July 4, 1961 H. F. NOWICKI ET AL 2,990,792

INDUSTRIAL APPARATUS

Filed March 12, 1958

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FIG. 1.

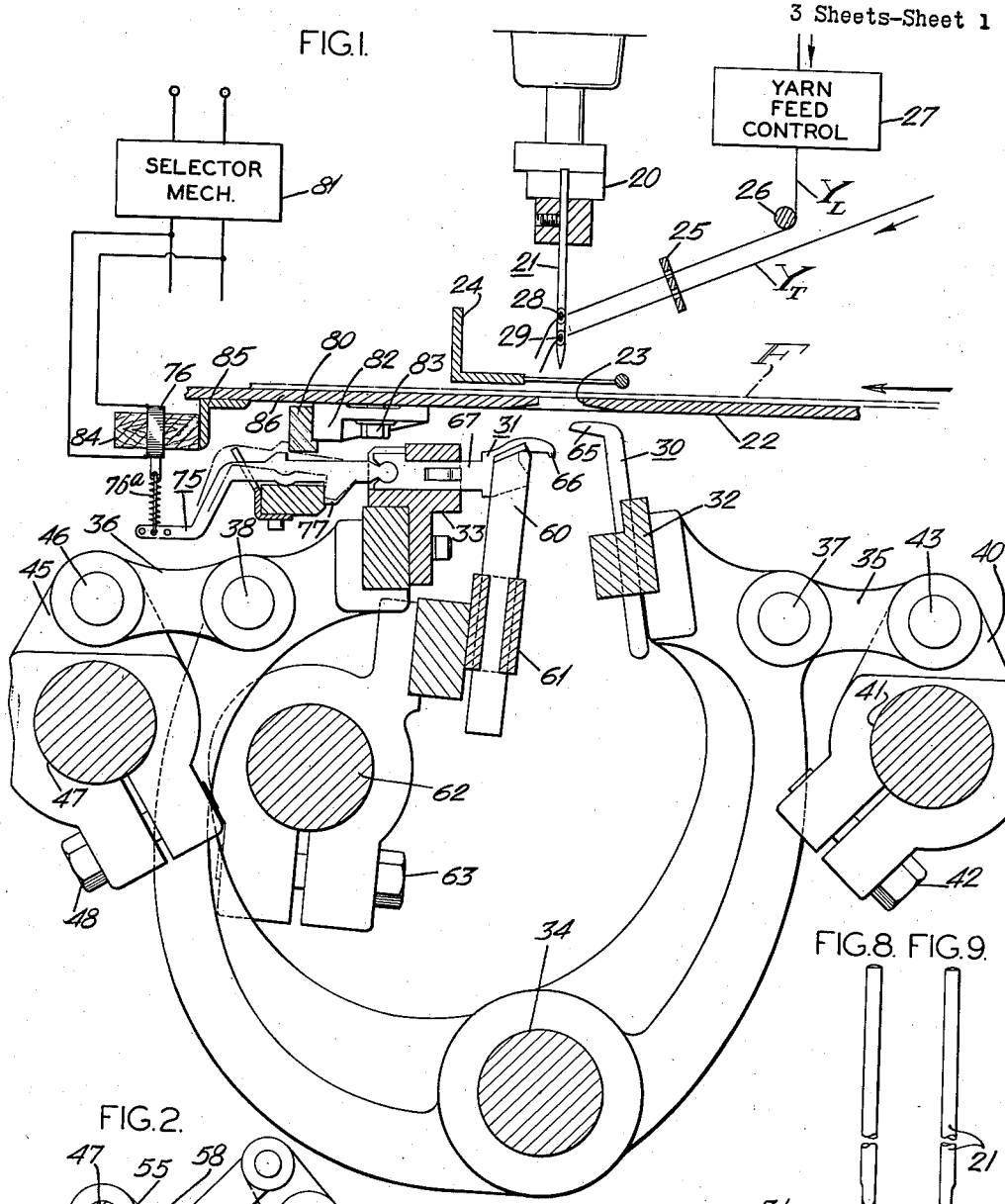


FIG. 2.

