Sept. 21, 1943. J. L. BAKER 2,329,739

PROCESS OF MAKING PILE FABRICS

Filed April 21, 1942

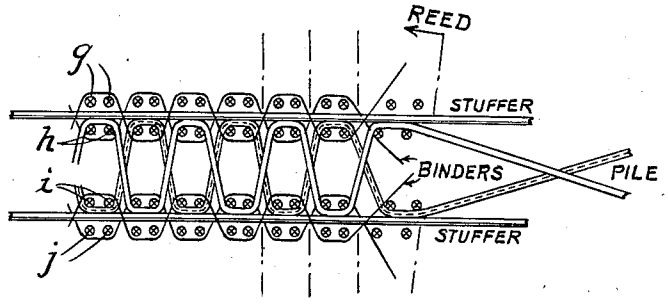


FIG. 1.

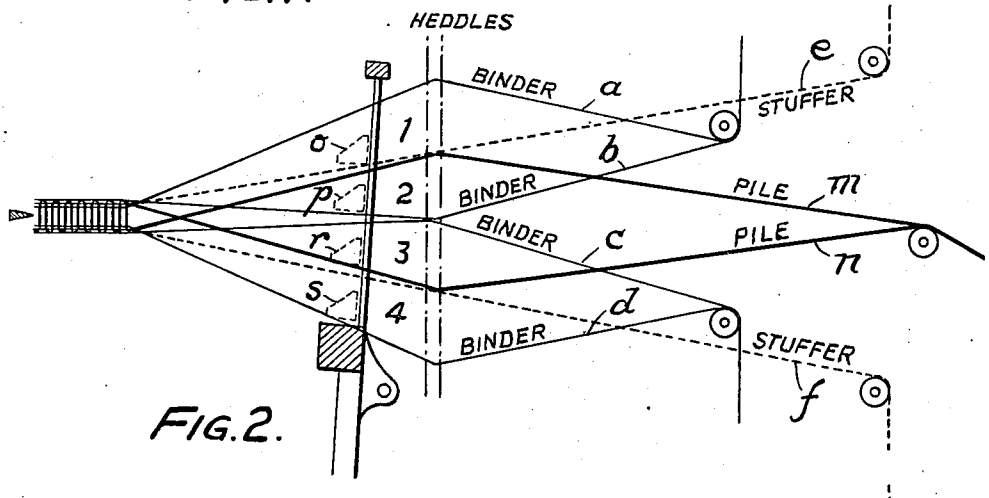


FIG. 2.

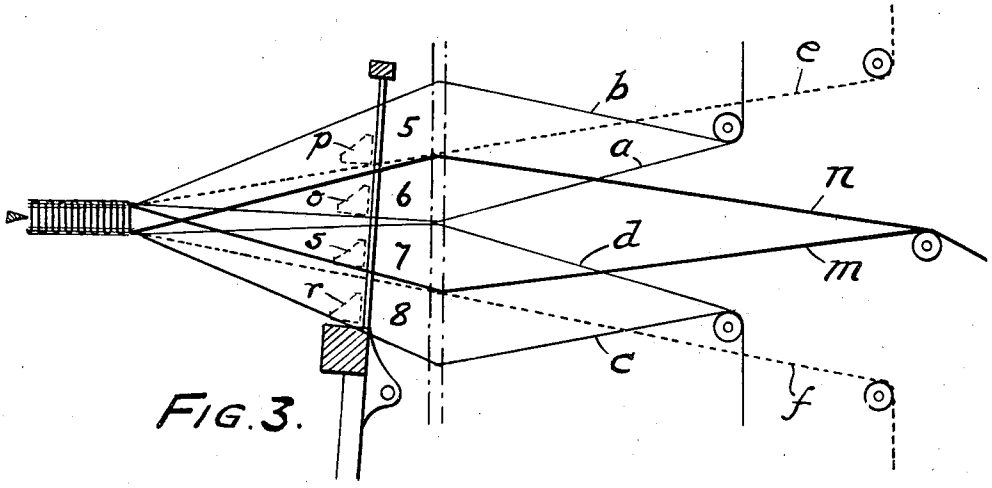


FIG. 3.

