Sept. 23, 1958 C. C. MINCHER ET AL 2,853,103

METHOD OF MAKING PILE FABRIC

Filed Oct. 20, 1954 4 Sheets-Sheet 1

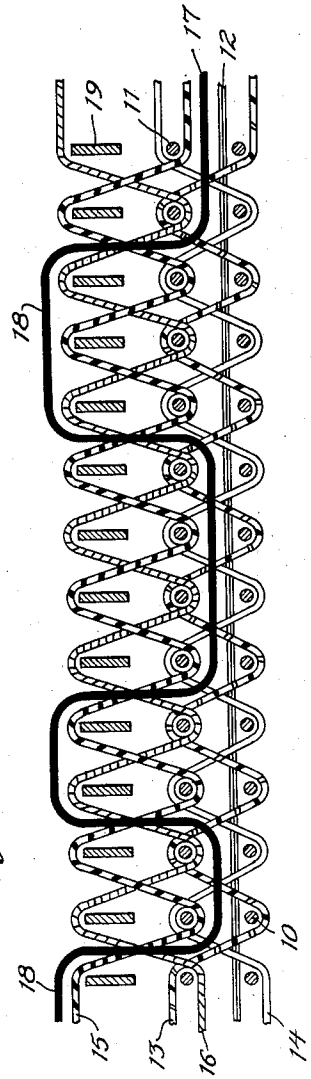


Fig. 1.

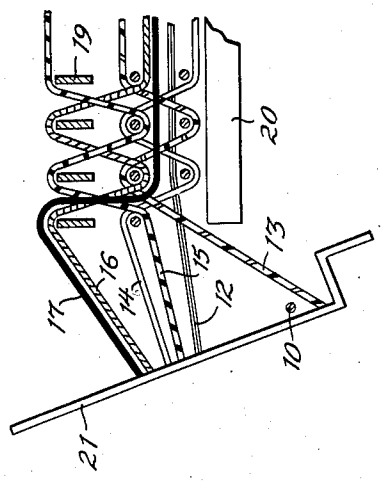


Fig. 3.

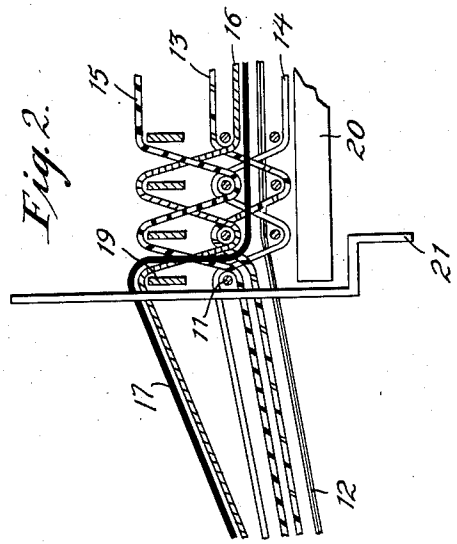


Fig. 2.

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Filed Oct. 20, 1954 4 Sheets-Sheet 2

Fig. 6.

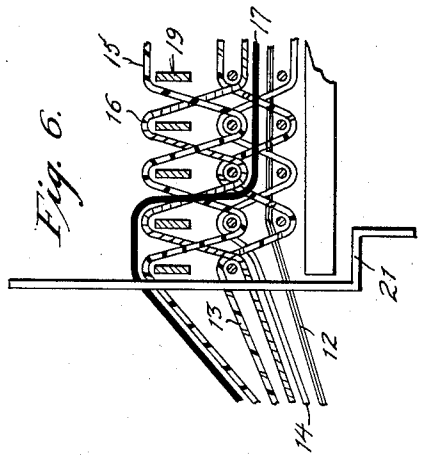


Fig. 9.

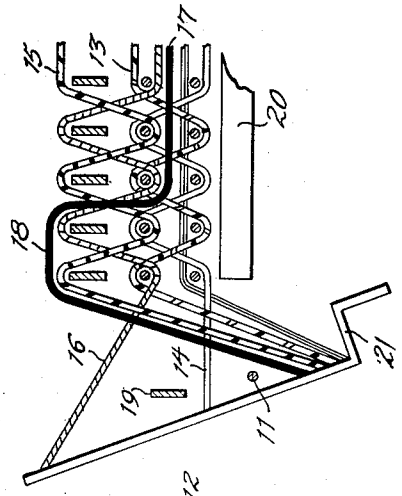


Fig. 5.