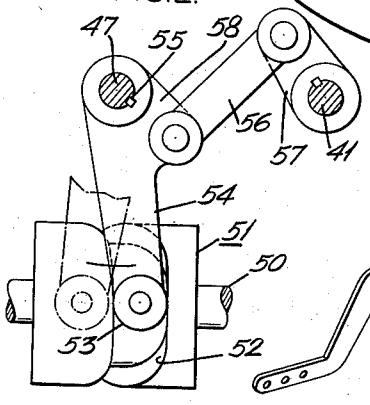


FIG. 7.

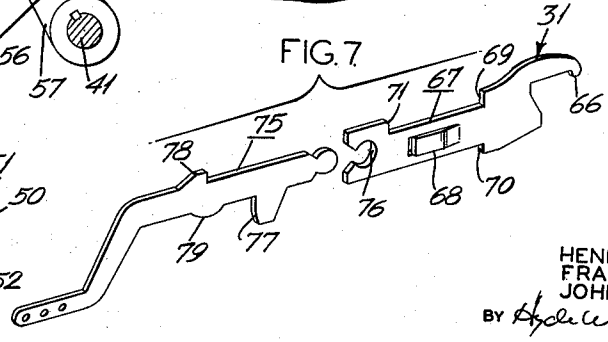


FIG. 8. FIG. 9.

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FIG. 10.

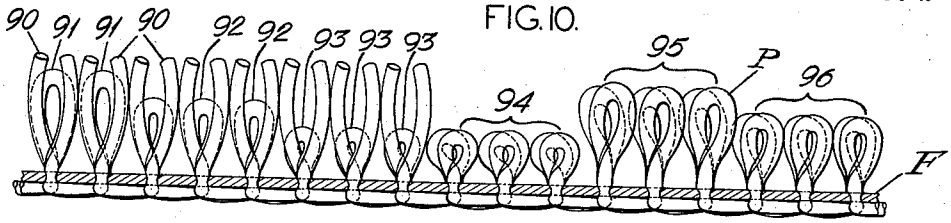


FIG. 3.

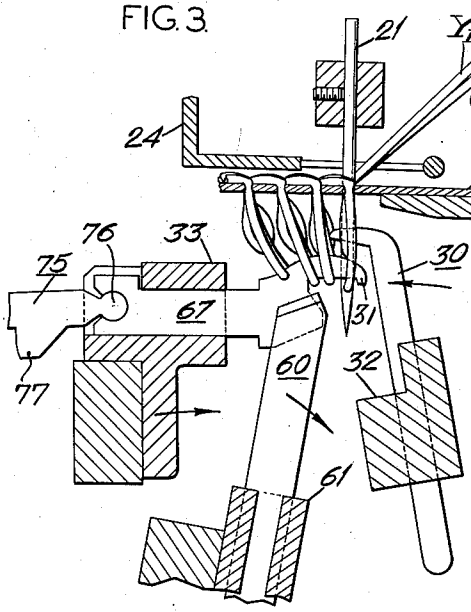


FIG. 4.

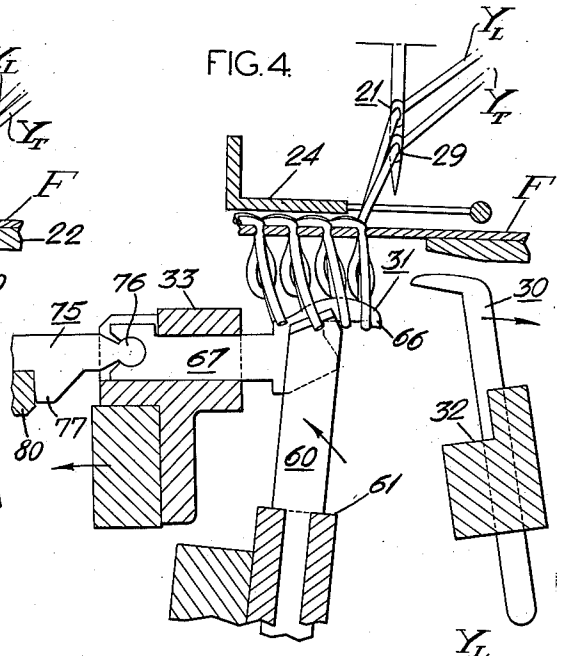


FIG. 5.

