No Model.)

C. C. KLEIN.

PILE FABRIC AND ART OF MANUFACTURING SAME.

No. 549,372. Patented Nov. 5, 1895.

FIG. 1.

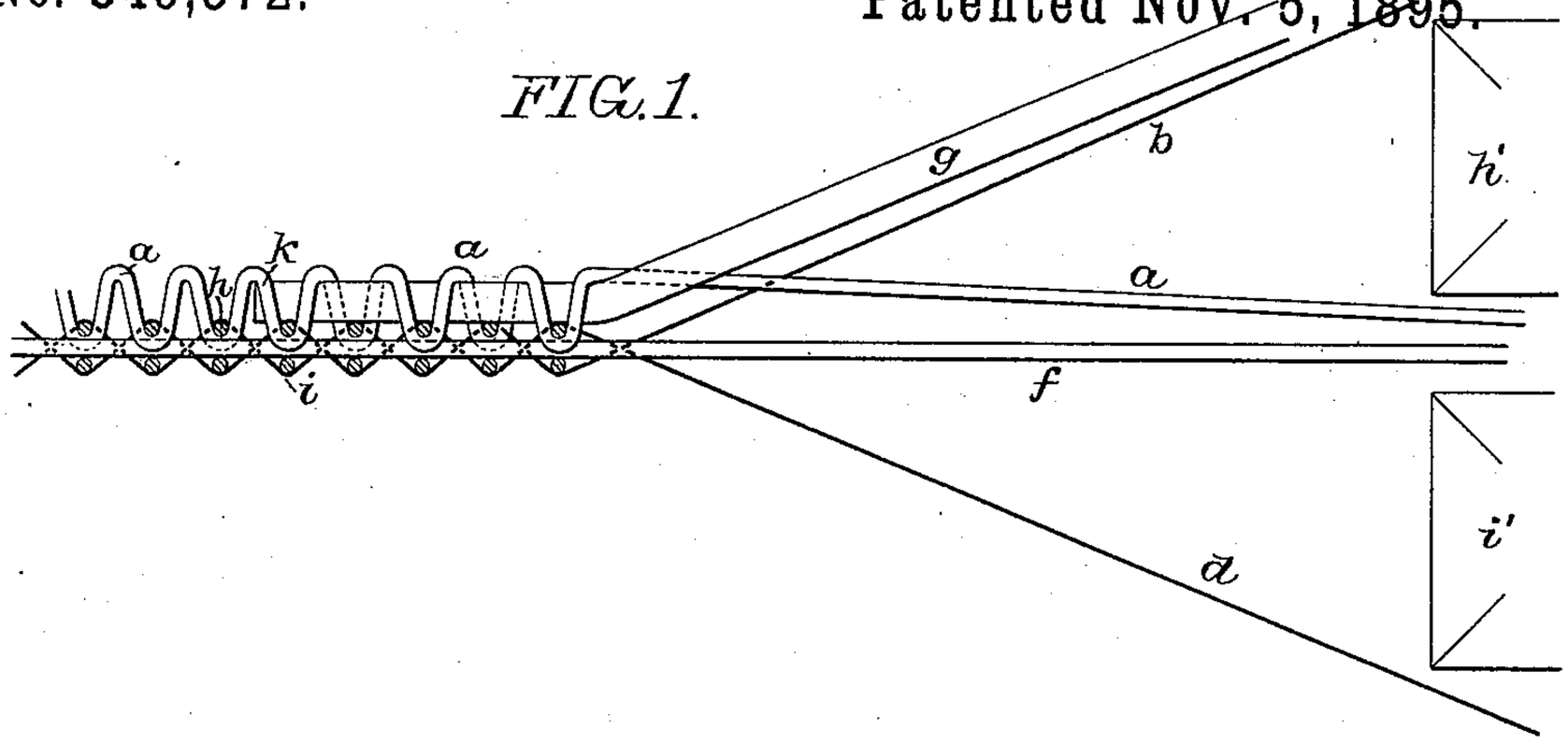


FIG. 2.