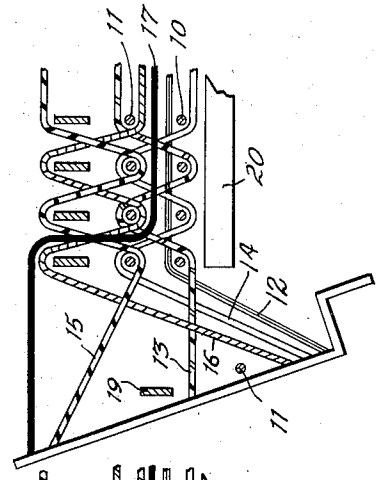


Fig. 8.

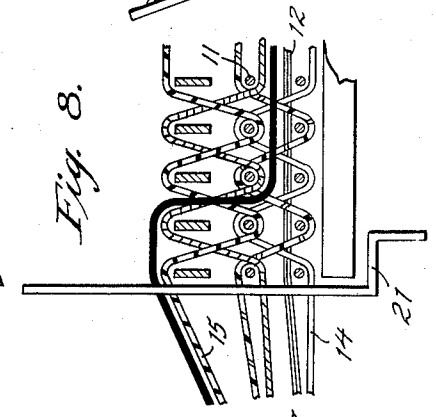


Fig. 4.

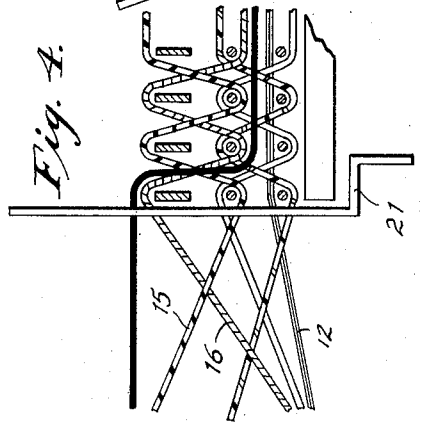
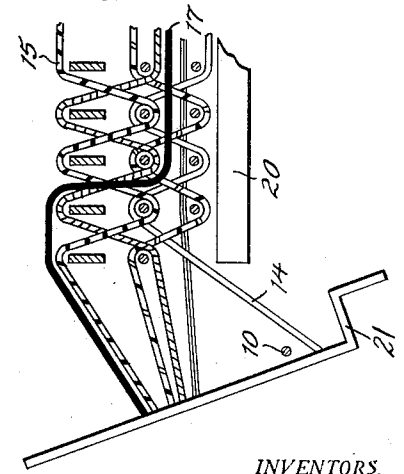


Fig. 7.



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Sept. 23, 1958 C. C. MINCHER ET AL 2,853,103

METHOD OF MAKING PILE FABRIC

Filed Oct. 20, 1954 4 Sheets-Sheet 3

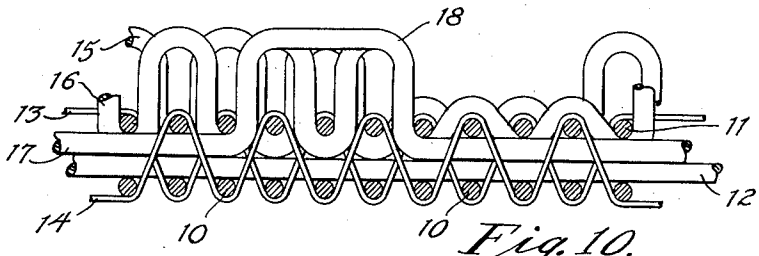


Fig. 10.