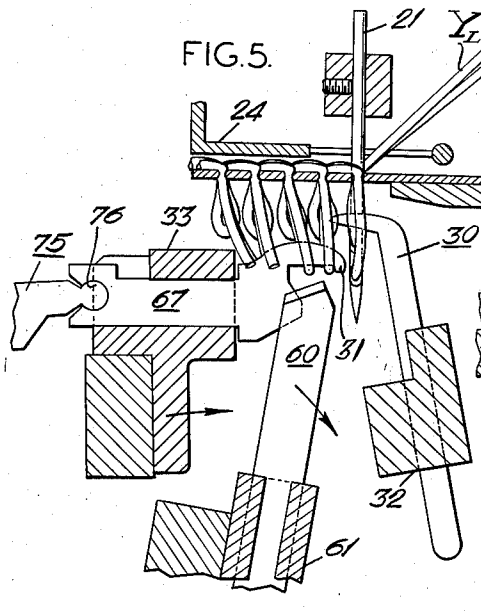
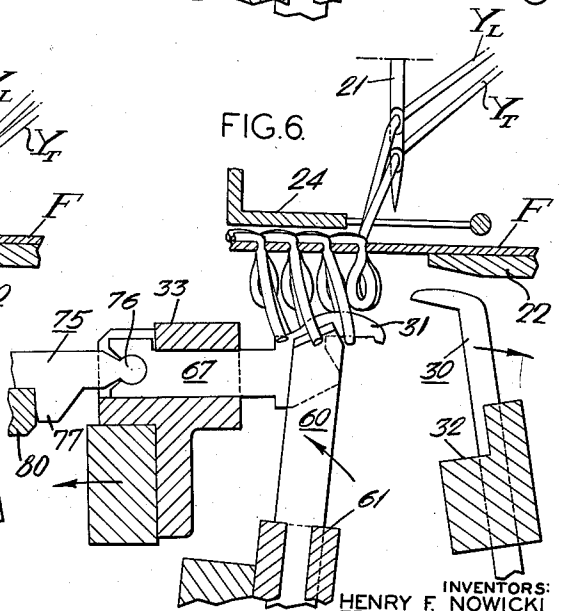


FIG. 6.



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FIG.15.

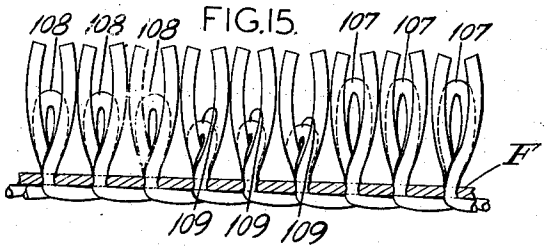


FIG.14.

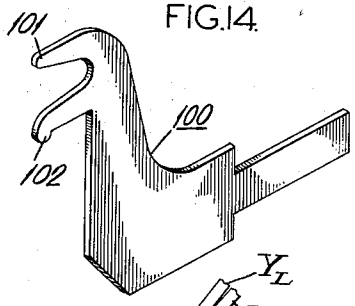


FIG.11.