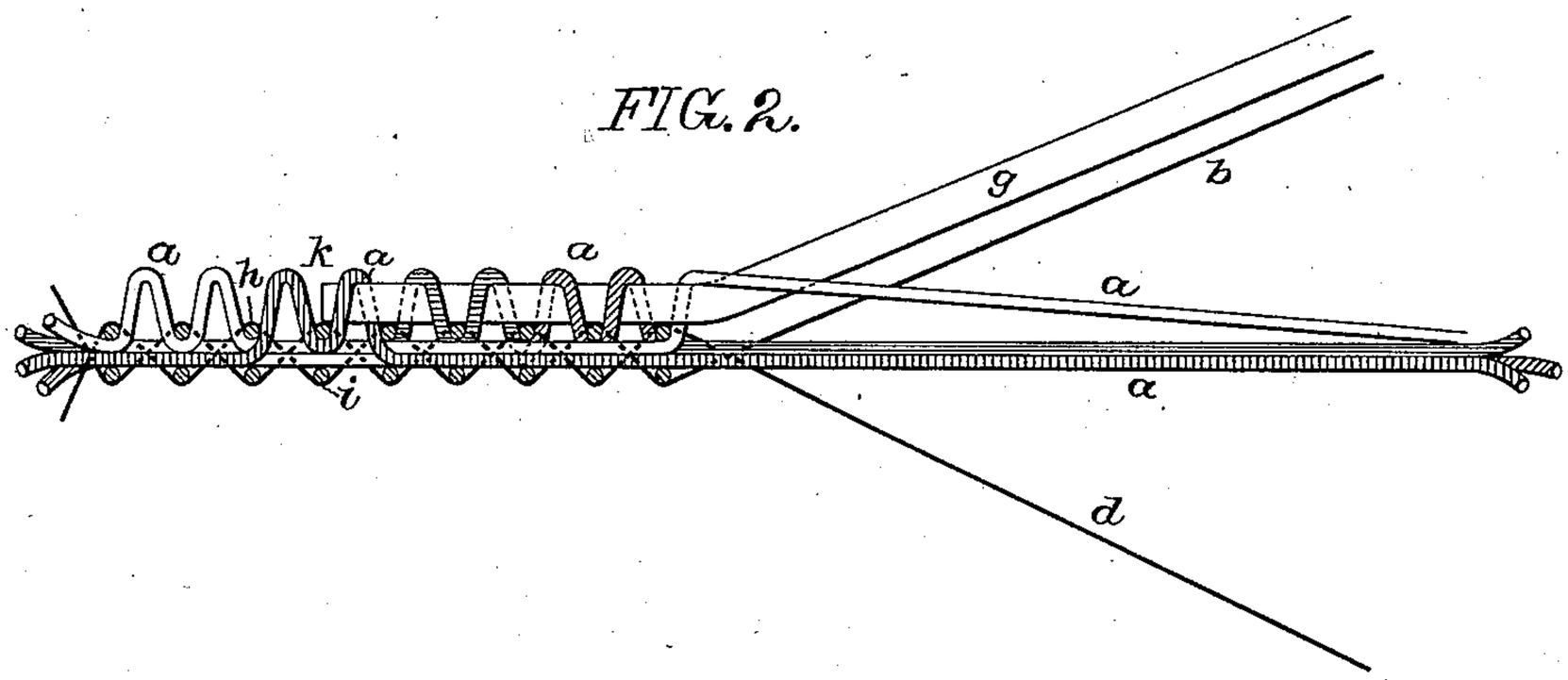


FIG. 3.