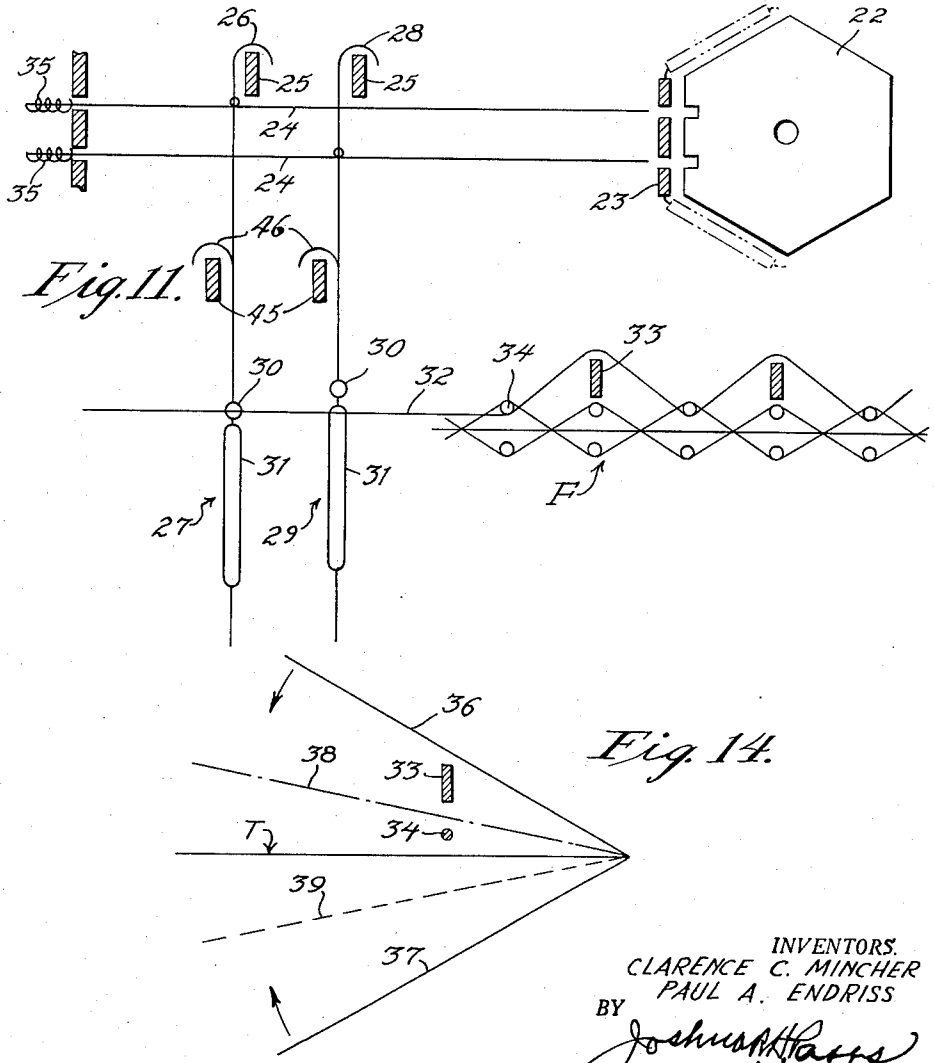


Fig. 11.

Fig. 14.

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Sept. 23, 1958 C. C. MINCHER ET AL 2,853,103

METHOD OF MAKING PILE FABRIC

Filed Oct. 20, 1954 4 Sheets-Sheet 4

Fig. 12.

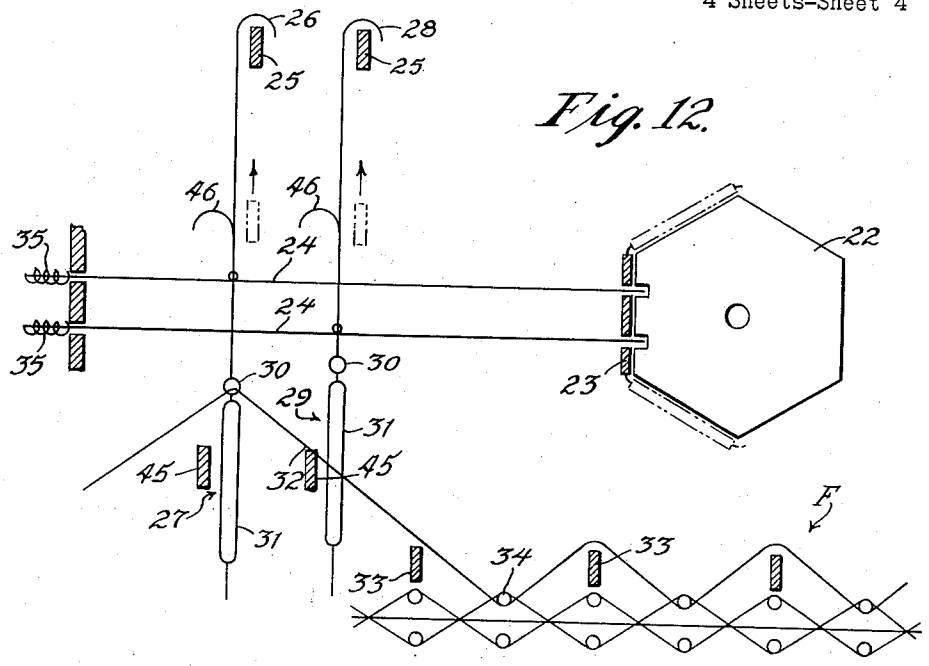
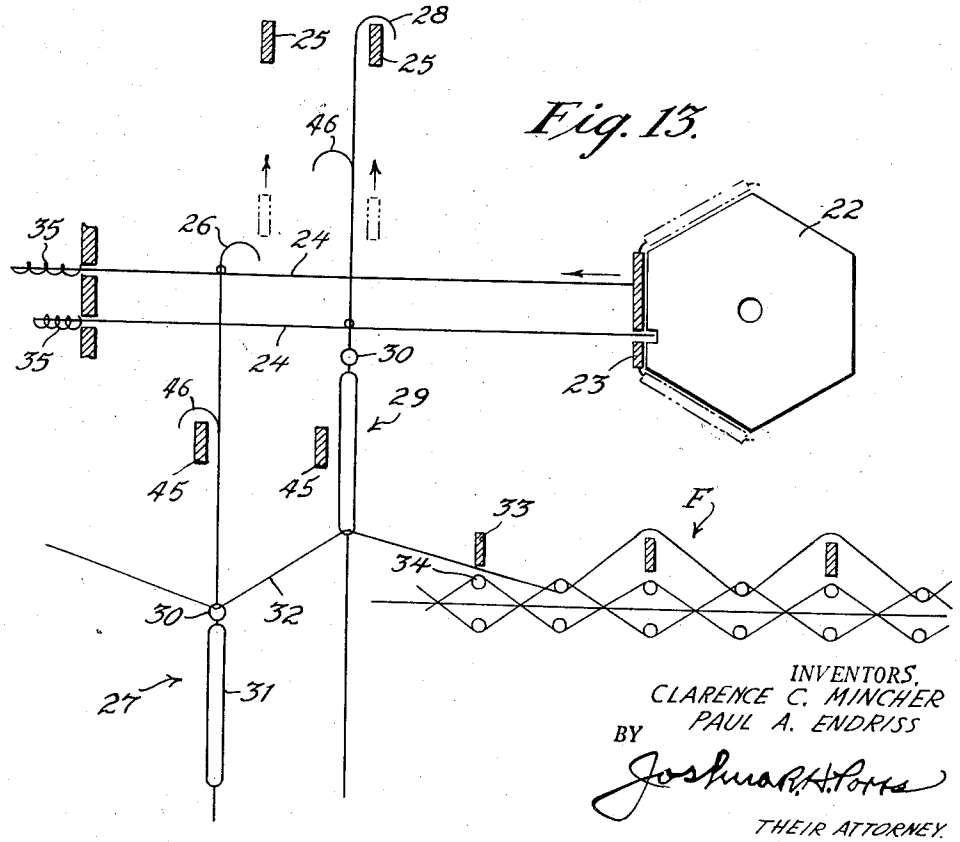