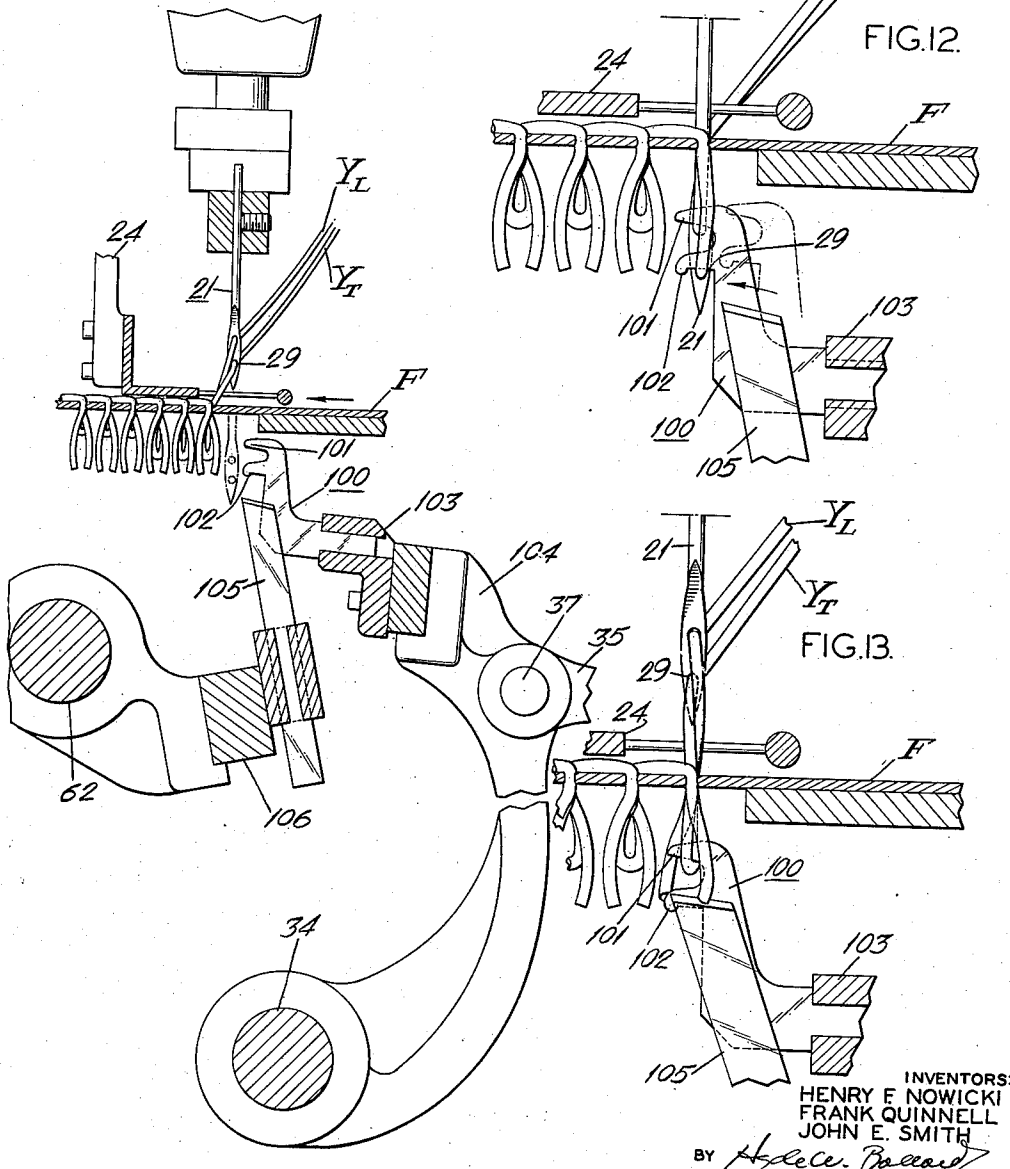


FIG.12.

FIG.13.

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INDUSTRIAL APPARATUS

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12 Claims. (Cl. 112—79)

This invention relates to method and apparatus for simultaneously and/or selectively producing cut and uncut pile in a tufted pile fabric such as a floor covering.

Since the introduction and increased acceptance of tufted rugs and carpets, efforts have been made to produce such a fabric having both cut and uncut pile without the necessity of passing the fabric through a tufting machine more than once. Because the loopers for producing uncut pile are differently shaped and face in the opposite direction than the loopers for producing the cut pile, no easy solution for this problem has been proposed. Tufted fabrics having cut and uncut pile but all produced with non-cutting loopers are disclosed and claimed in copending Thomas T. Janney and Adolph Klein application Serial No. 497,534 and copending Henry F. Nowicki application Serial No. 639,042, now Patent Nos. 2,876,525 and 2,884,680, respectively, which are illustrative of the development of the above desired fabric and method. It may be pointed out that while there are some advantages in a shearing operation to produce cut tufts in accordance with the teaching of the above applications, there are at least two very serious disadvantages; namely, the cost involved in running the fabric through an entirely separate apparatus which in turn requires maintenance, extra handling, etc.; second, there is a substantial waste in the expensive pile yarns since all the yarn which is sheared from the fabric is a total loss. The present invention completely overcomes these two disadvantages.