INVENTOR

Joseph L. Baker

BY

Bacon and Hardy

ATTORNEYS.

WITNESS:

Patented Sept. 21, 1943 2,329,739

UNITED STATES PATENT OFFICE

2,329,739

PROCESS OF MAKING PILE FABRICS

Joseph L. Baker, Langhorne Manor, Pa.

Application April 21, 1942, Serial No. 439,832

8 Claims. (Cl. 139—398)

My invention relates to the weaving of pile fabrics and comprises a novel process for making a double pile fabric composed of two fabrics (each comprising two series of binding warp threads, one series of stuffer warp threads, and weft yarns) connected by one or more (preferably two) series of pile warps common to both fabrics. The fabric produced by the process comprises a double fabric composed of two single fabrics each containing two sets of binder warps, a set of stuffer warps and pairs of filler or weft threads, the two single fabrics being united by one or more (preferably two) series of pile warp threads common to both fabrics. A fabric within the above description and a process of making it are disclosed in Letters Patent for a loom adapted to weave such a fabric, No. 2,285,793 issued to me June 9, 1942, on an application filed May 21, 1941, Ser. No. 394,409, and also in an application filed of even date herewith, Serial No. 439,831. The present invention, however, is an improvement on the process described in said patent and embodies other features that are hereinafter described and claimed.

The said patented machine comprises two weft yarn supplies, one at each side of the loom, and two shuttles each adapted to engage a weft yarn from the supply at each side of the loom and pull a double pick thereof across the loom and then release the yarn. Two series of binder warps and one series of stuffer warps are arranged at each level. The two shuttles traverse the loom simultaneously in opposite directions at two levels, one through a shed formed at the upper level and the other through a shed formed at the lower level. The two shuttles then again traverse the loom simultaneously in opposite directions at the two levels. A single set of pile warps is provided which, prior to each simultaneous movement of the two shuttles, is transferred from one shed to another. As the loom is constructed, each shuttle traverses the upper warp shed in one direction and then the lower warp shed in the opposite direction. In other words both shuttles traverse the loom, first at one level and then at the other level, in either a clockwise direction, or in a counter-clockwise direction.

The advantage of such a process, as compared with weaving on a standard loom whose shuttles carry their own supply, is that it more than doubles production. The weaving on such a standard loom of two fabrics simultaneously would just double production if it were not for the necessity, with the standard loom, of stopping the loom to replace filling whenever either shuttle requires replenishment. In the process of my patent it is not necessary to stop the loom to replenish the yarn, since the shuttles do not carry their own supply; and the yarn supplies at the sides of the loom can be replenished, without stopping the loom, by securing the tail end of one supply to the advance end of a new supply. A more important time-saving factor, however, is that the shuttles—which are really only weft carriers—are very light in weight as compared with ordinary shuttles carrying their own supply and can be operated more rapidly, that is, can insert more weft picks per minute, than can conventional shuttles. All these factors, taken together, give a speed of production that greatly exceeds the speed that would be attained by such mere duplication as would be involved in merely weaving simultaneously two independent fabrics on an ordinary loom.

The double fabric made by the process embodying the invention herein claimed differs from the double fabric disclosed in my said patent in that in the latter double fabric a single series of pile warps engages alternate double picks of weft in each fabric, whereas in the double fabric made by the process embodying the invention herein claimed a single series of pile warps engages every fourth double pick of weft in each fabric, another series of pile warps (if two be used) also engaging every fourth double pick of weft in each fabric, alternate double picks of weft thereby engaging alternate series of pile warps in each fabric.