Fig. 13.



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United States Patent Office 2,853,103
Patented Sept. 23, 1958

2,853,103

METHOD OF MAKING PILE FABRIC

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Application October 20, 1954, Serial No. 463,484

7 Claims. (Cl. 139—39)

This application is a continuation-in-part of our co-pending application, Serial Number 248,572, filed September 27, 1951, now abandoned, for improvements in a "Pile Fabric."

The present invention relates to pile fabrics of the type commonly employed in the manufacture of carpet and rugs and to a novel method for making such fabrics.

The weave of the present invention is of the same general type as the old and well-known Wilton weave, which is fully disclosed in United States Patents Numbers 760,985 and 760,986. In the Wilton weave a stuffer, which is included as a part of the warp, is located between the upper and lower layers of the filling which comprises the weft. The warp also includes the binders which are woven in with the filling and the pile yarns which provide the short pile loops and the long pile loops. Generally speaking, the long pile loops assume a raised position relative to the ground, and provide a desired decorative pattern. One feature which characterizes the old Wilton weave is that the short pile loops are bound in under every pick of the upper filling layer. This means that there is an open space above the picks of the upper filling layer, except for those portions which are covered by the long pile loops.

With the foregoing in mind, the present invention has in view as its foremost objective the provision of a pile fabric weave of the type indicated wherein the normally open spaces above the upper filling layer are covered. To accomplish this, two or more sets of warp yarns are used which are selectively raised to pass over one or more pile wires for producing ground pile loops and raised extended pile loops, respectively, and are floated above the picks of the upper filling layer so as to leave no open spaces. The present disclosure will be described in terms of three sets of warp yarns; however, it is to be understood that the invention is not to be limited to such an embodiment.

More specifically, in the present invention, two of the warp yarns are selectively raised so as to alternately pass over alternate single pile wires and picks of the upper filling layer and are bound in under adjacent picks of said upper layer providing the ground pile loops of the fabric. The third warp yarn is selectively raised to pass over two or more pile wires so as to provide a pile loop of greater extent, the said third warp being floated beneath the picks of the upper filling layer when not selected. Ordinarily, when the two warp yarns forming the ground pile loops are not selected, they are floated beneath the picks of the upper filling layer or are bound in to the back of the fabric, providing undesirable open spaces on the face of the fabric. By the present invention, the raising and lowering of these yarns is controlled so that each of the two warp yarns when not selected is floated over alternate picks of the upper filling layer and bound in or floated underneath adjacent picks of the upper layer. In this manner, the open spaces in the face of the pile fabric are covered at all times notwithstanding the fact that the two warp yarns have not been selected for forming ground pile loops.