The present invention contemplates a tufting machine having a double looper arrangement operatively associated with a single set of tufting needles. Two separate pile yarn ends are stitched into the fabric either through a single eye or double eyes in each needle and the looper or loopers cooperate with the yarns fed to single needles to selectively form cut or uncut pile with one yarn and controllable height uncut pile projections with the other yarn. In a preferred form of the invention the loopers have oppositely facing bills and are actuated in timed relation to each other to simultaneously engage yarn ends threaded through separate eyes on each needle. In another form of the invention a single looper is provided with two bills one of which controls the cut pile and the other the uncut pile.

A primary object of the invention, therefore, is to provide in a pile fabric tufting machine looper, bills which cooperate with a plurality of yarn ends on the same needle to simultaneously produce cut and uncut pile projections.

A further object of the invention is to provide in a tufting machine of the type described means for selectively disengaging the cut pile looper.

A further object of the invention is to provide in a tufting machine of the type described means for selectively disengaging the cut pile looper and means for controlling the height of the uncut pile projections.

A further object of the invention is to provide in a cut pile tufting machine an articulated cut pile looper having means for selectively retaining the looper from engaging pile yarn.

A further object of the invention is to provide a double bill looper and a pile cutting element cooperating with one of the bills on said looper.

A further object of the invention is to provide a novel

method for simultaneously producing cut and uncut pile projections in the same row.

A further object of the invention is to provide a novel method of producing controllable height uncut pile projections in the same row.

Further objects will be apparent from the specification and drawings in which:

FIGURE 1 is a schematic sectional view of a preferred form of the invention showing simultaneously actuated but separate cut and uncut pile loopers,

FIGURE 2 is a detail showing the actuating mechanism for the looper shafts of FIGURE 1,

FIGURES 3 and 4 show successive steps in the operation of the loopers of FIGURE 1 when producing cut and uncut pile simultaneously,

FIGURES 5 and 6 show the operation of the loopers of FIGURES 3 and 4 when producing only uncut pile,

FIGURE 7 is a perspective of the cut pile looper of FIGURE 1,

FIGURE 8 shows a tufting needle in which the loopers engage the yarns from opposite sides of the needle,

FIGURE 9 shows a needle similar to FIGURE 8 but with loopers operating on the same side of the needle,

FIGURE 10 is a fabric diagram taken on a longitudinal section illustrating the various types of pile projections which can be produced in accordance with the invention,

FIGURE 11 is a schematic diagram showing a modified form or dual bill looper,

FIGURES 12 and 13 are enlarged details showing successive steps in the operation of the looper of FIGURE 11,

FIGURE 14 is a perspective of the looper of FIGURES 11–13, and

FIGURE 15 is a sectional view of a fabric produced with the mechanism of FIGURES 11–14.

The invention comprises essentially the provision of one or more tufting needles in a tufting machine for pile fabrics at least some of which carry two pile yarn ends simultaneously through a backing fabric where each yarn end is engaged by one or two loopers depending upon whether it is desired to simultaneously tuft cut and/or uncut pile projections in the same row with each of the said yarn ends. A cut pile looper is positioned to engage one of the yarns carried by the needle, and in one form of the invention, means are provided for selectively retracting the cut pile looper in accordance with a predetermined pattern when it is desired to provide completely uncut pile in a chosen area. In addition, an uncut pile looper without a knife is positioned to engage the other of the yarn ends carried by the needle to provide uncut pile projections at all times, but the uncut pile projections are controllable as to height in accordance with a predetermined pattern. The cut and uncut pile loopers may work in opposite directions or in the same direction in accordance with the invention.