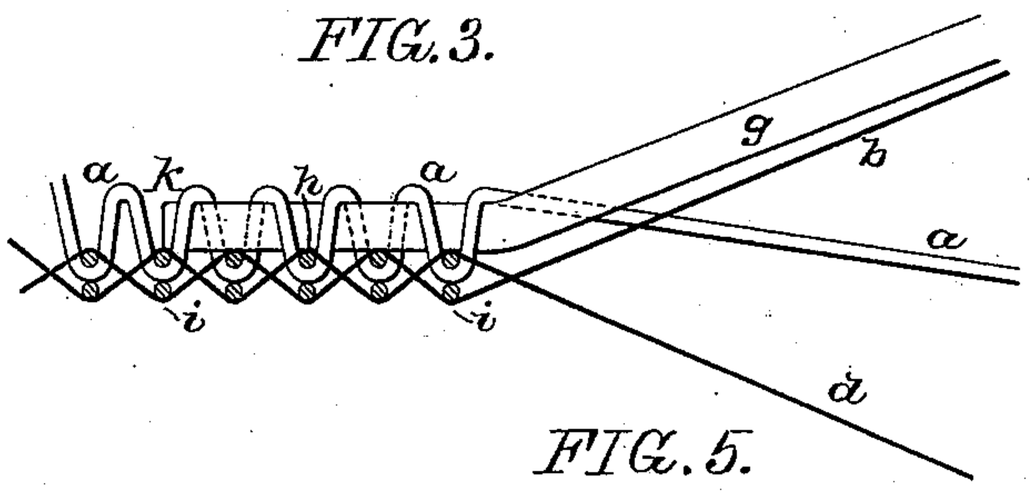


FIG. 4.

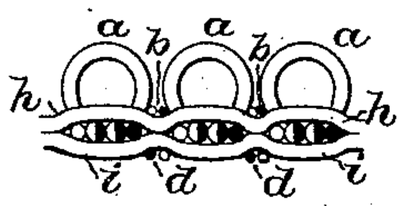
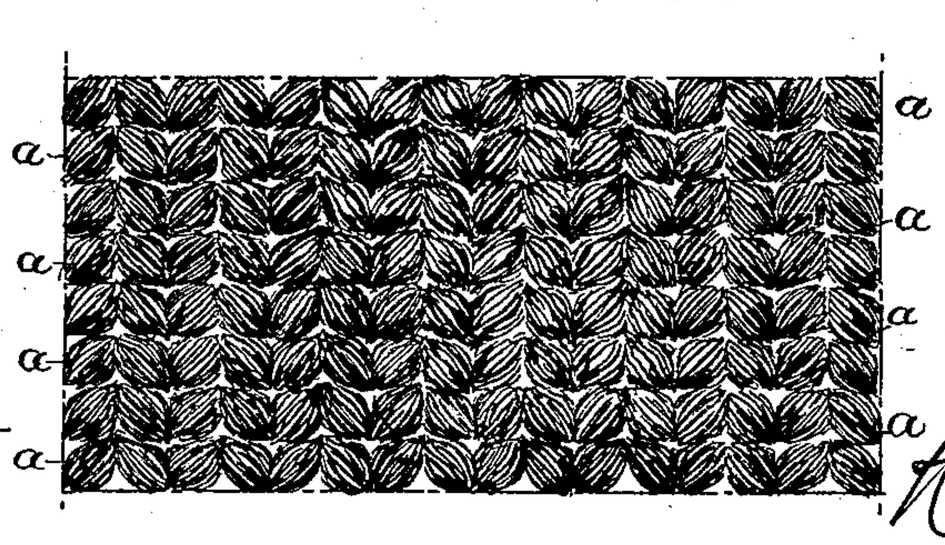


FIG. 5.



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UNITED STATES PATENT OFFICE.

CHARLES C. KLEIN, OF PHILADELPHIA, PENNSYLVANIA.

PILE FABRIC AND ART OF MANUFACTURING SAME.

SPECIFICATION forming part of Letters Patent No. 549,372, dated November 5, 1895.

Application filed October 14, 1893. Serial No. 488,156. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. KLEIN, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Pile Fabrics and Art of Manufacturing the Same, of which the following is a specification.

The objects of my invention are to expedite the weaving of pile fabrics and to obtain a pile fabric presenting a better surface than ordinary pile fabrics and without the usual imperfections on the back; and these objects I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 is a diagram illustrating my improved method of weaving pile fabrics, the diagram illustrating the operation in connection with a single series of pile-warp threads, it being understood that the other series of pile-warp threads are manipulated in the same manner in the production of the complete fabric. Figs. 2 and 3 are diagrams illustrating modifications of the invention. Fig. 4 is a transverse sectional diagram of a piece of my improved fabric, and Fig. 5 is a face view of a piece of the same.