It is to be noted that the selection of the individual warp yarns for forming the pile loops is carried out by the conventional jacquard mechanism, although the controlling of the raising and lowering of the warp yarns so as to float over the picks of the upper filling layer lies within the purview of the present invention.

The invention therefore comprises a pile fabric fabricated in a novel manner so as to provide a weave consisting of a weft made up of two layers of picks constituting an upper filling layer and a lower filling layer, and a warp comprising a stuffer interposed between the filling layers with binders passing over alternate picks of the upper and lower layers, a pair of ground pile warps forming ground pile loops and floats over the picks of the upper filling layer, and a third pile warp providing extended pile loops.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings wherein similar numerals refer to similar parts throughout the several views.

Figure 1 is a view, largely diagrammatic, taken as a longitudinal section through a pile fabric that is woven in accordance with the precepts of this invention, showing the wires in position and the various yarns distended.

Figure 2 is another diagrammatic view taken as a section through the fabric on the loom where the reed is located, and bringing out one step of the weaving operation.

Figure 3 is a diagrammatic view similar to Fig. 2, illustrating the formation of the shed for shooting a pick of the lower filling layer.

Figure 4 is another diagrammatic view, illustrating the relative position of the yarns after the reed has "beat up" the shot of Fig. 3.

Figure 5 is still another diagrammatic view of the same general type showing the formation of the shed for shooting a wire and a pick of the upper filling layer.

Figure 6 is another diagrammatic view depicting the relative position of the elements after the reed has beat up the shot of Fig. 5.

Figure 7 is a diagrammatic view illustrating the formation of the shed for shooting the next pick of the lower filling layer.

Figure 8 is a diagrammatic view showing the shot of Fig. 7 beaten up.

Figure 9 is a diagrammatic view illustrating the formation of the shed for shooting a wire and the next pick of the upper filling layer. It is this shot which is represented as being beaten up in Fig. 2.

Figure 10 is a longitudinal section through a fabric made in accordance with the method of the present invention, illustrating a composite portion of the fabric having ground pile loops, raised extended pile loops, and floats over the picks of the upper filling layer eliminating open spaces in the face of the fabric.

Figure 11 is a schematic diagram showing a conventional jacquard mechanism for producing a fabric of the Wilton weave type, and illustrating the arrangement of the hooks and heddles and the threading of the yarn ends therethrough for carrying out the present method.

Figure 12 is a schematic diagram similar to Fig. 11, but showing the jacquard as selecting the hook and heddle for producing a pile loop over a pile wire.

Figure 13 is a schematic diagram similar to Fig. 12, but showing the jacquard as selecting the hook and heddle for producing floats over the picks of the upper filling layer.

Figure 14 is a diagrammatic view illustrating the relative positions of the lash and grate of the jacquard, the

point of indexing by the present method, and the heights to which the yarn ends are raised for producing pile loops and floats above the picks of the upper filling layer.

Referring now to the drawings, and first more particularly to Fig. 10, the weave embodied in the pile fabric made by the method of the present invention is illustrated as consisting of a warp and a weft. The weft is made up of a lower layer of filling represented by the picks **10** and an upper layer of filling represented by the picks **11**. Between these two layers of filling there is interposed a stuffer **12**, which is a part of the warp.

Interwoven with the upper and lower layers of the filling are binders **13** and **14**. It will be noted that the binder **13** passes on the outside of alternate picks **10** and **11**, and this is also true of the binder **14**, with the latter passing on the outer side of those picks between those which are encompassed by the binder **13**.

The warp also includes a pair of ground pile warps represented at **15** and **16**, respectively. Each of these ground pile warps provides short ground pile loops and floats over the upper filling layer to cover the open spaces between picks, the ground pile warp **15** being bound in under alternate picks **11** of the upper filling layer with the ground pile warp **16** being bound in under the remaining alternate picks **11**. With this arrangement there is a loop of either one of the ground pile warps **15** and **16** over every pick **11** of the upper filling layer so as to eliminate any open spaces in the face of the fabric; and when the said warps have not been selected by the jacquard for loops, the floating thereof over the picks **11** further eliminates open spaces in the face of the fabric.

A third pile warp **17** provides the long extended pile loops **18**. Each of these extended pile loops **18** is selectively controlled by the jacquard to pass over two or more wires **19**, as illustrated in Fig. 1, presenting a raised pattern effect when the wires are removed. Actually, the loops **18** stand higher than the ground pile loops **15** and **16** due to the greater length of yarn in the loop between the picks **11** that bind it in, as compared with the loops **15** and **16**.

Referring now to Figs. 2 to 9, inclusive, a complete cycle of operation in the weaving of the pile fabric described above is shown. In these figures, the table of the loom is represented at **20** and the reed at **21**. Figure 2 shows the relative positions of the several yarns after the reed **21** has beat up the pick **11**, of the upper filling layer, and the wire **19** under the ground pile warp **16** and extended pile warp **17**.