A conventional tufting machine shown schematically in FIGURE 1 is provided with a vertically reciprocating needle bar **20** carrying one or more needles **21**. In a broad tufting machine there may be as many as 1200 of the needles carried in the same needle bar. A ground fabric F is fed over a throat plate **22** having a throat **23** where it is pierced by the needles **21** to produce the pile projections P on one side of fabric F. The machine is provided with the customary presser foot **24**, yarn guides **25** and **26** for the cut pile yarn Y_T, and the uncut or loop pile yarn ends Y_L which are drawn from a source not shown such as a creel. A conventional pattern attachment **27** is used for supplying loop pile yarn Y_L, such devices being well known in the art, examples of which may be found in United States Patent No. 2,782,905 and British Patent No. 780,370.

All or a selected number of the needles **21** are provided with two eyes **28** and **29** through which the loop yarn

ends Y_L and the tuft yarn ends Y_T are threaded respectively. The eyes **28** and **29** are in spaced vertical relation to each other on the needle so that the uncut yarn looper **30** engages the yarn Y_L carried through the needle eye **28**, whereas the cutting yarn looper **31** normally engages the yarn Y_T carried through needle eye **29**. Loopers **30** and **31** are mounted in looper brackets **32** and **33** respectively both of which are journaled on a shaft **34** under the throat **22** of the tufting machine. The loopers oscillate in timed relation with each other so that they engage the yarns Y_L and Y_T at substantially the same time when the needles **21** are inserted through the fabric F. The detailed operation and cooperation of the loopers with the pile yarns Y_L and Y_T will be explained more fully in connection with FIGURES 3–6.

Actuation of the brackets or rocket arms **32** and **33** is achieved by means of connecting links **35** and **36** attached to the brackets **32** and **33** respectively by pins **37** and **38**. The opposite end of link **35** is connected to a crank **40** clamped to shaft **41** by means of a capscrew **42**. A pin **43** provides pivoting connection between the link **35** and crank **40**. In a similar manner link **36** is connected to a crank **45** by means of pin **46** and the crank **45** is clamped to shaft **47** by means of capscrew **48**. It will be understood that we have shown and described the mechanism associated with a single needle **21**. However, the identical apparatus is duplicated for as many of the needles on the tufting machine as it may be desired to operate in accordance with the present invention. A driven shaft **50** of the tufting machine is provided with a barrel cam **51** having a cam track **52** which controls cam follower **53** attached to lever **54** (FIGURE 2). Lever **54** is keyed to shaft **47** at **55** and also actuates shaft **41** through a connecting link **56** pivotally attached to lever **57** on shaft **41** and lever **58** on shaft **47**. It will thus be apparent that oscillation of lever **54** simultaneously rocks shafts **41** and **47** in opposite directions so that the oppositely facing loopers **30** and **31** simultaneously engage yarns Y_L and Y_T. The cutting loopers **31** cooperate with oscillatable knives **60** which are mounted in the bracket **61** clamped to rockshaft **62** by capscrew **63**.

The mounting of the cut pile and uncut pile loopers shown in FIGURE 1 insofar as the facing directions of bill **65** on looper **30** and bill **66** on looper **31** is generally conventional since these bills face in opposite directions, It will be understood that all pile projections in the form of loops engaged on the bill **66** of looper **31** must be cut in order to permit the fabric to progress from right to left as shown in FIGURE 1. Where, however, it is desired to omit the cut pile in selected areas, we provide means for retracting the loopers **31** or any selected number of them so that the bill **66** will not engage any newly formed pile loops. For this purpose we utilize an articulated looper assembly shown clearly in FIGURE 7 in which the main looper body **67** is provided with a dimple or lancing **68** which presses against the side of a slot in looper bracket **33**. The upper edge of the looper body **67** is provided with two "retracted" limit stops **69** and **70** and one "extended" stop **71**. These stops permit limited travel of the looper **67** in the looper bracket **33**. An articulated extension **75** is connected to the looper body **67** at **76** so that limited up and down pivotal movement of the extension **75** with respect to the looper body **67** is permitted. A lower limit stop **77** is provided on extension **75** together with an upper limit stop **78**. A bearing **79** provides sliding contact between the extension **75** and the bottom of a slot in stationary bracket **80**. The extremities of element **75** are pivotally and resiliently connected to a small solenoid **76** by means of a spring loaded link **76***a*.