The more specific object of the present invention is to make the double fabric just described at double the speed at which the similar double fabric disclosed in my said patent can be made. To this end I provide four sets of binder warps, two for the upper fabric and two for the lower fabric; two sets of stuffer warps, one for the upper fabric and one for the lower fabric; and at least one set, and preferably two sets, of pile warps. Such a fabric, containing two sets of pile warps, is shown in the accompanying drawing, in which—

Fig. 1 is a diagram, along the line of the warp, of a fabric woven by my improved process.

Figs. 2 and 3 are diagrams, along the line of the warp, illustrating the alternate arrangement of warp sheds.

In the further description of the process, reference will be made to these figures. *a* and *b* are the two binder warps of the upper fabric; *c* and *d* the two binder warps of the lower fabric; *e* the

stuffer warp of the upper fabric; *f* the stuffer warp of the lower fabric; *g* and *h* the weft yarns of the upper fabric; *i* and *j* the weft yarns of the lower fabric; *m* and *n* the pile warps, each of which is common to both fabrics.

The warp heddles are manipulated to form four sheds having one arrangement of warps alternating with four sheds having another arrangement of warps. In Fig. 2, the four sheds are formed by the several warps as follows:

(1) Between binder warp *a* and stuffer warp *e*.
(2) Between pile warp *m* and binder warp *b*.
(3) Between binder warp *c* and pile warp *n*.
(4) Between stuffer warp *f* and binder warp *d*.

The alternate sheds, illustrated in Fig. 3, are formed as follows:

(5) Between binder warp *b* and stuffer warp *e*.
(6) Between pile warp *n* and binder warp *a*.
(7) Between binder warp *d* and pile warp *m*.
(8) Between stuffer warp *f* and binder warp *c*.

At each side of the loom are provided two weft yarn supplies. In one specific embodiment of the process, a bobbin carrying a supply of weft yarn *g* and a bobbin carrying a supply of weft yarn *i* are arranged at one side (say the left side) of the loom; and a bobbin carrying a supply of weft yarn *h* and a bobbin carrying a supply of weft yarn *j* are arranged at the other side of the loom. Shuttles *o*, *p*, *r* and *s* are provided for the four warp sheds. Each shuttle is of the type, hereinbefore described, shown and described in my said patent.

After one beat of the lay and the formation of sheds **1**, **2**, **3** and **4** hereinbefore described, shuttle *o* engages the supply of yarn *g* and, traveling from left to right, pulls a double pick thereof through shed **1**; shuttle *p* engages the supply of yarn *h* and, traveling from right to left, pulls a double pick thereof through shed **2**; shuttle *r* engages the supply of yarn *i* and, traveling from left to right, pulls a double pick thereof through shed **3**; and shuttle *s* engages the supply of yarn *j* and, traveling from right to left, pulls a double pick thereof through shed **4**. All the shuttles travel simultaneously.

Each of the shuttles, after it completes its traverse, releases the weft that it has pulled through the described warp shed.

The paths of the four shuttles, in their described traverse of the loom, are, of course, at different levels. Immediately after the four shuttles traverse the loom as described, shuttle *o* is dropped from the uppermost level to the next level below it and shuttle *p* is raised from the latter level to the uppermost level; while shuttle *s* is lifted from the lowest level to the next level above it and shuttle *r* is dropped from the latter level to the lowest level.

After the next beat of the lay and the formation of sheds **5**, **6**, **7** and **8** hereinbefore described, shuttle *p* engages the supply of yarn *g* and, traveling from left to right pulls a double pick thereof through shed **5**; shuttle *o* engages the supply of yarn *h* and, traveling from right to left, pulls a double pick thereof through shed **6**; shuttle *s* engages a supply of yarn *i* and, traveling from left to right, pulls a double pick thereof through shed **7**; and shuttle *r* engages the supply of yarn *j* and, traveling from right to left, pulls a double pick thereof through shed **8**.

Succeeding movements of heddles and shuttles are repetitious of the above operations, which results in the formation of a double fabric like that shown in Fig. 1.

As the woven double fabric is fed intermittently forward, the connecting pile yarns *m* and *n* are severed by a cutter and the two fabrics are wound around spike rolls, as disclosed in my said patent.