In the next phase of the operation, shown in Fig. 3, the binder warp **13** is lowered so as to form a lower shed for receiving the shot of the pick **10** in the lower filling layer. It will be noted that the lower side of the shed is formed by the binder **13** alone, while the upper side is formed by the stuffer **12**, ground pile warp **15**, binder warp **14**, ground pile warp **16**, and extended pile warp **17**.

With the binder warp **13** thus lowered, the pick **10** is shot in the lower shed formed thereby, whereupon the reed **21** beats up the said pick so as to lie below the pick **11** of the upper filling layer, as shown in Fig. 4.

Next, the ground pile warp **15** and extended pile warp **17** are selectively raised by the jacquard in readiness for insertion of the pile wire **19** therebeneath, the ground pile warp **16**, binder warp **14**, and stuffer **12** being lowered to form a lower shed for receiving the shot of pick **11** of the upper filling layer, as shown in Fig. 5. The pile wire **19** and pick **11** are inserted almost simultaneously and are beat up by the reed **21**, as shown in Fig. 6, the ground pile warp **15** passing over a single wire **19** and the extended pile yarn **17** passing over a second consecutive wire so as to form a long extended loop **18**.

The reed **21** is next retracted and the binder warp **14** lowered to form a lower shed for receiving the shot of pick **10** of the lower filling layer, as shown in Fig. 7,

whereupon the reed again beats up the pick **10** so as to lie below the pick **11** as in Fig. 8.

In the next phase of the operation, shown in Fig. 9, the extended pile yarn **17** which has formed a long pile loop **18** is floated beneath the picks **11** of the upper filling layer. To accomplish this, the pile yarn **17** is lowered, together with the ground pile warp **15**, binder warp **13**, and stuffer **12**, forming a lower shed for receiving the shot of pick **11**; and the ground pile warp **16** is selectively raised to form an upper shed for receiving the wire **19**. Thus, when the reed **21** beats up the shot of pick **11** and the wire **19**, the pile yarn **17** will float beneath the pick **11** and will remain in such position until again selectively raised by the jacquard.

With the pile yarn **17** thus floated beneath the picks **11** of the upper filling layer, it may be desirable to eliminate some of the ground pile loops of the ground pile warps **15** and **16** to produce a decorative pattern. At the same time it is desirable to float these warps **15** and **16** above the picks **11** of the upper filling layer, at locations spaced from the showing of Fig. 10, so as to eliminate open spaces in the face of the fabric. This is accomplished by a selective raising of the yarns to a controlled height above the table **20** of the loom, so as to pass above the picks **11** but under the wires **19**. The means by which a given yarn end may be made to form a pile loop or to float above the picks of the upper filling layer is depicted schematically in Figs. 11 to 14, inclusive.

Referring to Fig. 11, a conventional jacquard is shown schematically therein as including a cylinder **22**, index cards **23**, needles **24**, griff elements **25**, pile hooks **26**, pile heddles **27**, float hooks **28**, and float heddles **29**. Each of the heddles **27** and **29** has an eye **30** and an elongated loop **31**. The griff elements **25** are those parts of the jacquard which engage the hooks to raise the griff. A yarn end **32** is shown as being threaded through the eye **30** of the heddle **27** and through the loop **31** of the heddle **29**. In Fig. 11, the hooks **26** and **28** are shown in position over the griff elements **25** prior to selection by the index card and cylinder **22**. It will be noted that the cylinder **22** is out of engagement with the card **23**. A portion of fabric F is shown with the yarn end **32** passing over pile wires **33** and under picks **34** of the upper filling layer.

In forming a pile loop, the cylinder **22** moves transversely in the direction shown by the arrow in Fig. 12 so as to contact the index card **23** and move said card transversely also. To "select" hooks **26** and **28** for forming pile loops, the card **23** is provided with apertures which permit the needles **24** which control the said hooks to pass therethrough so as to be unaffected by the transverse movement of the cylinder and index card. The hooks **26** and **28** thus remain seated upon the griff elements **25**. As the griff elements rise, the hook **26** and heddle **27**, and the hook **28** and heddle **29**, will be lifted as shown in Fig. 12. It will be noted that the eye **30** of the heddle **27** through which the yarn **32** is threaded is effective in raising the said yarn to a position to permit the passage of a wire **33** therebeneath for forming a pile loop. The elongated loop **31** of the raised float heddle **29**, meanwhile, has no effect on the yarn end **32** since the said yarn end merely slides freely within said loop, as shown. After a pile wire **33** is inserted beneath the thus-raised yarn end **32**, the griff elements **25** are lowered and the cylinder **22** moved out of engagement with the index card **23** in readiness for receiving the next card for forming a pile loop or float over the upper filling layer, as the case may be.