The solenoids **76** are in turn energized and de-energized by a conventional pattern attachment **81** in accordance with well-known practice. When a solenoid **76** is energized, extension **75** is elevated as shown in broken lines in FIGURE 1 so that limit stop **78** is hooked under and in back of bracket **80**. This holds the looper **67** in a retracted position so that the oscillation of looper bracket **33** will not carry such a retracted looper forward to engage yarn Y_T carried by needle **21**. The support for the looper extension **75** is shown as a bracket **82** secured to the bottom of throat plate **22** by means of bolts **83**. The solenoids **76** are supported from the throat plate by means of a bracket **84** and angle iron **85**. The tufted fabric is carried over the section of the bed plate **86** which supports the members **82**—**85** so that no interference with the pile projections takes place.

Referring now to FIGURES 3 and 4, when the needle or needles **21** are inserted to their maximum depth through the fabric F, the loop yarn Y_L on each needle is engaged by its associated looper **30** and the cut yarn Y_T is engaged by the cutting looper **31**, the latter looper oscillating in an arcuate path below the path of oscillation of looper **30**. When a series of loops of the yarn Y_T has been engaged on the bill **66** of looper **31**, the oscillating action of knife **60** severs the farthest loop or loops to produce cut pile in the conventional manner. FIGURE 3 shows the knife retracted and FIGURE 4 shows the knife **60** advanced to cut the farthermost loop to form tufts **90**. During this relatively normal operation of the loopers yarn Y_L may be controlled to produce any height pile as shown in FIGURE 10. Also, the loopers **31** oscillate with their brackets **33** so that all of the yarn tufted through the needle eye **29** is converted into tufts **90** of substantially the same height.

Where the pattern requires no cut pile projections, a pattern tape or other selector mechanism **81** energizes solenoid **76** to lock the extension **75** behind the bracket **80** thus holding the cutting looper **31** in a stationary retracted position while the bracket **33** continues to oscillate against the friction of the dimple **68**. As long as loops of yarn Y_T still remain on the bill **66** of looper **31**, they will be gradually cut by knife **60** as shown in FIGURES 5 and 6 even though the looper itself fails to engage more yarn. FIGURE 5 shows the bill **66** of looper **31** missing the first loop on the needle **21** of yarn Y_T. However, since yarn Y_T is not caught by looper **31**, it will be picked up by the bill **65** of looper **30** so that when we are not producing cut tufts for pile, the uncut loops, whether high, low, or intermediate, will be the same height in each row since they are both caught by the same looper. Both effects are shown in FIGURE 10. Cut tufts **90** are stitched in the same longitudinal row as are high loops **91**, intermediate loops **92**, and low loops **93**. Where the cutting looper **31** for this particular row is retracted, then we have double low loops **94**, **94**, double high loops **95**, **95**, and double intermediate loops **96**, **96**. This permits a wide range of pattern effects to be accomplished particularly in view of the fact that the range occurs or may occur in each row of stitches. Under certain circumstances it may be desirable to thread the needles so that every other row, every third row, or every row is capable of simultaneously producing cut and uncut pile or variable height uncut pile with two loops per row.

A similar but somewhat more limited result may be achieved with the use of a single looper **100** (FIGURE 14) having an upper non-cutting bill **101** and a lower cutting bill **102**. This looper is held in oscillating looper bracket **103** which is in turn bolted to bracket **104**, journaled on shaft **34**, and actuated by link **35** and pin **37**. A knife **105** is adjustably mounted in a bracket **106** which in turn is controlled by shaft **62** in much the same manner illustrated and described in FIGURE 1. However, in FIGURE 11 the knife **105** cooperates with the looper **100** on the opposite side of the needle and, contrary to usual practice, the cutting looper bill **102** faces in the direction of fabric travel rather than against it.