The disclosure of mechanism to effect the above described operations is unnecessary, since such mechanism is fully illustrated and described in my said patent. However, the process embodying my invention is not dependent for its operation upon any particular mechanism. Indeed, aside from the necessity, from a practical commercial standpoint, of providing a power loom adapted to practice the process, its practice is not dependent upon any particular mechanism. For example, the fabric may be woven on a hand-operated loom.

While the mechanism for effecting the above described operations may be considered to involve little more than a duplication of the mechanism illustrated and described in my said patent, neither the process nor the resultant fabric constitutes a mere duplication, since the sheds are so formed that there is produced, not two double fabrics each like the double fabric produced by the patented loom, but only one double fabric. That is, both of the processes produce double fabrics, alike in that each single component fabric comprises two sets of binder warps and a set of stuffer warps, there being a set of pile warps common to both fabrics. While the fabric produced by the specific process herein described contains an additional set of pile warps common to both fabrics, one of them might be omitted.

The two fabrics, however, differ in that in the fabric disclosed in my said patent the single set of pile warps connect half the pairs of wefts of one fabric with half the pairs of wefts of the other fabric; while in the fabric produced by the process embodying the present invention each of the two sets of pile warps connects one-fourth of the pairs of wefts of one fabric with one-fourth of the pairs of wefts of the other fabric.

As above stated, it is not essential to utilize two sets of pile warps, since either the pile warps *m* or the pile warps *n* may be omitted, and in such a fabric, also, the single set of pile warps connects one-fourth of the pairs of wefts of one fabric with one-fourth of the pairs of wefts of the other fabric.

The advantage of the present process, therefore, over the process practiced in the said patented loom is not that it produces two double fabrics instead of one double fabric, but that it produces one double fabric having features in common with, but not identical with, the fabric disclosed in the patent, at twice the speed at which the double fabric of the patent is produced, and therefore at much over four times the speed of production of a single fabric on an ordinary pile fabric loom. Considering the factor of higher practicable speed of travel of the shuttles and the factor of continuous operation without replenishment of the shuttles, the speed of production approximates, and may exceed, five times the speed of production of the ordinary loom.

As one of a number of possible modifications, each of the shuttles may at all times traverse the loom on the same level, first in one direction and then in the other direction. This modification would necessitate the employment of eight yarn supplies, four at each side of the loom.

Less desirably, instead of utilizing four shuttles, of the kind described in my said patent, which are adapted to pull a double pick of yarn across the loom in each direction of traverse, four de-

vices known in the art as needles, having yarn-engaging means at only one end, may be used. Needles, therefore, can insert a double pick of weft in only one traverse of the loom. If their speed of operation is assumed to equal the speed of flying shuttles having weft-engaging means at both ends, the speed with which the double fabric is formed would be only half that which is attained with such shuttles, but would equal the speed of production attainable on the loom described in my said patent when operated as therein described.

While the employment of only one or two sets of pile threads is shown and described it will be understood that, in the weaving of multicolored fabrics, additional pile threads may be utilized, one being substituted for another when a change in color is to be made. When not required on the face of the fabric, these additional pile threads may be carried as dead threads in the body of one or the other fabrics; that is, through proper jacquard control, they would be made to act as stuffer threads. Therefore, in claiming a set of pile threads I mean to include another set of pile threads, or any one of a plurality of other sets of pile threads, that may be substituted therefor. It will also be understood that such substitute pile threads may be sufficient in number and so distributed as to dispense with the necessity of providing threads which function exclusively as stuffer threads.

As above suggested, while the pile threads may all be white or of natural color, some or all of them may be colored, or the yarn may be printed in such a way as to show a pattern when woven.

As an example of variously colored pile threads and the substitution of one set of pile threads for another set, a number of pile threads might be carried in each dent of the reed, half of different colors in the top cloth and half of (preferably) corresponding colors in the bottom cloth. By jacquard control one or more pile threads of (preferably) corresponding colors may be selected for each fabric (thus creating a figure or design in the woven fabric), the remaining pile threads functioning as stuffer threads as above described.