In forming these floats, the index card now selects the float hooks **28**, as shown in Fig. 13, exerting a pressure against the needle **24** attached to the pile hook **26** so as to unseat said hook from above the griff element **25**. Then, as the griff elements **25** rise, the float hook **28** and heddle **29** will be lifted with it, raising the yarn end **32** in its upward travel, while the pile hook **26** and heddle **27** will drop downwardly. But it will be noted from Fig. 13,

that the yarn end **32** does not rise to as great a height as it did when lifted by the pile hook **26** and heddle **27**. This is because the said yarn end passes through the large elongated opening of the loop **31** of said heddle, so that the yarn does not begin to rise until the bottom of the loop **31** contacts the yarn. Thus, since the length of this loop is equivalent to a substantial portion of the total vertical travel of the griff element **25**, the yarn end **32** is raised only a portion of the total vertical travel of the heddle **29**. But, it will be noted, the yarn end **32** has been raised sufficiently for a pick **34** of the upper filling layer to pass therebeneath with the wire **33** passing over the yarn. Thus, the yarn end **32** is said to "float" over the pick of the upper filling layer so as to avoid any open spaces in the face of the fabric. Then when the griff elements **25** move downwardly again and the cylinder **22** moves away from the index card, the springs **35** act on the needles **24** so as to place the hooks **26** over the griff element in readiness for the next weaving operation.

As an important feature of the present invention, the operations shown in Figs. 11–13 can be carried out in only one indexing per cycle of the jacquard mechanism. Ordinarily, two indexings are required per cycle of operation to produce both pile loops and floats above the upper filling layer, which, of course, requires twice as many index cards and consumes more time. By the present invention, the hooks **26** and **28** of the jacquard for forming the pile loops and floats above the upper filling layer are controlled so as to operate simultaneously at the same indexing, the index cards being cut accordingly for this purpose. To accomplish this, the griff and the grate **45** of the conventional jacquard mechanism are separately controlled so as to move independently toward each other from their uppermost and lowermost positions, respectively, and the yarns carried thereby meet for indexing at the level of the table **20** of the loom, whereupon the jacquard is indexed in contrast to the usual method of moving downwardly together and indexing at the lowermost position of the griff and grate below the table **20** of the loom. Thus, as shown diagrammatically in Fig. 14, the griff yarn **36** and grate yarn **37** are controlled in their vertical movement so as to approach each other simultaneously, whereby the yarns thereof meet for indexing at the table T, and then separating and returning to their respective upward and downward positions so that wires and picks may be inserted. The hooks **26** and **28** selected by the index card for forming pile loops travel upwardly with the griff on its return, carrying the heddles **27** and **29** and yarn ends **32** upwardly, as shown in Fig. 12 and as described above. At the same time, all the float hooks **28** selected by the index card for producing floats above the upper filling layer likewise travel upwardly with the griff on its return, carrying the float heddle **29** and yarn ends **32** with them, but the yarn ends **32** controlled by said hooks will not rise to the same height as the yarn for the pile loops due to the manner in which it is threaded through the elongated loop **31** of the heddle, as described above. The position of the floated yarn end is indicated at **38** in Fig. 14, a wire **33** being shown thereabove and a pick **34** therebeneath.

Thus, as shown in Figs. 12 and 13, each yarn end **32** is controlled by two sets of hooks and heddles so that either set may be selected for forming pile loops or floats, as desired. Each heddle **27** and **29** has a hook **46** which cooperates with the grate **45**.

All hooks that are not selected for producing pile loops or floats over the upper filling layer pass downwardly with the grate in the conventional manner, so that the yarn controlled thereby is tied in beneath the picks of the upper filling layer; that is, between the picks of the upper filling layer and those of the lower filling layer along with the stuffer warp.

By the method for controlling the yarn ends described above, index cards may be cut so that a given yarn end may be made to produce pile loops or floats above the upper filling layer, so as to leave no open spaces in the face of the fabric.

It is to be noted that if the indexing were carried out at the lowermost level of the grate, as is customarily done, it would be impossible to produce both pile loops and floats above the upper filling layer in one indexing per cycle using conventional index cards, hooks, and heddles, as contemplated by the present invention, because the float hooks would raise the yarn only to a level below the table T of the loom, as shown at **39** in Fig. 14, which would result in the yarn being bound in beneath pick **34** of the upper filling layer, leaving the undesirable open spaces which the present invention is designed to overcome. Thus, two indexings would be required per cycle, one indexing to produce the pile loops and one indexing to produce the desired floats. Needless to say, this would require twice the number of index cards as required by the present invention, and would consume more operating time.