The standard yarn feed control **27** is used to provide uncut pile in the form of loops of different controllable heights shown in FIGURE 15 as high loops **107**, **107**,

intermediate loops **108**, **108**, and low loops **109**, **109**. In effect, the operation and control of the height of the uncut pile supplied or made up from yarn Y_L is generally conventional. Simultaneously, however, cut tufts are made with the yarn Y_T fed through the lower eye **29** of needles **21**. The bill **102** of looper **100** picks up one loop at a time and the presser foot **24** assists in holding the stitches of the cut pile ends Y_T from pulling through. In addition, the tufting machine is so timed that the needles **21** are substantially withdrawn from the fabric before the cut is made. This is shown in FIGURES 12 and 13 in which both loopers are brought into engagement with their respective yarns Y_L and Y_T. The bills **101** and **102** on the looper **100** remain engaged with the loops until the needle **21** has been fully raised, whereupon the knife **105** oscillates to cut the particular pile yarn which has just been tufted. The height of the tip of needle **21** at the time the yarn Y_T was cut is sufficient to provide enough slack yarn between the eye **29** and the top of fabric F to provide the next tuft without substantially pulling back the previously cut tuft. In this way it is possible to produce a fabric having constant height high tufts and loops in the same row of contrasting color yarn as well as differential in height.

The invention is relatively simple and satisfactory in operation, provides a wide variety of pattern effects to be achieved, and above all, permits the production of cut and uncut tufted pile selectively and simultaneously.

Having thus described our invention, we claim:

1. Apparatus for simultaneously producing cut and uncut tufted pile fabric comprising a reciprocating needle bar, a plurality of pile yarn needles carried in said needle bar adapted to insert two pile yarns through a ground fabric, two eyes near the extremity of each of said needles through which the pile yarns are threaded an uncut pile looper oscillatably mounted to engage the yarn threaded through one of said eyes, a cut pile looper oscillatably mounted to engage the yarn threaded through the other one of said eyes in each needle, means for oscillating said loopers in timed relation to reciprocation of the needles, and a knife operatively associated with the cut pile looper for severing pile yarns engaged on said cut pile looper.

2. Apparatus in accordance with claim 1 in which both of the loopers comprise integrally formed bills facing in the same direction and mounted on an oscillating looper rockshaft, and cutting means operatively positioned with respect to one of said bills to cut pile loops engaged by said bill.

3. Apparatus in accordance with claim 1 in which the loopers are positioned to engage the pile yarn carried by the needle from the same side.

4. Apparatus in accordance with claim 1 in which the loopers are positioned to engage the pile yarn carried by the needle from opposite sides.

5. Apparatus in accordance with claim 1 having means for oscillating the knife.

6. Apparatus in accordance with claim 1 in which the loopers are individually journaled on a common shaft, and link means for oscillating each of the loopers simultaneously on said common shaft.

7. Apparatus in accordance with claim 1 having means for retracting selected cut pile loopers from engaging the yarn carried by the needles in accordance with a predetermined pattern.

8. Apparatus in accordance with claim 7 in which the looper disengaging means comprises an articulated extension connected to each looper, a friction driving connection between each looper and its associated oscillating means, a solenoid for pivoting the articulated extension with respect to the looper, a latch engageable by the extension on energization of the solenoid to retain the looper and extension in a retracted position, and a pattern selector mechanism for energizing the solenoid in accordance with a predetermined pattern.

9. Apparatus for simultaneously producing cut and uncut tufted pile fabric comprising a reciprocating needle bar, a plurality of pile yarn needles carried in said needle bar adapted to insert two pile yarns through a ground fabric, two eyes near the extremity of each of said needles through which the pile yarns are threaded said eyes being in axial spaced relation to each other on the shank of the needle, an uncut pile looper oscillatably mounted to engage the yarn threaded through one of said eyes, a cut pile looper oscillatably mounted to simultaneously engage the yarn threaded through the other one of said eyes in each needle, means for oscillating said loopers in timed relation to reciprocation of the needles, and a knife operatively associated with the cut pile looper for severing pile yarns engaged on said cut pile looper.

10. Apparatus in accordance with claim 9 having means for oscillating the knife.

11. Apparatus in accordance with claim 9 in which the loopers are individually journaled on a common shaft, and link means for oscillating each of the loopers simultaneously on said common shaft.

12. Apparatus in accordance with claim 9 having means for retracting selected cut pile loopers from engaging the yarn carried by the needles in accordance with a predetermined pattern.

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