What I claim and desire to protect by Letters Patent is:

1. The herein described process of weaving pile fabrics which comprises manipulating four sets of binder warp threads, two sets of stuffer warp threads and pile warp threads to form four sheds, one shed between one set of binder warp threads and one set of stuffer warp threads, an adjacent second shed between pile warp threads and a second set of binder warp threads, a next adjacent third shed between a third set of binder warp threads and the second set of stuffer warp threads, and a next adjacent shed between the second set of stuffer warp threads and the fourth set of binder warp threads, and inserting simultaneously double picks of weft yarns between all of said sheds; then manipulating the four sets of binder warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads and of the two last mentioned sets of binder warp threads and so manipulating pile warp threads that the second shed is formed between the first set of stuffer warp threads and the first set of binder warp threads and that the third shed is formed between the fourth set of binder warp threads and pile warp threads and inserting simultaneously double picks of weft yarn between all of said sheds: thereby forming two woven fabrics, each comprising two sets of binder warp threads and a set of stuffer warp threads, united by pile warp threads common to both fabrics.

2. The herein described process of weaving pile fabrics which comprises manipulating four sets of binder warp threads, two sets of stuffer warp threads and two sets of pile warp threads to form four sheds, one shed between one set of binder warp threads and one set of stuffer warp threads, an adjacent second shed between one set of pile warp threads and a second set of binder warp threads, a next adjacent third shed between a third set of binder warp threads and the other set of pile warp threads, and a next adjacent fourth shed between the second set of stuffer warp threads and the fourth set of binder warp threads, and inserting simultaneously double picks of weft yarns between all of said sheds; then manipulating the binder warp threads and pile warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads, of the two last mentioned sets of binder warp threads and of the two pile warp threads, and inserting simultaneously double picks of weft between all of said sheds; thereby forming two woven fabrics, each comprising two sets of binder warp threads and one set of stuffer warp threads, united by two sets of pile warp threads common to both fabrics.

3. The herein described process of weaving pile fabric which comprises manipulating four sets of binder warp threads and two sets of pile warp threads to form four sheds, one shed between one set of binder warp threads and one set of pile warp threads, an adjacent second shed between said set of pile warp threads and a second set of binder warp threads, a next adjacent third shed between a third set of binder warp threads and the other set of pile warp threads, and a next adjacent fourth shed between the last named set of pile warp threads and the fourth set of binder warp threads, and inserting simultaneously double picks of weft yarns between all of said sheds; then manipulating the binder warp threads and pile warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads, of the two last mentioned sets of binder warp threads, and of the two sets of pile warp threads, and inserting simultaneously double picks of weft yarns between all of said sheds; thereby forming two woven fabrics each comprising two sets of binder warp threads united by two sets of pile warp threads common to both fabrics.

4. The herein described process of weaving pile fabric which comprises manipulating four sets of binder warp threads and pile warp threads to form four sheds, one shed being between two sets of binder warp threads, an adjacent second shed between pile warp threads and one of the last named sets of binder warp threads, and each of the next two sheds between the other two sets of binder warp threads, and inserting simultaneously double picks of weft yarn between all of said sheds; then manipulating the four sets of binder warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads and of the two last mentioned sets of binder warp threads and so manipulating pile warp threads that the first and second sheds are formed between the first named two sets of binder warp threads, the third shed between pile warp threads and one of the second named two sets of binder warp threads and the fourth shed be-

tween the second named two sheds of binder warp threads, and simultaneously inserting double picks of weft yarn between all of said sheds: thereby forming two woven fabrics, each comprising two sets of binder warp threads united by pile threads common to both fabrics and engaging every fourth double pick of weft yarn.