In the diagram which I have shown in Fig. 1 as illustrating my invention the pile-warp thread is represented at *a*, while *b* and *d* represent binding-warp threads, *f* a stuffer-warp thread for the backing or body fabric, and *g* a false or pile-forming warp thread, *h* and *i'* representing weft-threads, which are inserted above and below the stuffer-warp threads and are interwoven with the binding-warp threads *b* and *d*, the wefts *h* serving to tie or bind into the backing or body fabric the loops of the pile-warp threads *a*.

The loops are formed in a direction transversely to the line of the warp by causing the pile-warp threads to be looped first to the right and then to the left of the false warp *g*, the wefts *h* tying said pile warp first on one side of the false warp and then on the opposite side of the same, as shown in the diagram.

The false warp may consist of a warp or strand of textile material or it may be a strip of wood, metal, or other material, and this warp extends into the fabric but a short distance beyond the beating-up point—as at *k*, for instance—so that the loops of pile warp formed over the same will leave it as the cloth is drawn forward by the take-up mechanism.

The false warp may be secured at the harness end to an ordinary form of doup-heddle and may thereby be caused to cross under the pile warp and be drawn up first on one side and then on the opposite side of the same; but by preference a reverse construction is adopted—that is to say, the pile warp is controlled and is caused to cross above the false warp and to descend first on one side of said false warp and then on the opposite side of the same. In the latter case the false warp is preferably carried by a vertically-moving frame or heddle, so as to be raised and lowered, for the false warp must be raised to the top of the shed formed for the passage of the shuttle *h'*, carrying the upper weft-thread *h*, and if it occupied this position permanently the pulling of the pile warp over the same by means of a doup-heddle would be a somewhat difficult operation. If, however, the pile warp is operated by shifting needles, such as are used in ordinary forms of cross-weaving looms, the false warp may permanently occupy the elevated position, as the side shifting of the pile warps will always be effected when said pile warps are elevated.

The binding-warps *b* and *d* are so operated as to form a single shed of binding-warp, crossed centrally by the stuffer-warp *f*, and in weaving the fabric the shuttles *h'* and *i'*, carrying the two weft-threads *h* and *i*, cross the loom simultaneously, so that the insertion of these two wefts, one above and one below the stuffer-warp, involves practically but a single pick of the loom, and the weaving of the fabric with the double-weft body or background is thus effected in about one-half the time required when these backing-wefts are picked in separately, as usual.

It is only in connection with the special plan described of forming the pile loops that this plan of picking in two shots of backing-wefts simultaneously through a shed of backing-warp can be economically employed, for if this plan was adopted in the weaving of ordinary pile fabrics in which the pile-loops are formed over transversely-inserted pile-wires, at least two alternately-actuated sets of pile

warps would have to be employed, since one set would have to be raised for the insertion of the pile-wire while the other set was depressed for the purpose of being tied into the backing, it being assumed that the pile-wire is inserted simultaneously with the insertion of the backing-wefts.

Various modifications in the character of the fabric are possible without departing from the essential features of my invention. For instance, the stuffer-warp may readily be dispensed with, especially in that class of fabrics in which the single-pile warp of Fig. 1 is replaced by a set of pile warps of different colors, as in Fig. 2, for the purpose of producing patterns or designs in different colors, either of the pile warps being selected to form the pile-loop, as the design requires, and the others remaining in the backing fabric, where they form a substitute for the stuffer-warp, as shown, or the stuffer-warp may be dispensed with even in single-pile warp fabrics, as in Fig. 3, for instance.

In cases where a cut-pile fabric is to be produced the forward or delivery end of the false warp may be furnished with a cutting-knife, so as to sever the pile-loops as they leave the same.

It will of course be understood that in all of the views of the drawings the fabric is shown in a loose or opened out condition and not as it appears when beaten up.