It is to be emphasized at this point, therefore, that it is only by separately and independently controlling the jacquard griff and grate so as to index at the table of the loom, in accordance with the teaching of the present invention, that the simultaneous provision of pile loops and floats above the upper filling layer may be accomplished with the conventional jacquard using conventional hooks and heddles.

As stated earlier in the specification, the present method can be carried out with two or more warp yarns, selectively raising yarn ends to form pile loops and selectively floating the yarn ends so as to pass over the picks of the upper filling layer, eliminating open spaces in the face of the fabric. Thus, by selectively raising the yarn ends to pass over one or more pile wires and by selectively floating the yarn ends as desired, a pattern effect may be achieved. And by the present method, this may be accomplished simply, with the existing jacquard mechanism and with only one indexing per cycle, by the simple expedient of independently controlling the movement of the jacquard griff and grate so as to index at the level of the table of the loom.

Reference is made in the foregoing specification to the griff and grate meeting at the level of the table. What is meant by this is that the yarn of the griff and the yarn of the grate meet at the level of the table rather than these loom elements themselves.

Although the present discussion has been limited to the above-described preferred embodiment, it is to be understood that variations thereof are possible without departing from the spirit of the invention. It is not intended, therefore, that this invention be limited to the particular embodiment disclosed, but only to the inventive concept as defined by the appended claims.

What is claimed is:

1. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises indexing at the table of the loom so as to select yarn ends for producing pile loops and floats above the upper filling layer, raising the selected yarn ends to different heights above the table of the loom for producing pile loops and floats above the upper filling layer, inserting pile wires beneath the higher yarn ends but above the lower yarn ends, and inserting upper picks beneath the lower yarn ends.

2. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises lowering the griff and raising the grate simultaneously so as to meet at the table of the loom, indexing at the table of the loom so as to select yarn ends for producing pile loops and floats above the upper filling layer, raising the griff and lowering the grate, the said

griff raising the selected yarn ends to different heights for producing the pile loops and floats above the upper filling layer, inserting pile wires beneath the higher yarn ends but above the lower yarn ends, and inserting upper picks beneath the lower yarn ends.

3. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises independently lowering the griff and independently raising the grate so as to meet at the table of the loom, indexing at the table of the loom so as to select yarn ends for producing pile loops and floats above the upper filling layer, raising the griff and lowering the grate, the said griff raising the selected yarn ends to different heights above the table of the loom for producing pile loops and floats above the upper filling layer, inserting pile wires beneath the higher yarn ends but above the lower yarn ends, and inserting upper picks beneath the lower yarn ends.

4. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises, threading each yarn end through both a pile heddle and a float heddle, indexing at the table of the loom so as to select pile heddles and float heddles for producing pile loops and floats above the upper filling layer, raising the selected heddles to different heights above the table of the loom, the float heddles lying below the pile heddles, inserting pile wires beneath the higher yarn ends but above the lower yarn ends, and inserting upper picks beneath the lower yarn ends.

5. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises, suspending pile heddles and float heddles from the griff of the jacquard, threading yarn ends through both a pile heddle and a float heddle, lowering the griff and raising the grate of the jacquard simultaneously, indexing as the griff and grate meet at the table of the loom so as to select pile heddles and float heddles for producing pile loops and floats above the upper filling layer, raising the griff so as to raise the selected heddles and yarn ends while lowering the grate at the same time, the pile heddles raising the yarn ends to a greater height than the float heddles, inserting pile wires beneath the higher yarn ends but above the lower yarn ends, and inserting upper picks beneath the lower yarn ends.

6. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops

and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises, suspending pile heddles and float heddles from the griff of the jacquard, threading yarn ends through the eye of the pile heddle and through the elongated loop of the float heddle, lowering the griff and raising the grate of the jacquard simultaneously, indexing as the griff and grate meet at the table of the loom so as to select pile heddles and float heddles for producing pile loops and floats above the upper filling layer, raising the griff so as to raise the selected heddles and yarn ends above the table of the loom while lowering the grate at the same time, the pile heddles raising the yarn ends to a greater height than the float heddles, inserting pile wires beneath the higher yarn ends but above the lower yarn ends, and inserting upper picks beneath the lower yarn ends.

7. In the weaving of pile fabric by means of a loom having a jacquard, the method for producing pile loops and floats above the upper filling layer with only one indexing per cycle of operation of the jacquard which comprises, indexing at the table of the loom so as to select yarn ends for producing pile loops and floats above the upper filling layer, raising the selected yarn ends to different heights above the table of the loom, inserting a pile wire and an upper pick beneath the higher yarn ends, beating up the said pile wire and upper pick into the fabric body, inserting a lower pick beneath the same higher yarn ends, beating up said lower pick, inserting an upper pick beneath the lower yarn ends, beating up said upper pick, inserting a lower pick beneath said lower yarn ends, and beating up said lower pick into the fabric body.

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