5. The herein described process of weaving pile fabrics which comprises manipulating four sets of binder warp threads, two sets of stuffer warp threads and pile warp threads to form four sheds, one shed between one set of binder warp threads and one set of stuffer warp threads, an adjacent second shed between pile warp threads and a second set of binder warp threads, a next adjacent third shed between a third set of binder warp threads and the second set of stuffer warp threads, and a next adjacent shed between the second set of stuffer warp threads and the fourth set of binder warp threads, and providing four weft yarn supplies; inserting simultaneously double picks of weft yarns between the four sheds respectively and then releasing the yarns; then manipulating the four sets of binder warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads and of the two last mentioned sets of binder warp threads and so manipulating pile warp threads that the second shed is formed between the first set of stuffer warp threads and the first set of binder warp threads and that the third shed is formed between the fourth set of binder warp threads and pile warp threads; then inserting simultaneously double picks of weft yarn between the four sheds respectively and then releasing the yarns: thereby forming two woven fabrics, each comprising two sets of binder warp threads and a set of stuffer warp threads, united by pile warp threads common to both fabrics.

6. The herein described process of weaving pile fabrics which comprises manipulating four sets of binder warp threads, two sets of stuffer warp threads and two sets of pile warp threads to form four sheds, one shed between one set of binder warp threads and one set of stuffer warp threads, an adjacent second shed between one set of pile warp threads and a second set of binder warp threads, a next adjacent third shed between a third set of binder warp threads and the other set of pile warp threads, and a next adjacent fourth shed between the second set of stuffer warp threads and the fourth set of binder warp threads, and providing four weft yarn supplies; inserting simultaneously double picks of weft yarns between the four sheds respectively and then releasing the yarns; then manipulating the binder warp threads and pile warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads, of the two last mentioned sets of binder warp threads and of the two pile warp threads; then inserting simultaneously double picks of weft between the four sheds respectively and then releasing the yarns; thereby forming two woven fabrics, each comprising two sets of binder warp threads and one set of stuffer warp threads, united by two sets of pile warp threads common to both fabrics.

7. The herein described process of weaving pile fabric which comprises manipulating four sets of binder warp threads and two sets of pile warp threads to form four sheds, one shed between one set of binder warp threads and one set of pile warp threads, an adjacent second shed between said set of pile warp threads and a second set of binder warp threads, a next adjacent third shed between a third set of binder warp threads and the other set of pile warp threads, and a next adjacent fourth shed between the last named set of pile warp threads and the fourth set of binder warp threads, and providing four yarn supplies; then inserting simultaneously double picks of weft yarns between the four sheds respectively and then releasing the yarns; then manipulating the binder warp threads and pile warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads, of the two last mentioned sets of binder warp threads, and of the two sets of pile warp threads; then inserting simultaneously double picks of weft yarns between the four sheds respectively and then releasing the larn: thereby forming two woven fabrics each comprising two sets of binder warp threads united by two sets of pile warp threads common to both fabrics.

8. The herein described process of weaving pile fabric which comprises manipulating four sets of binder warp threads and pile warp threads to form four sheds, one shed being between two sets of binder warp threads, an adjacent second shed between pile warp threads and one of the last named sets of binder warp threads, and each of the next two sheds between the other two sets of binder warp threads, and providing four yarn supplies; then inserting simultaneously double picks of weft yarn between the four sheds respectively and then releasing the yarns; then manipulating the four sets of binder warp threads to reverse the relative positions of the two first mentioned sets of binder warp threads and of the two last mentioned sets of binder warp threads and so manipulating pile warp threads that the first and second sheds are formed between the first named two sets of binder warp threads, the third shed between pile warp threads and one of the second named two sets of binder warp threads and the fourth shed between the second named two sheds of binder warp threads, then simultaneously inserting double picks of weft yarn between the four sheds respectively and then releasing the yarns; thereby forming two woven fabrics, each comprising two sets of binder warp threads united by pile threads common to both fabrics and engaging every fourth double pick of weft yarn.

JOSEPH L. BAKER.