition of said pile loops as the wire is drawn therethrough, said spring arm having at its trailing end a surface to engage and be depressed by said pattern cam and being of a height to pass through said loops without modification when said spring arm is depressed by said cam.

7. A loom wire, as set forth in claim 6, in which said arm carries a knife blade positioned to cut said pile loops when in raised position.

8. A loom wire, as set forth in claim 6, in which said arm includes a shoulder adapted to enlarge said pile loops.

9. A loom wire, as set forth in claim 6, in which said arm includes a shoulder to enlarge said pile loops and a knife blade positioned to cut said enlarged loops.

10. In a loom wire, as set forth in claim 6, a second

arm at said trailing end carrying a knife blade positioned to cut the pile loops when exposed thereto, said spring arm being retractible to expose said knife blade when depressed.

11. The method of making a pile fabric having pile loops formed over pile wires inserted into the warp shed, which comprises enlarging a portion only of the loops on a wire and cutting the remaining portion of the loops on said wire as the wire is withdrawn to form high uncut pile loops and low cut pile tufts.

12. The method of making a pile fabric having pile loops formed over pile wires inserted into the warp shed, which comprises enlarging a portion only of the loops on a wire and cutting another portion of the loops on said wire as the wire is withdrawn to form high uncut pile loops and low cut pile tufts.

13. The method of making a pile fabric which comprises forming a series of pile loops of uniform height over a single pile wire inserted in a warp shed and altering the condition of a selected portion only of the loops on said wire as the wire is withdrawn from the fabric.

14. The method of making a pile fabric which comprises forming a series of pile loops of uniform height over a pile wire inserted in a warp shed and enlarging a selected portion only of the loops on said wire while leaving the remaining portion of said loops low as the wire is withdrawn from the fabric, so as to form a combination of high and low pile loops of the same warp shed.

15. The method of making a pile fabric which comprises forming a series of pile loops of uniform height over a pile wire inserted in a warp shed and enlarging a selected portion only of the loops on said wire while leaving the remaining loops on said wire low and cutting said remaining loops as the wire is withdrawn from the fabric, so as to form a combination of high uncut pile loops and low cut pile tufts of the same warp shed.

16. The method of making a pile fabric which comprises forming a series of pile loops of uniform height over a pile wire inserted in a warp shed and enlarging and cutting a selected portion only of the loops on said wire and leaving the remaining loops on said wire low as the wire is withdrawn from the fabric, so as to form a combination of high cut pile tufts and low uncut pile loops of the same warp shed.

17. The method of making a pile fabric which comprises forming a series of pile loops of uniform height over a single pile wire having a knife at its trailing end inserted in the warp shed and causing said knife to cut a selected portion only of the loops on said wire as the wire is withdrawn from the fabric so as to form a combination of cut pile tufts and uncut pile loops of the same warp shed.

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