When the fabric is properly beaten up, the pile-loops of each row lie closely together, and as the loops of one row may be caused to closely approach those of the adjacent rows, as shown in Fig. 4, a fabric having a close pile surface can be produced by my invention, as will be seen on reference to Fig. 5. The pile-loops, moreover, occupy a zigzaz position, as shown in the latter figure, owing to the fact that they are crossed over the false warp first in one direction and then in the other. Hence a pile fabric made in accordance with my invention does not present the objectionable straight transverse rows of pile-loops, which are a defect in ordinary fabric in which the pile is formed over transverse wires.

I am aware that it is not new to form pile loops by carrying the pile warps back and forth over the false or pile-forming warps and tying them into a backing fabric first on one side of such false warps and then on the other side of the same, and I am also aware that fabrics have been woven with double sheds; but so far as I am aware I am the first to combine these two operations, and I am thereby enabled to materially cheapen and simplify the operation of weaving pile fabrics, since the formation of the pile loops and the insertion of both picks of binding-weft are the result of but a single operation of the harness and a single beat of the lay. Furthermore, the back weft *i* is beaten up simultaneously with the tying weft *h*, and hence provides a support for the pile warp and prevents the same from working through to the back of the fabric and marring the appearance of the same, as it frequently does when the shots of binding-weft are introduced successively. If it were not for the support afforded by the back weft *i*, the top weft *h* would draw the pile loops so tightly down upon the false warp that it would be impossible to draw the fabric over the same to the clearing-point. Hence the simultaneous insertion of the wefts *h* and *i* is essential to the practical carrying out of the method of weaving pile warps over longitudinal wires or false warps.

I am also aware that in some works on weaving ordinary Brussels fabric is represented as having the backing-wefts one above the other in the same shed of backing-warps; but practical weavers recognize this as simply a conventional method of illustration and are aware that in ordinary Brussels fabric the wefts are not so disposed, for they are inserted successively, and there is a movement of the take-up between the successive shots, this being the necessary result of the construction of all Brussels looms.

Another feature of my invention is that the upper weft *h* can be a fine weft of good material and the lower weft *i* a coarse weft of cheap material—a feature of construction which, if the wefts were introduced successively, would require the use of drop-boxes on the loom.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The mode herein described of weaving pile fabrics, said mode consisting in forming the pile loops by passing the pile warps back and forth over longitudinal false or pile-forming warps, and simultaneously producing a backing or body fabric by shedding the backing warps, picking in two weft shots simultaneously, one above and the other below the pile warps, thereby tying the pile loops first on one side of the false warps and then on the opposite side of the same by the upper weft threads of said backing or body fabric, and simultaneously covering and supporting the backs of the pile warps by the lower weft threads of the backing, substantially as specified.

2. The mode herein described of weaving pile fabrics, said mode consisting in forming the pile loops by passing the pile warps back and forth over longitudinal false or pile-forming warps, and simultaneously producing a backing or body fabric by shedding the backing warps, carrying a stuffer warp or warps centrally through the same, and picking in two weft shots simultaneously, one above and the other below the pile and stuffer warps, thereby tying in the pile loops first on one side of the false warps and then on the opposite side of the same by the upper weft threads of said backing or body fabric, and simultaneously covering and supporting the backs of the pile warps by the lower weft

threads of the backing, substantially as specified.

3. A pile fabric having a body or backing fabric composed of interwoven warps and two independent wefts, with two shoots of weft for each transverse row of pile loops, the said pile loops being disposed diagonally or in zig-zag relation to the warp line, engaging with the upper weft of said backing fabric and resting upon and being supported by the back weft of the same, substantially as specified.

4. A pile fabric having a body or backing fabric composed of a stuffer warp, binder warps and two independent wefts, one above and the other below said stuffer warp, and a pile surface composed of loops of pile warp disposed diagonally or in zig-zag relation to the warp line, engaging the upper weft of the backing fabric and resting upon and being supported by the lower weft of the same, there being both an upper and lower weft in the backing fabric for each transverse row of pile loops, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHAS. C. KLEIN.

Witnesses:
WILLIAM A. BARR,
JOSEPH H. KLEIN.